MAKING MODERN LIVING POSSIBLE

Operating Instructions

MCA 123 POWERLINK

VLT®
THE REAL DRIVE

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.

Safety Note

⚠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.

Safety Regulations

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.

Warning against Unintended Start

1. The motor can be brought to a stop with bus commands while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, there is a risk that motor starts.

3. A motor that has been stopped, can start if faults occur in the electronics of the frequency converter, or if a temporary overload, or a fault in the supply mains, or the motor connection ceases.

⚠WARNING

ELECTRICAL HAZARD

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

Contents

1 Introduction

1.1.1 About this Manual

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

1 Introduction

2 How to Install

3 How to Configure

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

4 Configure the Master

5 How to Control the Frequency Converter

7 Parameters

8 Application Examples

9 Troubleshooting

Terminology
In this manual the term Ethernet is used to describe the physical layer of the network and does not relate to the application protocol.

1.1.2 Assumptions

These operating instructions are under the conditions that the Danfoss POWERLINK option is used with a Danfoss VLT® AutomationDrive 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.

1.1.3 Hardware

This manual relates to the POWERLINK option MCA 123, type no. 130B5546 (uncoated) and 130B5646 (conformal coated).

1.1.4 Background Knowledge

The Danfoss POWERLINK Option Card is designed to communicate with any system complying with the POWERLINK 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.

1.1.5 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 EtherNet/IP Operating Instructions*.
- The *MCA 120 PROFINET Operation Instructions*.
- The *MCA 124 EtherCAT Operation Instructions*.
- The *MCA 123 Modbus TCP Operation Instructions*.

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

1.1.6 Abbreviations

1

Abbre-viation	Definition
API	Actual Packet Interval
ASnd	AsynchronousSend
CC	Control Card
CTW	Control Word
DCP	Discovery and Configuration Protocol
DHCP	Dynamic Host Configuration Protocol Configuration
EMC	Electromagnetic Compatibility
I/O	Input/Output
IP	Internet Protocol
PDO	Process Data Object
LCP	Local Control Panel
LED	Light Emitting Diode
LSB	Least Significant Bit
MAV	Main Actual Value (actual output)
MN	Managing Node
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)
SDO	Service Data Object
SoC	Start Of Cycle Frame
SoA	Start Of Asynchronous
STW	Status Word

Table 1.1 Overview of Abbreviations

2 How to Install

2.1 Installation

2.1.1 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 Series. This frame is deeper than the standard frame to allow space for the fieldbus option beneath
- Strain relief (only for A1 and A2 enclosures)

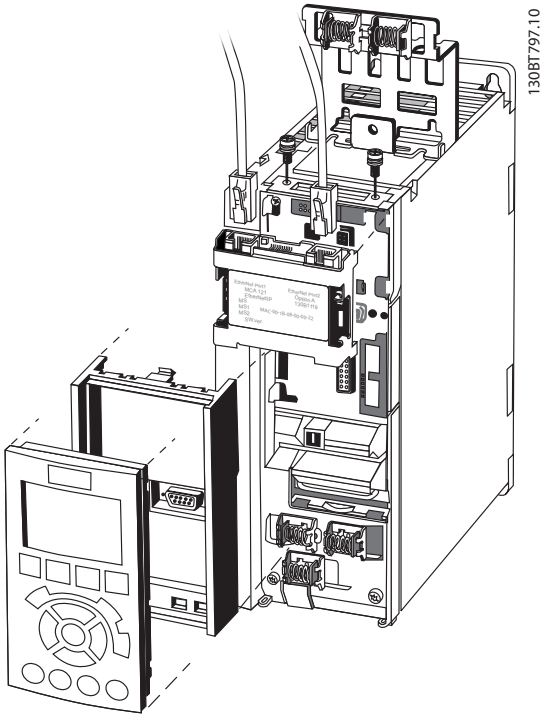

Illustration 2.1 Fieldbus Option Adaption Frame

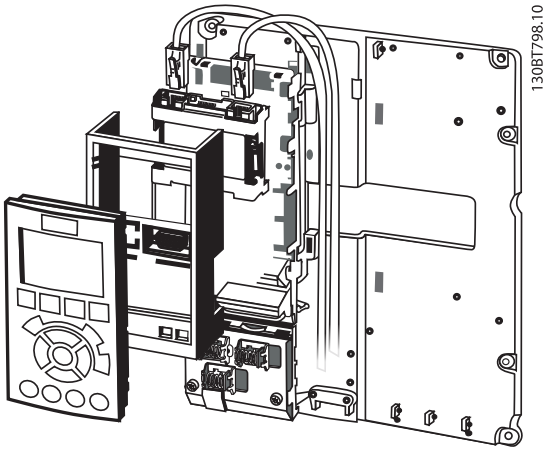

Illustration 2.2 Strain Relief for A1 and A2 Enclosures

Instructions

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

NOTE

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.

NOTE

After installing the MCA 123 POWERLINK option, set *8-01 Control Site* to: *[2] Control word only* or *[0] Digital and ctrl. word*.
8-02 Control Word Source to: *[3] Option A*

2.1.2 Network

It is important that the media chosen for Ethernet data transmission meets the required properties. Usually CAT 5e and six cables are recommended for industrial applications. Both types are available as Unshielded Twisted Pair and Shielded Twisted Pair. Generally, shielded cables are recommended for use in industrial environments and with frequency converters.
A maximum cable-length of 100 m is allowed between network devices.

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2.1.3 POWERLINK Cables

Cable type	Specification
Ethernet standard	Standard Ethernet (in accordance with IEEE 802.3), 100Base-TX (Fast Ethernet)
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 2.1 Specification of POWERLINK Cables

2.1.4 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 POWERLINK option:

LED label	Description
Status/Error	Module Status, reflects the activity on the POWERLINK slave.
Link/Collision Port 1	Link/Collision Port 1, reflects the activity on the POWERLINK port 1.
Link/Collision Port 2	Link/Collision Port 2, reflects the activity on the POWERLINK port 2.

Table 2.2 LEDs

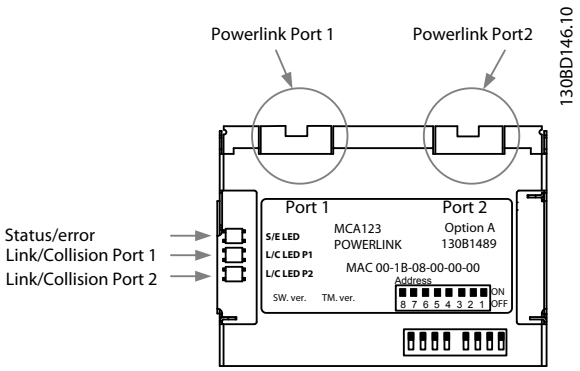

Illustration 2.3 Overview of the Option

S/E LED

Power OFF or state	LED
NMT_GS NMT_GS_INITIALISATION NMT_CS_NOT_ACTIVE NMT_MS_NOT_ACTIVE	Green:
Device Operational	Green: 
Flickering	
NMT_CS_BASIC_ETHERNET	Green: 
Blinking	
NMT_CS_Stopped	Green: 
Single flash	
NMT_CS_PRE_OPERATIONAL_1 NMT_MS_PRE_OPERATIONAL_1	Green: 
Double flash	
NMT_CS_PRE_OPERATIONAL_2 NMT_MS_PRE_OPERATIONAL_2	Green: 
Triple flash	
NMT_CS_READY_TO_OPERATE NMT_MS_READY_TO_OPERATE	Green: 

Table 2.3 Behaviour of S/E Leds

L/C LED

Power OFF or NO Link	Green:
Link	Green: 

Table 2.4 Behaviour of L/C LEDs

2

2.1.5 Topology

The POWERLINK module features a built-in POWERLINK slave controller and a two port HUB. This module enables the possibility for connecting several POWERLINK options in a line topology. If more than eight frequency converters are connected in line, it will require special attention towards the timing in the network.

It is important in a POWERLINK system, that the connection is done correctly. POWERLINK is based on HUB technology, which means that connecting a none POWERLINK device (for example, personal computer) leads to malfunction of the system.

NOTE

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

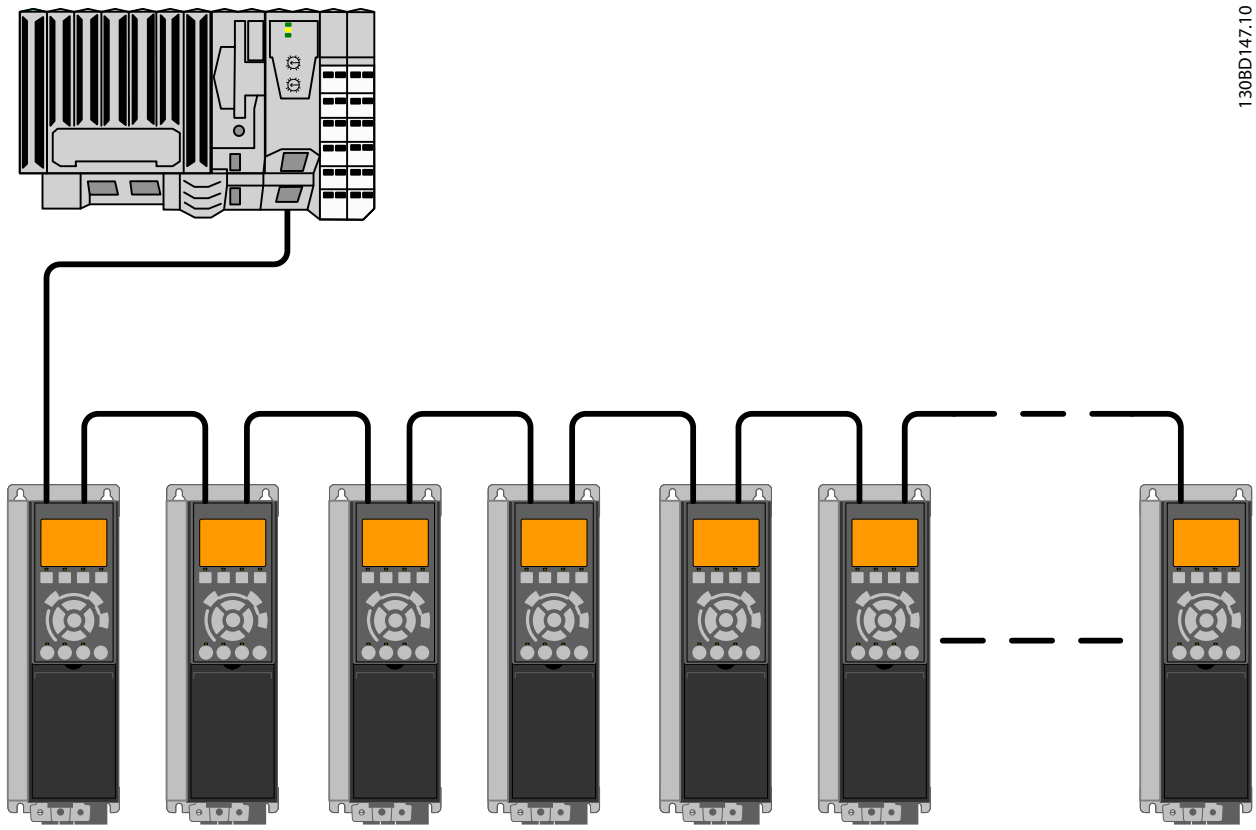

Illustration 2.4 Line Topology

Take care that following design rules are followed

1. Do not connect any non POWERLINK device (for example PC) to any free port as this will cause malfunction of the complete POWERLINK network.
2. In a line topology all frequency converters must be powered, either by mains or by a 24 V DC option cards, for the built-in POWERLINK slave controller to work.
3. To achieve interference-free operation of the Ethernet, observe the following EMC precautions. The correct handling of the motor cable shield is vital for the overall performance of the system. If the rules are not followed it will lead to loss of the control and malfunction of the system. The Ethernet communication cable must be kept away from motor and brake resistor cables to avoid coupling of high frequency noise between the cables. Normally, a minimum distance of 200 mm (8 inches) is sufficient, but maintaining the greatest possible distance between the cables is

recommended, especially where cables run in parallel, over long distances, or if drives with a bigger power size is installed. More information can be found in the norm IEC 61000-5-2:1997.

4. When crossing of cables is unavoidable, the Ethernet cable must cross motor and brake resistor cables at an angle of 90°.
5. Always observe relevant national and local regulations, for example regarding protective earth connection.

NOTE

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 POWERLINK slave controller to work.

2.1.6 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*.

NOTE

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.

NOTE

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°.

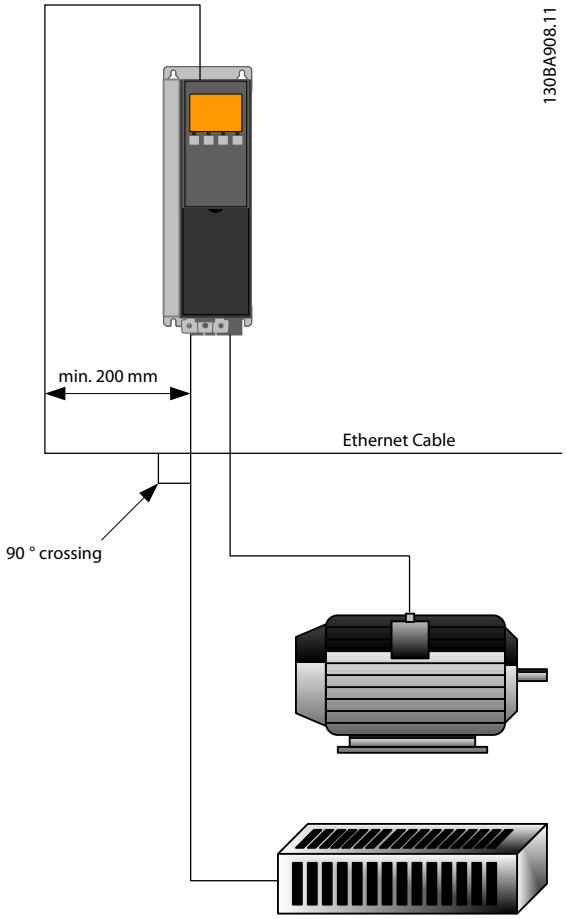

Illustration 2.5 Correct Crossing of Ethernet Cable

3 How to Configure

3.1.1 IP Settings

All IP-related parameters are located in parameter group *12-0* IP Settings*: The parameters are all set to POWERLINK standard values, so no setting is needed. In POWERLINK, the *12-00 IP Address Assignment* is fixed to the selection "From node ID". The IP address does follow the setting in *12-60 Node ID*, so that the IP address is 192.168.100.xxx, where xxx is the node ID. For *12-02 Subnet Mask*, this will be fixed to 255.255.255.0 and can not be changed.

The POWERLINK option offers two ways of IP address assignment via parameter or DIP switch.

3.1.2 Ethernet Link Parameters

Parameter group *12-1* Ethernet Link Parameters* holds Ethernet Link information:

12-10 Link Status

12-11 Link Duration

12-12 Auto Negotiation

12-13 Link Speed

12-14 Link Duplex

Each port has unique Ethernet Link Parameters.

12-10 Link Status displays Link or No Link according to the status of the present port.

12-11 Link Duration displays the duration of the link on the present port. If the link is broken, the counter is reset.

12-12 Auto Negotiation is a feature that enables two connected Ethernet devices to choose common transmission parameters, such as speed and duplex mode. In POWERLINK this feature is fixed to OFF and can not be changed.

12-13 Link Speed - displays the link speed for each port. If no link is present, “None” is displayed. In POWERLINK this feature is fixed to 100 MBaud and can not be changed.

12-14 Link Duplex - displays the duplex mode for each port. In POWERLINK, the Link Duplex is fixed to half Duplex, and cannot be changed.

3.2 Configure the Frequency Converter

3.2.1 VLT Parameters

Pay particular attention to the following parameters when configuring the frequency converter with a fieldbus interface.

- *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 fieldbus interface is disabled.
- After an initial power up, the frequency converter automatically detects whether a fieldbus option is installed in slot A, and sets *8-02 Control Word Source* to [Option A]. Adding, changing, or removing an option from an already commissioned frequency converter does not change *8-02 Control Word Source*. However, it causes a Trip Mode, and the frequency converter displays an error.
- *8-10 Control Word Profile*. Choose between the Danfoss FC Profile and the DS 402 profile. The change of *8-10 Control Word Profile* will first be active at the next powerup.
- *8-50 Coasting Select* to *8-56 Preset Reference Select*. Selection of how to gate fieldbus control commands with digital input command of the control card.

NOTE

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

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

3.3 Configure the POWERLINK Network

All POWERLINK stations that are connected to the same bus network must have a unique Node ID. The Node ID of the frequency converter can be selected via:

- Hardware switches (from version 2.00)
- *12-60 Node ID*

4 Configure the Master

4.1 Importing the XDD File

To configure a POWERLINK Master, the configuration tool needs an XDD file for each type of slave on the network. The XDD file is a text file containing the necessary communications setup data for a slave. Download the XDD file for the FC Series frequency converters at http://www.danfoss.com/BusinessAreas/DrivesSolutions/.

15-61 Option SW Version	File
1.x	FC 301: 0x0200008D_FC301_01.xdd FC 302: 0x0200008D_FC302_01.xdd

Table 4.1 POWERLINK SW Version XDD File

The following steps show how to add a new device to the Automation Studio Tool. For tools from other vendors, consult their relevant manuals.

1. In the Automation Studio, select the menu [Tools] and [Import Fieldbus Device].

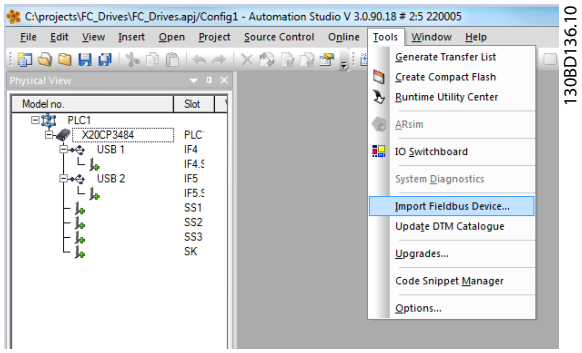

Illustration 4.1 Automation Studio

2. Select the XDD file and the Automation studio, imports it to its library. Use the [Save All] menu or the multiple floppy disc icon to save the new info.

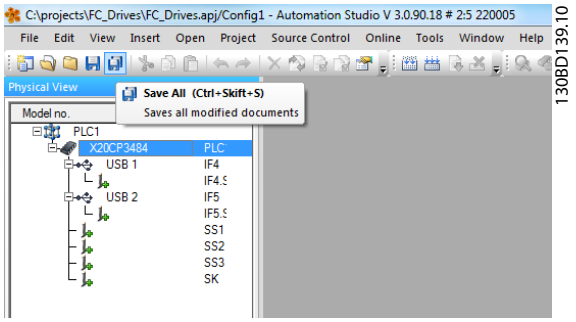

Illustration 4.2 Selecting the XDD File

4.2 Setting Up the Master

Select the POWERLINK I/O master to open the POWERLINK interface in the Automation Studio Master.

1. Right click and select [Open POWERLINK].

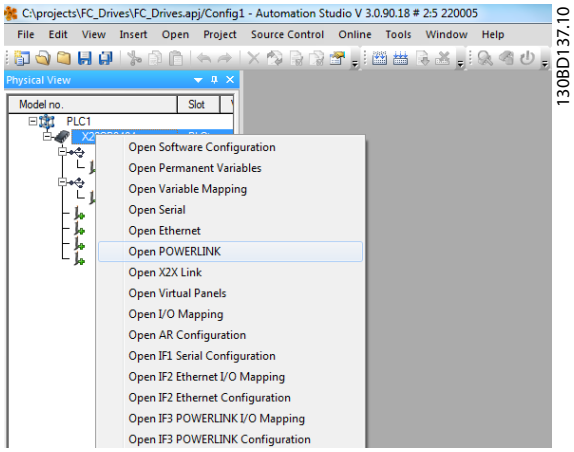

Illustration 4.3 Open POWERLINK

2. Right click the network icon, and select [Insert].

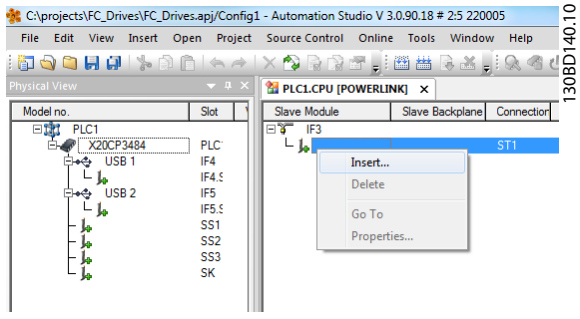

Illustration 4.4 Physical View

3. Select [Danfoss FC 302].

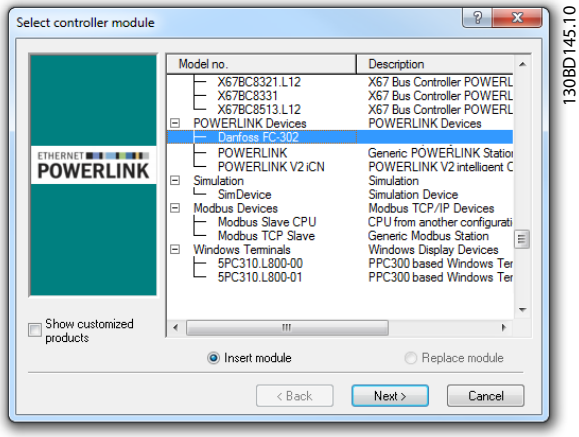

Illustration 4.5 Select Controller Module

Danfoss FC Series is inserted in the POWERLINK master system.

4. Configure the I/O configuration, right click on the Danfoss Icon and select [Open I/O Configuration].

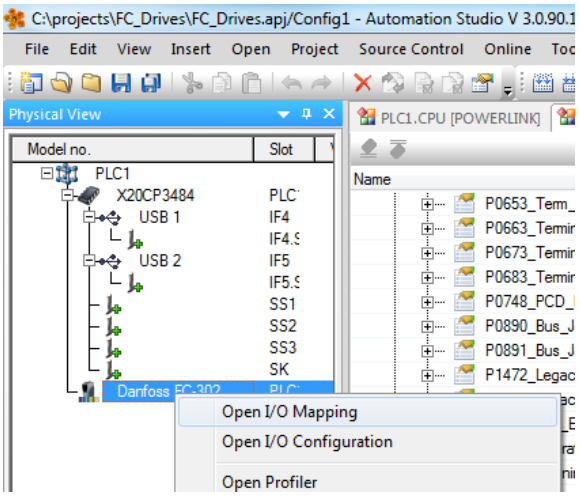

Illustration 4.6 I/O Configuration

5. By default the POWERLINK option does not have any process data assigned to its I/O mapping. This is done by selecting the channels (FC Parameter) as read or write. By selection the [+] sign in front of the channel menu, the list is expanded and the parameters can be selected. In this example following has been selected:
   - Object 2690 fieldbus control word 1
   - Object 2692 fieldbus reference 1
   - Object 2643 status word
   - Object 2645 main actual value

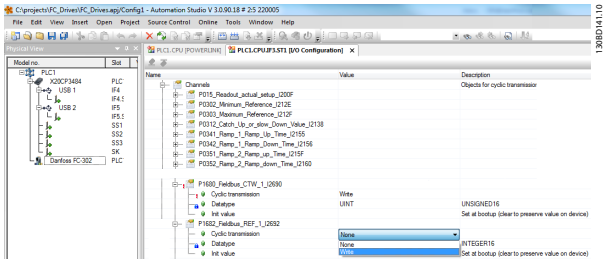

Illustration 4.7 Select Parameters

NOTE

Make sure that maximum ten channels are selected in each direction; or the PLC enters into an endless restart of the network.

6. The POWERLINK configuration does now contain the Danfoss FC Series frequency converter as its slave and communicates with the four words. The final step is to map the I/Os to PLC variables, which is done in the I/O mapping. This is selected via a right click on the [Danfoss FC 302] icon and select [Open I/O Mapping].

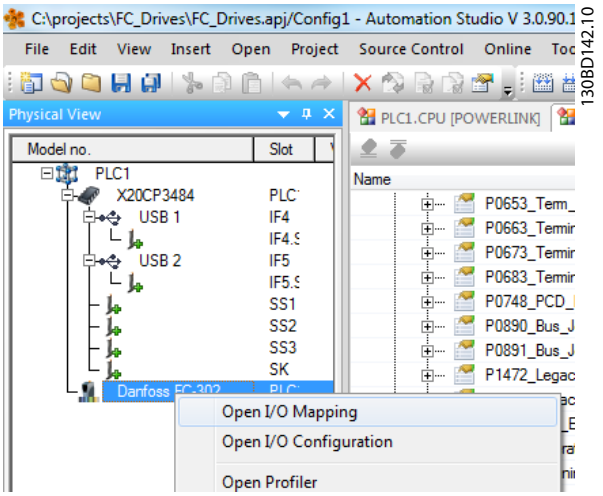

Illustration 4.8 Mapping the I/Os ot the PLC Variables

The mapping can now be done directly to previous defined variables.

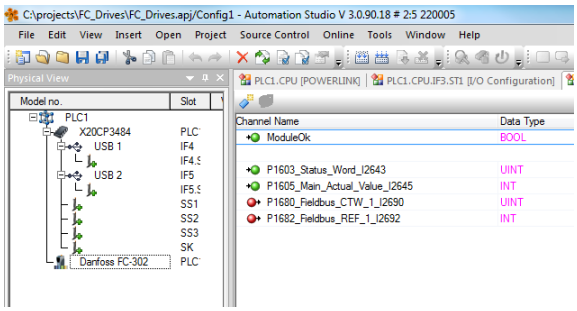

Illustration 4.9 Previous Defined Variables

Variables can also be directly declared, via selecting the Channel Name for each signal and enter the attributes directly.

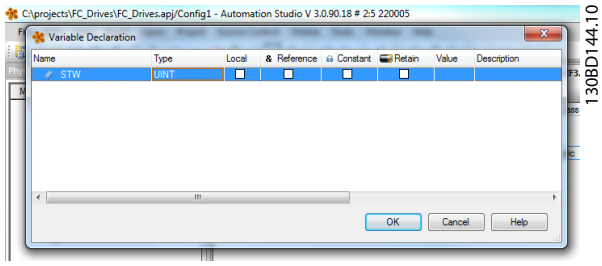

Illustration 4.10 Variables Directly Declared

This does insert the Danfoss FC 302 into the B&R system, and the frequency converter can now be controlled and supervised via the POWERLINK.

5 How to Control the Frequency Converter

5.1 PDO Communication

The VLT® AutomationDrive uses the following profiles:

- Frequency converter profiles
- CANopen DS 402 profile

For each of the two profiles there is a set of SDO objects that is only accessible if the profile is activated in *8-10 Control Word Profile*. The change will first be active at the next power up. The PDO communication has to be configured, where a subset of SDOs can be mapped into PDOs for cyclic communication.

PDO communication is reserved for high speed cyclic access to parameters for control and status of the frequency converter. The PLC sends out process control data, and the frequency converter responds with a PDO containing process status data. In the Danfoss POWERLINK interface both PDOs can be freely be configured.

Select the signals for transmission from the master to the frequency converter via the PLCs configuration tool. *12-21 Process Data Config Write*, *12-22 Process Data Config Read* and *12-23 Process Data Config Write Size* will be set from the PLC and can be used to control if the configuration has been sent correctly from the PLC.

The POWERLINK option has only one PDO available: PDO 23. The PDO 23 is flexible in size and is adjustable 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.

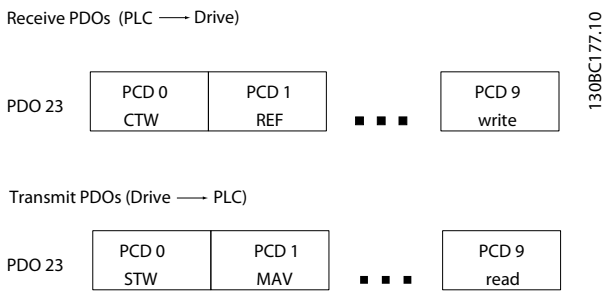

Illustration 5.1 Standard Telegram

5.2 Process Data

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

5.2.1 Process Control Data

The example in *Table 5.1* 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.

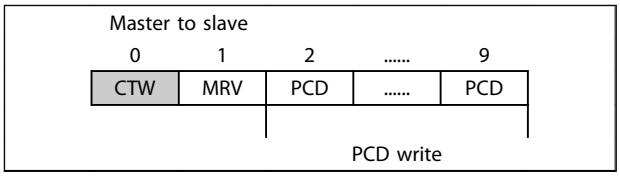

Table 5.1 Process Control Data (PCD)

PCD 0 contains a 16-bit control word where each bit controls a specific function of the frequency converter, see *5.3 Control Profile*. PCD 1 contains a 16-bit speed set point in percentage format. See *5.2.3 Reference Handling*.

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

5.2.2 Process Status Data

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

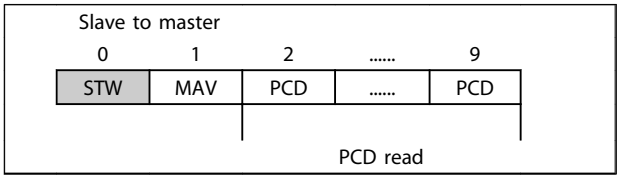

Table 5.2 Process Status Data

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 *5.2.3 Reference Handling*).

5.2.3 Reference Handling

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

For more information on reference handling, refer to the *FC Series Design Guide*.

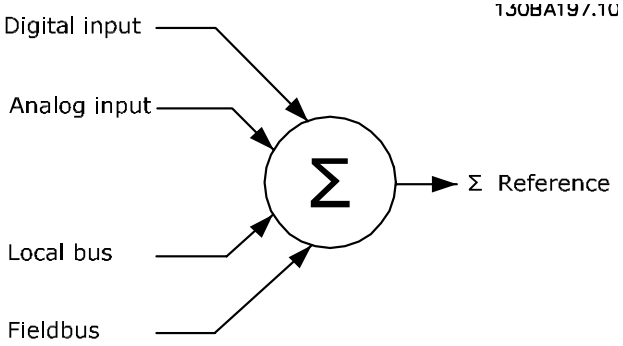

Illustration 5.2 Reference Handling

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

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

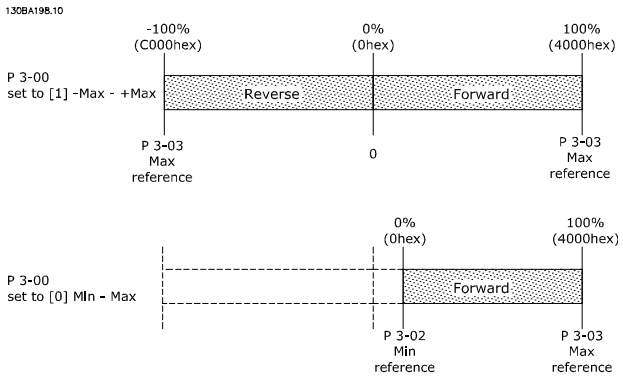

Illustration 5.3 Scaling of MAV and Reference

NOTE

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

The speed limit settings are depending on *0-02 Motor Speed Unit* and can be set to RPM or Hz. If *0-02 Motor Speed Unit* is set to RPM: The speed limit parameters *4-11 Motor Speed Low Limit [RPM]* and *4-13 Motor Speed High Limit [RPM]* limit the actual frequency converter output. If *0-02 Motor Speed Unit* set to Hz: The speed limit parameters *4-12 Motor Speed Low Limit [Hz]* and *4-14 Motor Speed High Limit [Hz]* limit the actual frequency converter output.

4-19 Max Output Frequency limits the maximum output and can also influence the maximum speed of the motor.

For reference and MAV formats, see *Table 5.3*.

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 5.3 Reference and MAV Formats

NOTE

Negative numbers are formed as a complement of two.

NOTE

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

1-00 Configuration Mode set to *[0] Speed open loop*.
3-00 Reference Range set to *[0] Min - Max*.
3-02 Minimum Reference set to 100 RPM.
3-03 Maximum Reference set to 3000 RPM.

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 5.4

5.2.4 Process Control Operation

In process control operation *1-00 Configuration Mode* is set to *[3] Process*.
The reference range in *3-00 Reference Range* is always *[0] Min-Max*.
- MRV represents the process setpoint.
- MAV expresses the actual process feedback (range ±200%).

5.2.5 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 *8-50 Coasting Select* to *8-56 Preset Reference Select*.

NOTE

Note the *8-01 Control Site* overrules the settings in *8-50 Coasting Select* to *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.

5

⚠CAUTION

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

5.3 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 *8-10 Control Word Profile*. The choice of profile affects the control and status word only. The change of *8-10 Control Word Profile* will first be activated at the next power up.

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. If the frequency converter is run in DS 402 profile, the DS 402 profile must be selected (for example, by *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.

5.4 Danfoss FC Control Profile

5.4.1 Control Word according to FC Profile (CTW)

To select Danfoss FC protocol in the control word, *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 5.5 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 *3-10 Preset Reference* according to *Table 5.6*.

NOTE

In *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] *3-10 Preset Reference*
0	1	2	[1] *3-10 Preset Reference*
1	0	3	[2] *3-10 Preset Reference*
1	1	4	[3] *3-10 Preset Reference*

Table 5.6 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 *2-01 DC Brake Current* and *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.

NOTE

In *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 *3-81 Quick Stop Ramp Time*.
Bit 04="1" - the frequency converter ramps the motor speed down to stop via *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 (*5-10 Terminal 18 Digital Input* to *5-15 Terminal 33 Digital Input*) programmed to *Speed up* and *Speed down*.
Bit 05="1" - use ramp.

NOTE

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

- **Bit 03 Coasting stop**
- **Bit 02 DC braking**
- **Digital input (*5-10 Terminal 18 Digital Input* to *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.

NOTE

In *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" - *3-19 Jog Speed [RPM]* determines the output frequency.

Bit 09, Selection of ramp 1/2
Bit 09="0" - ramp 1 is active (*3-40 Ramp 1 Type* to *3-47 Ramp 1 S-ramp Ratio at Decel. Start*).
Bit 09="1" - ramp 2 (*3-50 Ramp 2 Type* to *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 *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 *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 5.7*:

The function is only possible when *Multi-Set-ups* is selected in *0-10 Active Set-up*.

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

Table 5.7 Selection of Set-up

NOTE

In *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.

5.4.2 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 *8 Application Examples* 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 5.8 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 external 24 V 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 *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 *4-11 Motor Speed Low Limit [RPM]* or *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, autostart
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 *4-16 Torque Limit Motor Mode* or *4-17 Torque Limit Generator Mode*.
Bit 14="1" - the torque limits in *4-16 Torque Limit Motor Mode* and *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%.

5.5 DS 402 Control Profile

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

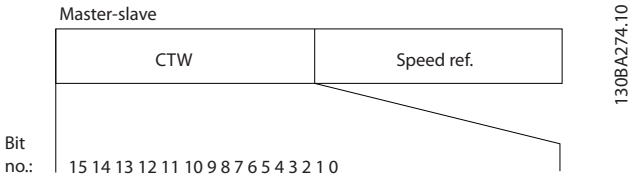

Illustration 5.4 Control Word Profile

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 5.9 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 *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 choosing among the four menu Set-ups in accordance with *Table 5.10*:

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

Table 5.10 Set-up Selection Table

Bit 15, Forward/reversing
Bit 15="0" - no reversing.
Bit 15="1" - reversing.

NOTE

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

5

5.5.2 Status Word According to DS 402 Profile

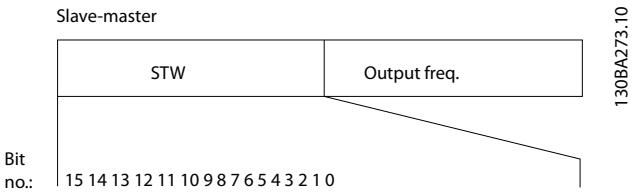

Illustration 5.5 Status Word Profile

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	Not running	Running
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	Reserved	
15	Reserved	

Table 5.11 Definition of Status Bits

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 *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.

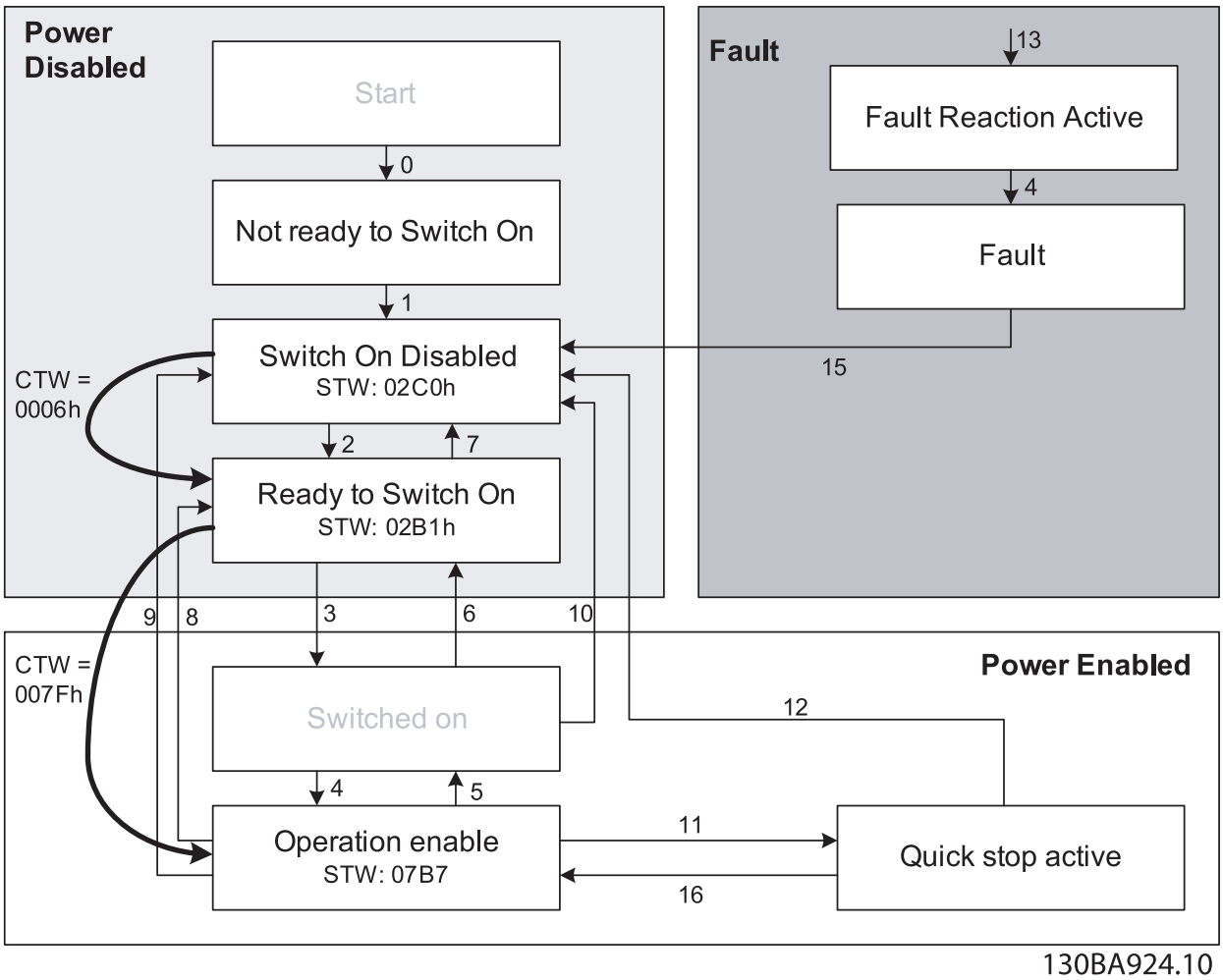

Illustration 5.6 DSP 402 State Machine

5.5.3 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 5.12 DSP 402 State Transitions

5.5.4 Status Word According to DS 402 Profile

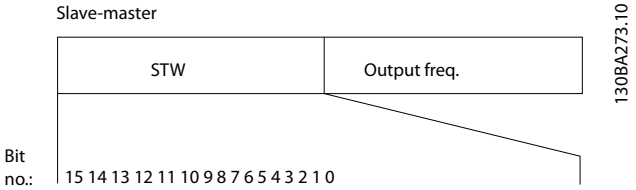

Illustration 5.7 Status Word Profile

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	Not running	Running
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	Reserved	
15	Reserved	

Table 5.13 Definition of Status Bits

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 *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

6 Communication Profile Area

6.1 Description - Communication Profile Area

6.1 Description - Communication Profile Area describes the general layout of the POWERLINK communication area which is supported. The process data objects are defined in this area.

6.2 1000-1FFF Communication Object Area

Index (hex)	Object (symbolic name)	Name	Type	Read/write
1000	VAR	Device type	UNSIGNED32	ro
1001	VAR	Error register	UNSIGNED8	ro
1006	VAR	Communication cycle period	UNSIGNED32	rw
1008	VAR	Manufacturer device name	VISIBLE_STRING	ro
1009	VAR	Manufacturer hardware version	VISIBLE_STRING	ro
100A	VAR	Manufacturer software version	VISIBLE_STRING	ro
1010	ARRAY	Store parameters	UNSIGNED32	rw
1011	ARRAY	Restore default parameters	UNSIGNED32	rw
0x1C14	VAR	DLL_CNLossOfSocTolerance_U32	UNSIGNED32	rw
0x1E40	RECORD	NWL_IpAddrTable_1_REC	NWL_IpAddrTable_TYPE	ro/rw
0x1E4A	RECORD	RECORD NWL_IpGroup_REC	NWL_IpGroup_TYPE	ro/rw
1018	RECORD	Identity object	Identity (23h)	ro
1020	RECORD	CFM_VerifyConfiguration_REC	CFM_VerifyConfiguration_TYPE	ro
1030	RECORD	NMT_InterfaceGroup_0h_REC	NMT_InterfaceGroup_0h_TYPE	ro
1031	RECORD	NMT_InterfaceGroup_1h_REC	NMT_InterfaceGroup_0h_TYPE	ro
1300	VAR	SDO_SequLayerTimeout_U32	UNSIGNED32	rw
1400	RECORD	PDO_RxCommParam_16h_REC	UNSIGNED8	ro
1600	ARRAY	PDO_RxMappParam_00h_AU64	UNSIGNED64	rw
1800	ARRAY	PDO_TxCommParam_16h_REC	UNSIGNED8	ro
1A00	ARRAY	PDO_TxMappParam_00h_AU64	UNSIGNED64	rw
1C0A	RECORD	DLL_CNCollision_REC	UNSIGNED32	rw
1C0B	RECORD	DLL_CNLossSoC_REC	UNSIGNED32	rw
1C0F	RECORD	DLL_CNCRCError_REC	UNSIGNED32	rw
1C14				
1E40				
1E4A				
1F82	VAR	NMT_FeatureFlags_U32	UNSIGNED32	ro
1F83	VAR	NMT_EPLVersion_U8	UNSIGNED8	ro
1F8C	VAR	NMT_CurrNMTState_U8	UNSIGNED8	ro
1F93	RECORD	NMT_EPLNodeID_REC	UNSIGNED8	ro
1F98	VAR	NMT_CycleTiming_REC	UNSIGNED32	ro
1F99	VAR	NMT_CNBasicEthernetTimeout_U32	UNSIGNED32	rw
1F9A	VAR	NMT_HostName_VSTR	VISIBLE_STRING32	rw
1F9E	VAR	NMT_ResetCmd_U8	UNSIGNED8	rw

Index (hex)	Object (symbolic name)	Name	Type	Read/write
2000-5FFF		Vendor specific area	See *6.3 2000-5FFF Danfoss Specific Object Area*	
603F	VAR	Error Code	UNSIGNED16	ro
6040	VAR	Control word	UNSIGNED16	rw
6041	VAR	Status word	UNSIGNED16	ro
6042	VAR	vl_target_velocity	SIGNED16	rw
6043	VAR	vl_velocity_demand	SIGNED16	ro
6044	VAR	vl_velocity_actual_value	SIGNED16	ro
6046	ARRAY	vl_velocity_min_max_amount	UNSIGNED32	ro
6048	RECORD	vl_velocity_acceleration	See description	ro
6049	RECORD	vl_velocity_deceleration	See description	ro
6060	VAR	Modes of operation	SIGNED8	rw
6061	VAR	Modes of operation display	SIGNED8	ro
6502	VAR	Supported drive mode	UNSIGNED32	ro
6504	VAR	Drive manufacture	VISIBLE_STRING	ro

Table 6.1 Communication Object Overview

6.2.1 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)		0=FC Profile 402=DS 402	

Table 6.2 1000h Device Type

6.2.2 1001h Error Register

This object is the error register of the device. Only bit 0 and bit 5 is supported. The two bits is active (high) if a alarm is active in alarm word 1 or alarm word 2.

Bit	Meaning
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communications error (overrun, error state)
5	Device profile specific
6	Reserved (always zero)
7	Manufacturer specific

Table 6.3 1001h Error Register

6.2.3 1006h Communication Cycle Period

This object defines the communication cycle time interval in µs. This object is reset to its default value by object 1011h. This object is set from the MN.

6.2.4 1008h Manufacturer Device Name

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

Index	Meaning
1008h	for example, FC 302

Table 6.4 1008h Manufacturer Device Name

6.2.5 1009h Manufacturer Hardware Version

This object contains the hardware version for the POWERLINK interface.

6.2.6 100Ah Manufacturer Software Version

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

6.2.7 1010h Store Parameters

In the standard configuration, the contents of parameters written via fieldbus are stored in volatile memory. 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. Writing to one of the indexes will set *12-28 Store Data Values*.

Index, sub-index	Meaning
1010h 0	Number sub-index supported
1010h 1	Save option parameters
1010h 2	Save communication option parameters
1010h 3	Reserved

Table 6.5 1010h Store Parameters

Writing the value "save" (0x65766173) to sub-index 1, stores all frequency converter parameters of all set-ups into non-volatile memory, all other values are rejected.

6.2.8 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.

The default value is restored.

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

Table 6.6 1011h Restore Default Parameters

Writing the value "load" (0x64616F6C) restores all frequency converter parameters of all set-ups to factory values, except the communications parameters. All other values are rejected, and abort code 0x08000020 is returned. The frequency converter has to be power cycled before the changes get active and the motor must be in the state coast or stopped.

6.2.9 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 6.7 1018h Identity Object

6.2.10 1020h CFM_VerifyConfiguration_REC

This object contains the devices local configuration date and time. The object values are set by managing node or configuration tool.

Index, sub-index	Meaning
1020h 0	Number of entries
1020h 1	ConfDate_U32, Days since January 1, 1984
1020h 2	ConfTime_U32, milliseconds after midnight
1020h 3	ConfId_U32, assigned by the configuration tool
1020h 4	VerifyConfInvalid_BOOL, Value False indicates that configuration was not modified since last storage of ConfId_U32

Table 6.8 1020h CFM_VerifyConfiguration_REC

6.2.11 1030h NMT_InterfaceGroup_0h_REC

This object is used to configure and retrieve parameters of the network interfaces (physical or virtual) via SDO.

Index, sub-index	Meaning
1030h 0	Number of entries
1030h 1	InterfaceIndex_U16
1030h 2	InterfaceDescription_VSTR t
1030h 3	InterfaceType_U8
1030h 4	InterfaceMtu_U16
1030h 5	InterfacePhysAddress_OSTR
1030h 6	InterfaceName_VSTR
1030h 7	InterfaceOperStatus_U8
1030h 8	InterfaceAdminState_U8
1030h 9	Valid_BOOL

Table 6.9 1030h NMT_InterfaceGroup_0h_REC

6.2.12 1031h NMT_InterfaceGroup_1h_REC

This object is used to configure and retrieve parameters of the network interfaces (physical or virtual) via SDO.

Index, sub-index	Meaning
1031h 0	Number of entries
1031h 1	InterfaceIndex_U16
1031h 2	InterfaceDescription_VSTR t
1031h 3	InterfaceType_U8
1031h 4	InterfaceMtu_U16
1031h 5	InterfacePhysAddress_OSTR
1031h 6	InterfaceName_VSTR
1031h 7	InterfaceOperStatus_U8
1031h 8	InterfaceAdminState_U8
1031h 9	Valid_BOOL

Table 6.10 1031h NMT_InterfaceGroup_1h_REC

6.2.13 1300h SDO_SequLayerTimeout_U32

This object provides a timeout value in [ms] for the connection abort recognition of the SDO sequence Layer. Default value is 30000. This object is linked to *12-62 SDO Timeout*.

6.2.14 1400h PDO_RxCommParam_16h_REC

This object describes attributes of PDO Communication for RPDO. Object indices describe the Node ID and PDO Mapping Version. Mapping Version must be set by configuration tool depending on PDO mapping.

High Nibble	Low Nibble
Main version	Sub version

Table 6.11 Mapping Version Structure

PDOs differing main version will be rejected. PDOs differing sub version is accepted. Mapping version 0 indicates that no mapping version is available.

Index, sub-index	Meaning
1400h 0	Number of sub-index supported
1400h 1	NodeID_U8
1400h 2	MappingVersion_U8

Table 6.12 1400h PDO_RxCommParam_16h_REC

6.2.15 1600h PDO_RxCommParam_00h _AU64

This objects indices describe mapping of object contained in RPDO payload to object dictionary entries.

Index, sub-index	Meaning
1600h 0	Number of sub-index supported
1600h 1	*12-21 Process Data Config Write*, [0] Index
1600h 2	*12-21 Process Data Config Write*, [1] Index
1600h 3	*12-21 Process Data Config Write*, [2] Index
1600h 4	*12-21 Process Data Config Write*, [3] Index
1600h 5	*12-21 Process Data Config Write*, [4] Index
1600h 6	*12-21 Process Data Config Write*, [5] Index
1600h 7	*12-21 Process Data Config Write*, [6] Index
1600h 8	*12-21 Process Data Config Write*, [7] Index
1600h 9	*12-21 Process Data Config Write*, [8] Index
1600h 10	*12-21 Process Data Config Write*, [9] Index

Table 6.13 1600h PDO_RxCommParam_00h _AU64

For every PDO channel up to ten objects can be mapped.

The offset related to the start address of the PDO payload and the length of data is provided for every mapped object.

Octet offset	Name	Description
0-1	Index	Index of the object to be mapped
2	Sub-index	Sub-index of the object to be mapped
3	reserved	
4-5	Offset	Offset related to start of PDO payload (Bit count)
6-7	Length	Length of the mapped object (Bit count)

Table 6.14 Description of Octet Offset

	MSB			
Bits	63 .. 48	47 .. 32	31 .. 24	23 .. 16
Name	Length	Offset	Reserved	Sub-index
Encoding	UNSIGNED16	UNSIGNED16	-	UNSIGNED8
	LSB			
Bits	15 .. 0			
Name	Index			
Encoding	UNSIGNED16			

Table 6.15 Internal Mapping of PDO Mapping Entry

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6.2.16 1800h PDO_TxCommParam_16h_REC

This object describes attributes of PDO Communication for RPDO. Object indices describe the Node ID and PDO Mapping Version. Mapping Version must be set by configuration tool depending on PDO mapping. Access is read/write. Mapping version 0 indicates that no mapping version is available.

Index, sub-index	Meaning
1400h 0	Number of sub-index supported
1400h 1	NodeID_U8
1400h 2	MappingVersion_U8

Table 6.16 1800h PDO_TxCommParam_16h_REC

6.2.17 1A00h PDO_TxMappParam_00h_AU64

This objects indices describe mapping of object contained in RPDO payload to object dictionary entries.

Index, sub-index	Meaning
1A00h0	Number of sub-index supported
1A00h1	12-22 Process Data Config Read, [0] Index
1A00h2	12-22 Process Data Config Read, [1] Index
1A00h3	12-22 Process Data Config Read, [2] Index
1A00h4	12-22 Process Data Config Read, [3] Index
1A00h5	12-22 Process Data Config Read, [4] Index
1A00h6	12-22 Process Data Config Read, [5] Index
1A00h7	12-22 Process Data Config Read, [6] Index
1A00h8	12-22 Process Data Config Read, [7] Index
1A00h9	12-22 Process Data Config Read, [8] Index
1A00h10	12-22 Process Data Config Read, [9] Index

Table 6.17 1A00h PDO_TxMappParam_00h_AU64

For every PDO channel up to ten objects is be mapped.

The offset related to the start address of the PDO payload and the length of data is provided for every mapped object.

Octet offset	Name	Description
0-1	Index	Index of the object to be mapped
2	Sub-index	Sub-index of the object to be mapped
3	Reserved	
4-5	Offset	Offset related to start of PDO payload (Bit count)
6-7	Length	Length of the mapped object (Bit count)

Table 6.18 Description of Octet Offset

Table 6.19 shows.

	MSB			
Bits	63 .. 48	47 .. 32	31 .. 24	23 .. 16
Name	Length	Offset	Reserved	Sub-index
Encoding	UNSIGNED16	UNSIGNED16	-	UNSIGNED8
	LSB			
	15 .. 0			
	Index			
	UNSIGNED16			

Table 6.19 Internal Mapping of PDO Mapping Entry

6.2.18 1C0Ah DLL_CNCollision_REC

This object contains information regarding collisions on the network.

Index, sub-index	Meaning
1C0Ah 0	Number of entries
1C0Ah 1	CumulativeCnt_U32
1C0Ah 2	ThresholdCnt_U32
1C0Ah 3	Threshold_U32

Table 6.20 1C0Ah DLL_CNCollision_REC

6.2.19 1C0Bh DLL_CNLossSoC_REC

This object contains information regarding loss of SoC on the network.

Index, sub-index	Meaning
1C0Bh 0	Number of entries
1C0Bh 1	CumulativeCnt_U32, [0] *12-68 Cumulative Counters*
1C0Bh 2	ThresholdCnt_U32, [0] *12-67 Threshold Counters*
1C0Bh 3	Threshold_U32, [0] *12-66 Threshold*

Table 6.21 1C0Bh DLL_CNLossSoC_REC

6.2.20 1C0Fh DLL_CNCRCError_REC.

This object contains information regarding “CRC Errors” on the network. CumulativeCnt_U32 increases with one each time a CRC error occurs. CumulativeCnt_U32 decrements with one for each cycle without an error. When CumulativeCnt_U32 is equal or larger than ThresholdCnt_U32, the drive issues Warning 34 in the display.

Index, sub-index	Meaning
1C0Fh 0	Number of entries
1C0Fh 1	CumulativeCnt_U32, [5] *12-68 Cumulative Counters*
1C0Fh 2	ThresholdCnt_U32, [5] *12-67 Threshold Counters*
1C0Fh 3	Threshold_U32, [5] *12-66 Threshold*

Table 6.22 1C0Fh DLL_CNCRCError_REC.

6.2.21 1F82 NMT_FeatureFlags_U32

Feature flags indicate communication profile specific properties of the frequency converter.

Bit	Name	Remark
0	Isochronous	
1	SDO by UDP/IP	Not supported
2	SDO by ASnd	
3	SDO by PDO	Not supported
4	NMT Info Services	Not supported
5	Extended NMT State Commands	Not supported
6	Dynamic PDO Mapping	
7	NMT Service by UDP/IP	Not supported
8	Configuration Manager	Not supported
9	Multiplexed Access	
10	NodeID setup by SW	Not supported
11	MN Basic Ethernet Mode	Not supported
12	Routing Type 1 Support	Not supported
13	Routing Type 2 Support	Not supported
14	SDO Read/Write All by Index	Not supported
15	SDO Read/Write Multiple Parameter by Index	Not supported
16..31	Reserved	

Table 6.23 Bit Description

6.2.22 1F83h NMT_ EPLVersion_U8

The object holds the POWERLINK communication profile version that is implemented.

High nibble	Low nibble
POWERLINK Main Version	POWERLINK Sub Version

Table 6.24 Implemented Communication Profile

6.2.23 1F8C NMT_CurrNMTState_U8

This object holds the node's current NMT state.

Binary value	NMT state
0001 1100	NMT_CS_NOT_ACTIVE (Default)
0001 1101	NMT_CS_PRE_OPERATIONAL_1
0101 1101	NMT_CS_PRE_OPERATIONAL_2
0110 1101	NMT_CS_READY_TO_OPERATE
1111 1101	NMT_CS_OPERATIONAL
0100 1101	NMT_CS_STOPPED
0001 1110	NMT_CS_BASIC_ETHERNET

Table 6.25 NMS State

6.2.24 1F93h NMT_EPLNodeID_REC

This object contains drives POWERLINK NodeID.

Index, sub-index	Meaning
1F93h 0	Number of entries
1F93h 1	NodeID_U8, [5] *12-68 Cumulative Counters*
1F93h 2	NodeIDByHW_BOOL, DIP switch reading

Table 6.26 1F93h NMT_EPLNodeID_REC.

6.2.25 1F98h NMT_CycleTiming_REC

This object contains node-specific timing parameters which influence the POWERLINK cycle timing.

Index, sub-index	Meaning	Remark
1F98h 0	Number of entries	
1F98h 1	IsochrTxMax-Payload_U16	Number of transmit bits, 320=10 signals, 32 bit each
1F98h 2	IsochrRxMax-Payload_U16	Number of receive bits, 320=10 signals, 32 bit each
1F98h 3	PResMaxLatency_U32	Latency, fixed to 10 (nS)
1F98h 4	PReqActPayloa-dLimit_U16	Set by MN during config-uration
1F98h 5	PResActPayloa-dLimit_U16	Set by MN during config-uration
1F98h 6	ASndMaxLatency_U32	Latency, fixed to 10 (nS)
1F98h 7	MultiplCycleCnt_U8	Set by MN during config-uration
1F98h 8	AsyncMTU_U16	Configurable in the range of 300 to 1500

Table 6.27 Node-specific Timing Parameters

6.2.26 1F99h NMT_CNBasicEthernetTimeout_U32

This object specifies the time in µs for which the option must wait for SoC before switching to basic Ethernet mode.

Index, sub-index	Meaning	Remark
1F99	NMT_CNBasicEthernet-Timeout_U32	Time in microseconds before switching to basic Ethernet mode. Default 5000000 (5 s) Mapped to *12-63 Basic Ethernet Timeout*

Table 6.28 Basic Ethernet Timeout

6.2.27 1F9Ah NMT_HostName_VSTR _U32

Index, sub-index	Meaning	Meaning
1F9A	NMT_HostName_VSTR	Mapped to *12-08 Host Name*

Table 6.29 DNS Host Name

6.2.28 1F9E NMT_ResetCmd_U8

This object is used to reset the frequency converter, communication or configuration.

Hex value	NMT service
FFh	NMTInvalidService
2Bh	NMTSwReset
28h	NMTResetNode
2Ah	NMTResetConfiguration
29h	NMTResetCommunication

Table 6.30 Reset Command

6.3 2000-5FFF Danfoss Specific Object Area

6.3.1 2000h–5FFFh Vendor Specific Object Area

The area 2000h to 5FFFh holds the indexes for accessing the Danfoss frequency converter 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 *0-01 Language*. The rest of the POWERLINK index follows the same rule, where the frequency converters parameter number plus 2000h gives the POWERLINK index. For example, reading the running hours in *15-01 Running Hours*, is calculated by 2000h + parameter number in hex number=2000h+5DD=index 25DDh. The XDD file only contains a subset of the frequency converters parameters. This subset has the indexes that are required for setting up the PDO communication. All parameters can be read or written via SDO communication from the PLC. *Table 6.31* shows a few indexes and their mapping.

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

Table 6.31 2000h-5FFFh Vendor Specific Object Area

6.4 6000-Device profile Object Area

6.4.1 6000h–9FFFh Standardised Device Profile Area

The area 6000h to 9FFFh holds the indexes specified by the IEC for various device profiles. The Danfoss POWERLINK does support three profiles, FC Profile, MCO, and the DS 402 profile, velocity mode. The profile is selected via *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 *8-10 Control Word Profile*.

Table 6.32 shows the support of indexes, depending on setting of *8-10 Control Word Profile* (Index 6060h)

Index	Name	8-10 Control Word Profile =FC Profile	8-10 Control Word Profile= MCO	8-10 Control Word Profile= DS 402
603Fh	Error code	-	-	√
6040h	Control word	-	-	√
6041h	Status word	-	-	√
6042h	Vl_target_velocity	-	-	√
6043h	Vl_velocity_demand	-	-	√
6044h	Vl_velocity_actual_value	-	-	√
6046h	Vl_velocity_min_max_amount	-	-	√
6048h	Vl_velocity_acceleration	-	-	√
6049h	Vl_velocity_deceleration	-	-	√
6060h	Modes of operation	√	√	√
6061h	Modes of operation display	√	√	√
6502h	Supported frequency converter mode	√	√	√
6504h	Frequency converter manufacture	√	√	√

Table 6.32 6000h-9FFFh Standardised Device Profile Area

6.4.2 603Fh Error Code

Error signaling mechanism is used to signal alarms and events generated on the frequency converter to the MN. The error code consist of 8 byte of data, where: Byte 0 (zero) is a copy of object 1001h. Byte 1 & 2, not used. Byte 3 contains: Bit 0=1, Alarmword 1 has an active Alarm (*16-90 Alarm Word*). Bit 1=1, Alarmword 2 has an active Alarm (Future ext. *16-91 Alarm Word 2*). Bit 2=0, Reserved. Bit 3=1, Warningword 1 has an active Warning (*16-92 Warning Word*). Bit 4=1, Warningword 2 has an active Warning (Future ext. *16-93 Warning Word 2*). Bit 5-7=0, Reserved. Byte 4 and 5, Profile specific. Byte 6 and 7, reserved.

6.4.3 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 *5.5 DS 402 Control Profile*.

6.4.4 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 *5.5 DS 402 Control Profile*.

6.4.5 6042h vl_target_velocity

The vl_target_velocity is the required velocity of the system. The velocity is in RPM.

6.4.6 6043h vl_velocity_demand

The vl_velocity_demand is the velocity of the system after the ramp controller. The velocity is in RPM.

6.4.7 6044h vl_actual_velocity_value

The vl_actual_velocity_value is the velocity at the motor shaft. The velocity is in RPM, and is obtained from *16-17 Speed [RPM]*. The velocity is in RPM.

6.4.8 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 *3-02 Minimum Reference* and *3-03 Maximum Reference*. The readout values in *3-02 Minimum Reference* and *3-03 Maximum Reference* will be truncated.

Index, sub-index	Meaning
1046h 0	Number of sub-index supported
1046h 1	vl_velocity_min_max_amount
1046h 2	vl_velocity_min_amount

Table 6.33 Minimum/Maximum RPM at Motor Shaft

6.4.9 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 *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 *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 6.34 6048h vl_velocity_acceleration

6.4.10 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 *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 *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 6.35 6049h vl_velocity_deceleration

6.4.11 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 *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 6.36 6060h Modes of Operation

6.4.12 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
-2	MCO profile (only possible if MCO305 is mounted)
-1	FC Profile
2	DS 402 profile

Table 6.37 6061h Modes of Operation Display

6.4.13 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.

6.4.14 6504h Frequency Converter Manufacturer

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

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

Table 6.38 6504h Drive Manufacturer (read only)

7 Parameters

7.1 Parameter Group 8-** Communication and Option

8-01 Control Site

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

8-02 Control Word Source

Select the source of the control word: one of two serial interfaces or four installed options. During initial power-up, the frequency converter automatically sets this parameter to *[3] Option A* if it detects a valid fieldbus option installed in slot A. If the option is removed, the frequency converter detects a change in the configuration, sets *8-02 Control Word Source* back to default setting RS-485, and the frequency converter trips. If an option is installed after initial power-up, the setting of *8-02 Control Word Source* does not change, but the frequency converter trips and displays: Alarm 67 *Option Changed*.
When retrofitting a bus option into a frequency converter, that did not have a bus option installed to begin with, take an ACTIVE decision to move the control to Bus based. This is done for safety reasons to avoid an accidental change.

Option:		Function:
[0]	None	
[1]	FC RS485	
[2]	FC USB	
[3]	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	
[30]	External Can	

NOTE

This parameter cannot be adjusted while the motor is running.

8-03 Control Word Timeout Time

Range:		Function:
1 s*	[0.1 - 18000 s]	Enter the maximum time expected to pass between the reception of two consecutive telegrams. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in *8-04 Control Word Timeout Function*is then carried out. A valid control word triggers the time-out counter.

8-04 Control Word Timeout Function

Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in *8-03 Control Word Timeout Time*.

Option:		Function:
[0]	Off	Resumes control via serial bus (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	Stops the motor, then resets the frequency converter to restart: via the fieldbus, via [Reset], or via a digital input.
[7]	Select setup 1	Changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes after a time-out, *8-05 End-of-Timeout Function* defines whether to resume the set-up used before the time-out, or to retain the set-up endorsed by the time-out function.
[8]	Select setup 2	See *[7] Select setup 1*
[9]	Select setup 3	See *[7] Select setup 1*
[10]	Select setup 4	See *[7] Select setup 1*
[26]	Trip	

NOTE

To change the set-up after a time-out, the following configuration is required:
Set *0-10 Active Set-up* to *[9] Multi set-up* and select the relevant link in *0-12 This Set-up Linked to*.

8-05 End-of-Timeout Function

Option:		Function:
		Select the action after receiving a valid control word following a time-out. This parameter is active only when *8-04 Control Timeout Function*

8-05 End-of-Timeout Function

Option:		Function:
		is set to *[7] Set-up 1*, *[8] Set-up 2*, *[9] Set-up 3* or *[10] Set-up 4*.
[0]	Hold set-up	Retains the set-up selected in *8-04 Control Timeout Function* and displays a warning, until *8-06 Reset Control Timeout* toggles. Then the frequency converter resumes its original set-up.
[1]	Resume set-up	Resumes the set-up active before the time-out.

8-06 Reset Control Word Timeout

This parameter is active only when *[0] Hold set-up* has been selected in *8-05 End-of-Timeout Function*.

Option:		Function:
[0]	Do not reset	Retains the set-up specified in *8-04 Control Word Timeout Function*, following a control word time-out.
[1]	Do reset	Returns the frequency converter to the original set-up following a control word time-out. The frequency converter performs the reset and then immediately reverts to the *[0] Do not reset* 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.	

NOTE

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 *16-90 Alarm Word* or *9-53 Profibus Warning Word*.
- *[2] Trigger alarms/warn.*: Send extended diagnosis/ emergency data if one or more alarms or warnings appear in alarm *16-90 Alarm Word*, *9-53 Profibus Warning Word*, or warning *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.	Select *[0]* for normal bus readouts.
[1]	Motor Data LP-Filter	Select *[1]* for filtered bus readouts of the following parameters: *16-10 Power [kW]* *16-11 Power [hp]* *16-12 Motor Voltage* *16-14 Motor current* *16-16 Torque [Nm]* *16-17 Speed [RPM]* *16-22 Torque [%]* *16-25 Torque [Nm] High*

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

Option:		Function:
		This parameter enables configuration of bits 12–15 in the status word.
[0]	No function	
[1] *	Profile Default	Function corresponds to the profile default selected in *8-10 Control Profile*.
[2]	Alarm 68 Only	Only set in case of an Alarm 68.
[3]	Trip excl. Alarm 68	Set in case of a trip, except if Alarm 68 executes the trip.
[10]	T18 DI status.	The bit indicates the status of terminal 18. "0" indicates that the terminal is low "1" indicates that the terminal is high
[11]	T19 DI status.	The bit indicates the status of terminal 19. "0" indicates that the terminal is low "1" indicates that the terminal is high
[12]	T27 DI status.	The bit indicates the status of terminal 27. "0" indicates that the terminal is low

8-13 Configurable Status Word STW

Option:		Function:
		"1" indicates that the terminal is high
[13]	T29 DI status.	The bit indicates the status of terminal 29. "0" indicates that the terminal is low "1" indicates that the terminal is high
[14]	T32 DI status.	The bit indicates the status of terminal 32. "0" indicates that the terminal is low "1" indicates that the terminal is high
[15]	T33 DI status.	The bit indicates the status of terminal 33. "0" indicates that the terminal is low "1" indicates that the terminal is high
[16]	T37 DI status	The bit indicates the status of terminal 37. 0" indicates T37 is low (safe stop) "1" indicates T37 is high (normal)
[21]	Thermal warning	The thermal warning turns on when the temperature exceeds the limit in the motor, the frequency converter, the brake resistor, or the thermistor.
[30]	Brake fault (IGBT)	Output is Logic '1' when the brake IGBT is short-circuited. Use this function to protect the frequency converter if there is a fault on the brake modules. Use the output/relay to cut out the main voltage from the frequency converter.
[40]	Out of ref. range	
[60]	Comtor 0	See parameter group *13-1* ComparatorsComparators*. If Comtor 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[61]	Comtor 1	See parameter group *13-1* ComparatorsComparators*. If Comtor 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[62]	Comtor 2	See parameter group *13-1* ComparatorsComparators*. If Comtor 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[63]	Comtor 3	See parameter group *13-1* ComparatorsComparators*. If Comtor 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[64]	Comtor 4	See parameter group *13-1* ComparatorsComparators*. If Comtor 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[65]	Comtor 5	See parameter group *13-1* ComparatorsComparators*. If Comtor 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[70]	Logic Rule 0	See parameter group *13-4* LC-4# Logic RulesLogic Rules*. If Logic Rule 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[71]	Logic Rule 1	See parameter group *13-4* LC-4# Logic RulesLogic Rules*. If Logic Rule 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[72]	Logic Rule 2	See parameter group *13-4* LC-4# Logic RulesLogic Rules*. If Logic Rule 2 is evaluated as

8-13 Configurable Status Word STW

Option:		Function:
		TRUE, the output goes high. Otherwise, it is low.
[73]	Logic Rule 3	See parameter group 13-4*. If Logic Rule 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[74]	Logic Rule 4	See parameter group *13-4* LC-4# Logic RulesLogic Rules*. If Logic Rule 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[75]	Logic Rule 5	See parameter group *13-4* LC-4# Logic RulesLogic Rules*. If Logic Rule 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[80]	SL Digital Output A	See *13-52 SL Controller Action*. The output goes high whenever the Smart Logic Action *[38] Set digital out A high* is executed. The output goes low whenever the Smart Logic Action *[32] Set digital out A low* is executed.
[81]	SL Digital Output B	See *13-52 SL Controller Action*. The input goes high whenever the Smart Logic Action *[39] Set digital out B high* is executed. The input goes low whenever the Smart Logic Action *[33] Set digital out B low* is executed.
[82]	SL Digital Output C	See *13-52 SL Controller Action*. The input goes high whenever the Smart Logic Action *[40] Set digital out C high* is executed. The input goes low whenever the Smart Logic Action *[34] Set digital out C low* is executed.
[83]	SL Digital Output D	See *13-52 SL Controller Action*. The input goes high whenever the Smart Logic Action *[41] Set digital out D high* is executed. The input goes low whenever the Smart Logic Action *[35] Set digital out D low* is executed.
[84]	SL Digital Output E	See *13-52 SL Controller Action*. The input goes high whenever the Smart Logic Action *[42] Set digital out E high* is executed. The input goes low whenever the Smart Logic Action *[36] Set digital out E low* is executed.
[85]	SL Digital Output F	See *13-52 SL Controller Action*. The input goes high whenever the Smart Logic Action *[43] Set digital out F high* is executed. The input goes low whenever the Smart Logic Action *[37] Set digital out F low* is executed.

8-14 Configurable Control Word CTW

Option:		Function:
		Selection of control word bit 10 if it is active low or active high.
[0]	None	
[1]	Profile default	
[2]	CTW Valid, active low	
[3]	Safe Option Reset	

8-14 Configurable Control Word CTW		
Option:		**Function:**
[4]	PID error inverse	When enabled, it inverts the resulting error from the process PID controller. Available only if "Configuration Mode" is set to "Surface Winder", "Extended PID Speed OL" or "Extended PID Speed CL".
[5]	PID reset I part	When enabled, resets the I-part of the Process PID controller. Equivalent to *7-40 Process PID I-part Reset*. Available only if "Configuration Mode" is set to "Surface Winder", "Extended PID Speed OL" or "Extended PID Speed CL".
[6]	PID enable	When enabled, enables the extended process PID controller. Equivalent to *7-50 Process PID Extended PID*. Available only if "Configuration Mode" is set "Extended PID Speed OL" or "Extended PID Speed CL".

8-50 Coasting Select		
Option:		**Function:**
		Select control of the coasting function via the terminals (digital input) and/or via the bus.
[0]	Digital input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.

8-51 Quick Stop Select		
Select control of the Quick Stop function via the terminals (digital input) and/or via the bus.		
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. **NOTE** **Only selection *[0] Digital input* is available when *1-10 Motor Construction* is set to *[1] PM non-salient SPM*.**
[0]	Digital input	Activates Start command via a digital input.

8-52 DC Brake Select		
Option:		**Function:**
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.

8-53 Start Select		
Option:		**Function:**
		Select control of the frequency converter start function via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates Start command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activates Start command via the fieldbus/serial communication port OR via one of the digital inputs.

8-54 Reversing Select		
Option:		**Function:**
[0]	Digital input	Select control of the frequency converter reverse function via the terminals (digital input) and/or via the fieldbus.
[1]	Bus	Activates the Reverse command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates the Reverse command via the fieldbus/serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activates the Reverse command via the fieldbus/serial communication port OR via one of the digital inputs.

8-55 Set-up Select		
Option:		**Function:**
		Select control of the frequency converter set-up selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port or fieldbus option.

8-55 Set-up Select		
Option:		**Function:**
[2]	Logic AND	Activates the set-up selection via the fieldbus/ serial communication port, AND additionally via one of the digital inputs.
[3]	Logic OR	Activate the set-up selection via the fieldbus/ serial communication port OR via one of the digital inputs.

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.

7.2 Parameter Group 12-** Ethernet

7.2.1 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 *12-01 IP Address* 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. [20] *From Node ID address is set from *12-60 Node ID*.

12-01 IP Address		
Range:		**Function:**
0 *	[0 - 2147483647]	Configure the IP address of the option. Read-only if *12-00 IP Address Assignment* set to DHCP or BOOTP. In POWERLINK the IP address follows the *12-60 Node ID* 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 *12-00 IP Address Assignment* 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 *12-00 IP Address Assignment* set to DHCP or BOOTP. In a non-routed network this address is set to the IP address of the IO Device

12-08 Host Name		
Range:		**Function:**
0 *	[0 - 2147483647]	Logical (given) name of option. The display of the frequency converter only shows the first 19 characters, but the remaining characters are stored in the frequency converter. The frequency converter can accept longer text than 19 characters, but it is recommended to limit the length to 19 characters.

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

7.2.2 12-1* Ethernet Link Parameters

12-1* Ethernet Link parameters		
Option:		**Function:**
		Applies for whole parameter group.
[0]	Port 1	Index [0] goes for Port 1. For EtherCAT it goes for In Port.
[1]	Port 2	Index [1] goes for Port 2. For EtherCAT it goes for out Port.

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

12-11 Link Duration		
Range:		**Function:**
Size related*	[0 - 0]	Read only. Displays 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 *12-13 Link Speed* and *12-14 Link Duplex*.

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12-12 Auto Negotiation		
Option:	Function:	
[1]	On	

NOTE

In POWERLINK this parameter is fixed to OFF setting.

12-13 Link Speed		
Option:		Function:
		Forces the link speed for each port in 10 Mbps or 100 Mbps. If *12-12 Auto Negotiation* is set to: ON, this parameter is read only and displays the actual link speed. If no link is present, “None” is displayed.
[0]	None	
[1]	10 Mbps	
[2]	100 Mbps	

NOTE

In POWERLINK this parameter is locked to 100 Mbs.

12-14 Link Duplex		
Option:		Function:
		Forces the duplex for each port to Full or Half duplex. If *12-12 Auto Negotiation* is set to: [ON], this parameter is read only.
[0]	Half Duplex	
[1]	Full Duplex	

NOTE

In POWERLINK this parameter is locked to half duplex.

7.2.3 12-2* Process Data

12-20 Control Instance		
Range:		Function:
	[None, 20, 21, 23, 100, 101, 103]	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).

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. Same applies for *12-22 Process Data Config Read*, *12-23 Process Data Config Write Size* and *12-24 Process Data Config Read Size*.

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	

7.2.4 12-6* Ethernet PowerLink

12-60 Node ID		
Range:		Function:
1 *	[1 - 239]	Enter the Node ID in this parameter or alternatively in the hardware switch. In order to adjust the Node ID in *12-60 Node ID*, the hardware switch must be set to o or 254 (i.e. all switches set to [ON] or to [OFF]). Otherwise this parameter displays the actual setting of the switch. Setting this parameter will first be active at the next power up cycle.

12-62 SDO Timeout		
Range:		Function:
30000 ms*	[0 - 2000000000 ms]	*12-62 SDO Timeout* is the SDO Timeout in milliseconds. Value of this parameter is read during

12-62 SDO Timeout		
Range:		**Function:**
		communication initialization into Object 1300h

12-63 Basic Ethernet Timeout		
Range:		**Function:**
5000.000 ms*	[0 - 2100000 ms]	*12-63 Basic Ethernet Timeout* in microseconds. This parameter is mapped to Object 1F99h. If the POWERLINK interface does not receive a SoC frame within the specified period of time, the interface shifts to standard Ethernet mode. This feature is first available from version 2.00 of the POWERLINK Interface.

12-66 Threshold		
Range:		**Function:**
15 *	[0 - 99999]	*12-66 Threshold* holds six threshold values. If one of these thresholds are exceeded, the POWERLINK Interface exits operational mode. The parameters are set to optimal settings and should not be changed. The actual value of the counters can be read out via *12-67 Threshold Counters*.

12-67 Threshold Counters		
Range:		**Function:**
0 *	[0 - 65538]	*12-67 Threshold Counters* hold 6 counters. The counter reflects the actual value in the POWERLINK interface. Counters increases with a count of eight at detection of an error and decreases with a count of one when no errors are detected. The values are read only.

12-68 Cumulative Counters		
Range:		**Function:**
0 *	[0 - 65535]	Loss off SoC Cumulative. This parameter reflects the value in object 1C0Bh, subindex 1.

12-69 Ethernet PowerLink Status		
Range:		**Function:**
0 *	[0 - 4294967295]	

7.2.5 12-8* Other Ethernet Services

12-80 FTP Server		
Option:		**Function:**
[0]	Disabled	Disables the built-in FTP server.
[1]	Enabled	Enables the built-in FTP server.

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

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

12-89 Transparent Socket Channel Port		
Range:		**Function:**
Size related*	[0 - 0.]	Configures 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.

7.2.6 12-9* Advanced Ethernet Settings

12-90 Cable Diagnostic		
Option:		**Function:**
		Enables/disables advanced Cable diagnosis function. If enabled, the distance to cable errors can be read out in *12-93 Cable Error Length*. The parameter resumes to the default setting of Disable after the diagnostics have finished.
[0]	Disabled	
[1]	Enabled	

NOTE

The cable diagnostics function is only issued on ports where there is no link (see *12-10 Link Status*, *Link Status*)

12-91 Auto Cross Over		
Option:		**Function:**
[0]	Disabled	Disables the auto cross-over function.
[1]	Enabled	Enables the auto cross-over function.

12-93 Cable Error Length		
Range:		**Function:**
0 *	[0 - 65535]	If Cable Diagnostics is enabled in *12-90 Cable Diagnostic*, 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 displayed in meters with an accuracy of ±2 m. The value 0 means that no errors detected.

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7.3 POWERLINK - Specific Parameter List

Parameter	Default value	Range	Conversion index	Data type
8-01 Control Site	[0] Dig. & ctrl. word	[0-2]	-	Uint8
8-02 Control Word Source	[0] FC RS485	[0-4]	-	Uint8
8-03 Control Word Timeout Time	1	0.1-18000	-1	Uint32
8-04 Control Word Timeout Function	[0] Off	[0-10]	-	Uint8
8-05 End-of-Timeout Function	[0] Hold set-up	[0-1]	-	Uint8
8-06 Reset Control Word Timeout	[0] Do not reset	[0-1]	-	Uint8
8-07 Diagnosis Trigger	[0] Disable	[0-3]	-	Uint8
8-10 Control Word Profile	[0] FC profile	[0-x]	-	Uint8
8-13 Configurable Status Word STW				
8-50 Coasting Select	[3] *Logic OR	[0-3]	-	Uint8
8-51 Quick Stop Select	[3] *Logic OR	[0-3]	-	Uint8
8-52 DC Brake Select	[3] *Logic OR	[0-3]	-	Uint8
8-53 Start Select	[3] *Logic OR	[0-3]	-	Uint8
8-54 Reversing Select	[3] *Logic OR	[0-3]	-	Uint8
8-55 Set-up Select	[3] *Logic OR	[0-3]	-	Uint8
8-56 Preset Reference Select	[3] *Logic OR	[0-3]	-	Uint8
8-90 Bus Jog 1 Speed	100 rpm	0-*4-13 Motor Speed High Limit [RPM]*	67	Uint16
8-91 Bus Jog 2 Speed	200 rpm	0-*4-13 Motor Speed High Limit [RPM]*	67	Uint16
12-00 IP Address Assignment	[20] *From node ID	-	-	Unsigned 8
12-01 IP Address	192.168.100.xxx	-	-	Unsigned 32
12-02 Subnet Mask	255.255.255.0	-	-	Unsigned 32
12-03 Default Gateway	0.0.0.0	-	-	Unsigned 32
12-08 Host Name		-	-	String
12-09 Physical Address	00:1B:08:00:00:00	-	-	Visible string 17
12-10 Link Status	[0] No Link	[0-1]	-	Unsigned 8
12-11 Link Duration	00:00:00:00	-	-	Time diff. w/date
12-12 Auto Negotiation	[1] On	[0-1]	-	Unsigned 8
12-13 Link Speed	[0] None	[0-2]	-	Unsigned 8
12-14 Link Duplex	[1] Full Duplex	[0-1]	-	Unsigned 8[
12-20 Control Instance	Application Dependent	0-255		
12-21 Process Data Config Write	Application Dependent			
12-22 Process Data Config Read	16		1-32	
12-23 Process Data Config Write Size	16		1-32	
12-24 Process Data Config Read Size	0	0-4294967295		
12-28 Store Data Values				
12-29 Store Always	[0] Off			
12-60 Node ID	[0]	[0-240]		Unsigned 8
12-80 FTP Server	[0] Disable	[0–1]	-	Unsigned 8
12-81 HTTP Server	[0] Disable	[0–1]	-	Unsigned 8
12-82 SMTP Service	[0] Disable	[0–1]	-	Unsigned 8
12-89 Transparent Socket Channel Port	[0] Disable	[0–1]	-	Unsigned 8
12-90 Cable Diagnostic	[0] Disable	[0-1]	-	Unsigned 8
12-91 Auto Cross Over	[0] Enable	[0-1]	-	Unsigned 8
12-93 Cable Error Length	0	0-200	0	Unsigned 16
12-98 Interface Counters	0	0-65535	-	Unsigned 16
12-99 Media Counters	0	0-65535	-	Unsigned 16
16-84 Comm. Option STW	0	0-FFFF	0	V2
16-90 Alarm Word	0	0-FFFF	0	Uint32

Parameter	Default value	Range	Conversion index	Data type
16-92 Warning Word	0	0-FFFF	0	Uint32

Table 7.1 Specific Parameters

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

8 Application Examples

8.1 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 frequency converter is set to FC profile in *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	
From controller	04	7C	20	00	00	00	00	00
	STW		MAV		PCD[2]		PCD[3]	
From frequency converter	0F	07	20	00	3F	A6	00	08
Byte #	1	2	3	4	5	6	7	8

Table 8.1 Example of FC Profile

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 POWERLINK cable is broken, the master has a system failure, or the PLC is in stop mode.

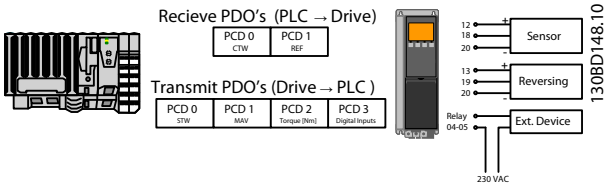

Illustration 8.1 Application Example

Program the frequency converter as shown in *Table 8.2*.

Parameter	Setting
4-10 Motor Speed Direction	[2] Both directions
5-10 Terminal 18 Digital Input	[0] No operation
5-11 Terminal 19 Digital Input	[10] Reversing
5-40 Function Relay	[36/37] Control word bit 11/12
8-03 Control Word Timeout Time	1 s
8-04 Control Word Timeout Function	[2] Stop
8-10 Control Word Profile	[0] FC Profile
8-50 Coasting Select	[1] Bus
8-51 Quick Stop Select	[1] Bus
8-52 DC Brake Select	[1] Bus
8-53 Start Select	[1] Bus
8-54 Reversing Select	[2] Logic AND
8-55 Set-up Select	[1] Bus
8-56 Preset Reference Select	[1] Bus

Table 8.2 Programming of Frequency Converter

8.2 Example: Simple Control Word, Reference, Status Word and Main Actual Value

This example shows how the control word telegram relates to the controller and the frequency converter, using FC Control Profile.

The control word telegram is sent from the PLC to the frequency converter. Standard Telegram 1 is used in the example to demonstrate the full range of modules. All the values shown are arbitrary, and are provided for demonstration purposes only.

	PCD																															
	0				1				2				3																			
	CTW				MRV				PCD				PCD																			
	04	7C	20	00																												
PQW:	256				258				260				262																			
	CTW				MRV																											
Bit no.:	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	0				4				7				C				2				0				0				0			

Table 8.3 Standard Telegram 1 Example

Table 8.3 indicates the bits contained within the control word, and how they are presented as process data in Standard Telegram 1 for this example.

Table 8.4 indicates which bit functions, and which corresponding bit values are active for this example.

8

Bit	Bit value=0	Bit value=1	Bit value	
00	Reference value	External selection lsb	0	C
01	Reference value	External selection msb	0	
02	DC brake	Ramp	1	
03	Coasting	Enable	1	
04	Quick stop	Ramp	1	7
05	Freeze output	Ramp enable	1	
06	Ramp stop	Start	1	
07	No function	Reset	0	
08	No function	Jog	0	4
09	Ramp 1	Ramp 2	0	
10	Data not valid	Valid	1	
11	No function	Relay 01 active	0	
12	No function	Relay 02 active	0	0
13	Parameter set-up	Selection lsb	0	
14	Parameter set-up	Selection msb	0	
15	No function	Reversing	0	

Function active

Function inactive

Table 8.4 Bit Functions

9 Troubleshooting

9.1.1 LED Status

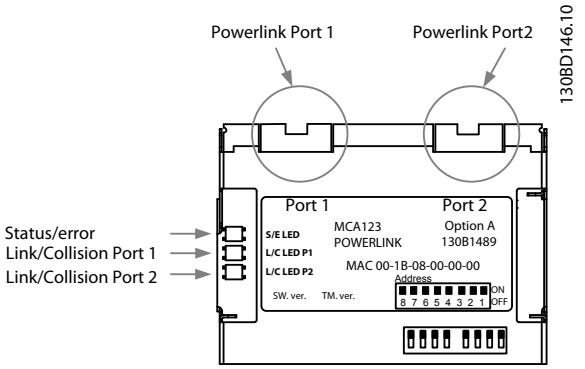

Illustration 9.1 LED Status

Power OFF or state	**LED**
NMT_GS NMT_GS_INITIALISATION NMT_CS_NOT_ACTIVE NMT_MS_NOT_ACTIVE	Green:
Device Operational	Green:
Flickering	
NMT_CS_BASIC_ETHERNET	Green:
Blinking	
NMT_CS_Stopped	Green:
Single flash	
NMT_CS_PRE_OPERATIONAL_1 NMT_MS_PRE_OPERATIONAL_1	Green:
Double flash	
NMT_CS_PRE_OPERATIONAL_2 NMT_MS_PRE_OPERATIONAL_2	Green:
Triple flash	
NMT_CS_READY_TO_OPERATE NMT_MS_READY_TO_OPERATE	Green:

Table 9.1 S/E LED

Power OFF or NO Link	Green:
Link	Green:

Table 9.2 L/C LED

9.1.2 No Communication with the Frequency Converter

If there is no communication with the frequency converter, proceed with the following checks:

Check 1: Is the cabling correct?
Check that the cable is mounted correctly. Check if the corresponding XDD files L/C LED shows link activity.

Check 2: Does the hardware configuration match?
Check that the *12-60 Node ID* in the master matches the value in *12-50 Configured Station Alias*

Check 3: Is the correct XDD file installed?
Download the correct XDD file from *http://www.danfoss.com/BusinessAreas/DrivesSolutions/*.
Check that the process data matches the active profile in the drive.

Check 4: What is the value of *12-69 Ethernet PowerLink Status*?
The *12-69 Ethernet PowerLink Status* contains 32 bits, which each is linked to internal information. The different bits give an overview over possible errors.

Bit no.	Description	Value=[0]	Value=[1]	Comment
0	Initialisation State		NMT_GS_INITILASATION	Mapped to Object 1F8Ch (WHAT79188)
1	Not Active State		NMT_CS_NOT_ACTIVE	Mapped to Object 1F8Ch (WHAT79188)
2	Basic Ethernet State		NMT_CS_BASIC_ETHERNET	Mapped to Object 1F8Ch (WHAT79188)
3	Pre-Operational 1 State		NMT_CS_PRE_OPERATIONAL_1	Mapped to Object 1F8Ch (WHAT79188)
4	Pre-Operational 2 State		NMT_CS_PRE_OPERATIONAL_2	Mapped to Object 1F8Ch (WHAT79188)
5	Ready to Operate State		NMT_CS_OPERATIONAL	Mapped to Object 1F8Ch (WHAT79188)
6	Operational State		NMT_CS_STOPPED	Mapped to Object 1F8Ch (WHAT79188)
7	Stopped State			Value shall be read as 0
8	Reserved			Value shall be read as 0
9	Reserved			Value shall be read as 0
10	Reserved			Value shall be read as 0
11	Reserved			Value shall be read as 0
12	Reserved			Value shall be read as 0
13	Reserved			Value shall be read as 0
14	Reserved			Value shall be read as 0
15	Reserved			Value shall be read as 0
16	Reserved			Value shall be read as 0
17	Reserved			Value shall be read as 0
18	Reserved			Value shall be read as 0
19	Reserved			Value shall be read as 0
20	Physical link on Port 1	No link present on Port 1	Link present on Port 1	Mapped to object 1030h subindex 7
21	Physical link on Port 2	No link present on Port 2	Link present on Port 2	Mapped to object 1030h subindex 7
22	Reserved			Value shall be read as 0
23	Reserved			Value shall be read as 0
24	W34 source No Op State			Mapped to object 178Ch (WHAT79188)
25	W34 source Alarm			Mapped to Alarm Word and Alarm Word 1
26	W34 source IP Address Conflict			IP address conflict detection in Basic Ethernet mode
27	W34 source Invalid Node ID			Value read from DIP switch
28	W34 source Incorrect PDO mapping			Set on incorrect Tx or Rx PDO mapping
29	Reserved			Value shall be read as 0

Bit no.	Description	Value=[0]	Value=[1]	Comment
30	Reserved			Value shall be read as 0
31	Reserved			Value shall be read as 0

Table 9.3 POWERLINK Bits

9.1.3 Warning 34 Appears even though Communication is Established

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).

9.1.4 Frequency Converter Does Not Respond to Control Signals

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

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

Table 9.4 to *Table 9.11* show a coast command's effect upon the frequency converter for the full range of *8-50 Coasting Select* settings.

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

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

NOTE

Coasting, Quick Stop, and DC brake functions are active for logic 0.

Terminal	Bit 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 9.4 [0] Digital Input

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

Terminal	Bit 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 9.5 [1] Serial Communication

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

Terminal	Bit 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 9.6 [2] Logic AND

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

Terminal	Bit 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 9.7 [3] Logic OR

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

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

Terminal	Bit 06/15	Function
0	0	Stop/Anti-clockwise
0	1	Stop/Anti-clockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 9.8 [0] Digital input

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

Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Start/Clockwise
1	0	Stop/Anti-clockwise
1	1	Start/Clockwise

Table 9.9 [1] Serial Communication

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

Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Stop/Anti-clockwise
1	0	Stop/Anti-clockwise
1	1	Start/Clockwise

Table 9.10 [2] Logic AND

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

Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Start/Clockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 9.11 [3] Logic OR

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

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

Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. Set-up no.
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 9.12 [0] Digital Input

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

Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. Set-up no.
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 9.13 [1] Serial Communication

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

Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref. Set-up no.
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 9.14 [2] Logic AND

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

Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref, Set-up no.
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 9.15 [3] Logic OR

9.1.5 Alarm and Warning Words

Alarm word, Warning word, and POWERLINK Status 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 POWERLINK Status word can also be displayed using the serial bus in *16-90 Alarm Word*, *16-92 Warning Word*, and *12-69 Ethernet PowerLink Status*.

Bit (Hex)	Unit diagnose bit	Alarm word (16-90 Alarm Word)	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 9.16 FC 301/FC 302

Bit (Hex)	Unit diagnose bit	Warning word (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 9.17 FC 301/FC 302

Bit (Hex)	Comm. option STW (*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 9.18 FC 301/FC 302

NOTE

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

9.1.6 Warning and Alarm Messages

There is a clear distinction between alarms and warnings. When there is an alarm, the frequency converter enters 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, on the other hand, may come when a warning condition appears, then disappear when conditions return 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.

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