



# Operating Instructions MCA 124 EtherCAT





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# 1 Safety

## 1.1 Safety

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It has been assumed that all devices are sitting behind a firewall that does packet filtering and the environment has implemented restrictions on the software that can run inside the firewall. All nodes are assumed to be "trusted" nodes.

### **WARNING**

#### **HIGH VOLTAGE**

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

1. The frequency converter must be disconnected from mains before carrying out repair work. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
2. The off-command on the serial bus does not disconnect the equipment from mains and should not be used as a safety switch.
3. Correct protective earthing or grounding of the equipment must be established. The user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage currents are higher than 3.5 mA.
5. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.

1. The motor can be brought to a stop with bus commands while the frequency converter is connected to mains. These stop functions do NOT provide protection against unintended starts.
2. While parameters are being changed, there is a risk that motor starts.
3. Electronic faults in the frequency converter and cease of
  - temporary overload
  - faults in supply mains, or
  - fault in the motor connection

can cause an unintended start.

## **⚠ WARNING**

### **ELECTRICAL HAZARD**

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

## 1.2 EtherCAT®

EtherCAT is a Ethernet based realtime communication, which allows a master to communicate to slave in a interval down to 30 microseconds. The size of the network is almost unlimited since up to 65535 devices can be connected. These factors do make EtherCAT to one of the fastest Ethernet based protocols in the marked.

The topology in EtherCAT can be made as line, tree or as star. This gives the user the flexibility to route the cabling in the most optimal way.

On the application level EtherCAT applies CANopen as the application layer. This incorporates the usages of PDO (Process data Objects) for control of the devices and SDO (Service Data Objects) for acyclic access to parameters of the devices.

More information on EtherCAT can be found on the EtherCAT technology groups homepage: [www.ethercat.org](http://www.ethercat.org).



Illustration 1.1 EtherCAT® is Registered Trademark and Patented Technology, Licensed by Beckhoff Automation GmbH, Germany

## 2 Introduction

### 2.1.1 About this Manual

First time users can obtain the most essential information for quick installation and set-up in these chapters:

- chapter 2 Introduction
- chapter 3 How to Install
- chapter 4 How to Configure

For more detailed information, including the full range of set-up options and diagnosis tools, refer to the chapters:

- chapter 5 Configure the Master
- chapter 6 How to Control the Frequency Converter
- chapter 8 Parameters
- chapter 9 Application Examples
- chapter 10 Troubleshooting

#### Terminology:

In this manual several terms for Ethernet are used.

- **EtherCAT**, is the term used to describe the EtherCAT protocol.
- **Ethernet**, is a common term used to describe the physical layer of the network and does not relate to the application protocol.

### 2.1.2 Assumptions

These operating instructions are under the conditions that the Danfoss EtherCAT option is used with a Danfoss FC 301/FC 302 frequency converter. The installed controller must support the interfaces described in this document. Strictly observe all the requirements stipulated in the controller and the frequency converter, along with all limitations herein.

### 2.1.3 Hardware

This manual relates to the EtherCAT option MCA 124, type no. 130B5546 (uncoated) and 130B5646 (conformal coated).

### 2.1.4 Background Knowledge

The Danfoss EtherCAT Option Card is designed to communicate with any system complying with the EtherCAT standard. Familiarity with this technology is assumed. Issues regarding hardware or software produced by other manufacturers, including commissioning tools, are

beyond the scope of this manual, and not the responsibility of Danfoss.

For information regarding commissioning tools, or communication to a non-Danfoss node, consult the appropriate manuals.

### 2.1.5 Available Literature

#### Available Literature for FC 301/FC 302

- The *VLT AutomationDrive Operating Instructions*, provide the necessary information for getting the frequency converter up and running.
- The *VLT AutomationDrive Design Guide*, entails all technical information about the frequency converter design and applications including encoder, resolver, and relay options.
- The *VLT AutomationDrive Profibus Operating Instructions*, provide the information required for controlling, monitoring, and programming the frequency converter via a Profibus fieldbus.
- The *VLT AutomationDrive DeviceNet Operating Instructions*, provide the information required for controlling, monitoring, and programming the frequency converter via a DeviceNet fieldbus.
- The *VLT AutomationDrive MCT 10 Set-up Software Operating Instructions*, provide information for installation and use of the software on a PC.
- The *VLT AutomationDrive IP21/Type 1 Instruction*, provides information for installing the IP21/Type 1 option.
- The *VLT AutomationDrive 24 V DC Backup Instruction*, provides information for installing the 24 V DC Backup option.
- The *VLT AutomationDrive CanOpen Operating Instructions*.
- The *VLT AutomationDrive Modbus TCP Operating Instructions*.
- The *MCA 121/FCD 302 EtherNet/IP Operating Instructions*.
- The *MCA 120 PROFINET Operation Instruction*.

Danfoss technical literature is also available online at <http://www.danfoss.com/BusinessAreas/DrivesSolutions/>

Abbreviation	Definition
API	Actual Packet Interval
CC	Control Card
CTW	Control Word
DCP	Discovery and Configuration Protocol
DHCP	Dynamic Host Configuration Protocol
EMC	Electromagnetic Compatibility
I/O	Input/Output
IP	Internet Protocol
LCP	Local Control Panel
LED	Light Emitting Diode
LSB	Least Significant Bit
MAV	Main Actual Value (actual output)
MSB	Most Significant Bit
MRV	Main Reference Value
N/A	Not applicable
PC	Personal Computer
PCD	Process Control Data
PLC	Programmable Logic Controller
PNU	Parameter Number
REF	Reference (=MRV)
STW	Status Word

Table 2.1 Abbreviations



## 3 How to Install

### 3.1.1 How to Install Option in Frequency Converter

Items required for installing a fieldbus option in the frequency converter:

- The fieldbus option
- Fieldbus option adaptor frame for the FC 300. This frame is deeper than the standard frame to allow space for the fieldbus option beneath
- Strain relief (only for A1 and A2 enclosures)

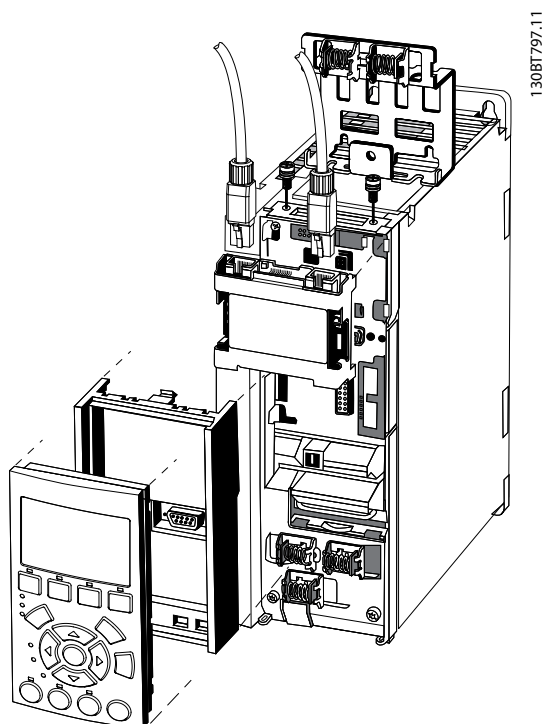


Illustration 3.1

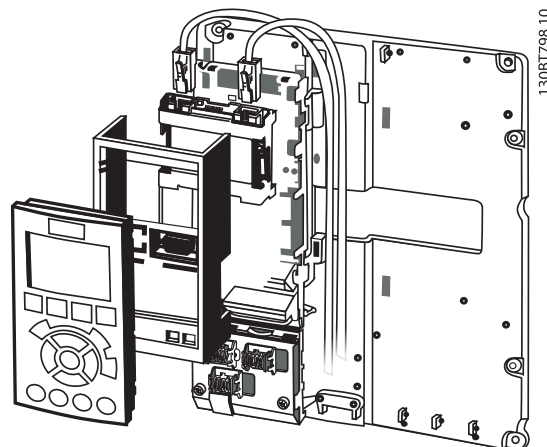


Illustration 3.2

#### Instructions:

1. Remove LCP panel from the FC 300.
2. Remove the frame located beneath and discard it.
3. Push the option into place. The Ethernet connectors must be facing upwards.
4. Remove both knock-outs on the fieldbus option adaptor frame.
5. Push the fieldbus option adaptor frame for the FC 300 into place.
6. Replace the LCP and attach cable.

#### NOTICE

Do not strip and ground the Ethernet cable via the strain relief-plate! The grounding of screened Ethernet cable is done through the RJ-45 connector on the option.

#### NOTICE

After installing the MCA 124 EtherCAT option, set *parameter 8-01 Control Site* and *parameter 8-02 Control Word Source* as follows:  
*parameter 8-01 Control Site: [2] Control word only or [0] Digital and ctrl. word*  
*parameter 8-02 Control Word Source: [3] Option A*

### 3.1.2 Network

It is important that the media selected for Ethernet data transmission meets the required properties. Usually CAT 5e and six cables are recommended for industrial applications. Both types are available as unscreened twisted pair and screened twisted pair. Generally, screened cables are recommended for use in industrial environments and with frequency converters.

A maximum cable-length of 100 m is allowed between network devices.

### 3.1.3 EtherCAT Cables

Cable Type	Specification
Ethernet standard	Standard Ethernet (in accordance with IEEE 802.3), 100Base-TX (FastEthernet)
Cable Type	S/FTP (Screened Foiled Twisted Pair, ISO(IEC 11801 or EN 50173), CAT 5e
Damping	23.2 dB (at 100 MHz and 100 m each)
Crosstalk damping	24 dB (at 100 MHz and 100 m each)
Return loss	10 dB (100 m each)
Surge impedance	100 Ω

Table 3.1 Specification of EtherCAT Cables

### 3.1.4 LED Behaviour

The option has 3 bicolored LEDs that allow a fast and detailed diagnosis. The three LEDs are each linked to its unique part of the EtherCAT option:

LED Label	Description
Status	Module Status, reflects the activity on the EtherCAT slave
Link/Act In	Link/status In, reflects the activity on the IN port
Link/Act Out	Link/status In, reflects the activity on the OUT port

Table 3.2

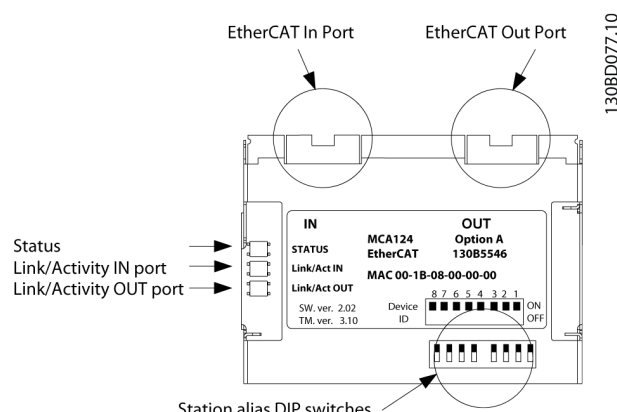


Illustration 3.3 Overview of the Option

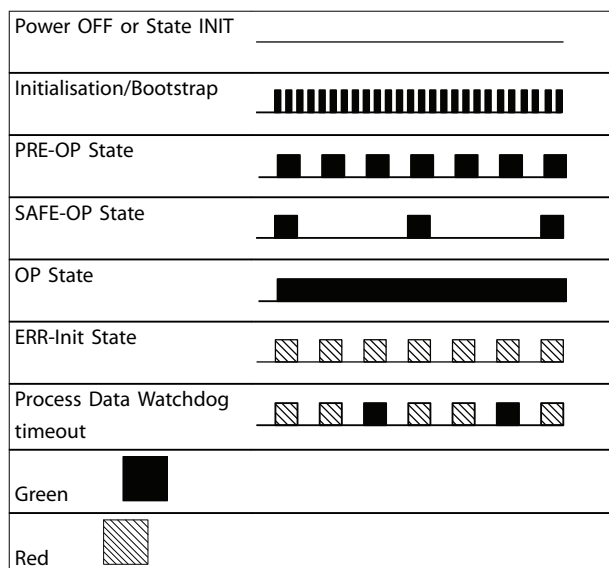


Table 3.3 Indication of Status LED

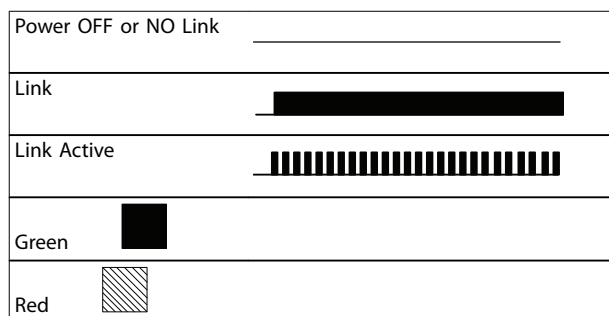


Table 3.4 Link/Act LED

### 3.1.5 Topology

The EtherCAT module features a built-in EtherCAT slave controller, thus having two Ethernet RJ-45 connectors. This module enables the possibility for connecting several EtherCAT options in a line topology.

It is important in a EtherCAT system, that the connection is done correctly. EtherCAT options has to be connected so that a OUT port always connects to a IN port on the next slave in the network. If this is not fulfilled the EtherCAT will go into error mode.

### NOTICE

Do not connect any non-EtherCAT device to the last port as this causes malfunction of the complete EtherCAT network.

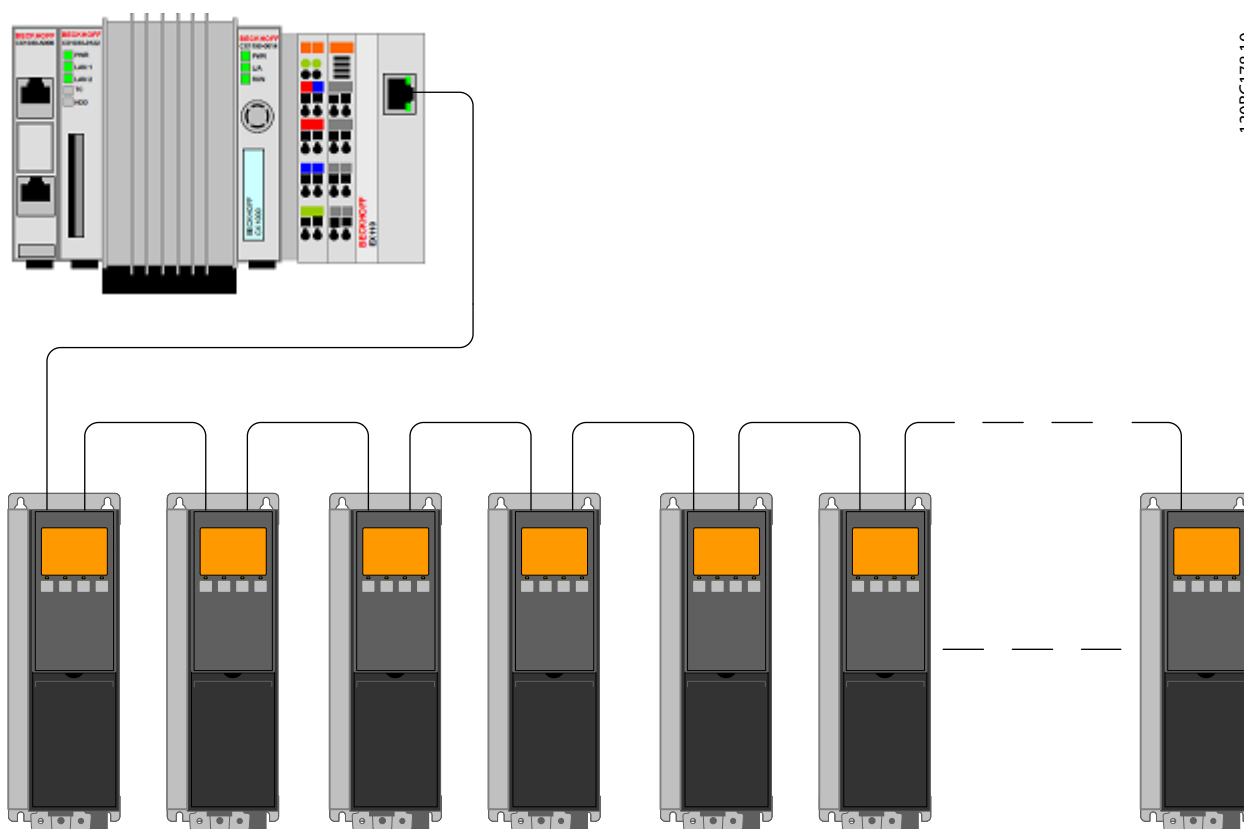


Illustration 3.4 Line Topology

### NOTICE

In a line topology all frequency converters must be powered, either by mains or by their 24 V DC option cards, for the built-in EtherCAT slave controller to work. Mounting frequency converters of different power-sizes in a line topology can result in unwanted power-off behavior, while using control word timeout (*parameter 8-02 Control Word Source* to *parameter 8-06 Reset Control Word Timeout*). Mount the frequency converters with the longest discharge time first in the line topology.

### NOTICE

Always observe relevant national and local regulations, for example regarding protective earth connection.

The Ethernet communication cable must be kept away from motor and brake resistor cables to avoid coupling of high frequency noise between the cables. When crossing is unavoidable, the Ethernet cable must cross motor and brake resistor cables at an angle of 90°.

## 3.1.6 EMC Precautions

To achieve interference-free operation of the Ethernet, observe the following EMC precautions. Additional EMC information is available in the *VLT AutomationDrive Design Guide*.

### NOTICE

The correct handling of the shield of the motor cable is vital for the overall performance of the system. If the rules are not followed it can lead to loss of the control and malfunction of the system.

3

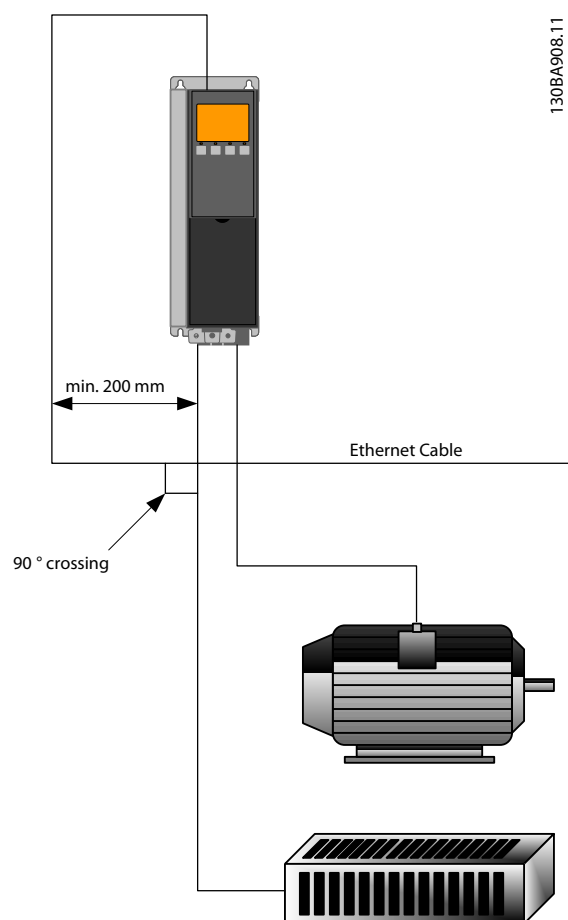


Illustration 3.5 Correct Crossing of Ethernet Cable

## 4 How to Configure

### 4.1.1 IP Settings

All IP-related parameters are located in parameter group 12-0\* *IP Settings*: The parameters are all set to EtherCAT standard values, so no setting is needed.

The EtherCAT option offers several ways of IP address assignment.

Parameter group 12-1\* *Ethernet Link Parameters*:

- *Parameter 12-10 Link Status*
- *Parameter 12-11 Link Duration*
- *Parameter 12-12 Auto Negotiation*
- *Parameter 12-13 Link Speed*
- *Parameter 12-14 Link Duplex*

Each port has unique Ethernet Link Parameters.

*Parameter 12-10 Link Status* and *parameter 12-11 Link Duration* displays information on the link status, per port. *Parameter 12-10 Link Status* displays Link or No Link according to the status of the present port. *Parameter 12-11 Link Duration* displays the duration of the link on the present port. If the link is lost, the counter is reset.

*Parameter 12-12 Auto Negotiation* is a feature that enables 2 connected Ethernet devices to select common transmission parameters, such as speed and duplex mode. In this process, the connected devices first share their capabilities and then select the fastest transmission mode they both support.

Incapability between the connected devices could lead to decreased communication performance.

To prevent this, Auto Negotiation can be disabled.

If *parameter 12-12 Auto Negotiation* is set to OFF, link speed and duplex mode can be configured manually in *parameter 12-13 Link Speed* and *parameter 12-12 Auto Negotiation*.

*Parameter 12-13 Link Speed* - displays/sets the link speed for each port. If no link is present, "None" is displayed.

*Parameter 12-14 Link Duplex* - displays/sets the duplex mode for each port.

### 4.2 Configure the Frequency Converter

#### 4.2.1 VLT Parameters

Pay particular attention to the following parameters when configuring the frequency converter with an EtherCAT interface.

- *Parameter 0-40 [Hand on] Key on LCP*. If the [Hand on] key on the frequency converter is activated, control of the frequency converter via the EtherCAT interface is disabled.
- After an initial power up, the frequency converter automatically detects whether a fieldbus option is installed in slot A, and set *parameter 8-02 Control Word Source* to [Option A]. Adding, changing, or removing an option from an already commissioned frequency converter, does not change *parameter 8-02 Control Word Source*. However, it causes a Trip Mode, and the frequency converter displays an error.
- *Parameter 8-10 Control Word Profile*. Choose between the Danfoss FC Profile and the DS 402 profile.
- *Parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*. Selection of how to gate EtherCAT control commands with digital input command of the control card.

#### NOTICE

**When *parameter 8-01 Control Site* is set to [2] Control word only, the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select* are overruled, and all act on Bus-control.**

- *Parameter 8-03 Control Word Timeout Time* to *parameter 8-05 End-of-Timeout Function*. The reaction in the event of a bus time-out is set via these parameters.

### 4.3 Configure the EtherCAT Network

All EtherCAT stations that are connected to the same bus network must have a unique station alias number. The station alias of the frequency converter can be selected via:

- Hardware switches
- *parameter 12-50 Configured Station Alias*
- The TwinCAT under the EtherCAT⇒advance setting⇒ESC⇒E2PROM⇒Configured station alias setting

If parameter 12-50 Configured Station Alias, can only be set if all address switches are set to ON or OFF.

### 4.3.1.1 Setting the EtherCAT Station Alias using the Hardware Switches

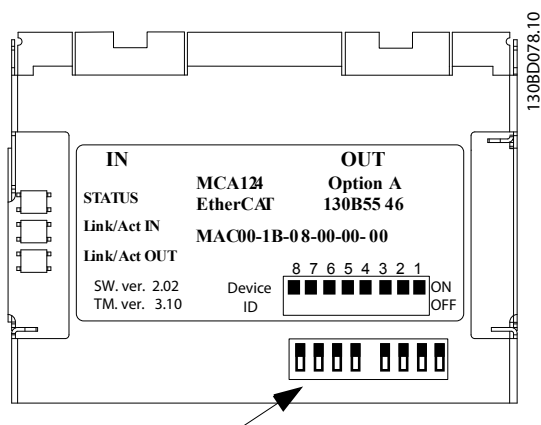
Using the hardware switches it is possible to select an address range from 1 to 254 according to *Table 4.1*:

Switch	8	7	6	5	4	3	2	1
Address value	+128	+64	+32	16	+8	+4	+2	+1
Address 5	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
Address 35	OFF	OFF	ON	OFF	OFF	OFF	ON	ON
Address 82	OFF	ON	OFF	ON	OFF	OFF	ON	OFF
Address 147	ON	OFF	OFF	ON	OFF	OFF	ON	ON

Table 4.1 Address Range

#### NOTICE

Switch off the power supply before changing the hardware switches. The address change will come into effect at the next power-up, and can be read in parameter 12-50 Configured Station Alias. Note the location and sequence of the hardware switches as illustrated in *Illustration 4.1*.



Station alias DIP switches

Illustration 4.1

## 5 Configure the Master

### 5.1 Import

#### 5.1.1 Importing the XML File

To configure an EtherCAT Master, the configuration tool needs an XML file for each type of slave on the network. The XML file is a text file containing the necessary communications set-up data for a slave. Download the XML file for the FC 300 at <http://www.danfoss.com/BusinessAreas/DrivesSolutions/EtherCAT/EtherCAT+files.htm>.

Option version	File
1.x, 2.x and 3.x	Danfoss_FC_series_ECAT_019.XML

Table 5.1

The steps outlined in *chapter 5.2.1 Setting up the Master* shows how to add a new device to the TwinCAT Tool. For tools from other vendors, consult their relevant manuals.

Copy the XML file from the Danfoss Web page to the location: *C:\TwinCAT\Io\EtherCAT*, and restart the TwinCAT System Manager. This will update the Device Description library of TwinCAT. If an older version of the XML file is installed, this has to be erased. If the older versions are not erased it can lead to wrong identification of the Drive on the EtherCAT network. The XML file contains three entries, FC 300, FC 301 and FC 302. The FC 300 is the the entry for older EtherCAT drive version 1.02, Where the EtherCAT version 2.xx are handled via the entries FC 301 and FC 302.

### 5.2 Setting Up

#### 5.2.1 Setting up the Master

##### Inserting the Danfoss EtherCAT slave to the TwinCAT Master

1. Right click and select EtherCAT I/O master.
2. Select *Append Box...*

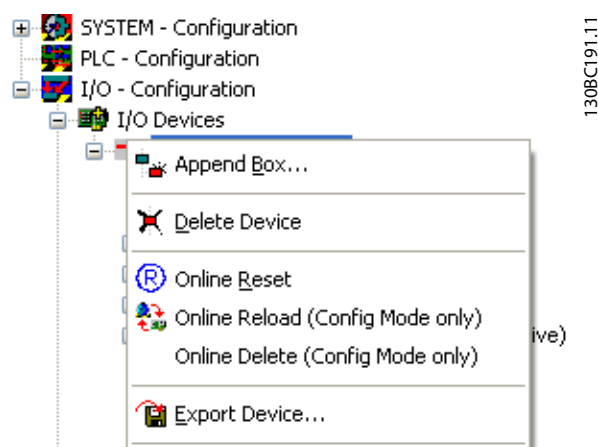


Illustration 5.1

3. Select *Danfoss Power Electronics* in the I/O Catalogue of the *Insert EtherCAT Device* window.
4. Select *VLT FC Series*.
5. Select *FC-300 VLT AutomationDrive*.

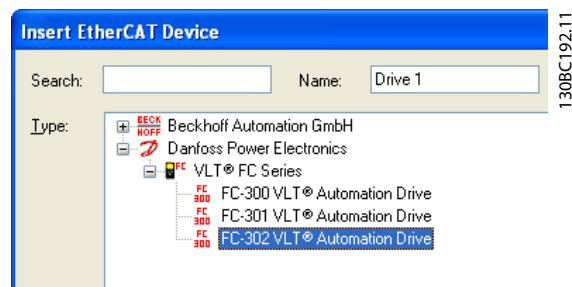


Illustration 5.2

*Danfoss FC-300* is inserted into the EtherCAT master system.

5

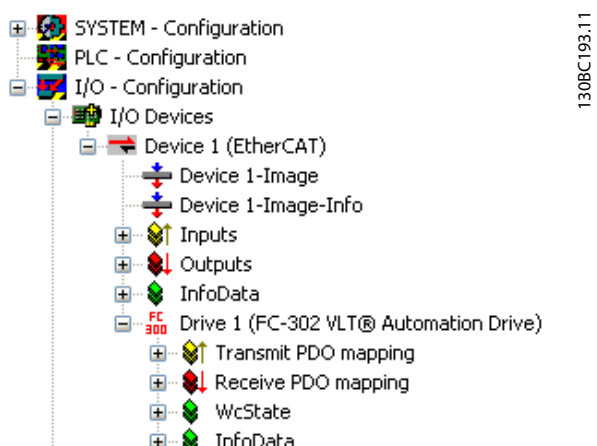


Illustration 5.3

To function properly, each of the four process data must be linked to variables inside the PLC. In this example, two transmit variables and two receive variables have been inserted in the PLC memory. To see a list of matching data

1. Select the variable.
2. Click the *Linked to...* button in the right window.

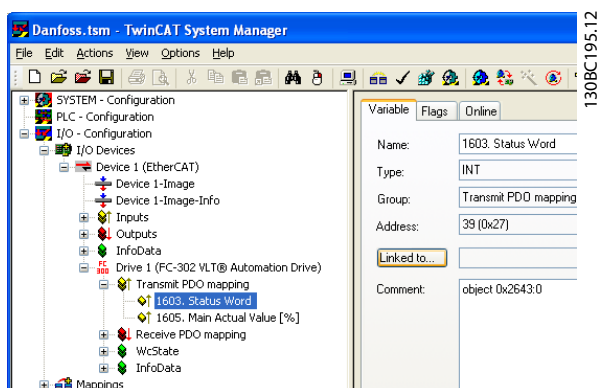


Illustration 5.4

In the following example, the status word is linked to the variable STW.

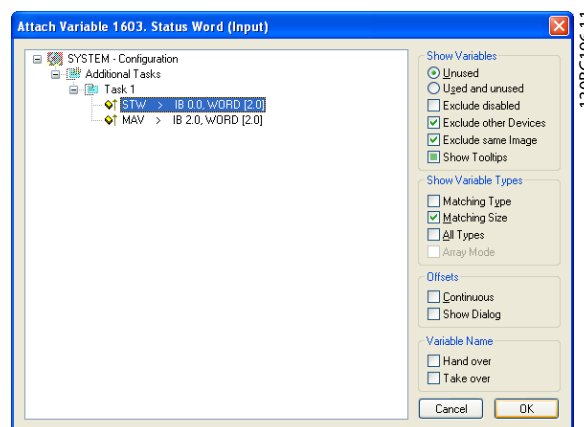


Illustration 5.5

The status word is now linked to the variable STW in the PLC. Remaining variables must be mapped equally to the variables in the PLC.

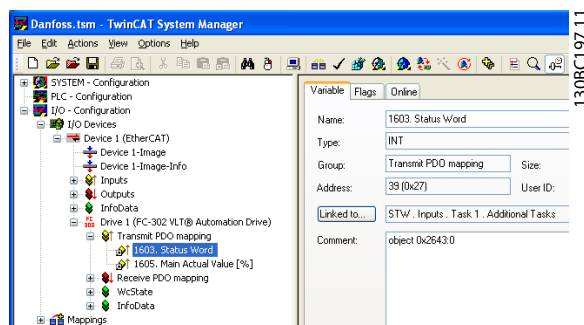


Illustration 5.6

After a successfully integrating the frequency converter to the TwinCAT system, the frequency converter is now ready for operation.



## 6 How to Control the Frequency Converter

### 6.1 PDO Communication

The DS402 profile for frequency converters specifies a number of communication objects (SDOs). SDOs are suitable for data exchange between a process controller, for example a PLC, and frequency converters. Some SDOs are defined for cyclic data transfer, so that process data (PCD) can be transferred from the controller to the slave and vice versa. PDOs are used for cyclic data, a subset of the SDOs are PDO mappable.

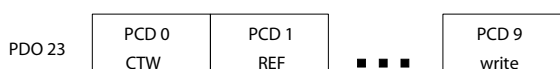
PDO 23 is pure process data objects for applications requiring no cyclic parameter access. The PLC sends out process control data, and the frequency converter then responds with a transmit PDO containing process status data. In the Danfoss EtherCAT interface all PDOs are free selectable. The first two words of the process data area (PCD 0 and PCD1) are set to a default value at factory, but can be changed.

Select the signals for transmission from the master to the frequency converter in *parameter 12-21 Process Data Config Write* (request from master to the frequency converter). Select the signals for transmission from the frequency converter to the master in *parameter* (response: FC ⇒ master).

The EtherCAT option has only one PDO available - PDO 23. The PDO 23 is flexible in size, so that it can be adjusted to fit all needs (max. 10 PCDs). The selection is made in the master configuration, and is then automatically downloaded to the frequency converter during the transition from Init to Pre-Op. No manual setting of PPO types in the frequency converter is required.

Selection [1] *Standard telegram 1* is equivalent to PDO 23.

Receive PDOs (PLC → Drive)



Transmit PDOs (Drive → PLC)

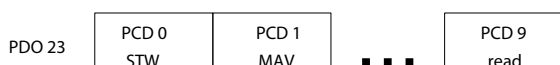


Illustration 6.1

### 6.2 Process Data

Use the process data part of the PDO for controlling and monitoring the frequency converter via the EtherCAT.

#### 6.2.1 Process Control Data

The example in *Table 6.1* shows control and reference sent from the PLC to the frequency converter, and status word and Main Actual Value sent from the frequency converter to the PLC.

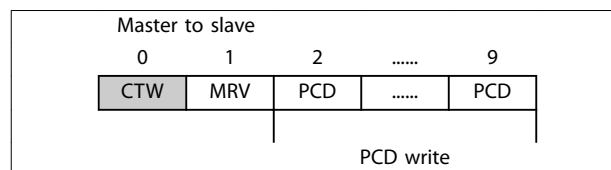


Table 6.1 Process Control Data (PCD)

PCD 0 contains a 16-bit control word where each bit controls a specific function of the frequency converter, see *chapter 6.3 Control Profile*. PCD 1 contains a 16-bit speed setpoint in percentage format. See *chapter 6.2.3 Reference Handling*.

The content of PCD 2 to PCD 9 is read only.

#### 6.2.2 Process Status Data

Process data sent from the frequency converter contain information about the current state of the frequency converter.

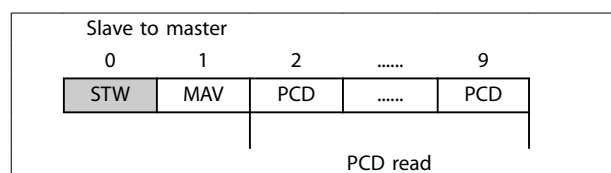


Table 6.2 Process Status Data

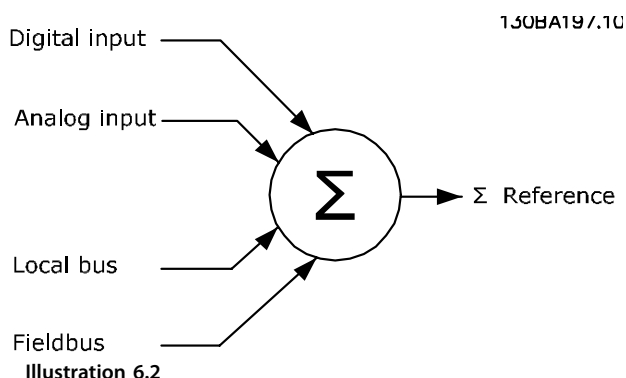
PCD 0 contains a 16-bit status word where each bit contains information regarding a possible state of the frequency converter.

PCD 1 contains per default the value of the current speed of the frequency converter in percentage format (see *chapter 6.2.3 Reference Handling*).

#### 6.2.3 Reference Handling

The reference handling in FC 301/FC 302 is an advanced mechanism that sums up references from different sources.

For more information on reference handling, refer to the *FC 301/FC 302 Design Guide*.



MRV/MAV	Integer in hex	Integer in decimal
100%	4000	16.384
75%	3000	12.288
50%	2000	8.192
25%	1000	4.096
0%	0	0
-25%	F000	-4.096
-50%	E000	-8.192
-75%	D000	-12.288
-100%	C000	-16.384

Table 6.3 Reference and MAV Formats

### NOTICE

Negative numbers are formed as a complement of two.

### NOTICE

The data type for MRV and MAV is 16-bit standardised value, which can express a range from -200% to +200% (8001 to 7FFF).

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The reference, or speed set point (MRV, sent via EtherCAT), is always transmitted to the frequency converter in percentage format as integers represented in hexadecimal (0-4000 hex).

Depending on the setting of *parameter 3-00 Reference Range* the reference and MAV are scaled accordingly:

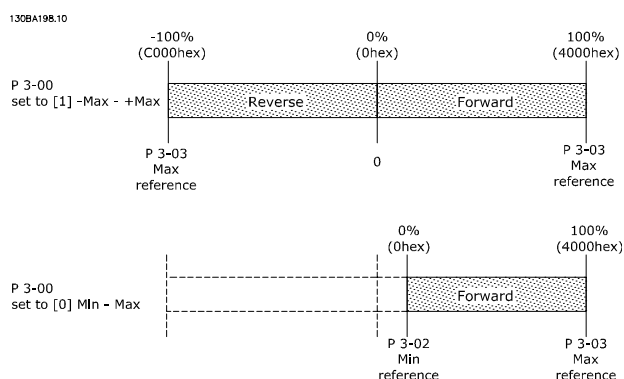


Illustration 6.3

### NOTICE

If *parameter 3-00 Reference Range* is set to [0] Min - Max, a negative reference is handled as 0%.

The speed limit parameters in *parameter 4-11 Motor Speed Low Limit [RPM]* to *parameter 4-14 Motor Speed High Limit [Hz]* limits the actual frequency converter output. *parameter 4-19 Max Output Frequency* sets the final speed limit.

The reference and the MAV have the format which appears from *Table 6.3*.

MRV/MAV		Actual Speed
0%	0 hex	100 RPM
25%	1000 hex	825 RPM
50%	2000 hex	1550 RPM
75%	3000 hex	2275 RPM
100%	4000 hex	3000 RPM

Table 6.4

## 6.2.4 Process Control Operation

In process control operation *parameter 1-00 Configuration Mode* is set to [3] Process.

The reference range in *parameter 3-00 Reference Range* is always [0] Min-Max.

- MRV represents the process setpoint.
- MAV expresses the actual process feedback (range  $\pm 200\%$ ).

## 6.2.5 Influence of the Digital Input Terminals upon FC Control Mode

The influence of the digital input terminals upon control of the frequency converter can be programmed in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

## NOTICE

Note the *parameter 8-01 Control Site* overrules the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*, and *Terminal 37 Coasting Stop (safe)* overrules any parameter.

Each digital input signal can be programmed to logic AND, logic OR, or to have no relation to the corresponding bit in the control word. This way, fieldbus only, fieldbus AND Digital Input, or Ether Fieldbus OR Digital input terminal can initiate a specific control command, that is stop/coast.

## CAUTION

To control the frequency converter via EtherCAT, set *parameter 8-50 Coasting Select* to either [1] *Bus*, or to [2] *Logic AND*. Then set *parameter 8-01 Control Site* to [0] *Digital and ctrl.word* or [2] *control word only*.

More detailed information and examples of logical relationship options are provided in *chapter 10 Troubleshooting*.

## 6.3 Control Profile

The frequency converter can be controlled according to the DS 402 profile, or the Danfoss FC profile. Select the desired control profile in *parameter 8-10 Control Word Profile*. The choice of profile affects the control and status word only.

The desired control profile can also be controlled by object 6060 Modes of operation and readout by object 6061 Modes of operation display. Value -1 indicates frequency converter profile. Value 2 indicates DS 402 Velocity mode. The XDD file has default process data mapping. If frequency converter is run in DS 402 profile, the DS 402 profile must be selected (for example, by *parameter 8-10 Control Word Profile* or object 6060). The four process data Control Word, Reference, Status Word and Main Actual Value will the information in according the specification. Make sure that the profile selected is also the profile used in the PLC.

## 6.4 DS 402 Control Profile

### 6.4.1 Control Word According to DSP 402 Profile (Parameter 8-10=DSP 402 profile)

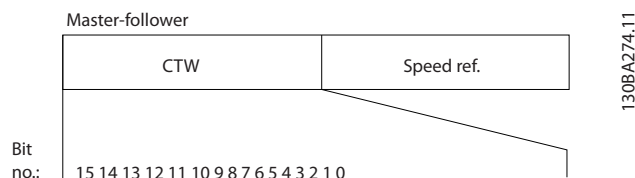


Illustration 6.4 Control Word Profile

Bit	Bit value=0	Bit value=1
00	Switch off	Switch on
01	Disable voltage	Enable voltage
02	Quick stop	Run
03	Disable operation	Enable operation
04	Disable ramp	Enable ramp
05	Freeze	Run enable
06	Ramp stop	Start
07	No function	Reset
08	Reserved	
09	Reserved	
10	Reserved	
11	Jog 1 OFF	Jog 1 ON
12	Reserved	
13	Setup select (LSB)	
14	Setup select (MSB)	
15	Forward	Reversing

Table 6.5 Definition of Control Bits

### Explanation of the control bits

Bit 00, Switch OFF/ON

Bits 00, Switch OFF/ON

Bit 00="0" - executes transition 2, 6 or 8.

Bit 00="1" - executes transition 3.

Bit 01, Disable/Enable Voltage

Bit 01="0" - executes transition 9, 10 or 12.

Bit 01="1" - enables voltage.

Bit 02, Quick stop/Run

Bit 02="0" - executes transition 7, 10 or 11.

Bit 02="1" - quick stop not active.

Bit 03, Disable/enable Operation

Bit 03="0" - executes transition 5.

Bit 03="1" - enables operation.

Bit 04, Quick-stop/ramp

Bit 04="0" - executes transition 7 or 11, Quick stop.

Bit 04="1" - enables ramp.

#### Bit 05, Freeze output frequency/run enable

Bit 05="0" - the given output frequency is maintained even if the reference is changed.

Bit 05="1" - the frequency converter is again able to regulate, and the given reference is followed.

#### Bit 06, Ramp stop/start

Bit 06="0" - the frequency converter controls the motor down to stop.

Bit 01="1" - gives a start command to the frequency converter.

#### Bit 07, No function/reset

Reset of trip.

Bit 07="0" - there is no reset.

Bit 07="1" - a trip is reset.

#### Bit 08, 09 and 10

DSP402 reserved.

#### Bit 11, Jog 1 OFF/ON

Activation of pre-programmed speed in *parameter 8-90 Bus Jog 1 Speed*

JOG 1 is only possible if Bit 04="0", and bit 00-03="1".

#### Bit 12

Danfoss reserved.

#### Bits 13/14, Selection of Setup

Bits 13 and 14 are used for selecting among the four menu set-ups in accordance with *Table 6.6*:

Set-up	Bit 14	Bit 13
0	0	1
0	1	2
1	0	3
1	1	4

Table 6.6 Set-up Selection Table

#### Bit 15, Forward/reversing

Bit 15="0" - no reversing.

Bit 15="1" - reversing.

### NOTICE

In factory setting reversing is set to [digital] in *parameter 8-54 Reversing Select*.

## 6.4.2 Status Word According to DS 402 Profile

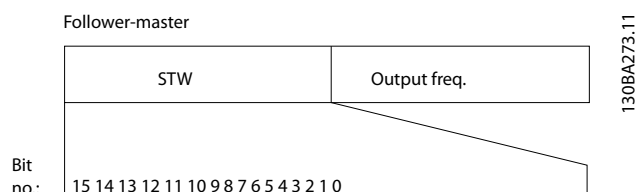


Illustration 6.5

Bit	Bit value=0	Bit value=1
00	Not ready to switch ON	Ready to switch ON
01	Switched OFF	Switched ON
02	Operation disabled	Operation enabled
03	No malfunction	Malfunction
04	Voltage disabled	Voltage enabled
05	Quick stop	Run
06	Switch on disable	Switch on enable
07	No warning	Warning
08	Reserved	
09	Remote disabled	Remote enabled
10	Set point not reached	Set point reached
11	Speed limit not active	Speed limit active
12	Reserved	
13	Reserved	
14	Not running	Running
15	Reserved	

Table 6.7

### Explanation of the status bits

#### Bit 00, Not ready to switch on/Ready to switch on

Bit 00="0" - state less than "Ready to switch on".

Bit 00="1" - state at least = "Ready to Switch on".

#### Bit 01, Switch off/Switch on

Bit 00="0" - state less than "Switched on".

Bit 00="1" - state at least = "Switched on".

#### Bit 02, Operation disable/Operation enable

Bit 00="0" - state less than "Operation enable".

Bit 00="1" - state at least = "Operation enable".

#### Bit 03, No fault/trip

Bit 03="0" - the frequency converter is not in a fault condition.

Bit 03="1" - the frequency converter has tripped and needs a reset signal to run.

#### Bit 04, Voltage disable/Voltage enable

Bit 04="0" - control word bit 01="1".

Bit 04="1" - control word bit 01="0".

Bit 05, Quick stop/Run

Bit 05="0" - control word bit 02="1".

Bit 05="1" - control word bit 02="0".

Bit 06, Start enable/Start disable

Bit 06="0" - state is not "Switch on disable".

Bit 06="1" - state = "Switch on enable".

Bit 07, No warning/Warning

Bit 07="0" - no warning situation.

Bit 07="1" - a warning has occurred.

Bit 08, Danfoss reserved:

Bit 09, Remote disable/Remote enable

Bit 09="0" - the frequency converter has been stopped with the stop key on the LCP, or [Local] has been selected in *parameter 3-13 Reference Site*.

Bit 09="1" - it is possible to control the frequency converter via the serial port.

Bit 10, Set point not reached/Set point reached

Bit 10="0" - the actual motor speed is different from the speed reference set. This situation can occur while the speed is ramped up/down during start/stop.

Bit 10="1" - the present motor speed equals the speed reference set.

Bit 11, Speed limit not active/speed limit active

Bit 11="0" - the output frequency is out of the range set in parameters 4-11/4-12 *Motor Speed low Limit RPM/Hz* or parameters 4-13/4-14 *Motor Speed high Limit RPM/Hz*.

Bit 11="1" - the output frequency is within the mentioned range.

Bit 12, DSP 402 reserved

Bit 13, DSP 402 reserved

Bit 14, Running/Not running

Bit 14="0" - the motor is not running.

Bit 14="1" - the frequency converter has a valid start signal or that the output frequency is greater than 0 Hz.

Bit 15, Danfoss reserved.

**8-10 Control Profile**

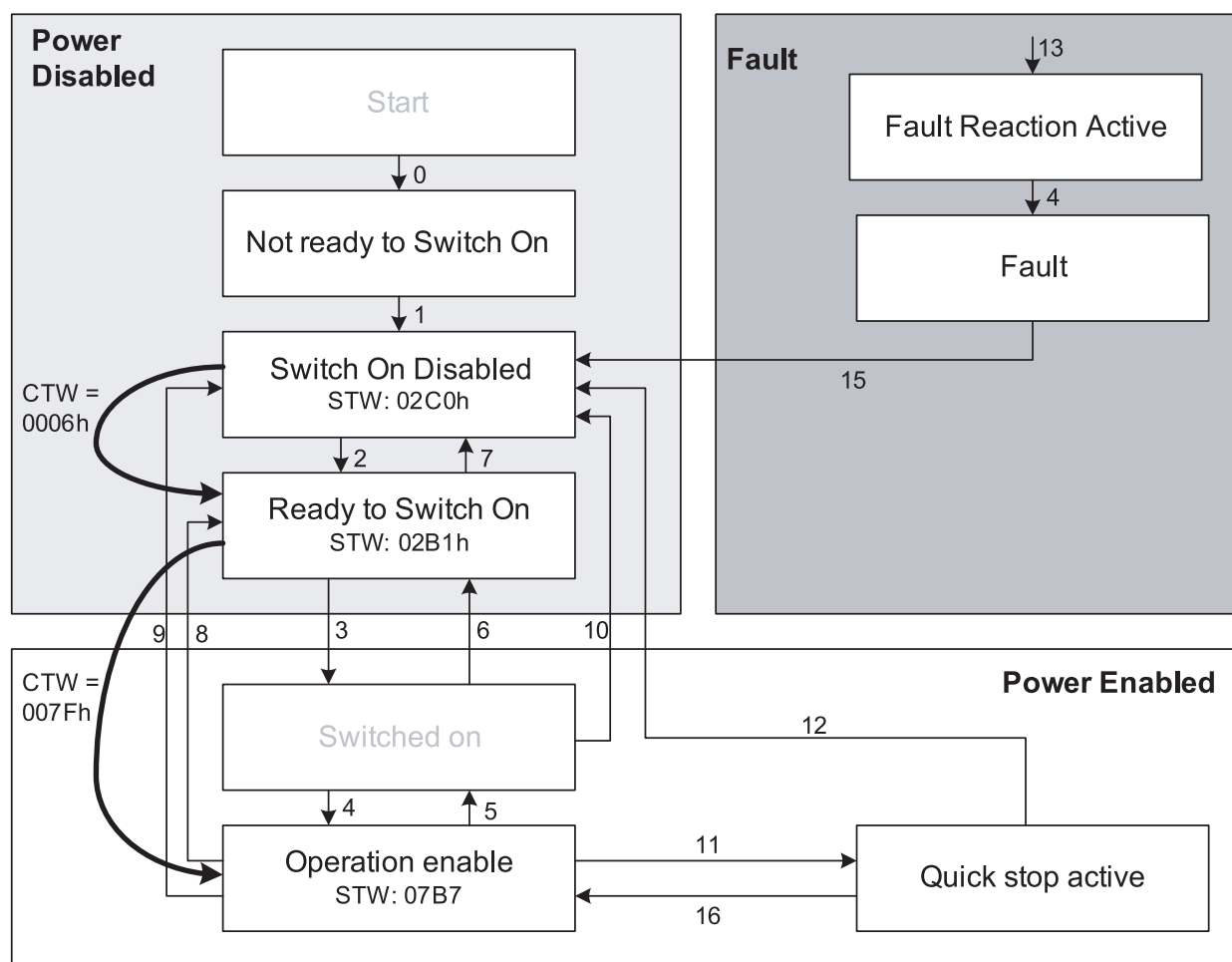
**Option:**

**Function:**

[0] *	FC profile	
[7]	CANOpen DSP 402	

*FC Profile* is the default control profile for the frequency converter, whereas *CANOpen DSP 402* is the CiA standardized control profile, featuring the special DSP 402 transition state machine.

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Illustration 6.6 DSP 402 State Machine

### 6.4.3 DSP 402 State Transitions

Transition	State	Control word	Status word	Action
-	Start condition	0000	0000	-
0	Start-up⇒Not ready to switch on	0000	0200	-
1	Switch On Disabled⇒Switch On Disabled	0000, 0001	0240	-
2	Not Ready to Switch On⇒Switched On	0006	0231	-
3	Ready to Switch On⇒Switched On	0007	0233	-
4	Switched On⇒Ready to Switch On	000F	0237	-
5	Operation Enabled⇒Switched On	0007	0233	Motor ramps to 0 RPM with programmed ramp down parameter.
6	Switched On⇒Ready to Switch On	0006	0231	-
7	Ready to Switch On⇒Switch On Disable	0001, 0000	0240	-
8	Operation Enable⇒Ready to Switch On	0006	0231	If the motor is not braked, and the power section is switched off immediately, the motor is free to rotate.
9	Operation Enable⇒Switch On Disable	0001, 0000	0240	If the motor is not braked, and the power section is switched off immediately, the motor is free to rotate.
10	Switched On⇒Switched On Disable	0001, 0000	0240	If the motor is not braked, and the power section is switched off immediately, the motor is free to rotate.
11	Operation Enabled⇒Quick Stop Active	0002	0207	Motor ramps to 0 RPM with programmed quick ramp parameter.
11	Operation Enabled⇒Quick Stop Active	0003	0217	Motor ramps to 0 RPM with programmed quick ramp parameter.
12	Quick Stop Active⇒Switch On Disabled	0001, 0000	0240	If the motor is not braked, and the power section is switched off immediately, the motor is free to rotate.
13	All states⇒Fault Reaction Active	xxxx	023F	-
14	Fault Reaction Active⇒Fault	xxxx	023F	-
15	Fault⇒Switch On Disabled	0000	0240	-
16	Quick Stop Active⇒Operation Enable (not supported)	-	-	-

Table 6.8 DSP 402 State Transitions

## 6.5 Danfoss FC Control Profile

### 6.5.1 Control Word according to FC Profile (CTW)

To select Danfoss FC protocol in the control word, *parameter 8-10 Control Word Profile* must be set to [0] *frequency converter profile*. The control word is used to send commands from a master (PLC or PC) to a slave (frequency converter).

Bit	Bit value=0	Bit value=1
00	Reference value	external selection lsb
01	Reference value	external selection msb
02	DC brake	Ramp
03	Coasting	No coasting
04	Quick stop	Ramp
05	Hold output frequency	Use ramp
06	Ramp stop	Start
07	No function	Reset
08	No function	Jog
09	Ramp 1	Ramp 2
10	Data invalid	Data valid
11	No function	Relay 01 active
12	No function	Relay 04 active
13	Parameter set-up	selection lsb
14	Parameter set-up	selection msb
15	No function	Reverse

Table 6.9 Bit Values for FC Control Word

## Explanation of the control bits

### Bits 00/01 Reference value

Bits 00 and 01 are used to choose between the four reference values, which are pre-programmed in *parameter 3-10 Preset Reference* according to *Table 6.10*.

## NOTICE

In *parameter 8-56 Preset Reference Select* a selection is made to define how Bit 00/01 gates with the corresponding function on the digital inputs.

Bit 01	Bit 00	Programmed ref. value	Parameter
0	0	1	[0] <i>Parameter 3-10 Preset Reference</i>
0	1	2	[1] <i>Parameter 3-10 Preset Reference</i>
1	0	3	[2] <i>Parameter 3-10 Preset Reference</i>
1	1	4	[3] <i>Parameter 3-10 Preset Reference</i>

Table 6.10 Programmed Reference Values for Bits

### Bit 02, DC brake

Bit 02="0" - leads to DC braking and stop. Braking current and duration are set in *parameter 2-01 DC Brake Current* and *parameter 2-02 DC Braking Time*.

Bit 02="1" - leads to ramping.

### Bit 03, Coasting

Bit 03="0" - causes the frequency converter to immediately coast the motor to a standstill.

Bit 03="1" - enables the frequency converter to start the motor if the other starting conditions have been fulfilled.

## NOTICE

In *parameter 8-50 Coasting Select* a selection is made to define how Bit 03 gates with the corresponding function on a digital input.

### Bit 04, Quick stop

Bit 04="0" - causes a quick stop, ramping the motor speed down to stop via *parameter 3-81 Quick Stop Ramp Time*.

Bit 04="1" - the frequency converter ramps the motor speed down to stop via *parameter 3-81 Quick Stop Ramp Time*.

### Bit 05, Hold output frequency

Bit 05="0" - causes the present output frequency (in Hz) to freeze. The frozen output frequency can only be changed with the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*) programmed to *Speed up* and *Speed down*.

Bit 05="1" - use ramp.

## NOTICE

If *Freeze output* is active, stop the frequency converter with

- Bit 03 Coasting stop
- Bit 02 DC braking
- Digital input (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*) programmed to *DC braking*, *Coasting stop*, or *Reset and coasting stop*.

### Bit 06, Ramp stop/start

Bit 06="0" - causes a stop, in which the motor speed is ramped down to stop via the selected *ramp down* parameter.

Bit 06="1" - permits the frequency converter to start the motor, if the other starting conditions have been fulfilled.

## NOTICE

In *parameter 8-53 Start Select* a selection is made to define how Bit 06 Ramp stop/start gates with the corresponding function on a digital input.

### Bit 07, Reset

Bit 07="0" - does not cause a reset.

Bit 07="1" - causes the reset of a trip. Reset is activated on the signals leading edge, that is, when changing from logic "0" to logic "1".

### Bit 08, Jog

Bit 08="0" - no function.

Bit 08="1" - *parameter 3-19 Jog Speed [RPM]* determines the output frequency.

### Bit 09, Selection of ramp 1/2

Bit 09="0" - ramp 1 is active (*parameter 3-40 Ramp 1 Type* to *parameter 3-47 Ramp 1 S-ramp Ratio at Decel. Start*).

Bit 09="1" - ramp 2 (*parameter 3-50 Ramp 2 Type* to *parameter 3-57 Ramp 2 S-ramp Ratio at Decel. Start*) is active.

### Bit 10, Data not valid/Data valid

Is used to tell the frequency converter whether it should use or ignore the control word.

Bit 10="0" - the control word is ignored.

Bit 10="1" - the control word is used. This function is relevant, because the control word is always contained in the telegram, regardless of which type of telegram is used. Thus, it is possible to turn off the control word, if it is not wished to use it when updating or reading parameters.

### Bit 11, Relay 01

Bit 11="0" - relay 01 not activated.

Bit 11="1" - relay 01 activated, provided Control word bit 11 has been chosen in *parameter 5-40 Function Relay*.

### Bit 12, Relay 04

Bit 12="0" - relay 04 has not been activated.



Bit 12="1" - relay 04 has been activated, provided *Control word bit 12* has been chosen in *parameter 5-40 Function Relay*.

#### Bit 13/14, Selection of set-up

Bits 13 and 14 are used to choose from the four menu set-ups according to *Table 6.11*:

The function is only possible when [9] *Multi-Set-up* is selected in *parameter 0-10 Active Set-up*.

Set-up	Bit 14	Bit 13
1	0	0
2	0	1
3	1	0
4	1	1

Table 6.11 Selection of Set-up

### NOTICE

In *parameter 8-55 Set-up Select* a selection is made to define how Bit 13/14 gates with the corresponding function on the digital inputs.

#### Bit 15 Reverse

Bit 15="0" - no reversing.

Bit 15="1" - reversing.

## 6.5.2 Status Word according to FC Profile (STW)

The status word is used to inform the master (for example, a PC) of the operation mode of the slave (frequency converter).

Refer to for an example of a status word telegram using PPO type 3.

Bit	Bit=0	Bit=1
00	Control not ready	Control ready
01	Frequency converter not ready	Frequency converter ready
02	Coasting	Enable
03	No error	Trip
04	No error	Error (no trip)
05	Reserved	-
06	No error	Triplock
07	No warning	Warning
08	Speed reference	Speed=reference
09	Local operation	Bus control
10	Out of frequency limit	Frequency limit ok
11	No operation	In operation
12	Frequency converter OK	Stopped, autostart
13	Voltage OK	Voltage exceeded
14	Torque OK	Torque exceeded
15	Timer OK	Timer exceeded

Table 6.12 Definition of Status Bits

#### Explanation of the status bits

##### Bit 00, Control not ready/ready

Bit 00="0" - the frequency converter has tripped.

Bit 00="1" - the frequency converter controls are ready, but the power component is not necessarily receiving any power supply (in case of 24 V external supply to controls).

##### Bit 01, frequency converter ready

Bit 01="0" - the frequency converter is not ready for operation.

Bit 01="1" - the frequency converter is ready for operation, but there is an active coasting command via the digital inputs or via serial communication.

##### Bit 02, Coasting stop

Bit 02="0" - the frequency converter has released the motor.

Bit 02="1" - the frequency converter can start the motor when a start command is given.

##### Bit 03, No error/trip

Bit 03="0" - the frequency converter is not in fault mode.

Bit 03="1" - the frequency converter is tripped, and that a reset signal is required to re-establish operation.

##### Bit 04, No error/error (no trip)

Bit 04="0" - the frequency converter is not in fault mode.

Bit 04="1" - there is a frequency converter error but no trip.

##### Bit 05, Not used

Bit 05 is not used in the status word.

##### Bit 06, No error/triplock

Bit 06="0" - the frequency converter is not in fault mode.

Bit 06="1" - the frequency converter is tripped, and locked.

##### Bit 07, No warning/warning

Bit 07="0" - there are no warnings.

Bit 07="1" - a warning has occurred.

##### Bit 08, Speed reference/speed = reference

Bit 08="0" - the motor is running, but that the present speed is different from the preset speed reference. It could, for example, be the case while the speed is being ramped up/down during start/stop.

Bit 08="1" - the present motor present speed matches the preset speed reference.

##### Bit 09, Local operation/bus control

Bit 09="0" - [Stop/Reset] is activated on the control unit, or that *Local control* in *parameter 3-13 Reference Site* is selected. It is not possible to control the frequency converter via serial communication.

Bit 09="1" - it is possible to control the frequency converter via the fieldbus/serial communication.

##### Bit 10, Out of frequency limit

Bit 10="0" - the output frequency has reached the value in *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-13 Motor Speed High Limit [RPM]*.

Bit 10="1" - the output frequency is within the defined limits.

**Bit 11, No operation/in operation**

Bit 11="0" - the motor is not running.

Bit 11="1" - the frequency converter has a start signal or the output frequency is greater than 0 Hz.

**Bit 12, frequency converter OK/stopped, auto start**

Bit 12="0" - there is no temporary over temperature on the frequency converter.

Bit 12="1" - the frequency converter has stopped because of over temperature, but the unit has not tripped and resumes operation once the over temperature stops.

**Bit 13, Voltage OK/limit exceeded**

Bit 13="0" - there are no voltage warnings.

Bit 13="1" - the DC voltage in the frequency converters intermediate circuit is too low or too high.

**Bit 14, Torque OK/limit exceeded**

Bit 14="0" - the motor current is lower than the torque limit selected in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.

Bit 14="1" - the torque limits in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode* have been exceeded.

**Bit 15, Timer OK/limit exceeded**

Bit 15="0" - the timers for motor thermal protection and VLT thermal protection, respectively, have not exceeded 100%.

Bit 15="1" - one of the timers has exceeded 100%.

## 7 Communication Profile Area

This chapter describes the general layout of the supported POWERLINK communication area. The process data objects are defined in this area.

### 7.2 1000-1FFF Communication Object Area

#### 7.2.1 1000 - 1FFF Communication Object Overview

Index (hex)	Object (Symbolic Name)	Name	Type	Read/Write
1000	VAR	Device type	UNSIGNED32	ro
1001	VAR	Error register	UNSIGNED8	ro
1002	VAR	Manufacturer status register	UNSIGNED32	ro
1003	ARRAY	Pre-defined error field	UNSIGNED32	ro
1008	VAR	Manufacturer device name	VISIBLE_STRING	constant
1009	VAR	Manufacturer hardware version	VISIBLE_STRING	constant
100A	VAR	Manufacturer software version	VISIBLE_STRING	constant
1010	ARRAY	Store parameters	UNSIGNED32	rw
1011	ARRAY	Restore default parameters	UNSIGNED32	rw
1018	RECORD	Identity object	Identity (23h)	ro
1100	VAR	EtherCAT address	UNSIGNED16	ro
1110	ARRAY	Virtual MAC address	UNSIGNED8	ro
1111	ARRAY	Virtual IP address info	UNSIGNED8	rw
1616	ARRAY	Receive PDO parameter	UNSIGNED32	rw
1A16	ARRAY	Transmit PDO parameter	UNSIGNED32	rw
1C00	RECORD	Sync manager type	UNSIGNED8	ro
1C12	RECORD	RxPDO assign	UNSIGNED16	rw
1C13	RECORD	TxPDO assign	UNSIGNED16	rw
2000-5FFF		Vendor specific area	See chapter 7.3.1 2000h-5FFFh Danfoss Specific Object Area	
6040	VAR	Control word	UNSIGNED16	rw
6041	VAR	Status word	UNSIGNED16	ro
6042	VAR	VI_target_velocity	SIGNED16	rw
6043	VAR	VI_velocity_demand	SIGNED16	ro
6044	VAR	VI_actual_value	SIGNED16	ro
6046	ARRAY	VI_velocity_min_max_amount	UNSIGNED32	ro
6048	RECORD	VI_velocity_acceleration	See description	ro
6049	RECORD	VI_velocity_acceleration	See description	ro
604C	ARRAY	VI dimension factor	UNSIGNED32	rw
6060	VAR	Modes of operation	UNSIGNED8	rw
6061	VAR	Modes of operation display	UNSIGNED8	ro
6502	VAR	Supported frequency converter mode	UNSIGNED32	ro
6504	VAR	Frequency converter manufacture	VISIBLE_STRING	ro

Table 7.1 Communication Object Overview

#### 7.2.2 1000h Device Type

This object describes the type of device and its functionality. It is composed of a 16-bit field describing the device profile used, and a second 16-bit field providing additional information about optional functionality of the device.

Additional Information				Device Profile Number	
Mode Bits		Type Bits		Bits	
31..	24	23..	16	15..	0
0		1 (frequency converters, DS402)		402	
0		1 (frequency converters, Danfoss)		-1	

Table 7.2 1000h Device Type

Device type will show 0x10192 when DS402 profile is selected in frequency converter, and 0 in case of FC profile.

### 7.2.3 1001h Error Register

This object is the error register of the device. Only bit 0 is supported. The other information of errors is read with object 603Fh.

Bit	Meaning
0	Generic error

Table 7.3 1001h Error Register

### 7.2.4 1002h Manufacturer Status Register

The contents of this object are manufacturer specific, and inform of the state of the frequency converter:

Value	Meaning
1	Init
2	Pre-operational
3	Boot
4	Safe-operational
5	Operational

Table 7.4 1002h Manufacturer Status Register

### 7.2.5 1003h Predefined Error Field

Holds the error on the frequency converter. Setting index 0 to 0 erases the field. Disabling the diagnosis trigger (FC p807) disables the display of values in this object (that is, they stay at 0).

Index	Meaning
1003h 0	Number of stored errors
1003h 1	Current error

Table 7.5 1003h Predefined Error Field

The current error consist of two 16 bit word, where the most significant word holds the information if a warning or alarm is set.

Bit0	1, Alarmword 1 has an active Alarm (parameter 16-90 Alarm Word)
Bit1	1, Alarmword 2 has an active Alarm (parameter 16-91 Alarm Word 2)
Bit2	0, Reserved
Bit3	1, Warningword 1 has an active Warning (P 16-92)
Bit4	1, Warningword 2 has an active Warning (P 16-93)
Bit5-15	0, Reserved

Table 7.6

The least significant word reflects the following possible errors:

Code (hex)	Meaning
0	No fault
1000	General fault
2130	Short circuit
2213	Overcurr. during startup
2240	Short to earth
2310	Continuous overcurrent
2311	Current inside the device, no. 1
3100	Mains voltage
3130	Phase failure
3210	Overvoltage inside the device
3220	undervoltage inside the device
3300	Output voltage
4210	Exceed device temperature
4310	Excess frequency converter temperature
5110	Low voltage power supply
5112	+24 V power supply
5210	Measurement circuit
6100	Internal software fault
7110	Brake chopper
8100	Communication
8302	Torque limiting

Table 7.7

### 7.2.6 1008h Manufacturer Device Name

This object contains the device name as defined in *parameter 15-40 FC Type*.

### 7.2.7 1009h Manufacturer Hardware Version

This object contains the Danfoss FC hardware version.

### 7.2.8 100Ah Manufacturer Software Version

This object contains the Danfoss software version as displayed in *parameter 15-49 SW ID Control Card*.

## 7.2.9 1010h Store Parameters

In the standard configuration, the contents of parameters written via fieldbus are stored in volatile memory, that is, the changed data will be lost after a power cycle. This index permits non-volatile storage of all frequency converter parameters which have been changed.

Index, Sub-Index	Meaning
1010h 0	Number sub-index supported
1010h 1	Save option parameters
1010h 2	Save communication option parameters
1010h 3	Reserved
1010h 4	Save edit setup
1010h 5	Save frequency converter parameters/all set-ups

Table 7.8 1010h Store Parameters

Writing the value "save" (0x65766c173) to sub-index 1 stores all frequency converter parameters of all set-ups into non-volatile memory, all other values are rejected. Sub-index 4 does the same for the Edit Set-up. This function is handled via *parameter 12-28 Store Data Values*.

## 7.2.10 1011h Restore Default Parameters

To restore factory default settings:

1. Write the value "load" to sub-index 1.
2. Initiate the next power cycle manually.
3. The default value is restored.

Index, sub-index	Meaning
1011h 0	Number of sub-index supported
1011h 1	Restore all default parameters and restart
1011h 2	Restore communication related parameters

Table 7.9 1011h Restore Default Parameters

Writing the value "load" (0x64616F6C) stores all frequency converter parameters of all set-ups into non-volatile memory, all other values are rejected, and errors code 0x08000020 is returned. The frequency converter has to be power cycled before the changes get active. These objects execute an initialisation command in *parameter 14-22 Operation Mode*.

## 7.2.11 1018h Identity Object

This object contains general information about the device.

The vendor ID (sub-index 1h) contains a unique value allocated to each manufacturer.

The manufacturer-specific product code (sub-index 2h) identifies a specific device version.

The manufacturer-specific revision number (sub-index 3h) consists of a major revision number and a minor revision number.

Index, sub-index	Meaning
1018h 0	Number of entries
1018h 1	Vendor ID
1018h 2	Product code
1018h 3	Revision number (major revision number and minor revision number)
1018h 4	Serial number

Table 7.10 1018h Identity Object

## 7.2.12 1100h EtherCAT Address

This object contains the EtherCAT address of the device assigned by the master.

## 7.2.13 1110h Virtual MAC Address

This object contains the virtual MAC address for the EoE communication.

Index, Sub-Index	Meaning
1110h 0	Number sub-index supported
1110h 1	Byte 0 of MAC address (LSB)
1110h 2	Byte 1 of MAC address
1110h 3	Byte 2 of MAC address
1110h 4	Byte 3 of MAC address
1110h 5	Byte 4 of MAC address
1110h 6	Byte 5 of MAC address (MSB)

Table 7.11 1110h Virtual MAC Address

## 7.2.14 1111h Virtual IP Address Info

This object contains the virtual IP Info objects about IP addresses, gateways, DNS etc.

Index, Sub-Index	Meaning	Data Type
1111h 0	Number sub-index supported	UNSIGNED8
1111h 1	IP Address	UNSIGNED32
1111h 2	Subnet Mask	UNSIGNED32
1111h 3	Default Gateway	UNSIGNED32
1111h 4	DNS Server	UNSIGNED32
1111h 5	DNS Name	STRING

Table 7.12 1111h Virtual IP Address Info

For the DNS Name, the maximum string length is 97 characters, where the DNS Name consist of the host name and the DNS name separated by a "."

## 7.2.15 1C00h Sync Manager Type

This object contains a list of all configured sync managers and their types.

Index, Sub-Index	Meaning
1C00h 0	Number of entries
1C00h 1	Sync-Manager Type Channel 1: Mailbox Write
1C00h 2	Sync-Manager Type Channel 2: Mailbox Read
1C00h 3	Sync-Manager Type Channel 3: Process Data Write (Outputs)
1C00h 4	Sync-Manager Type Channel 4: Process Data Read (Inputs)

Table 7.13 1C00h Sync Manager Type

## 7.2.16 1C12h RxPDO Assignment

Sync manager 2 is used for process output data. Multiple RxPDOs can be mapped to this sync manager. Object 1C12h contains the list of all RxPDOs.

Index, Sub-Index	Meaning
1C00h 0	Number of entries
1C00h 1	RxPDO configurable

Table 7.14 1C12h RxPDO Assignment

## 7.2.17 1C13h TxPDO Assignment

Sync manager 3 is used for process input data. Multiple RxPDOs can be mapped to this sync manager. Object 1C13h contains the list of all TxPDOs.

Index, Sub-Index	Meaning
1C00h 0	Number of entries
1C00h 1	RxPDO configurable

Table 7.15 1C13h TxPDO Assignment

## 7.3 2000-5FFF Danfoss Specific Object Area

### 7.3.1 2000h-5FFFh Danfoss Specific Object Area

The area 2000h to 5FFFh holds the indexes for accessing the Danfoss FC parameters. All parameters in the frequency converter are linked to indexes in this area. The first index

available is index 2001h. This index is linked to the frequency converters parameter 1 (language). The rest of the EtherCAT index follows the same rule, where the frequency converters parameter number plus 2000h gives the EtherCAT index. For example, the reading the running hours in *parameter 15-01 Running Hours*, is calculated by  $2000h + \text{parameter number in hex number} = 2000h + 5DD = \text{index } 25DDh$ . The xml file does only contain a subset of the frequency converters parameters. This subset has the indexes that are required for setting up the PDO communication. If a full list is required, the full list can be readout from the frequency converter. This list allows access to all parameters. This generates the correct information regarding option installed in the B and C slot. Table 7.16 shows a few indexes and their mapping.

Index	Parameter
2001h	parameter 0-01 Language
2002h	parameter 0-02 Motor Speed Unit
2003h	parameter 0-03 Regional Settings
..	
2078h	parameter 1-20 Motor Power [kW]
2079h	parameter 1-22 Motor Voltage
..	
24B1h	parameter 12-01 IP Address
24B2h	parameter 12-02 Subnet Mask

Table 7.16 2000h-5FFFh Vendor Specific Object Area

## 7.4 6000-Device profile Object Area

### 7.4.1 6000h-9FFFh Standardised Device Profile Area

The area 6000h to 9FFFh holds the indexes specified by the ETG (EtherCAT user Group) for various device profiles. The Danfoss EtherCAT does support three profiles, FC Profile, MCO and the DS 402 profile, velocity mode. The profile is selected via *parameter 8-10 Control Word Profile*, Control Word Profile, or via Index 6060h Modes of operation. The profile area has up to 13 indexes depending on the selection made in *parameter 8-10 Control Word Profile*.

Table 7.17 shows the support of indexes, depending on setting of *parameter 8-10 Control Word Profile* (Index 6060h)

Index	Name	parameter 8-10 Control Word Profile=FC Profile	parameter 8-10 Control Word Profile=MCO	parameter 8-10 Control Word Profile=DS 402
6040h	Control word	-	-	√
6041h	Status word	-	-	√
6042h	VI_target_velocity	-	-	√
6043h	VI_velocity_demand	-	-	√
6044h	VI_velocity_effort	-	-	√
6046h	VI_velocity_min_max_amount	-	-	√
6048h	VI_velocity_acceleration	-	-	√
6049h	VI_velocity_deceleration	-	-	√
604Ch	VI dimension factor	-	-	√
6060h	Modes of operation	√	√	√
6061h	Modes of operation display	√	√	√
6502h	Supported frequency converter mode	√	√	√
6504h	Frequency converter manufacture	√	√	√

Table 7.17 6000h-9FFFh Standardised Device Profile Area

## 7.4.2 6040h Control Word

This object contains the control word in accordance with DS 402. The control word consists of 16 bit, these 16 bit are used for controlling the frequency converter (for example, start, stop, reset). The control word is described in *chapter 6.4 DS 402 Control Profile*.

## 7.4.3 6041h Status Word

This object contains the Status word in accordance to DS 402. The status word consists of 16 bit. The 16 bits show the state and status of the frequency converter (for example, running, ramping, on speed). The Status word is described in *chapter 6.4 DS 402 Control Profile*.

## 7.4.4 6042h vl\_target\_velocity

The vl\_target\_velocity is the required velocity of the system. The velocity is in RPM.

## 7.4.5 6043h vl\_velocity\_demand

The vl\_velocity\_demand is the velocity of the system after the ramp controller. The velocity is in RPM.

## 7.4.6 6044h vl\_actual\_value

The vl\_actual\_value is the velocity at the motor shaft. The velocity is in RPM, and is obtained from *parameter 16-17 Speed [RPM]*.

## 7.4.7 6046h vl\_velocity\_min\_max\_amount

The vl\_velocity\_min\_max\_amount is the minimum and maximum RPM at the motor shaft. The two values are obtained from *parameter 3-02 Minimum Reference* and

*parameter 3-03 Maximum Reference*. The readout values in *parameter 3-02 Minimum Reference* and *parameter 3-03 Maximum Reference* will be truncated.

## 7.4.8 6048h vl\_velocity\_acceleration

The vl\_velocity\_acceleration index specifies the slope of the acceleration ramp. It is generated as the quotient of the delta\_speed and delta\_time. The Delta time is stored in *parameter 3-41 Ramp 1 Ramp up Time*, and the Delta speed is store locally in the options non volatile memory. After a power down the delta speed will be generated from the frequency converter *parameter 1-25 Motor Nominal Speed*. This can give a different readout from the frequency converter, but the slope value is maintained.

Index, sub-index	Meaning
1048h 0	Number of sub-index supported
1048h 1	Delta speed
1048h 2	Delta time

Table 7.18 6048h vl\_velocity\_acceleration

## 7.4.9 6049h vl\_velocity\_deceleration

The vl\_velocity\_deceleration index specifies the slope of the deceleration ramp. It is generated as the quotient of the delta\_speed and delta\_time. The Delta time is stored in *parameter 3-42 Ramp 1 Ramp Down Time*, and the Delta speed is stored locally in the options non volatile memory. After a power down, the delta speed is generated from the frequency converter *parameter 1-25 Motor Nominal Speed*. This can give a different readout from the frequency converter, but the slope value is maintained.

Index, sub-index	Meaning
1049h 0	Number of sub-index supported
1049h 1	Delta speed
1049h 2	Delta time

Table 7.19 6049h vl\_velocity\_deceleration

## 7.4.10 604Ch vl\_dimension\_factor

The vl\_dimension\_factor configures the numerator and denominator of the factor. The vl\_dimension\_factor serves to include gearing in calculation or serves to scale specific units of the user. It influences the vl\_target\_velocity, vl\_velocity\_indexes.

Index, sub-index	Meaning
104Ch 0	Number of sub-index supported
104Ch 1	Numerator
104Ch 2	Denominator

Table 7.20 604Ch vl\_dimension\_factor

## 7.4.11 6060h Modes of Operation

This index is used for selection the Danfoss FC profile, MCO profile, or the DS 402 profile. The index links directly to *parameter 8-10 Control Word Profile*. If this value is changed while in operation, the option enters the "Error PREOP" state.

Index, 6060h value	Meaning
-2	MCO profile (only possible if MCO305 is mounted)
-1	FC Profile
2	DS 402 profile

Table 7.21 6060h Modes of Operation

## 7.4.12 6061h Modes of Operation Display

This index is used to display which mode the frequency converter is in. The mode can be changed via index 6060. The values are the same as used for index 6060.

Index, 6061h value	Meaning
-1	Default display operation

Table 7.22 6061h Modes of Operation Display

## 7.4.13 6502h Supported Frequency Converter Mode

This index informs the user of which operating mode the frequency converter is capable of. Bit 1 is set, indicating that the frequency converter can run DS 402 velocity mode, bit 16 FC profile and 17 indicates MCO profile.

## 7.4.14 6504h Frequency Converter Manufacturer

The data is coded as a string.

### Emergency Object

This section describes the general layout of the EtherCAT emergency object. The emergency object is used to signal error states in the frequency converters to the master. The frequency converter can be programmed automatically to send the EMCY object if an alarm or warning is activated. The frequency converter resends the EMCY object if one of the alarms or warnings is removed.

### Communication Object Overview

The EMCY object always consists of 8 bytes data, see *Table 7.23*:

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
EMCY code		Object 1001h	Vendor specific information				
		See <i>Table 7.27</i>	Reserved	Reserved	Reserved	Reserved	Reserved

Table 7.23 Communication Object Overview

This index does readout the name of the drive manufacturer. Data is coded as a string.

Index, sub-index	Meaning
6504Ch 0	Manufacturer "DANFOSS DRIVES"

Table 7.24 6504h Drive Manufacturer (read only)



Code (hex)	Meaning
0	No fault
1000	General fault
2130	Short Circuit
2213	Overcurr. during startup
2240	Short to earth
2310	Continuous overcurrent
2311	Current inside the device, No. 1
3100	Mains voltage
3130	Phase failure
3210	Overvoltage inside the device
3220	Undervoltage inside the device
3300	Output voltage
4210	Exceed device temperature
4310	Excess frequency converter temperature
5110	Low voltage power supply
5112	+24 V Power supply
5210	Measurement circuit
6100	Internal software fault
7110	Brake chopper
8100	Communication
8302	Torque limiting

Table 7.25 Byte 0 and 1

0	No errors
1	Error active

Table 7.26 Byte 2

Bit0	1, Alarmword 1 has an active Alarm (parameter 16-90 Alarm Word)
Bit1	1, Alarmword 2 has an active Alarm (parameter 16-91 Alarm Word 2)
Bit2	0, Reserved
Bit3	1, Warningword 1 has an active Warning (P 16-92)
Bit4	1, Warningword 2 has an active Warning (P 16-93)
Bit5-15	0, Reserved

Table 7.27 Byte 3

Reserved
----------

Table 7.28 Byte 4 to byte 7

## 8 Parameters

### 8.1 Parameter Group 0-\*\* Operation/Display

0-37 Display Text 1		
Range:	Function:	
0 * [0 - 0]	<p>In this parameter, it is possible to write an individual text string to be shown in the LCP or to be read via serial communication.</p> <p>To show the text permanently, select [37] Display Text 1 in 1 of the following parameters:</p> <ul style="list-style-type: none"> <li>Parameter 0-20 Display Line 1.1 Small.</li> <li>Parameter 0-21 Display Line 1.2 Small.</li> <li>Parameter 0-22 Display Line 1.3 Small.</li> <li>Parameter 0-23 Display Line 2 Large.</li> <li>Parameter 0-24 Display Line 3 Large.</li> <li>Parameter 0-37 Display Text 1.</li> </ul> <p>Changing parameter 12-08 Host Name changes parameter 0-37 Display Text 1 - but not vice versa.</p>	

### 8.2 Parameter Group 8-\*\* Communication and Option

8-01 Control Site		
Option:	Function:	
	The setting in this parameter overrides the settings in parameter 8-50 Coasting Select to parameter 8-56 Preset Reference Select.	
[0]	Digital and ctrl.word	Use both digital input and control word.
[1]	Digital only	Use digital inputs only.
[2]	Controlword only	Use control word only.

8-03 Control Word Timeout Time		
Range:	Function:	
1.0 s* [0.1 - 18000.0 s]	<p>Enter the maximum time expected to pass between the reception of 2 consecutive telegrams. If this time is exceeded, it indicates that the telegram communication has stopped. The function selected in parameter 8-04 Control Word Timeout Function is then carried out. A valid control word triggers the timeout counter.</p>	

8-04 Control Word Timeout Function		
<p>Select the timeout function. The timeout function activates when the control word fails to be updated within the time period specified in parameter 8-03 Control Word Timeout Time.</p>		
Option:	Function:	
	<p><b>NOTICE</b></p> <p>To change the set-up after a timeout, configure as follows:</p> <ol style="list-style-type: none"> <li>Set parameter 0-10 Active Set-up to [9] Multi set-up.</li> <li>Select the relevant link in parameter 0-12 This Set-up Linked to.</li> </ol>	
[0]	Off	Resumes control via fieldbus (fieldbus or standard), using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at jog frequency until communication resumes.
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	<p>Stops the motor, then resets the frequency converter to restart:</p> <ul style="list-style-type: none"> <li>Via the fieldbus.</li> <li>Via [Reset].</li> <li>Via a digital input.</li> </ul>
[7]	Select setup 1	Changes the set-up after a control word timeout. If communication resumes after a timeout, parameter 8-05 End-of-Timeout Function either resumes the set-up used before the timeout, or retains the set-up endorsed by the timeout function.
[8]	Select setup 2	See [7] Select set-up 1.
[9]	Select setup 3	See [7] Select set-up 1.
[10]	Select setup 4	See [7] Select set-up 1.
[26]	Trip	

8-05 End-of-Timeout Function		
Option:	Function:	
		Select the action after receiving a valid control word following a timeout.  This parameter is active only when <i>parameter 8-04 Control Timeout Function</i> is set to: <ul style="list-style-type: none"> <li>• [7] Set-up 1.</li> <li>• [8] Set-up 2.</li> <li>• [9] Set-up 3.</li> <li>• [10] Set-up 4.</li> </ul>
[0]	Hold set-up	Retains the set-up selected in <i>parameter 8-04 Control Timeout Function</i> and shows a warning until <i>parameter 8-06 Reset Control Timeout</i> toggles. Then the frequency converter resumes its original set-up.
[1]	Resume set-up	Resumes the set-up that was active before the timeout.

8-06 Reset Control Word Timeout		
This parameter is active only when [0] <i>Hold set-up</i> has been selected in <i>parameter 8-05 End-of-Timeout Function</i> .		
Option:	Function:	
[0]	Do not reset	Retains the set-up specified in <i>parameter 8-04 Control Word Timeout Function</i> , following a control word timeout.
[1]	Do reset	Restores the frequency converter to the original set-up following a control word timeout. The frequency converter performs the reset and then immediately reverts to the [0] <i>Do not reset</i> setting.

8-07 Diagnosis Trigger		
This parameter enables and controls the frequency converter diagnosis/Emergency function. In Profibus, it expands the diagnosis data to 24 byte. In EtherCAT, it activates the transmission of the Emergency object. In POWERLINK, it enables the Error signaling. The Emergency/Error signaling object consists of 8 byte of data, where byte 3 indicates an active alarm or warning. Bit 0=1 Alarmword 1 has an active Alarm. Bit 1=1 Alarmword 2 has an active Alarm. Bit 2, reserved, Bit 3=1 Warningword 1 has an active warning. Bit 4=1 Warningword 2 has an active warning. Bits 5-7, reserved.		
Option:	Function:	
[0]	Disable	
[1]	Trigger on alarms	
[2]	Trigger alarm/warn.	

**NOTICE**

The following is only valid for Profibus and EtherCAT.

- [0] *Disable*: Do not send extended diagnosis/emergency data even if they appear in the frequency converter.
- [1] *Trigger on alarms*: Send extended diagnosis/emergency data when one or more alarms appear in alarm *parameter 16-90 Alarm Word* or *parameter 9-53 Profibus Warning Word*.
- [2] *Trigger alarms/warn.*: Send extended diagnosis/emergency data if one or more alarms or warnings appear in alarm *parameter 16-90 Alarm Word*, *parameter 9-53 Profibus Warning Word*, or warning *parameter 16-92 Warning Word*.

Enabling diagnosis can cause increased bus traffic. Not all fieldbus types support Diagnosis functions.

8-08 Readout Filtering		
If the speed feedback value readouts on fieldbus are fluctuating, this function is used. Select filtered, if the function is required. A power cycle is required for changes to take effect.		
Option:	Function:	
[0]	Motor Data Std-Filt.	Normal fieldbus readouts.
[1]	Motor Data LP-Filter	Filtered fieldbus readouts of the following parameters: <ul style="list-style-type: none"> <li>• <i>Parameter 16-10 Power [kW]</i>.</li> <li>• <i>Parameter 16-11 Power [hp]</i>.</li> <li>• <i>Parameter 16-12 Motor Voltage</i>.</li> <li>• <i>Parameter 16-14 Motor Current</i>.</li> <li>• <i>Parameter 16-16 Torque [Nm]</i>.</li> <li>• <i>Parameter 16-17 Speed [RPM]</i>.</li> <li>• <i>Parameter 16-22 Torque [%]</i>.</li> <li>• <i>Parameter 16-25 Torque [Nm] High</i>.</li> </ul>

8-10 Control Word Profile		
Select the interpretation of the control and status words corresponding to the installed fieldbus. Only the selections valid for the fieldbus installed in slot A are visible in the LCP display. If the parameter is changed while the frequency converter is in operation mode, the frequency converter goes to error state, and the control of the frequency converter is lost. This parameter should not be changed while the motor is running, since it can lead to a unknown state of the profile.		
Option:	Function:	
[0] *	FC Profile	
[7]	CANopen DSP 402	

8-13 Configurable Status Word STW		
Array [16]		
Option:	Function:	
		This parameter enables configuration of bits 12-15 in the status word.
[0]	No function	

8-13 Configurable Status Word STW		
Array [16]		
Option:	Function:	
[1] Profile Default	The function corresponds to the profile default selected in <i>parameter 8-10 Control Profile</i> .	
[2] Alarm 68 Only	Only set if <i>alarm 68, Safe Torque Off</i> occurs.	
[3] Trip excl Alarm 68	Set if a trip occurs, except if <i>alarm 68, Safe Torque Off</i> executes the trip.	
[16] T37 DI status	The bit indicates the status of terminal 37. 0 indicates that T37 is low (Safe Torque Off). 1 indicates that T37 is high (normal).	

8-14 Configurable Control Word CTW		
Array [15]		
Option:	Function:	
	This parameter is not valid in software versions before 4.93.	
[0] None	The frequency converter ignores the information in this bit.	
[1] Profile default	The functionality of the bit is depending on the selection <i>parameter 8-10 Control Word Profile</i> .	
[2] CTW Valid, active low	If set to 1, the frequency converter ignores the remaining bits of the control word.	
[3] Safe Option Reset	This function is only available in bits 12–15 of the control word, if a safety option is mounted in the frequency converter. The reset is executed on a 0⇒1 transition, and resets the safety option as set in <i>parameter 42-24 Restart Behaviour</i> .	
[4] PID error inverse	Inverts the resulting error from the process PID controller. Available only if <i>parameter 1-00 Configuration Mode</i> is set to [6] <i>Surface Winder</i> , [7] <i>Extended PID Speed OL</i> , or [8] <i>Extended PID Speed CL</i> .	
[5] PID reset I part	Resets the I-part of the process PID controller. Equivalent to <i>parameter 7-40 Process PID I-part Reset</i> . Available only if <i>parameter 1-00 Configuration Mode</i> is set to [6] <i>Surface Winder</i> , [7] <i>Extended PID Speed OL</i> , or [8] <i>Extended PID Speed CL</i> .	
[6] PID enable	Enables the extended process PID controller. Equivalent to <i>parameter 7-50 Process PID Extended PID</i> . Available only if <i>parameter 1-00 Configuration Mode</i> is set to [6] <i>Surface Winder</i> , [7] <i>Extended PID Speed OL</i> , or [8] <i>Extended PID Speed CL</i> .	

8-50 Coasting Select		
Option:	Function:	
	Select the trigger for the coasting function.	

8-50 Coasting Select		
Option:	Function:	
[0] Digital input	A digital input triggers the coasting function.	
[1] Bus	A serial communication port or the fieldbus triggers the coasting function.	
[2] Logic AND	The fieldbus/serial communication port and a digital input trigger the coasting function.	
[3] Logic OR	The fieldbus/serial communication port or a digital input triggers the coasting function.	

8-51 Quick Stop Select		
Select the trigger for the quick stop function.		
Option:	Function:	
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3]	Logic OR	

8-52 DC Brake Select		
Option:	Function:	
	Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.	
	<b>NOTICE</b> When <i>parameter 1-10 Motor Construction</i> is set to [1] <i>PM non-salient SPM</i> , only selection [0] <i>Digital input</i> is available.	
[0] Digital input	Activate a start command via a digital input.	
[1] Bus	Activate a start command via the serial communication port or fieldbus option.	
[2] Logic AND	Activate a start command via the fieldbus/serial communication port, and also via 1 of the digital inputs.	
[3] Logic OR	Activate a start command via the fieldbus/serial communication port, or via 1 of the digital inputs.	

8-53 Start Select		
Option:	Function:	
	Select the trigger for the start function.	
[0] Digital input	A digital input triggers the start function.	
[1] Bus	A serial communication port or the fieldbus triggers the start function.	
[2] Logic AND	The fieldbus/serial communication port and a digital input trigger the start function.	
[3] Logic OR	The fieldbus/serial communication port or a digital input triggers the start function.	

8-54 Reversing Select		
Option:	Function:	
		Select the trigger for the reversing function.
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

8-55 Set-up Select		
Option:	Function:	
		Select the trigger for the set-up selection.
[0]	Digital input	A digital input triggers the set-up selection.
[1]	Bus	A serial communication port or the fieldbus triggers the set-up selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the set-up selection.
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the set-up selection.

8-90 Bus Jog 1 Speed		
Range:	Function:	
100 RPM* [ 0 - par. 4-13 RPM]		Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

8-91 Bus Jog 2 Speed		
Range:	Function:	
200 RPM* [ 0 - par. 4-13 RPM]		Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

## 8.3 Parameter Group 12-\*\* Ethernet

### 8.3.1 12-0\* IP Settings

12-00 IP Address Assignment		
Option:	Function:	
		Selects the IP Address assignment method.
[0]	MANUAL	IP-address can be set in <i>parameter 12-01 IP Address</i> IP Address.
[1]	DHCP	IP-address is assigned via DHCP server.
[2]	BOOTP	IP-address is assigned via BOOTP server.
[10]	DCP	DCP Assigned via the DCP protocol.

12-01 IP Address		
Range:	Function:	
0 * [ 0 - 2147483647 ]		Configure the IP address of the option. Read-only, if <i>parameter 12-00 IP Address Assignment</i> is set to DHCP or BOOTP. In POWERLINK, the IP address follows the <i>parameter 12-60 Node ID</i> last byte and the first part is fixed to 192.168.100 (node ID).

12-02 Subnet Mask		
Range:	Function:	
0 * [ 0 - 4244635647 ]		Configure the IP subnet mask of the option. Read-only, if <i>parameter 12-00 IP Address Assignment</i> is set to DHCP or BOOTP. In POWERLINK, it is fixed to 255.255.255.0.

12-03 Default Gateway		
Range:	Function:	
0 * [ 0 - 2147483647 ]		Configure the IP default gateway of the option. Read-only, if <i>parameter 12-00 IP Address Assignment</i> is set to DHCP or BOOTP. In a non-routed network, this address is set to the IP address of the IO Device.

12-04 DHCP Server		
Range:	Function:	
0 * [ 0 - 2147483647 ]		Read-only. Show the IP address of the found DHCP or BOOTP server.

12-05 Lease Expires		
Range:	Function:	
Size related* [ 0 - 0 ]		Read-only. Show the lease time left for the current DHCP-assigned IP address.

12-06 Name Servers		
Range:	Function:	
0 * [ 0 - 2147483647 ]		IP addresses of domain name servers. Can be automatically assigned when using DHCP.

12-07 Domain Name		
Range:	Function:	
0 [ 0 - 2147483647 ]		Domain name of the attached network. Can be automatically assigned when using DHCP network.

12-08 Host Name		
Range:	Function:	
0 * [ 0 - 2147483647 ]		Logical (given) name of option.

12-08 Host Name		
Range:		Function:
		<b>NOTICE</b> The display of the frequency converter only shows the first 19 characters, but the remaining characters are stored in the frequency converter. If hardware switches are different from all ON or all OFF, the switches have priority.

12-09 Physical Address		
Range:		Function:
0 *	[0 - 0 ]	Read-only. Show the physical (MAC) address of the option.

### 8.3.2 12-1\* Ethernet Link Parameters

### 8.3.3 12-1\* Ethernet Link Parameters

Applies for the whole parameter group.

Index [0] is used for port 1, and index [1] is used for port 2. For EtherCAT, index [0] is for the in-port and index [1] is for the out-port.

12-10 Link Status		
Option:		Function:
		Read-only. Show the link status of the Ethernet ports.
[0]	No Link	
[1]	Link	

12-11 Link Duration		
Range:		Function:
Size related*	[0 - 0 ]	Read-only. Show the duration of the present link on each port in dd:hh:mm:ss.

12-12 Auto Negotiation		
Option:		Function:
		Configures Auto Negotiation of Ethernet link parameters, for each port: ON or OFF.
[0]	Off	Link Speed and Link Duplex can be configured in parameter 12-13 Link Speed and parameter 12-14 Link Duplex.
[1]	On	

## NOTICE

It is recommended to set *parameter 12-12 Auto Negotiation* to [0] Off for the EtherCAT option and for the connected port. This setting ensures that the connected ports are set to an optimized Link Speed with Link Duplex setting. If only one of the ports in a link is set to *Auto Negotiation ON*, the ports can switch to half duplex, which results in poor network performance. Most switches today have Auto negotiation set, but it can then take longer to establish a connection. In POWERLINK this parameter is locked to OFF position.

12-13 Link Speed		
Option:		Function:
		Force the link speed for each port in 10 Mbps or 100 Mbps. If <i>parameter 12-12 Auto Negotiation</i> is set to [1] On, this parameter is read-only and shows the actual link speed. If no link is present, None is shown.
[0]	None	
[1]	10 Mbps	
[2]	100 Mbps	

## NOTICE

In POWERLINK, this parameter is locked to 100 Mbs.

12-14 Link Duplex		
Option:		Function:
		<b>NOTICE</b> In POWERLINK, this parameter is locked to half duplex.  Force the duplex for each port to full or half duplex. If <i>parameter 12-12 Auto Negotiation</i> is set to [1] On, this parameter is read-only.
[0]	Half Duplex	
[1]	Full Duplex	

### 8.3.4 12-2\* Process Data

12-20 Control Instance		
Range:		Function:
		Read-only. Displays the connection to the master. In Ethernet/IP: If no CIP connection is present, None is displayed. In EtherCAT: If no connection is active None is displayed, else it displays the active PDO. In POWERLINK: If no connection is active None is displayed, else it displays the active PDO (23).
	[None, 20, 21, 23, 100, 101, 103]	

### 12-21 Process Data Config Write

Range:	Function:
[[0 - 9] PCD read 0 - 9]	Configuration of readable process data. In POWERLINK, this parameter is read-only. The same applies for: <ul style="list-style-type: none"> <li>parameter 12-22EN-22 Process Data Config Read</li> <li>parameter 12-23 Process Data Config Write Size</li> <li>parameter 12-24 Process Data Config Read Size</li> </ul>

### 12-22 Process Data Config Read

Range:	Function:
[[0 - 9] PCD read 0 - 9]	Configuration of readable process data.

### 12-23 Process Data Config Write Size

Range:	Function:
16 * [8 - 32]	Sets the number of bits being sent from the frequency converter as process data. The setting counts from right (LSB). The value 1 means that only the least significant bit of the signal is transferred from the frequency converter.

### 12-24 Process Data Config Read Size

Range:	Function:
16 * [8 - 32]	Sets the number of bits being sent to the frequency converter as process data. The setting counts from right (LSB). The value 1 means that only the least significant bit of the signal is transferred to the frequency converter. The preceding bits are set to zero.

### 12-28 Store Data Values

Option:	Function:
[0] Off	
[1] Store all setups	
[2] Store all setups	

### 12-29 Store Always

Option:	Function:
	Activates function that always stores received parameter data in non-volatile memory (EEPROM).
[0] * Off	
[1] On	

## 8.3.5 12-5\* EtherCAT

### 12-50 Configured Station Alias

Range:	Function:
0 * [0 - 65535]	This parameter shows the configured EtherCAT station alias for the frequency converter.

### 12-50 Configured Station Alias

Range:	Function:
	Changes are first active after a power cycle. If the DIP switches all are set to ON or all to OFF, the display setting has priority over the DIP switch. Else the DIP switch settings has priority over the parameter. In this case the parameter will reflect the setting of the DIP switches. Changes to the DIP switch setting, will first be active after a power up.

### 12-51 Configured Station Address

Range:	Function:
0 * [0 - 65535]	This parameter shows the configured station address. The parameter can only be set by the master at power up.

### 12-59 EtherCAT Status

Range:		Function:																																																								
0 *	[0 - 4294967295 ]	<div><p>This parameter contains status information on the EtherCAT interface. Each of the 32 bits are linked to a status information of the EtherCAT interface.</p><ul style="list-style-type: none"><li>Bit 0-7 contains info from ESC register 0x0130 (AL Status)</li><li>Bit 8-15 is reserved for future use</li><li>Bit 16-27 contains info from ESC register 0x0110 and 0x0111 (DL status)</li><li>Bit 28-31 is reserved for future use</li></ul></div> <table><tr><th>Bit</th><th>0</th><th>1</th><th>Meaning</th></tr><tr><td>0</td><td></td><td>Init State</td><td>EtherCAT Statemachine state</td></tr><tr><td>1</td><td></td><td>Pre-OP</td><td>EtherCAT Statemachine state</td></tr><tr><td>2</td><td></td><td>Safe-OP</td><td>EtherCAT Statemachine state</td></tr><tr><td>3</td><td></td><td>Operational</td><td>EtherCAT Statemachine state</td></tr><tr><td>4</td><td></td><td></td><td>Reserved</td></tr><tr><td>5</td><td></td><td></td><td>Reserved</td></tr><tr><td>6</td><td></td><td></td><td>Reserved</td></tr><tr><td>7</td><td></td><td></td><td>Reserved</td></tr><tr><td>8</td><td></td><td></td><td>Reserved</td></tr><tr><td>9</td><td></td><td></td><td>Reserved</td></tr><tr><td>10</td><td></td><td></td><td>Reserved</td></tr><tr><td>11</td><td></td><td></td><td>Reserved</td></tr><tr><td>12</td><td></td><td></td><td>Reserved</td></tr></table>	Bit	0	1	Meaning	0		Init State	EtherCAT Statemachine state	1		Pre-OP	EtherCAT Statemachine state	2		Safe-OP	EtherCAT Statemachine state	3		Operational	EtherCAT Statemachine state	4			Reserved	5			Reserved	6			Reserved	7			Reserved	8			Reserved	9			Reserved	10			Reserved	11			Reserved	12			Reserved
Bit	0	1	Meaning																																																							
0		Init State	EtherCAT Statemachine state																																																							
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2		Safe-OP	EtherCAT Statemachine state																																																							
3		Operational	EtherCAT Statemachine state																																																							
4			Reserved																																																							
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7			Reserved																																																							
8			Reserved																																																							
9			Reserved																																																							
10			Reserved																																																							
11			Reserved																																																							
12			Reserved																																																							

12-59 EtherCAT Status				
Range:		Function:		
Bit	0	1	Meaning	
13			Reserved	
14			Reserved	
15			Reserved	
16	EEPROM not loaded, PDI not operational	EEPROM loaded correctly, PDI operational	PDI Operational	
17	Watchdog expired	Watchdog reloaded	PDI Watchdog Status	
18	Deactivated for all ports	Activated for all ports	Enhanced link detection	
19			Reserved	
20	No link	Link detected	Physical link on Port 0	
21	No link	Link detected	Physical link on Port 1	
22			Reserved	
23			Reserved	
24	Open	Closed	Loop port 0	
25	No stable communication	Communication established	Communication on port 0	
26	Open	Closed	Loop port 1	
27	No stable communication	Communication established	Communication on port 1	
28			Reserved	
29			Reserved	
30			Reserved	
31			Reserved	

Table 8.1 Bit Interpretation

### 8.3.6 12-8\* Other Ethernet Services

12-80 FTP Server		
Option:	Function:	
[0]	Disabled	Disable the built-in FTP server.
[1]	Enabled	Enable the built-in FTP server.

12-81 HTTP Server		
Option:	Function:	
[0]	Disabled	Disable the built-in HTTP (web) server.
[1]	Enabled	Enable the built-in HTTP (web) server.

12-82 SMTP Service		
Option:	Function:	
[0]	Disabled	Disable the SMTP (e-mail) service on the option.
[1]	Enabled	Enable the SMTP (e-mail) service on the option.

12-89 Transparent Socket Channel Port		
Range:	Function:	
Size related*	[ 0 - 0. ]	Configure the TCP port number for the transparent socket channel. This configuration enables FC telegrams to be sent transparently on Ethernet via TCP. Default value is 4000, 0 means disabled. The MCT 10 Set-up Software uses this port.

### 8.3.7 12-9\* Advanced Ethernet Settings

12-90 Cable Diagnostic		
Option:	Function:	
	<p><b>NOTICE</b></p> <p>The cable diagnostics function is only issued on ports where there is no link (see <i>parameter 12-10 Link Status, Link Status</i>).</p> <p>Enable/disable advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in <i>parameter 12-93 Cable Error Length</i>. The parameter resumes to the default setting of disable after the diagnostics have finished.</p>	
[0]	Disabled	Disable the cable diagnostic function.
[1]	Enabled	Enable the cable diagnostic function.

12-91 Auto Cross Over		
Option:	Function:	
[0]	Disabled	Disable the auto-crossover function.
[1]	Enabled	Enable the auto-crossover function.

12-93 Cable Error Length		
Range:	Function:	
0 * [ 0 - 65535 ]	If cable diagnostics is enabled in <i>parameter 12-90 Cable Diagnostic</i> , the built-in switch is possible via time domain reflectometry (TDR). This measurement technique detects common cabling problems such as open circuits, short circuits, and impedance mismatches, or breaks in transmission cables. The distance from the option to the error is shown in meters with an accuracy of $\pm 2$ m (6.56 ft). The value 0 means that no errors are detected.	



## 8.4 EtherCAT-specific Parameter List

Parameter	Default value	Range	Conversion index	Data type
Parameter 8-01 Control Site	[0] Dig. & ctrl. word	[0-2]	-	Uint8
Parameter 8-02 Control Word Source	[0] FC RS485	[0-4]	-	Uint8
Parameter 8-03 Control Word Timeout Time	1	0.1-18000	-1	Uint32
Parameter 8-04 Control Word Timeout Function	[0] Off	[0-10]	-	Uint8
Parameter 8-05 End-of-Timeout Function	[0] Hold set-up	[0-1]	-	Uint8
Parameter 8-06 Reset Control Word Timeout	[0] Do not reset	[0-1]	-	Uint8
Parameter 8-07 Diagnosis Trigger	[0] Disable	[0-3]	-	Uint8
Parameter 8-10 Control Word Profile	[0] FC profile	[0-x]	-	Uint8
Parameter 8-13 Configurable Status Word STW				
Parameter 8-50 Coasting Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-51 Quick Stop Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-52 DC Brake Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-53 Start Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-54 Reversing Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-55 Set-up Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-56 Preset Reference Select	[3] *Logic OR	[0-3]	-	Uint8
Parameter 8-90 Bus Jog 1 Speed	100 rpm	0-parameter 4-13 Motor Speed High Limit [RPM]	67	Uint16
Parameter 8-91 Bus Jog 2 Speed	200 rpm	0-parameter 4-13 Motor Speed High Limit [RPM]	67	Uint16
parameter 12-00 IP Address Assignment	0.0.0.0	-	-	Unsigned 8
parameter 12-01 IP Address	0.0.0.0	-	-	Unsigned 32
parameter 12-02 Subnet Mask	0.0.0.0	-	-	Unsigned 32
parameter 12-03 Default Gateway	0.0.0.0	-	-	Unsigned 32
parameter 12-04 DHCP Server	0.0.0.0	-	-	Unsigned 32
parameter 12-05 Lease Expires	0	-	-	Unsigned 32
parameter 12-06 Name Servers	0.0.0.0	-	-	Unsigned 32
parameter 12-07 Domain Name		-	-	String
parameter 12-08 Host Name		-	-	String
Parameter 12-09 Physical Address	00:1B:08:00:00:00	-	-	Visible string 17
Parameter 12-10 Link Status	[0] No Link	[0-1]	-	Unsigned 8
Parameter 12-11 Link Duration	00:00:00:00	-	-	Time diff. w/ date
Parameter 12-12 Auto Negotiation	[1] On	[0-1]	-	Unsigned 8
Parameter 12-13 Link Speed	[0] None	[0-2]	-	Unsigned 8
Parameter 12-14 Link Duplex	[1] Full Duplex	[0-1]	-	Unsigned 8[
parameter 12-20 Control Instance	Application Dependent	0-255		
parameter 12-21 Process Data Config Write	Application Dependent			
parameter 12-22EN-22 Process Data Config Read	16	1-32		
parameter 12-23 Process Data Config Write Size	16	1-32		
parameter 12-24 Process Data Config Read Size	0	0-4294967295		
parameter 12-28 Store Data Values				
parameter 12-29 Store Always	[0] Off			

Parameter	Default value	Range	Conversion index	Data type
parameter 12-50 Configured Station Alias	0	-	-	Unsigned 16
parameter 12-51 Configured Station Address	0	-	-	Unsigned 16
parameter 12-59 EtherCAT Status	0	-	-	Unsigned 32
Parameter 12-80 FTP Server	[0] Disable	[0-1]	-	Unsigned 8
Parameter 12-81 HTTP Server	[0] Disable	[0-1]	-	Unsigned 8
Parameter 12-82 SMTP Service	[0] Disable	[0-1]	-	Unsigned 8
Parameter 12-89 Transparent Socket Channel Port	[0] Disable	[0-1]	-	Unsigned 8
Parameter 12-90 Cable Diagnostic	[0] Disable	[0-1]	-	Unsigned 8
Parameter 12-91 Auto Cross Over	[0] Enable	[0-1]	-	Unsigned 8
Parameter 12-93 Cable Error Length	0	0-200	0	Unsigned 16
Parameter 12-98 Interface Counters	0	0-65535	-	Unsigned 16
Parameter 12-99 Media Counters	0	0-65535	-	Unsigned 16
Parameter 16-84 Comm. Option STW	0	0-FFFF	0	V2
Parameter 16-90 Alarm Word	0	0-FFFF	0	Uint32
Parameter 16-92 Warning Word	0	0-FFFF	0	Uint32

**Table 8.2**

Refer to the relevant Operating Instructions for a comprehensive parameter list.



## 9 Application Examples

### 9.1 Example: Process Data with PDO 23

This example shows how to work with PDO 23, which consists of Control Word/Status Word and Reference/Main Actual Value. In the example the drive is set to FC profile in *Parameter 8-10 Control Word Profile*. The PDO contains up

to ten objects, which can be programmed to monitor process signals:

	PCD							
	0		1		2		3	
	CTW		MRV		PCD[2]		PCD	
	04	7C	20	00	00	00	00	00
	STW		MAV		PCD[2]		PCD[3]	
	0F	07	20	00	3F	A6	00	08
Byte #	1	2	3	4	5	6	7	8

Table 9.1

9

The application requires monitoring of the motor torque and digital input, so PCD 2 is set up to read the current motor torque. PCD 3 is set up to monitor the state of an external sensor via the process signal digital input. The sensor is connected to digital input 18.

An external device is also controlled via control word bit 11 and the built-in relay of the frequency converter. Reversing is permitted only when the reversing bit 15 in the control word and the digital input 19 are set to high.

For safety reasons, the frequency converter stops the motor if the EtherCAT cable is broken, the master has a system failure, or the PLC is in stop mode.

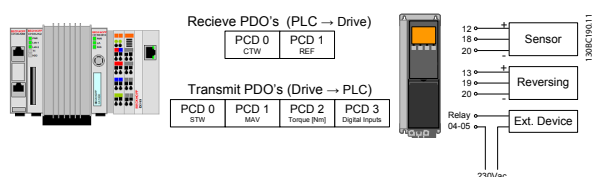


Illustration 9.1

Program the frequency converter as follows:

Parameter	Setting
Parameter 4-10 Motor Speed Direction	[2] Both directions
Parameter 5-10 Terminal 18 Digital Input	[0] No operation
Parameter 5-11 Terminal 19 Digital Input	[10] Reversing
Parameter 5-40 Function Relay	[36/37] Control word bit 11/12
Parameter 8-03 Control Word Timeout Time	1 s
Parameter 8-04 Control Word Timeout Function	[2] Stop
Parameter 8-10 Control Word Profile	[0] FC Profile
Parameter 8-50 Coasting Select	[1] Bus
Parameter 8-51 Quick Stop Select	[1] Bus
Parameter 8-52 DC Brake Select	[1] Bus
Parameter 8-53 Start Select	[1] Bus
Parameter 8-54 Reversing Select	[2] Logic AND
Parameter 8-55 Set-up Select	[1] Bus
Parameter 8-56 Preset Reference Select	[1] Bus
parameter 12-21 Process Data Config Write	[0] Sub index <i>parameter 16-80 Fieldbus CTW 1</i> [1] Sub index <i>parameter 16-85 FC Port CTW 1</i>
Parameter 12-22 Process Data Config Read	[0] Sub index <i>parameter 16-03 Status Word</i> [1] Sub index <i>parameter 16-05 Main Actual Value [%]</i> [2] Sub index <i>parameter 16-16 Torque [Nm]</i> [3] Sub index <i>parameter 16-60 Digital Input</i>
<i>parameter 12-23 Process Data Config Write Size</i>	[0] Sub index 16 [1] Sub index 16
<i>parameter 12-24 Process Data Config Read Size</i>	[0] Sub index 16 [1] Sub index 16 [2] Sub index 16 [3] Sub index 16

Table 9.2









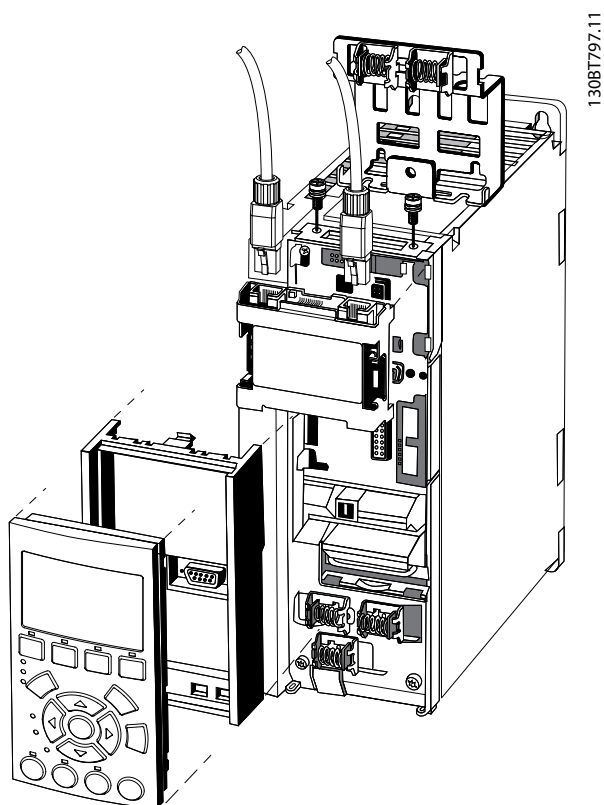


Illustration 10.2

Parameter 15-61 Option SW Version	XML File
1.x	Danfoss_FC_series_ECAT_00 1.XML
1.x or 2.x	Danfoss_FC_series_ECAT_00 20.XML

Table 10.3

If the master is in stop mode, Warning 34 appears. Check that the master is in run mode. If the frequency converter is not in operational state, Warning 34 will appear (60 s after power up or immediately if the frequency converter has been in operational state).

**Check 1: Is the control word valid?**

If bit 10 = 0 in the control word, the frequency converter does not accept the control word.

**Check 2: Is the relationship between bits in the control word and the terminal I/Os correct?**

Check the logical relationship in the frequency converter.

Define the desired logical relationship in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select* according to the following range of options. Select the FC control mode, digital input and/or serial communication, using *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.

If *parameter 8-01 Control Site* is set to digital only, the frequency converter does not react on commands sent via the control word.

Table 10.4 to Table 10.11 show a coast command's effect upon the frequency converter for the full range of *parameter 8-50 Coasting Select* settings.

The effect of control mode upon the function of *parameter 8-50 Coasting Select*, *parameter 8-51 Quick Stop Select*, and *parameter 8-52 DC Brake Select* is as follows:

If [0] *Digital input* is selected, the terminals control the coast and DC brake functions.

**NOTICE**

Coasting, quick stop, and DC brake functions are active for logic 0.

Terminal	Bits 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	Coast/DC brake/Q-Stop
1	0	No Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.4 [0] Digital Input

If [1] *Serial communication* is selected, commands are activated only when given via serial communication.

Terminal	Bits 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	No Coast/DC brake/Q-Stop
1	0	Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.5 [1] Serial Communication

If [2] *Logic AND* is selected, both signals must be activated to perform the function.

Terminal	Bits 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	No Coast/DC brake/Q-Stop
1	0	No Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.6 [2] Logic AND

If [3] *Logic OR* is selected, activation of one signal activates the function.

Terminal	Bits 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	Coast/DC brake/Q-Stop
1	0	Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.7 [3] Logic OR

The effect of control mode upon the function of *parameter 8-53 Start Select* and *parameter 8-54 Reversing Select*:

If [0] *Digital input* is selected, the terminals control the start and reversing functions.

Terminal	Bits 06/15	Function
0	0	Stop/Counterclockwise
0	1	Stop/Counterclockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 10.8 [0] Digital input

If [1] *Serial communication* is selected, commands are activated only when given via serial communication.

Terminal	Bits 02/03/04	Function
0	0	Stop/Counterclockwise
0	1	Start/Clockwise
1	0	Stop/Counterclockwise
1	1	Start/Clockwise

Table 10.9 [1] Serial Communication

If [2] *Logic AND* is selected, both signals must be activated to perform the function.

Terminal	Bits 02/03/04	Function
0	0	Stop/Counterclockwise
0	1	Stop/Counterclockwise
1	0	Stop/Counterclockwise
1	1	Start/Clockwise

Table 10.10 [2] Logic AND

If [3] *Logic OR* is selected, activation of one signal activates the function.

Terminal	Bits 02/03/04	Function
0	0	Stop/Counterclockwise
0	1	Start/Clockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 10.11 [3] Logic OR

The effect of control mode upon the function of *parameter 8-55 Set-up Select* and *parameter 8-56 Preset Reference Select*:

If [0] *Digital input* is selected, the terminals control the set-up and preset reference functions.

Terminal		Bits 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. set-up number
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	2
0	1	0	1	2
0	1	1	0	2
0	1	1	1	2
1	0	0	0	3
1	0	0	1	3
1	0	1	0	3
1	0	1	1	3
1	1	0	0	4
1	1	0	1	4
1	1	1	0	4
1	1	1	1	4

Table 10.12 [0] Digital Input

If [1] *Serial communication* is selected, commands are activated only when given via serial communication.

Terminal		Bits 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. set-up number
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	1
0	1	0	1	2
0	1	1	0	3
0	1	1	1	4
1	0	0	0	1
1	0	0	1	2
1	0	1	0	3
1	0	1	1	4
1	1	0	0	1
1	1	0	1	2
1	1	1	0	3
1	1	1	1	4

Table 10.13 [1] Serial Communication

If [2] *Logic AND* is selected, both signals must be activated to perform the function.

Terminal		Bits 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. set-up number
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	2
0	1	1	0	1
0	1	1	1	2
1	0	0	0	1
1	0	0	1	1
1	0	1	0	3
1	0	1	1	3
1	1	0	0	1
1	1	0	1	2
1	1	1	0	3
1	1	1	1	4

Table 10.14 [2] Logic AND

If [3] Logic OR is selected, activation of 1 signal activates the function.

Terminal		Bits 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. set-up number
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	2
0	1	0	1	2
0	1	1	0	4
0	1	1	1	4
1	0	0	0	3
1	0	0	1	4
1	0	1	0	3
1	0	1	1	4
1	1	0	0	4
1	1	0	1	4
1	1	1	0	4

Table 10.15 [3] Logic OR

### 10.1.3 Alarm and Warning Words

Alarm word, Warning word, and EtherCAT warning word are shown in the display in Hex format. If there is more than one warning or alarm, a sum of all warnings or alarms is shown. Alarm word, warning word, and EtherCAT warning word can also be displayed using the serial bus in *parameter 16-90 Alarm Word*, *parameter 16-92 Warning Word*, and *parameter 12-59 EtherCAT Status*.

Bit (Hex)	Unit diagnose bit	Alarm word ( <i>parameter 16-90 Alarm Word</i> )	Alarm no.
00000001	48	Brake check	28
00000002	49	Power card over temperature	29
00000004	50	Earth fault	14
00000008	51	Control card over temperature	65
00000010	52	Control word timeout	18
00000020	53	Over current	13
00000040	54	Torque limit	12
00000080	55	Motor thermistor over temp.	11
00000100	40	Motor ETR over temperature	10
00000200	41	Inverter overloaded	9
00000400	42	DC link under voltage	8
00000800	43	DC link over voltage	7
00001000	44	Short circuit	16
00002000	45	Inrush fault	33
00004000	46	Mains phase loss	4
00008000	47	AMA not OK	50
00010000	32	Live zero error	2
00020000	33	Internal fault	38
00040000	34	Brake overload	26
00080000	35	Motor phase U is missing	30
00100000	36	Motor phase V is missing	31
00200000	37	Motor phase W is missing	32
00400000	38	Fieldbus comm. fault	34
00800000	39	24 V supply fault	47
01000000	24	Mains failure	36
02000000	25	1.8 V supply fault	48
04000000	26	Brake resistor short circuit	25
08000000	27	Brake chopper fault	27
10000000	28	Option change	67
20000000	29	Drive initialisation	80
40000000	30	Safe stop	68
80000000	31	Mechanical brake low	63

Table 10.16

Bit (Hex)	Unit diagnose bit	Warning word (parameter 16-92 Warning Word)	Alarm no.
00000001	112	Brake check	28
00000002	113	Power card over temperature	29
00000004	114	Earth fault	14
00000008	115	Control card	65
00000010	116	Control word timeout	18
00000020	117	Over current	13
00000040	118	Torque limit	12
00000080	119	Motor thermistor over temp.	11
00000100	104	Motor ETR over temperature	10
00000200	105	Inverter overloaded	9
00000400	106	DC link under voltage	8
00000800	107	DC link over voltage	7
00001000	108	DC link voltage low	6
00002000	109	DC link voltage high	5
00004000	110	Mains phase loss	4
00008000	111	No motor	3
00010000	96	Live zero error	2
00020000	97	10 V low	1
00040000	98	Brake overload	26
00080000	99	Brake resistor short circuit	25
00100000	100	Brake chopper fault	27
00200000	101	Speed limit	49
00400000	102	Fieldbus comm. fault	34
00800000	103	24 V supply fault	47
01000000	88	Mains failure	36
02000000	89	Current limit	59
04000000	90	Low temperature	66
08000000	91	Voltage limit	64
10000000	92	Encoder loss	61
20000000	93	Output frequency limit	62
40000000	94	Unused	-
80000000	95	Warning word 2 (ext. stat. word)	-

Table 10.17

Bit (Hex)	Unit diagnose bit	PROFIBUS warning word (parameter 9-53 Profibus Warning Word)
00000001	160	Connection with DP-master is not ok
00000002	161	Unused
00000004	162	FDL (Fieldbus Data link Layer) is not ok
00000008	163	Clear data command received
00000010	164	Actual value is not updated
00000020	165	Baudrate search
00000040	166	PROFIBUS ASIC is not transmitting
00000080	167	Initialising of PROFIBUS is not ok
00000100	152	Drive is tripped
00000200	153	Internal CAN error
00000400	154	Wrong configuration data from PLC
00000800	155	Wrong ID sent by PLC
00001000	156	Internal error occurred
00002000	157	Not configured
00004000	158	Timeout active
00008000	159	Warning 34 active

Table 10.18

Bit (Hex)	Comm. option STW (parameter 16-84 Comm. Option STW)
00000001	parameterization ok
00000002	configuration ok
00000004	clearmode active
00000008	baudrate search
00000010	waiting for parameterization
00000020	waiting for configuration
00000040	in data exchange
00000080	not used
00000100	not used
00000200	not used
00000400	not used
00000800	MCL2/1 connected
00001000	MCL2/2 connected
00002000	MCL2/3 connected
00004000	data transport active
00008000	not used

Table 10.19

## NOTICE

Parameter 16-84 Comm. Option STW is not part of extended diagnosis.

There is a clear distinction between alarms and warnings. An alarm make the frequency converter enter a fault condition. After the cause for the alarm has been cleared, the master will have to acknowledge the alarm message before the frequency converter can start operating again. A warning condition triggers a warning which disappears when condition returns to normal, without interfering with the process.

**Warnings**

A single bit within a warning word represents warnings within the frequency converter. Bit status *[0] False* means no warning, while bit status *[1] True* means warning. Any bit change in the warning word is notified by a change of bit 7 in the status word.

**Alarms**

Following an alarm message, the frequency converter enters fault condition. When the fault has been removed and the controller has acknowledged the alarm message by setting bit 7 in the control word, the frequency converter resumes operation. A single bit within an alarm word represents alarms within the frequency converter. Bit status *[0] False* means no fault, while bit status *[1] True* means fault.

## 11 Warnings and Alarms

### 11.1 Status Messages

#### 11.1.1 Warning and Alarm Messages

The LEDs on the LCP signal a warning or an alarm. A code in the display is also shown.

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

An alarm makes the frequency converter trip. Alarms must be reset to restart operation once their cause has been rectified.

##### 3 ways of resetting alarms

- By pressing [Reset].
- Via a digital input with the reset function.
- Via serial communication/optional fieldbus.

#### NOTICE

After a manual reset pressing [Reset], press [Auto On] to restart the motor.

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 can be reset as described once the cause has been rectified.

Alarms that are not trip locked can also be reset using the automatic reset function in *parameter 14-20 Reset Mode*. (Warning: automatic wake-up is possible).

When a warning or alarm is marked against a code in *Table 11.1*, this means that either a warning occurs before an alarm, or that it is possible to specify whether it is a warning or an alarm that is shown for a given fault.

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

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If an alarm cannot be reset, the reason could be that its cause has not been rectified, or the alarm is triplocked (see also *Table 11.1*).

#### 11.1.2 Alarm and Warning List

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
1	10 V low	X			
2	Live zero error	(X)	(X)		<i>Parameter 6-01 Live Zero Timeout Function</i>
3	No motor	(X)			<i>Parameter 1-80 Function at Stop</i>
4	Mains phase loss	(X)	(X)	(X)	<i>Parameter 14-12 Function at Mains Imbalance</i>
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC overvoltage	X	X		
8	DC undervoltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR overtemperature	(X)	(X)		<i>Parameter 1-90 Motor Thermal Protection</i>
11	Motor thermistor overtemperature	(X)	(X)		<i>Parameter 1-90 Motor Thermal Protection</i>
12	Torque limit	X	X		
13	Overcurrent	X	X	X	
14	Earth fault	X	X	X	
15	Hardware mismatch		X	X	

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
16	Short circuit		X	X	
17	Control word time-out	(X)	(X)		Parameter 8-04 Control Word Timeout Function
22	Hoist mech. brake				
23	Internal fan fault	X			
24	External fan fault	X			Parameter 14-53 Fan Monitor
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		Parameter 2-13 Brake Power Monitoring
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		Parameter 2-15 Brake Check
29	Heat sink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	Parameter 4-58 Missing Motor Phase Function
31	Motor phase V missing	(X)	(X)	(X)	Parameter 4-58 Missing Motor Phase Function
32	Motor phase W missing	(X)	(X)	(X)	Parameter 4-58 Missing Motor Phase Function
33	Inrush fault		X	X	
34	Fieldbus communication fault	X	X		
36	Mains failure	X	X		
38	Internal fault		X	X	
39	Heat sink sensor		X	X	
40	Overload of digital output terminal 27	(X)			Parameter 5-00 Digital I/O Mode, parameter 5-01 Terminal 27 Mode
41	Overload of digital output terminal 29	(X)			Parameter 5-00 Digital I/O Mode, parameter 5-02 Terminal 29 Mode
42	Overload of digital output on X30/6	(X)			Parameter 5-32 Term X30/6 Digi Out (MCB 101)
42	Overload of digital output on X30/7	(X)			Parameter 5-33 Term X30/7 Digi Out (MCB 101)
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			
61	Tracking error	(X)	(X)		Parameter 4-30 Motor Feedback Loss Function
62	Output frequency at maximum limit	X			
63	Mechanical brake low		(X)		Parameter 2-20 Release Brake Current
64	Voltage limit	X			
65	Control board overtemperature	X	X	X	
66	Heat sink temperature low	X			
67	Option configuration has changed		X		

Number	Description	Warning	Alarm/trip	Alarm/trip lock	Parameter reference
68	Safe stop	(X)	(X) <sup>1)</sup>		Parameter 5-19 Terminal 37 Safe Stop
69	Pwr. card temp		X	X	
70	Illegal FC configuration			X	
71	PTC 1 safe stop	X	X <sup>1)</sup>		Parameter 5-19 Terminal 37 Safe Stop
72	Dangerous failure			X <sup>1)</sup>	Parameter 5-19 Terminal 37 Safe Stop
73	Safe stop auto restart				
77	Reduced power mode	X			Parameter 14-59 Actual Number of Inverter Units
79	Illegal PS config		X	X	
80	Frequency converter Initialised to default value		X		
81	CSIV corrupt				
82	CSIV parameter error				
85	Profibus/Profisafe error				
90	Encoder loss	(X)	(X)		Parameter 17-61 Feedback Signal Monitoring
91	Analogue input 54 wrong settings			X	S202
100-199	See Operating Instructions for MCO 305				
243	Brake IGBT	X	X		
244	Heat sink temp	X	X	X	
245	Heat sink sensor		X	X	
246	Pwr.card supply		X	X	
247	Pwr.card temp		X	X	
248	Illegal PS config		X	X	
250	New spare part			X	Parameter 14-23 Typecode Setting
251	New type code		X	X	

Table 11.1 Alarm/Warning Code List

(X) Dependent on parameter

1) Cannot be auto reset via parameter 14-20 Reset Mode

A trip is the action when an alarm has appeared. The trip coasts the motor and can be reset by pressing [Reset] or by making a reset by a [1] digital input (Parameter group 5-1\* Digital I/O Mode ). The event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, that can damage the frequency converter or connected parts. A trip lock situation can only be reset by a power cycling.

Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

Table 11.2 LED Indication



Bit	Hex	Dec	Alarm word	Alarm word 2	Warning word	Warning word 2	Extended status word
0	00000001	1	Brake check	ServiceTrip, Read/Write	Brake check		Ramping
1	00000002	2	Pwr. card temp	ServiceTrip, (reserved)	Pwr. card temp		AMA running
2	00000004	4	Earth fault	ServiceTrip, Typecode/ Sparepart	Earth fault		Start CW/CCW
3	00000008	8	Ctrl.card temp	ServiceTrip, (reserved)	Ctrl.card temp		Slow down
4	00000010	16	Ctrl. word TO	ServiceTrip, (reserved)	Ctrl. word TO		Catch up
5	00000020	32	Overcurrent		Overcurrent		Feedback high
6	00000040	64	Torque limit		Torque limit		Feedback low
7	00000080	128	Motor Th over		Motor Th over		Output current high
8	00000100	256	Motor ETR over		Motor ETR over		Output current low
9	00000200	512	Inverter overld.		Inverter overld.		Output freq high
10	00000400	1024	DC undervolt		DC undervolt		Output freq low
11	00000800	2048	DC overvolt		DC overvolt		Brake check OK
12	00001000	4096	Short circuit		DC voltage low		Braking max
13	00002000	8192	Inrush fault		DC voltage high		Braking
14	00004000	16384	Mains ph. loss		Mains ph. loss		Out of speed range
15	00008000	32768	AMA not OK		No motor		OVC active
16	00010000	65536	Live zero error		Live zero error		AC brake
17	00020000	131072	Internal fault	KTY error	10 V low	KTY Warn	Password timelock
18	00040000	262144	Brake overload	Fans error	Brake overload	Fans Warn	Password protection
19	00080000	524288	U phase loss	ECB error	Brake resistor	ECB Warn	
20	00100000	1048576	V phase loss		Brake IGBT		
21	00200000	2097152	W phase loss		Speed limit		
22	00400000	4194304	Fieldbus fault		Fieldbus fault		Unused
23	00800000	8388608	24 V supply low		24 V supply low		Unused
24	01000000	16777216	Mains failure		Mains failure		Unused
25	02000000	33554432	1.8 V supply low		Current limit		Unused
26	04000000	67108864	Brake resistor		Low temp		Unused
27	08000000	134217728	Brake IGBT		Voltage limit		Unused
28	10000000	268435456	Option change		Encoder loss		Unused
29	20000000	536870912	Drive Initialised		Output freq. lim.		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	Dangerous failure (A72)	Extended status word		Unused

Table 11.3 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 *parameter 16-94 Ext. Status Word*.

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