



# Operating Instructions

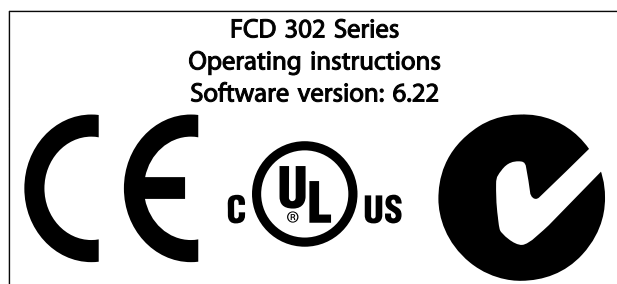
VLT<sup>®</sup> Decentral Drive FCD 302

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# 1 Introduction



## 1.1.1 Symbols

The following symbols are used in this manual:



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



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

## CAUTION

Indicates a situation that may result in equipment or property-damage-only accidents.

## NOTE

Indicates highlighted information that should be regarded with attention to avoid mistakes or operate equipment at less than optimal performance.

★ Indicates default setting of parameter.

## 1.1 Safety



### HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input power. Installation, start-up and maintenance should be performed by qualified personnel only. Failure to perform installation, start-up and maintenance by qualified personnel could result in death or serious injury.



### UNINTENDED START

When the frequency converter is connected to the AC mains, the motor may be started by means of an external switch, a serial bus command, an input reference signal, or a cleared fault condition. Use appropriate cautions to guard against an unintended start.



### DISCHARGE TIME

Frequency converters contain DC link capacitors that can remain charged even when AC mains input power is disconnected. To avoid electrical hazards, remove AC mains input power from the frequency converter before doing any service or repair and wait at least 4 minutes.

## 1.2 Purpose of the Manual

This manual is intended to provide detailed information for the installation and start up of the frequency converter. Chapter Pre-installation Planning provides requirements for installation, wiring, and environmental considerations. Chapter Installation provides detailed procedures for start-up and functional testing. The remaining chapters provide supplementary details. These include user interface, basic operational concepts, programming and application examples, start-up troubleshooting, and equipment specifications.

Optional equipment is available that may change some of the procedures described. Be sure to see the instructions supplied with those options for specific requirements.

### 1.3 Additional Resources

Other resources are available to understand advanced frequency controller functions and programming.

- The *Programming Guide*, MG.04.GX.YY, provides greater detail in how to work with parameters and many application examples
- The *Design Guide*, MG.04.HX.YY, is intended to provide detailed capabilities and functionality to design motor control systems.
- Training courses both on-line and in person.
- Phone and on-line help.
- Installation, set up, and commissioning is also available by Danfoss trained and approved installers.
- Danfoss sales representatives are also trained to provide customer service and instruction for applications

Contact your Danfoss supplier or go to [www.Danfoss.com](http://www.Danfoss.com) for downloads or additional information.

### 1.4 Product Overview

A frequency converter is an electronic motor controller that converts AC mains input into a variable AC waveform output. The frequency and voltage of the output are regulated to control the motor speed or torque.

In addition, the frequency converter monitors the system and motor status, issues warnings or alarms for fault conditions, starts and stops the motor, optimizes energy efficiency, provides line harmonics protection, and offers many more control, monitoring, and efficiency functions. Operation and monitoring functions are available as status indications to an outside control system or serial communication network.

The FCD 302 designed for decentral mounting, e.g. in the food and beverage industry, or for other material handling applications. With the FCD 302 it is possible to utilize the cost saving potential by placing the power electronics decentrally, and thus make the central panels obsolete saving cost, space and effort for installation and wiring. The basic design with a plugable electronic part and a flexible and “spacious” wiring box is extremely service-friendly, and it is easy to change electronics without the need for unwiring.

The FCD 302 is a part of the VLT® frequency converter family, which means similar functionality, programming, and operating as the other family members.

### 1.5 Internal Frequency Converter Controller Functions

Below is a block diagram of the frequency converter's internal components. See *Table 1.1* for their functions.

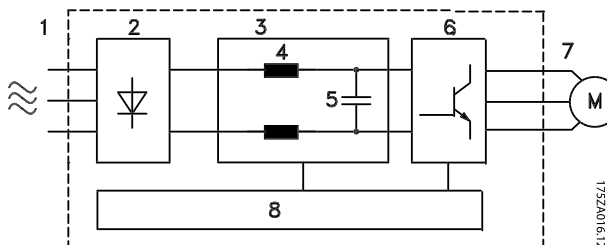


Illustration 1.1 Frequency Converter Block Diagram

Area	Title	Functions
1	Mains input	Three-phase AC mains power supply to the frequency converter.
2	Recifier	The rectifier bridge converts the AC input to DC current for use within the frequency converter.
3	DC bus	The frequency converter's intermediate DC-bus circuit handles the DC current for internal routing.
4	DC line reactors	<ul style="list-style-type: none"> <li>• Filter the intermediate DC circuit voltage</li> <li>• Prove line transient protection</li> <li>• Reduce RMS current</li> <li>• Raise the power factor reflected back to the line</li> <li>• Reduce harmonics on the AC input</li> </ul>
5	Capacitor bank	<ul style="list-style-type: none"> <li>• Stores the DC power</li> <li>• Provides a regulated DC current supply</li> <li>• Provides ride-through protection for short power losses</li> </ul>
6	Inverter	The inverter converts the DC into a controlled PWM AC waveform for a controlled variable output to the motor.
7	Output to motor	By controlling the voltage and frequency, the frequency converter provides regulated motor control from 0-50/60 Hz at 100% supply voltage.
8	Control circuitry	<ul style="list-style-type: none"> <li>• Input power, internal processing, output, and motor current are monitored to provide efficient operation and control</li> <li>• User interface and external commands are monitored and performed</li> <li>• Status output and control can be provided</li> </ul>

Table 1.1 Frequency Converter Internal Components

### 1.6 Type Code Description

Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	39	39	
	F	C	D	3	0	2	P				T	4				H	1												X	A		B		X	X	X	X	X	X	D

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Position	Description	Choices/options	
01-03	Product group	FCD	Decentral Drive
04-06	Frequency converter series	302	Advanced performance
07-10	Power size	PK37	0.37kW/0.5HP
		PK55	0.55kW/0.75HP
		PK75	0.75kW/1.0HP
		P1K1	1.1kW/1.5HP
		P1K5	1.5kW/2.0HP
		P2K2	2.2kW/3.0HP
		P3K0	3.0kW/4.0HP
		PXXX	Installation box only (without power section)
11-12	Phases, Mains voltage	T	Three phase
		4	380-480V AC
13-15	Enclosure	B66	Standard Black - IP66/Type 4X
		W66	Standard White - IP66/Type 4X
		W69	Hygienic White - IP66K/Type 4X
16-17	RFI filter	H1	RFI filter class A1/C2
18	Brake	X	No brake
		S	Brake chopper + mechanical brake Supply
19	Hardware configuration	1	Complete product, small enclosure, stand alone mount
		2	Complete product, small enclosure, motor mount
		3	Complete product, large enclosure, stand alone mount
		X	Drive part, small enclosure (No installation box)
		Y	Drive part, large enclosure (No installation box)
		R	Installation box, small enclosure, stand alone mount (No drive part)
		S	Installation box, small enclosure, motor mount (No drive part)
		T	Installation box, large enclosure, stand alone mount (No drive part)

Position	Description	Choices/options	
20	Brackets	X	No brackets
		E	Flat brackets
		F	40mm brackets
21	Threads	X	No installation box
		M	Metric threads
22	Switch option	X	No switch option
		E	Service switch on mains side
		F	Service switch on motor side
23	Display	X	No display connector (No installation box)
		C	With Display Connector
24	Sensor plugs	X	No sensor plugs
		E	Direct mount 4xM12
		F	Direct mount 6xM12
25	Motor plug	X	No motor plug
26	Mains plug	X	No mains plug
27	Fieldbus plug	X	No fieldbus plug
28	Reserved	X	For future use
29-30	A option	AX	No A option
		A0	PROFIBUS DP
		AN	EtherNet/IP
		AL	PROFINET
31-32	B option	BX	No B option
		BR	Encoder option
		BU	Resolver option
33-37	Reserved	XXXXX	For future use
38-39	D option	DX	No D option
		D0	24 V DC back-up input

Not all choices/options are available for each FCD 302 variant. To verify if the appropriate version is available, please consult the Drive Configurator on the internet: <http://driveconfig.danfoss.com>.

#### NOTE

**A and D options for FCD 302 are integrated in the control card and therefore pluggable options for FC-drives can not be used here. Future retrofit will require exchange of the entire control card. B options are pluggable, using the same concept and parts as for FC-drives.**

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## 2 Installation

### 2.1 Check List

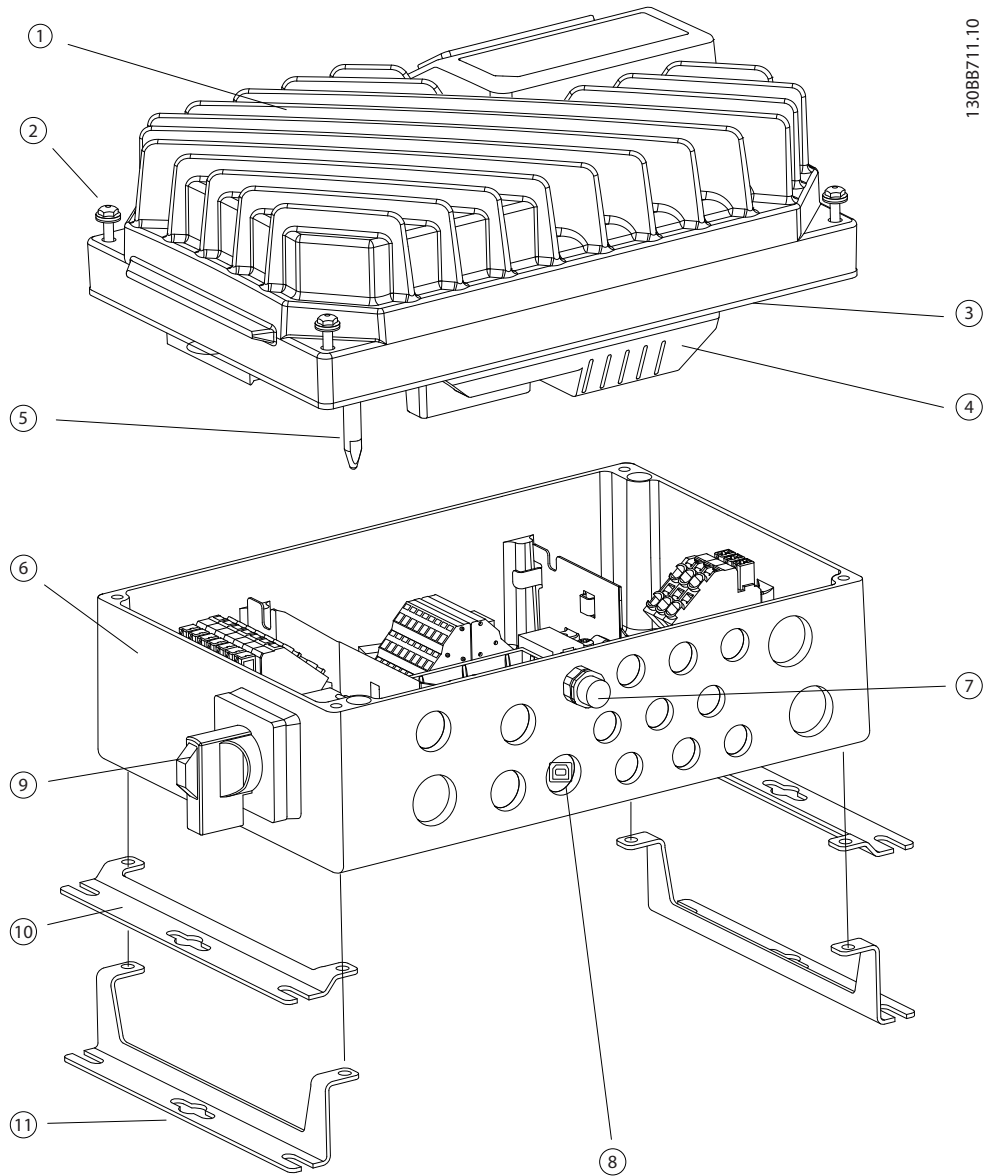
The packaging contains:

- Accessories bag(s)
- Documentation
- The unit

Depending on options fitted there may be one or two bags and one or more booklets.

- When unpacking the frequency converter, ensure that the unit is undamaged and complete
- Compare model number of unit on the name plate to what was ordered to verify the proper equipment.
- Ensure the mains (power) supply, frequency converter, and motor are rated for same voltage.

2.2 Exploded View of the FCD 302



1	Electronics (drive) part	7	Display connection
2	Fastening screws (4 x, one in each corner)	8	Access to USB port
3	Sealing gasket	9	Service switch-motor side
4	Protection cover	10	Flat mounting brackets
5	Ground connection pin	11	40mm mounting bracket
6	Installation box		



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2.3 Mechanical Installation

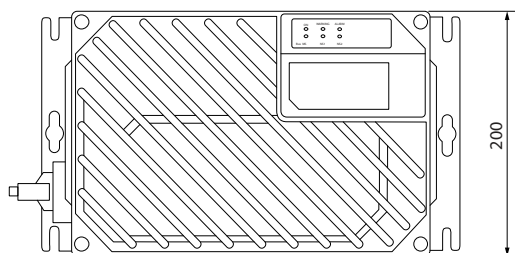
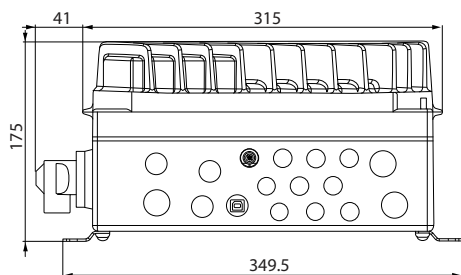
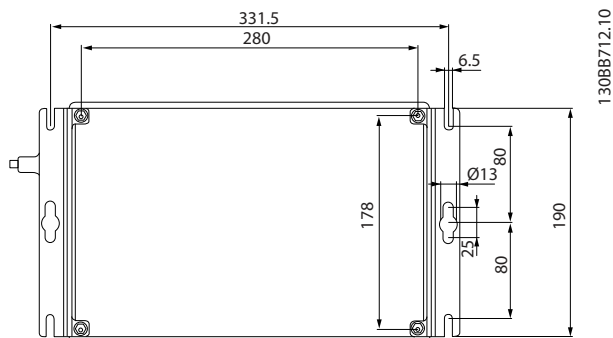
2.3.1 Recommended Tools and Equipment

Equipment	Size	Description
Screwdrivers		
Spanner (Hex)	8	For fastening screws/mounting brackets
Slotted	0.4 x 2.5	For spring loaded power and control terminals
Slotted/Torx	1.0x5.5/TX20	For cable clamps inside the installation box
Spanner	19, 24, 28	For blind-plugs
Hammer		For knock-out holes (motor mount version)
Drilling machine		For preparing universal adaptor plate (motor mount version)

Motor side	1xM20, 1xM25
Control side	2xM20, 9xM16 <sup>1)</sup>
Mains side	2xM25

<sup>1)</sup> Also used for 4xM12/6xM12 sensor/actuator sockets.

2.3.2 Mechanical Dimensions



Cable entries, holes sizes (small frame size).

### 2.3.3 Cooling

The FCD 302 has no forced cooling. It relies only on natural convection for cooling using the cooling fins.

- A minimum of 100mm (4in) top and bottom air cooling clearance must be provided. See *Illustration 2.1*.
- Derating starts above 40°C (104°F) and 1000m (3300ft) elevation above sea level. See the equipment Design Guide for detailed information.

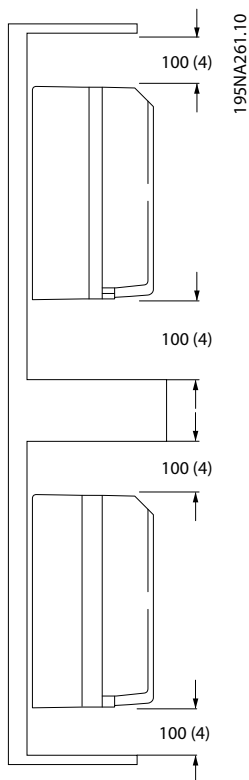


Illustration 2.1 Top and Bottom Cooling Clearance

### 2.3.4 Mounting

The FCD 302 consists of two parts: The installation box and the electronic part. See section 2.2 *Exploded View of the FCD 302*.

#### **WARNING**

**Do not switch on the mains before the 4 screws are tightened**

#### Stand alone mounting

- The holes on the rear of the installation box are used to fix mounting brackets
- Ensure that the strength of the mounting location can support the unit weight
- Make sure that the proper mounting screws or bolts are used

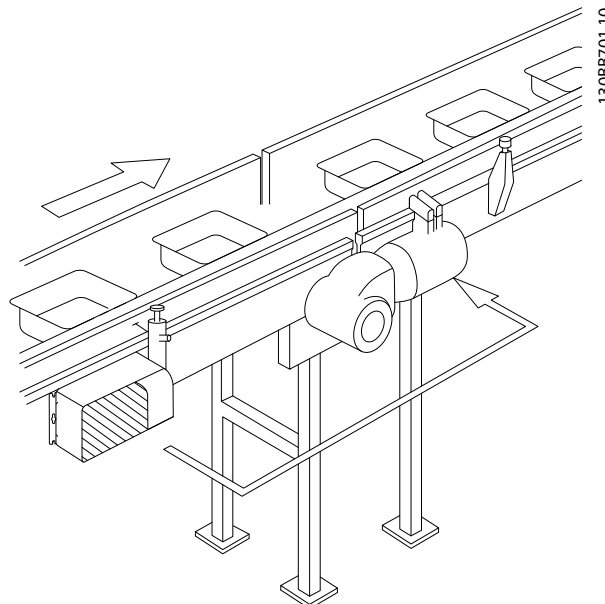


Illustration 2.2 FCD 302 Stand Alone Mounted with Mounting Brackets

#### Motor mounting

- The larger hole on the rear of the installation box is used for passing the motor cable
- Eight knock out points are available around the hole for the motor cable to fix the frequency converter on the motor terminal box or adaptor plate

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Universal adaptor plate(175N2115):

1. Prepare the adaptor plate for mounting on the motor by drilling the fixing holes and the hole for the cables.
2. Mount the plate on the motor with the normal terminal box gasket.
3. Knock out the four outer holes on the installation box for mounting the adaptor plate.
4. Mount the terminal box onto the motor by the 4 sealing screws and the gasket supplied. Use the supplied star washers for securing PE connection according to EN 60204. The screws must be tightened with 5Nm.

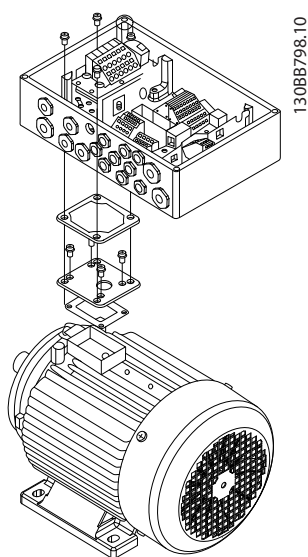


Illustration 2.3 FCD 302 Motor Mounted with an Adaptor Plate

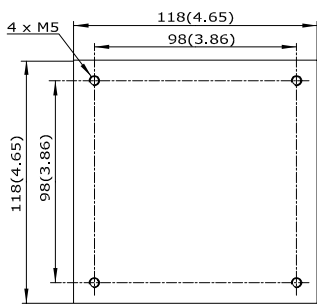
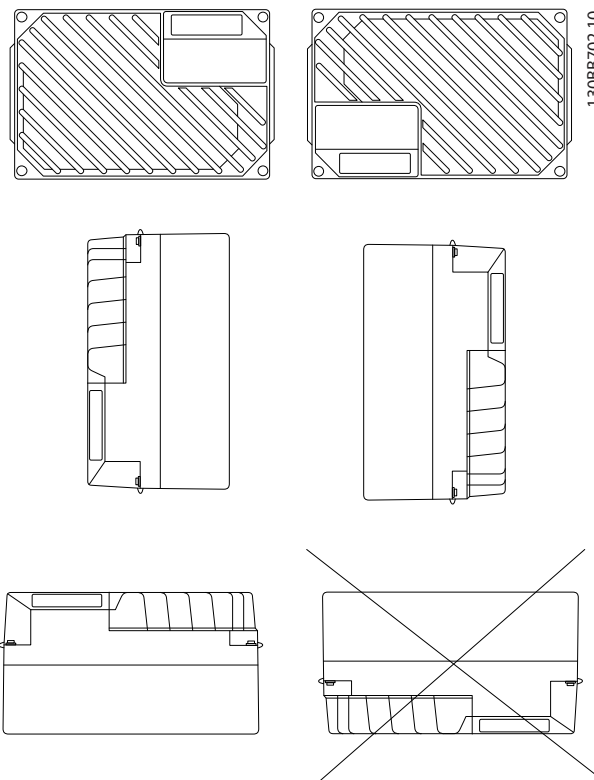


Illustration 2.4 Universal Adaptor Plate

Allowed mounting positions



2.3.4.1 Hygienic Installation

The FCD 302 is designed according to the EHEDG guidelines, suitable for installation in environments with high focus on cleanability.

The FCD 302 must be mounted vertically on a wall or machine frame, thereby liquids will drain of the enclosure due to the slightly sloped top and cooling fin design.

For the best possible cleanability of the FCD 302 in the installation, use cable glands especially designed for hygienic installations, e.g. Rittal HD 2410.110/120/130.

**NOTE**

Only frequency converters configured as hygienic enclosure designation, FCD 302 P XXX T4 W69, will carry the EHEDG certification.

2.3.4.2 Cleaning

The enclosure (IP66/NEMA type 4x indoor) will offer protection against dirt and water ingress, and is designed suitable for cleaning as performed in food and beverage plants with the concentrations of cleaning solvent as recommended by the manufacturer. High pressure cleaning in very short distance or long time with hot water may damage gaskets and labels.

### 2.3.5 Tightening Torques

For compressing the gasket between the two parts, the screws must be tightened with 2.8-3.0Nm. Tighten the screws in a cross-over way.

### 2.4 Electrical Installation

The frequency converter must be wired for operation in the following manner:

- Wire the motor to the frequency converter output terminals.
- Connect control and serial communication wiring.
- Wire the AC mains to the frequency converter input terminals.
- After power has been applied, input and motor power must be checked, and control terminals programmed for intended functions.

This section provides detailed descriptions of the requirements and procedures to accomplish these tasks. *The following illustration* shows a basic electrical connection.

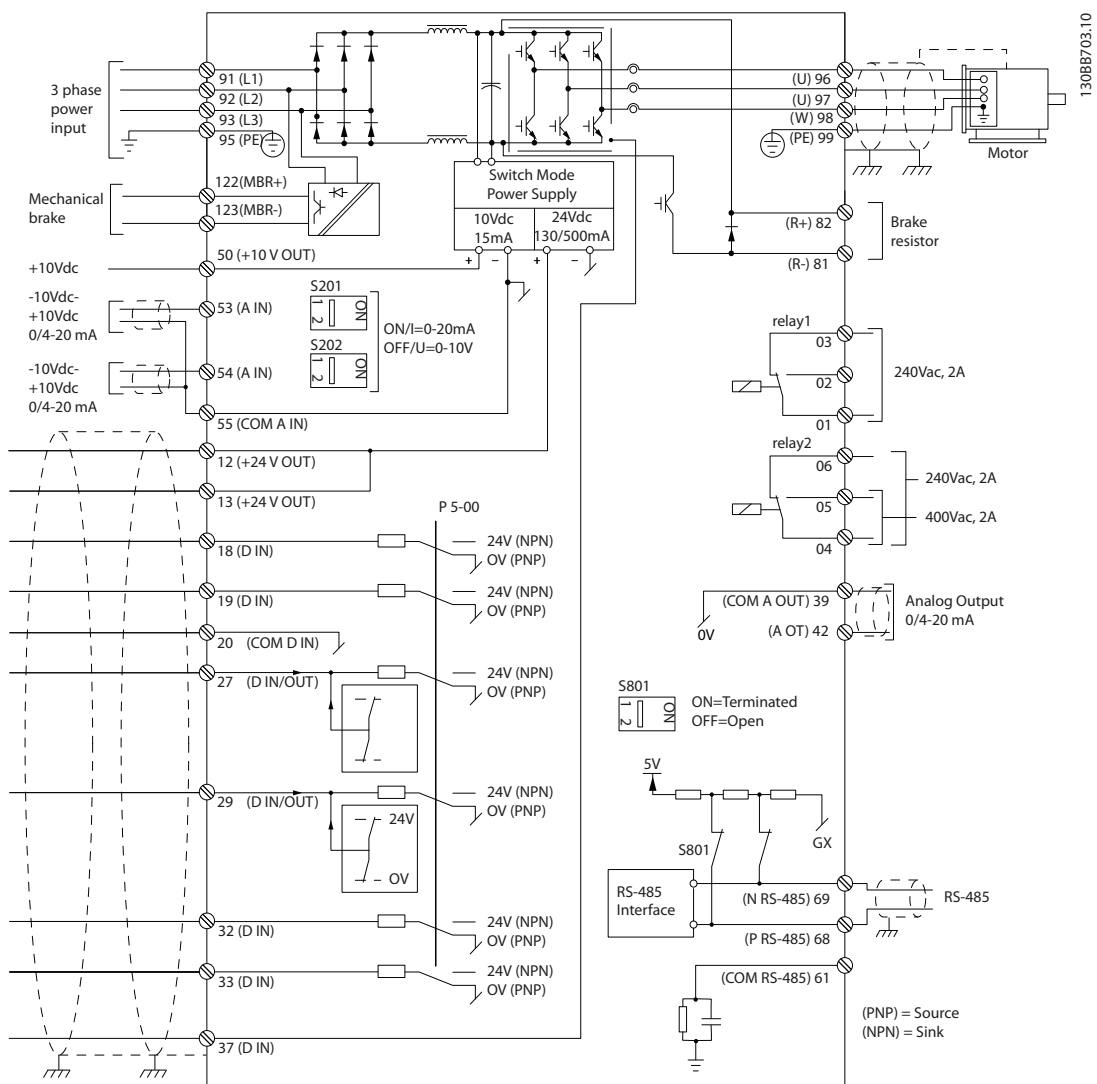


Illustration 2.5 Electrical Installation

### 2.4.1 Requirements

#### **⚠ WARNING**

##### **EQUIPMENT HAZARD**

Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. It is strongly recommended that installation, start-up, and maintenance be performed only by trained and qualified personnel. Failure to follow these guidelines could result in death or serious injury.

##### **For your safety, comply with the following requirements:**

- Electronic controls equipment is connected to hazardous mains voltage. Extreme care should be taken to protect against electrical hazards when applying power to the unit.
- Wear safety glasses whenever working on electric control or rotating equipment.
- Run motor cables from multiple frequency converters separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out.

##### **Overload and equipment protection**

- An electronically activated function within the frequency converter provides overload protection for the motor. Set *1-90 Motor Thermal Protection* to ETR (Electronic Thermal Relay) for warning trip if desired. It measures motor current and is internally set based on the value in *1-24 Motor Current*. A 1.2 x FLA (full load amps) service factor is built-in and maintained. Should the motor current increase above that value, the overload will calculate the level of increase to activate timing for the trip (controller output stop) function. The higher the

current draw, the quicker the trip response. The overload provides Class 20 motor protection. See chapter 7 *Troubleshooting* for details on the trip function.

- Because the motor wiring carries high frequency current, it is important that wiring for mains input power, motor power, and control are run separately. Use separated shielded wire or metallic conduit. Failure to isolate power, motor, and control wiring could result in less than optimum equipment performance.
- When being placed in cable trays, sensitive cables such as telephone or data cables should not be placed in the same cable tray as the motor cable. If signal cables run across power cables, this is done at an angle of 90°.

##### **Wire type and ratings**

- All wiring must comply with local and national regulations regarding cross-section and ambient temperature requirements.
- The screen must have low RF impedance, which is achieved by a braided screen of copper, aluminium or iron.
- Danfoss recommends that all power connections be made with a minimum 75°C rated copper wire.
- See section 8.1 *Electrical Data and Wire Sizes* for recommended wire sizes.

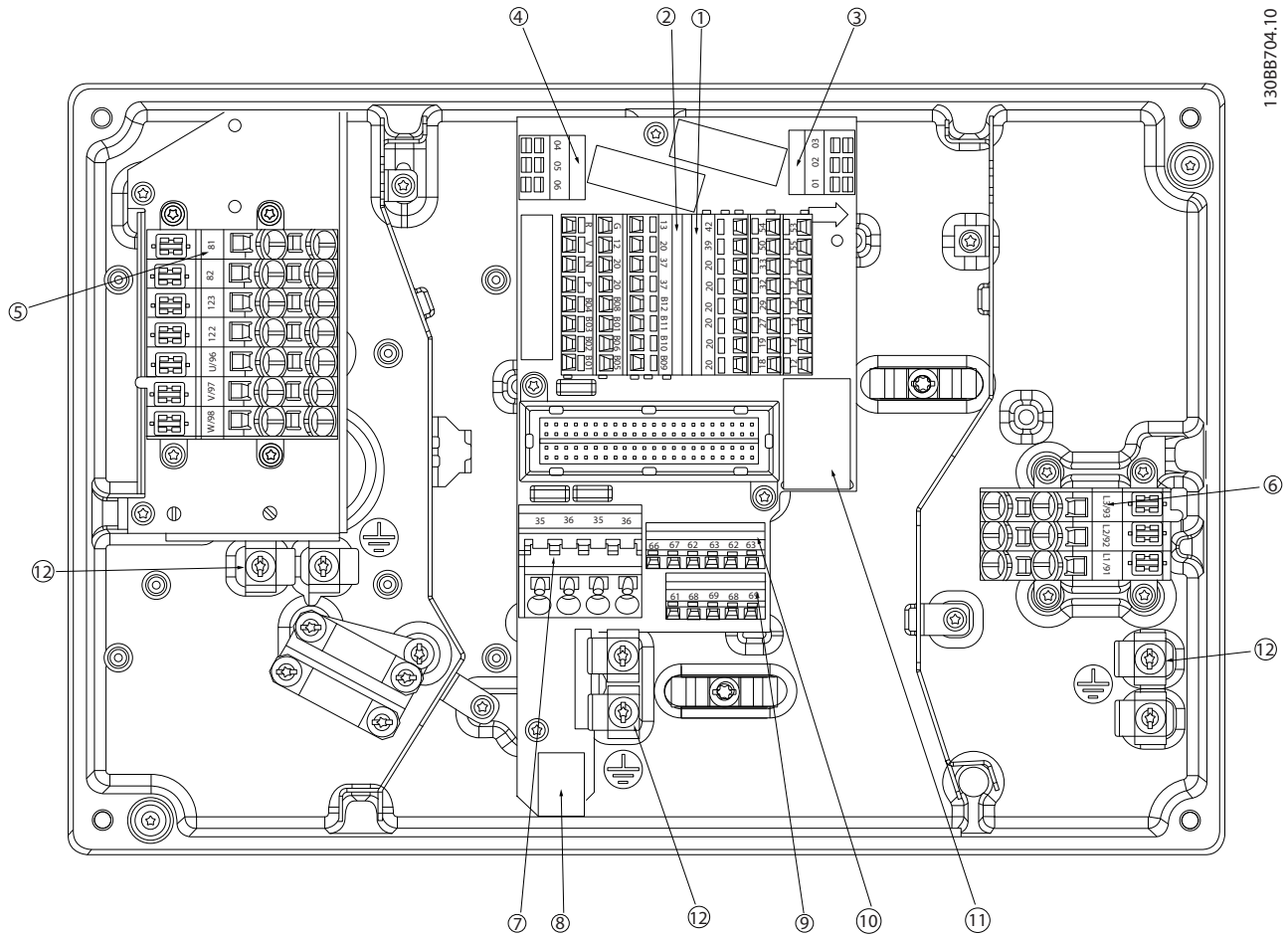
##### **Cable glands**

It must be assured that appropriate cable glands needed for the environment are chosen and carefully mounted.

#### **⚠ WARNING**

**Do not plug/unplug the electronic part with mains voltage switched on.**

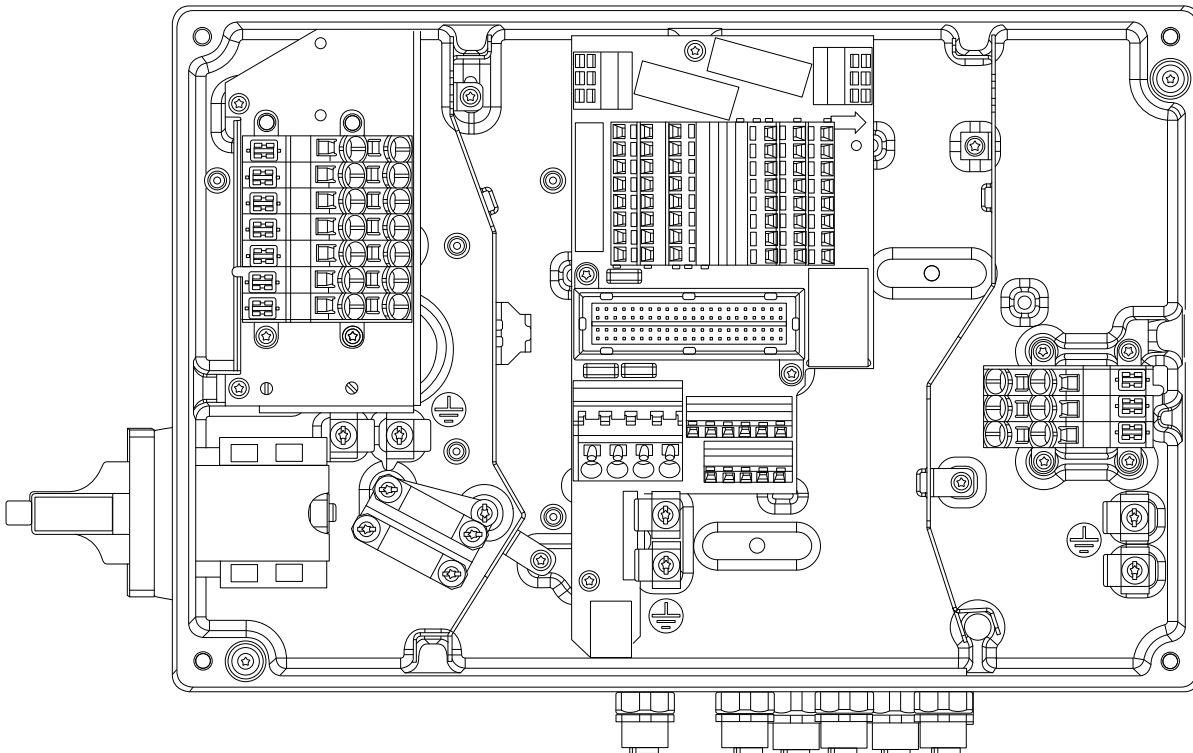
2.4.2 Location of Terminals



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1	Digital inputs/outputs	7	24V DC back-up input
2	Safe stop, LCP connection, B-option	8	USB port
3	Relay 1	9	Standard bus/RS-485
4	Relay 2	10	Profibus
5	Motor, mechanical brake, brake resistor	11	Ethernet dual port RS-485
6	Mains	12	Protective Earth (PE)



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Illustration 2.6 Service Switch on Motor Side and Sensor Plugs

### 2.4.3 Terminal Types

Motor, control, and mains terminals are spring loaded (CAGE-CLAMP) type.

1. Open the contact by inserting a small screwdriver into the slot above the contact, as shown in *Illustration 2.7*.
2. Insert the stripped wire into the contact.
3. Remove the screwdriver to fasten the wire into the contact.
4. Ensure the contact is firmly established and not loose. Loose wiring can result in equipment faults or injury.

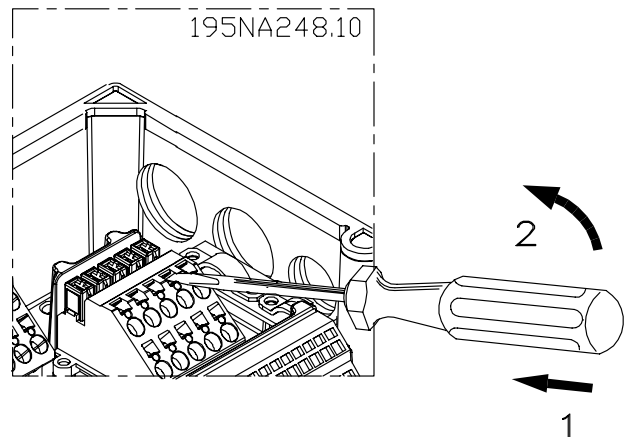


Illustration 2.7 Opening the Terminals

### 2.4.4 Motor Connection

#### **WARNING**

#### INDUCED VOLTAGE

Run output motor cables from multiple frequency converters separately. Induced voltage from output motor cables run together can charge equipment capacitors even with the equipment turned off and locked out. Failure to run output motor cables separately could result in death or serious injury.

## CAUTION

### WIRING ISOLATION

Run input power, motor wiring and control wiring in three separate metallic conduits or use separated shielded motor and control cables for high frequency noise isolation. Failure to isolate power, motor and control wiring could result in less than optimum frequency converter and associated equipment performance.

### MOTOR PROTECTION

Protection against motor overload is not included in the factory setting. If this function is desired, set *1-90 Motor Thermal Protection* to data value ETR trip 1 [4] or data value ETR warning 1 [3].

- Connect the motor to terminals 96, 97, 98.
- Connect earth to PE-terminal.
- Make sure the screen of the motor cable is properly earthed at both ends (motor and frequency converter).
- For correct dimensioning of cable cross-section see section 8.1.1 *Electrical Data and Wire Sizes*.

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

## NOTE

Do not install power factor correction capacitors between the frequency converter and the motor.  
Do not wire a starting or pole-changing device between the frequency converter and the motor.

### 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 *Illustration 2.8*, is only recommended for short cable lengths (max. 10m).
- When motors are connected in parallel, *1-29 Automatic Motor Adaptation (AMA)* cannot be used.

## CAUTION

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).

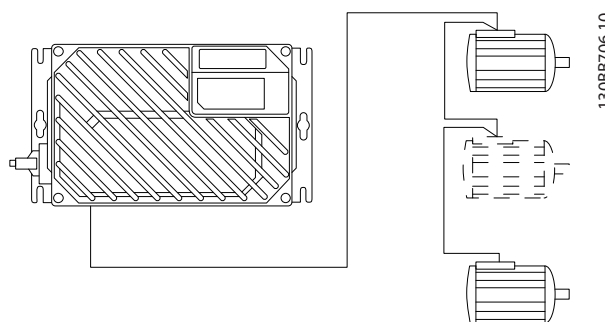


Illustration 2.8 Parallel Connection of Motors

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.

### 2.4.5 Control Wiring

## WARNING

### UNINTENDED START

When frequency converter is connected to AC mains input power, the motor may start at any time. The frequency converter, motor, and any driven equipment must be in operational readiness. Failure to be in operational readiness when the frequency converter is connected to AC mains could result in death, serious injury, equipment, or property damage.

- It is recommended that control wiring is rated for 600V.
- Isolate control wiring from high power components in the frequency converter.
- If the frequency converter is connected to a thermistor, for PELV isolation, control wiring must be reinforced/double insulated.
- See section 8.2 *General Specifications* for control terminal wiring sizes and maximum loads.

Terminal No.	Function
01, 02, 03	Relay1 output. Useable for AC or DC voltage and resistive or inductive loads.
04, 05, 06	Relay2 output. Useable for AC or DC voltage and resistive or inductive loads .

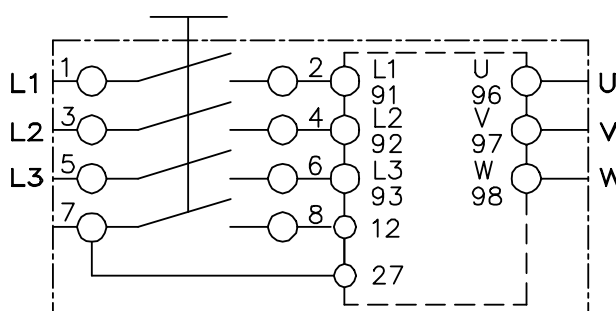
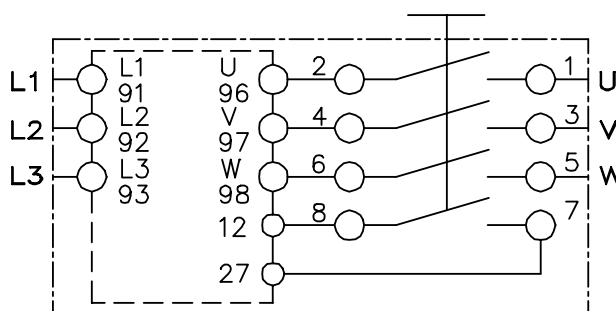


12, 13	24V DC digital supply voltage. Useable for digital inputs and external transducers. To use the 24V DC for digital input common, programme 5-00 <i>Digital I/O Mode</i> for PNP operation.
18, 19, 32, 33	Digital inputs. Selectable for NPN or PNP function in 5-00 <i>Digital I/O Mode</i> . Default is PNP.
27, 29	Digital inputs or outputs. Programmable for either 5-01 <i>Terminal 27 Mode</i> for terminal 27 and 5-02 <i>Terminal 29 Mode</i> for 29 selects input/output function. Default setting is input.
35	Common (-) for external 24V control back up supply. Optional.
36	External + 24V control back up supply. Optional.
37	Safe Stop. See Safe Stop installation for details.
20	Common for digital inputs. To use for digital input common, programme 5-00 <i>Digital I/O Mode</i> for NPN operation.
39	Common for analog output.
42	Analog output. Programmable for various functions in parameter group 6-5*. The analog signal is 0 to 20mA or 4 to 20mA at a maximum of 500Ω.
50	10V DC analog supply voltage. 15mA maximum commonly used for a potentiometer or thermistor.
53, 54	Analog input. Selectable for voltage (0±10V) or current (0- or 4-±20mA). Closed is for current and open is for voltage. Switches are located on the frequency converter control card. See 2.4.13 <i>DIP Switches</i>
55	Common for analog inputs.
61	Common for serial communication (RS-485 interface). See 2.4.12 <i>Grounding Shielded Control Cables</i>
68 (+), 69 (-)	RS-485 interface. When the frequency converter is connected to an RS-485 serial communication bus, a switch on control card is provided for termination resistance. ON for termination and OFF for no termination.
62	RxD/TxD -P (red cable) for PROFIBUS. See dedicated literature (MCA 101) for details.
63	RxD/TxD -N (green cable) for PROFIBUS.
66	0V for PROFIBUS.
67	+5V for PROFIBUS.
B01-B12	B-option. See dedicated literature for details.
G, R, V, N, P	Connection of LCP.

- Depending on the configuration of the equipment, input power will be connected to the mains input terminals or the input disconnect.
- Ground the cable in accordance with grounding instructions provided in *General Earth (Ground) Requirements*.
- All frequency converters may be used with an isolated input source as well as with ground reference power lines. When supplied from an isolated mains source (IT mains or floating delta) or TT/TN-S mains with a grounded leg (grounded delta), set 14-50 *RFI Filter* to OFF. When off, the internal RFI filter capacitors between the chassis and the intermediate circuit are isolated to avoid damage to the intermediate circuit and to reduce earth capacity currents in accordance with IEC 61800-3.

No.			
91	92	93	Mains voltage 3 x 380-480V
L1	L2	L3	
PE			Earth connection

### 2.4.7 Motor and Mains Connection with Service Switch



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### 2.4.6 AC Mains Input Connection

- Size wiring based upon the input current of the frequency converter. See the maximum wire size in the Input Current and Wire tables in section *Specifications*.
- Comply with local and national electrical codes for cable sizes.
- Connect 3-phase AC input power wiring to terminals L1, L2, and L3.

### 2.4.8 Brake Resistor

No.	81 (optional function)	82 (optional function)	Brake resistor terminals
	R-	R+	

- The connection cable to the brake resistor must be screened/armoured. Connect the screen to the metal cabinet of the frequency converter and to the metal cabinet of the brake resistor by means of cable clamps.
- Dimension the cross-section of the brake cable to match the brake torque.

### 2.4.9 Mechanical Brake

No.	122 (optional function)	123 (optional function)	
	MBR+	MBR-	Mechanical brake (UDC=0.45 x mains voltage) max. 0.8 A

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

- The brake is controlled using the special mechanical brake control/ supply terminals 122 and 123.
- Select *Mechanical brake control* [32] in parameter group 5-4\*, Array [1], Relay 2 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.

### NOTE

Since the Mechanical Brake Control/Supply terminals 122 and 123 are set through parameter group 5-4\*, Array [1], Relay 2, only one relay output (Relay 1) will be available for free programming.

### 2.4.10 Connection of Sensors/Actuators on M12 Sockets

Pin	Wire colour	Terminal	Function
1	Brown	12	+24V
2	White	Reserved*	Reserved
3	Blue	20	0V
4	Black	18, 19, 32, 33	Digital input

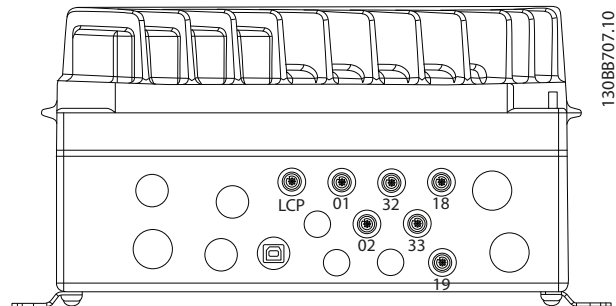
Table 2.1 4 x M12 Connection Input

Pin	Wire colour	Terminal	Function
1	Brown	Reserved*	Reserved
2	White	Reserved*	Reserved
3	Blue	20	0V
4	Black	02, 05	N.O. (24V)

Table 2.2 2 x M12 Connection Output

### NOTE

\* Reserved wires for optional used. If not utilised, they can be cut off.



### 2.4.11 Earth (Grounding) Requirements

#### **⚠ WARNING**

##### GROUNDING HAZARD

For operator safety, it is important to ground frequency converter properly in accordance with national and local electrical codes as well as instructions contained within these instructions. Ground currents are higher than 3.5mA. Failure to ground frequency converter properly could result in death or serious injury.

#### NOTE

It is the responsibility of the user or certified electrical installer to ensure correct grounding (earthing) of the equipment in accordance with national and local electrical codes and standards.

- Proper protective grounding for equipment with ground currents higher than 3.5mA must be established, see *Leakage Current (3.5mA)* following.
- A dedicated ground wire is required for input power and motor.
- Use the clamps provided with on the equipment for proper ground connections.
- Use of high-strand wire to reduce electrical noise is recommended.

#### **⚠ CAUTION**

##### PE CONNECTION

The metal pins in the corners of the electronic part and the holes on the corner of the installation box are essential for the protective earth connection. Make sure they are not loosened, removed, or violated in any way. See *Illustration 2.9*.

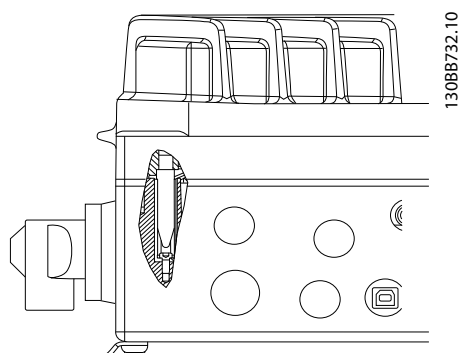
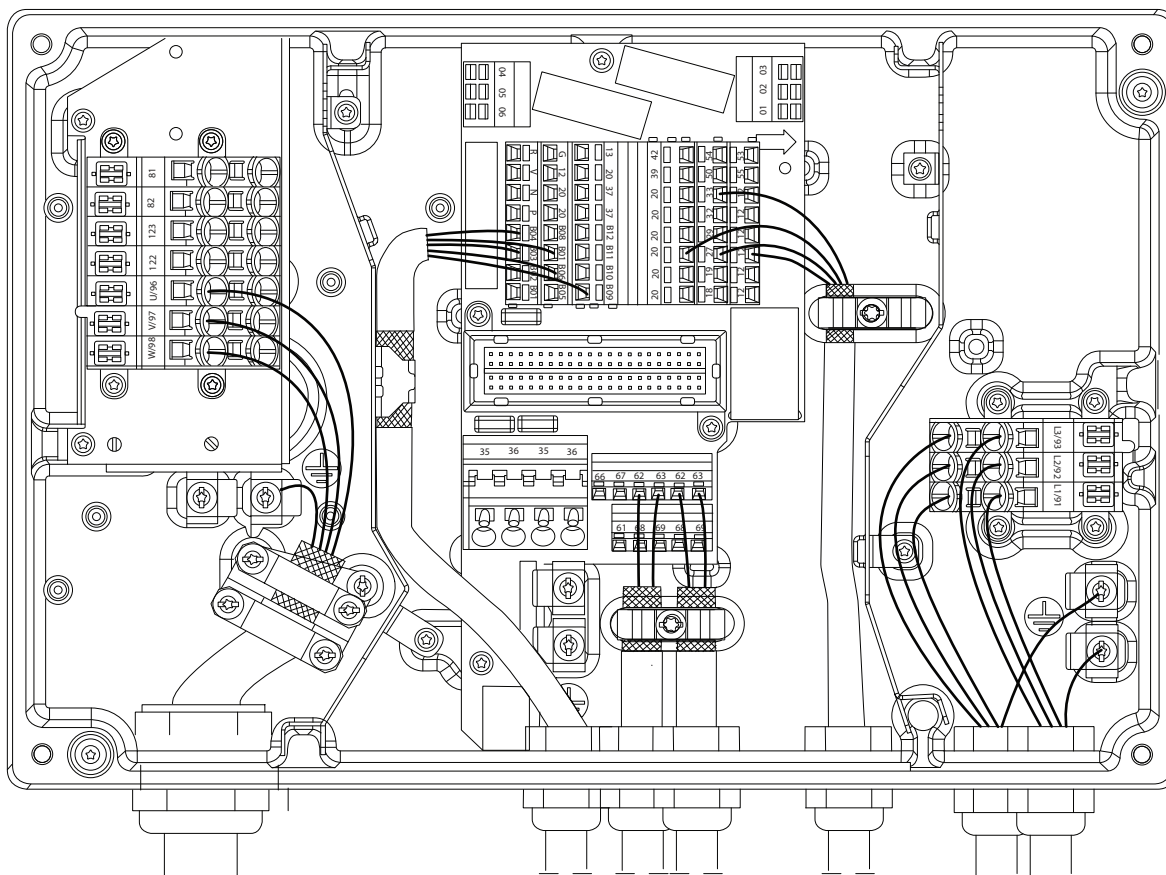


Illustration 2.9 PE Connection between the Installation Box and the Electronic Part

**Grounding shielded cable**

Earthing (grounding) clamps are provided for motor and control wiring (see *Illustration 2.10*).



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**Illustration 2.10 Earthing (Grounding) Clamp for Motor and Control Wiring**

1. Use a wire stripper to remove the insulation for proper grounding.
2. Secure the grounding clamp to the stripped portion of the wire with the screws provided.
3. Secure the grounding wire to the grounding clamp provided.

earth grounding must be reinforced in one of the following ways:

- Earth ground wire of at least 10mm<sup>2</sup>.
- Two separate earth ground wires both complying with the dimensioning rules.

**RCD use**

A fault current in the frequency converter or at the output power terminals might contain a DC component, and charging of the filter capacitors might cause a transient earth current. Where Residual Current Devices (RCDs), also known as Earth Leakage Circuit Breakers (ELCBs), are used, the following must be taken into account:

- Use RCDs of type B only
- Use RCDs with an inrush delay
- Use RCDs of 300mA, if possible

**Leakage current (3.5mA)**

**NOTE**

**Follow national and local codes regarding protective earthing of equipment with a leakage current > 3.5mA.**

The frequency converter technology implies high frequency switching at high power. This will generate a leakage current in the earth connection. RFI filtering and screened motor cables contribute to this phenomenon. According to EN/IEC61800-5-1 (Power Drive System Product Standard) which implies special means if the leakage current exceeds 3.5 mA,

2

### 2.4.12 Grounding Shielded Control Cables

See *Illustration 2.11* for details.

#### A. Correct grounding

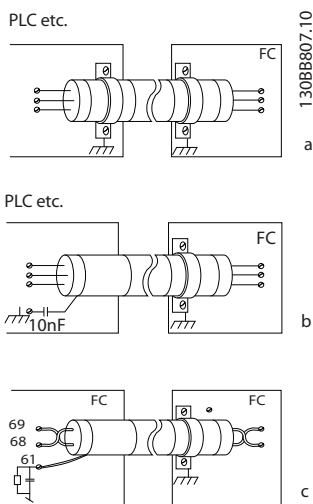
Secure control and serial communication cables with grounding clamps provided at both ends to ensure best possible electrical contact.

#### B. 50/60Hz ground loops

With very long control cables, ground loops may occur. To eliminate ground loops, connect one end of the screen to ground with a 10nF capacitor (keeping leads short).

#### C. Serial communication

To eliminate low-frequency noise between frequency converters, connect one end of the screen to terminal 61. This terminal is connected to ground via an internal RC link. Use twisted-pair cables to reduce interference between conductors.



### 2.4.13 DIP Switches

- Analog input terminals 53 and 54 can select for either voltage (0-10V) or current (0-20mA) input signals
- Set switches S201 (terminal 53) and S202 (terminal 54) to select the signal type. ON is for current, OFF for voltage
- Terminal 53 default is for a speed reference in open loop
- Terminal 54 default is for a feedback signal in closed loop

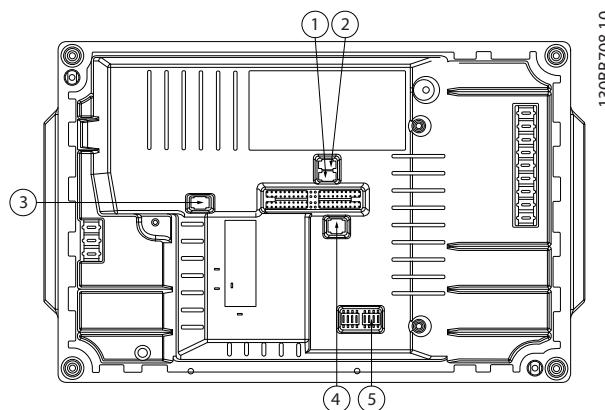


Illustration 2.11 Location of DIP Switches

1	S201 - terminal 53
2	S202 - terminal 54
3	S801 - standard bus termination
4	Profibus termination
5	Profibus address

### NOTE

Switches 4 and 5 are only valid for units fitted with Profibus.

### 2.4.14 Serial Communication

Connect RS-485 serial communication wiring to terminals (+)68 and (-)69.

- Switch S801 (BUS TER.) can be used to enable termination on the RS-485 port (terminals 68 and 69). See *Illustration 2.11* above.
- Shielded serial communication cable is recommended
- See *2.4.12 Grounding Shielded Control Cables* for proper grounding
- Two communication protocols are internal to the frequency converter
  - Danfoss FC
  - Modbus RTU
- For basic serial communication set up, select the following
  - Protocol type in *8-30 Protocol*
  - Frequency converter address in *8-31 Address*
  - Baud rate in *8-32 FC Port Baud Rate*
- Functions can be programmed remotely using the protocol software and RS-485 connection or in parameter. group 8-\*\*\* *Communications and Options*

- Selecting a specific communication protocol changes various default parameter settings to match that protocol's specifications along with making additional protocol-specific parameters available
- Control card options are available to provide additional communication protocols. See the option-card documentation for installation and operation instructions
  - PROFIBUS
  - Ethernet/IP
  - PROFINET

### 2.4.15 Connection to PC

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

The PC is connected via a standard (host/device) USB cable, or via the RS-485 interface.

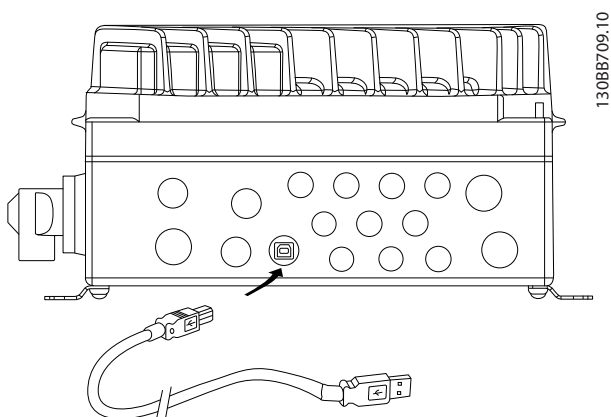


Illustration 2.12 USB Connection

### **CAUTION**

The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. The USB connection is not galvanically isolated from protection earth. Use only isolated laptop/PC as connection to the USB connector on frequency converter or an isolated USB cable/converter.

### 2.4.16 Safe Stop

The FCD 302 is available with safe stop functionality via control terminal 37. Safe stop disables the control voltage of the power semiconductors of the frequency controller output stage which in turn prevents generating the voltage required to rotate the motor. When the Safe Stop (T37) is activated, the frequency converter issues an alarm, trips the

unit, and coasts the motor to a stop. Manual restart is required. The safe stop function can be used for stopping the frequency converter in emergency stop situations. In the normal operating mode when safe stop is not required, use the frequency converter's regular stop function instead. When automatic restart is used – the requirements according to ISO 12100-2 paragraph 5.3.2.5 must be fulfilled.

### Liability Conditions

It is the responsibility of the user to ensure personnel installing and operating the Safe Stop function:

- Read and understand the safety regulations concerning health and safety/accident prevention
- Understand the generic and safety guidelines given in this description and the extended description in the *Design Guide*
- Have a good knowledge of the generic and safety standards applicable to the specific application

User is defined as: integrator, operator, servicing, maintenance staff.

### Protective Measures

- Safety engineering systems may only be installed and commissioned by qualified and skilled personnel
- The cable between terminal 37 and the external safety device must be short circuit protected according to ISO 13849-2 table D.4
- If any external forces influence the motor axis (e.g. suspended loads), additional measures (e.g., a safety holding brake) are required in order to eliminate hazards

### Safe Stop Installation and Set-Up

### **WARNING**

#### Safe Stop Function!

The safe stop function does NOT isolate mains voltage to the frequency converter or auxiliary circuits. Perform work on electrical parts of the frequency converter or the motor only after isolating the mains voltage supply and waiting the length of time specified under Safety in this manual. Failure to isolate the mains voltage supply from the unit and waiting the time specified could result in death or serious injury.

- It is not recommended to stop the frequency converter by using the Safe Torque Off function. If a running frequency converter is stopped by using the function, the unit will trip and stop by coasting. If this is not acceptable, e.g. causes danger, the frequency converter and machinery must be stopped using the appropriate stopping mode

2

before using this function. Depending on the application a mechanical brake may be required.

- Concerning synchronous and permanent magnet motor frequency converters in case of a multiple IGBT power semiconductor failure: In spite of the activation of the Safe Torque Off function, the frequency converter system can produce an alignment torque which maximally rotates the motor shaft by  $180/p$  degrees.  $p$  denotes the pole pair number.
- This function is suitable for performing mechanical work on the frequency converter system or affected area of a machine only. It does not provide electrical safety. This function should not be used as a control for starting and/or stopping the frequency converter.

The following requirements have to be met to perform a safe installation of the frequency converter:

1. Remove the jumper wire between control terminals 37 and 12 or 13. Cutting or breaking the jumper is not sufficient to avoid short-circuiting. (See jumper in *Illustration 2.13.*)
2. Connect an external Safety monitoring relay via a NO safety function (the instruction for the safety device must be followed) to terminal 37 (safe stop) and either terminal 12 or 13 (24V DC). The Safety monitoring relay must comply with Category 3 (EN 954-1) / PL "d" (ISO 13849-1).

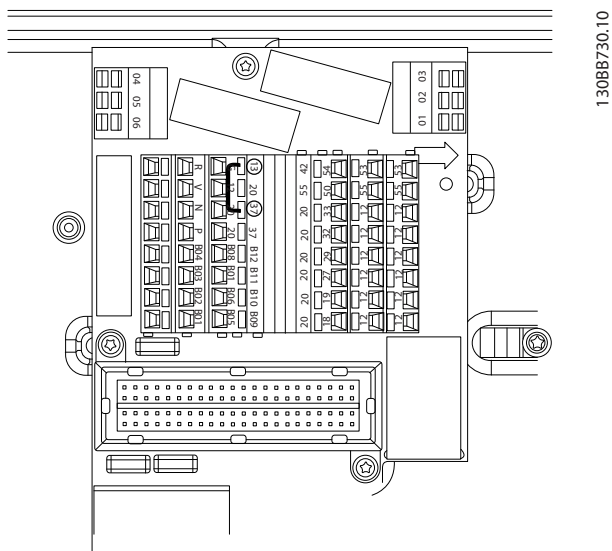
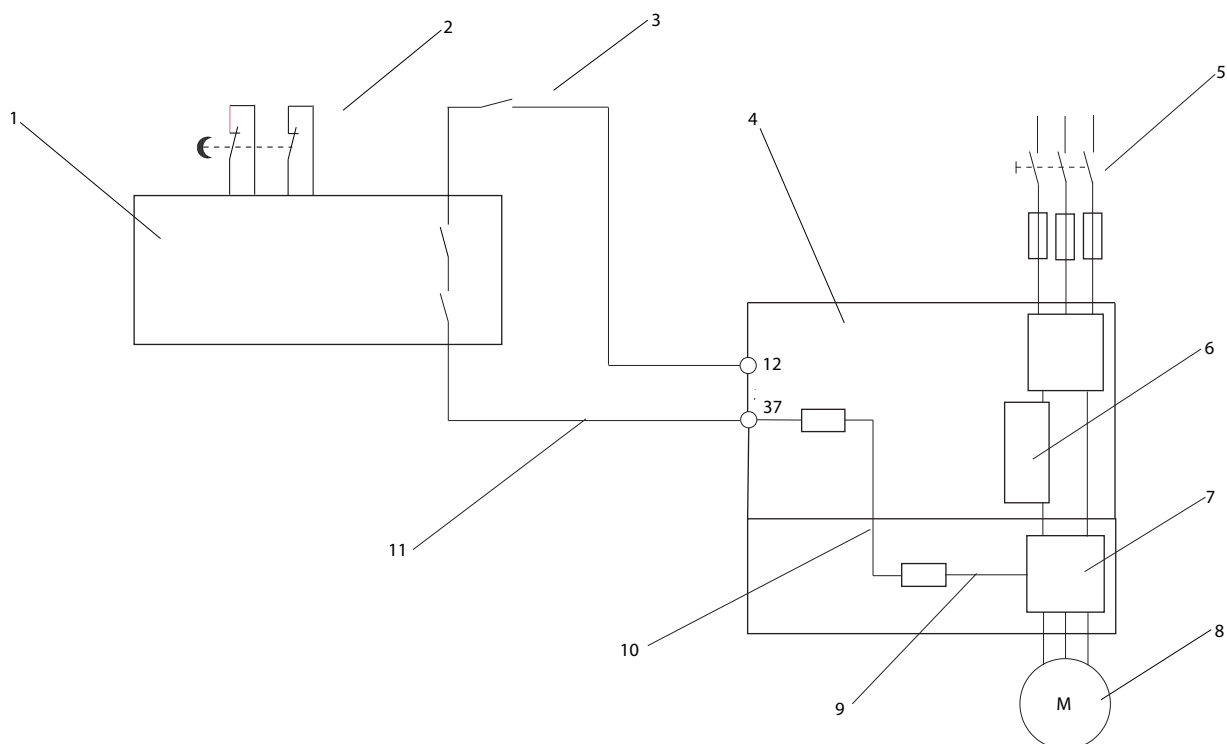


Illustration 2.13 Jumper Between Terminal 13 and 37



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Illustration 2.14 Installation to Achieve a Stopping Category 0 (EN 60204-1) with Safety Cat. 3 (EN 954-1) / PL "d" (ISO 13849-1).

1	Safety device Cat. 3 (circuit interrupt device, possibly with release input)	7	Inverter module
2	Door contact	8	Motor
3	Contactora (Coast)	9	5V DC
4	Frequency converter	10	Safe channel
5	Mains	11	Short-circuit protected cable (according to ISO 13849-2 table D.4)
6	Control board		



### 3 Start Up and Functional Testing

3

3.1 Pre-start

3.1.1 Safety Inspection

**⚠WARNING**

**HIGH VOLTAGE**

If input and output connections have been connected improperly, there is risk for high voltage on these terminals. For initial start up, make no assumptions about power components. Follow pre-start procedures. Failure to follow pre-start procedures could result in personal injury or damage to equipment.

1. Input power to the unit must be OFF and locked out.
2. Verify there is no voltage on input terminals L1 (91), L2 (92), and L3 (93), phase-to-phase and phase-to ground.
3. Verify there is no voltage on output terminals 96 (U), 97(V), and 98 (W), phase-to-phase and phase-to ground.
4. Confirm continuity of the motor by measuring ohm values on U-V (96-97), V-W (97-98), and W-U (98-96).
5. Inspect the frequency converter for loose connections on terminals.
6. Close the box, mounting the electronic part onto the installation box.
7. Check for proper grounding of the frequency converter as well as the motor.
8. Record the following motor-nameplate data: power, voltage, frequency, full load current, and nominal speed. These values will be needed to program motor nameplate data later on.
9. Confirm that the supply voltage matches voltage of frequency converter and motor.

3.1.2 Start Up Check List

**CAUTION**

Before applying power to the unit, inspect the entire installation as detailed in the table below.

Inspect for	Description	<input checked="" type="checkbox"/>
Auxiliary equipment	<ul style="list-style-type: none"> <li>• Look for auxiliary equipment, switches, disconnects, or input fuses/circuit breakers that may reside on input power side of frequency converter or output side to motor. Examine their operational readiness and ensure they are ready in all respects for operation at full speed.</li> <li>• Check function and installation of any sensors used for feedback to frequency converter</li> <li>• Remove power factor correction caps on motor(s), if present</li> </ul>	
Cable routing	Ensure that input power, motor wiring and control wiring are separated or in three separate metallic conduits for high frequency noise isolation.	
Control wiring	<ul style="list-style-type: none"> <li>• Check for broken or damaged wires and connections</li> <li>• Check the voltage source of the signals, if necessary</li> <li>• The use of shielded cable or twisted pair is recommended. Ensure the shield is terminated correctly at both ends.</li> </ul>	
EMC considerations	Check for proper installation with regard to electromagnetic compatibility.	
Environmental considerations	See equipment label for the maximum ambient operating temperature limits. Temperature is not to exceed 40°C (104°F). Humidity levels must be 5-95% non-condensing.	
Cooling clearance	Units require top and bottom clearance adequate to ensure proper air flow for cooling.	
Fusing and circuit breakers	Check that all fuses are inserted firmly and in operational condition and that all circuit breakers are in the open position. Check for proper fusing or circuit breakers.	

Inspect for	Description	☑
Input and output power wiring	<ul style="list-style-type: none"> <li>• Check for loose connections</li> <li>• Check for proper fusing or circuit breakers</li> </ul>	
Switches	Ensure that all switch and disconnect settings are in the proper position.	
Grounding	The equipment requires a dedicated ground wire from its chassis to the plant ground. Check for good ground connections that are tight and free of oxidation.	
Installation box and electronics part	Ensure the installation box and the electronics part is properly closed. Check that all four fastening screws are tightened with the right torque.	
Cable glands and blind plugs	Ensure the cable glands and blind plugs are properly tightened, to guarantee the right enclosure protection degree is achieved. Liquids and/or excessive dust ingress in the drive may result in less than optimum performance or damage.	
Vibration	Look for any unusual amount of vibration the equipment may be subjected to. The panel should be mounted solidly or use shock mounts as necessary.	

Table 3.1 Start Up Check List

### 3.2 Applying Power to the Frequency Converter

#### **⚠ WARNING**

##### HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input power. Installation, start-up and maintenance should be performed by qualified personnel only. Failure to perform installation, start-up and maintenance by qualified personnel could result in death or serious injury.

1. Perform pre-start up procedure described in section *Pre-start*.
2. Confirm input line voltage is balanced within 3%. If not, correct input voltage imbalance before proceeding. Repeat procedure after voltage correction.
3. Ensure optional equipment wiring, if present, matches installation application.
4. Ensure that all operator devices are in OFF position.

#### **⚠ WARNING**

##### UNINTENDED START

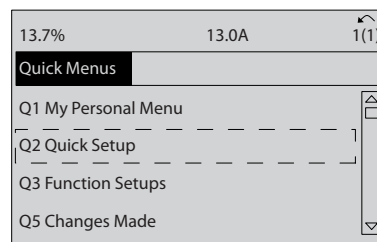
When frequency converter is connected to AC mains input power, the motor may start at any time. The frequency converter, motor, and any driven equipment must be in operational readiness. Failure to be in operational readiness when the frequency converter is connected to AC mains could result in death, serious injury, equipment, or property damage.

5. Apply power to the unit. DO NOT start the frequency converter at this time. For units with a disconnect switch on the mains side, turn to the ON position to apply power to the frequency converter.

### 3.3 Basic Operational Programming

Frequency converters require basic operational programming prior to running for best performance. Basic operational programming requires entering motor-nameplate data for the motor being operated and the minimum and maximum motor speeds. Enter this data in accordance with the following procedure. See User Interface, for detailed instructions on entering data through the LCP. This data needs to be entered with power ON, but prior to operating the frequency converter.

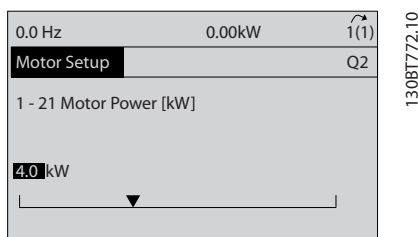
1. Press [Quick Menu] on the LCP.
2. Use the navigation keys to scroll to parameter group Q2 *Quick Setup* and press [OK].



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3. Select language and press [OK]. Then enter the motor data in parameters 1-20/1-21 through 1-25. The information can be found on the motor nameplate. The entire quick menu is shown in *International/North American Default Parameter Settings*

- 1-20 Motor Power [kW]
- 1-21 Motor Power [HP]
- 1-22 Motor Voltage
- 1-23 Motor Frequency
- 1-24 Motor Current
- 1-25 Motor Nominal Speed



4. Continue set-up of Quick Menu parameters:
  - 5-12 Terminal 27 Digital Input. If terminal default is *Coast inverse* it is possible to change this setting to *No function*.
  - 1-29 Automatic Motor Adaptation (AMA). Set desired AMA function. Enable complete AMA is recommended. See detailed section *Automatic Motor Adaptation*.
  - 3-02 Minimum Reference. Set the minimum speed of the motor shaft.
  - 3-03 Maximum Reference. Set the maximum speed of the motor shaft.
  - 3-41 Ramp 1 Ramp up Time. Set the ramping up time with reference to synchronous motor speed, ns
  - 3-42 Ramp 1 Ramp Down Time. Set the ramping down time with reference to synchronous motor speed, ns
  - 3-13 Reference Site. Set the site from where the reference must work

See *Quick Menu Parameters* for further details.

### 3.4 Automatic Motor Adaptation

Automatic motor adaptation (AMA) is a test procedure that measures the electrical characteristics of the motor to optimize compatibility between the frequency converter and the motor. The frequency converter builds a mathematical model of the motor for regulating output motor current. The procedure also tests the input phase balance of electrical power and compares the motor characteristics with the data entered in parameters 1-20 to 1-25. It is recommended to run this procedure at start up. It does not cause the motor to run or harm to the motor. The procedure should be run on a cold motor for best results.

#### To run AMA

1. Enter the motor name plate data in the drive, as described in the previous section *Basic Operational Programming*.
2. Connect terminal 37 to terminal 12.
3. Connect terminal 27 to terminal 12 or set 5-12 Terminal 27 Digital Input to *No function*.

4. Activate the AMA 1-29 Automatic Motor Adaptation (AMA).
5. Choose between complete or reduced AMA.
6. Press the [OK] key. The display shows *Press [Hand on] to start*.
7. Press the [Hand on] key. A progress bar indicates if the AMA is in progress.

#### Stop the AMA during operation

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 contacting 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.

### 3.5 Local-control Test

#### **WARNING**

#### MOTOR START

Ensure that the motor, system, and any attached equipment are ready for start. Failure to ensure that the motor, system, and any attached equipment is ready for start could result in personal injury or equipment damage.

### NOTE

The [Hand On] key on the LCP provides a local start command to the frequency converter. The [OFF] key provides the stop function. When operating in local mode, the up and down arrows on the LCP increase and decrease the speed output of the frequency converter. The left and right arrow keys move the display cursor in the numeric display. Moving the cursor left of the decimal point provides quicker input changes.

1. Press [Hand On].
2. Accelerate the frequency converter by pressing [▲] to full speed.

3. Note any acceleration problems.
4. Press [OFF].
5. Note any deceleration problems.

If acceleration problems were encountered

- If warnings or alarms occur, see chapter *Warnings and Alarms*
- Check that motor data is entered correctly
- Increase the ramp-up time in *3-41 Ramp 1 Ramp up Time*
- Increase current limit in *4-18 Current Limit*
- Increase torque limit in *4-16 Torque Limit Motor Mode*

If deceleration problems were encountered

- If warnings or alarms occur, see chapter *Warnings and Alarms*
- Check that motor data is entered correctly
- Increase the ramp-down time in *3-42 Ramp 1 Ramp Down Time*
- Enable overvoltage control in *2-17 Overvoltage Control*

See *Warning and Alarm Types* for resetting the frequency converter after a trip.

### 3.6 System Start Up

The first three sections in this chapter conclude the procedures for applying power to the frequency converter, basic programming, set up, and functional testing. The procedures in this section require user-wiring and application programming to be completed. The following procedure is recommended after application set up by the user is completed.

#### **CAUTION**

##### **MOTOR START**

**Ensure that the motor, system, and any attached equipment is ready for start. Failure to ensure that the motor, system, and any attached equipment is ready for start could result in personal injury or equipment damage.**

1. Press [Auto On].
2. Ensure that external control functions are properly wired to the frequency converter and all programming completed.
3. Apply an external run command.
4. Adjust the speed reference throughout the speed range.
5. Remove the external run command.
6. Note any problems.

If warnings or alarms occur, see chapter *Warnings and Alarms*.

## 4 User Interface

### 4.1 Local Control Panel

The local control panel (LCP) is the combined display and keypad, which can be attached to the display connector outside the unit (without opening the enclosure) via the LCP cable/plug. The LCP is the user interface to the frequency converter.

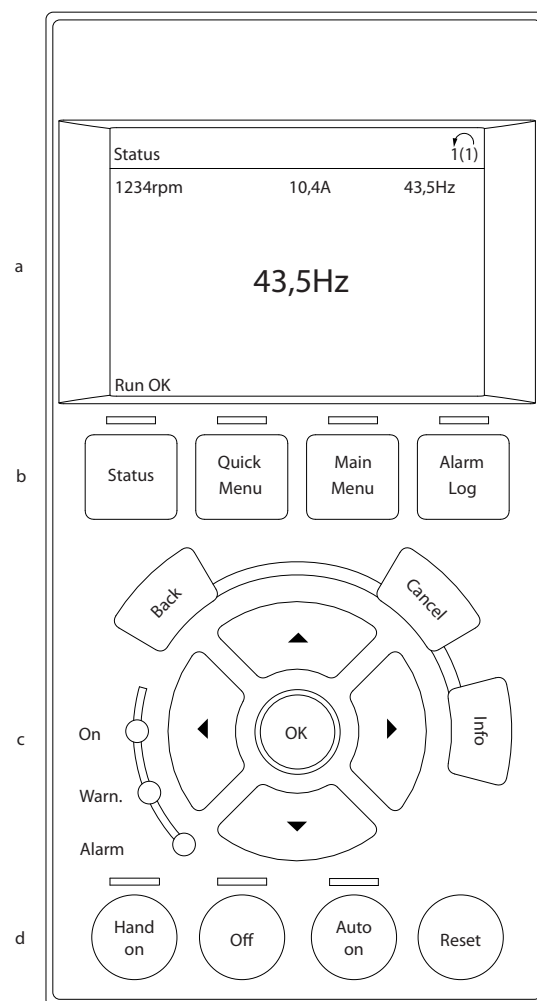
The LCP has several user functions.

- Start, stop, and control speed when in local control
- Display operational data, status, warnings and cautions
- Programming frequency converter functions
- Manually reset the frequency converter after a fault when auto-reset is inactive

An optional numeric LCP (NLCP) is also available. The NLCP operates in a manner similar to the LCP. See the Programming Guide for details on use of the NLCP.

#### 4.1.1 LCP Layout

The LCP is divided into four functional groups (see *Illustration 4.1*).



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Illustration 4.1 LCP

- Display area.
- Display menu keys for changing the display to show status options, programming, or error message history.
- Navigation keys for programming functions, moving the display cursor, and speed control in local operation. Also included are the status indicator lights.
- Operational mode keys and reset.

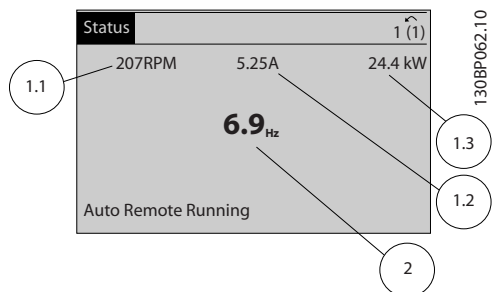
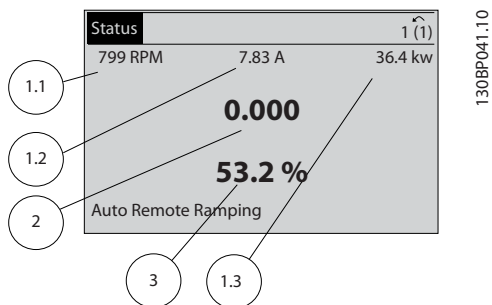
### 4.1.2 Setting LCP Display Values

The display area is activated when the frequency converter receives power from mains voltage, a DC bus terminal, or an external 24V supply.

The information displayed on the LCP can be customized for user application.

- Each display readout has a parameter associated with it.
- Options are selected in the quick menu Q3-13 *Display Settings*.
- Display 2 has an alternate larger display option.
- The frequency converter status at the bottom line of the display is generated automatically and is not selectable. See 6 *Status Indication* for definitions and details.

Display	Parameter number	Default setting
1.1	0-20	Motor RPMs
1.2	0-21	Motor current
1.3	0-22	Motor power (kW)
2	0-23	Motor frequency
3	0-24	Reference in percent



### 4.1.3 Display Menu Keys

Menu keys are used for menu access for parameter set-up, toggling through status display modes during normal operation, and viewing fault log data.



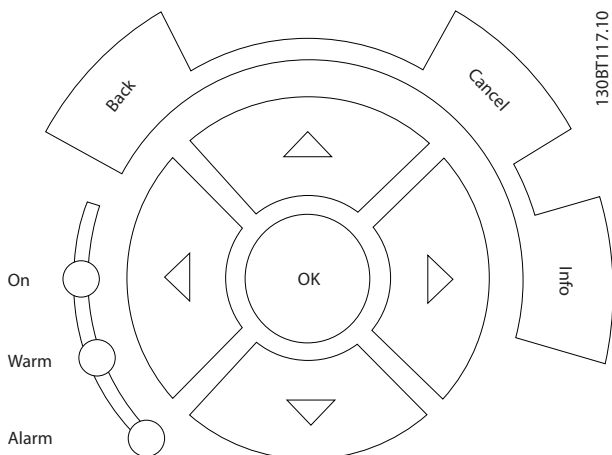
130BP045.10

Key	Function
<b>Status</b>	<p>Press to show operational information.</p> <ul style="list-style-type: none"> <li>• In Auto mode, press and hold to toggle between status read-out displays</li> <li>• Press repeatedly to scroll through each status display</li> <li>• Press and hold [Status] plus [▲] or [▼] to adjust the display brightness</li> <li>• The symbol in the upper right corner of the display shows the direction of motor rotation and which set-up is active. This is not programmable.</li> </ul>
<b>Quick Menu</b>	<p>Allows access to programming parameters for initial set up instructions and many detailed application instructions.</p> <ul style="list-style-type: none"> <li>• Press to access Q2 <i>Quick Setup</i> for sequenced instructions to program the basic frequency controller set up</li> <li>• Press to access Q3 <i>Function Setups</i> for sequenced instructions to program applications</li> <li>• Follow the sequence of parameters as presented for the function set up</li> </ul>
<b>Main Menu</b>	<p>Allows access to all programming parameters.</p> <ul style="list-style-type: none"> <li>• Press twice to access top-level index</li> <li>• Press once to return to the last location accessed</li> <li>• Press and hold to enter a parameter number for direct access to that parameter</li> </ul>
<b>Alarm Log</b>	<p>Displays a list of current warnings, the last 10 alarms, and the maintenance log.</p> <ul style="list-style-type: none"> <li>• For details about the frequency converter before it entered the alarm mode, select the alarm number using the navigation keys and press [OK].</li> </ul>

4

### 4.1.4 Navigation Keys

Navigation keys are used for programming functions and moving the display cursor. The navigation keys also provide speed control in local (hand) operation. Three frequency converter status indicator lights are also located in this area.



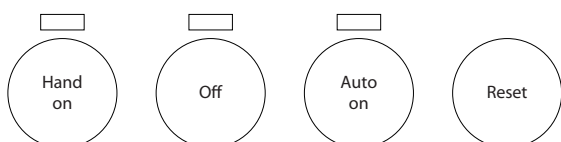
130BT117.10

Key	Function
<b>Back</b>	Reverts to the previous step or list in the menu structure.
<b>Cancel</b>	Cancels the last change or command as long as the display mode has not changed.
<b>Info</b>	Press for a definition of the function being displayed.
<b>Navigation Keys</b>	Use the four navigation arrows to move between items in the menu.
<b>OK</b>	Use to access parameter groups or to enable a choice.

Light	Indicator	Function
Green	ON	The ON light activates when the frequency converter receives power from mains voltage, a DC bus terminal, or an external 24 V supply.
Yellow	WARN	When warning conditions are met, the yellow WARN light comes on and text appears in the display area identifying the problem.
Red	ALARM	A fault condition causes the red alarm light to flash and an alarm text is displayed.

### 4.1.5 Operation Keys

Operation keys are found at the bottom of the control panel.



130BP046.10

Key	Function
<b>Hand On</b>	Press to start the frequency converter in local control. <ul style="list-style-type: none"> <li>Use the navigation keys to control frequency converter speed</li> <li>An external stop signal by control input or serial communication overrides the local hand on</li> </ul>
<b>Off</b>	Stops the motor but does not remove power to the frequency converter.
<b>Auto On</b>	Puts the system in remote operational mode. <ul style="list-style-type: none"> <li>Responds to an external start command by control terminals or serial communication</li> <li>Speed reference is from an external source</li> </ul>
<b>Reset</b>	Resets the frequency converter manually after a fault has been cleared.

### 4.2 Back Up and Copying Parameter Settings

Programming data is stored internally in the frequency converter.

- The data can be up loaded into the LCP memory as a storage back up
- Once stored in the LCP, the data can be downloaded back into the frequency converter
- Or downloaded into other frequency converters by connecting the LCP into those units and downloading the stored settings. (This is a quick way to program multiple units with the same settings.)
- Initialisation of the frequency converter to restore factory default settings does not change data stored in the LCP memory

### **WARNING**

#### UNINTENDED START!

When frequency converter is connected to AC mains, the motor may start at any time. The frequency converter, motor, and any driven equipment must be in operational readiness. Failure to be in operational readiness when the frequency converter is connected to AC mains could result in death, serious injury, equipment, or property damage.

### 4.2.1 Uploading Data to the LCP

1. Press [OFF] to stop the motor before uploading or downloading data.
2. Go to *0-50 LCP Copy*.
3. Press [OK].
4. Select *All to LCP*.
5. Press [OK]. A progress bar shows the uploading process.
6. Press [Hand On] or [Auto On] to return to normal operation.

### 4.2.2 Downloading Data from the LCP

1. Press [OFF] to stop the motor before uploading or downloading data.
2. Go to *0-50 LCP Copy*.
3. Press [OK].
4. Select *All from LCP*.
5. Press [OK]. A progress bar shows the downloading process.
6. Press [Hand On] or [Auto On] to return to normal operation.

## 4.3 Restoring Default Settings

### CAUTION

Initialisation restores the unit to factory default settings. Any programming, motor data, localization, and monitoring records will be lost. Uploading data to the LCP provides a backup prior to initialisation.

Restoring the frequency converter parameter settings back to default values is done by initialisation of the frequency converter. Initialisation can be through *14-22 Operation Mode* or manually.

- Initialisation using *14-22 Operation Mode* does not change frequency converter data such as operating hours, serial communication selections, personal menu settings, fault log, alarm log, and other monitoring functions
- Using *14-22 Operation Mode* is generally recommended
- Manual initialisation erases all motor, programming, localization, and monitoring data and restores factory default settings

### 4.3.1 Recommended Initialisation

1. Press [Main Menu] twice to access parameters.
2. Scroll to *14-22 Operation Mode*.
3. Press [OK].
4. Scroll to *Initialisation*.
5. Press [OK].
6. Remove power to the unit and wait for the display to turn off.
7. Apply power to the unit.

Default parameter settings are restored during start up. This may take slightly longer than normal.

8. Alarm 80 is displayed.
9. Press [Reset] to return to operation mode.

### 4.3.2 Manual Initialisation

1. Remove power to the unit and wait for the display to turn off.
2. Press and hold [Status], [Main Menu], and [OK] at the same time and apply power to the unit.

Factory default parameter settings are restored during start up. This may take slightly longer than normal.

Manual initialisation does not reset the following frequency converter information

- *15-00 Operating Hours*
- *15-03 Power Up's*
- *15-04 Over Temp's*
- *15-05 Over Volt's*



## 5 Programming

### 5

### 5.1 Introduction

The frequency converter is programmed for its application functions using parameters. Parameter are accessed by pressing either [Quick Menu] or [Main Menu] on the LCP. (See chapter *User Interface* for details on using the LCP function keys.) Parameters may also be accessed through a PC using the MCT 10 Set-up Software (see section *5.4.1 Remote Programming with* ).

The quick menu is intended for initial start up. Data entered in a parameter can change the options available in the parameters following that entry. The quick menu presents easy guidelines for getting most systems up and running.

The main menu accesses all parameters and allows for advanced frequency converter applications.

### 5.2 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

0-01 Language		
Option:	Function:	
	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
[52]	Hrvatski	

1-20 Motor Power [kW]		
Range:	Function:	
Application dependent*	[Application dependant]	Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. This parameter is visible in LCP if <i>0-03 Regional Settings is International</i> [0].
<p><b>NOTE</b> Four sizes down, one size up from nominal unit rating.</p>		

1-22 Motor Voltage		
Range:	Function:	
Size related*	[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 <i>1-50 Motor Magnetisation at</i>

1-23 Motor Frequency		
Range:	Function:	
	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:	
Size related*	[0.10 - 10000.00 A]	

**NOTE**

This parameter cannot be adjusted while the motor is running.

1-25 Motor Nominal Speed		
Range:	Function:	
Size related*	[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]

**5-12 Terminal 27 Digital Input**

Option:	Function:	
	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 <i>Automatic Motor Adaptation</i> . 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]	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 $X_n$ .
[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.

## NOTE

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 10min, depending on the power rating of the motor.

## NOTE

Avoid generating external torque during AMA.

## NOTE

If one of the settings in par. 1-2\* is changed, par. 1-30 to par. 1-39, the Advanced Motor Parameters, will return to default setting.

5

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 <i>Min.- Max.</i> [0]. The Minimum Reference unit matches: <ul style="list-style-type: none"> <li>The choice of configuration in 1-00 Configuration Mode Configuration Mode: for Speed closed loop [1], RPM; for Torque [2], Nm.</li> <li>The unit selected in 3-01 Reference/Feedback Unit.</li> </ul>

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: <ul style="list-style-type: none"> <li>The choice of configuration in 1-00 Configuration Mode: for Speed closed loop [1], RPM; for Torque [2], Nm.</li> <li>The unit selected in 3-00 Reference Range.</li> </ul>

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. $Par. 3 - 41 = \frac{t_{acc}[s] \times n_s [RPM]}{ref[RPM]}$

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. $Par. 3 - 42 = \frac{t_{dec}[s] \times n_s [RPM]}{ref[RPM]}$

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

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

1-\*\* Load and Motor parameters

2-\*\* Brakes

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 RS-485-485 and FC USB port parameters.

9-\*\* Profibus

13-\*\* Smart Logic Control parameters

14-\*\* Special function parameters

15-\*\* Drive information parameters

16-\*\* Read out parameters

17-\*\* Motor Feedback Option parameters

30-\*\* Special Features

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.

## 5.3.1 0-\*\* Operation/Display

5

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
<b>0-0* Basic Settings</b>						
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
<b>0-1* Set-up Operations</b>						
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
<b>0-2* LCP Display</b>						
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	SR	1 set-up	TRUE	0	UInt16
<b>0-3* LCP Custom Readout</b>						
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 CustomReadoutUnit	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]
<b>0-4* LCP Keypad</b>						
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
<b>0-5* Copy/Save</b>						
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
<b>0-6* Password</b>						
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

5.3.2 1-\*\* Load/Motor

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>1-0* General Settings</b>							
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
<b>1-1* Motor Selection</b>							
1-10	Motor Construction	[0] Asynchron	All set-ups		FALSE	-	Uint8
<b>1-2* Motor Data</b>							
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
<b>1-3* Adv. Motor Data</b>							
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
<b>1-5* Load Indep. Setting</b>							
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

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>1-6* Load Depen. Setting</b>							
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
<b>1-7* Start Adjustments</b>							
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
<b>1-8* Stop Adjustments</b>							
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
<b>1-9* Motor Temperature</b>							
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

## 5.3.3 2-\*\* Brakes

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>2-0* DC-Brake</b>							
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
<b>2-1* Brake Energy Funct.</b>							
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
<b>2-2* Mechanical Brake</b>							
2-20	Release Brake Current	I <sub>max</sub> VLT (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



## 5.3.4 3-\*\* Reference/Ramps

5

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>3-0* Reference Limits</b>							
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
<b>3-1* References</b>							
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
<b>3-4* Ramp 1</b>							
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
<b>3-5* Ramp 2</b>							
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
<b>3-6* Ramp 3</b>							
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
<b>3-7* Ramp 4</b>							
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	Conversion index	Type
<b>3-8* Other Ramps</b>							
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
<b>3-9* Digital Pot.Meter</b>							
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

## 5.3.5 4-\*\* Limits / Warnings

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>4-1* Motor Limits</b>							
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
<b>4-2* Limit Factors</b>							
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
<b>4-3* Motor Speed Mon.</b>							
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
<b>4-5* Adj. Warnings</b>							
4-50	Warning Current Low	0.00 A	All set-ups		TRUE	-2	Uint32
4-51	Warning Current High	I <sub>max</sub> VLT (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
<b>4-6* Speed Bypass</b>							
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

5.3.6 5-\*\* Digital In/Out

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>5-0* Digital I/O mode</b>							
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
<b>5-1* Digital Inputs</b>							
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
<b>5-3* Digital Outputs</b>							
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
<b>5-4* Relays</b>							
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
<b>5-5* Pulse Input</b>							
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

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>5-6* Pulse Output</b>							
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
<b>5-7* 24V Encoder Input</b>							
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
<b>5-9* Bus Controlled</b>							
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

5.3.7 6-\*\* Analog In/Out

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>6-0* Analog I/O Mode</b>							
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
<b>6-1* Analog Input 1</b>							
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
<b>6-2* Analog Input 2</b>							
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
<b>6-3* Analog Input 3</b>							
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
<b>6-4* Analog Input 4</b>							
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
<b>6-5* Analog Output 1</b>							
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
<b>6-6* Analog Output 2</b>							
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

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>6-7* Analog Output 3</b>							
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
<b>6-8* Analog Output 4</b>							
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

5.3.8 7-\*\* Controllers

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>7-0* Speed PID Ctrl.</b>							
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
<b>7-1* Torque PI Ctrl.</b>							
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
<b>7-2* Process Ctrl. Feedb</b>							
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
<b>7-3* Process PID Ctrl.</b>							
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
<b>7-4* Adv. Process PID I</b>							
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
<b>7-5* Adv. Process PID II</b>							
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



## 5.3.9 8-\*\* Comm. and Options

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Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>8-0* General Settings</b>							
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
<b>8-1* Ctrl. Word Settings</b>							
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
<b>8-3* FC Port Settings</b>							
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
<b>8-4* FC MC protocol set</b>							
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
<b>8-5* Digital/Bus</b>							
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
<b>8-8* FC Port Diagnostics</b>							
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
<b>8-9* Bus Jog</b>							
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

**5.3.10 9-\*\* Profibus**

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion 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

## 5.3.11 13-\*\* Smart Logic

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>13-0* SLC Settings</b>							
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
<b>13-1* Comparators</b>							
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
<b>13-2* Timers</b>							
13-20	SL Controller Timer	App.Dependent	1 set-up		TRUE	-3	TimD
<b>13-4* Logic Rules</b>							
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
<b>13-5* States</b>							
13-51	SL Controller Event	null	2 set-ups		TRUE	-	Uint8
13-52	SL Controller Action	null	2 set-ups		TRUE	-	Uint8

## 5.3.12 14-\*\* Special Functions

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>14-0* Inverter Switching</b>							
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
<b>14-1* Mains On/Off</b>							
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
<b>14-2* Trip Reset</b>							
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
<b>14-3* Current Limit Ctrl.</b>							
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
<b>14-4* Energy Optimising</b>							
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
<b>14-5* Environment</b>							
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	Conversion index	Type
<b>14-7* Compatibility</b>							
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
<b>14-8* Options</b>							
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
<b>14-9* Fault Settings</b>							
14-90	Fault Level	null	1 set-up		TRUE	-	Uint8

5.3.13 15-\*\* Drive Information

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>15-0* Operating Data</b>							
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
<b>15-1* Data Log Settings</b>							
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
<b>15-2* Historic Log</b>							
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
<b>15-3* Fault Log</b>							
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
<b>15-4* Drive Identification</b>							
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]

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>15-6* Option Ident</b>							
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]
<b>15-9* Parameter Info</b>							
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

5.3.14 16-\*\* Data Readouts

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>16-0* General Status</b>							
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
<b>16-1* Motor Status</b>							
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
<b>16-3* Drive Status</b>							
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
<b>16-5* Ref. &amp; Feedb.</b>							
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



Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>16-6* Inputs &amp; Outputs</b>							
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
<b>16-8* Fieldbus &amp; FC Port</b>							
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
<b>16-9* Diagnosis Readouts</b>							
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

## 5.3.15 17-\*\* Motor Feedb.Option

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>17-1* Inc. Enc. Interface</b>							
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
<b>17-2* Abs. Enc. Interface</b>							
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
<b>17-5* Resolver Interface</b>							
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
<b>17-6* Monitoring and App.</b>							
17-60	Feedback Direction	[0] Clockwise	All set-ups		FALSE	-	Uint8
17-61	Feedback Signal Monitoring	[1] Warning	All set-ups		TRUE	-	Uint8

## 5.3.16 30-\*\* Special Features

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
<b>30-0* Wobbler</b>							
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
<b>30-2* Adv. Start Adjust</b>							
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
<b>30-8* Compatibility (I)</b>							
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

## 5.4 Remote Programming with MCT 10 Set-up Software

Danfoss offers a software program available for developing, storing, and transferring frequency converter programming. The MCT 10 Set-up Software allows the user to connect a PC to the frequency converter and perform live programming rather than using the LCP. Also, all frequency converter programming can be done off-line and simply downloaded into frequency converter. Or the entire frequency converter profile can be loaded onto the PC for back up storage or analysis.

The USB connector or RS-485 terminal are available for connecting to the frequency converter.

MCT 10 Set-up Software is available for free download at <http://www.Danfoss.com> and enter MCT-10 download in the search window. A CD is also available by requesting part number 130B1000. A user's manual provides detailed operation instructions.

## 6 Status Indication

### 6.1 Frontal LEDs

The actual status can be read on the outside of the FCD products. Six LEDs signal the actual status of the unit with the meaning described in the following table.

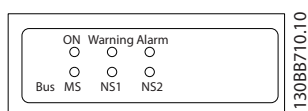


Illustration 6.1 Frontal LEDs

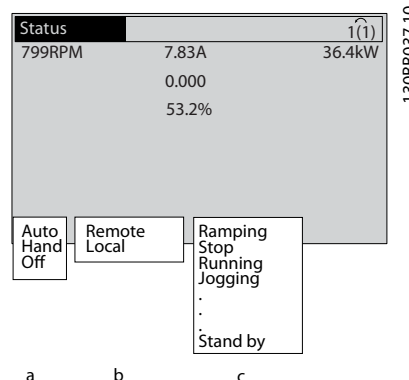


Illustration 6.2 Status Display

Name	Colour	Status	Indication
ON	Green	On	The frequency converter receives power from mains voltage, or external 24V supply.
		Off	No power from mains voltage, or external 24V supply.
Warning	Yellow	On	Warning situation is present.
		Off	No warning is present.
Alarm	Red	Flashing	Alarm is present.
		Off	No alarm is present
Bus MS	Only relevant if optional fieldbus is present. See fieldbus manual for specific information.		Bus Module Status
Bus NS1		Bus Network Status 1	
Bus NS2		Bus Network Status 2	

### 6.2 Status Display

When the frequency converter is in status mode, status messages are generated automatically from within the frequency converter and appear in the bottom line of the display (see *Illustration 6.2.*)

- The first word on the status line indicates where the stop/start command originates.
- The second word on the status line indicates where the speed control originates.
- The last part of the status line gives the present frequency converter status. These show the operational mode the frequency converter is in.

#### NOTE

In auto/remote mode, the frequency converter requires external commands to execute functions.

### 6.3 Status Message Definitions Table

The next three tables define the meaning of the status message display words.

	Operation Mode
Off	The frequency converter does not react to any control signal until [Auto On] or [Hand On] is pressed.
Auto On	The frequency converter is controlled from the control terminals and/or the serial communication.
Hand On	The frequency converter can be controlled by the navigation keys on the LCP. Stop commands, reset, reversing, DC brake, and other signals applied to the control terminals can override local control.

	Reference Site
Remote	The speed reference is given from external signals, serial communication, or internal preset references.
Local	The frequency converter uses [Hand On] control or reference values from the LCP.

	<b>Operation Status</b>
AC Brake	AC Brake was selected in <i>2-10 Brake Function</i> . The AC brake over-magnetizes the motor to achieve a controlled slow down.
AMA finish OK	Automatic motor adaptation (AMA) was carried out successfully.
AMA ready	AMA is ready to start. Press [Hand On] to start.
AMA running	AMA process is in progress.
Braking	The brake chopper is in operation. Generative energy is absorbed by the brake resistor.
Braking max.	The brake chopper is in operation. The power limit for the brake resistor defined in <i>2-12 Brake Power Limit (kW)</i> is reached.
Coast	<ul style="list-style-type: none"> <li>Coast inverse was selected as a function for a digital input (parameter group 5-1*). The corresponding terminal is not connected.</li> <li>Coast activated by serial communication</li> </ul>
Ctrl. Ramp-down	Control Ramp-down was selected in <i>14-10 Mains Failure</i> . <ul style="list-style-type: none"> <li>The mains voltage is below the value set in <i>14-11 Mains Voltage at Mains Fault</i> at mains fault</li> <li>The frequency converter ramps down the motor using a controlled ramp down</li> </ul>
Current High	The frequency converter output current is above the limit set in <i>4-51 Warning Current High</i> .
Current Low	The frequency converter output current is below the limit set in <i>4-52 Warning Speed Low</i>
DC Hold	DC hold is selected in <i>1-80 Function at Stop</i> and a stop command is active. The motor is held by a DC current set in <i>2-00 DC Hold/Preheat Current</i> .
DC Stop	The motor is held with a DC current ( <i>2-01 DC Brake Current</i> ) for a specified time ( <i>2-02 DC Braking Time</i> ). <ul style="list-style-type: none"> <li>DC Brake is activated in <i>2-03 DC Brake Cut In Speed [RPM]</i> and a Stop command is active.</li> <li>DC Brake (inverse) is selected as a function for a digital input (parameter group 5-1*). The corresponding terminal is not active.</li> <li>The DC Brake is activated via serial communication.</li> </ul>
Feedback high	The sum of all active feedbacks is above the feedback limit set in <i>4-57 Warning Feedback High</i> .
Feedback low	The sum of all active feedbacks is below the feedback limit set in <i>4-56 Warning Feedback Low</i> .

	<b>Operation Status</b>
Freeze output	The remote reference is active which holds the present speed. <ul style="list-style-type: none"> <li>Freeze output was selected as a function for a digital input (Group 5-1*). The corresponding terminal is active. Speed control is only possible via the terminal functions speed up and speed down.</li> <li>Hold ramp is activated via serial communication.</li> </ul>
Freeze output request	A freeze output command has been given, but the motor will remain stopped until a run permissive signal is received.
Freeze ref.	<i>Freeze Reference</i> was chosen as a function for a digital input (parameter group 5-1*). The corresponding terminal is active. The frequency converter saves the actual reference. Changing the reference is now only possible via terminal functions speed up and speed down.
Jog request	A jog command has been given, but the motor will be stopped until a run permissive signal is received via a digital input.
Jogging	The motor is running as programmed in <i>3-19 Jog Speed [RPM]</i> . <ul style="list-style-type: none"> <li>Jog was selected as function for a digital input (parameter group 5-1*). The corresponding terminal (e.g. Terminal 29) is active.</li> <li>The Jog function is activated via the serial communication.</li> <li>The Jog function was selected as a reaction for a monitoring function (e.g. No signal). The monitoring function is active.</li> </ul>
Motor check	In <i>1-80 Function at Stop, Motor Check</i> was selected. A stop command is active. To ensure that a motor is connected to the frequency converter, a permanent test current is applied to the motor.
OVC control	<i>Overvoltage control</i> was activated in <i>2-17 Overvoltage Control</i> . The connected motor is supplying the frequency converter with generative energy. The overvoltage control adjusts the V/Hz ratio to run the motor in controlled mode and to prevent the frequency converter from tripping.
PowerUnit Off	(For frequency converters with an external 24V power supply installed only.) Mains supply to the frequency converter is removed, but the control card is supplied by the external 24V.

	<b>Operation Status</b>
Protection md	Protection mode is active. The unit has detected a critical status (an overcurrent or overvoltage). <ul style="list-style-type: none"> <li>To avoid tripping, switching frequency is reduced to 4kHz.</li> <li>If possible, protection mode ends after approximately 10sec.</li> <li>Protection mode can be restricted in <i>14-26 Trip Delay at Inverter Fault</i></li> </ul>
QStop	The motor is decelerating using <i>3-81 Quick Stop Ramp Time</i> . <ul style="list-style-type: none"> <li><i>Quick stop inverse</i> was chosen as a function for a digital input (parameter group 5-1*). The corresponding terminal is not active.</li> <li>The quick stop function was activated via serial communication.</li> </ul>
Ramping	The motor is accelerating/decelerating using the active Ramp Up/Down. The reference, a limit value or a standstill is not yet reached.
Ref. high	The sum of all active references is above the reference limit set in <i>4-55 Warning Reference High</i> .
Ref. low	The sum of all active references is below the reference limit set in <i>4-54 Warning Reference Low</i> .
Run on ref.	The frequency converter is running in the reference range. The feedback value matches the setpoint value.
Run request	A start command has been given, but the motor is stopped until a run permissive signal is received via digital input.
Running	The motor is driven by the frequency converter.
Sleep Mode	The energy saving function is enabled. This means that at present the motor has stopped, but that it will restart automatically when required.
Speed high	Motor speed is above the value set in <i>4-53 Warning Speed High</i> .
Speed low	Motor speed is below the value set in <i>4-52 Warning Speed Low</i> .
Standby	In Auto On mode, the frequency converter will start the motor with a start signal from a digital input or serial communication.
Start delay	In <i>1-71 Start Delay</i> , a delay starting time was set. A start command is activated and the motor will start after the start delay time expires.
Start fwd/rev	Start forward and start reverse were selected as functions for two different digital inputs (parameter group 5-1*). The motor will start in forward or reverse depending on which corresponding terminal is activated.
Stop	The frequency converter has received a stop command from the LCP, digital input or serial communication.

	<b>Operation Status</b>
Trip	An alarm occurred and the motor is stopped. Once the cause of the alarm is cleared, the frequency converter can be reset manually by pressing [Reset] or remotely by control terminals or serial communication.
Trip lock	An alarm occurred and the motor is stopped. Once the cause of the alarm is cleared, power must be cycled to the frequency converter. The frequency converter can then be reset manually by pressing [Reset] or remotely by control terminals or serial communication.

## 7 Troubleshooting

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	





No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
16	Short Circuit		X	X	
17	Control word time-out	(X)	(X)		8-04 Control Word Timeout Function
22	Hoist Mech. Brake	(X)	(X)		Parameter group 2-2*
23	Internal Fan Fault	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		
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
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			
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) <sup>1)</sup>		5-19 Terminal 37 Safe Stop
69	Pwr. Card Temp		X	X	
70	Illegal FC configuration			X	
73	Safe Stop Auto Restart	(X)	(X)		5-19 Terminal 37 Safe Stop
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		

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
82	CSIV parameter error		X		
85	Profibus/Profisafe Error		X		
90	Feedback Monitor	(X)	(X)		17-61 Feedback Signal Monitoring
91	Analogue input 54 wrong settings			X	S202
250	New spare part			X	14-23 Typecode Setting
251	New Type Code		X	X	

**Table 7.1 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 (par. 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 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

Alarm Word Extended Status Word							
Bit	Hex	Dec	Alarm Word	Alarm Word 2	Warning Word	Warning Word 2	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
3	00000008	8	Ctrl.Card Temp (A65)	ServiceTrip, (reserved)	Ctrl.Card Temp (W65)	reserved	Slow Down
4	00000010	16	Ctrl. Word TO (A17)	ServiceTrip, (reserved)	Ctrl. Word TO (W17)		Catch Up
5	00000020	32	Over Current (A13)	reserved	Over Current (W13)	reserved	Feedback High
6	00000040	64	Torque Limit (A12)	reserved	Torque Limit (W12)	reserved	Feedback Low
7	00000080	128	Motor Th Over (A11)	reserved	Motor Th Over (W11)	reserved	Output Current High
8	00000100	256	Motor ETR Over (A10)	reserved	Motor ETR Over (W10)	reserved	Output Current Low
9	00000200	512	Inverter Overld. (A9)	reserved	Inverter Overld (W9)	reserved	Output Freq High
10	00000400	1024	DC under Volt (A8)	reserved	DC under Volt (W8)		Output Freq Low
11	00000800	2048	DC over Volt (A7)	reserved	DC over Volt (W7)		Brake Check OK
12	00001000	4096	Short Circuit (A16)	reserved	DC Voltage Low (W6)	reserved	Braking Max
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
18	00040000	262144	Brake Overload (A26)	Fans error	Brake Overload (W26)	Fans Warn	Password Protection
19	00080000	524288	U phase Loss (A30)	ECB error	Brake Resistor (W25)	ECB Warn	
20	00100000	1048576	V phase Loss (A31)	reserved	Brake IGBT (W27)	reserved	
21	00200000	2097152	W phase Loss (A32)	reserved	Speed Limit (W49)	reserved	
22	00400000	4194304	Fieldbus Fault (A34)	reserved	Fieldbus Fault (W34)	reserved	Unused
23	00800000	8388608	24V 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 7.2 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*.

**WARNING 1, 10 Volts low:**

The 10V voltage from terminal 50 on the control card is below 10V.

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

**WARNING/ALARM 2, Live zero error:**

The signal on terminal 53 or 54 is less than 50% of the value set in *6-10 Terminal 53 Low Voltage*, *6-12 Terminal 53 Low Current*, *6-20 Terminal 54 Low Voltage*, or *6-22 Terminal 54 Low Current* respectively.

**WARNING/ALARM 3, No motor:**

No motor has been connected to the output of the frequency converter.

**WARNING/ALARM 4, Mains phase loss:**

A phase is missing on the supply side, or the mains voltage imbalance is too high.

This message also appears in case of a fault in the input rectifier on the frequency converter.

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

**WARNING 5, DC link voltage high:**

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

**WARNING 6, DC link voltage low**

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

**WARNING/ALARM 7, DC over voltage:**

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

**Possible corrections:**

Connect a brake resistor

Extend the ramp time

Activate functions in *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 "voltage warning low" limit (see table above), the frequency converter checks if 24V backup supply is connected.

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

To check whether the supply voltage matches the frequency converter, see section *8.2 General Specifications*.

**WARNING/ALARM 9, Inverter overloaded:**

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

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

**WARNING/ALARM 10, Motor ETR over temperature:**

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

**WARNING/ALARM 11, Motor thermistor over temp:**

The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in *1-90 Motor Thermal Protection*. 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 aKTY sensor is used, check for correct connection between terminal 54 and 55.

**WARNING/ALARM 12, Torque limit:**

The torque is higher than the value in *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).

**WARNING/ALARM 13, Over Current:**

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

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

**ALARM 14, Earth fault:**

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

Turn off the frequency converter and remove the earth fault.

**ALARM 15, Incomplete hardware:**

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

**ALARM 16, Short-circuit**

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

Turn off the 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.

*8-03 Control Word Timeout Time* could possibly be increased.

**WARNING/ALARM 22, Hoist Mechanical 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* (set to [0] Disabled).

**WARNING 25, Brake resistor short-circuited:**

The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see *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 120sec., on the basis of the resistance value of the brake resistor (*2-11 Brake Resistor (ohm)*) 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/ALARM 27, Brake chopper fault:**

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

Turn off the frequency converter and remove the brake resistor.

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.

**CAUTION**

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

**WARNING/ALARM 28, Brake check failed:**

Brake resistor fault: the brake resistor is not connected/ working.

**ALARM 29, Drive over temperature:**

The cut-out temperature of the heat-sink is 95°C ±5 °C. The temperature fault cannot be reset, until the temperature of the heatsink is below 70°C ±5°C.

**The fault could be:**

- Ambient temperature too high
- Too long motor cable

**ALARM 30, Motor phase U missing:**

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

Turn off the frequency converter and check motor phase U.

**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. See section *8.2 General Specifications* for the allowed number of power ups within one minute.

**WARNING/ALARM 34, Fieldbus communication fault:**

The fieldbus on the communication option card is not working correctly. Please check parameters associated with the module and check the wiring for fieldbus.

**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. Possible correction: check the fuses to the frequency converter

**ALARM 37, Phase imbalance:**

There is a current imbalance between the power units

**ALARM 38, Internal fault:**

By this alarm it may be necessary to contact your Danfoss supplier. Some typical alarm messages:

0	The serial port cannot be initialized. Serious hardware failure
256	The power EEPROM data is defect or too old
512	The control board EEPROM data is defect or too old
513	Communication time out Reading EEPROM data
514	Communication time out Reading EEPROM data
515	The Application Orientated Control cannot recognize the EEPROM data
516	Cannot write to the EEPROM because a write command is on progress
517	The write command is under time out
518	Failure in the EEPROM
519	Missing or invalid BarCode data in EEPROM 1024 – 1279 CAN telegram cannot be sent. (1027 indicate a possible hardware failure)
1281	Digital Signal Processor flash time-out
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
1315	Option SW in slot A is not supported (not allowed)

1316	Option SW in slot B is not supported (not allowed)
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
2315	Missing SW version from power unit
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
3072-5122	Parameter value is outside its limits. Perform a initialization. Parameter number causing the alarm: Subtract the code from 3072. Ex Error code 3238: 3238-3072 = 166 is outside the limit
5123	Option in slot A: Hardware incompatible with Control board hardware
5124	Option in slot B: 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*.

**ALARM 45, Earth fault 2:**

There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself. Turn off the frequency converter and remove the earth fault. This alarm is detected under the start-up test sequence.

**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 24V DC 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, 24V supply low:**

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

**WARNING 48, 1.8V supply low:**

Contact your Danfoss supplier.

**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:**

The motor is not suitable for the particular size of drive. Start the AMA procedure once again by *1-29 Automatic Motor Adaptation (AMA)*, eventually with a reduced AMA function. If still failing; check the motor data.

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

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

**ALARM 52, AMA low Inom:**

The motor current is too low. Check the settings.

**ALARM 53, AMA motor too big:**

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

**ALARM 54, AMA motor too small:**

The motor is too small for the AMA to be carried out.

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

The motor 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  $R_s$  and  $R_r$  are increased. In most cases, however, this is not critical.

**ALARM 58, AMA internal fault:**

Contact your Danfoss supplier.

**WARNING 59, Current limit:**

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 24V DC 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/ALARM 61, Feedback Error:**

An error between calculated speed and speed measurement from feedback device. The function Warning/Alarm/Disabling setting is in *4-30 Motor Feedback Loss Function*. Accepted error setting in *4-31 Motor Feedback Speed Error* and the allowed time the error occur setting 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*. This is a warning in VVC<sup>plus</sup> mode and an alarm (trip) in Flux mode.

**ALARM 63, Mechanical Brake Low:**

The actual motor current has not exceeded the “release brake” current within the “Start delay” time window.

**WARNING 64, Voltage Limit:**

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

**WARNING/ALARM/TRIP 65, Control Card Over Temperature:**

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

**WARNING 66, Heatsink Temperature Low:**

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

**ALARM 67, Option Configuration has Changed:**

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

**ALARM 68, Safe Stop:**

Safe Stop has been activated. To resume normal operation, apply 24V DC to T-37. Press reset button on LCP.

**WARNING 68, Safe Stop:**

Safe Stop has been activated. Normal operation is resumed when Safe Stop is disabled. Warning: Automatic Restart!

**ALARM 69, Power card temperature**

The temperature sensor on the power card is either too hot or too cold.

**ALARM 70, Illegal FC Configuration:**

Actual combination of control board and power board is illegal.

**WARNING 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.

**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 78, Tracking Error:**

The difference between set point value and actual value has exceeded the value in 4-35 *Tracking Error*. Disable the function by 4-34 *Tracking Error Function* or select an alarm/warning also in 4-34 *Tracking Error Function*. Investigate the mechanics around the load and motor, Check feedback connections from motor – encoder – to drive. Select motor feedback function in 4-30 *Motor Feedback Loss Function*. Adjust tracking error band in 4-35 *Tracking Error* and 4-37 *Tracking Error Ramping*.

**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 Initialised to Default Value:**

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

**ALARM 81, CSIV corrupt:**

CSIV file has syntax errors.

**ALARM 82, CSIV parameter error:**

CSIV failed to init a parameter.

**ALARM 85, Dang fail PB:**

Profibus/Profisafe Error.

**ALARM 86, Dang fail DI:**

Sensor Error.

**ALARM 88, Option Detection:**

A change in the option layout has been detected. This alarm occurs when 14-89 *Option Detection* is set to [0] *Frozen configuration* and the option layout for some reason has changed. An option layout change has to be enabled in 14-89 *Option Detection* before the change is accepted. If the change of configuration is not accepted, it is only possible to reset Alarm 88 (Trip-lock) when the option configuration has been re-established/corrected.

**ALARM 90, Feedback Monitor:**

Check the connection to encoder/ resolver option and eventually replace the MCB 102or MCB 103.

**ALARM 91, Analogue Input 54 Wrong Settings:**

Switch S202 has to be set in position OFF (voltage input) when a KTY sensor is connected to analogue input terminal 54.

**ALARM 250, New Spare Part:**

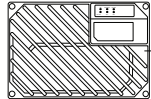
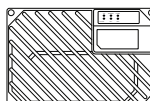
The power or Switch Mode Power Supply has been exchanged. The frequency converter type code must be restored in the EEPROM. Select the correct type code in 14-23 *Typecode Setting* according to the label on unit. Remember to select ‘Save to EEPROM’ to complete.

**ALARM 251, New Type Code:**

The Frequency Converter has got a new type code.

## 8 Specifications

### 8.1 Electrical Data and Wire Sizes

Mains Supply 3 x 380 - 480VAC							
Frequency Converter		PK37	PK55	PK75	P1K1	P1K5	P2K2
Typical Shaft Output [kW]		0.37	0.55	0.75	1.1	1.5	2.2
Typical Shaft Output [HP] at 460V		0.5	0.75	1.0	1.5	2.0	3.0
Output current							
 130BB799.10	Continuous (3 x 380-440V) [A]	1.3	1.8	2.4	3.0	4.1	5.2
	Intermittent (3 x 380-440V) [A]	2.1	2.9	3.8	4.8	6.6	8.3
	Continuous (3 x 441-480V) [A]	1.2	1.6	2.1	3.0	3.4	4.8
	Intermittent (3 x 441-480V) [A]	1.9	2.6	3.4	4.8	5.4	7.7
	Continuous kVA (400V AC) [kVA]	0.9	1.3	1.7	2.1	2.8	3.9
	Continuous kVA (460V AC) [kVA]	0.9	1.3	1.7	2.4	2.7	3.8
	Max. cable size: (mains, motor, brake) [mm <sup>2</sup> / AWG]	6/10					
Max. input current							
 130BB800.10	Continuous (3 x 380-440V) [A]	1.2	1.6	2.2	2.7	3.7	5.0
	Intermittent (3 x 380-440V) [A]	1.9	2.6	3.5	4.3	5.9	8.0
	Continuous (3 x 441-480V) [A]	1.0	1.4	1.9	2.7	3.1	4.3
	Intermittent (3 x 441-480V) [A]	1.6	2.2	3.0	4.3	5.0	6.9
	Max. pre-fuses IEC/UL [A]	25					
	Power loss at max. load [W]	35	42	46	58	62	88
	Efficiency	0.93	0.95	0.96	0.96	0.97	0.97
Weight [kg]						9.8	



## 8.2 General Specifications

### Mains supply (L1, L2, L3)

Supply voltage	380-480V±1%
----------------	-------------

#### Mains voltage low / mains drop-out:

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

Supply frequency	50/60Hz± 5%
------------------	-------------

Max. imbalance temporary between mains phases	3.0% of rated supply voltage
---	------------------------------

True Power Factor ( $\lambda$ )	≥ 0.9 nominal at rated load
---------------------------------	-----------------------------

Displacement Power Factor ( $\cos \phi$ )	near unity (> 0.98)
---	---------------------

Switching on input supply L1, L2, L3 (power-ups)	maximum 2 times/min.
--	----------------------

The unit is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical Amperes, 480V maximum.

### Motor output (U, V, W):

Output voltage	0 - 100% of supply voltage
----------------	----------------------------

Output frequency	0 - 1000Hz
------------------	------------

Output frequency in Flux Mode	0 - 300Hz
-------------------------------	-----------

Switching on output	Unlimited
---------------------	-----------

Ramp times	0.01 - 3600 sec.
------------	------------------

### Torque Characteristics

Starting torque (Constant torque)	maximum 160% for 60 sec. <sup>1)</sup>
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Starting torque	maximum 180% up to 0.5 sec. <sup>1)</sup>
-----------------	---

Overload torque (Constant torque)	maximum 160% for 60 sec. <sup>1)</sup>
-----------------------------------	--

Starting torque (Variable torque)	maximum 110% for 60 sec. <sup>1)</sup>
-----------------------------------	--

Overload torque (Variable torque)	maximum 110% for 60 sec. <sup>1)</sup>
-----------------------------------	--

<sup>1)</sup> Percentage relates to the nominal torque.

### Cable lengths and cross sections for control cables<sup>1)</sup>:

Max. motor cable length, screened	10m
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Max. motor cable length, unscreened	10m
-------------------------------------	-----

Maximum cross section to control terminals, flexible/ rigid wire without cable end sleeves	1.5mm <sup>2</sup> /16 AWG
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Maximum cross section to control terminals, flexible wire with cable end sleeves	1.5mm <sup>2</sup> /16AWG
--	---------------------------

Maximum cross section to control terminals, flexible wire with cable end sleeves with collar	1.5mm <sup>2</sup> /16AWG
--	---------------------------

Minimum cross section to control terminals	0.25mm <sup>2</sup> / 24AWG
--	-----------------------------

<sup>1)</sup>Power cables, see tables in section Electrical Data of 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.
- 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 drive.

Digital inputs:

Programmable digital inputs	4 (6) <sup>1)</sup>
Terminal number	18, 19, 27 <sup>1)</sup> , 29 <sup>1)</sup> , 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 <sup>2)</sup>	> 19V DC
Voltage level, logic '1' NPN <sup>2)</sup>	< 14V DC
Maximum voltage on input	28V DC
Pulse frequency range	0 - 110kHz
(Duty cycle) Min. pulse width	4.5ms
Input resistance, R <sub>i</sub>	approx. 4kΩ

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.

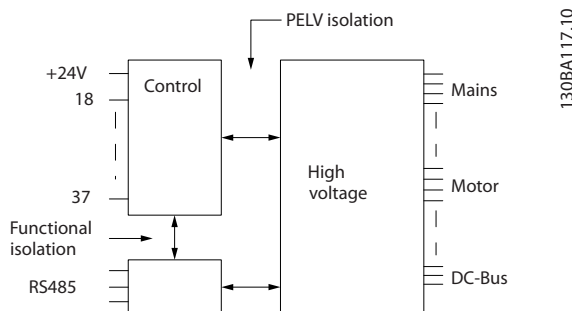
Safe stop Terminal 37 (Terminal 37 is fixed PNP logic):

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

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 <sub>i</sub>	approx. 10kΩ
Max. voltage	± 20V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20mA (scaleable)
Input resistance, R <sub>i</sub>	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.



Pulse/encoder inputs:

Programmable pulse/encoder inputs	2/1
Terminal number pulse/encoder	29, 33 <sup>1)</sup> / 32 <sup>2)</sup> , 33 <sup>2)</sup>
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 <i>Digital input</i>
Maximum voltage on input	28V DC
Input resistance, $R_i$	approx. 4 k $\Omega$
Pulse input accuracy (0.1 - 1kHz)	Max. error: 0.1% of full scale
Encoder input accuracy (1 - 110kHz)	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.*

<sup>1)</sup> Pulse inputs are 29 and 33

<sup>2)</sup> Encoder inputs: 32 = A, and 33 = B

**Analog output:**

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20mA
Max. load GND - analog output	500 $\Omega$
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, 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).*

**Digital output:**

Programmable digital/pulse outputs	2
Terminal number	27, 29 <sup>1)</sup>
Voltage level at digital/frequency output	0 - 24V
Max. output current (sink or source)	40mA
Max. load at frequency output	1k $\Omega$
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

<sup>1)</sup> 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.*

**Control card, 24V DC output:**

Terminal number	12, 13
Output voltage	24V +1, -3V
Max. load	600mA

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

**Relay outputs:**

Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1) <sup>1)</sup> on 1-3 (NC), 1-2 (NO) (Resistive load)	240V AC, 2A
Max. terminal load (AC-15) <sup>1)</sup> (Inductive load @ cos $\phi$ 0.4)	240V AC, 0.2 A
Max. terminal load (DC-1) <sup>1)</sup> on 1-2 (NO), 1-3 (NC) (Resistive load)	48V DC, 1A
Max. terminal load (DC-13) <sup>1)</sup> (Inductive load)	24V DC, 0.1A
Relay 02 Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1) <sup>1)</sup> on 4-5 (NO) (Resistive load) <sup>2)3)</sup> Overvoltage cat. II	240V AC, 2 A
Max. terminal load (AC-15) <sup>1)</sup> on 4-5 (NO) (Inductive load @ cos $\phi$ 0.4)	240V AC, 0.2A

Max. terminal load (DC-1) <sup>1)</sup> on 4-5 (NO) (Resistive load)	80V DC, 2 A
Max. terminal load (DC-13) <sup>1)</sup> on 4-5 (NO) (Inductive load)	24V DC, 0.1A
Max. terminal load (AC-1) <sup>1)</sup> on 4-6 (NC) (Resistive load)	240V AC, 2 A
Max. terminal load (AC-15) <sup>1)</sup> (Inductive load @ cosφ 0.4)	240V AC, 0.2A
Max. terminal load (DC-1) <sup>1)</sup> on 4-6 (NO), 4-5 (NC) (Resistive load)	48V DC, 1A
Max. terminal load (DC-13) <sup>1)</sup> (Inductive load)	24V DC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24V DC 10mA, 24V AC 20mA

1) IEC 60947 part 4 and 5

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

2) Overvoltage Category II

3) UL applications 300V AC 2A

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 characteristics:

Resolution of output frequency at 0 - 1000Hz	± 0.003Hz
Repeat accuracy of <i>Precise start/stop</i> (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

Control card performance:

Scan interval	1ms
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Surroundings:

Enclosure rating	IP66/Type 4X (indoor)
Vibration test	1.7g RMS
Max. relative humidity	5% - 95%(IEC 60 721-3-3; Class 3K3 (non-condensing) during operation
Ambient temperature	Max. 40°C (24-hour average maximum 35°C)

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	0°C
Minimum ambient temperature at reduced performance	-10 °C
Maximum altitude above sea level	1000m

Derating for high altitude, see section on special conditions

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 not galvanically isolated from protection earth. Use only an isolated laptop as PC connection to the USB connector on the frequency converter.

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