Contents

1 How to Read these Operating Instructions

1.1.1 How to Read these Operating Instructions

The frequency converter is designed to provide high shaft performance on electrical motors. Please read this manual carefully for proper use. Incorrect handling of the frequency converter may cause improper operation of the frequency converter or related equipment, shorten lifetime or cause other troubles.

These Operating Instructions will help you get started, install, program, and troubleshoot your frequency converter.

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

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

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

Chapter 4, **How to Programme**, shows how to operate and programme the frequency converter via the LCP.

Chapter 5, **General Specifications**, contains technical data about the frequency converter.

Chapter 6, **Warnings and Alarms**, assists in solving problems that may occur when using the frequency converter.

Available literature
- The VLT AutomationDrive Operating Instructions - High Power, MG.33.UX.YY provide the necessary information for getting the drive up and running.

- The VLT AutomationDrive Design Guide MG. 33.BX.YY entails all technical information about the drive and customer design and applications.

- The VLT AutomationDrive Programming Guide MG. 33.MX.YY provides information on how to programme and includes complete parameter descriptions.

- The VLT AutomationDrive Profibus Operating Instructions MG.33.CX.YY provide the information required for controlling, monitoring and programming the drive via a Profibus fieldbus.

- The VLT AutomationDrive DeviceNet Operating Instructions MG.33.DX.YY provide the information required for controlling, monitoring and programming the drive via a DeviceNet fieldbus.

X = Revision number
YY = Language code

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

1.1.2 Approvals
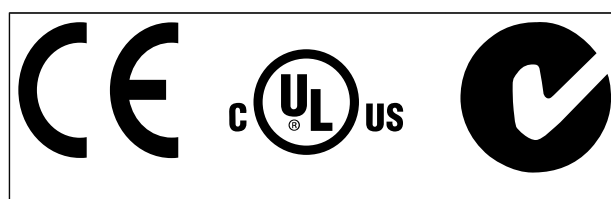
1.1.3 Symbols

Symbols used in this Operating Instructions.

NOTE
Indicates something to be noted by the reader.

⚠CAUTION
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or equipment damage.

⚠WARNING
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

*	Indicates default setting

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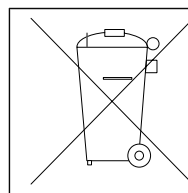
Equipment containing electrical components may not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

1

1.1.5 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 Compatibility	EMC
Electronic Thermal Relay	ETR
frequency converter	FC
Gram	g
Hertz	Hz
Horsepower	hp
Kilohertz	kHz
Local Control Panel	LCP
Meter	m
Millihenry Inductance	mH
Milliampere	mA
Millisecond	ms
Minute	min
Motion Control Tool	MCT
Nanofarad	nF
Newton Meters	Nm
Nominal motor current	$I_{M,N}$
Nominal motor frequency	$f_{M,N}$
Nominal motor power	$P_{M,N}$
Nominal motor voltage	$U_{M,N}$
Parameter	par.
Protective Extra Low Voltage	PELV
Printed Circuit Board	PCB
Rated Inverter Output Current	I_{INV}
Revolutions Per Minute	RPM
Regenerative terminals	Regen
Second	sec.
Synchronous Motor Speed	n_s
Torque limit	T_{LIM}
Volts	V
The maximum output current	$I_{VLT,MAX}$
The rated output current supplied by the frequency converter	$I_{VLT,N}$

2 Safety Instructions and General Warning

⚠CAUTION

The frequency converter DC link capacitors remain charged after power has been disconnected. To avoid electrical shock hazard, disconnect the frequency converter from the mains before carrying out maintenance. Before doing service on the frequency converter wait at least the amount of time indicated below:

380 - 500V	250 - 800kW	40 minutes
525 - 690V	355 - 1200kW	30 minutes

> **VLT AutomationDrive**
> **Operating Instructions**
> **Software version: 6.3x**
>
> These Operating Instructions can be used for all VLT AutomationDrive frequency converters with software version 6.2x. The software version number can be seen from *15-43 Software Version*.

2.1.1 High Voltage

⚠WARNING

The voltage of the frequency converter is dangerous whenever the frequency converter is connected to mains. Incorrect installation or operation of the motor or frequency converter may cause damage to the equipment, serious personal injury or death. The instructions in this manual must consequently be observed, as well as applicable local and national rules and safety regulations.

⚠WARNING

Installation in high altitudes
380 - 500V: At altitudes above 3km, please contact Danfoss regarding PELV.
525 - 690V: At altitudes above 2km, please contact Danfoss regarding PELV.

2.1.2 Safety Instructions

- Make sure the frequency converter is properly connected to earth.
- 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 *1-90 Motor Thermal Protection* to value *ETR trip* or *ETR warning*. For the North American market: ETR

functions provide class 20 motor overload protection, in accordance with NEC.

- The earth leakage current exceeds 3.5mA.
- The [OFF] key is not a safety switch. It does not disconnect the frequency converter from mains.

2.1.3 General Warning

⚠WARNING

Warning:
Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.
Also make sure that other voltage inputs have been disconnected, such as load-sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back-up. When using the frequency converter: wait at least 40 minutes.
Shorter time is allowed only if indicated on the nameplate for the specific unit.

⚠CAUTION

Leakage Current
The earth leakage current from the frequency converter exceeds 3.5mA. To ensure that the earth cable has a good mechanical connection to the earth connection (terminal 95), the cable cross section must be at least 10 mm^2 or 2 rated earth wires terminated separately. For proper earthing for EMC, see section *Earthing* in the *How to Install* chapter.
Residual Current Device
This product can cause a D.C. current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also RCD Application Note MN.90.Gx.02 (x=version number).
Protective earthing of the frequency converter and the use of RCD's must always follow national and local regulations.

2.1.4 Before Commencing Repair Work

1. Disconnect the frequency converter from mains
2. Disconnect DC bus terminals 88 and 89 from load share applications
3. Wait for discharge of the DC-link. See period of time on the warning label
4. Remove motor cable

2

2.1.5 Avoid Unintended Start

While the frequency converter is connected to mains, the motor can be started/stopped using digital commands, bus commands, references or via the Local Control Panel (LCP):

- Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended start.

- To avoid unintended start, always activate the [OFF] key before changing parameters.

- An electronic fault, temporary overload, a fault in the mains supply, or lost motor connection may cause a stopped motor to start. The frequency converter with Safe Stop provides protection against unintended start, if the Safe Stop Terminal 37 is deactivated or disconnected.

2.1.6 Safe Stop

The FC 302 can perform the safety function *Safe Torque Off* (As defined by draft CD 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. Prior to integration and use of Safe Stop in an installation, a thorough risk analysis on the installation must be carried out in order to determine whether the Safe Stop functionality and safety category are appropriate and sufficient. 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 Operating Instructions are not sufficient for a correct and safe use of the Safe Stop functionality!

2.1.7 Safe Stop Installation

To carry out an installation of a Category 0 Stop (EN60204) in conformity with Safety Category 3 (EN954-1), follow these instructions:

1. The bridge (jumper) between Terminal 37 and 24V DC must be removed. Cutting or breaking the jumper is not sufficient. Remove it entirely to avoid short-circuiting. See jumper on *Illustration 2.1*.

2. Connect terminal 37 to 24V DC by a short-circuit protected cable. The 24V DC voltage supply must be interruptible by an EN954-1 Category 3 circuit interrupt device. If the interrupt device and the frequency converter are placed in the same installation panel, you can use an unscreened cable instead of a screened one.
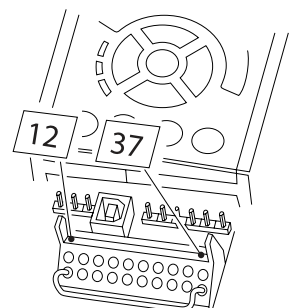
Illustration 2.1 Bridge jumper between terminal 37 and 24 VDC

Illustration 2.2 shows a Stopping Category 0 (EN 60204-1) with safety Category 3 (EN 954-1). The circuit interrupt is caused by an opening door contact. The illustration also shows how to connect a non-safety related hardware coast.
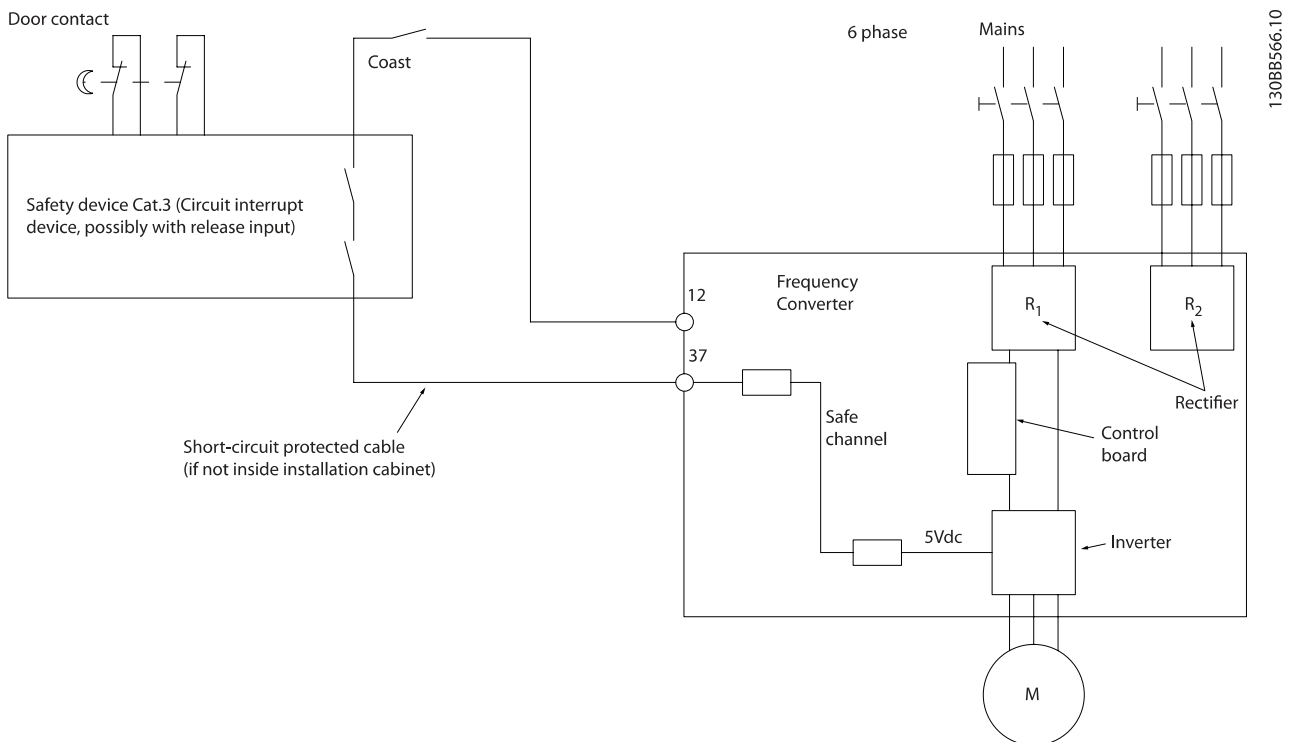
Illustration 2.2 Essential aspects of an installation to achieve a Stopping Category 0 (EN 60204-1) with safety Category 3 (EN 954-1).

2.1.8 IT Mains

14-50 RFI Filter can be used to disconnect the internal RFI capacitors from the RFI filter to ground in the 380 - 500V frequency converters. If this is done it will reduce the RFI performance to A2 level. For the 525 - 690V frequency converters, *14-50 RFI Filter* has no function. The RFI switch cannot be opened.

3 How to Install

3.1 Pre-installation

3.1.1 Planning the Installation Site

NOTE

Before performing the installation it is important to plan the installation of the frequency converter. Neglecting this may result in extra work during and after installation.

Select the best possible operation site by considering the following (see details on the following pages, and the respective Design Guides):

- Ambient operating temperature
- Installation method
- How to cool the unit
- Position of the frequency converter
- Cable routing
- Ensure the power source supplies the correct voltage and necessary current
- Ensure that the motor current rating is within the maximum current from the frequency converter
- If the frequency converter is without built-in fuses, ensure that the external fuses are rated correctly.

3.1.2 Receiving the Frequency Converter

When receiving the frequency converter please make sure that the packaging is intact, and be aware of any damage that might have occurred to the unit during transport. In case damage has occurred, contact immediately the shipping company to claim the damage.

3.1.3 Transportation and Unpacking

Before unpacking the frequency converter it is recommended that it is located as close as possible to the final installation site.
Remove the box and handle the frequency converter on the pallet, as long as possible.

3.1.4 Lifting

Always lift the frequency converter in the dedicated lifting eyes. For all D and E2 (IP00) enclosures, use a bar to avoid bending the lifting holes of the frequency converter.
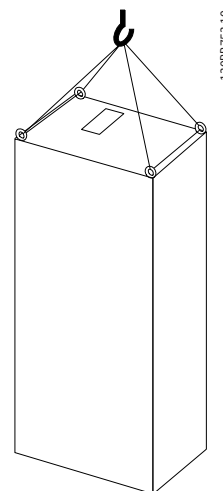
Illustration 3.1 Recommended lifting method, frame size F8.
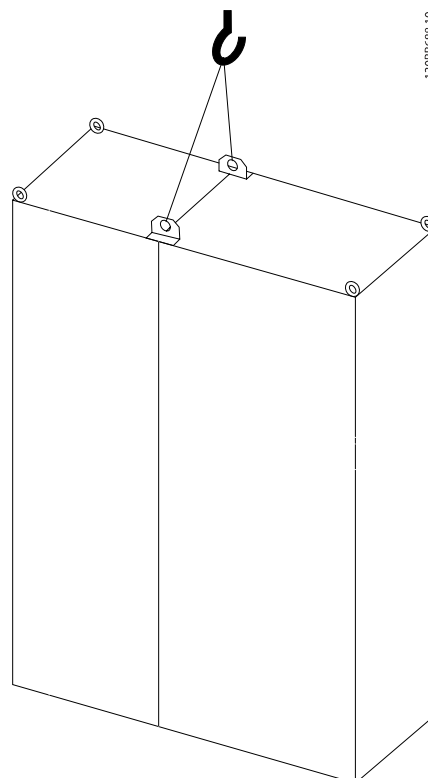
Illustration 3.2 Recommended lifting method, frame size F9/F10.
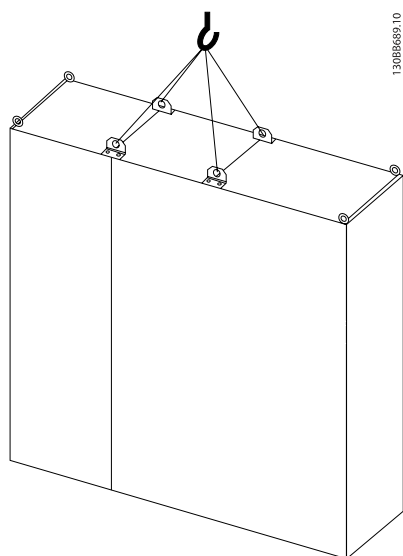
Illustration 3.3 Recommended lifting method, frame size F11/F12/F13.

NOTE

Note the plinth is provided in the same packaging as the frequency converter but is not attached during shipment. The plinth is required to allow airflow to the drive to provide proper cooling. The F frames should be positioned on top of the plinth in the final installation location. The angle from the top of the drive to the lifting cable should be 60° C or greater.

In addition to the drawings above a spreader bar is an acceptable way to lift the F Frame.

3.1.5 Mechanical Dimensions

3

IP 21/54 - NEMA 1/12

F11

IP 21/54 - NEMA 1/12

F10

130BB570.10

607

3940 m3/Hr 2320 CFM

IP/21 NEMA 1 4200 m3/Hr 2472 CFM

IP/54 NEMA 12 3150 m3/Hr 1854 CFM

2400

2280
2205
1497

130BB569.10

607

3940 m3/Hr 2320 CFM

IP/21 NEMA 1 2800 m3/Hr 1648 CFM

IP/54 NEMA 12 2100 m3/Hr 1236 CFM

1600

2280
2205
1497

All dimensions in mm

3

IP 21/54 - NEMA 1/12

F13

130BB572.10

607

4925 m3/Hr 2900 CFM

IP/21 NEMA 1
4200 m3/Hr
2472 CFM

IP/54 NEMA 12
3150 m3/Hr
1854 CFM

2800

2205

1497

2280

IP 21/54 - NEMA 1/12

F12

130BB571.10

607

4925 m3/Hr 2900 CFM

IP/21 NEMA 1
2800 m3/Hr
2472 CFM

IP/54 NEMA 12
3150 m3/Hr
1854 CFM

2000

2205

1497

2280

All dimensions in mm

Mechanical dimensions, frame sizes E and F							
Frame size			F8	F9	F10	F11	F12	F13
High overload rated power - 160% overload torque			250 - 400kW (380 - 500V) 355 - 560kW (525-690V)	250 - 400kW (380 - 500V) 355 - 560kW (525-690V)	450 - 630kW (380 - 500V) 630 - 800kW (525-690V)	710 - 800kW (380 - 500V) 900 - 1200kW (525-690V)	450 - 630kW (380 - 500V) 630 - 800kW (525-690V)	710 - 800kW (380 - 500V) 900 - 1200kW (525-690V)
IP NEMA			21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12	21, 54 Type 12
Shipping dimensions [mm]		Height	2324	2324	2324	2324	2324	2324
		Width	970	1568	1760	2559	2160	2960
		Depth	1130	1130	1130	1130	1130	1130
Drive dimensions [mm]		Height	2204	2204	2204	2204	2204	2204
		Width	800	1400	1600	2200	2000	2600
		Depth	606	606	606	606	606	606
Max weight [kg]			440	656	880	1096	1022	1238

NOTE

The F frames have six different sizes, F8, F9, F10, F11, F12 and F13 The F8, F10 and F12 consist of an inverter cabinet on the right and rectifier cabinet on the left. The F9, F11 and F13 have an additional options cabinet left of the rectifier cabinet. The F9 is an F8 with an additional options cabinet. The F11 is an F10 with an additional options cabinet. The F13 is an F12 with an additional options cabinet.

3

3.2 Mechanical Installation

Preparation of the mechanical installation of the frequency converter must be done carefully to ensure a proper result and to avoid additional work during installation. Start taking a close look at the mechanical drawings at the end of this instruction to become familiar with the space demands.

3.2.1 Tools Needed

To perform the mechanical installation the following tools are needed:

- Drill with 10 or 12mm drill

- Tape measure

- Wrench with relevant metric sockets (7-17mm)

- Extensions to wrench

- Sheet metal punch for conduits or cable glands in IP 21/Nema 1 and IP 54 units

- Lifting bar to lift the unit (rod or tube max. Ø 25mm (1 inch), able to lift minimum 400kg (880lbs)).

- Crane or other lifting aid to place the frequency converter in position

- A Torx T50 tool is needed to install the E1 in IP21 and IP54 enclosure types.

3.2.2 General Considerations

Space
Ensure proper space above and below the frequency converter to allow airflow and cable access. In addition space in front of the unit must be considered to enable opening of the door of the panel.
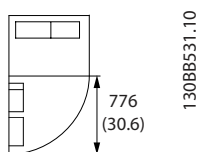
Illustration 3.4 Space in front of IP21/IP54 enclosure type, frame size F8
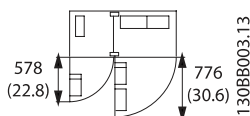
Illustration 3.5 Space in front of IP21/IP54 enclosure type, frame size F9
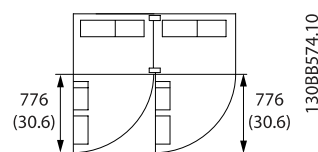
Illustration 3.6 Space in front of IP21/IP54 enclosure type, frame size F10
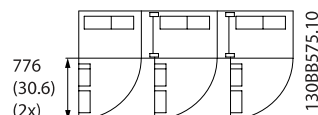
Illustration 3.7 Space in front of IP21/IP54 enclosure type, frame size F11
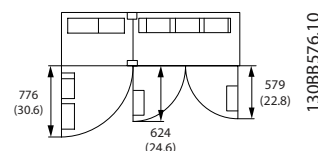
Illustration 3.8 Space in front of IP21/IP54 enclosure type, frame size F12
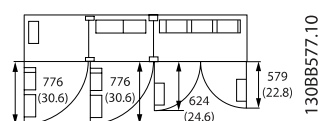
Illustration 3.9 Space in front of IP21/IP54 enclosure type, frame size F13

Wire access
Ensure that proper cable access is present including necessary bending allowance.

NOTE

All cable lugs/ shoes must mount within the width of the terminal bus bar.

3.2.3 Terminal Locations

The F enclosures have six different sizes, F8, F9, F10, F11, F12 and F13 The F8, F10 and F12 consist of an inverter cabinet on the right and rectifier cabinet on the left. The F9, F11 and F13 have an additional options cabinet left of the rectifier cabinet. The F9 is an F8 with an additional options cabinet. The F11 is an F10 with an additional options cabinet. The F13 is an F12 with an additional options cabinet.

Terminal locations - Inverter and Rectifier Frame size F8 and F9
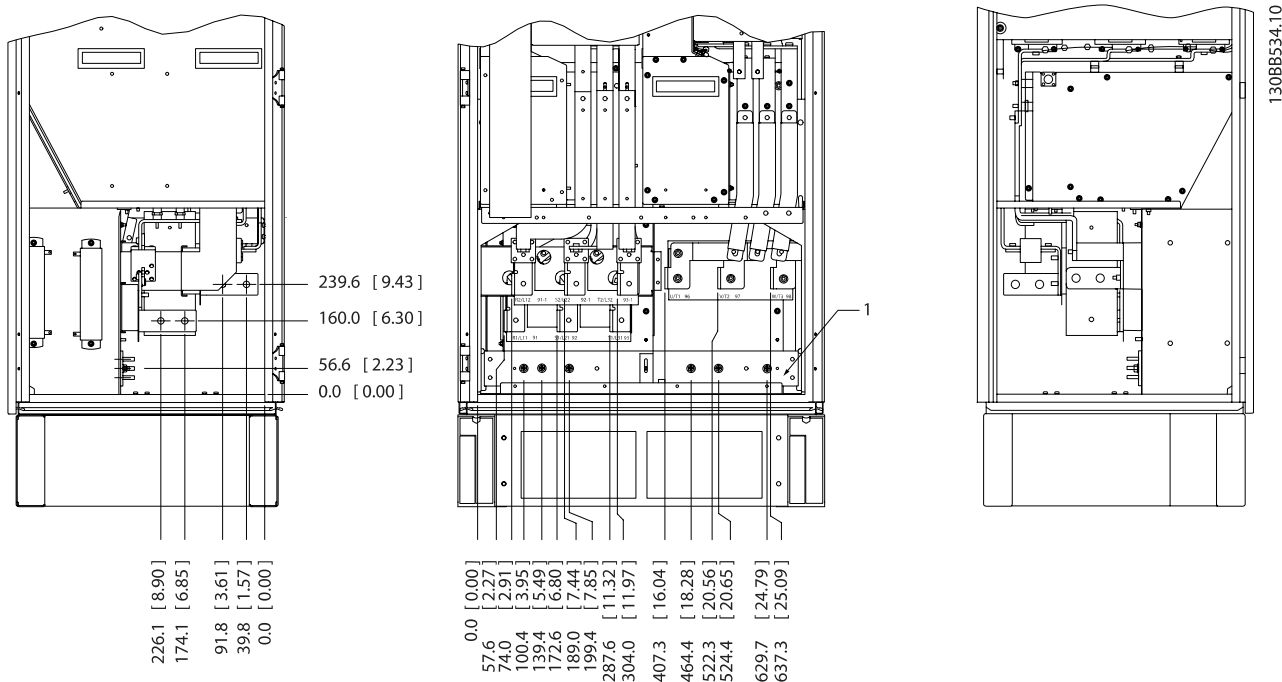
Illustration 3.10 Terminal locations - Inverter and Rectifier Cabinet - F8 and F9 (front, left and right side view). The gland plate is 42mm below .0 level.
1) Earth ground bar

3

Terminal locations – Inverter Frame size F10 and F11
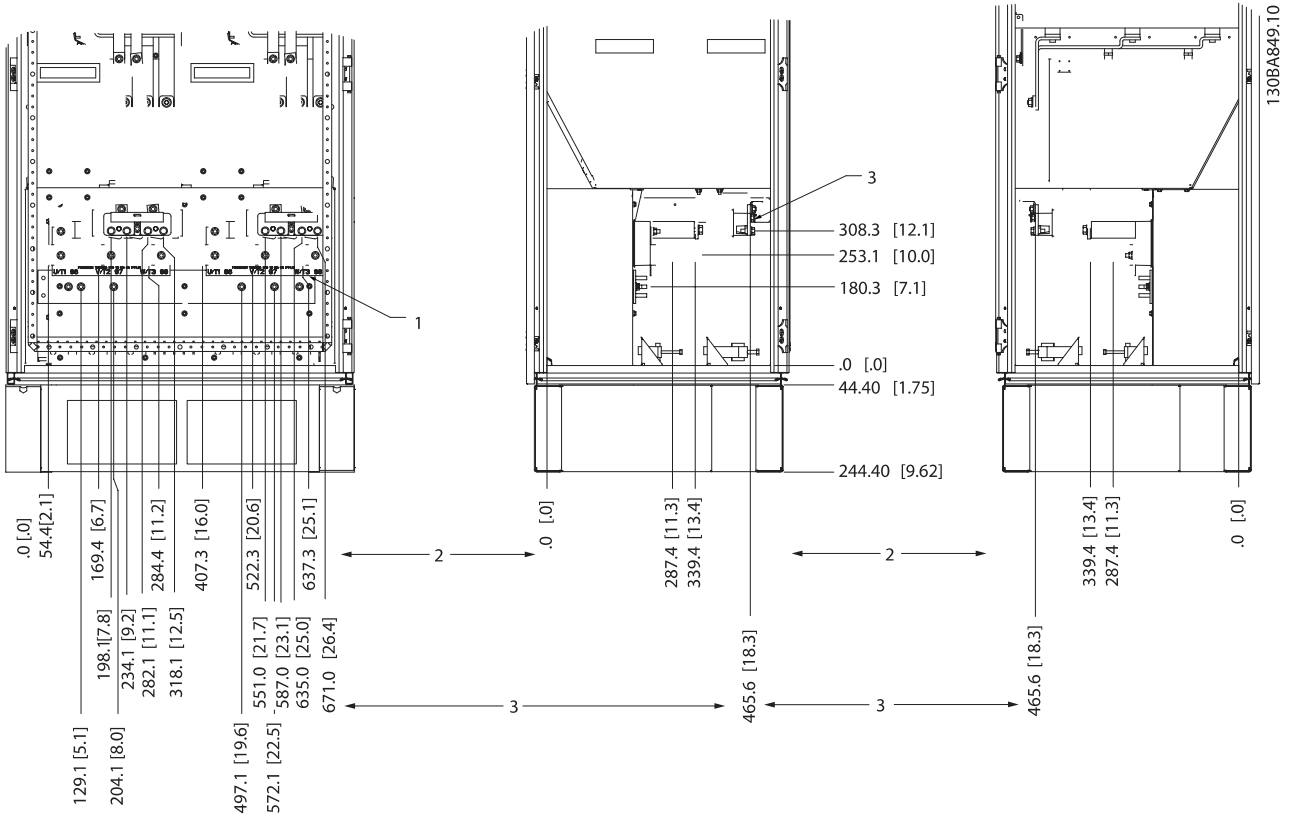
Illustration 3.11 Terminal locations – Inverter Cabinet (front, left and right side view). The gland plate is 42mm below .0 level.
1) Earth ground bar
2) Motor terminals
3) Brake terminals

Terminal locations – Inverter Frame size F12 and F13
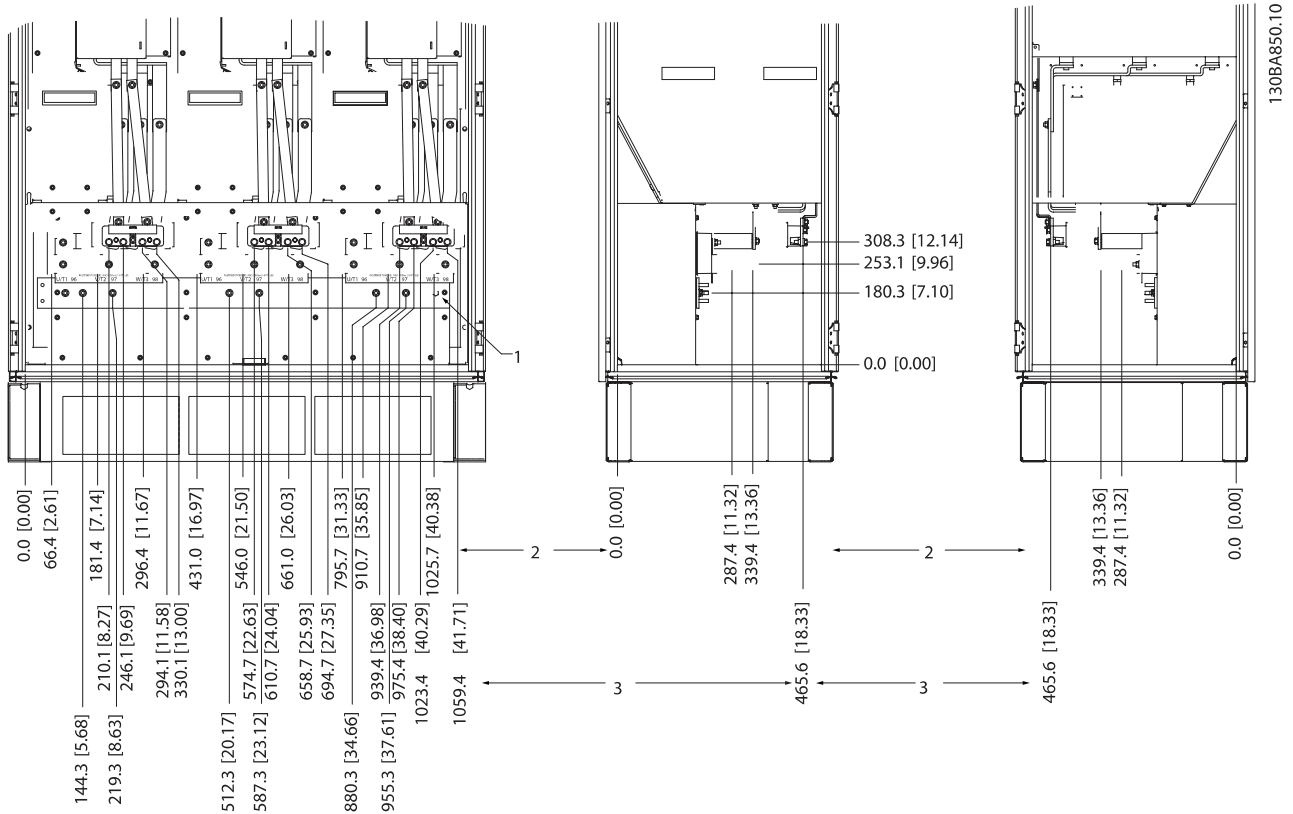
Illustration 3.12 Terminal locations – Inverter Cabinet (front, left and right side view). The gland plate is 42mm below .0 level.
1) Earth ground bar

Terminal locations – Rectifier (F10, F11, F12 and F13)
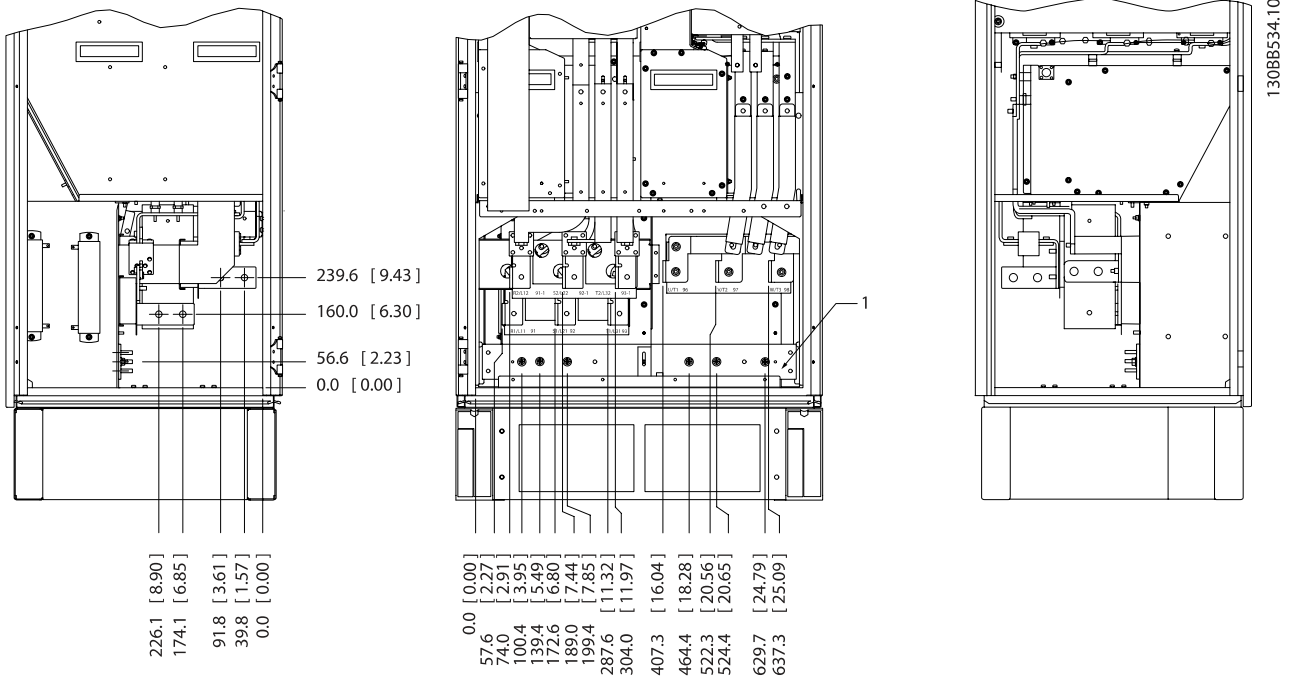
Illustration 3.13 Terminal locations – Rectifier (Left side, front and right side view). The gland plate is 42mm below .0 level.
1) Loadshare Terminal (-)
2) Earth ground bar
3) Loadshare Terminal (+)

Terminal locations – Options Cabinet Frame Size F9
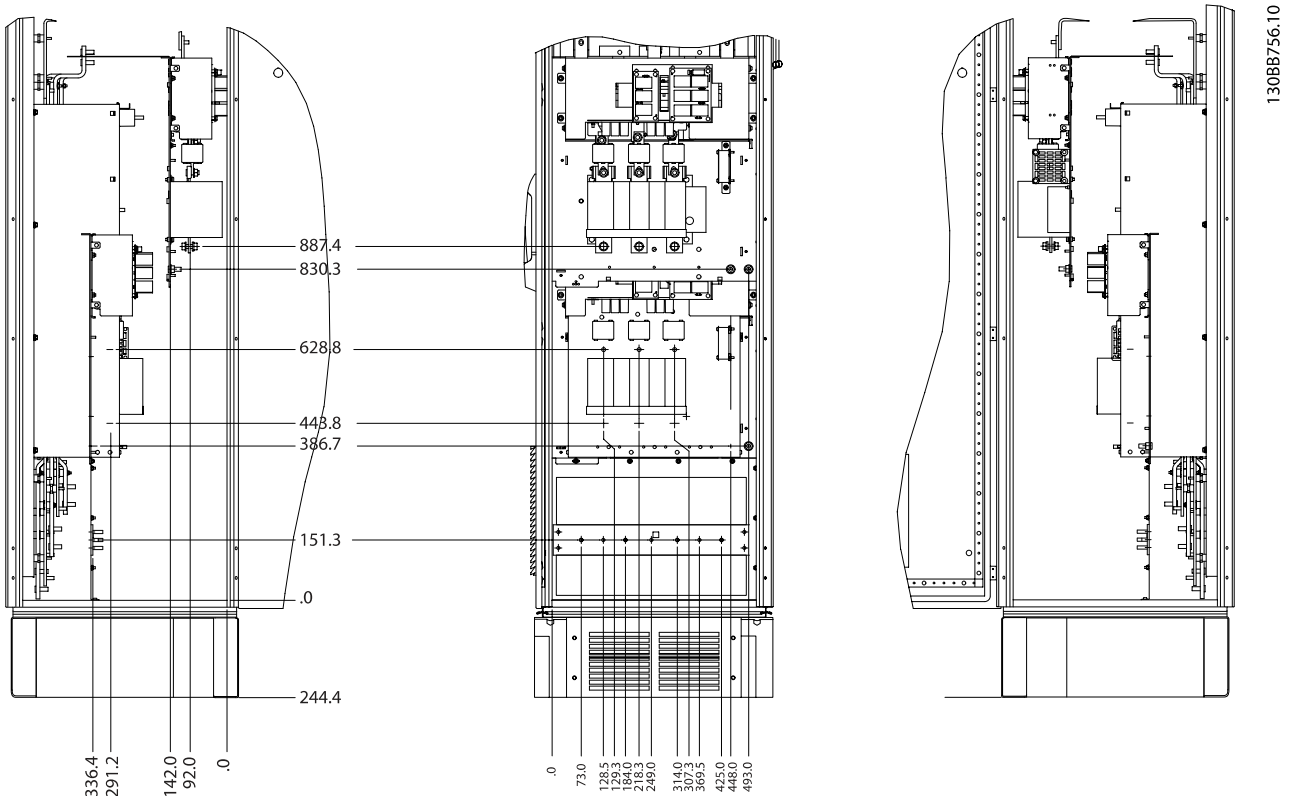
Illustration 3.14 Terminal locations – Options Cabinet (Left side, front and right side view).

Terminal locations – Options Cabinet Frame Size F11/F13
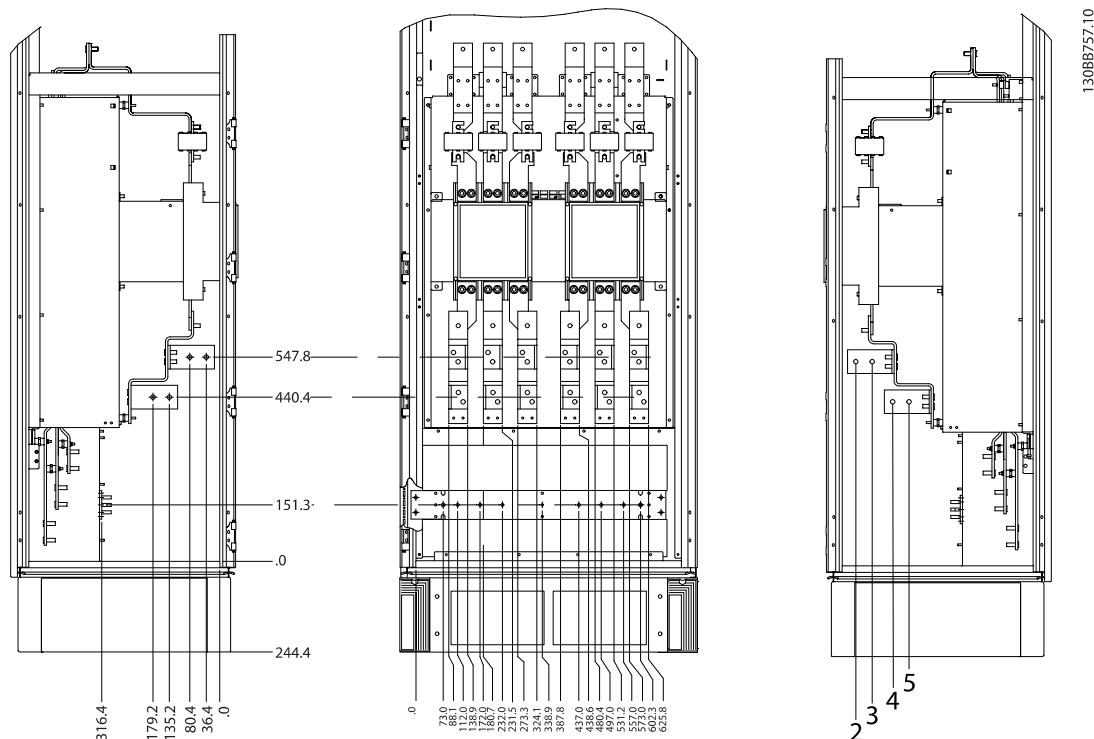
Illustration 3.15 Terminal locations – Options Cabinet (Left side, front and right side view).

Power size	2	3	4	5
450kW (480V), 630-710kW (690V)	34.9	86.9	122.2	174.2
500-800kW (480V), 800-1000kW (690V)	46.3	98.3	119.0	171.0

Table 3.1 Dimension for terminal

3

3.2.4 Cooling and Airflow

Cooling

Cooling can be obtained in different ways, by using the cooling ducts in the bottom and the top of the unit, by taking air in and out the back of the unit or by combining the cooling possibilities.

Duct cooling

A dedicated option has been developed to optimize installation of frequency converters in Rittal TS8 enclosures utilizing the fan of the frequency converter for forced air cooling of the backchannel. The air out the top of the enclosure could but ducted outside a facility so the heat loses from the backchannel are not dissipated within the control room reducing air-conditioning requirements of the facility.

Please see *Installation of Duct Cooling Kit in Rittal enclosures*, for further information.

Back cooling

The backchannel air can also be ventilated in and out the back of a Rittal TS8 enclosure. This offers a solution where the backchannel could take air from outside the facility and return the heat loses outside the facility thus reducing air-conditioning requirements.

Airflow

The necessary airflow over the heat sink must be secured. The flow rate is shown below.

Enclosure protection	Door fan(s) / Top fan airflow	Heatsink fan(s)
IP21 / NEMA 1	700 m^3/h (412 cfm)*	985 m^3/h (580 cfm)*
IP54 / NEMA 12	525 m^3/h (309 cfm)*	985 m^3/h (580 cfm)*

Table 3.2 Heatsink Air Flow

* Airflow per fan. Frame size F contain multiple fans.

NOTE
The fan runs for the following reasons:

1. **AMA**
2. **DC Hold**
3. **Pre-Mag**
4. **DC Brake**
5. **60% of nominal current is exceeded**
6. **Specific heatsink temperature exceeded (power size dependent).**

Once the fan is started it will run for minimum 10 minutes.

External ducts

If additional duct work is added externally to the Rittal cabinet the pressure drop in the ducting must be calculated. Use the charts below to derate the frequency converter according to the pressure drop.
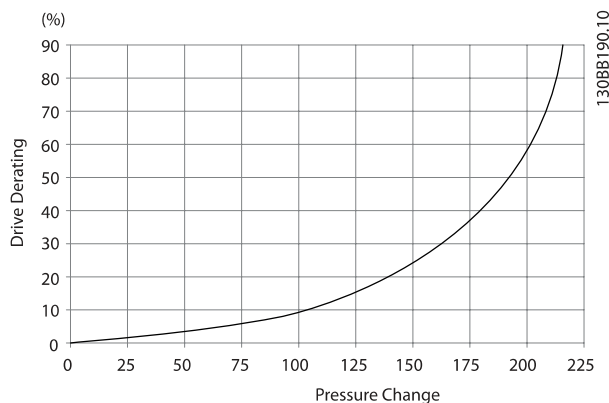
Illustration 3.16 F frame Derating vs. Pressure Change

Drive air flow: 985 m^3/h (580 cfm)

3.2.5 Gland/Conduit Entry - IP21 (NEMA 1) and IP54 (NEMA12)

Cables are connected through the gland plate from the bottom. Remove the plate and plan where to place the entry for the glands or conduits. Prepare holes in the marked area on the drawing.

NOTE
The gland plate must be fitted to the frequency converter to ensure the specified protection degree, as well as ensuring proper cooling of the unit. If the gland plate is not mounted, the frequency converter may trip on Alarm 69, Pwr. Card Temp
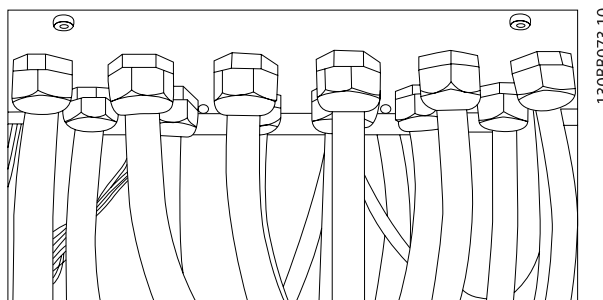
Illustration 3.17 Example of proper installation of the gland plate.

Frame size F8
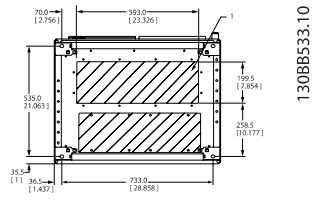
Frame size F9

Frame size F10

Frame size F11

130BB695.10

Frame size F12

130BB696.10

Frame size F13

130BB697.10
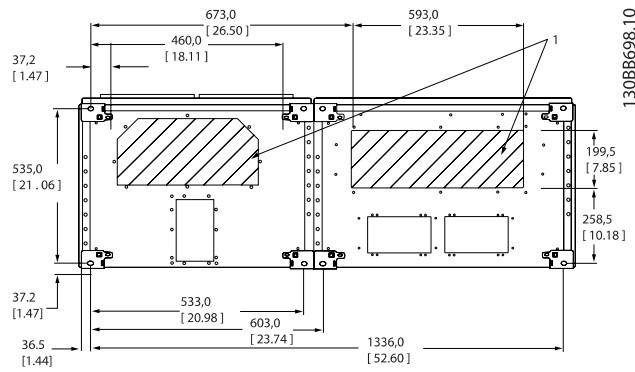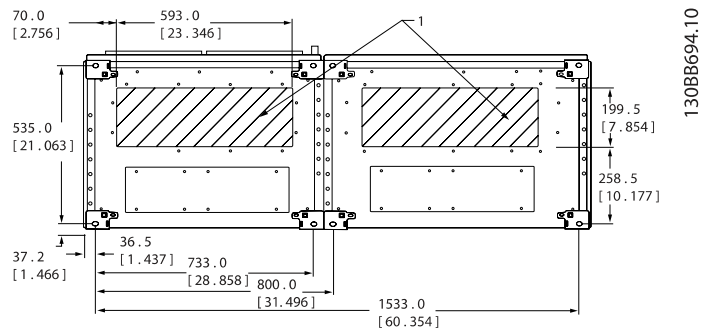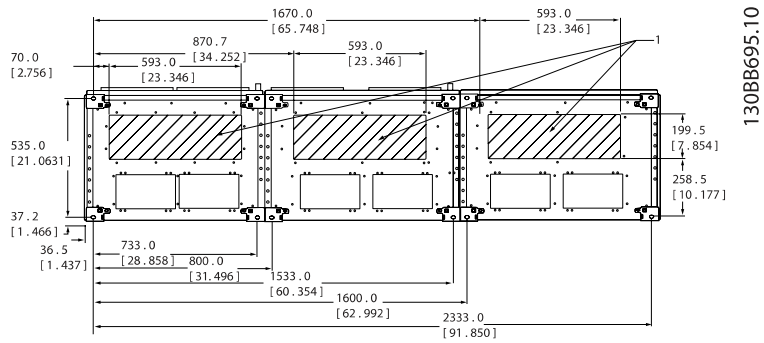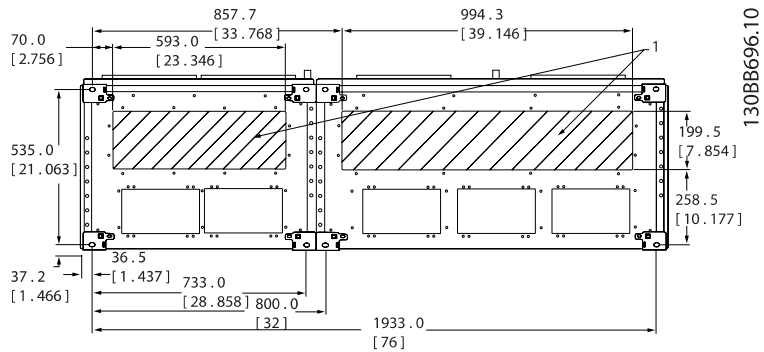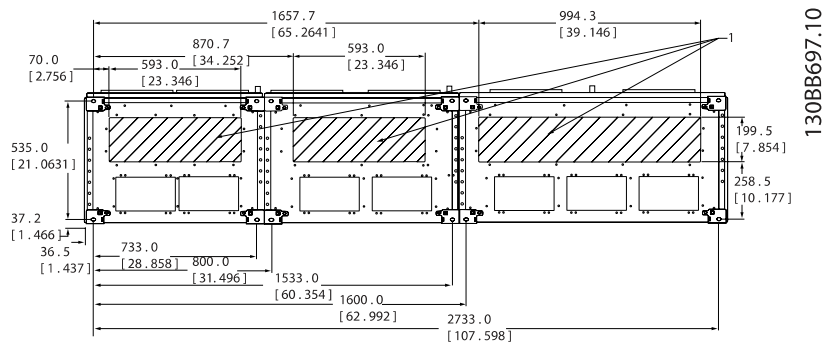
F8-F13: Cable entries viewed from the bottom of the frequency converter - 1) Place conduits in marked areas

3.3 Field Installation of Options

Space Heaters and Thermostat
Mounted on the cabinet interior of frame size F10-F13 frequency converters, space heaters controlled via automatic thermostat help control humidity inside the enclosure, extending the lifetime of drive components in damp environments. The thermostat default settings turn on the heaters at 10°C (50°F) and turn them off at 15.6°C (60°F).

Cabinet Light with Power Outlet
A light mounted on the cabinet interior of frame size F10-F13 frequency converters increase visibility during servicing and maintenance. The housing the light includes a power outlet for temporarily powering tools or other devices, available in two voltages:

- 230V, 50Hz, 2.5A, CE/ENEC

- 120V, 60Hz, 5A, UL/cUL

Transformer Tap Setup
If the Cabinet Light & Outlet and/or the Space Heaters & Thermostat are installed Transformer T1 requires the taps to be set to the proper input voltage. A 380-480/ 500V unit will initially be set to the 525V tap and a 525-690V unit will be set to the 690V tap to insure no over-voltage of secondary equipment occurs if the tap is not changed prior to power being applied. See *Table 3.3* to set the proper tap at terminal T1 located in the rectifier cabinet. For location in the frequency converter, see illustration of rectifier in the *Power Connections* section.

Input Voltage Range	Tap to Select
380V-440V	400V
441V-490V	460V
491V-550V	525V
551V-625V	575V
626V-660V	660V
661V-690V	690V

NAMUR Terminals
NAMUR is an international association of automation technology users in the process industries, primarily chemical and pharmaceutical industries in Germany. Selection of this option provides terminals organized and labeled to the specifications of the NAMUR standard for drive input and output terminals. This requires MCB 112 PTC Thermistor Card and MCB 113 Extended Relay Card.

RCD (Residual Current Device)
Uses the core balance method to monitor ground fault currents in grounded and high-resistance grounded systems (TN and TT systems in IEC terminology). There is a pre-warning (50% of main alarm set-point) and a main alarm set-point. Associated with each set-point is an SPDT alarm relay for external use. Requires an external "window-type" current transformer (supplied and installed by customer).

- Integrated into the drive's safe-stop circuit

- IEC 60755 Type B device monitors AC, pulsed DC, and pure DC ground fault currents

- LED bar graph indicator of the ground fault current level from 10–100% of the set-point

- Fault memory

- TEST / RESET button

Insulation Resistance Monitor (IRM)
Monitors the insulation resistance in ungrounded systems (IT systems in IEC terminology) between the system phase conductors and ground. There is an ohmic pre-warning and a main alarm set-point for the insulation level. Associated with each set-point is an SPDT alarm relay for external use. Note: only one insulation resistance monitor can be connected to each ungrounded (IT) system.

- Integrated into the drive's safe-stop circuit

- LCD display of the ohmic value of the insulation resistance

- Fault Memory

- INFO, TEST, and RESET buttons

IEC Emergency Stop with Pilz Safety Relay
Includes a redundant 4-wire emergency-stop push-button mounted on the front of the enclosure and a Pilz relay that monitors it in conjunction with the drive's safe-stop circuit and the mains contactor located in the options cabinet.

Manual Motor Starters
Provide 3-phase power for electric blowers often required for larger motors. Power for the starters is provided from the load side of any supplied contactor, circuit breaker, or disconnect switch. Power is fused before each motor starter, and is off when the incoming power to the drive is off. Up to two starters are allowed (one if a 30A, fuse-protected circuit is ordered). Integrated into the drive's safe-stop circuit. Unit features include:

- Operation switch (on/off)

- Short-circuit and overload protection with test function

- Manual reset function

30 Ampere, Fuse-Protected Terminals

- 3-phase power matching incoming mains voltage for powering auxiliary customer equipment

- Not available if two manual motor starters are selected

- Terminals are off when the incoming power to the drive is off

- Power for the fused protected terminals will be provided from the load side of any supplied contactor, circuit breaker, or disconnect switch.

3

24V DC Power Supply

- 5A, 120W, 24V DC

- Protected against output over-current, overload, short circuits, and over-temperature

- For powering customer-supplied accessory devices such as sensors, PLC I/O, contactors, temperature probes, indicator lights, and/or other electronic hardware

- Diagnostics include a dry DC-ok contact, a green DC-ok LED, and a red overload LED

External Temperature Monitoring

Designed for monitoring temperatures of external system components, such as the motor windings and/or bearings. Includes eight universal input modules plus two dedicated thermistor input modules. All ten modules are integrated into the drive's safe-stop circuit and can be monitored via a fieldbus network (requires the purchase of a separate module/bus coupler).

Universal inputs (8)

Signal types:
- RTD inputs (including Pt100), 3-wire or 4-wire

- Thermocouple

- Analog current or analog voltage

Additional features:
- One universal output, configurable for analog voltage or analog current

- Two output relays (N.O.)

- Dual-line LC display and LED diagnostics

- Sensor lead wire break, short-circuit, and incorrect polarity detection

- Interface setup software

Dedicated thermistor inputs (2)

Features:

- Each module capable of monitoring up to six thermistors in series

- Fault diagnostics for wire breakage or short-circuits of sensor leads

- ATEX/UL/CSA certification

- A third thermistor input can be provided by the PTC Thermistor Option Card MCB 112, if necessary

3.4 Electrical Installation

3.4.1 Power Connections

Cabling and Fusing

NOTE

Cables General
All cabling must comply with national and local regulations on cable cross-sections and ambient temperature. UL applications require 75°C copper conductors. 75 and 90°C copper conductors are thermally acceptable for the frequency converter to use in non UL applications.

The power cable connections are situated as shown below. Dimensioning of cable cross section must be done in accordance with the current ratings and local legislation. See the *Specifications* section for details.

For protection of the frequency converter, the recommended fuses must be used or the unit must be with built-in fuses. Recommended fuses can be seen in the tables of the fuse section. Always ensure that proper fusing is made according to local regulation.

The mains connection is fitted to the mains switch if this is included.
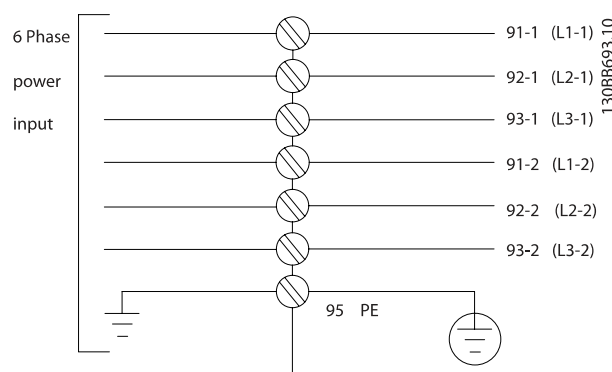
NOTE

The motor cable must be screened/armoured. If an unscreened/unarmoured cable is used, some EMC requirements are not complied with. Use a screened/armoured motor cable to comply with EMC emission specifications. For more information, see *EMC specifications* in the *Design Guide*.

See section *General Specifications* for correct dimensioning of motor cable cross-section and length.
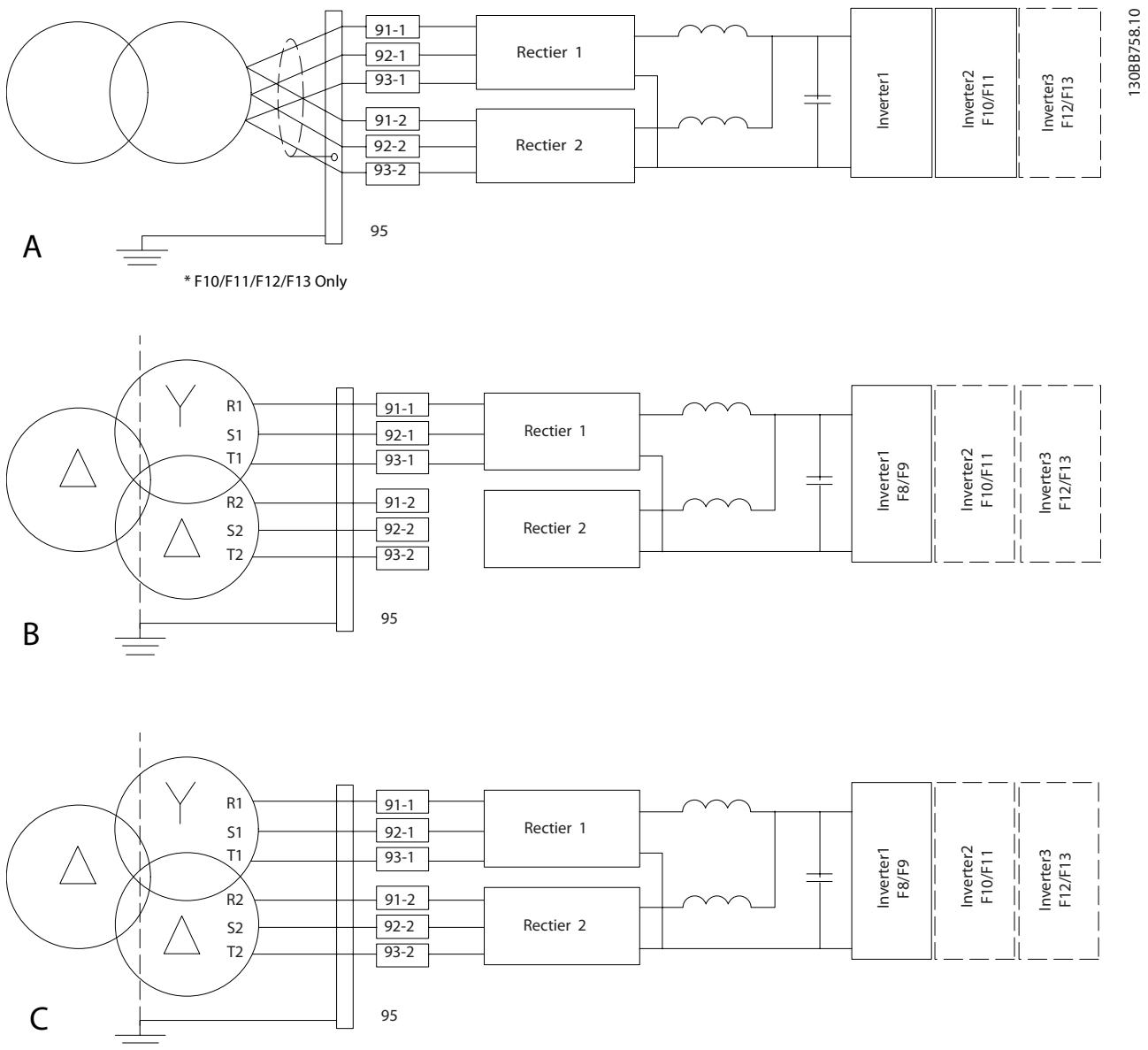
Illustration 3.18

A) 6-Pulse Connection[1), 2), 3)]

B) Modified 6-Pulse Connection[2), 3), 4)]

C) 12-Pulse Connection[3), 5)]

Notes:

1) Parallel connection shown. A single three phase cable may be used with sufficient carrying capability. Shorting busbars must be installed.

2) 6-pulse connection eliminates the harmonics reduction benefits of the 12-pulse rectifier.

3) Suitable for IT and TN mains connection.

4) In the unlikely event that one of the 6-pulse modular rectifiers becomes inoperable, it is possible to operate the drive at reduced load with a single 6-pulse rectifier. Contact factory for reconnection details.

5) No paralleling of mains cabling is shown here.

3

Screening of cables:

Avoid installation with twisted screen ends (pigtails). They spoil the screening effect at higher frequencies. If it is necessary to break the screen to install a motor isolator or motor contactor, the screen must be continued at the lowest possible HF impedance.

Connect the motor cable screen to both the de-coupling plate of the frequency converter and to the metal housing of the motor.

Make the screen connections with the largest possible surface area (cable clamp). This is done by using the supplied installation devices within the frequency converter.

Cable-length and cross-section:

The frequency converter has been EMC tested with a given length of cable. Keep the motor cable as short as possible to reduce the noise level and leakage currents.

Switching frequency:

When frequency converters are used together with Sine-wave filters to reduce the acoustic noise from a motor, the switching frequency must be set according to the instruction in *14-01 Switching Frequency*.

Term. no.	96	97	98	99	
	U	V	W	PE[1]	Motor voltage 0-100% of mains voltage. 3 wires out of motor
	U1	V1	W1	PE[1]	Delta-connected
	W2	U2	V2		6 wires out of motor
	U1	V1	W1	PE[1]	Star-connected U2, V2, W2 U2, V2 and W2 to be interconnected separately.

[1]Protected Earth Connection

In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a frequency converter), fit a Sine-wave filter on the output of the frequency converter.
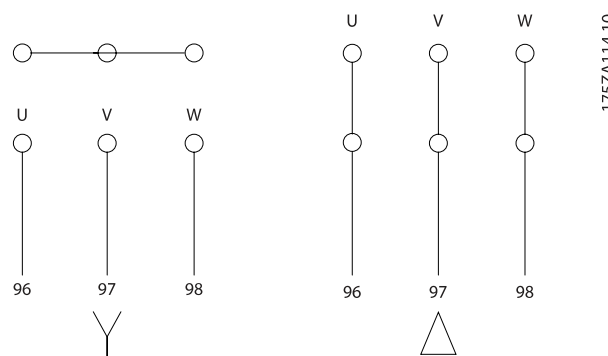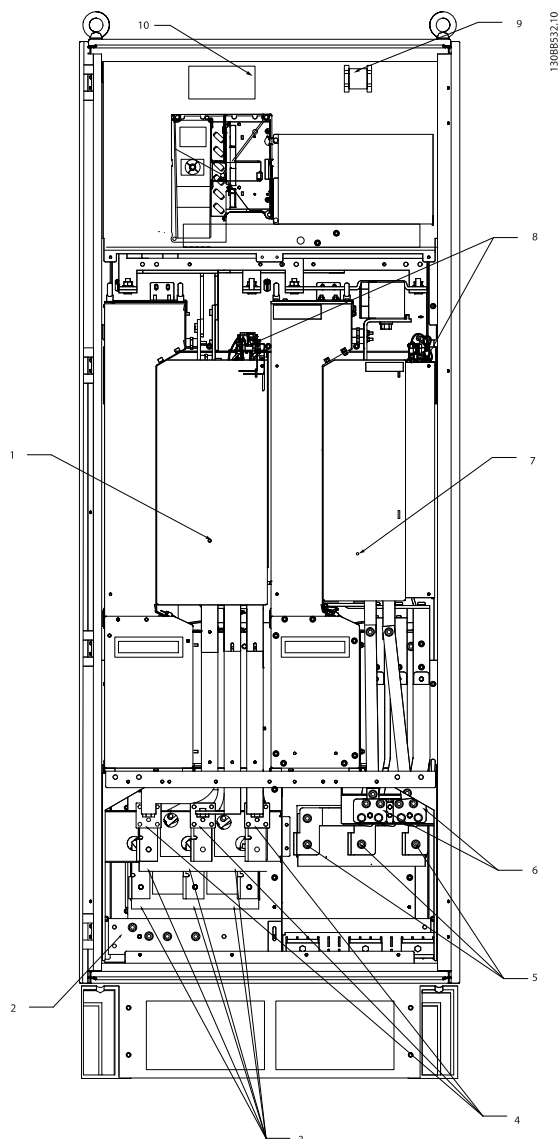
Illustration 3.19 Rectifier and Inverter Cabinet, frame size F8 and F9

1)	12-pulse rectifier module			5)	Motor connection			
2)	Ground / Earth PE Terminals				U	V	W	
3)	Line / Fuses				T1	T2	T3	
	R1	S1	T1		96	97	98	
	L1-1	L2-1	L3-1	6)	Brake Terminals			
	91-1	92-1	93-1		-R	+R		
4)	Line / Fuses				81	82		
	R2	S2	T2	7)	Inverter Module			
	L2-1	L2-2	L3-2	8)	SCR Enable / Disable			
	91-2	92-2	93-2	9)	Relay 1		Relay 2	
					01	02	03	04	05	06
				10)	Auxillary Fan			
					104	106		

3
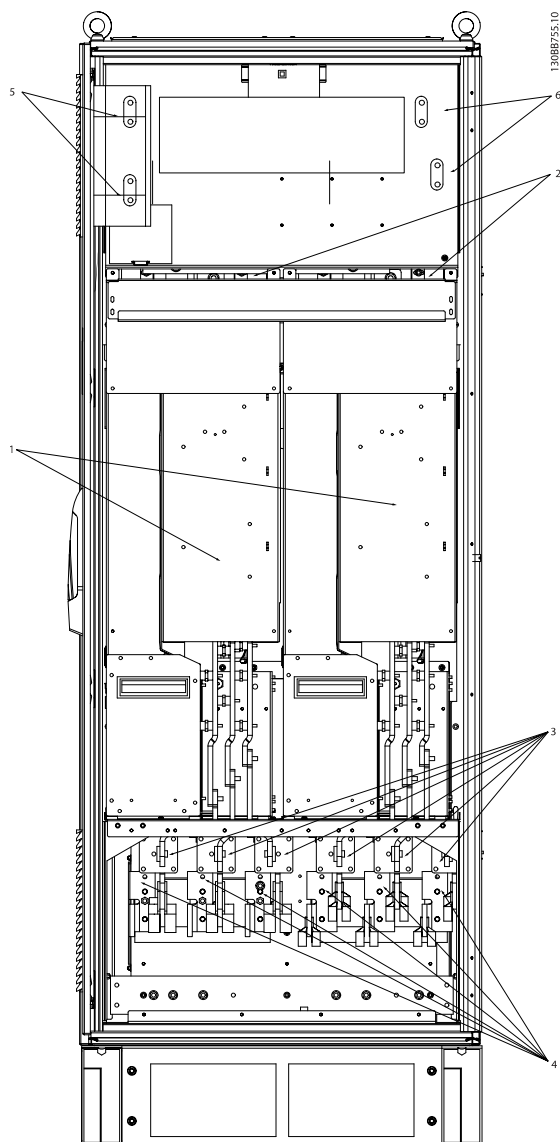
Illustration 3.20 Rectifier Cabinet, frame size F10 and F12

1)	12-pulse rectifier module		4)	Line		
2)	AUX Fan			R1 S1 T1 R2 S2 T2		
	100 101 102 103			L1-1 L2-1 L3-1 L1-2 L2-2 L3-2		
	L1 L2 L1 L2		5)	DC Bus Connections for common DC Bus		
3)	Line Fuses F10/F12 (6 Pieces)			DC+ DC-		
			6)	DC Bus Connections for common DC Bus		
				DC+ DC-		
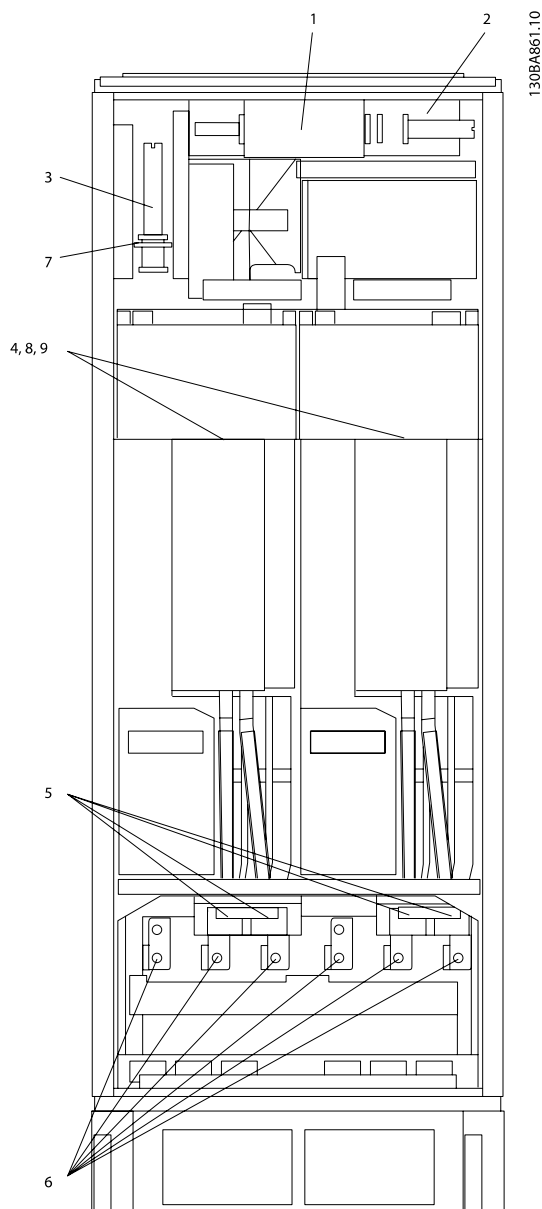
Illustration 3.21 Inverter Cabinet, frame size F10 and F11

1)	External Temperature Monitoring			6)	Motor		
2)	AUX Relay				U	V	W
	01	02	03		96	97	98
	04	05	06		T1	T2	T3
3)	NAMUR			7)	NAMUR Fuse. See fuse tables for part numbers		
4)	AUX Fan			8)	Fan Fuses. See fuse tables for part numbers		
	100 101 102 103			9)	SMPS Fuses. See fuse tables for part numbers		
	L1 L2 L1 L2						
5)	Brake						
	-R	+R					
	81	82					

3

Illustration 3.22 Inverter Cabinet, frame size F12 and F13

1)	External Temperature Monitoring			6)	Motor		
2)	AUX Relay				U	V	W
	01	02	03		96	97	98
	04	05	06		T1	T2	T3
3)	NAMUR			7)	NAMUR Fuse. See fuse tables for part numbers		
4)	AUX Fan			8)	Fan Fuses. See fuse tables for part numbers		
	100	101	102 103	9)	SMPS Fuses. See fuse tables for part numbers		
	L1	L2	L1 L2				
5)	Brake						
	-R	+R					
	81	82					

3

Illustration 3.23 Options Cabinet, frame size F9

1)	Pilz Relay Terminal						
2)	RCD or IRM Terminal						
3)	Mains/6 phase						
	R1	S1	T1	R2	S2	T2	
	91-1	92-1	93-1	91-2	92-2	93-2	
	L1-1	L2-1	L3-1	L1-2	L2-2	L3-2	

4)	Safety Relay Coil Fuse with PILS Relay
	See fuse tables for part numbers
5)	Line Fuses, (6 pieces)
	See fuse tables for part numbers
6)	2 x 3-phase manual disconnect

3
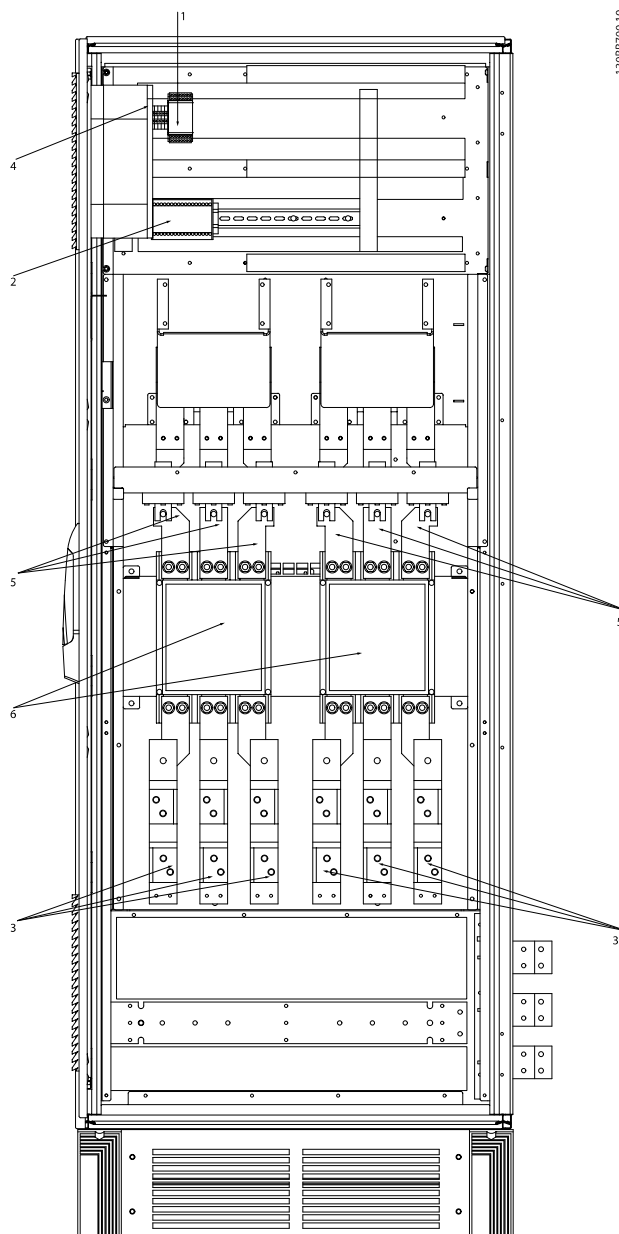
Illustration 3.24 Options Cabinet, frame size F11 and F13

1)	Pilz Relay Terminal					4)	Safety Relay Coil Fuse with PILS Relay
2)	RCD or IRM Terminal						See fuse tables for part numbers
3)	Mains/6 phase					5)	Line Fuses, (6 pieces)
	R1	S1	T1	R2	S2	T2	See fuse tables for part numbers
	91-1	92-1	93-1	91-2	92-2	93-2	6) 2 x 3-phase manual disconnect
	L1-1	L2-1	L3-1	L1-2	L2-2	L3-2	

3.4.2 Earthing

The following basic issues need to be considered when installing a frequency converter, so as to obtain electro-magnetic compatibility (EMC).

- Safety earthing: Please note that the frequency converter has a high leakage current and must be earthed appropriately for safety reasons. Apply local safety regulations.

- High-frequency earthing: Keep the earth wire connections as short as possible.

Connect the different earth systems at the lowest possible conductor impedance. The lowest possible conductor impedance is obtained by keeping the conductor as short as possible and by using the greatest possible surface area. The metal cabinets of the different devices are mounted on the cabinet rear plate using the lowest possible HF impedance. This avoids having different HF voltages for the individual devices and avoids the risk of radio interference currents running in connection cables that may be used between the devices. The radio interference will have been reduced.

In order to obtain a low HF impedance, use the fastening bolts of the devices as HF connection to the rear plate. It is necessary to remove insulating paint or similar from the fastening points.

3.4.3 Extra Protection (RCD)

ELCB relays, multiple protective earthing or earthing can be used as extra protection, provided that local safety regulations are complied with.

In the case of an earth fault, a DC component may develop in the fault current.

If ELCB relays are used, local regulations must be observed. Relays must be suitable for protection of 3-phase equipment with a bridge rectifier and for a brief discharge on power-up.

See also the section *Special Conditions* in the Design Guide.

3.4.4 RFI Switch

Mains supply isolated from earth
If the frequency converter is supplied from an isolated mains source (IT mains, floating delta and grounded delta) or TT/TN-S mains with grounded leg, the RFI switch is recommended to be turned off (OFF) [1] via *14-50 RFI Filter* on the drive and *14-50 RFI Filter* on the filter. For further reference, see IEC 364-3. In case optimum EMC performance is needed, parallel motors are connected or the motor cable length is above 25 m, it is recommended to set *14-50 RFI Filter* to [ON].

[1] Not available for 525-600/690V frequency converters.
In OFF, the internal RFI capacities (filter capacitors) between the chassis and the intermediate circuit are cut off to avoid damage to the intermediate circuit and to reduce the earth capacity currents (according to IEC 61800-3).
Please also refer to the application note *VLT on IT mains, MN. 90.CX.02.* It is important to use isolation monitors that are capable for use together with power electronics (IEC 61557-8).

3.4.5 Torque

When tightening all electrical connections it is important to tighten with the correct torque. Too low or too high torque results in a poor electrical connection. Use a torque wrench to ensure correct torque
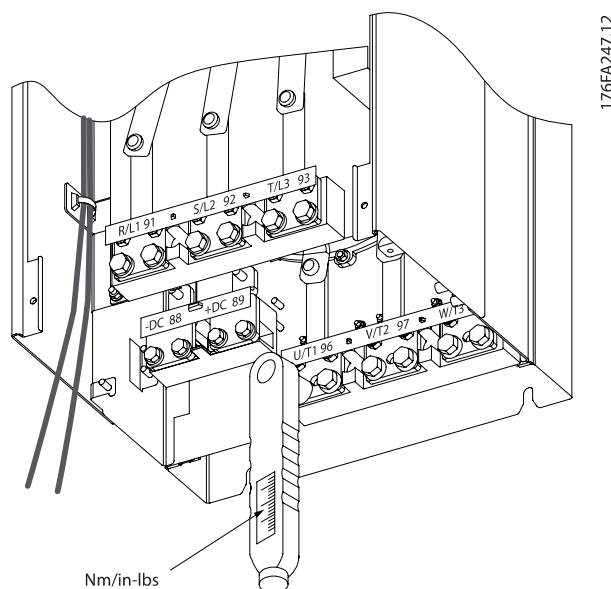
Illustration 3.25 Always use a torque wrench to tighten the bolts.

Frame size	Terminal	Torque	Bolt size
F8-F13	Mains Motor	19-40Nm (168-354in-lbs)	M10
	Brake Regen	8.5-20.5Nm (75-181in-lbs) 8.5-20.5Nm (75-181in-lbs)	M8 M8

Table 3.3 Tightening torques

3.4.6 Shielded Cables

NOTE
Danfoss recommends to use shielded cables between the LCL filter and the AFE unit. Unshielded cables can be between transformer and LCL filter input side.

It is important that shielded and armoured cables are connected in a proper way to ensure the high EMC immunity and low emissions.

The connection can be made using either cable glands or clamps:
- EMC cable glands: Generally available cable glands can be used to ensure an optimum EMC connection.
- EMC cable clamp: Clamps allowing easy connection are supplied with the frequency converter.

3.4.7 Motor Cable

The motor must be connected to terminals U/T1/96, V/T2/97, W/T3/98. Earth to terminal 99. All types of three-phase asynchronous standard motors can be used with a frequency converter unit. The factory setting is for clockwise rotation with the frequency converter output connected as follows:

Terminal No.	Function
96, 97, 98, 99	Mains U/T1, V/T2, W/T3
	Earth

- Terminal U/T1/96 connected to U-phase
- Terminal V/T2/97 connected to V-phase
- Terminal W/T3/98 connected to W-phase

F frame Requirements
F8/F9 requirements: The cables are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

F10/F11 requirements: Motor phase cable quantities must be multiples of 2, resulting in 2, 4, 6, or 8 (1 cable is not allowed) to obtain equal amount of wires attached to both inverter module terminals. The cables are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.

F12/F13 requirements: Motor phase cable quantities must be multiples of 3, resulting in 3, 6, 9, or 12 (1 or 2 cables are not allowed) to obtain equal amount of wires attached to each inverter module terminal. The wires are required to be equal length within 10% between the inverter module terminals and the first common point of a phase. The recommended common point is the motor terminals.
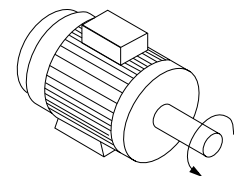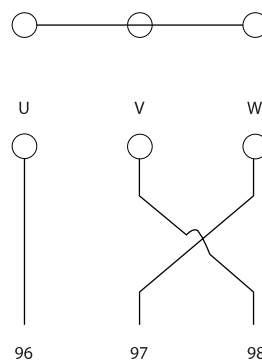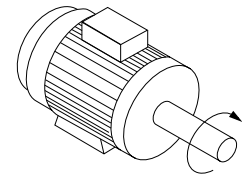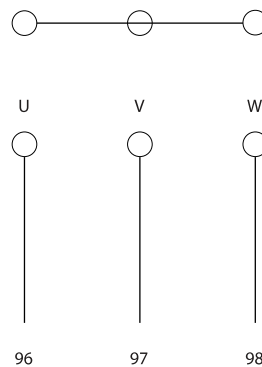
The direction of rotation can be changed by switching two phases in the motor cable or by changing the setting of *4-10 Motor Speed Direction*.

Motor rotation check can be performed using *1-28 Motor Rotation Check* and following the steps shown in the display.

Output junction box requirements: The length, minimum 2.5m, and quantity of cables must be equal from each inverter module to the common terminal in the junction box.

NOTE
If a retrofit applications requires unequal amount of wires per phase please consult the factory for requirements and documentation or use the top/bottom entry side cabinet option.

3.4.8 Brake Cable Drives with Factory Installed Brake Chopper Option

(Only standard with letter B in position 18 of typecode).

The connection cable to the brake resistor must be screened and the max. length from frequency converter to the DC bar is limited to 25m (82ft).

Terminal No.	Function
81, 82	Brake resistor terminals

The connection cable to the brake resistor must be screened. Connect the screen by means of cable clamps to the conductive back plate at the frequency converter and to the metal cabinet of the brake resistor.
Size the brake cable cross-section to match the brake torque. See also *Brake Instructions, MI.90.Fx.yy* and *MI.50.Sx.yy* for further information regarding safe installation.

⚠WARNING

Please note that voltages up to 1099 VDC, depending on the supply voltage, may occur on the terminals.

F Frame Requirements
The brake resistor(s) must be connected to the brake terminals in each inverter module.

3.4.9 Shielding against Electrical Noise

Before mounting the mains power cable, mount the EMC metal cover to ensure best EMC performance.

NOTE
The EMC metal cover is only included in units with an RFI filter.
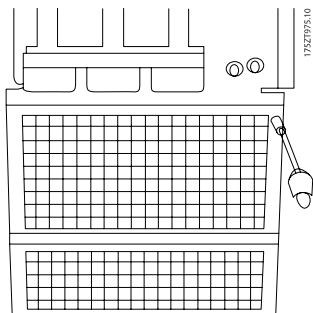
Illustration 3.26 Mounting of EMC shield.

3.4.10 Mains Connection

Mains must be connected to terminals 91-1, 92-1, 93-1, 91-2, 92-2 and 93-2 (see *Table 3.4*). Earth is connected to the terminal to the right of terminal 93.

Terminal No.	Function
91-1, 92-1, 93-1	Mains R1/L1-1, S1/L2-1, T1/L3-1
91-2, 92-2, 93-2	Mains R2/L1-2, S2/L2-2, T2/L3-2
94	Earth

NOTE
Check the name plate to ensure that the mains voltage of the frequency converter matches the power supply of your plant.

Ensure that the power supply can supply the necessary current to the frequency converter.

If the unit is without built-in fuses, ensure that the appropriate fuses have the correct current rating.

3.4.11 External Fan Supply

In case the frequency converter is supplied by DC or if the fan must run independently of the power supply, an external power supply can be applied. The connection is made on the power card.

Terminal No.	Function
100, 101	Auxiliary supply S, T
102, 103	Internal supply S, T

The connector located on the power card provides the connection of line voltage for the cooling fans. The fans are connected from factory to be supplied form a common AC line (jumpers between 100-102 and 101-103). If external supply is needed, the jumpers are removed and the supply is connected to terminals 100 and 101. A 5A fuse should be used for protection. In UL applications this should be LittleFuse KLK-5 or equivalent.

3.4.12 Fuses

Branch circuit protection:
In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be short-circuited and over-current protected according to national/international regulations.

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

Over-current protection
Provide overload protection to avoid fire hazard due to overheating of the cables in the installation. The frequency converter is equipped with an internal over-current

protection that can be used for upstream overload protection (UL-applications excluded). See *4-18 Current Limit*. Moreover, fuses or circuit breakers can be used to provide the over-current protection in the installation. Over-current protection must always be carried out according to national regulations.

UL compliance

The fuses below are suitable for use on a circuit capable of delivering 100,000 Arms (symmetrical), 240V, or 480V, or 500V, or 600V depending on the drive voltage rating. With the proper fusing the drive Short Circuit Current Rating (SCCR) is 100,000 Arms.

Power size	Frame	Rating		Bussmann	Spare Bussmann	Est. Fuse Power Loss [W]	
FC-302	Size	Voltage (UL)	Amperes	P/N	P/N	400V	460V
P250T5	F8/F9	700	700	170M4017	176F9179	25	19
P315T5	F8/F9	700	700	170M4017	176F9179	30	22
P355T5	F8/F9	700	700	170M4017	176F9179	38	29
P400T5	F8/F9	700	700	170M4017	176F9179	3500	2800
P450T5	F10/F11	700	900	170M6013	176F9180	3940	4925
P500T5	F10/F11	700	900	170M6013	176F9180	2625	2100
P560T5	F10/F11	700	900	170M6013	176F9180	3940	4925
P630T5	F10/F11	700	1500	170M6018	176F9181	45	34
P710T5	F12/F13	700	1500	170M6018	176F9181	60	45
P800T5	F12/F13	700	1500	170M6018	176F9181	83	63

Table 3.4 Line Fuses, 380-500V

Power size	Frame	Rating		Bussmann	Spare Bussmann	Est. Fuse Power Loss [W]	
FC-302	Size	Voltage (UL)	Amperes	P/N	P/N	600V	690V
P355T7	F8/F9	700	630	170M4016	176F9179	13	10
P400T7	F8/F9	700	630	170M4016	176F9179	17	13
P500T7	F8/F9	700	630	170M4016	176F9179	22	16
P560T7	F8/F9	700	630	170M4016	176F9179	24	18
P630T7	F10/F11	700	900	170M6013	176F9180	26	20
P710T7	F10/F11	700	900	170M6013	176F9180	35	27
P800T7	F10/F11	700	900	170M6013	176F9180	44	33
P900T7	F12/F13	700	1500	170M6018	176F9181	26	20
P1M0T7	F12/F13	700	1500	170M6018	176F9181	37	28
P1M2T7	F12/F13	700	1500	170M6018	176F9181	47	36

Table 3.5 Line Fuses, 525-690V

Size/Type	Bussmann PN*	Rating	Siba
P450	170M8611	1100 A, 1000 V	20 781 32.1000
P500	170M8611	1100 A, 1000 V	20 781 32.1000
P560	170M6467	1400 A, 700 V	20 681 32.1400
P630	170M6467	1400 A, 700 V	20 681 32.1400
P710	170M8611	1100 A, 1000 V	20 781 32.1000
P800	170M6467	1400 A, 700 V	20 681 32.1400

Table 3.6 Inverter module DC Link Fuses, 380-500V

Size/Type	Bussmann PN*	Rating	Siba
P630	170M8611	1100 A, 1000 V	20 781 32. 1000
P710	170M8611	1100 A, 1000 V	20 781 32. 1000
P800	170M8611	1100 A, 1000 V	20 781 32. 1000
P900	170M8611	1100 A, 1000 V	20 781 32. 1000
P1M0	170M8611	1100 A, 1000 V	20 781 32. 1000
P1M2	170M8611	1100A, 1000V	20 781 32.1000

Table 3.7 Inverter module DC Link Fuses, 525-690V

*170M fuses from Bussmann shown use the -/80 visual indicator, -TN/80 Type T, -/110 or TN/110 Type T indicator fuses of the same size and amperage may be substituted for external use.

Supplementary fuses

	Size/Type	Bussmann PN*	Rating	Alternative Fuses
2.5-4.0 A Fuse	P450-P800, 380-500 V	LPJ-6 SP or SPI	6 A, 600 V	Any listed Class J Dual Element, Time Delay, 6A
	P630-P1M2, 525-690 V	LPJ-10 SP or SPI	10 A, 600 V	Any listed Class J Dual Element, Time Delay, 10 A
4.0-6.3 A Fuse	P450-P800, 380-500 V	LPJ-10 SP or SPI	10 A, 600 V	Any listed Class J Dual Element, Time Delay, 10 A
	P630-P1M2, 525-690 V	LPJ-15 SP or SPI	15 A, 600 V	Any listed Class J Dual Element, Time Delay, 15 A
6.3 - 10 A Fuse	P450-P800600HP-1200HP, 380-500 V	LPJ-15 SP or SPI	15 A, 600 V	Any listed Class J Dual Element, Time Delay, 15 A
	P630-P1M2, 525-690 V	LPJ-20 SP or SPI	20 A, 600 V	Any listed Class J Dual Element, Time Delay, 20A
10 - 16 A Fuse	P450-P800, 380-500 V	LPJ-25 SP or SPI	25 A, 600 V	Any listed Class J Dual Element, Time Delay, 25 A
	P630-P1M2, 525-690 V	LPJ-20 SP or SPI	20 A, 600 V	Any listed Class J Dual Element, Time Delay, 20 A

Table 3.8 Manual Motor Controller Fuses

Frame size	Bussmann PN*	Rating
F8-F13	KTK-4	4 A, 600V

Table 3.9 SMPS Fuse

Size/Type	Bussmann PN*	LittelFuse	Rating
P315-P800, 380-500 V		KLK-15	15A, 600V
P500-P1M2, 525-690 V		KLK-15	15A, 600V

Table 3.10 Fan Fuses

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F13	LPJ-30 SP or SPI	30 A, 600 V	Any listed Class J Dual Element, Time Delay, 30 A

Table 3.11 30 A Fuse Protected Terminal Fuse

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F13	LPJ-6 SP or SPI	6 A, 600 V	Any listed Class J Dual Element, Time Delay, 6 A

Table 3.12 Control Transformer Fuse

Frame size	Bussmann PN*	Rating
F8-F13	GMC-800MA	800mA, 250V

Table 3.13 NAMUR Fuse

3

Frame size	Bussmann PN*	Rating	Alternative Fuses
F8-F13	LP-CC-6	6A, 600V	Any listed Class CC, 6A

Table 3.14 Safety Relay Coil Fuse with PILS Relay

3.4.13 Mains Disconnectors

Frame size	Power & Voltage
F9	P250 380-500V & P355-P560 525-690V
	P315-P400 380-500V
F11	P450 380-500V & P630-P710 525-690V
	P500-P630 380-500V & P800 525-690V
F13	P710-P800 380-500V & P900-P1M2 525-690V

3.4.14 Motor Insulation

For motor cable lengths ≤ the maximum cable length listed in the General Specifications tables the following motor insulation ratings are recommended because the peak voltage can be up to twice the DC link voltage, 2.8 times the mains voltage, due to transmission line effects in the motor cable. If a motor has lower insulation rating it recommended to use a du/dt or sine wave filter.

Nominal Mains Voltage	Motor Insulation
$U_N \leq 420$ V	Standard $U_{LL} = 1300V$
$420V < U_N \leq 500$ V	Reinforced $U_{LL} = 1600V$
$500V < U_N \leq 600$ V	Reinforced $U_{LL} = 1800V$
$600V < U_N \leq 690$ V	Reinforced $U_{LL} = 2000V$

3.4.15 Motor Bearing Currents

All motors installed with FC 302 250kW or higher power drives should have NDE (Non-Drive End) insulated bearings installed to eliminate circulating bearing currents. To minimize DE (Drive End) bearing and shaft currents proper grounding of the drive, motor, driven machine, and motor to the driven machine is required.

Standard Mitigation Strategies:
1. Use an insulated bearing

2. Apply rigorous installation procedures

   - Ensure the motor and load motor are aligned

   - Strictly follow the EMC Installation guideline

   - Reinforce the PE so the high frequency impedance is lower in the PE than the input power leads

   - Provide a good high frequency connection between the motor and the frequency converter for instance by screened cable which has a 360° connection in the motor and the frequency converter

   - Make sure that the impedance from frequency converter to building ground is lower that the grounding impedance of the machine. This can be difficult for pumps

   - Make a direct earth connection between the motor and load motor

3. Lower the IGBT switching frequency

4. Modify the inverter waveform, 60° AVM vs. SFAVM

5. Install a shaft grounding system or use an isolating coupling

6. Apply conductive lubrication

7. Use minimum speed settings if possible

8. Try to ensure the line voltage is balanced to ground. This can be difficult for IT, TT, TN-CS or Grounded leg systems

9. Use a dU/dt or sinus filter

3.4.16 Brake Resistor Temperature Switch

Torque: 0.5-0.6Nm (5in-lbs)
Screw size: M3

This input can be used to monitor the temperature of an externally connected brake resistor. If the input between 104 and 106 is established, the frequency converter will trip on warning / alarm 27, "Brake IGBT". If the connection is closed between 104 and 105, the frequency converter will trip on warning / alarm 27, "Brake IGBT".
A KLIXON switch must be installed that is `normally closed'. If this function is not used, 106 and 104 must be short-circuited together.
Normally closed: 104-106 (factory installed jumper)
Normally open: 104-105

Terminal No.	Function
106, 104, 105	Brake resistor temperature switch.

If the temperature of the brake resistor gets too high and the thermal switch drops out, the frequency converter will stop braking. The motor will start coasting.
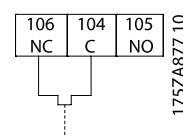
3.4.17 Control Cable Routing

Tie down all control wires to the designated control cable routing as shown in the picture. Remember to connect the shields in a proper way to ensure optimum electrical immunity.

Fieldbus connection
Connections are made to the relevant options on the control card. For details see the relevant fieldbus instruction. The cable must be placed in the provided path inside the frequency converter and tied down together with other control wires.

Installation of 24 Volt external DC Supply
Torque: 0.5 - 0.6Nm (5in-lbs)
Screw size: M3

No.	Function
35 (-), 36 (+)	24V external DC supply

24 VDC external supply can be used as low-voltage supply to the control card and any option cards installed. This enables full operation of the LCP (including parameter setting) without connection to mains. Please note that a warning of low voltage will be given when 24 VDC has been connected; however, there will be no tripping.

⚠️WARNING

Use 24 VDC supply of type PELV to ensure correct galvanic isolation (type PELV) on the control terminals of the frequency converter.

3.4.18 Access to Control Terminals

All terminals to the control cables are located beneath the LCP. They are accessed by opening the door of the IP21/ 54 version or removing the covers of the IP00 version.

3.4.19 Electrical Installation, Control Terminals

To connect the cable to the terminal:
1. Strip insulation by about 9-10mm
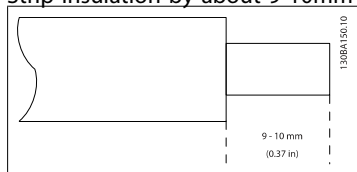
2. Insert a screwdriver[1] in the square hole.

3. Insert the cable in the adjacent circular hole.
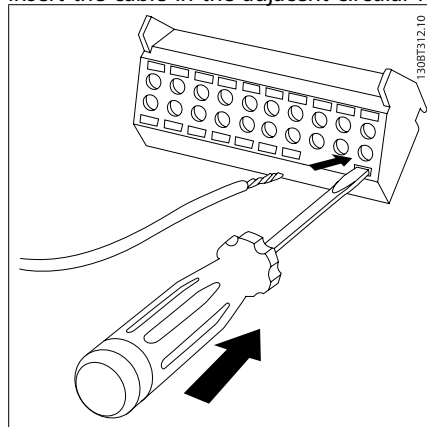
4. Remove the screwdriver. The cable is now mounted in the terminal.

To remove the cable from the terminal:
1. Insert a screw driver[1] in the square hole.

2. Pull out the cable.

[1] Max. 0.4 x 2.5mm

3
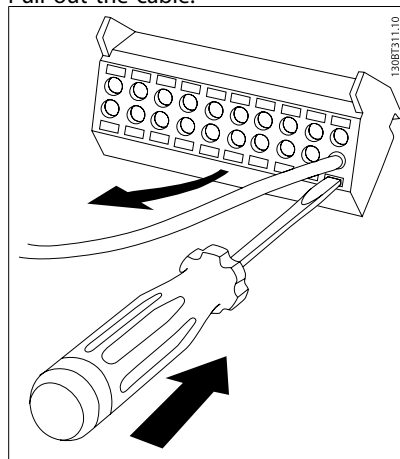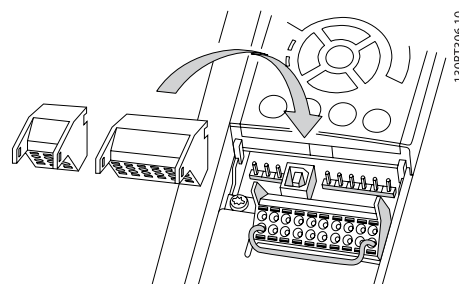
3.5 Connection Examples

3.5.1 Start/Stop

Terminal 18 = *5-10 Terminal 18 Digital Input* [8] *Start*
Terminal 27 = *5-12 Terminal 27 Digital Input* [0] *No operation*
(Default *coast inverse*)

Terminal 37 = Safe stop
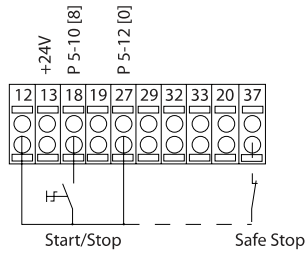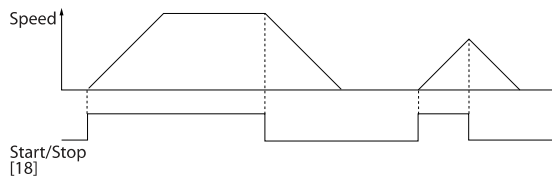
3.5.2 Pulse Start/Stop

Terminal 18 = *5-10 Terminal 18 Digital Input* [9] *Latched start*
Terminal 27= *5-12 Terminal 27 Digital Input* [6] *Stop inverse*

Terminal 37 = Safe stop
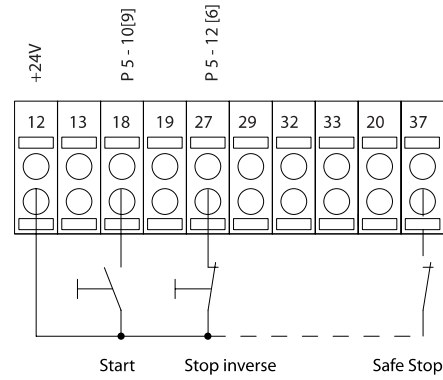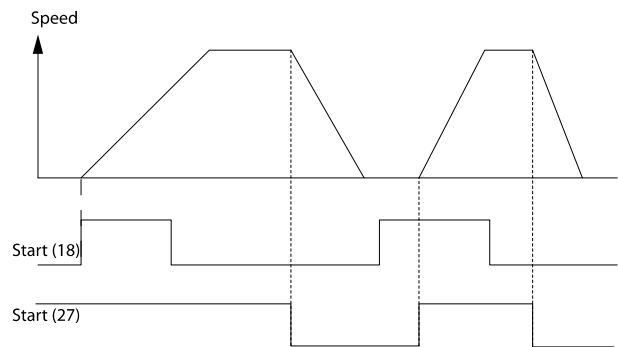
3.5.3 Speed Up/Down

Terminals 29/32 = Speed up/down

Terminal 18 = *5-10 Terminal 18 Digital Input* Start [9] (default)

Terminal 27 = *5-12 Terminal 27 Digital Input* Freeze reference [19]

Terminal 29 = *5-13 Terminal 29 Digital Input* Speed up [21]

Terminal 32 = *5-14 Terminal 32 Digital Input* Speed down [22]

NOTE: Terminal 29 only in FC x02 (x=series type).

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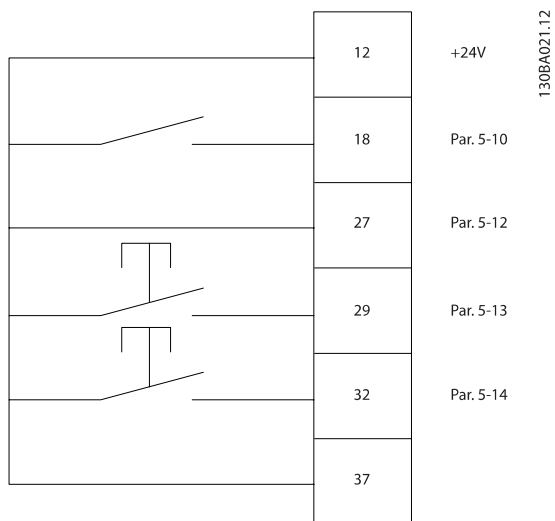
3.5.4 Potentiometer Reference

Voltage reference via a potentiometer

Reference Source 1 = [1] *Analog input 53* (default)

Terminal 53, Low Voltage = 0V

Terminal 53, High Voltage = 10V

Terminal 53, Low Ref./Feedback = 0 RPM

Terminal 53, High Ref./Feedback = 1500 RPM

Switch S201 = OFF (U)
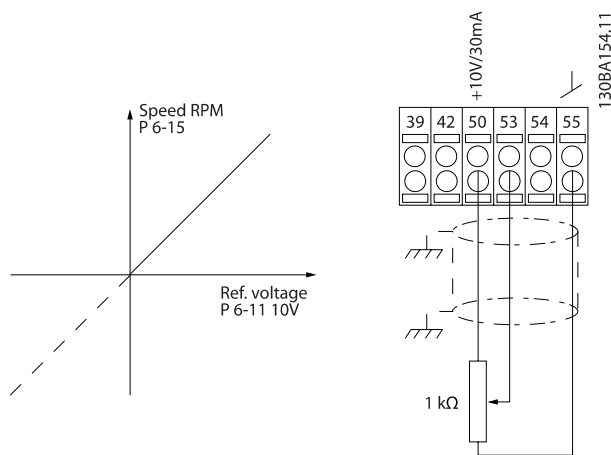
3.6.1 Electrical Installation, Control Cables

CONTROL CARD CONNCECTION

Terminal	Connection
1	CONTROL CARD PIN 20 (TERMINAL JUMPERED TOGETHER)
1	
1	
2	CUSTOMER SUPPLIED (TERMINAL JUMPERED TOGETHER)
3	
3	
3	
10	MCB 113 PIN X46/1
11	MCB 113 PIN X46/3
12	MCB 113 PIN X46/5
13	MCB 113 PIN X46/7
14	MCB 113 PIN X46/9
15	MCB 113 PIN X46/11
16	MCB 113 PIN X46/13
17	MCB 113 PIN 12
18	CONTROL CARD PIN 37
30	TB08 PIN 01
31	TB08 PIN 02
32	TB08 PIN 04
33	TB08 PIN 05
34	MCB 113 PIN X47/1
35	MCB 113 PIN X47/3
36	MCB 113 PIN X47/2
37	MCB 113 PIN X47/4
38	MCB 113 PIN X47/6
39	MCB 113 PIN X47/5
40	MCB 113 PIN X47/7
41	MCB 113 PIN X47/9
42	MCB 113 PIN X47/8
50	CONTROL CARD PIN 53
51	CONTROL CARD PIN 55
60	MCB 113 PIN X45/1
61	MCB 113 PIN X45/2
62	MCB 113 PIN X45/3
63	MCB 113 PIN X45/4
90	MCB 112 PIN 1
91	MCB 112 PIN 2

TB7

CUSTOMER SUPPLIED 24V RET.
CUSTOMER SUPPLIED 24V

118 117
+ -
REGEN TERMINALS

INVERTER CABINET CUSTOMER CONNECTION DETAILS

TB8

PILZ TERMINALS
C14
C13
A2
FUSE
TB4

AUX FAN L1 L2 100 101
AUX FAN L1 L2 102 103

W 98 V 97 U 96 — 3
W 98 V 97 U 96 TB3 INVERTER 1 — 2
R- 81 EXTARNAL BRAKE
R+ 82 EXTARNAL BRAKE
TB3 INVERTER 1

W 98 V 97 U 96 TB3 INVERTER 2 — 1
R- 81 EXTARNAL BRAKE
R+ 82 EXTARNAL BRAKE
TB3 INVERTER 2

130BB760.10

Illustration 3.27 Diagram showing all electrical terminals without options

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* in the frequency converter Design Guide. See also sections Safe Stop and Safe Stop Installation.

1) F8/F9 = (1) set of terminals.
2) F10/F11 = (2) sets of terminals.
3) F12/F13 = (3) sets of terminals.

3

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

If this occurs, it may be necessary to break the screen or insert a 100nF capacitor between screen and chassis.

The digital and analog inputs and outputs must be connected separately to the frequency converter common inputs (terminal 20, 55, 39) to avoid earth currents from both groups to affect other groups. For example, switching on the digital input may disturb the analog input signal.
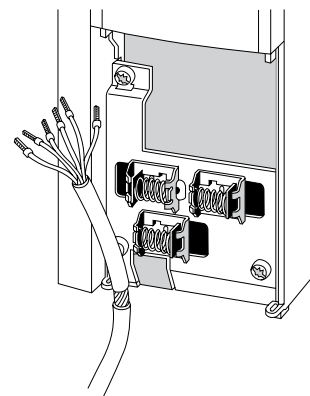
Input polarity of control terminals
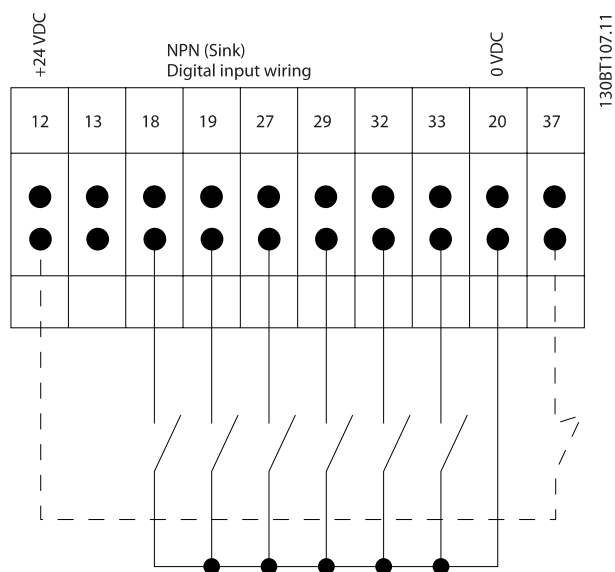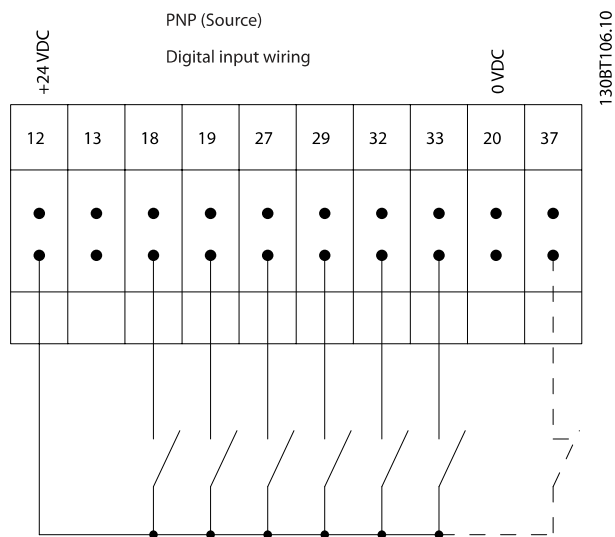
Connect the wires as described in the Operating Instruction for the frequency converter. Remember to connect the shields in a proper way to ensure optimum electrical immunity.

NOTE
Control cables must be screened/armoured.

3.6.2 Switches S201, S202, and S801

Switches S201 (A53) and S202 (A54) are used to select a current (0-20mA) or a voltage (-10 to 10V) 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

NOTE
When changing the function of S201, S202 or S801 be careful not to use force for the switch over. It is recommended to remove the LCP fixture (cradle) when operating the switches. The switches must not be operated with power on the frequency converter.
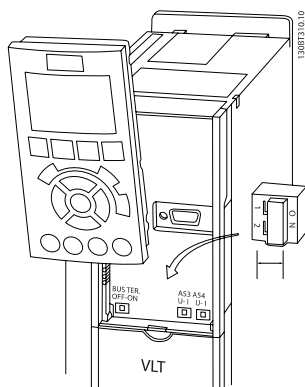
3.6 Final Set-Up and Test

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

Step 1. Locate the motor name plate
NOTE
The motor is either star- (Y) or delta- connected (Δ). This information is located on the motor name plate data.
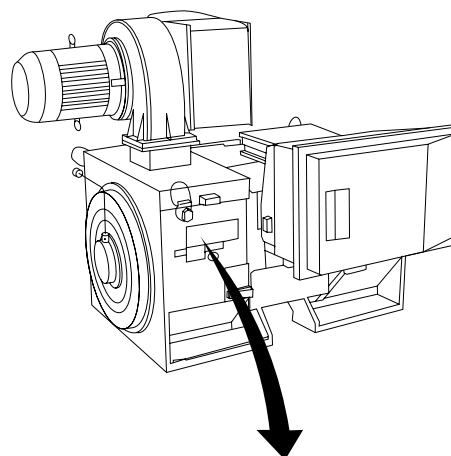
THREE PHASE INDUCTION MOTOR					
MOD MCV 315E	Nr.	135189 12 04		IL/IN 6.5	
kW 400		PRIMARY		SF 1.15	
HP 536	V 690	A 410.6	CONN Y	COS f 0.85	40
mm 1481	V	A	CONN	AMB 40	°C
Hz 50	V	A	CONN	ALT 1000	m
DESIGNN		SECONDARY		RISE 80	°C
DUTY S1	V	A	CONN	ENCLOSURE IP23	
INSUL I	EFFICIENCY %	95.8%	100%	95.8%	75%	WEIGHT 1.83 ton
⚠ CAUTION					

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

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

3

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 (if terminal 37 is available).

2. Connect terminal 27 to terminal 12 or set *5-12 Terminal 27 Digital Input* to 'No function' (*5-12 Terminal 27 Digital Input* [0])

3. Activate the AMA *1-29 Automatic Motor Adaptation (AMA)*.

4. Choose between complete or reduced AMA. If a Sine-wave filter is mounted, run only the reduced AMA, or remove the Sine-wave 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.

Stop the AMA during operation

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

Successful AMA

1. The display shows "Press [OK] to finish AMA".

2. Press the [OK] key to exit the AMA state.

Unsuccessful AMA

1. The frequency converter enters into alarm mode. A description of the alarm can be found in the *Warnings and Alarms* chapter.

2. "Report Value" in the [Alarm Log] shows the last measuring sequence carried out by the AMA, before the frequency converter entered alarm mode. This number along with the description of the alarm will assist you in troubleshooting. If you contact Danfoss for service, make sure to mention number and alarm description.

NOTE
Unsuccessful AMA is often caused by incorrectly registered motor name plate data or a too big difference between the motor power size and the frequency converter power size.

Step 4. Set speed limit and ramp time

3-02 Minimum Reference
3-03 Maximum Reference

Table 3.15 Set up the desired limits for speed and ramp time.

4-11 Motor Speed Low Limit [RPM] or *4-12 Motor Speed Low Limit [Hz]*
4-13 Motor Speed High Limit [RPM] or *4-14 Motor Speed High Limit [Hz]*

3-41 Ramp 1 Ramp up Time
3-42 Ramp 1 Ramp Down Time

3.7 Additional Connections

3.7.1 Mechanical Brake Control

In hoisting/lowering applications, it is necessary to be able to control an electro-mechanical brake:

- Control the brake using any relay output or digital output (terminal 27 or 29).

- Keep the output closed (voltage-free) as long as the frequency converter is unable to 'support' the motor, for example due to the load being too heavy.

- Select *Mechanical brake control* [32] in par. 5-4* for applications with an electro-mechanical brake.

- The brake is released when the motor current exceeds the preset value in *2-20 Release Brake Current*.

- The brake is engaged when the output frequency is less than the frequency set in *2-21 Activate Brake Speed [RPM]*or *2-22 Activate Brake Speed [Hz]*, and only if the frequency converter carries out a stop command.

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

3.7.2 Parallel Connection of Motors

The frequency converter can control several parallel-connected motors. The total current consumption of the motors must not exceed the rated output current $I_{M,N}$ for the frequency converter.

NOTE
Installations with cables connected in a common joint as in the illustration below, is only recommended for short cable lengths.

NOTE
When motors are connected in parallel, *1-29 Automatic Motor Adaptation (AMA)* cannot be used.

NOTE
The electronic thermal relay (ETR) of the frequency converter cannot be used as motor protection for the individual motor in systems with parallel-connected motors. Provide further motor protection by e.g. thermistors in each motor or individual thermal relays (circuit breakers are not suitable as protection).
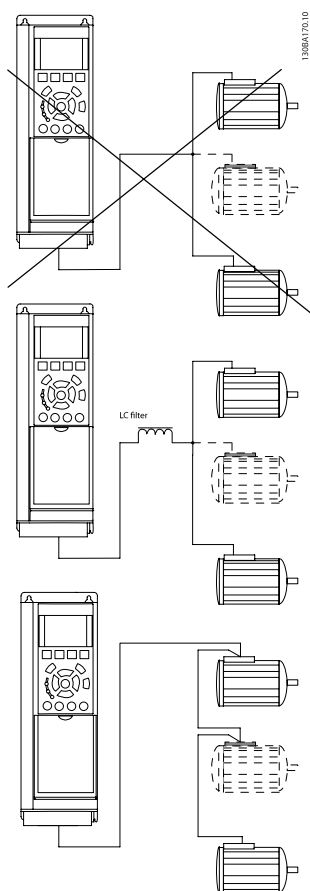
Problems may arise at start and at low RPM values if motor sizes are widely different because small motors' relatively high ohmic resistance in the stator calls for a higher voltage at start and at low RPM values.

3.7.3 Motor Thermal Protection

The electronic thermal relay in the frequency converter has received UL-approval for single motor protection, when *1-90 Motor Thermal Protection* is set for *ETR Trip* and *1-24 Motor Current* is set to the rated motor current (see motor name plate).
For thermal motor protection it is also possible to use the MCB 112 PTC Thermistor Card option. This card provides ATEX certificate to protect motors in explosion hazardous areas, Zone 1/21 and Zone 2/22. Please refer to the *Design Guide* for further information.

4 How to Programme

4.1.1 How to Programme on the Graphical LCP

The following instructions are valid for the graphical LCP(LCP 102)

The control panel is divided into four functional groups

1. Graphical display with Status lines.

2. Menu keys and indicator lights - changing parameters and switching between display functions.

3. Navigation keys and indicator lights (LEDs).

4. Operation keys and indicator lights (LEDs).

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

Display lines

a. **Status line:** Status messages displaying icons and graphic.

b. **Line 1-2:** Operator data lines displaying data defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.

c. **Status line:** Status messages displaying text.
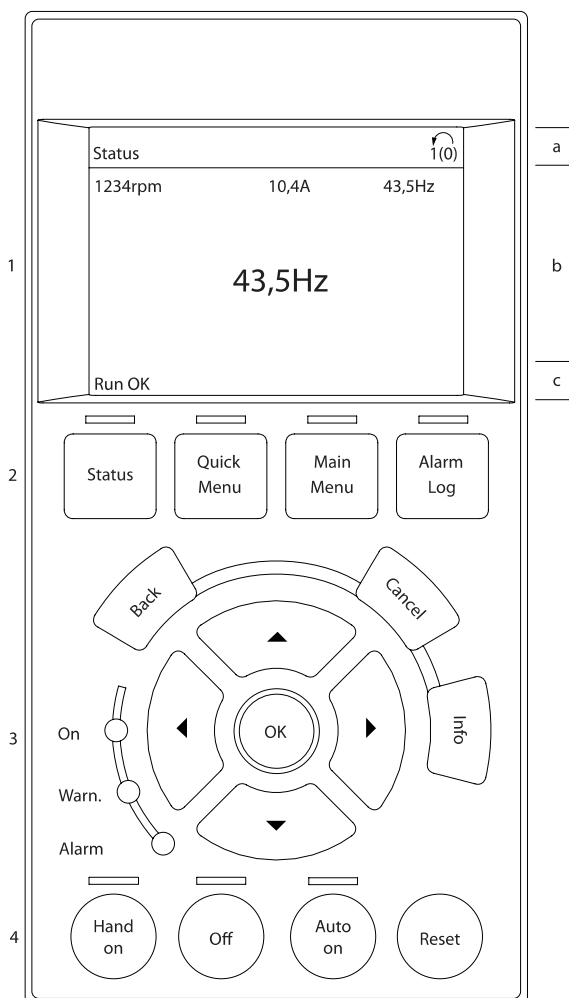
4.1.2 Initial Commissioning

The easiest way of carrying out the initial commissioning is by using the Quick Menu button and follow the quick set-up procedure using LCP 102 (read table from left to right). The example applies to open loop applications.

Press				
Quick Menu	↓	Q2 Quick Menu	OK	↓
0-01 *Language*	OK	Set language	↓	
1-20 *Motor Power [kW]*	OK	Set Motor nameplate power	↓	
1-22 Motor Voltage	OK	Set Nameplate voltage	↓	
1-23 *Motor Frequency*	OK	Set Nameplate frequency	↓	
1-24 Motor Current	OK	Set Nameplate current	↓	
1-25 Motor Nominal Speed	OK	Set Nameplate speed in RPM	↓	
5-12 Terminal 27 Digital Input	OK	If terminal default is *Coast inverse* it is possible to change this setting to *No function*. No connection to terminal 27 is then needed for running AMA	↓	
1-29 Automatic Motor Adaptation (AMA)	OK	Set desired AMA function. Enable complete AMA is recommended	↓	
3-02 *Minimum Reference*	OK	Set the minimum speed of the motor shaft	↓	
3-03 *Maximum Reference*	OK	Set the maximum speed of the motor shaft	↓	
3-41 *Ramp 1 Ramp up Time*	OK	Set the ramping up time with reference to synchronous motor speed, n_s	↓ ↓	
3-42 *Ramp 1 Ramp Down Time*	OK	Set the ramping down time with reference to synchronous motor speed, n_s	↓	
3-13 Reference Site	OK	Set the site from where the reference must work	↓	

4.1 Quick Setup

0-01 Language		
Option:		**Function:**
		Defines the language to be used in the display. The frequency converter can be delivered with 4 different language packages. English and German are included in all packages. English cannot be erased or manipulated.
[0] *	English	Part of Language packages 1 - 4
[1]	Deutsch	Part of Language packages 1 - 4
[2]	Francais	Part of Language package 1
[3]	Dansk	Part of Language package 1
[4]	Spanish	Part of Language package 1
[5]	Italiano	Part of Language package 1
	Svenska	Part of Language package 1
[7]	Nederlands	Part of Language package 1
[10]	Chinese	Part of Language package 2
	Suomi	Part of Language package 1
[22]	English US	Part of Language package 4
	Greek	Part of Language package 4
	Bras.port	Part of Language package 4
	Slovenian	Part of Language package 3
	Korean	Part of Language package 2
	Japanese	Part of Language package 2
	Turkish	Part of Language package 4
	Trad.Chinese	Part of Language package 2
	Bulgarian	Part of Language package 3
	Srpski	Part of Language package 3
	Romanian	Part of Language package 3
	Magyar	Part of Language package 3
	Czech	Part of Language package 3
	Polski	Part of Language package 4
	Russian	Part of Language package 3
	Thai	Part of Language package 2
	Bahasa Indonesia	Part of Language package 2

1-20 Motor Power [kW]		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the nominal motor power in kW according to the motor

1-20 Motor Power [kW]		
Range:		**Function:**
		nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. This parameter is visible in LCP if *0-03 Regional Settings* is *International* [0].

NOTE
Four sizes down, one size up from nominal unit rating.

1-22 Motor Voltage		
Range:		**Function:**
400. V*	[10. - 1000. V]	

1-23 Motor Frequency		
Range:		**Function:**
Application dependent*	[20 - 1000 Hz]	Min - Max motor frequency: 20 - 1000Hz. Select the motor frequency value from the motor nameplate data. If a value different from 50Hz or 60Hz is selected, it is necessary to adapt the load independent settings in *1-50 Motor Magnetisation at Zero Speed* to *1-53 Model Shift Frequency*. For 87Hz operation with 230/400V motors, set the nameplate data for 230V/50Hz. Adapt *4-13 Motor Speed High Limit [RPM]* and *3-03 Maximum Reference* to the 87Hz application.

1-24 Motor Current		
Range:		**Function:**
7.20 A*	[0.10 - 10000.00 A]	

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

1-25 Motor Nominal Speed		
Range:		**Function:**
1420. RPM*	[100 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. This data is used for calculating automatic motor compensations.

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

5-12 Terminal 27 Digital Input

Option: Function:

Select the function from the available digital input range.

No operation	[0]
Reset	[1]
Coast inverse	[2]
Coast and reset inverse	[3]
Quick stop inverse	[4]
DC-brake inverse	[5]
Stop inverse	[6]
Start	[8]
Latched start	[9]
Reversing	[10]
Start reversing	[11]
Enable start forward	[12]
Enable start reverse	[13]
Jog	[14]
Preset ref bit 0	[16]
Preset ref bit 1	[17]
Preset ref bit 2	[18]
Freeze reference	[19]
Freeze output	[20]
Speed up	[21]
Speed down	[22]
Set-up select bit 0	[23]
Set-up select bit 1	[24]
Catch up	[28]
Slow down	[29]
Pulse input	[32]
Ramp bit 0	[34]
Ramp bit 1	[35]
Mains failure inverse	[36]
DigiPot Increase	[55]
DigiPot Decrease	[56]
DigiPot Clear	[57]
Reset Counter A	[62]
Reset Counter B	[65]

1-29 Automatic Motor Adaptation (AMA)

Option: Function:

The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (par. 1-30 to par. 1-35) at motor standstill.
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. This parameter cannot be adjusted while the motor is running.

[0] *	OFF	

1-29 Automatic Motor Adaptation (AMA)

Option: Function:

[1]	Enable complete AMA	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. **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 may be adjusted to obtain optimal start performance.
[2]	Enable reduced AMA	Performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the drive and the motor.

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.

It is important to set motor par. 1-2* 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.

Avoid generating external torque during AMA.

If one of the settings in par. 1-2* is changed, par. 1-30 to par. 1-39, the advanced motor parameters, will return to default setting.

3-02 Minimum Reference

Range:		Function:
Application dependent*	[Application dependant]	Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. Minimum Reference is active only when *3-00 Reference Range* is set to *Min.- Max.* [0]. The Minimum Reference unit matches: - The choice of configuration in *1-00 Configuration Mode Configuration Mode*: for *Speed closed loop* [1], RPM; for *Torque* [2], Nm. - The unit selected in *3-01 Reference/Feedback Unit*.

3-03 Maximum Reference		
Range:		**Function:**
Application dependent*	[Application dependant]	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 *1-00 Configuration Mode*: for *Speed closed loop* [1], RPM; for *Torque* [2], Nm.
		• The unit selected in *3-00 Reference Range*.

3-41 Ramp 1 Ramp up Time		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the ramp-up time, i.e. the acceleration time from 0RPM to the synchronous motor speed n$_s$. Choose a ramp-up time such that the output current does not exceed the current limit in *4-18 Current Limit* during ramping. The value 0.00 corresponds to 0.01 sec. in speed mode. See ramp-down time in *3-42 Ramp 1 Ramp Down Time*.
		$Par. \; 3-41 \; = \; \dfrac{t_{acc}[s] \; x \; n_s[RPM]}{ref[RPM]}$

3-42 Ramp 1 Ramp Down Time		
Range:		**Function:**
Application dependent*	[Application dependant]	Enter the ramp-down time, i.e. the deceleration time from the synchronous motor speed n$_s$ 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 *4-18 Current Limit*. The value 0.00 corresponds to 0.01 s in speed mode. See ramp-up time in *3-41 Ramp 1 Ramp up Time*.
		$Par. \; 3-42 \; = \; \dfrac{t_{dec}[s] \; x \; n_s[RPM]}{ref[RPM]}$

4.2 Parameter Lists

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

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

Conversion index
This number refers to a conversion figure used when writing or reading to and from the frequency converter.

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

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

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

Parameters for the frequency converter are grouped into various parameter groups for easy selection of the correct parameters for optimized operation of the frequency converter.

0-** Operation and Display parameters for basic frequency converter settings

1-** Load and Motor parameters, includes all load and motor related parameters

2-** Brake parameters

3-** References and ramping parameters, includes DigiPot function

4-** Limits Warnings, setting of limits and warning parameters

5-** Digital inputs and outputs, includes relay controls

6-** Analog inputs and outputs

7-** Controls, setting parameters for speed and process controls

8-** Communication and option parameters, setting of FC RS485 and FC USB port parameters.

9-** Profibus parameters

10-** DeviceNet and CAN Fieldbus parameters

12-** Ethernet parameters

13-** Smart Logic Control parameters

14-** Special function parameters

15-** Drive information parameters

16-** Read out parameters

17-** Encoder Option parameters

18-** Data Readouts 2

30-** Special Features

32-** MCO 305 Basic parameters

33-** MCO 305 Advanced parameters

34-** MCO Data Readout parameters

35-** Sensor Input Option

4.2.1 0-** Operation/Display

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
0-0* Basic Settings							
0-01	Language	[0] English	1 set-up		TRUE	-	Uint8
0-02	Motor Speed Unit	[0] RPM	2 set-ups		FALSE	-	Uint8
0-03	Regional Settings	[0] International	2 set-ups		FALSE	-	Uint8
0-04	Operating State at Power-up (Hand)	[1] Forced stop, ref=old	All set-ups		TRUE	-	Uint8
0-09	Performance Monitor	0.0 %	All set-ups		TRUE	-1	Uint16
0-1* Set-up Operations							
0-10	Active Set-up	[1] Set-up 1	1 set-up		TRUE	-	Uint8
0-11	Edit Set-up	[1] Set-up 1	All set-ups		TRUE	-	Uint8
0-12	This Set-up Linked to	[0] Not linked	All set-ups		FALSE	-	Uint8
0-13	Readout: Linked Set-ups	0 N/A	All set-ups		FALSE	0	Uint16
0-14	Readout: Edit Set-ups / Channel	0 N/A	All set-ups		TRUE	0	Int32
0-2* LCP Display							
0-20	Display Line 1.1 Small	1617	All set-ups		TRUE	-	Uint16
0-21	Display Line 1.2 Small	1614	All set-ups		TRUE	-	Uint16
0-22	Display Line 1.3 Small	1610	All set-ups		TRUE	-	Uint16
0-23	Display Line 2 Large	1613	All set-ups		TRUE	-	Uint16
0-24	Display Line 3 Large	1602	All set-ups		TRUE	-	Uint16
0-25	My Personal Menu	App.Dependent	1 set-up		TRUE	0	Uint16
0-3* LCP Custom Readout							
0-30	Unit for User-defined Readout	[0] None	All set-ups		TRUE	-	Uint8
0-31	Min Value of User-defined Readout	0.00 CustomReadoutUnit	All set-ups		TRUE	-2	Int32
0-32	Max Value of User-defined Readout	100.00 CustomRea-doutUnit	All set-ups		TRUE	-2	Int32
0-37	Display Text 1	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-4* LCP Keypad							
0-40	[Hand on] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-41	[Off] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-42	[Auto on] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-43	[Reset] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-44	[Off/Reset] Key on LCP	null	All set-ups		TRUE	-	Uint8
0-45	[Drive Bypass] Key on LCP	null	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 N/A	1 set-up		TRUE	0	Int16
0-61	Access to Main Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8
0-65	Quick Menu Password	200 N/A	1 set-up		TRUE	0	Int16
0-66	Access to Quick Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8
0-67	Bus Password Access	0 N/A	All set-ups		TRUE	0	Uint16

4.2.2 1-** Load/Motor

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
1-0* General Settings							
1-00	Configuration Mode	null	All set-ups		TRUE	-	Uint8
1-01	Motor Control Principle	null	All set-ups		FALSE	-	Uint8
1-02	Flux Motor Feedback Source	[1] 24V encoder	All set-ups		FALSE	-	Uint8
1-03	Torque Characteristics	[0] Constant torque	All set-ups	x	TRUE	-	Uint8
1-04	Overload Mode	[0] High torque	All set-ups		FALSE	-	Uint8
1-05	Local Mode Configuration	[2] As mode par 1-00	All set-ups		TRUE	-	Uint8
1-06	Clockwise Direction	[0] Normal	All set-ups		FALSE	-	Uint8
1-1* Motor Selection							
1-10	Motor Construction	[0] Asynchron	All set-ups		FALSE	-	Uint8
1-2* Motor Data							
1-20	Motor Power [kW]	App.Dependent	All set-ups		FALSE	1	Uint32
1-21	Motor Power [HP]	App.Dependent	All set-ups		FALSE	-2	Uint32
1-22	Motor Voltage	App.Dependent	All set-ups		FALSE	0	Uint16
1-23	Motor Frequency	App.Dependent	All set-ups		FALSE	0	Uint16
1-24	Motor Current	App.Dependent	All set-ups		FALSE	-2	Uint32
1-25	Motor Nominal Speed	App.Dependent	All set-ups		FALSE	67	Uint16
1-26	Motor Cont. Rated Torque	App.Dependent	All set-ups		FALSE	-1	Uint32
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All set-ups		FALSE	-	Uint8
1-3* Adv. Motor Data							
1-30	Stator Resistance (Rs)	App.Dependent	All set-ups		FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	App.Dependent	All set-ups		FALSE	-4	Uint32
1-33	Stator Leakage Reactance (X1)	App.Dependent	All set-ups		FALSE	-4	Uint32
1-34	Rotor Leakage Reactance (X2)	App.Dependent	All set-ups		FALSE	-4	Uint32
1-35	Main Reactance (Xh)	App.Dependent	All set-ups		FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	App.Dependent	All set-ups		FALSE	-3	Uint32
1-37	d-axis Inductance (Ld)	App.Dependent	All set-ups	x	FALSE	-4	Int32
1-39	Motor Poles	App.Dependent	All set-ups		FALSE	0	Uint8
1-40	Back EMF at 1000 RPM	App.Dependent	All set-ups	x	FALSE	0	Uint16
1-41	Motor Angle Offset	0 N/A	All set-ups		FALSE	0	Int16
1-5* Load Indep. Setting							
1-50	Motor Magnetisation at Zero Speed	100 %	All set-ups		TRUE	0	Uint16
1-51	Min Speed Normal Magnetising [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
1-52	Min Speed Normal Magnetising [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
1-53	Model Shift Frequency	App.Dependent	All set-ups	x	FALSE	-1	Uint16
1-54	Voltage reduction in fieldweakening	0 V	All set-ups		FALSE	0	Uint8
1-55	U/f Characteristic - U	App.Dependent	All set-ups		TRUE	-1	Uint16
1-56	U/f Characteristic - F	App.Dependent	All set-ups		TRUE	-1	Uint16
1-58	Flystart Test Pulses Current	30 %	All set-ups		FALSE	0	Uint16
1-59	Flystart Test Pulses Frequency	200 %	All set-ups		FALSE	0	Uint16

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
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	App.Dependent	All set-ups		TRUE	0	Int16
1-63	Slip Compensation Time Constant	App.Dependent	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	x	TRUE	0	Uint8
1-67	Load Type	[0] Passive load	All set-ups	x	TRUE	-	Uint8
1-68	Minimum Inertia	App.Dependent	All set-ups	x	FALSE	-4	Uint32
1-69	Maximum Inertia	App.Dependent	All set-ups	x	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
1-73	Flying Start	null	All set-ups		FALSE	-	Uint8
1-74	Start Speed [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
1-75	Start Speed [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
1-76	Start Current	0.00 A	All set-ups		TRUE	-2	Uint32
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]	App.Dependent	All set-ups		TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
1-83	Precise Stop Function	[0] Precise ramp stop	All set-ups		FALSE	-	Uint8
1-84	Precise Stop Counter Value	100000 N/A	All set-ups		TRUE	0	Uint32
1-85	Precise Stop Speed Compensation Delay	10 ms	All set-ups		TRUE	-3	Uint8
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 Resource	[0] None	All set-ups		TRUE	-	Uint8
1-94	ATEX ETR cur.lim. speed reduction	0.0%	2 set-ups	x	TRUE	-1	Uint16
1-95	KTY Sensor Type	[0] KTY Sensor 1	All set-ups	x	TRUE	-	Uint8
1-96	KTY Thermistor Resource	[0] None	All set-ups	x	TRUE	-	Uint8
1-97	KTY Threshold level	80 °C	1 set-up	x	TRUE	100	Int16
1-98	ATEX ETR interpol. points freq.	App.Dependent	1 set-up	x	TRUE	-1	Int16
1-99	ATEX ETR interpol points current	App.Dependent	2 set-ups	x	TRUE	0	Int16

4.2.3 2-** Brakes

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
2-0* DC-Brake							
2-00	DC Hold Current	50 %	All set-ups		TRUE	0	Uint8
2-01	DC Brake Current	50 %	All set-ups		TRUE	0	Uint16
2-02	DC Braking Time	10.0 s	All set-ups		TRUE	-1	Uint16
2-03	DC Brake Cut In Speed [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
2-04	DC Brake Cut In Speed [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
2-05	Maximum Reference	MaxReference (P303)	All set-ups		TRUE	-3	Int32
2-1* Brake Energy Funct.							
2-10	Brake Function	null	All set-ups		TRUE	-	Uint8
2-11	Brake Resistor (ohm)	App.Dependent	All set-ups		TRUE	0	Uint16
2-12	Brake Power Limit (kW)	App.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
2-16	AC brake Max. Current	100.0 %	All set-ups		TRUE	-1	Uint32
2-17	Over-voltage Control	[0] Disabled	All set-ups		TRUE	-	Uint8
2-18	Brake Check Condition	[0] At Power Up	All set-ups		TRUE	-	Uint8
2-19	Over-voltage Gain	100 %	All set-ups		TRUE	0	Uint16
2-2* Mechanical Brake							
2-20	Release Brake Current	ImaxVLT (P1637)	All set-ups		TRUE	-2	Uint32
2-21	Activate Brake Speed [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
2-22	Activate Brake Speed [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
2-23	Activate Brake Delay	0.0 s	All set-ups		TRUE	-1	Uint8
2-24	Stop Delay	0.0 s	All set-ups		TRUE	-1	Uint8
2-25	Brake Release Time	0.20 s	All set-ups		TRUE	-2	Uint16
2-26	Torque Ref	0.00 %	All set-ups		TRUE	-2	Int16
2-27	Torque Ramp Time	0.2 s	All set-ups		TRUE	-1	Uint8
2-28	Gain Boost Factor	1.00 N/A	All set-ups		TRUE	-2	Uint16

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4.2.4 3-** Reference/Ramps

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
3-0* Reference Limits							
3-00	Reference Range	null	All set-ups		TRUE	-	Uint8
3-01	Reference/Feedback Unit	null	All set-ups		TRUE	-	Uint8
3-02	Minimum Reference	App.Dependent	All set-ups		TRUE	-3	Int32
3-03	Maximum Reference	App.Dependent	All set-ups		TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All set-ups		TRUE	-	Uint8
3-1* References							
3-10	Preset Reference	0.00 %	All set-ups		TRUE	-2	Int16
3-11	Jog Speed [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
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		TRUE	-	Uint8
3-14	Preset Relative Reference	0.00 %	All set-ups		TRUE	-2	Int32
3-15	Reference Resource 1	null	All set-ups		TRUE	-	Uint8
3-16	Reference Resource 2	null	All set-ups		TRUE	-	Uint8
3-17	Reference Resource 3	null	All set-ups		TRUE	-	Uint8
3-18	Relative Scaling Reference Resource	[0] No function	All set-ups		TRUE	-	Uint8
3-19	Jog Speed [RPM]	App.Dependent	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	App.Dependent	All set-ups		TRUE	-2	Uint32
3-42	Ramp 1 Ramp Down Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-45	Ramp 1 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-46	Ramp 1 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-47	Ramp 1 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-48	Ramp 1 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-5* Ramp 2							
3-50	Ramp 2 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-51	Ramp 2 Ramp up Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-52	Ramp 2 Ramp down Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-55	Ramp 2 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-56	Ramp 2 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-57	Ramp 2 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-58	Ramp 2 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-6* Ramp 3							
3-60	Ramp 3 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-61	Ramp 3 Ramp up Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-62	Ramp 3 Ramp down Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-65	Ramp 3 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-66	Ramp 3 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-67	Ramp 3 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-68	Ramp 3 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-7* Ramp 4							
3-70	Ramp 4 Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-71	Ramp 4 Ramp up Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-72	Ramp 4 Ramp Down Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-75	Ramp 4 S-ramp Ratio at Accel. Start	50 %	All set-ups		TRUE	0	Uint8
3-76	Ramp 4 S-ramp Ratio at Accel. End	50 %	All set-ups		TRUE	0	Uint8
3-77	Ramp 4 S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-78	Ramp 4 S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
3-8* Other Ramps							
3-80	Jog Ramp Time	App.Dependent	All set-ups		TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	App.Dependent	2 set-ups		TRUE	-2	Uint32
3-82	Quick Stop Ramp Type	[0] Linear	All set-ups		TRUE	-	Uint8
3-83	Quick Stop S-ramp Ratio at Decel. Start	50 %	All set-ups		TRUE	0	Uint8
3-84	Quick Stop S-ramp Ratio at Decel. End	50 %	All set-ups		TRUE	0	Uint8
3-9* Digital Pot.Meter							
3-90	Step Size	0.10 %	All set-ups		TRUE	-2	Uint16
3-91	Ramp Time	1.00 s	All set-ups		TRUE	-2	Uint32
3-92	Power Restore	[0] Off	All set-ups		TRUE	-	Uint8
3-93	Maximum Limit	100 %	All set-ups		TRUE	0	Int16
3-94	Minimum Limit	-100 %	All set-ups		TRUE	0	Int16
3-95	Ramp Delay	App.Dependent	All set-ups		TRUE	-3	TimD

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4.2.5 4-** Limits / Warnings

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
4-1* Motor Limits							
4-10	Motor Speed Direction	null	All set-ups		FALSE	-	Uint8
4-11	Motor Speed Low Limit [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
4-12	Motor Speed Low Limit [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	App.Dependent	All set-ups		TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100.0 %	All set-ups		TRUE	-1	Uint16
4-18	Current Limit	App.Dependent	All set-ups		TRUE	-1	Uint32
4-19	Max Output Frequency	132.0 Hz	All set-ups		FALSE	-1	Uint16
4-2* Limit Factors							
4-20	Torque Limit Factor Source	[0] No function	All set-ups		TRUE	-	Uint8
4-21	Speed Limit Factor Source	[0] No function	All set-ups		TRUE	-	Uint8
4-3* Motor Speed Mon.							
4-30	Motor Feedback Loss Function	[2] Trip	All set-ups		TRUE	-	Uint8
4-31	Motor Feedback Speed Error	300 RPM	All set-ups		TRUE	67	Uint16
4-32	Motor Feedback Loss Timeout	0.05 s	All set-ups		TRUE	-2	Uint16
4-34	Tracking Error Function	null	All set-ups		TRUE	-	Uint8
4-35	Tracking Error	10 RPM	All set-ups		TRUE	67	Uint16
4-36	Tracking Error Timeout	1.00 s	All set-ups		TRUE	-2	Uint16
4-37	Tracking Error Ramping	100 RPM	All set-ups		TRUE	67	Uint16
4-38	Tracking Error Ramping Timeout	1.00 s	All set-ups		TRUE	-2	Uint16
4-39	Tracking Error After Ramping Timeout	5.00 s	All set-ups		TRUE	-2	Uint16
4-5* Adj. Warnings							
4-50	Warning Current Low	0.00 A	All set-ups		TRUE	-2	Uint32
4-51	Warning Current High	ImaxVLT (P1637)	All set-ups		TRUE	-2	Uint32
4-52	Warning Speed Low	0 RPM	All set-ups		TRUE	67	Uint16
4-53	Warning Speed High	outputSpeedHighLimit (P413)	All set-ups		TRUE	67	Uint16
4-54	Warning Reference Low	-999999.999 N/A	All set-ups		TRUE	-3	Int32
4-55	Warning Reference High	999999.999 N/A	All set-ups		TRUE	-3	Int32
4-56	Warning Feedback Low	-999999.999 Reference- FeedbackUnit	All set-ups		TRUE	-3	Int32
4-57	Warning Feedback High	999999.999 Reference- FeedbackUnit	All set-ups		TRUE	-3	Int32
4-58	Missing Motor Phase Function	null	All set-ups		TRUE	-	Uint8
4-6* Speed Bypass							
4-60	Bypass Speed From [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16
4-62	Bypass Speed To [RPM]	App.Dependent	All set-ups		TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	App.Dependent	All set-ups		TRUE	-1	Uint16

4.2.6 5-** Digital In/Out

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
5-0* Digital I/O mode							
5-00	Digital I/O Mode	[0] PNP	All set-ups		FALSE	-	Uint8
5-01	Terminal 27 Mode	[0] Input	All set-ups		TRUE	-	Uint8
5-02	Terminal 29 Mode	[0] Input	All set-ups	x	TRUE	-	Uint8
5-1* Digital Inputs							
5-10	Terminal 18 Digital Input	null	All set-ups		TRUE	-	Uint8
5-11	Terminal 19 Digital Input	null	All set-ups		TRUE	-	Uint8
5-12	Terminal 27 Digital Input	null	All set-ups		TRUE	-	Uint8
5-13	Terminal 29 Digital Input	null	All set-ups	x	TRUE	-	Uint8
5-14	Terminal 32 Digital Input	null	All set-ups		TRUE	-	Uint8
5-15	Terminal 33 Digital Input	null	All set-ups		TRUE	-	Uint8
5-16	Terminal X30/2 Digital Input	null	All set-ups		TRUE	-	Uint8
5-17	Terminal X30/3 Digital Input	null	All set-ups		TRUE	-	Uint8
5-18	Terminal X30/4 Digital Input	null	All set-ups		TRUE	-	Uint8
5-19	Terminal 37 Safe Stop	[1] Safe Stop Alarm	1 set-up		TRUE	-	Uint8
5-20	Terminal X46/1 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-21	Terminal X46/3 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-22	Terminal X46/5 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-23	Terminal X46/7 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-24	Terminal X46/9 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-25	Terminal X46/11 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-26	Terminal X46/13 Digital Input	[0] No operation	All set-ups		TRUE	-	Uint8
5-3* Digital Outputs							
5-30	Terminal 27 Digital Output	null	All set-ups		TRUE	-	Uint8
5-31	Terminal 29 Digital Output	null	All set-ups	x	TRUE	-	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	null	All set-ups		TRUE	-	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	null	All set-ups		TRUE	-	Uint8
5-4* Relays							
5-40	Function Relay	null	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	x	TRUE	0	Uint32
5-51	Term. 29 High Frequency	100 Hz	All set-ups	x	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0.000 ReferenceFeed-backUnit	All set-ups	x	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	App.Dependent	All set-ups	x	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All set-ups	x	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 ReferenceFeed-backUnit	All set-ups		TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	App.Dependent	All set-ups		TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All set-ups		FALSE	-3	Uint16

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
5-6* Pulse Output							
5-60	Terminal 27 Pulse Output Variable	null	All set-ups		TRUE	-	Uint8
5-62	Pulse Output Max Freq #27	App.Dependent	All set-ups		TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	null	All set-ups	x	TRUE	-	Uint8
5-65	Pulse Output Max Freq #29	App.Dependent	All set-ups	x	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	null	All set-ups		TRUE	-	Uint8
5-68	Pulse Output Max Freq #X30/6	App.Dependent	All set-ups		TRUE	0	Uint32
5-7* 24V Encoder Input							
5-70	Term 32/33 Pulses per Revolution	1024 N/A	All set-ups		FALSE	0	Uint16
5-71	Term 32/33 Encoder Direction	[0] Clockwise	All set-ups		FALSE	-	Uint8
5-9* Bus Controlled							
5-90	Digital & Relay Bus Control	0 N/A	All set-ups		TRUE	0	Uint32
5-93	Pulse Out #27 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
5-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
5-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	x	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	x	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16

4.2.7 6-** Analog In/Out

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
6-0* Analog I/O 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 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	App.Dependent	All set-ups		TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups		TRUE	-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 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	App.Dependent	All set-ups		TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-3* Analog Input 3							
6-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	App.Dependent	All set-ups		TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-4* Analog Input 4							
6-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups		TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10.00 V	All set-ups		TRUE	-2	Int16
6-44	Term. X30/12 Low Ref./Feedb. Value	0 ReferenceFeedbackUnit	All set-ups		TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	App.Dependent	All set-ups		TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
6-5* Analog Output 1							
6-50	Terminal 42 Output	null	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
6-53	Term 42 Output Bus Ctrl	0.00 %	All set-ups		TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
6-55	Analog Output Filter	[0] Off	1 set-up		TRUE	-	Uint8
6-6* Analog Output 2							
6-60	Terminal X30/8 Output	null	All set-ups		TRUE	-	Uint8
6-61	Terminal X30/8 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-63	Terminal X30/8 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
6-7* Analog Output 3							
6-70	Terminal X45/1 Output	null	All set-ups		TRUE	-	Uint8
6-71	Terminal X45/1 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-72	Terminal X45/1 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-73	Terminal X45/1 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-74	Terminal X45/1 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16
6-8* Analog Output 4							
6-80	Terminal X45/3 Output	null	All set-ups		TRUE	-	Uint8
6-81	Terminal X45/3 Min. Scale	0.00 %	All set-ups		TRUE	-2	Int16
6-82	Terminal X45/3 Max. Scale	100.00 %	All set-ups		TRUE	-2	Int16
6-83	Terminal X45/3 Bus Control	0.00 %	All set-ups		TRUE	-2	N2
6-84	Terminal X45/3 Output Timeout Preset	0.00 %	1 set-up		TRUE	-2	Uint16

4.2.8 7-** Controllers

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
7-0* Speed PID Ctrl.							
7-00	Speed PID Feedback Source	null	All set-ups		FALSE	-	Uint8
7-02	Speed PID Proportional Gain	App.Dependent	All set-ups		TRUE	-3	Uint16
7-03	Speed PID Integral Time	App.Dependent	All set-ups		TRUE	-4	Uint32
7-04	Speed PID Differentiation Time	App.Dependent	All set-ups		TRUE	-4	Uint16
7-05	Speed PID Diff. Gain Limit	5.0 N/A	All set-ups		TRUE	-1	Uint16
7-06	Speed PID Lowpass Filter Time	App.Dependent	All set-ups		TRUE	-4	Uint16
7-07	Speed PID Feedback Gear Ratio	1.0000 N/A	All set-ups		FALSE	-4	Uint32
7-08	Speed PID Feed Forward Factor	0 %	All set-ups		FALSE	0	Uint16
7-1* Torque PI Ctrl.							
7-12	Torque PI Proportional Gain	100 %	All set-ups		TRUE	0	Uint16
7-13	Torque PI Integration Time	0.020 s	All set-ups		TRUE	-3	Uint16
7-2* Process Ctrl. Feedb							
7-20	Process CL Feedback 1 Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-22	Process CL Feedback 2 Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-3* Process PID Ctrl.							
7-30	Process PID Normal/ Inverse Control	[0] Normal	All set-ups		TRUE	-	Uint8
7-31	Process PID Anti Windup	[1] On	All set-ups		TRUE	-	Uint8
7-32	Process PID Start Speed	0 RPM	All set-ups		TRUE	67	Uint16
7-33	Process PID Proportional Gain	0.01 N/A	All set-ups		TRUE	-2	Uint16
7-34	Process PID Integral Time	10000.00 s	All set-ups		TRUE	-2	Uint32
7-35	Process PID Differentiation Time	0.00 s	All set-ups		TRUE	-2	Uint16
7-36	Process PID Diff. Gain Limit	5.0 N/A	All set-ups		TRUE	-1	Uint16
7-38	Process PID Feed Forward Factor	0 %	All set-ups		TRUE	0	Uint16
7-39	On Reference Bandwidth	5 %	All set-ups		TRUE	0	Uint8
7-4* Adv. Process PID I							
7-40	Process PID I-part Reset	[0] No	All set-ups		TRUE	-	Uint8
7-41	Process PID Output Neg. Clamp	-100 %	All set-ups		TRUE	0	Int16
7-42	Process PID Output Pos. Clamp	100 %	All set-ups		TRUE	0	Int16
7-43	Process PID Gain Scale at Min. Ref.	100 %	All set-ups		TRUE	0	Int16
7-44	Process PID Gain Scale at Max. Ref.	100 %	All set-ups		TRUE	0	Int16
7-45	Process PID Feed Fwd Resource	[0] No function	All set-ups		TRUE	-	Uint8
7-46	Process PID Feed Fwd Normal/ Inv. Ctrl.	[0] Normal	All set-ups		TRUE	-	Uint8
7-48	PCD Feed Forward	0 N/A	All set-ups	x	TRUE	0	Uint16
7-49	Process PID Output Normal/ Inv. Ctrl.	[0] Normal	All set-ups		TRUE	-	Uint8
7-5* Adv. Process PID II							
7-50	Process PID Extended PID	[1] Enabled	All set-ups		TRUE	-	Uint8
7-51	Process PID Feed Fwd Gain	1.00 N/A	All set-ups		TRUE	-2	Uint16
7-52	Process PID Feed Fwd Ramp up	0.01 s	All set-ups		TRUE	-2	Uint32
7-53	Process PID Feed Fwd Ramp down	0.01 s	All set-ups		TRUE	-2	Uint32
7-56	Process PID Ref. Filter Time	0.001 s	All set-ups		TRUE	-3	Uint16
7-57	Process PID Fb. Filter Time	0.001 s	All set-ups		TRUE	-3	Uint16

4.2.9 8-** Comm. and Options

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
8-0* General Settings							
8-01	Control Site	[0] Digital and ctrl.word	All set-ups		TRUE	-	Uint8
8-02	Control Word Source	null	All set-ups		TRUE	-	Uint8
8-03	Control Word Timeout Time	1.0 s	1 set-up		TRUE	-1	Uint32
8-04	Control Word Timeout Function	null	1 set-up		TRUE	-	Uint8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up		TRUE	-	Uint8
8-06	Reset Control Word Timeout	[0] Do not reset	All set-ups		TRUE	-	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups		TRUE	-	Uint8
8-08	Readout Filtering	null	All set-ups		TRUE	-	Uint8
8-1* Ctrl. Word Settings							
8-10	Control Word Profile	[0] FC profile	All set-ups		TRUE	-	Uint8
8-13	Configurable Status Word STW	null	All set-ups		TRUE	-	Uint8
8-14	Configurable Control Word CTW	[1] Profile default	All set-ups		TRUE	-	Uint8
8-3* FC Port Settings							
8-30	Protocol	[0] FC	1 set-up		TRUE	-	Uint8
8-31	Address	1 N/A	1 set-up		TRUE	0	Uint8
8-32	FC Port Baud Rate	null	1 set-up		TRUE	-	Uint8
8-33	Parity / Stop Bits	[0] Even Parity, 1 Stop Bit	1 set-up		TRUE	-	Uint8
8-34	Estimated cycle time	0 ms	2 set-ups		TRUE	-3	Uint32
8-35	Minimum Response Delay	10 ms	All set-ups		TRUE	-3	Uint16
8-36	Max Response Delay	App.Dependent	1 set-up		TRUE	-3	Uint16
8-37	Max Inter-Char Delay	App.Dependent	1 set-up		TRUE	-5	Uint16
8-4* FC MC protocol set							
8-40	Telegram selection	[1] Standard telegram 1	2 set-ups		TRUE	-	Uint8
8-41	Parameters for signals	0	All set-ups		FALSE	-	Uint16
8-42	PCD write configuration	App.Dependent	All set-ups		TRUE	-	Uint16
8-43	PCD read configuration	App.Dependent	All set-ups		TRUE	-	Uint16
8-5* Digital/Bus							
8-50	Coasting Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-51	Quick Stop Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-52	DC Brake Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-53	Start Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-54	Reversing Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-55	Set-up Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-56	Preset Reference Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-57	Profidrive OFF2 Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-58	Profidrive OFF3 Select	[3] Logic OR	All set-ups		TRUE	-	Uint8
8-8* FC Port Diagnostics							
8-80	Bus Message Count	0 N/A	All set-ups		TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	All set-ups		TRUE	0	Uint32
8-82	Slave Messages Rcvd	0 N/A	All set-ups		TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	All set-ups		TRUE	0	Uint32
8-9* Bus Jog							
8-90	Bus Jog 1 Speed	100 RPM	All set-ups		TRUE	67	Uint16
8-91	Bus Jog 2 Speed	App.Dependent	All set-ups		TRUE	67	Uint16

4.2.10 9-** Profibus

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
9-00	Setpoint	0 N/A	All set-ups		TRUE	0	Uint16
9-07	Actual Value	0 N/A	All set-ups		FALSE	0	Uint16
9-15	PCD Write Configuration	App.Dependent	1 set-up		TRUE	-	Uint16
9-16	PCD Read Configuration	App.Dependent	2 set-ups		TRUE	-	Uint16
9-18	Node Address	126 N/A	1 set-up		TRUE	0	Uint8
9-22	Telegram Selection	[100] None	1 set-up		TRUE	-	Uint8
9-23	Parameters for Signals	0	All set-ups		TRUE	-	Uint16
9-27	Parameter Edit	[1] Enabled	2 set-ups		FALSE	-	Uint16
9-28	Process Control	[1] Enable cyclic master	2 set-ups		FALSE	-	Uint8
9-44	Fault Message Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-45	Fault Code	0 N/A	All set-ups		TRUE	0	Uint16
9-47	Fault Number	0 N/A	All set-ups		TRUE	0	Uint16
9-52	Fault Situation Counter	0 N/A	All set-ups		TRUE	0	Uint16
9-53	Profibus Warning Word	0 N/A	All set-ups		TRUE	0	V2
9-63	Actual Baud Rate	[255] No baudrate found	All set-ups		TRUE	-	Uint8
9-64	Device Identification	0 N/A	All set-ups		TRUE	0	Uint16
9-65	Profile Number	0 N/A	All set-ups		TRUE	0	OctStr[2]
9-67	Control Word 1	0 N/A	All set-ups		TRUE	0	V2
9-68	Status Word 1	0 N/A	All set-ups		TRUE	0	V2
9-71	Profibus Save Data Values	[0] Off	All set-ups		TRUE	-	Uint8
9-72	ProfibusDriveReset	[0] No action	1 set-up		FALSE	-	Uint8
9-75	DO Identification	0 N/A	All set-ups		TRUE	0	Uint16
9-80	Defined Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-81	Defined Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-82	Defined Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-83	Defined Parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-84	Defined Parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16
9-90	Changed Parameters (1)	0 N/A	All set-ups		FALSE	0	Uint16
9-91	Changed Parameters (2)	0 N/A	All set-ups		FALSE	0	Uint16
9-92	Changed Parameters (3)	0 N/A	All set-ups		FALSE	0	Uint16
9-93	Changed parameters (4)	0 N/A	All set-ups		FALSE	0	Uint16
9-94	Changed parameters (5)	0 N/A	All set-ups		FALSE	0	Uint16
9-99	Profibus Revision Counter	0 N/A	All set-ups		TRUE	0	Uint16

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4.2.11 10-** CAN Fieldbus

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
10-0* Common Settings							
10-00	CAN Protocol	null	2 set-ups		FALSE	-	Uint8
10-01	Baud Rate Select	null	2 set-ups		TRUE	-	Uint8
10-02	MAC ID	App.Dependent	2 set-ups		TRUE	0	Uint8
10-05	Readout Transmit Error Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-06	Readout Receive Error Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-07	Readout Bus Off Counter	0 N/A	All set-ups		TRUE	0	Uint8
10-1* DeviceNet							
10-10	Process Data Type Selection	null	All set-ups		TRUE	-	Uint8
10-11	Process Data Config Write	App.Dependent	All set-ups		TRUE	-	Uint16
10-12	Process Data Config Read	App.Dependent	All set-ups		TRUE	-	Uint16
10-13	Warning Parameter	0 N/A	All set-ups		TRUE	0	Uint16
10-14	Net Reference	[0] Off	2 set-ups		TRUE	-	Uint8
10-15	Net Control	[0] Off	2 set-ups		TRUE	-	Uint8
10-2* COS Filters							
10-20	COS Filter 1	0 N/A	All set-ups		FALSE	0	Uint16
10-21	COS Filter 2	0 N/A	All set-ups		FALSE	0	Uint16
10-22	COS Filter 3	0 N/A	All set-ups		FALSE	0	Uint16
10-23	COS Filter 4	0 N/A	All set-ups		FALSE	0	Uint16
10-3* Parameter Access							
10-30	Array Index	0 N/A	2 set-ups		TRUE	0	Uint8
10-31	Store Data Values	[0] Off	All set-ups		TRUE	-	Uint8
10-32	Devicenet Revision	App.Dependent	All set-ups		TRUE	0	Uint16
10-33	Store Always	[0] Off	1 set-up		TRUE	-	Uint8
10-34	DeviceNet Product Code	App.Dependent	1 set-up		TRUE	0	Uint16
10-39	Devicenet F Parameters	0 N/A	All set-ups		TRUE	0	Uint32
10-5* CANopen							
10-50	Process Data Config Write.	App.Dependent	2 set-ups		TRUE	-	Uint16
10-51	Process Data Config Read.	App.Dependent	2 set-ups		TRUE	-	Uint16

4.2.12 12-** Ethernet

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
12-0* IP Settings							
12-00	IP Address Assignment	null	2 set-ups		TRUE	-	Uint8
12-01	IP Address	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-02	Subnet Mask	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-03	Default Gateway	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-04	DHCP Server	0 N/A	2 set-ups		TRUE	0	OctStr[4]
12-05	Lease Expires	App.Dependent	All set-ups		TRUE	0	TimD
12-06	Name Servers	0 N/A	1 set-up		TRUE	0	OctStr[4]
12-07	Domain Name	0 N/A	1 set-up		TRUE	0	VisStr[48]
12-08	Host Name	0 N/A	1 set-up		TRUE	0	VisStr[48]
12-09	Physical Address	0 N/A	1 set-up		TRUE	0	VisStr[17]
12-1* Ethernet Link Parameters							
12-10	Link Status	[0] No Link	1 set-up		TRUE	-	Uint8
12-11	Link Duration	App.Dependent	All set-ups		TRUE	0	TimD
12-12	Auto Negotiation	[1] On	2 set-ups		TRUE	-	Uint8
12-13	Link Speed	[0] None	2 set-ups		TRUE	-	Uint8
12-14	Link Duplex	[1] Full Duplex	2 set-ups		TRUE	-	Uint8
12-2* Process Data							
12-20	Control Instance	App.Dependent	1 set-up		TRUE	0	Uint8
12-21	Process Data Config Write	App.Dependent	All set-ups		TRUE	-	Uint16
12-22	Process Data Config Read	App.Dependent	All set-ups		TRUE	-	Uint16
12-23	Process Data Config Write Size	16 N/A	All set-ups		TRUE	0	Uint32
12-24	Process Data Config Read Size	16 N/A	All set-ups		TRUE	0	Uint32
12-27	Primary Master	0 N/A	1 set-up		FALSE	0	
12-28	Store Data Values	[0] Off	All set-ups		TRUE	-	Uint8
12-29	Store Always	[0] Off	1 set-up		TRUE	-	Uint8
12-3* EtherNet/IP							
12-30	Warning Parameter	0 N/A	All set-ups		TRUE	0	Uint16
12-31	Net Reference	[0] Off	2 set-ups		TRUE	-	Uint8
12-32	Net Control	[0] Off	2 set-ups		TRUE	-	Uint8
12-33	CIP Revision	App.Dependent	All set-ups		TRUE	0	Uint16
12-34	CIP Product Code	App.Dependent	1 set-up		TRUE	0	Uint16
12-35	EDS Parameter	0 N/A	All set-ups		TRUE	0	Uint32
12-37	COS Inhibit Timer	0 N/A	All set-ups		TRUE	0	Uint16
12-38	COS Filter	0 N/A	All set-ups		TRUE	0	Uint16
12-4* Modbus TCP							
12-40	Status Parameter	0 N/A	All set-ups		TRUE	0	Uint16
12-41	Slave Message Count	0 N/A	All set-ups		TRUE	0	Uint32
12-42	Slave Exception Message Count	0 N/A	All set-ups		TRUE	0	Uint32
12-5* EtherCAT							
12-50	Configured Station Alias	0 N/A	1 set-up		FALSE	0	Uint16
12-51	Configured Station Address	0 N/A	All set-ups		TRUE	0	Uint16
12-59	EtherCAT Status	0 N/A	All set-ups		TRUE	0	Uint32

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
12-8* Other Ethernet Services							
12-80	FTP Server	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-81	HTTP Server	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-82	SMTP Service	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-89	Transparent Socket Channel Port	App.Dependent	2 set-ups		TRUE	0	Uint16
12-9* Advanced Ethernet Services							
12-90	Cable Diagnostic	[0] Disabled	2 set-ups		TRUE	-	Uint8
12-91	MDI-X	[1] Enabled	2 set-ups		TRUE	-	Uint8
12-92	IGMP Snooping	[1] Enabled	2 set-ups		TRUE	-	Uint8
12-93	Cable Error Length	0 N/A	1 set-up		TRUE	0	Uint16
12-94	Broadcast Storm Protection	-1 %	2 set-ups		TRUE	0	Int8
12-95	Broadcast Storm Filter	[0] Broadcast only	2 set-ups		TRUE	-	Uint8
12-96	Port Mirroring	null	2 set-ups		TRUE	-	Uint8
12-98	Interface Counters	4000 N/A	All set-ups		TRUE	0	Uint32
12-99	Media Counters	0 N/A	All set-ups		TRUE	0	Uint32

4.2.13 13-** Smart Logic

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
13-0* SLC Settings							
13-00	SL Controller Mode	null	2 set-ups		TRUE	-	Uint8
13-01	Start Event	null	2 set-ups		TRUE	-	Uint8
13-02	Stop Event	null	2 set-ups		TRUE	-	Uint8
13-03	Reset SLC	[0] Do not reset SLC	All set-ups		TRUE	-	Uint8
13-1* Comparators							
13-10	Comparator Operand	null	2 set-ups		TRUE	-	Uint8
13-11	Comparator Operator	null	2 set-ups		TRUE	-	Uint8
13-12	Comparator Value	App.Dependent	2 set-ups		TRUE	-3	Int32
13-2* Timers							
13-20	SL Controller Timer	App.Dependent	1 set-up		TRUE	-3	TimD
13-4* Logic Rules							
13-40	Logic Rule Boolean 1	null	2 set-ups		TRUE	-	Uint8
13-41	Logic Rule Operator 1	null	2 set-ups		TRUE	-	Uint8
13-42	Logic Rule Boolean 2	null	2 set-ups		TRUE	-	Uint8
13-43	Logic Rule Operator 2	null	2 set-ups		TRUE	-	Uint8
13-44	Logic Rule Boolean 3	null	2 set-ups		TRUE	-	Uint8
13-5* States							
13-51	SL Controller Event	null	2 set-ups		TRUE	-	Uint8
13-52	SL Controller Action	null	2 set-ups		TRUE	-	Uint8

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4.2.14 14-** Special Functions

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
14-0* Inverter Switching							
14-00	Switching Pattern	null	All set-ups		TRUE	-	Uint8
14-01	Switching Frequency	null	All set-ups		TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups		FALSE	-	Uint8
14-04	PWM Random	[0] Off	All set-ups		TRUE	-	Uint8
14-06	Dead Time Compensation	[1] On	All set-ups		TRUE	-	Uint8
14-1* Mains On/Off							
14-10	Mains Failure	[0] No function	All set-ups		FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	App.Dependent	All set-ups		TRUE	0	Uint16
14-12	Function at Mains Imbalance	[0] Trip	All set-ups		TRUE	-	Uint8
14-13	Mains Failure Step Factor	1.0 N/A	All set-ups		TRUE	-1	Uint8
14-14	Kin. Backup Time Out	60 s	All set-ups		TRUE	0	Uint8
14-2* Trip Reset							
14-20	Reset Mode	[0] Manual reset	All set-ups		TRUE	-	Uint8
14-21	Automatic Restart Time	App.Dependent	All set-ups		TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All set-ups		TRUE	-	Uint8
14-23	Typecode Setting	null	2 set-ups		FALSE	-	Uint8
14-24	Trip Delay at Current Limit	60 s	All set-ups		TRUE	0	Uint8
14-25	Trip Delay at Torque Limit	60 s	All set-ups		TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	App.Dependent	All set-ups		TRUE	0	Uint8
14-28	Production Settings	[0] No action	All set-ups		TRUE	-	Uint8
14-29	Service Code	0 N/A	All set-ups		TRUE	0	Int32
14-3* Current Limit Ctrl.							
14-30	Current Lim Ctrl, Proportional Gain	100 %	All set-ups		FALSE	0	Uint16
14-31	Current Lim Ctrl, Integration Time	0.020 s	All set-ups		FALSE	-3	Uint16
14-32	Current Lim Ctrl, Filter Time	1.0 ms	All set-ups		TRUE	-4	Uint16
14-35	Stall Protection	[1] Enabled	All set-ups		FALSE	-	Uint8
14-4* Energy Optimising							
14-40	VT Level	66 %	All set-ups		FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	App.Dependent	All set-ups		TRUE	0	Uint8
14-42	Minimum AEO Frequency	10 Hz	All set-ups		TRUE	0	Uint8
14-43	Motor Cosphi	App.Dependent	All set-ups		TRUE	-2	Uint16
14-5* Environment							
14-50	RFI Filter	[1] On	1 set-up	x	FALSE	-	Uint8
14-51	DC Link Compensation	[1] On	1 set-up		TRUE	-	Uint8
14-52	Fan Control	[0] Auto	All set-ups		TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	All set-ups		TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	All set-ups		FALSE	-	Uint8
14-56	Capacitance Output Filter	App.Dependent	All set-ups		FALSE	-7	Uint16
14-57	Inductance Output Filter	App.Dependent	All set-ups		FALSE	-6	Uint16
14-59	Actual Number of Inverter Units	App.Dependent	1 set-up	x	FALSE	0	Uint8

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
14-7* Compatibility							
14-72	Legacy Alarm Word	0 N/A	All set-ups		FALSE	0	Uint32
14-73	Legacy Warning Word	0 N/A	All set-ups		FALSE	0	Uint32
14-74	Leg. Ext. Status Word	0 N/A	All set-ups		FALSE	0	Uint32
14-8* Options							
14-80	Option Supplied by External 24VDC	[1] Yes	2 set-ups		FALSE	-	Uint8
14-89	Option Detection	[0] Protect Option Config.	1 set-up		TRUE	-	Uint8
14-9* Fault Settings							
14-90	Fault Level	null	1 set-up		TRUE	-	Uint8

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4.2.15 15-** Drive Information

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
15-0* Operating Data							
15-00	Operating Hours	0 h	All set-ups		FALSE	74	Uint32
15-01	Running Hours	0 h	All set-ups		FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All set-ups		FALSE	75	Uint32
15-03	Power Up's	0 N/A	All set-ups		FALSE	0	Uint32
15-04	Over Temp's	0 N/A	All set-ups		FALSE	0	Uint16
15-05	Over Volt's	0 N/A	All set-ups		FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All set-ups		TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All set-ups		TRUE	-	Uint8
15-1* Data Log Settings							
15-10	Logging Source	0	2 set-ups		TRUE	-	Uint16
15-11	Logging Interval	App.Dependent	2 set-ups		TRUE	-3	TimD
15-12	Trigger Event	[0] False	1 set-up		TRUE	-	Uint8
15-13	Logging Mode	[0] Log always	2 set-ups		TRUE	-	Uint8
15-14	Samples Before Trigger	50 N/A	2 set-ups		TRUE	0	Uint8
15-2* Historic Log							
15-20	Historic Log: Event	0 N/A	All set-ups		FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	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 N/A	All set-ups		FALSE	0	Uint8
15-31	Fault Log: Value	0 N/A	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 N/A	All set-ups		FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All set-ups		FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-46	Frequency Converter Ordering No	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-47	Power Card Ordering No	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-48	LCP Id No	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-51	Frequency Converter Serial Number	0 N/A	All set-ups		FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All set-ups		FALSE	0	VisStr[19]
15-59	CSIV Filename	App.Dependent	1 set-up		FALSE	0	VisStr[16]

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
15-6* Option Ident							
15-60	Option Mounted	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-62	Option Ordering No	0 N/A	All set-ups		FALSE	0	VisStr[8]
15-63	Option Serial No	0 N/A	All set-ups		FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-72	Option in Slot B	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-73	Slot B Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-74	Option in Slot C0	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-75	Slot C0 Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-76	Option in Slot C1	0 N/A	All set-ups		FALSE	0	VisStr[30]
15-77	Slot C1 Option SW Version	0 N/A	All set-ups		FALSE	0	VisStr[20]
15-9* Parameter Info							
15-92	Defined Parameters	0 N/A	All set-ups		FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All set-ups		FALSE	0	Uint16
15-98	Drive Identification	0 N/A	All set-ups		FALSE	0	VisStr[40]
15-99	Parameter Metadata	0 N/A	All set-ups		FALSE	0	Uint16

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4.2.16 16-** Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
16-0* General Status							
16-00	Control Word	0 N/A	All set-ups		FALSE	0	V2
16-01	Reference [Unit]	0.000 ReferenceFeed-backUnit	All set-ups		FALSE	-3	Int32
16-02	Reference %	0.0 %	All set-ups		FALSE	-1	Int16
16-03	Status Word	0 N/A	All set-ups		FALSE	0	V2
16-05	Main Actual Value [%]	0.00 %	All set-ups		FALSE	-2	N2
16-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups		FALSE	-2	Int32
16-1* Motor Status							
16-10	Power [kW]	0.00 kW	All set-ups		FALSE	1	Int32
16-11	Power [hp]	0.00 hp	All set-ups		FALSE	-2	Int32
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	Int32
16-15	Frequency [%]	0.00 %	All set-ups		FALSE	-2	N2
16-16	Torque [Nm]	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
16-19	KTY sensor temperature	0 °C	All set-ups		FALSE	100	Int16
16-20	Motor Angle	0 N/A	All set-ups		TRUE	0	Uint16
16-21	Torque [%] High Res.	0.0 %	All set-ups		FALSE	-1	Int16
16-22	Torque [%]	0 %	All set-ups		FALSE	0	Int16
16-25	Torque [Nm] High	0.0 Nm	All set-ups		FALSE	-1	Int32
16-3* Drive Status							
16-30	DC Link Voltage	0 V	All set-ups		FALSE	0	Uint16
16-32	Brake Energy /s	0.000 kW	All set-ups		FALSE	0	Uint32
16-33	Brake Energy /2 min	0.000 kW	All set-ups		FALSE	0	Uint32
16-34	Heatsink Temp.	0 °C	All set-ups		FALSE	100	Uint8
16-35	Inverter Thermal	0 %	All set-ups		FALSE	0	Uint8
16-36	Inv. Nom. Current	App.Dependent	All set-ups		FALSE	-2	Uint32
16-37	Inv. Max. Current	App.Dependent	All set-ups		FALSE	-2	Uint32
16-38	SL Controller State	0 N/A	All set-ups		FALSE	0	Uint8
16-39	Control Card Temp.	0 °C	All set-ups		FALSE	100	Uint8
16-40	Logging Buffer Full	[0] No	All set-ups		TRUE	-	Uint8
16-41	LCP Bottom Statusline	0 N/A	All set-ups		TRUE	0	VisStr[50]
16-49	Current Fault Source	0 N/A	All set-ups	x	TRUE	0	Uint8
16-5* Ref. & Feedb.							
16-50	External Reference	0.0 N/A	All set-ups		FALSE	-1	Int16
16-51	Pulse Reference	0.0 N/A	All set-ups		FALSE	-1	Int16
16-52	Feedback [Unit]	0.000 ReferenceFeed-backUnit	All set-ups		FALSE	-3	Int32
16-53	Digi Pot Reference	0.00 N/A	All set-ups		FALSE	-2	Int16
16-57	Feedback [RPM]	0 RPM	All set-ups		FALSE	67	Int32

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
16-6* Inputs & Outputs							
16-60	Digital Input	0 N/A	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 N/A	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 N/A	All set-ups		FALSE	-3	Int32
16-65	Analog Output 42 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All set-ups		FALSE	0	Int16
16-67	Freq. Input #29 [Hz]	0 N/A	All set-ups	x	FALSE	0	Int32
16-68	Freq. Input #33 [Hz]	0 N/A	All set-ups		FALSE	0	Int32
16-69	Pulse Output #27 [Hz]	0 N/A	All set-ups		FALSE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	x	FALSE	0	Int32
16-71	Relay Output [bin]	0 N/A	All set-ups		FALSE	0	Int16
16-72	Counter A	0 N/A	All set-ups		TRUE	0	Int32
16-73	Counter B	0 N/A	All set-ups		TRUE	0	Int32
16-74	Prec. Stop Counter	0 N/A	All set-ups		TRUE	0	Uint32
16-75	Analog In X30/11	0.000 N/A	All set-ups		FALSE	-3	Int32
16-76	Analog In X30/12	0.000 N/A	All set-ups		FALSE	-3	Int32
16-77	Analog Out X30/8 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-78	Analog Out X45/1 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-79	Analog Out X45/3 [mA]	0.000 N/A	All set-ups		FALSE	-3	Int16
16-8* Fieldbus & FC Port							
16-80	Fieldbus CTW 1	0 N/A	All set-ups		FALSE	0	V2
16-82	Fieldbus REF 1	0 N/A	All set-ups		FALSE	0	N2
16-84	Comm. Option STW	0 N/A	All set-ups		FALSE	0	V2
16-85	FC Port CTW 1	0 N/A	All set-ups		FALSE	0	V2
16-86	FC Port REF 1	0 N/A	All set-ups		FALSE	0	N2
16-9* Diagnosis Readouts							
16-90	Alarm Word	0 N/A	All set-ups		FALSE	0	Uint32
16-91	Alarm Word 2	0 N/A	All set-ups		FALSE	0	Uint32
16-92	Warning Word	0 N/A	All set-ups		FALSE	0	Uint32
16-93	Warning Word 2	0 N/A	All set-ups		FALSE	0	Uint32
16-94	Ext. Status Word	0 N/A	All set-ups		FALSE	0	Uint32

4.2.17 17-** Motor Feedb.Option

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
17-1* Inc. Enc. Interface							
17-10	Signal Type	[1] RS422 (5V TTL)	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)	App.Dependent	All set-ups		FALSE	0	Uint32
17-24	SSI Data Length	13 N/A	All set-ups		FALSE	0	Uint8
17-25	Clock Rate	App.Dependent	All set-ups		FALSE	3	Uint16
17-26	SSI Data Format	[0] Gray code	All set-ups		FALSE	-	Uint8
17-34	HIPERFACE Baudrate	[4] 9600	All set-ups		FALSE	-	Uint8
17-5* Resolver Interface							
17-50	Poles	2 N/A	1 set-up		FALSE	0	Uint8
17-51	Input Voltage	7.0 V	1 set-up		FALSE	-1	Uint8
17-52	Input Frequency	10.0 kHz	1 set-up		FALSE	2	Uint8
17-53	Transformation Ratio	0.5 N/A	1 set-up		FALSE	-1	Uint8
17-56	Encoder Sim. Resolution	[0] Disabled	1 set-up		FALSE	-	Uint8
17-59	Resolver Interface	[0] Disabled	All set-ups		FALSE	-	Uint8
17-6* Monitoring and App.							
17-60	Feedback Direction	[0] Clockwise	All set-ups		FALSE	-	Uint8
17-61	Feedback Signal Monitoring	[1] Warning	All set-ups		TRUE	-	Uint8

4.2.18 18-** Data Readouts 2

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
18-3* Analog Readouts							
18-36	Analog Input X48/2 [mA]	0.000 N/A	All set-ups		TRUE	-3	Int32
18-37	Temp. Input X48/4	0 N/A	All set-ups		TRUE	0	Int16
18-38	Temp. Input X48/7	0 N/A	All set-ups		TRUE	0	Int16
18-39	Temp. Input X48/10	0 N/A	All set-ups		TRUE	0	Int16
18-6* Inputs & Outputs 2							
18-60	Digital Input 2	0 N/A	All set-ups		FALSE	0	Uint16
18-90 PID Readouts							
18-90	Process PID Error	0.0 %	All set-ups		FALSE	-1	Int16
18-91	Process PID Output	0.0 %	All set-ups		FALSE	-1	Int16
18-92	Process PID Clamped Output	0.0 %	All set-ups		FALSE	-1	Int16
18-93	Process PID Gain Scaled Output	0.0 %	All set-ups		FALSE	-1	Int16

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4.2.19 30-** Special Features

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
30-0* Wobbler							
30-00	Wobble Mode	[0] Abs. Freq., Abs. Time	All set-ups		FALSE	-	Uint8
30-01	Wobble Delta Frequency [Hz]	5.0 Hz	All set-ups		TRUE	-1	Uint8
30-02	Wobble Delta Frequency [%]	25 %	All set-ups		TRUE	0	Uint8
30-03	Wobble Delta Freq. Scaling Resource	[0] No function	All set-ups		TRUE	-	Uint8
30-04	Wobble Jump Frequency [Hz]	0.0 Hz	All set-ups		TRUE	-1	Uint8
30-05	Wobble Jump Frequency [%]	0 %	All set-ups		TRUE	0	Uint8
30-06	Wobble Jump Time	App.Dependent	All set-ups		TRUE	-3	Uint16
30-07	Wobble Sequence Time	10.0 s	All set-ups		TRUE	-1	Uint16
30-08	Wobble Up/ Down Time	5.0 s	All set-ups		TRUE	-1	Uint16
30-09	Wobble Random Function	[0] Off	All set-ups		TRUE	-	Uint8
30-10	Wobble Ratio	1.0 N/A	All set-ups		TRUE	-1	Uint8
30-11	Wobble Random Ratio Max.	10.0 N/A	All set-ups		TRUE	-1	Uint8
30-12	Wobble Random Ratio Min.	0.1 N/A	All set-ups		TRUE	-1	Uint8
30-19	Wobble Delta Freq. Scaled	0.0 Hz	All set-ups		FALSE	-1	Uint16
30-2* Adv. Start Adjust							
30-20	High Starting Torque Time [s]	0.00 s	All set-ups	x	TRUE	-2	Uint8
30-21	High Starting Torque Current [%]	100.0 %	All set-ups	x	TRUE	-1	Uint32
30-22	Locked Rotor Protection	[0] Off	All set-ups	x	TRUE	-	Uint8
30-23	Locked Rotor Detection Time [s]	0.10 s	All set-ups	x	TRUE	-2	Uint8
30-8* Compatibility (I)							
30-80	d-axis Inductance (Ld)	App.Dependent	All set-ups	x	FALSE	-6	Int32
30-81	Brake Resistor (ohm)	App.Dependent	1 set-up		TRUE	-2	Uint32
30-83	Speed PID Proportional Gain	App.Dependent	All set-ups		TRUE	-4	Uint32
30-84	Process PID Proportional Gain	0.100 N/A	All set-ups		TRUE	-3	Uint16

4.2.20 32-** MCO Basic Settings

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
32-0* Encoder 2							
32-00	Incremental Signal Type	[1] RS422 (5V TTL)	2 set-ups		TRUE	-	Uint8
32-01	Incremental Resolution	1024 N/A	2 set-ups		TRUE	0	Uint32
32-02	Absolute Protocol	[0] None	2 set-ups		TRUE	-	Uint8
32-03	Absolute Resolution	8192 N/A	2 set-ups		TRUE	0	Uint32
32-04	Absolute Encoder Baudrate X55	[4] 9600	All set-ups		FALSE	-	Uint8
32-05	Absolute Encoder Data Length	25 N/A	2 set-ups		TRUE	0	Uint8
32-06	Absolute Encoder Clock Frequency	262.000 kHz	2 set-ups		TRUE	0	Uint32
32-07	Absolute Encoder Clock Generation	[1] On	2 set-ups		TRUE	-	Uint8
32-08	Absolute Encoder Cable Length	0 m	2 set-ups		TRUE	0	Uint16
32-09	Encoder Monitoring	[0] Off	2 set-ups		TRUE	-	Uint8
32-10	Rotational Direction	[1] No action	2 set-ups		TRUE	-	Uint8
32-11	User Unit Denominator	1 N/A	2 set-ups		TRUE	0	Uint32
32-12	User Unit Numerator	1 N/A	2 set-ups		TRUE	0	Uint32
32-13	Enc.2 Control	[0] No soft changing	2 set-ups		TRUE	-	Uint8
32-14	Enc.2 node ID	127 N/A	2 set-ups		TRUE	0	Uint8
32-15	Enc.2 CAN guard	null	2 set-ups		TRUE	-	Uint8
32-3* Encoder 1							
32-30	Incremental Signal Type	[1] RS422 (5V TTL)	2 set-ups		TRUE	-	Uint8
32-31	Incremental Resolution	1024 N/A	2 set-ups		TRUE	0	Uint32
32-32	Absolute Protocol	[0] None	2 set-ups		TRUE	-	Uint8
32-33	Absolute Resolution	8192 N/A	2 set-ups		TRUE	0	Uint32
32-35	Absolute Encoder Data Length	25 N/A	2 set-ups		TRUE	0	Uint8
32-36	Absolute Encoder Clock Frequency	262.000 kHz	2 set-ups		TRUE	0	Uint32
32-37	Absolute Encoder Clock Generation	[1] On	2 set-ups		TRUE	-	Uint8
32-38	Absolute Encoder Cable Length	0 m	2 set-ups		TRUE	0	Uint16
32-39	Encoder Monitoring	[0] Off	2 set-ups		TRUE	-	Uint8
32-40	Encoder Termination	[1] On	2 set-ups		TRUE	-	Uint8
32-43	Enc.1 Control	[0] No soft changing	2 set-ups		TRUE	-	Uint8
32-44	Enc.1 node ID	127 N/A	2 set-ups		TRUE	0	Uint8
32-45	Enc.1 CAN guard	null	2 set-ups		TRUE	-	Uint8
32-5* Feedback Source							
32-50	Source Slave	[2] Encoder 2	2 set-ups		TRUE	-	Uint8
32-51	MCO 302 Last Will	[1] Trip	2 set-ups		TRUE	-	Uint8
32-52	Source Master	[1] Encoder 1 X56	2 set-ups		TRUE	-	Uint8

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
32-6* PID Controller							
32-60	Proportional factor	30 N/A	2 set-ups		TRUE	0	Uint32
32-61	Derivative factor	0 N/A	2 set-ups		TRUE	0	Uint32
32-62	Integral factor	0 N/A	2 set-ups		TRUE	0	Uint32
32-63	Limit Value for Integral Sum	1000 N/A	2 set-ups		TRUE	0	Uint16
32-64	PID Bandwidth	1000 N/A	2 set-ups		TRUE	0	Uint16
32-65	Velocity Feed-Forward	0 N/A	2 set-ups		TRUE	0	Uint32
32-66	Acceleration Feed-Forward	0 N/A	2 set-ups		TRUE	0	Uint32
32-67	Max. Tolerated Position Error	20000 N/A	2 set-ups		TRUE	0	Uint32
32-68	Reverse Behavior for Slave	[0] Reversing allowed	2 set-ups		TRUE	-	Uint8
32-69	Sampling Time for PID Control	1 ms	2 set-ups		TRUE	-3	Uint16
32-70	Scan Time for Profile Generator	1 ms	2 set-ups		TRUE	-3	Uint8
32-71	Size of the Control Window (Activation)	0 N/A	2 set-ups		TRUE	0	Uint32
32-72	Size of the Control Window (Deactiv.)	0 N/A	2 set-ups		TRUE	0	Uint32
32-73	Integral limit filter time	0 ms	2 set-ups		TRUE	-3	Int16
32-74	Position error filter time	0 ms	2 set-ups		TRUE	-3	Int16
32-8* Velocity & Accel.							
32-80	Maximum Velocity (Encoder)	1500 RPM	2 set-ups		TRUE	67	Uint32
32-81	Shortest Ramp	1.000 s	2 set-ups		TRUE	-3	Uint32
32-82	Ramp Type	[0] Linear	2 set-ups		TRUE	-	Uint8
32-83	Velocity Resolution	100 N/A	2 set-ups		TRUE	0	Uint32
32-84	Default Velocity	50 N/A	2 set-ups		TRUE	0	Uint32
32-85	Default Acceleration	50 N/A	2 set-ups		TRUE	0	Uint32
32-86	Acc. up for limited jerk	100 ms	2 set-ups		TRUE	-3	Uint32
32-87	Acc. down for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-88	Dec. up for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-89	Dec. down for limited jerk	0 ms	2 set-ups		TRUE	-3	Uint32
32-9* Development							
32-90	Debug Source	[0] Controlcard	2 set-ups		TRUE	-	Uint8

4.2.21 33-** MCO Adv. Settings

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
33-0* Home Motion							
33-00	Force HOME	[0] Home not forced	2 set-ups		TRUE	-	Uint8
33-01	Zero Point Offset from Home Pos.	0 N/A	2 set-ups		TRUE	0	Int32
33-02	Ramp for Home Motion	10 N/A	2 set-ups		TRUE	0	Uint32
33-03	Velocity of Home Motion	10 N/A	2 set-ups		TRUE	0	Int32
33-04	Behaviour during HomeMotion	[0] Revers and index	2 set-ups		TRUE	-	Uint8
33-1* Synchronization							
33-10	Sync Factor Master	1 N/A	2 set-ups		TRUE	0	Int32
33-11	Sync Factor Slave	1 N/A	2 set-ups		TRUE	0	Int32
33-12	Position Offset for Synchronization	0 N/A	2 set-ups		TRUE	0	Int32
33-13	Accuracy Window for Position Sync.	1000 N/A	2 set-ups		TRUE	0	Int32
33-14	Relative Slave Velocity Limit	0 %	2 set-ups		TRUE	0	Uint8
33-15	Marker Number for Master	1 N/A	2 set-ups		TRUE	0	Uint16
33-16	Marker Number for Slave	1 N/A	2 set-ups		TRUE	0	Uint16
33-17	Master Marker Distance	4096 N/A	2 set-ups		TRUE	0	Uint32
33-18	Slave Marker Distance	4096 N/A	2 set-ups		TRUE	0	Uint32
33-19	Master Marker Type	[0] Encoder Z positive	2 set-ups		TRUE	-	Uint8
33-20	Slave Marker Type	[0] Encoder Z positive	2 set-ups		TRUE	-	Uint8
33-21	Master Marker Tolerance Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-22	Slave Marker Tolerance Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-23	Start Behaviour for Marker Sync	[0] Start Function 1	2 set-ups		TRUE	-	Uint16
33-24	Marker Number for Fault	10 N/A	2 set-ups		TRUE	0	Uint16
33-25	Marker Number for Ready	1 N/A	2 set-ups		TRUE	0	Uint16
33-26	Velocity Filter	0 us	2 set-ups		TRUE	-6	Int32
33-27	Offset Filter Time	0 ms	2 set-ups		TRUE	-3	Uint32
33-28	Marker Filter Configuration	[0] Marker filter 1	2 set-ups		TRUE	-	Uint8
33-29	Filter Time for Marker Filter	0 ms	2 set-ups		TRUE	-3	Int32
33-30	Maximum Marker Correction	0 N/A	2 set-ups		TRUE	0	Uint32
33-31	Synchronisation Type	[0] Standard	2 set-ups		TRUE	-	Uint8
33-32	Feed Forward Velocity Adaptation	0 N/A	2 set-ups		TRUE	0	Uint32
33-33	Velocity Filter Window	0 N/A	2 set-ups		TRUE	0	Uint32
33-34	Slave Marker filter time	0 ms	2 set-ups		TRUE	-3	Uint32
33-4* Limit Handling							
33-40	Behaviour at End Limit Switch	[0] Call error handler	2 set-ups		TRUE	-	Uint8
33-41	Negative Software End Limit	-500000 N/A	2 set-ups		TRUE	0	Int32
33-42	Positive Software End Limit	500000 N/A	2 set-ups		TRUE	0	Int32
33-43	Negative Software End Limit Active	[0] Inactive	2 set-ups		TRUE	-	Uint8
33-44	Positive Software End Limit Active	[0] Inactive	2 set-ups		TRUE	-	Uint8
33-45	Time in Target Window	0 ms	2 set-ups		TRUE	-3	Uint8
33-46	Target Window LimitValue	1 N/A	2 set-ups		TRUE	0	Uint16
33-47	Size of Target Window	0 N/A	2 set-ups		TRUE	0	Uint16

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
33-5* I/O Configuration							
33-50	Terminal X57/1 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-51	Terminal X57/2 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-52	Terminal X57/3 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-53	Terminal X57/4 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-54	Terminal X57/5 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-55	Terminal X57/6 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-56	Terminal X57/7 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-57	Terminal X57/8 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-58	Terminal X57/9 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-59	Terminal X57/10 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-60	Terminal X59/1 and X59/2 Mode	[1] Output	2 set-ups		FALSE	-	Uint8
33-61	Terminal X59/1 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-62	Terminal X59/2 Digital Input	[0] No function	2 set-ups		TRUE	-	Uint8
33-63	Terminal X59/1 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-64	Terminal X59/2 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-65	Terminal X59/3 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-66	Terminal X59/4 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-67	Terminal X59/5 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-68	Terminal X59/6 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-69	Terminal X59/7 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-70	Terminal X59/8 Digital Output	[0] No function	2 set-ups		TRUE	-	Uint8
33-8* Global Parameters							
33-80	Activated Program Number	-1 N/A	2 set-ups		TRUE	0	Int8
33-81	Power-up State	[1] Motor on	2 set-ups		TRUE	-	Uint8
33-82	Drive Status Monitoring	[1] On	2 set-ups		TRUE	-	Uint8
33-83	Behaviour afterError	[0] Coast	2 set-ups		TRUE	-	Uint8
33-84	Behaviour afterEsc.	[0] Controlled stop	2 set-ups		TRUE	-	Uint8
33-85	MCO Supplied by External 24VDC	[0] No	2 set-ups		TRUE	-	Uint8
33-86	Terminal at alarm	[0] Relay 1	2 set-ups		TRUE	-	Uint8
33-87	Terminal state at alarm	[0] Do nothing	2 set-ups		TRUE	-	Uint8
33-88	Status word at alarm	0 N/A	2 set-ups		TRUE	0	Uint16
33-9* MCO Port Settings							
33-90	X62 MCO CAN node ID	127 N/A	2 set-ups		TRUE	0	Uint8
33-91	X62 MCO CAN baud rate	[20] 125 Kbps	2 set-ups		TRUE	-	Uint8
33-94	X60 MCO RS485 serial termination	[0] Off	2 set-ups		TRUE	-	Uint8
33-95	X60 MCO RS485 serial baud rate	[2] 9600 Baud	2 set-ups		TRUE	-	Uint8

4.2.22 34-** MCO Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver- sion index	Type
34-0* PCD Write Par.							
34-01	PCD 1 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-02	PCD 2 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-03	PCD 3 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-04	PCD 4 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-05	PCD 5 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-06	PCD 6 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-07	PCD 7 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-08	PCD 8 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-09	PCD 9 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-10	PCD 10 Write to MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-2* PCD Read Par.							
34-21	PCD 1 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-22	PCD 2 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-23	PCD 3 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-24	PCD 4 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-25	PCD 5 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-26	PCD 6 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-27	PCD 7 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-28	PCD 8 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-29	PCD 9 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-30	PCD 10 Read from MCO	0 N/A	All set-ups		TRUE	0	Uint16
34-4* Inputs & Outputs							
34-40	Digital Inputs	0 N/A	All set-ups		TRUE	0	Uint16
34-41	Digital Outputs	0 N/A	All set-ups		TRUE	0	Uint16
34-5* Process Data							
34-50	Actual Position	0 N/A	All set-ups		TRUE	0	Int32
34-51	Commanded Position	0 N/A	All set-ups		TRUE	0	Int32
34-52	Actual Master Position	0 N/A	All set-ups		TRUE	0	Int32
34-53	Slave Index Position	0 N/A	All set-ups		TRUE	0	Int32
34-54	Master Index Position	0 N/A	All set-ups		TRUE	0	Int32
34-55	Curve Position	0 N/A	All set-ups		TRUE	0	Int32
34-56	Track Error	0 N/A	All set-ups		TRUE	0	Int32
34-57	Synchronizing Error	0 N/A	All set-ups		TRUE	0	Int32
34-58	Actual Velocity	0 N/A	All set-ups		TRUE	0	Int32
34-59	Actual Master Velocity	0 N/A	All set-ups		TRUE	0	Int32
34-60	Synchronizing Status	0 N/A	All set-ups		TRUE	0	Int32
34-61	Axis Status	0 N/A	All set-ups		TRUE	0	Int32
34-62	Program Status	0 N/A	All set-ups		TRUE	0	Int32
34-64	MCO 302 Status	0 N/A	All set-ups		TRUE	0	Uint16
34-65	MCO 302 Control	0 N/A	All set-ups		TRUE	0	Uint16
34-7* Diagnosis readouts							
34-70	MCO Alarm Word 1	0 N/A	All set-ups		FALSE	0	Uint32
34-71	MCO Alarm Word 2	0 N/A	All set-ups		FALSE	0	Uint32

4.2.23 35-** Sensor Input Option

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conver-sion index	Type
35-0* Temp. Input Mode							
35-00	Term. X48/4 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-01	Term. X48/4 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-02	Term. X48/7 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-03	Term. X48/7 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-04	Term. X48/10 Temp. Unit	[60] °C	All set-ups		TRUE	-	Uint8
35-05	Term. X48/10 Input Type	[0] Not Connected	All set-ups		TRUE	-	Uint8
35-06	Temperature Sensor Alarm Function	[5] Stop and trip	All set-ups		TRUE	-	Uint8
35-1* Temp. Input X48/4							
35-14	Term. X48/4 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-15	Term. X48/4 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-16	Term. X48/4 Low Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-17	Term. X48/4 High Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-2* Temp. Input X48/7							
35-24	Term. X48/7 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-25	Term. X48/7 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-26	Term. X48/7 Low Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-27	Term. X48/7 High Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-3* Temp. Input X48/10							
35-34	Term. X48/10 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16
35-35	Term. X48/10 Temp. Monitor	[0] Disabled	All set-ups		TRUE	-	Uint8
35-36	Term. X48/10 Low Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-37	Term. X48/10 High Temp. Limit	App.Dependent	All set-ups		TRUE	0	Int16
35-4* Analog Input X48/2							
35-42	Term. X48/2 Low Current	4.00 mA	All set-ups		TRUE	-5	Int16
35-43	Term. X48/2 High Current	20.00 mA	All set-ups		TRUE	-5	Int16
35-44	Term. X48/2 Low Ref./Feedb. Value	0.000 N/A	All set-ups		TRUE	-3	Int32
35-45	Term. X48/2 High Ref./Feedb. Value	100.000 N/A	All set-ups		TRUE	-3	Int32
35-46	Term. X48/2 Filter Time Constant	0.001 s	All set-ups		TRUE	-3	Uint16

5 General Specifications

Mains supply (L1-1, L2-1, L3-1, L1-2, L2-2, L3-2):

Supply voltage	FC 302: 380-500V ±10%
Supply voltage	FC 302: 525-690V ±10%

Mains voltage low / mains drop-out:

During low mains voltage or a mains drop-out, the frequency converter continues until the intermediate circuit voltage drops below the minimum stop level, which corresponds typically to 15% below the lowest rated supply voltage. Power-up and full torque cannot be expected at mains voltage lower than 10% below the lowest rated supply voltage.

Supply frequency	50/60Hz ±5%
Max. imbalance temporary between mains phases	3.0% of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cos ϕ) near unity	(> 0.98)
Switching on input supply L1-1, L2-1, L3-1, L1-2, L2-2, L3-2 (power-ups)	maximum 1 time/ 2 min.
Environment according to EN60664-1	over-voltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 500/600/690V maximum.

Motor output (U, V, W):

Output voltage	0 - 100% of supply voltage
Output frequency	0 - 800* Hz
Switching on output	Unlimited
Ramp times	0.01 - 3600 sec.

* Voltage and power dependent

Torque characteristics:

Starting torque (Constant torque)	maximum 160% for 60 sec.[1]
Starting torque	maximum 180% up to 0.5 sec.[1]
Overload torque (Constant torque)	maximum 160% for 60 sec.[1]
Starting torque (Variable torque)	maximum 110% for 60 sec.[1]
Overload torque (Variable torque)	maximum 110% for 60 sec.

Torque rise time in (independent of fsw)	10ms
Torque rise time in FLUX (for 5kHz fsw)	1ms

[1] *Percentage relates to the nominal torque.*

[2] *The torque response time depends on application and load but as a general rule, the torque step from 0 to reference is 4-5 x torque rise time.*

Digital inputs:

Programmable digital inputs	4 (6)
Terminal number	18, 19, 27[1], 29, 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24V DC
Voltage level, logic'0' PNP	< 5V DC
Voltage level, logic'1' PNP	> 10V DC
Voltage level, logic '0' NPN[2]	> 19V DC
Voltage level, logic '1' NPN[2]	< 14V DC
Maximum voltage on input	28V DC
Pulse frequency range	0 - 110kHz
(Duty cycle) Min. pulse width	4.5ms
Input resistance, R_i	approx.4kΩ

Safe stop Terminal 37[3] (Terminal 37 is fixed PNP logic):

Voltage level	0 - 24V DC
Voltage level, logic'0' PNP	< 4V DC
Voltage level, logic'1' PNP	>20V DC

Nominal input current at 24V	50mA rms
Nominal input current at 20V	60mA rms
Input capacitance	400nF

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 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.

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	-10 to +10V (scaleable)
Input resistance, R_i	approx. 10kΩ
Max. voltage	± 20V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20mA (scaleable)
Input resistance, R_i	approx. 200Ω
Max. current	30mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	100Hz

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

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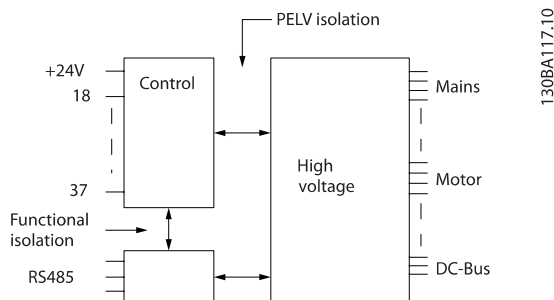
Pulse/encoder inputs:

Programmable pulse/encoder inputs	2/1
Terminal number pulse/encoder	29[1)], 33[2)] / 32[3)], 33[3)]
Max. frequency at terminal 29, 32, 33	110kHz (Push-pull driven)
Max. frequency at terminal 29, 32, 33	5kHz (open collector)
Min. frequency at terminal 29, 32, 33	4Hz
Voltage level	see section on Digital input
Maximum voltage on input	28V DC
Input resistance, R_i	approx. 4kΩ
Pulse input accuracy (0.1 - 1kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1 - 11 kHz)	Max. error: 0.05 % of full scale

The pulse and encoder inputs (terminals 29, 32, 33) are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

[1)] *FC 302 only*

[2)] *Pulse inputs are 29 and 33*

[3)] *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 - 24V
Max. output current (sink or source)	40mA
Max. load at frequency output	1kΩ
Max. capacitive load at frequency output	10nF
Minimum output frequency at frequency output	0Hz
Maximum output frequency at frequency output	32kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

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

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

Analog output:

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

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

Control card, 24V DC output:

Terminal number	12, 13
Output voltage	24V +1, -3V
Max. load	200mA

The 24V 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, 10V DC output:

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

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

Control card, RS-485 serial communication:

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

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

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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 ground connection is <u>not</u> galvanically isolated from protection earth. Use only an isolated laptop as PC connection to the USB connector on the frequency converter.

Relay outputs:

Programmable relay outputs	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)	240V AC, 2 A
Max. terminal load (AC-15)[1] (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1] on 1-2 (NO), 1-3 (NC) (Resistive load)	60V DC, 1A
Max. terminal load (DC-13)[1] (Inductive load)	24V 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)	400V AC, 2A
Max. terminal load (AC-15)[1] on 4-5 (NO) (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1] on 4-5 (NO) (Resistive load)	80 V DC, 2A
Max. terminal load (DC-13)[1] on 4-5 (NO) (Inductive load)	24V DC, 0.1A
Max. terminal load (AC-1)[1] on 4-6 (NC) (Resistive load)	240V AC, 2A
Max. terminal load (AC-15)[1] on 4-6 (NC) (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1)[1] on 4-6 (NC) (Resistive load)	50V DC, 2 A
Max. terminal load (DC-13)[1] on 4-6 (NC) (Inductive load)	24V DC, 0.1A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24V DC 10mA, 24V AC 20mA
Environment according to EN 60664-1	over-voltage 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, screened/armoured	150m
Max. motor cable length, unscreened/unarmoured	300m
Maximum cross section to control terminals, flexible/ rigid wire without cable end sleeves	$1.5mm^2$/16 AWG
Maximum cross section to control terminals, flexible wire with cable end sleeves	$1mm^2$/18 AWG
Maximum cross section to control terminals, flexible wire with cable end sleeves with collar	$0.5mm^2$/20 AWG
Minimum cross section to control terminals	$0.25mm^2$/ 24 AWG

Control card performance:

Scan interval	1ms

Control characteristics:

Resolution of output frequency at 0 - 1000Hz	± 0.003Hz
Repeat accuracy of *Precise start/stop* (terminals 18, 19)	≤± 0.1msec
System response time (terminals 18, 19, 27, 29, 32, 33)	≤ 2ms
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 - 4000rpm: error ±8rpm
Speed accuracy (closed loop), depending on resolution of feedback device	0 - 6000rpm: error ±0.15rpm
Torque control accuracy (speed feedback)	max error±5% of rated torque

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

Surroundings:

Enclosure	IP 21/ Type 1, IP 54/ Type 12
Vibration test	0.7 g
Max. relative humidity	5% - 95%(IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 60068-2-43)	class H$_2$5
Ambient temperature (with SFAVM switching mode)	
- with derating	Max. 55 °C[1]

- at full continuous drive output current	Max. 45 °C[1]

1) For more information on derating, see special conditions in the Design Guide

Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level without derating	1000m

Derating for high altitude, see special conditions in the Design Guide

EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011
	EN 61800-3, EN 61000-6-1/2,
EMC standards, Immunity	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 frequency converter trips if the temperature reaches a predefined level. An overload temperature cannot be reset until the temperature of the heatsink is below the values stated in the tables on the following pages (Guideline - these temperatures may vary for different power sizes, frame sizes, enclosure ratings etc.).

- The frequency converter is protected against short-circuits on motor terminals U, V, W.

- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load).

- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.

- The frequency converter constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the frequency converter can adjust the switching frequency and/ or change the switching pattern in order to ensure the performance of the frequency converter.

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Mains Supply 6 x 380 - 500V AC								
FC 302	P250		P315		P355		P400	
High/ Normal Load*	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 400V [kW]	250	315	315	355	355	400	400	450
Typical Shaft output at 460V [HP]	350	450	450	500	500	600	550	600
Typical Shaft output at 500V [kW]	315	355	355	400	400	500	500	530
Enclosure IP21	F8/F9		F8/F9		F8/F9		F8/F9	
Enclosure IP54	F8/F9		F8/F9		F8/F9		F8/F9	
Output current								
Continuous (at 400V) [A]	480	600	600	658	658	745	695	800
Intermittent (60 sec overload) (at 400V) [A]	720	660	900	724	987	820	1043	880
Continuous (at 460/ 500V) [A]	443	540	540	590	590	678	678	730
Intermittent (60 sec overload) (at 460/ 500V) [A]	665	594	810	649	885	746	1017	803
Continuous KVA (at 400V) [KVA]	333	416	416	456	456	516	482	554
Continuous KVA (at 460V) [KVA]	353	430	430	470	470	540	540	582
Continuous KVA (at 500V) [KVA]	384	468	468	511	511	587	587	632
Max. input current								
Continuous (at 400V) [A]	472	590	590	647	647	733	684	787
Continuous (at 460/ 500V) [A]	436	531	531	580	580	667	667	718
Max. cable size, mains [mm^2 (AWG[2))]	4x90 (3/0)		4x90 (3/0)		4x240 (500 mcm)		4x240 (500 mcm)	
Max. cable size, motor [mm^2 (AWG[2))]	4x240 (4x500 mcm)		4x240 (4x500 mcm)		4x240 (4x500 mcm)		4x240 (4x500 mcm)	
Max. cable size, brake [mm^2 (AWG[2))	2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)	
Max. external mains fuses [A] [1]	700							
Estimated power loss at 400V [W] [4)	5164	6790	6960	7701	7691	8879	8178	9670
Estimated power loss at 460V [W]	4822	6082	6345	6953	6944	8089	8085	8803
Weight,enclosure IP21, IP 54 [kg]	440/656							
Efficiency[4)	0.98							
Output frequency	0 - 600Hz							
Heatsink overtemp. trip	95°C							
Power card ambient trip	68°C							
* High overload = 160% torque during 60 sec., Normal overload = 110% torque during 60 sec.								

Mains Supply 6 x 380 - 500V AC

FC 302	P450		P500		P560		P630		P710		P800	
High/ Normal Load *	HO	NO	HO	NO	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 400V [kW]	450	500	500	560	560	630	630	710	710	800	800	1000
Typical Shaft output at 460V [HP]	600	650	650	750	750	900	900	1000	1000	1200	1200	1350
Typical Shaft output at 500V [kW]	530	560	560	630	630	710	710	800	800	1000	1000	1100
EnclosureIP21, 54 without/ with options cabinet	F10/F11		F10/F11		F10/F11		F10/F11		F12/F13		F12/F13	
Output current												
Continuous (at 400V) [A]	800	880	880	990	990	1120	1120	1260	1260	1460	1460	1720
Intermittent (60 sec overload) (at 400V) [A]	1200	968	1320	1089	1485	1232	1680	1386	1890	1606	2190	1892
Continuous (at 460/ 500V) [A]	730	780	780	890	890	1050	1050	1160	1160	1380	1380	1530
Intermittent (60 sec overload) (at 460/ 500V) [A]	1095	858	1170	979	1335	1155	1575	1276	1740	1518	2070	1683
Continuous KVA (at 400V) [KVA]	554	610	610	686	686	776	776	873	873	1012	1012	1192
Continuous KVA (at 460V) [KVA]	582	621	621	709	709	837	837	924	924	1100	1100	1219
Continuous KVA (at 500V) [KVA]	632	675	675	771	771	909	909	1005	1005	1195	1195	1325
Max. input current												
Continuous (at 400V) [A]	779	857	857	964	964	1090	1090	1227	1227	1422	1422	1675
Continuous (at 460/ 500V) [A]	711	759	759	867	867	1022	1022	1129	1129	1344	1344	1490
Max. cable size,motor [mm² (AWG²)]	8x150 (8x300 mcm)								12x150 (12x300 mcm)			
Max. cable size,mains [mm² (AWG²)]	6x120 (6x250 mcm)											
Max. cable size, brake [mm² (AWG²)]	4x185 (4x350 mcm)								6x185 (6x350 mcm)			
Max. external mains fuses [A] [1]	900								1500			
Estimated power loss at 400V [W] [4]	9492	10647	10631	12338	11263	13201	13172	15436	14967	18084	16392	20358
Estimated power loss at 460V [W]	8730	9414	9398	11006	10063	12353	12332	14041	13819	17137	15577	17752
F9/F11/F13 max. added losses A1 RFI, CB or Disconnect, & contactor F9/F11/F13	893	963	951	1054	978	1093	1092	1230	2067	2280	2236	2541
Max. panel options losses	400											
Weight, enclosure IP21, IP 54 [kg]	1004/ 1299		1004/ 1299		1004/ 1299		1004/ 1299		1246/ 1541		1246/ 1541	
Weight Rectifier Module [kg]	102		102		102		102		136		136	
Weight Inverter Module [kg]	102		102		102		136		102		102	
Efficiency[4]	0.98											
Output frequency	0-600Hz											
Heatsink overtemp. trip	95 °C											
Power card ambient trip	68 °C											
* High overload = 160% torque during 60 sec., Normal overload = 110% torque during 60 sec.												

Mains Supply 3 x 525- 690V AC								
FC 302	P355		P400		P500		P560	
High/ Normal Load	HO	NO	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550V [kW]	315	355	315	400	400	450	450	500
Typical Shaft output at 575V [HP]	400	450	400	500	500	600	600	650
Typical Shaft output at 690V [kW]	355	450	400	500	500	560	560	630
Enclosure IP21	F8/F9		F8/F9		F8/F9		F8/F9	
Enclosure IP54	F8/F9		F8/F9		F8/F9		F8/F9	
Output current								
Continuous (at 550V) [A]	395	470	429	523	523	596	596	630
Intermittent (60 sec overload) (at 550V) [A]	593	517	644	575	785	656	894	693
Continuous (at 575/ 690V) [A]	380	450	410	500	500	570	570	630
Intermittent (60 sec overload) (at 575/ 690V) [A]	570	495	615	550	750	627	855	693
Continuous KVA (at 550V) [KVA]	376	448	409	498	498	568	568	600
Continuous KVA (at 575V) [KVA]	378	448	408	498	498	568	568	627
Continuous KVA (at 690V) [KVA]	454	538	490	598	598	681	681	753
Max. input current								
Continuous (at 550V) [A]	381	453	413	504	504	574	574	607
Continuous (at 575V) [A]	366	434	395	482	482	549	549	607
Continuous (at 690V) [A]	366	434	395	482	482	549	549	607
Max. cable size, mains [mm² (AWG)]	4x85 (3/0)							
Max. cable size, motor [mm² (AWG)]	4 x 250 (500 mcm)							
Max. cable size, brake [mm² (AWG)]	2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)		2 x 185 (2 x 350 mcm)	
Max. external mains fuses [A] [1]	630							
Estimated power loss at 600 V [W] [4]	5107	6132	5538	6903	7336	8343	8331	9244
Estimated power loss at 690 V [W] [4]	5383	6449	5818	7249	7671	8727	8715	9673
Weight, enclosure IP21, IP 54 [kg]	440/656							
Efficiency[4]	0.98							
Output frequency	0 - 500Hz							
Heatsink overtemp. trip	85 °C							
Power card ambient trip	68 °C							
* High overload = 160% torque during 60 sec., Normal overload = 110% torque during 60 sec.								

Mains Supply 3 x 525- 690V AC						
FC 302	P630		P710		P800	
High/ Normal Load	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550V [kW]	500	560	560	670	670	750
Typical Shaft output at 575V [HP]	650	750	750	950	950	1050
Typical Shaft output at 690V [kW]	630	710	710	800	800	900
Enclosure IP21, 54 without/ with options cabinet	F10/F11		F10/F11		F10/F11	
Output current						
Continuous (at 550V) [A]	659	763	763	889	889	988
Intermittent (60 sec overload) (at 550V) [A]	989	839	1145	978	1334	1087
Continuous (at 575/ 690V) [A]	630	730	730	850	850	945
Intermittent (60 sec overload) (at 575/ 690V) [A]	945	803	1095	935	1275	1040
Continuous KVA (at 550V) [KVA]	628	727	727	847	847	941
Continuous KVA (at 575V) [KVA]	627	727	727	847	847	941
Continuous KVA (at 690V) [KVA]	753	872	872	1016	1016	1129
Max. input current						
Continuous (at 550V) [A]	642	743	743	866	866	962
Continuous (at 575V) [A]	613	711	711	828	828	920
Continuous (at 690V) [A]	613	711	711	828	828	920
Max. cable size, motor [mm² (AWG[2])]	8x150 (8x300 mcm)					
Max. cable size,mains [mm² (AWG[2])]	6x120 (6x250 mcm)					
Max. cable size, brake [mm² (AWG[2])	4x185 (4x350 mcm)					
Max. external mains fuses [A] [1]	900					
Estimated power loss at 600V [W] [4]	9201	10771	10416	12272	12260	13835
Estimated power loss at 690V [W] [4]	9674	11315	10965	12903	12890	14533
F3/F4 Max added losses CB or Disconnect & Contactor	342	427	419	532	519	615
Max panel options losses	400					
Weight, enclosure IP21, IP 54 [kg]	1004/ 1299		1004/ 1299		1004/ 1299	
Weight, Rectifier Module [kg]	102		102		102	
Weight, Inverter Module [kg]	102		102		136	
Efficiency[4]	0.98					
Output frequency	0-500Hz					
Heatsink overtemp. trip	85 °C					
Power card ambient trip	68 °C					
* High overload = 160% torque during 60 s, Normal overload = 110% torque during 60 s						

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Mains Supply 3 x 525- 690VAC						
FC 302	P900		P1M0		P1M2	
High/ Normal Load*	HO	NO	HO	NO	HO	NO
Typical Shaft output at 550V [kW]	750	850	850	1000	1000	1100
Typical Shaft output at 575V [HP]	1050	1150	1150	1350	1350	1550
Typical Shaft output at 690V [kW]	900	1000	1000	1200	1200	1400
Enclosure IP21, 54 without/ with options cabinet	F12/F13		F12/F13		F12/F13	
Output current						
Continuous (at 550V) [A]	988	1108	1108	1317	1317	1479
Intermittent (60 sec overload) (at 550V) [A]	1482	1219	1662	1449	1976	1627
Continuous (at 575/ 690V) [A]	945	1060	1060	1260	1260	1415
Intermittent (60 sec overload) (at 575/ 690V) [A]	1418	1166	1590	1386	1890	1557
Continuous KVA (at 550V) [KVA]	941	1056	1056	1255	1255	1409
Continuous KVA (at 575V) [KVA]	941	1056	1056	1255	1255	1409
Continuous KVA (at 690V) [KVA]	1129	1267	1267	1506	1506	1691
Max. input current						
Continuous (at 550V) [A]	962	1079	1079	1282	1282	1440
Continuous (at 575V) [A]	920	1032	1032	1227	1227	1378
Continuous (at 690V) [A]	920	1032	1032	1227	1227	1378
Max. cable size, motor [mm² (AWG[2])]	12x150 (12x300 mcm)					
Max. cable size,mains F12 [mm² (AWG[2])]	8x240 (8x500 mcm)					
Max. cable size,mains F13 [mm² (AWG[2])]	8x400 (8x900 mcm)					
Max. cable size, brake [mm² (AWG[2])	6x185 (6x350 mcm)					
Max. external mains fuses [A] [1]	1600		2000		2500	
Estimated power loss at 600 V [W] [4]	13755	15592	15107	18281	18181	20825
Estimated power loss at 690V [W] [4]	14457	16375	15899	19207	19105	21857
F3/F4 Max added losses CB or Disconnect & Contactor	556	665	634	863	861	1044
Max panel options losses	400					
Weight, enclosure IP21, IP 54 [kg]	1246/ 1541		1246/ 1541		1280/1575	
Weight, Rectifier Module [kg]	136		136		136	
Weight, Inverter Module [kg]	102		102		136	
Efficiency[4]	0.98					
Output frequency	0-500 Hz					
Heatsink overtemp. trip	85 °C					
Power card ambient trip	68 °C					
* High overload = 160% torque during 60 sec., Normal overload = 110% torque during 60 sec.						

1) For type of fuse see section *Fuses.*

2) American Wire Gauge.

3) Measured using 5 m screened motor cables at rated load and rated frequency.

4) The typical power loss is at nominal load conditions and expected to be within +/-15% (tolerence relates to variety in voltage and cable conditions).
Values are based on a typical motor efficiency (eff2/eff3 border line). Motors with lower efficiency will also add to the power loss in the frequency converter and opposite.
If the switching frequency is increased compared to the default setting, the power losses may rise significantly.
LCP and typical control card power consumptions are included. Further options and customer load may add up to 30W to the losses. (Though typical only 4W extra for a fully loaded control card, or options for slot A or slot B, each).
Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (+/-5%).

6 Warnings and Alarms

6.1 Status Messages

6.1.1 Warnings/Alarm Messages

A warning or an alarm is signalled by the relevant LED on the front of the frequency converter 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 frequency converter 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.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional fieldbus.

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 mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter 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 *14-20 Reset Mode* (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.

This is possible, for instance, in *1-90 Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the frequency converter is reset.

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		6-01 Live Zero Timeout Function
3	No motor	(X)			1-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	14-12 Function at Mains Imbalance
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over-voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR over temperature	(X)	(X)		1-90 Motor Thermal Protection
11	Motor thermistor over temperature	(X)	(X)		1-90 Motor Thermal Protection
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth Fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word time-out	(X)	(X)		8-04 Control Word Timeout Function

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
20	Temp. Input Error				
21	Param Error				
22	Hoist Mech. Brake	(X)	(X)		Parameter group 2-2*
23	Internal Fans	X			
24	External Fans	X			
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		2-13 Brake Power Monitoring
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		2-15 Brake Check
29	Heatsink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	4-58 Missing Motor Phase Function
33	Inrush Fault		X	X	
34	Fieldbus communication fault	X	X		
35	Option Fault				
36	Mains failure	X	X		
37	Phase imbalance		X		
38	Internal Fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			5-00 Digital I/O Mode, 5-01 Terminal 27 Mode
41	Overload of Digital Output Terminal 29	(X)			5-00 Digital I/O Mode, 5-02 Terminal 29 Mode
42	Ovrld X30/6-7	(X)			
43	Ext. Supply (option)				
45	Earth Fault 2	X	X	X	
46	Pwr. card supply		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 time-out		X		
58	AMA internal fault	X	X		
59	Current limit	X			
60	External Interlock	X	X		
61	Feedback Error	(X)	(X)		4-30 Motor Feedback Loss Function
62	Output Frequency at Maximum Limit	X			
63	Mechanical Brake Low		(X)		2-20 Release Brake Current
64	Voltage Limit	X			

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Configuration has Changed		X		
68	Safe Stop	(X)	(X)[1]		5-19 Terminal 37 Safe Stop
69	Pwr. Card Temp		X	X	
70	Illegal FC configuration			X	
71	PTC 1 Safe Stop				
72	Dangerous failure				
73	Safe Stop Auto Restart	(X)	(X)		5-19 Terminal 37 Safe Stop
74	PTC Thermistor			X	
75	Illegal Profile Sel.		X		
76	Power Unit Setup	X			
77	Reduced power mode	X			14-59 Actual Number of Inverter Units
78	Tracking Error	(X)	(X)		4-34 Tracking Error Function
79	Illegal PS config		X	X	
80	Drive Initialized to Default Value		X		
81	CSIV corrupt		X		
82	CSIV parameter error		X		
83	Illegal Option Combination			X	
84	No Safety Option		X		
88	Option Detection			X	
89	Mechanical Brake Sliding	X			
90	Feedback Monitor	(X)	(X)		17-61 Feedback Signal Monitoring
91	Analog input 54 wrong settings			X	S202
163	ATEX ETR cur.lim.warning	X			
164	ATEX ETR cur.lim.alarm		X		
165	ATEX ETR freq.lim.warning	X			
166	ATEX ETR freq.lim.alarm		X		
243	Brake IGBT	X	X	X	
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr.card supply			X	
247	Pwr.card temp		X	X	
248	Illegal PS config			X	
249	Rect. low temp.	X			
250	New spare parts			X	
251	New Type Code		X	X	

Table 6.1 Alarm/Warning code list

(X) Dependent on parameter
1) Can not be Auto reset via *14-20 Reset Mode*
A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing the reset button or make a reset by a digital input (parameter group 5-1* [1]). The origin event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which may cause damage to the frequency converter or connected parts. A Trip Lock situation can only be reset by a power cycling.

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

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
Alarm Word Extended Status Word							
0	00000001	1	Brake Check (A28)	ServiceTrip, Read/Write	Brake Check (W28)	reserved	Ramping
1	00000002	2	Heatsink temp. (A29)	ServiceTrip, (reserved)	Heatsink temp. (W29)	reserved	AMA Running
2	00000004	4	Earth Fault (A14)	ServiceTrip, Typecode/Sparepart	Earth Fault (W14)	reserved	Start CW/CCW NOT start_possible start_possible is active, when the DI selections [12] OR [13] are active and the requested direction matches the reference sign
3	00000008	8	Ctrl.Card Temp (A65)	ServiceTrip, (reserved)	Ctrl.Card Temp (W65)	reserved	Slow Down slow down command active, e.g. via CTW bit 11 or DI
4	00000010	16	Ctrl. Word TO (A17)	ServiceTrip, (reserved)	Ctrl. Word TO (W17)		Catch Up catch up command active, e.g. via CTW bit 12 or DI
5	00000020	32	Over Current (A13)	reserved	Over Current (W13)	reserved	Feedback High feedback > p4-57
6	00000040	64	Torque Limit (A12)	reserved	Torque Limit (W12)	reserved	Feedback Low feedback < p4-56
7	00000080	128	Motor Th Over (A11)	reserved	Motor Th Over (W11)	reserved	Output Current High current > p4-51
8	00000100	256	Motor ETR Over (A10)	reserved	Motor ETR Over (W10)	reserved	Output Current Low current < p4-50
9	00000200	512	Inverter Overld. (A9)	reserved	Inverter Overld (W9)	reserved	Output Freq High speed > p4-53
10	00000400	1024	DC under Volt (A8)	reserved	DC under Volt (W8)		Output Freq Low speed < p4-52
11	00000800	2048	DC over Volt (A7)	reserved	DC over Volt (W7)		Brake Check OK brake test NOT ok
12	00001000	4096	Short Circuit (A16)	reserved	DC Voltage Low (W6)	reserved	Braking Max BrakePower > BrakePowerLimit (p212)
13	00002000	8192	Inrush Fault (A33)	reserved	DC Voltage High (W5)		Braking
14	00004000	16384	Mains ph. Loss (A4)	reserved	Mains ph. Loss (W4)		Out of Speed Range
15	00008000	32768	AMA Not OK	reserved	No Motor (W3)		OVC Active
16	00010000	65536	Live Zero Error (A2)	reserved	Live Zero Error (W2)		AC Brake
17	00020000	131072	Internal Fault (A38)	KTY error	10V Low (W1)	KTY Warn	Password Timelock number of allowed password trials exceeded - timelock active
18	00040000	262144	Brake Overload (A26)	Fans error	Brake Overload (W26)	Fans Warn	Password Protection p0-61 = ALL_NO_ACCESS OR BUS_NO_ACCESS OR BUS_READONLY

Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	Extended Status Word
19	00080000	524288	U phase Loss (A30)	ECB error	Brake Resistor (W25)	ECB Warn	Reference High reference > p4-55
20	00100000	1048576	V phase Loss (A31)	reserved	Brake IGBT (W27)	reserved	Reference Low reference < p4-54
21	00200000	2097152	W phase Loss (A32)	reserved	Speed Limit (W49)	reserved	Local Reference reference site = REMOTE -> auto on pressed & active
22	00400000	4194304	Fieldbus Fault (A34)	reserved	Fieldbus Fault (W34)	reserved	Protection Mode
23	00800000	8388608	24 V Supply Low (A47)	reserved	24V Supply Low (W47)	reserved	Unused
24	01000000	16777216	Mains Failure (A36)	reserved	Mains Failure (W36)	reserved	Unused
25	02000000	33554432	1.8V Supply Low (A48)	reserved	Current Limit (W59)	reserved	Unused
26	04000000	67108864	Brake Resistor (A25)	reserved	Low Temp (W66)	reserved	Unused
27	08000000	134217728	Brake IGBT (A27)	reserved	Voltage Limit (W64)	reserved	Unused
28	10000000	268435456	Option Change (A67)	reserved	Encoder loss (W90)	reserved	Unused
29	20000000	536870912	Drive Initialized(A80)	Feedback Fault (A61, A90)	Feedback Fault (W61, W90)		Unused
30	40000000	1073741824	Safe Stop (A68)	PTC 1 Safe Stop (A71)	Safe Stop (W68)	PTC 1 Safe Stop (W71)	Unused
31	80000000	2147483648	Mech. brake low (A63)	Dangerous Failure (A72)	Extended Status Word		Unused

Table 6.2 Description of Alarm Word, Warning Word and Extended Status Word

The alarm words, warning words and extended status words can be read out via serial bus or optional fieldbus for diagnose. See also *16-94 Ext. Status Word*.

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WARNING 1, 10 volts low

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

This condition can be caused by a short in a connected potentiometer or improper wiring of the potentiometer.

Troubleshooting: Remove the wiring from terminal 50. If the warning clears, the problem is with the customer wiring. If the warning does not clear, replace the control card.

WARNING/ALARM 2, Live zero error

This warning or alarm will only appear if programmed by the user in *6-01 Live Zero Timeout Function*. The signal on one of the analog inputs is less than 50% of the minimum value programmed for that input. This condition can be caused by broken wiring or faulty device sending the signal.

Troubleshooting:

> Check connections on all the analog input terminals. Control card terminals 53 and 54 for signals, terminal 55 common. MCB 101 terminals 11 and 12 for signals, terminal 10 common. MCB 109 terminals 1, 3, 5 for signals, terminals 2, 4, 6 common).

> Check that the drive programming and switch settings match the analog signal type.

> Perform Input Terminal Signal Test.

WARNING/ALARM 3, No motor

No motor has been connected to the output of the frequency converter. This warning or alarm will only appear if programmed by the user in *1-80 Function at Stop*.

Troubleshooting: Check the connection between the drive and the motor.

WARNING/ALARM 4, Mains phase loss

A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter. Options are programmed at *14-12 Function at Mains Imbalance*.

Troubleshooting: Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high

The intermediate circuit voltage (DC) is higher than the high voltage warning limit. The limit is dependent on the drive voltage rating. The frequency converter is still active.

WARNING 6, DC link voltage low

The intermediate circuit voltage (DC) is lower than the low voltage warning limit. The limit is dependent on the drive voltage rating. The frequency converter is still active.

WARNING/ALARM 7, DC overvoltage

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Troubleshooting:

> Connect a brake resistor

> Extend the ramp time

> Change the ramp type

> Activate functions in *2-10 Brake Function*

> Increase *14-26 Trip Delay at Inverter Fault*

WARNING/ALARM 8, DC under voltage

If the intermediate circuit voltage (DC) drops below the under voltage limit, the frequency converter checks if a 24V backup supply is connected. If no 24V backup supply is connected, the frequency converter trips after a fixed time delay. The time delay varies with unit size.

Troubleshooting:

> Check that the supply voltage matches the frequency converter voltage.

> Perform Input voltage test

> Perform soft charge and rectifier circuit test

WARNING/ALARM 9, Inverter overloaded

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

Troubleshooting:

> Compare the output current shown on the LCP keypad with the drive rated current.

> Compare the output current shown on the LCP keypad with measured motor current.

> Display the Thermal Drive Load on the keypad and monitor the value. When running above the drive continuous current rating, the counter should increase. When running below the drive continuous current rating, the counter should decrease.

Note: See the derating section in the Design Guide for more details if a high switching frequency is required.

WARNING/ALARM 10, Motor overload temperature

According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter gives a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. The fault is that the motor is overloaded by more than 100% for too long.

Troubleshooting:

> Check if motor is over heating.

> If the motor is mechanically overloaded

> That the motor *1-24 Motor Current* is set correctly.

> Motor data in *1-20 Motor Power [kW]* through *1-25 Motor Nominal Speed* are set correctly.

The setting in *1-91 Motor External Fan*.

Run AMA in *1-29 Automatic Motor Adaptation (AMA)*.

WARNING/ALARM 11, Motor thermistor over temp

The thermistor or the thermistor connection is disconnected. Select whether the frequency converter gives a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*.

Troubleshooting:

Check if motor is over heating.

Check if the motor is mechanically overloaded.

Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+10V supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50.

If a KTY sensor is used, check for correct connection between terminal 54 and 55.

If using a thermal switch or thermistor, check the programming of *1-93 Thermistor Resource* matches sensor wiring.

If using a KTY sensor, check the programming of *1-95 KTY Sensor Type*, *1-96 KTY Thermistor Resource*, and *1-97 KTY Threshold level* match sensor wiring.

WARNING/ALARM 12, Torque limit

The torque is higher than the value in *4-16 Torque Limit Motor Mode* (in motor operation) or the torque is higher than the value in *4-17 Torque Limit Generator Mode* (in regenerative operation). *14-25 Trip Delay at Torque Limit* can be used to change this from a warning only condition to a warning followed by an alarm.

WARNING/ALARM 13, Over Current

The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning lasts about 1.5 sec., then the frequency converter trips and issues an alarm. If extended mechanical brake control is selected, trip can be reset externally.

Troubleshooting:

This fault may be caused by shock loading or fast acceleration with high inertia loads.

Turn off the frequency converter. Check if the motor shaft can be turned.

Check that the motor size matches the frequency converter.

Incorrect motor data in *1-20 Motor Power [kW]* through *1-25 Motor Nominal Speed*.

ALARM 14, Earth (ground) fault

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.

Troubleshooting:

Turn off the frequency converter and remove the earth fault.

Measure the resistance to ground of the motor leads and the motor with a megohmmeter to check for earth faults in the motor.

Perform current sensor test.

ALARM 15, Hardware mismatch

A fitted option is not operational with the present control board hardware or software.

Record the value of the following parameters and contact your Danfoss supplier:

15-40 FC Type

15-41 Power Section

15-42 Voltage

15-43 Software Version

15-45 Actual Typecode String

15-49 SW ID Control Card

15-50 SW ID Power Card

15-60 Option Mounted

15-61 Option SW Version

ALARM 16, Short circuit

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

WARNING/ALARM 17, Control word timeout

There is no communication to the frequency converter. The warning will only be active when *8-04 Control Word Timeout Function* is NOT set to OFF.
If *8-04 Control Word Timeout Function* is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down until it trips, while giving an alarm.

Troubleshooting:

Check connections on the serial communication cable.

Increase *8-03 Control Word Timeout Time*

Check operation of the communication equipment.

Verify proper installation based on EMC requirements.

WARNING 22, Hoist Mech. Brake:

Report value will show what kind it is.
0 = The torque ref. was not reached before timeout.
1 = There was no brake feedback before timeout.

WARNING 23, Internal fan fault

The fan warning function is an extra protection function that checks if the fan is running / mounted. The fan warning can be disabled in *14-53 Fan Monitor* ([0] Disabled).

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For the D, E, and F Frame drives, the regulated voltage to the fans is monitored.

Troubleshooting:

Check fan resistance.

Check soft charge fuses.

WARNING 24, External fan fault

The fan warning function is an extra protection function that checks if the fan is running / mounted. The fan warning can be disabled in *14-53 Fan Monitor* ([0] Disabled).

For the D, E, and F Frame drives, the regulated voltage to the fans is monitored.

Troubleshooting:

Check fan resistance.

Check soft charge fuses.

WARNING 25, Brake resistor short circuit

The brake resistor is monitored during operation. If it short circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see *2-15 Brake Check*).

WARNING/ALARM 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 seconds, on the basis of the resistance value of the brake resistor, and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip* [2] has been selected in *2-13 Brake Power Monitoring*, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

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

WARNING/ALARM 27, Brake chopper fault

The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and issues a warning. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.
Turn off the frequency converter and remove the brake resistor.
This alarm/ warning could also occur should the brake resistor overheat. Terminal 104 to 106 are available as brake resistor. Klixon inputs, see section Brake Resistor Temperature Switch.

WARNING/ALARM 28, Brake check failed

Brake resistor fault: the brake resistor is not connected or not working.
Check *2-15 Brake Check*.

ALARM 29, Heatsink temp

The maximum temperature of the heatsink has been exceeded. The temperature fault will not be reset until the temperature falls below a defined heatsink temperature. The trip and reset point are different based on the drive power size.

Troubleshooting:

Ambient temperature too high.

Too long motor cable.

Incorrect clearance above and below the drive.

Dirty heatsink.

Blocked air flow around the drive.

Damaged heatsink fan.

For the D, E, and F Frame drives, this alarm is based on the temperature measured by the heatsink sensor mounted inside the IGBT modules. For the F Frame drives, this alarm can also be caused by the thermal sensor in the Rectifier module.

Troubleshooting:

Check fan resistance.

Check soft charge fuses.

IGBT thermal sensor.

ALARM 30, Motor phase U missing

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

ALARM 31, Motor phase V missing

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

ALARM 32, Motor phase W missing

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

ALARM 33, Inrush fault

Too many power-ups have occurred within a short time period. Let unit cool to operating temperature.

WARNING/ALARM 34, Fieldbus communication fault

The fieldbus on the communication option card is not working.

WARNING/ALARM 36, Mains failure

This warning/alarm is only active if the supply voltage to the frequency converter is lost and *14-10 Mains Failure* is NOT set to OFF. Check the fuses to the frequency converter

ALARM 38, Internal fault

It may be necessary to contact your Danfoss supplier. Some typical alarm messages:

0	Serial port cannot be initialized. Serious hardware failure
256-258	Power EEPROM data is defect or too old
512	Control board EEPROM data is defect or too old
513	Communication time out reading EEPROM data
514	Communication time out reading EEPROM data
515	Application Orientated Control cannot recognize the EEPROM data
516	Cannot write to the EEPROM because a write command is on progress
517	Write command is under time out
518	Failure in the EEPROM
519	Missing or invalid Barcode data in EEPROM
783	Parameter value outside of min/max limits
1024-1279	A cantelegram that has to be sent, couldn't be sent
1281	Digital Signal Processor flash timeout
1282	Power micro software version mismatch
1283	Power EEPROM data version mismatch
1284	Cannot read Digital Signal Processor software version
1299	Option SW in slot A is too old
1300	Option SW in slot B is too old
1301	Option SW in slot C0 is too old
1302	Option SW in slot C1 is too old
1315	Option SW in slot A is not supported (not allowed)
1316	Option SW in slot B is not supported (not allowed)
1317	Option SW in slot C0 is not supported (not allowed)
1318	Option SW in slot C1 is not supported (not allowed)
1379	Option A did not respond when calculating Platform Version.
1380	Option B did not respond when calculating Platform Version.
1381	Option C0 did not respond when calculating Platform Version.
1382	Option C1 did not respond when calculating Platform Version.
1536	An exception in the Application Orientated Control is registered. Debug information written in LCP
1792	DSP watchdog is active. Debugging of power part data Motor Orientated Control data not transferred correctly
2049	Power data restarted
2064-2072	H081x: option in slot x has restarted
2080-2088	H082x: option in slot x has issued a powerup-wait
2096-2104	H083x: option in slot x has issued a legal powerup-wait
2304	Could not read any data from power EEPROM
2305	Missing SW version from power unit
2314	Missing power unit data from power unit
2315	Missing SW version from power unit
2316	Missing io_statepage from power unit
2324	Power card configuration is determined to be incorrect at power up
2325	A power card has stopped communicating while main power is applied
2326	Power card configuration is determined to be incorrect after the delay for power cards to register
2327	Too many power card locations have been registered as present
2330	Power size information between the power cards does not match
2561	No communication from DSP to ATACD
2562	No communication from ATACD to DSP (state running)
2816	Stack overflow Control board module
2817	Scheduler slow tasks
2818	Fast tasks
2819	Parameter thread
2820	LCP Stack overflow
2821	Serial port overflow
2822	USB port overflow
2836	cfListMempool to small
3072-5122	Parameter value is outside its limits
5123	Option in slot A: Hardware incompatible with Control board hardware
5124	Option in slot B: Hardware incompatible with Control board hardware
5125	Option in slot C0: Hardware incompatible with Control board hardware
5126	Option in slot C1: Hardware incompatible with Control board hardware
5376-6231	Out of memory

ALARM 39, Heatsink sensor

No feedback from the heatsink temperature sensor.

The signal from the IGBT thermal sensor is not available on the power card. The problem could be on the power card, on the gate drive card, or the ribbon cable between the power card and gate drive card.

WARNING 40, Overload of Digital Output Terminal 27

Check the load connected to terminal 27 or remove short-circuit connection. Check *5-00 Digital I/O Mode* and *5-01 Terminal 27 Mode*.

WARNING 41, Overload of Digital Output Terminal 29

Check the load connected to terminal 29 or remove short-circuit connection. Check *5-00 Digital I/O Mode* and *5-02 Terminal 29 Mode*.

WARNING 42, Overload of Digital Output on X30/6 or Overload of Digital Output on X30/7

For X30/6, check the load connected to X30/6 or remove short-circuit connection. Check *5-32 Term X30/6 Digi Out (MCB 101)*.

For X30/7, check the load connected to X30/7 or remove short-circuit connection. Check *5-33 Term X30/7 Digi Out (MCB 101)*.

ALARM 46, Power card supply

The supply on the power card is out of range.

There are three power supplies generated by the switch mode power supply (SMPS) on the power card: 24V, 5V, +/-18V. When powered with 24 VDC with the MCB 107 option, only the 24V and 5V supplies are monitored. When powered with three phase mains voltage, all three supplied are monitored.

WARNING 47, 24 V supply low

The 24 VDC is measured on the control card. The external 24 VDC backup power supply may be overloaded, otherwise contact your Danfoss supplier.

WARNING 48, 1.8 V supply low

The 1.8 Volt DC supply used on the control card is outside of allowable limits. The power supply is measured on the control card.

WARNING 49, Speed limit

The speed is not within the specified range in *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]*.

ALARM 50, AMA calibration failed

Contact your Danfoss supplier.

ALARM 51, AMA check Unom and Inom

The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom

The motor current is too low. Check the settings.

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

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

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

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

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

ALARM 58, AMA internal fault
Contact your Danfoss supplier.

WARNING 59, Current limit
The current is higher than the value in *4-18 Current Limit*.

WARNING 60, External interlock
External interlock has been activated. To resume normal operation, apply 24 VDC to the terminal programmed for external interlock and reset the frequency converter (via serial communication, digital I/O, or by pressing reset button on keypad).

WARNING 61, Tracking error
An error has been detected between calculated motor speed and speed measurement from feedback device. The function for Warning/Alarm/Disable is set in *4-30 Motor Feedback Loss Function*, error setting in *4-31 Motor Feedback Speed Error*, and the allowed error time in *4-32 Motor Feedback Loss Timeout*. During a commissioning procedure the function may be effective.

WARNING 62, Output frequency at maximum limit
The output frequency is higher than the value set in *4-19 Max Output Frequency*

WARNING 64, Voltage limit
The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65, Control card over temperature
Control card over temperature: The cutout temperature of the control card is 80° C.

WARNING 66, Heatsink temperature low
This warning is based on the temperature sensor in the IGBT module.

Troubleshooting:

The heatsink temperature measured as 0° C could indicate that the temperature sensor is defective causing the fan speed to increase to the maximum. If the sensor wire between the IGBT and the gate drive card is disconnected, this warning would result. Also, check the IGBT thermal sensor.

ALARM 67, Option module 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 VDC to terminal 37, then send a reset signal (via Bus, Digital I/O, or by pressing the reset key. See *5-19 Terminal 37 Safe Stop*.

ALARM 69, Power card temperature
The temperature sensor on the power card is either too hot or too cold.

Troubleshooting:
        Check the operation of the door fans.

        Check that the filters for the door fans are not blocked.

        Check that the gland plate is properly installed on IP 21 and IP 54 (NEMA 1 and NEMA 12) drives.

ALARM 70, Illegal FC Configuration
Actual combination of control board and power board is illegal.

WARNING/ALARM 71, PTC 1 safe stop
Safe Stop has been activated from the MCB 112 PTC Thermistor Card (motor too warm). Normal operation can be resumed when the MCB 112 applies 24V DC to T-37 again (when the motor temperature reaches an acceptable level) and when the Digital Input from the MCB 112 is deactivated. When that happens, a reset signal must be is be sent (via serial communication, digital I/O, or by pressing reset button on keypad). Note that if automatic restart is enabled, the motor may start when the fault is cleared.

ALARM 72, Dangerous failure
Safe stop with trip lock. Unexpected signal levels on safe stop and digital input from the MCB 112 PTC thermistor card.

WARNING/ALARM 73, Safe stop auto restart
Safe stopped. Note that with automatic restart enabled, the motor may start when the fault is cleared.

WARNING 76, Power Unit Setup
The required number of power units does not match the detected number of active power units.

Troubleshooting:
When replacing an F frame module this will occur if the power specific data in the module power card does not match the rest of the drive. Please confirm the spare part and its power card are the correct part number.

WARNING 77, Reduced power mode:
This warning indicates that the drive is operating in reduced power mode (i.e. less than the allowed number of inverter sections). This warning will be generated on power cycle when the drive is set to run with fewer inverters and will remain on.

ALARM 79, Illegal power section configuration
The scaling card is the incorrect part number or not installed. Also MK102 connector on the power card could not be installed.

ALARM 80, Drive initialized to default value
Parameter settings are initialized to default settings after a manual reset.

WARNING 81, CSIV corrupt:
CSIV file has syntax errors.

WARNING 82, CSIV parameter error:
CSIV parameter error

WARNING 85, Dang fail PB:
Profibus/Profisafe Error

ALARM 91, Analog input 54 wrong settings
Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analog input terminal 54.

ALARM 243, Brake IGBT
This alarm is only for F Frame drives. It is equivalent to Alarm 27. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F100 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 244, Heatsink temperature
This alarm is only for F Frame drives. It is equivalent to Alarm 29. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F10 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 245, Heatsink sensor
This alarm is only for F Frame drives. It is equivalent to Alarm 39. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F10 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 246, Power card supply
This alarm is only for F Frame drives. It is equivalent to Alarm 46. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F10 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 247, Power card temperature
This alarm is only for F Frame drives. It is equivalent to Alarm 69. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F10 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 248, Illegal power section configuration
This alarm is only for F Frame drives. It is equivalent to Alarm 79. The report value in the alarm log indicates which power module generated the alarm:

1 = left most inverter module.

2 = middle inverter module in F12 or F13 drive.

2 = right inverter module in F10 or F11 drive.

3 = right inverter module in F12 or F13 drive.

5 = rectifier module.

ALARM 250, New spare part
The power or switch mode power supply has been exchanged. The frequency converter type code must be restored in the EEPROM. Select the correct type code in *14-23 Typecode Setting* according to the label on the unit. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New type code
The frequency converter has a new type code.

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