MAKING MODERN LIVING POSSIBLE

Programming Guide

VLT® CANopen MCA 105

VLT® AutomationDrive FC 301/302

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THE REAL DRIVE

Contents

1 Introduction

1.1 Purpose of the Manual

The *VLT® CANopen MCA 105 Programming Guide* provides information about configuring the system, controlling the frequency converter, parameter access, programming, as well as troubleshooting.
The programming guide is intended for use by qualified personnel who are familiar with the VLT® frequency converter, with CANopen technology, and with the PC or PLC that is used as a master in the system.
Read the instructions before programming and follow the procedures in this manual.

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1.2 Additional Resources

Resources available for the frequency converters and optional equipment:

- The *VLT® AutomationDrive FC 301/FC 302 Operating Instructions* provide the necessary information for getting the frequency converter up and running.
- The *VLT® AutomationDrive FC 301/FC 302 Design Guide* provides detailed information about capabilities and functionality to design motor control systems.
- The *VLT® AutomationDrive FC 301/FC 302 Programming Guide* provides greater detail on working with parameters and many application examples.
- The *VLT® CANopen MCA 105 Installation Guide* provides information about installing the CANopen and troubleshooting.
- The *VLT® CANopen MCA 105 Programming Guide* provides information about configuring the system, controlling the frequency converter, parameter access, programming, troubleshooting, as well as some typical application examples.

Supplementary publications and manuals are available from Danfoss. See *vlt-drives.danfoss.com/Support/Technical-Documentation/* for listings.

1.3 Document and Software Version

This manual is regularly reviewed and updated. All suggestions for improvement are welcome. *Table 1.1* shows the document version and the corresponding software version.

Edition	Remarks	Software version
MG92G1xx	–	–

Table 1.1 Document and Software Version

1.4 Product Overview

This programming guide relates to the CANopen interface.
Ordering number:

- 130B1103 (uncoated)
- 130B1205 (coated)

CANopen is a low-level network that standardises communications between industrial devices (sensors, limit switches, motor controls) and high-level devices (controllers). CANopen follows the open systems interconnection (OSI) model and is based on CAN technology for media access control and physical signalling.
Configure CANopen systems to operate in a master-slave or a distributed control architecture using peer-to-peer communication. Up to 127 nodes in a multi-drop network topology are supported. By using the same cable for communication, the bus can power the communication options directly. Nodes can be removed or inserted without powering down the network.
Each node on the network has its own unique communication object identifier (COB-ID) to distinguish it on the network. The access control is based on the CSMA/CA (carrier sense multiple access/collision avoidance) principle, meaning that all nodes may have access to the network at the same time. When 2 nodes attempt to get control of the network bus simultaneously, the CAN protocol resolves the issue by arbitration. In this way, collisions on the network are avoided.
CANopen defines device profiles for devices belonging to specific classes. For other devices, define a custom class to make it CANopen compatible. All of the above enhances the interchangeability and interoperability of the network.

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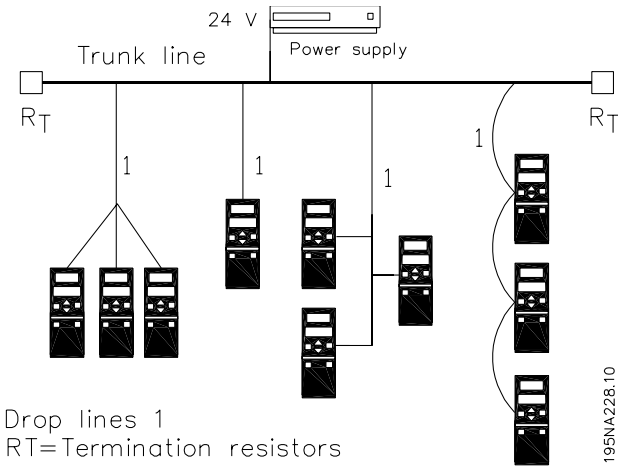

Illustration 1.1 Topology

VLT® CANopen MCA 105 is designed to communicate with any master abiding by the DeviceNet standard. And it is intended for use with:

- VLT® AutomationDrive FC 301.
- VLT® AutomationDrive FC 302.

1.5 Approvals and Certifications

More approvals and certifications are available. For more information, contact a Danfoss local partner.

1.6 Symbols, Abbreviations, and Conventions

Abbreviation	Definition
CAN	Controller area network
CiA	CAN in automation
COB	Communication object
COB-ID	Communication object identifier
CTW	Control word
EDS	Electronic data sheet
EMC	Electromagnetic compatibility
EMCY	Emergency message
I/O	Input/output
LCP	Local control panel
LED	Light emitting diode
LSB	Least significant bit
MAV	Main actual value (actual output)
MRV	Main reference value
MSB	Most significant bit
NMT	Network management
N/A	Not applicable
OD	Object directory
PCD	Process data
PDO	Process data object
PLC	Programmable logic controller
PNU	Parameter number
REC	Receive error counter
RPDO	Receive process data object
RPM	Revolutions per minute; unit for the speed of a revolving motor
RTR	Remote transmission request frame
RX	Receive data
STW	Status word
SDO	Service data object
SYNC	Object for synchronisation of process data
TEC	Transmit error counter
TPDO	Transmit process data object
TX	Transmit data

Table 1.2 Symbols and Abbreviations

Conventions

Numbered lists indicate procedures.

Bullet lists indicate other information and description of illustrations.

Italicised text indicates:

- Cross-reference.
- Link.
- Parameter name.
- Footnote.
- Parameter group.
- Parameter option.
- Alarms/warnings.

2 Safety

2.1 Safety Symbols

The following symbols are used in this manual:

⚠WARNING

Indicates a potentially hazardous situation that could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation that could result in minor or moderate injury. It can also be used to alert against unsafe practices.

NOTICE

Indicates important information, including situations that can result in damage to equipment or property.

2.2 Qualified Personnel

Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install and operate this equipment.

Qualified personnel are defined as trained staff, who are authorised to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Additionally, the qualified personnel must be familiar with the instructions and safety measures described in these operating instructions.

2.3 Safety Precautions

⚠WARNING

HIGH VOLTAGE

Frequency converters contain high voltage when connected to AC mains input, DC supply, or load sharing. Failure to perform installation, start-up, and maintenance by qualified personnel can result in death or serious injury.

- **Only qualified personnel must perform installation, start-up, and maintenance.**

⚠WARNING

UNINTENDED START

When the frequency converter is connected to AC mains, DC supply, or load sharing, the motor may start at any time. Unintended start during programming, service, or repair work can result in death, serious injury, or property damage. The motor can start with an external switch, a fieldbus command, an input reference signal from the LCP or LOP, via remote operation using MCT 10 Set-up Software, or after a cleared fault condition.
To prevent unintended motor start:

- **Disconnect the frequency converter from the mains.**
- **Press [Off/Reset] on the LCP before programming parameters.**
- **Completely wire and assemble the frequency converter, motor, and any driven equipment before connecting the frequency converter to AC mains, DC supply, or load sharing.**

⚠WARNING

DISCHARGE TIME

The frequency converter contains DC-link capacitors that can remain charged even when the frequency converter is not powered. Failure to wait the specified time after power has been removed before performing service or repair work, can result in death or serious injury.

- **Stop the motor.**
- **Disconnect the AC mains and remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.**
- **Disconnect or lock the PM motor.**
- **Wait for the capacitors to discharge fully before performing any service or repair work. The duration of waiting time is specified in the relevant frequency converter operating instructions, *Chapter 2 Safety*.**

⚠WARNING

LEAKAGE CURRENT HAZARD

Leakage currents exceed 3.5 mA. Failure to ground the frequency converter properly can result in death or serious injury.

- **Ensure the correct grounding of the equipment by a certified electrical installer.**

2

⚠WARNING

EQUIPMENT HAZARD

Contact with rotating shafts and electrical equipment can result in death or serious injury.

- **Ensure that only trained and qualified personnel perform installation, start-up, and maintenance.**
- **Ensure that electrical work conforms to national and local electrical codes.**
- **Follow the procedures in this manual.**

⚠CAUTION

INTERNAL FAILURE HAZARD

An internal failure in the frequency converter can result in serious injury, when the frequency converter is not properly closed.

- **Ensure that all safety covers are in place and securely fastened before applying power.**

3 Configuration

3.1 Configure the CANopen Network

3.1.1 Object Model

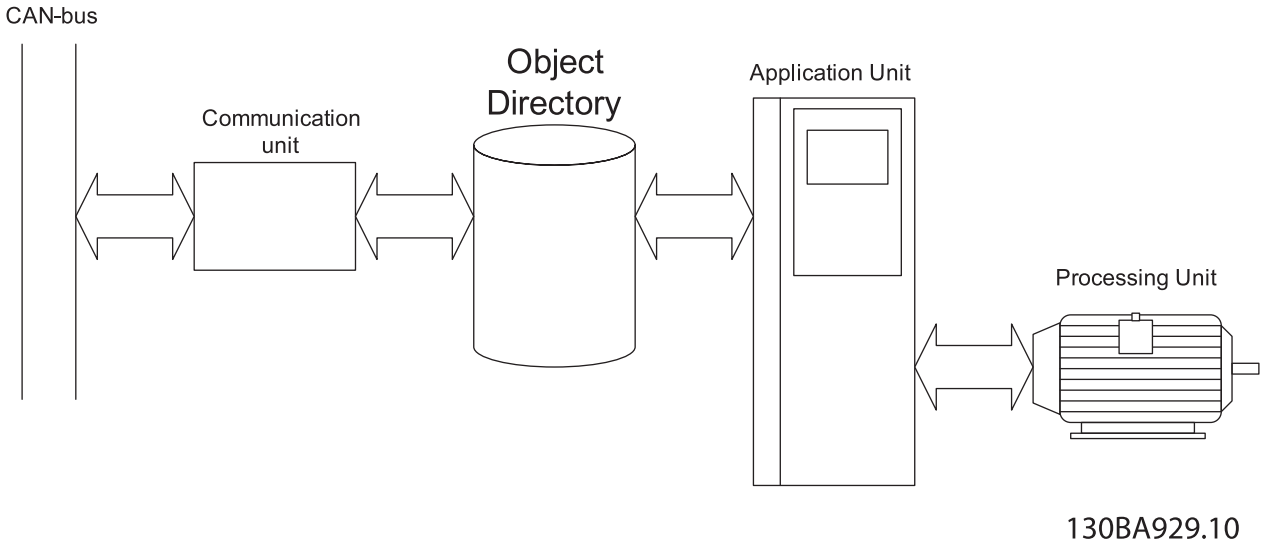

Illustration 3.1 Functional Principle of CANopen Nodes

All information accessible via the CAN-bus is stored in the object directory (OD).
The contents of the OD are organised in *Table 3.1*.

Object directory index range	Object type
0000h	Not used
0001h–025Fh	Data types
0260h–0FFFh	Reserved
1000h–1FFFh	Communication object area
2000h–5FFFh	Manufacturer-specific area
6000h–9FFFh	Standardised device profile area
A000h–FFFFh	Reserved

Table 3.1 Contents of the OD

For a complete overview of the supported objects in the OD, refer to *chapter 7 Object Directory*.

3.1.2 Communication in CANopen

Communication with the frequency converter in CANopen is achieved via service data objects (SDOs), process data objects (PDOs), and network management (NMT).

PDOs represent real-time process data with high priority. PDOs are only available if the node is in operational state.

SDOs represent non-time-critical data and are used to configure the frequency converter. SDOs are only available if node is in both operational and pre-operational state.

NMT functions monitor the network stability and include synchronisation, detection of faults, and emergency message transmission.

COB-Identifiers (ID)
Each communication object has a unique identity (COB-ID) comprising the function code and the node ID (node address), see *Illustration 3.2*.

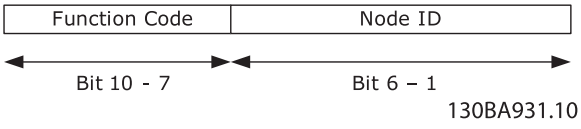

Illustration 3.2 COB-ID

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Object	Function code (binary)	Resulting COB-ID	Communication parameter in OD
NMT	0000	0	–
SYNC	0001	125	(1005h)
Time stamp	0010	256	–
EMERGENCY	0001	129 (81h)–255 (FFh)	1014h
PDO1 (tx)	0011	385 (181h)–511 (1FFh)	1800h
PDO1 (rx)	0100	513 (201h)–639(27Fh)	1400h
PDO2 (tx)	0101	641 (281h)–767(2FFh)	1801h
PDO2 (rx)	0110	769 (301h)–895 (37Fh)	1401h
PDO3 (tx)	0111	897 (381h)–1023 (3FFh)	1802h
PDO3 (rx)	1000	1025 (401h)–1151 (47Fh)	1402h
PDO4 (tx)	1001	1153 (481h)–1279 (4FFh)	1803h
PDO4 (rx)	1010	1281 (501h)–1407 (57Fh)	1403h
SDO (tx)	1011	1409 (581h)–1535 (5FFh)	1200h – ...
SDO (rx)	1100	1537 (601h)–1663 (67Fh)	1200h – ...
NMT error control (Nodeguarding)	1110	1793 (701h)–1919 (77Fh)	1016h, 1017h (100Eh)

Table 3.2 Communication Object

Transmit and receive is always seen from the node's point of view:

- RX = Nodes receiving data (Controller -> node)
- TX = Nodes transmitting data (node -> controller)

Example:

- COB-ID 383 = PDO3 transmit, from node address 3.
- COB-ID 185 = PDO1 transmit, from node address 5.
- COB-ID 604 = SDO receive, to node address 4.

3.1.3 Controlling the Network

In each CANopen node, a state machine controls the different states of the node.
After power-up, the node transmits a boot-up message with the COB-ID: 700h + Node ID, and goes from initialisation to pre-operational state.
In this state, SDO communication is possible, but not PDO communication.

The node must have a start network-command from an NMT-master to enter the operational state.
In operational state, both SDO and PDO communication are possible.

The NMT-state of the node is displayed with the green NS LED:

- Flashing = Pre-operational.
- Solid on = Operational.
- Single flash = Stopped.

A reset node or reset communication-command from the NMT-master makes the node jump to initialisation state and directly on to pre-operational state.

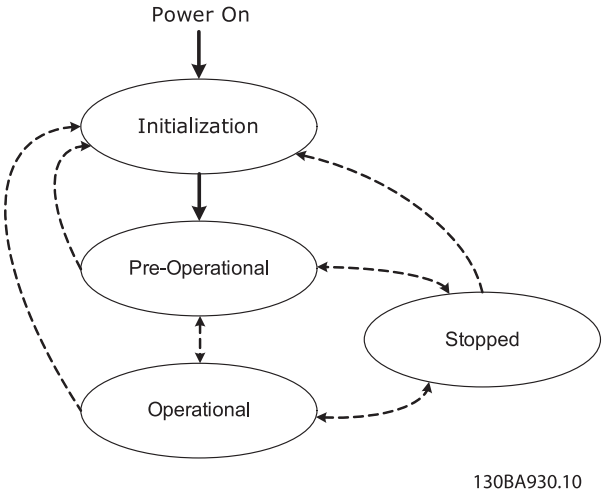

Illustration 3.3 Controlling the Network

3.1.4 Error Control

CANopen offers 2 ways of error-control: Node guarding and Heartbeat.

In node guarding, the NMT-master sends a remote-frame (RTR) cyclically: 700 + node ID.
The node replies with its actual status.
The node (frequency converter) monitors the reception of the RTR-frames, and thereby monitors the presence of the NMT-master.
Configure the monitoring of the NMT-master via:

- OD: 100C Guard time in [ms].
- OD: 100D Life time factor.

If *Guard Time x Life Time Factor* has expired, the action programmed in the *parameter 8-04 Control Word Timeout Function* is executed.

The option can also be configured as heartbeat producer via:

- OD: 1017 *Producer Heartbeat time* [ms].

The MCA 105 option continuously transmits heartbeats (RTRs with the frequency converters actual status) that can be monitored by, for example, an NMT-master.

NOTICE

The MCA105 option does not support the heartbeat consumer function.

Emergency object (EMCY)
The emergency object is used to signal error states, and is sent automatically if an alarm in the frequency converter occurs containing the data described in the following. If the alarm is removed, another emergency telegram is sent out with the contents 0, signalling the end of the frequency converter's alarm state.

Configure the behaviour of the EMCY object via *parameter 8-07 Diagnosis Trigger*.

If *parameter 8-07 Diagnosis Trigger* is set to *[0] Disable*, the EMCY is not sent at all. If it is set to *Trigger alarms*, it is sent if an alarm occurs. If it is set to *Trigger alarms and warnings*, it is sent if an alarm or a warning occurs.

OD 1014h contains the COB-ID of the node's EMCY message. This is fixed to 80h + node ID.

The EMCY always consists of 8 bytes with the full data as described in *Table 3.3*.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
EMCY code* (OD: 1003 [1])		OD: 1001h	Vendor-specific information				

Table 3.3 EMCY Consists of 8 Bytes with the Full Data

*= For more information on EMCY codes, refer to *chapter 8 Troubleshooting*.

Bit 0	1, alarm word 1 has an active alarm (parameter 16-90)
Bit 1	1, alarm word 2 has an active alarm (parameter 16-91)
Bit 2	0, Reserved
Bit 3	1, warning word 1 has an active warning (parameter 16-92)
Bit 4	1, warning word 2 has an active warning (parameter 16-93)
Bit 5–7	0, reserved

Table 3.4 Byte 3 Description

Bus error counters
The frequency converter contains 2 CAN-bus error counters:

- *Parameter 10-05 Readout Transmit Error Counter* (TEC).
- *Parameter 10-06 Readout Receive Error Counter* (REC).

These counters determine the error-state of the CANopen node.

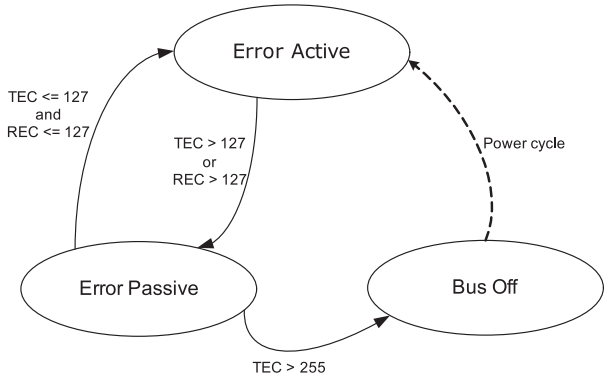

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Illustration 3.4 Bus Error Counters

TEC is incremented with 8 if a transmit-error occurs and decremented with 1 if a transmission is successful.
REC is incremented with 1 if a receive error is detected (8 if the transmitting node is in error active-mode) and decremented with 1 if a reception is successful.

In normal operation the node is in error active state.
If the TEC or REC exceeds the value: 127, the node enters error passive state.
In Error passive state, the error-flag is not transmitted dominantly but recessively.
This means that an error passive node, as receiver, cannot block communication from other nodes.
A node in error passive state has a lower prioritised access to the bus.

If the TEC exceeds 255 (248 + 8), the node enters bus off state.
In bus off state, the MS LED turns solid red, and a warning 34 is issued.
Power-cycle the frequency converter to leave the bus off state.

3

3.1.5 SDO Communication

All CANopen objects and frequency converter parameters can be accessed via SDOs (service data objects).
For a description of supported SDO abort codes, refer to *chapter 8 Troubleshooting*.

	COB-ID	
Transmit SDO	1409 (581h)–1535 (5FFh)	580h + Node ID
Receive SDO	1537 (601h)–1663 (67Fh)	600h + Node ID

Table 3.5 COB-ID's for SDO Communication

COB-ID	CS	OD-Index		Sub-ind.	Data			
600+ID	See following text	01	20	00	00	00	00	00

Table 3.6 Structure of a SDO-message (Request)

The CS-field contains the command and response specifiers. See *Table 3.7* and *Table 3.8*.

Command	CS
Write request 4 bytes	23h
Write request 2 bytes	2Bh
Write request 1 byte	2Fh
Read request (any)	40h

Table 3.7 Command

Response	CS
Write response (any)	60h
Read response 4 bytes	43h
Read response 2 bytes	4Bh
Read response 1 byte	4Fh
Error response	80h

Table 3.8 Response

Saving OD entries
In standard configuration, all parameters + OD entries are stored in volatile (RAM) memory only. To store current network configuration in non-volatile memory, use OD index 1010h.

To save parameters, write the value 65766173 (save) to the appropriated sub-index in OD: 1010h.

OD index	Subindex	Description
1010h	0	Number of entries
	1	Save all parameters + OD entries
	2	Save all communication parameters + OD entries
	3	Reserved
	4	Save edit set-up (Danfoss specific)

Table 3.9 Saving OD Entries

Restoring OD entries
To restore factory defaults, use OD index 1011h.
To restore default parameters the value "**64616F6C**" (load) must be written to the appropriated sub-index in OD: 1011h

OD index	Subindex	Description
1011h	0	Number of entries
	1	Restore all parameters + OD entries*
	2	Restore all communication parameters + OD entries and restart

Table 3.10 Restoring OD Entries

** requires power cycle*

NOTICE

Frequency converter displays Alarm 80 "Drive initialised" after restores.

3.2 Configure the Master

3.2.1 EDS File

A large part area of the system configuration is the setting of application-related parameters. EDS (electronic data sheet) files simplify the setting up of most of the CANopen configurable parameters. The EDS file contains all supported communication-specific objects (OD 1000h + 1FFFh) and a selected number of manufacturer-specific objects (frequency converter parameters) in the OD range 2000h–5FFFh.

Danfoss provides a generic English EDS file covering all voltage and power sizes for off-line configuration.

Download the EDS file from *www.danfoss.com/BusinessAreas/DrivesSolutions/Softwaredownload/DDFieldbus_Setup_Files.htm*.

NOTICE

The EDS files do not contain all parameters but a selected, limited number of parameters with generic minimum, maximum, and default values.

3.2.2 Configuring the CANopen Master

The following example shows the details in setting up the CANopen configuration on a Moeller XC-CPU201 PLC.

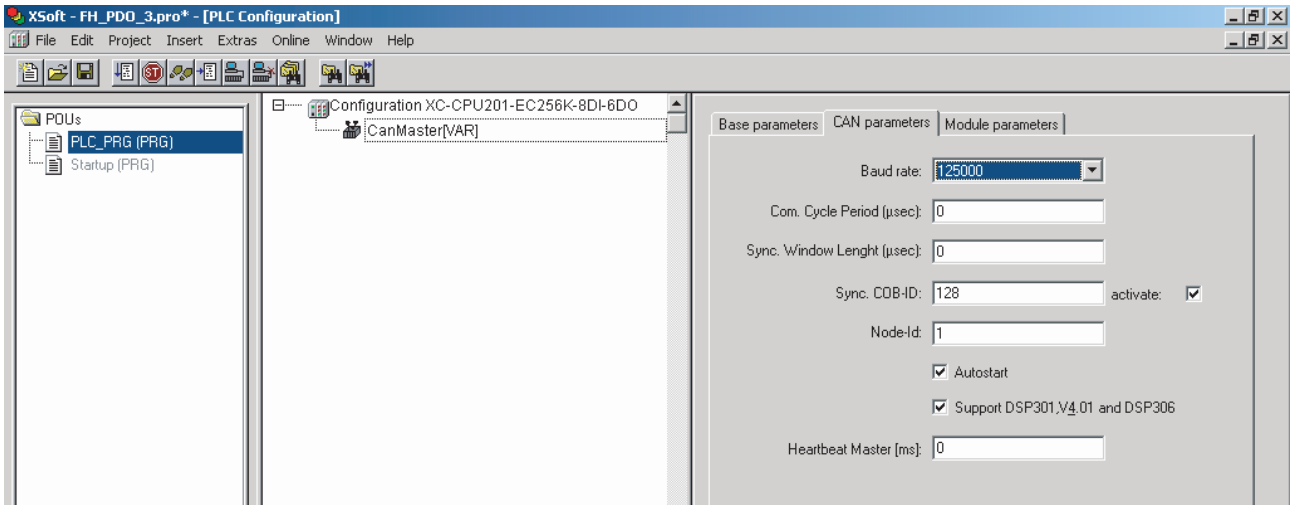

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Illustration 3.5 Setting up the Baud Rate and Node-ID on the CanMaster (CANopen Scanner)

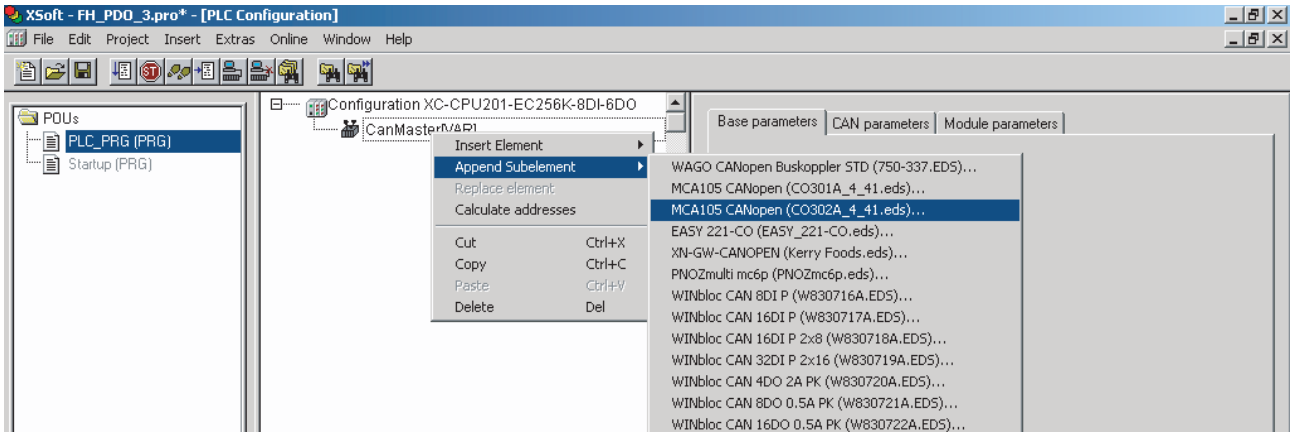

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Illustration 3.6 Appending a CANopen Node, from EDS File Library, by Rght-clicking CanMaster

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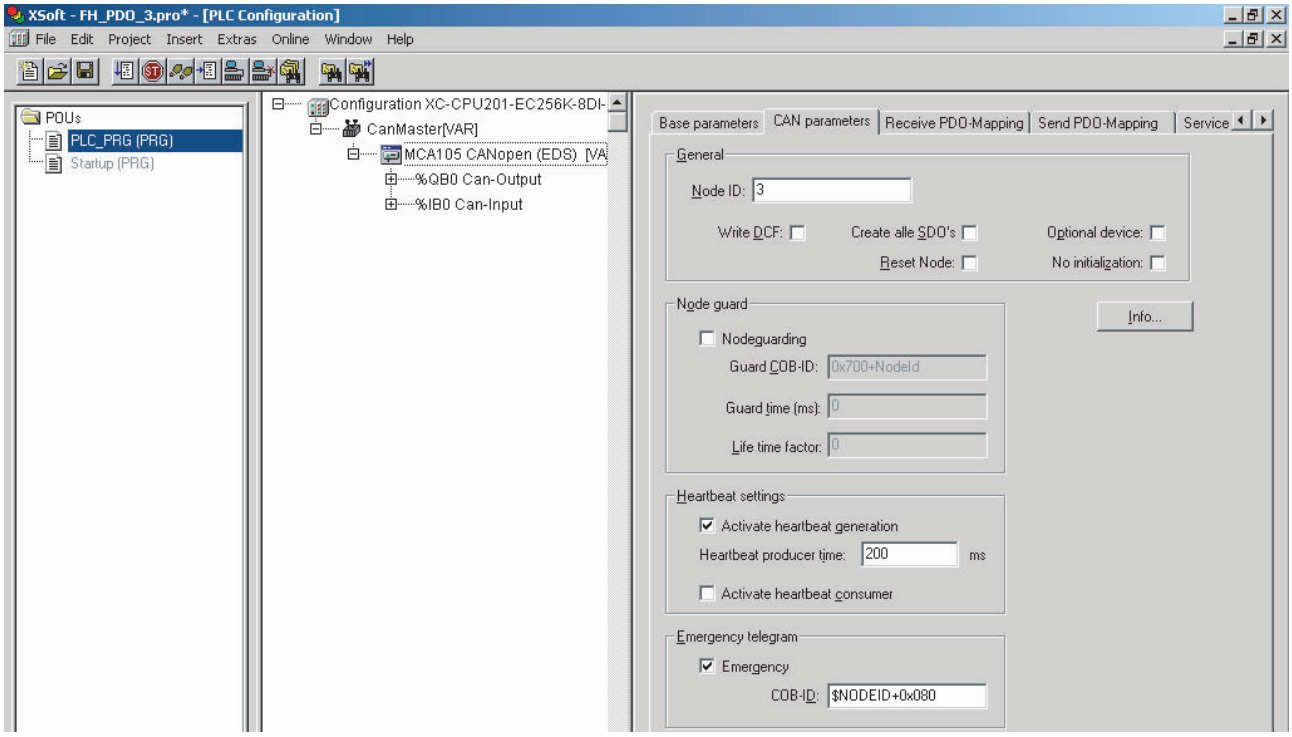

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Illustration 3.7 Configuring the CAN Parameters like Node-ID, Node-guarding, Heartbeat, and so on, on Node

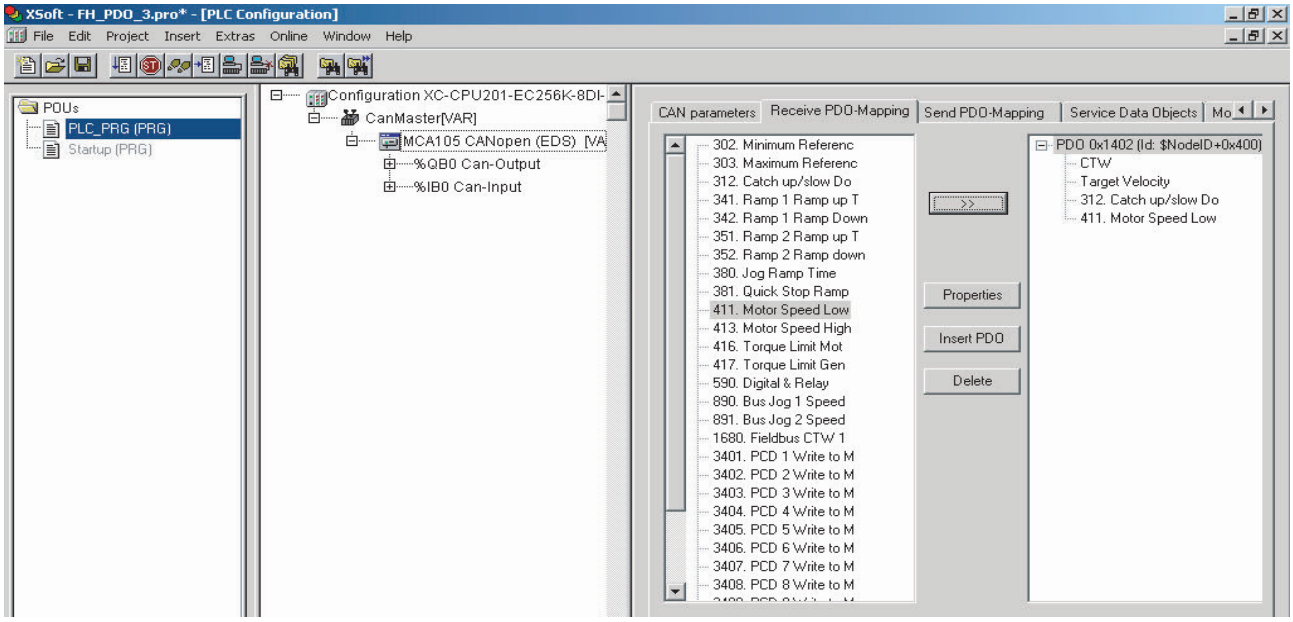

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Illustration 3.8 Configuring Receive and Transmit PDO-mapping. Here PDO 1402 with *Parameter 3-12 Catch up/slow Down Value* and *Parameter 4-11 Motor Speed Low Limit [RPM]*

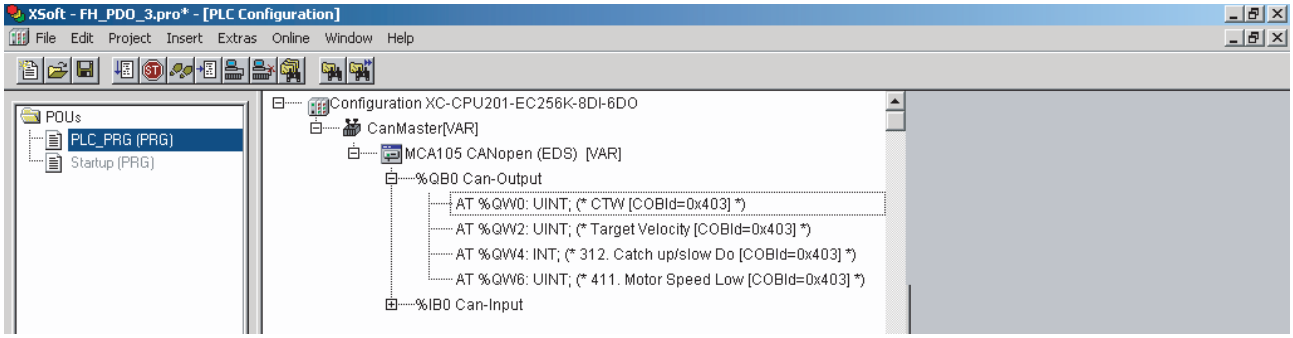

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Illustration 3.9 PLC Memory Mapping

3.3 Configure the Frequency Converter

3.3.1 Frequency Converter Parameters

Pay particular attention to the following parameters when configuring an VLT® AutomationDrive FC 300 with a CANopen interface. Refer to *chapter 6 Parameters* for more details about each parameter.

Parameter 0-40 [Hand on] Key on LCP
If the *[Hand On]* key on the frequency converter is pressed, control of the frequency converter via the CANopen interface is disabled.

Parameter 8-02 Control Word Source
After initial power-up, the frequency converter automatically detects whether a fieldbus option is installed in slot A, and sets *parameter 8-02 Control Word Source* to *[Option A]*. If an option is added to, changed in, or removed from an already commissioned frequency converter, it does not change *parameter 8-02 Control Word Source*.

Parameter 8-10 Control Word Profile
Select between the Danfoss FC Profile and the DSP 402 profile for CANopen. Refer to *chapter 4 Control*.

Parameter 8-01 Control Site* and *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select
Refer to *chapter 4 Control*.
Selection of how to gate the CANopen control commands with digital input command of the control card.
Set *Parameter 8-01 Control Site* to: *[2] Control word only*or *[0] Digital and ctrl. word*.

NOTICE

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

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

- *Parameter 10-01 Baud Rate Select*
  Default is 125 kbps.
- *Parameter 10-02 MAC ID*
  Default is 127.

4 Control

4.1 PDO Communication

The real-time data transfer is performed by process data objects (PDO).
The PDOs correspond to entries in the device object dictionary and provide the interface to the application objects.

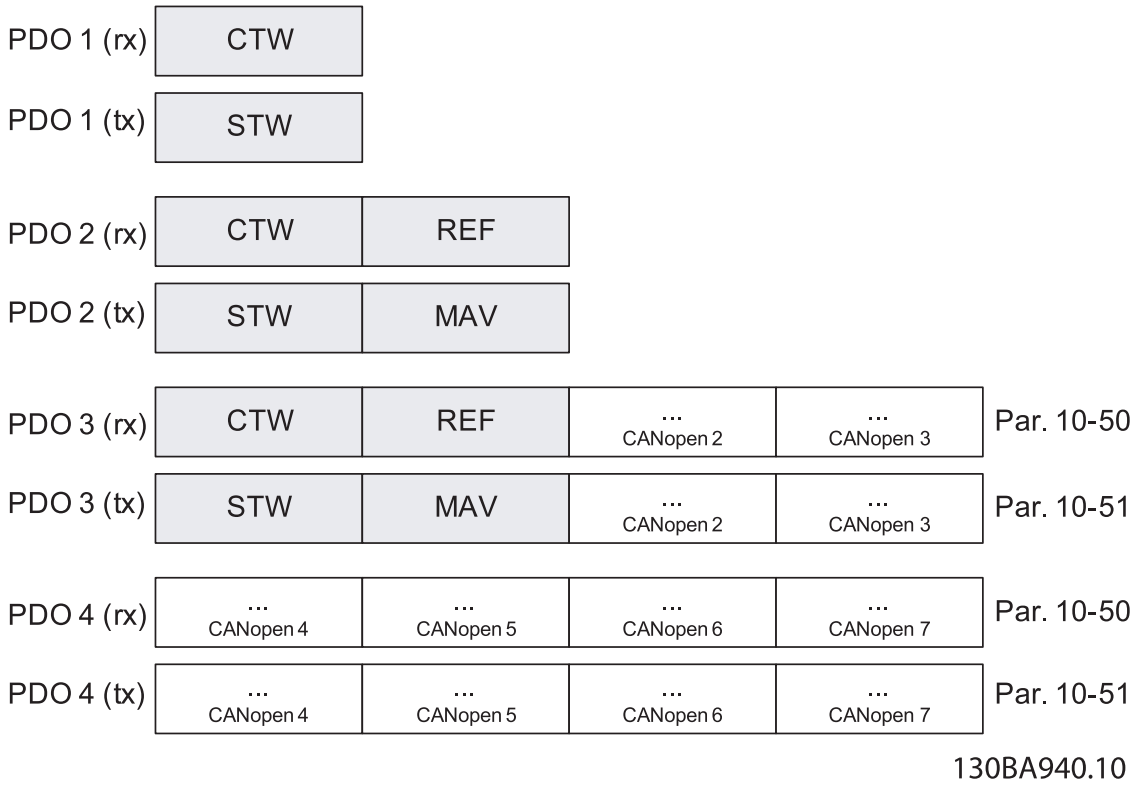

Illustration 4.1 PDO Types

NOTICE

Control word (CTW), status word (STW), reference (REF), and Main Actual Value (MAV) are fixed in PDO type 1–3. PDO type 4 is free configurable.

All receive and transmit PDOs can be configured via the OD.

Map process data into receive and transmit PDOs via *parameter 10-50 Process Data Config Write.* and *parameter 10-51 Process Data Config Read.* or via OD: 1600–1603 for receive PDOs and OD: 1A00–1A03 for transmit PDOs.

4.1.1 PDO Configuration

Index	Name	Sub index	Description		Value Sub index 2	Transmission type
1400h	1st receive PDO (PDO 1)	0	Number of entries.	⇒	1...240	SYNC
1401h	2nd receive PDO (PDO 2)	1	COB ID.	⇒	1...240	SYNC
1402h	3rd receive PDO (PDO 3)	2	Transmission type.	⇒	254...255	COS
1403h	4th receive PDO (PDO 4)			⇒	254...255	COS
1600h	1st receive PDO mapping (PDO 1) COB-ID 201h–27Fh	0	Number of entries.			
		1	1st mapped object (60400010h control word, fixed) (*parameter 10-50 Process Data Config Write.* [0])			
1601h	2nd receive PDO mapping (PDO 2) COB-ID 301h–37Fh	0	Number of entries			
		1	1st mapped object (60400010h control word, fixed) (*parameter 10-50 Process Data Config Write.* [0])			
		2	2nd mapped object (60420010h target velocity, fixed) (*parameter 10-50 Process Data Config Write.* [1])			
1602h	3rd receive PDO mapping (PDO 3) COB-ID 401h–47Fh	0	Number of entries.			
		1	1st mapped object (60400010h control word, fixed) (*parameter 10-50 Process Data Config Write.* [0])			
		2	2nd mapped object (60420010h target velocity, fixed) (*parameter 10-50 Process Data Config Write.* [1])			
		3	3rd mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [2])			
		4	4th mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [3])			
1603h	4th receive PDO mapping (PDO 4) COB-ID 501h–57Fh	0	Number of entries.			
		1	5th mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [4])			
		2	6th mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [5])			
		3	7th mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [6])			
		4	8th mapped object (2000h + parameter number) (*parameter 10-50 Process Data Config Write.* [7])			

Table 4.1 Receive PDO Configuration

Index	Name	Sub index	Description		Value sub index 2	Transmission type
		0	Number of entries.	⇒	0	SYNC, non-cyclic
1800h	1st transmit PDO (PPO 1)	1	COB ID.	⇒	0	SYNC, non-cyclic
1801h	2nd transmit PDO (PPO 2)	2	Transmission type.	⇒	1...240	SYNC
1802h	3rd transmit PDO (PPO 3)	3	Inhibit time.	⇒	1...240	SYNC
1803h	4th transmit PDO (PPO 4)	4	Reserved.	⇒	254...255	COS
		5	Event timer.	⇒	254...255	COS
1A00h	1st transmit PDO mapping (PDO 1) COB-ID 181h–1FFh	0	Number of entries.			
		1	1st mapped object (60410010h status word, fixed) (*parameter 10-51 Process Data Config Read.* [0])			
1A01h	2nd transmit PDO mapping (PDO 2) COB-ID 281h–2FFh	0	Number of entries.			
		1	1st mapped object (60410010h status word, fixed) (*parameter 10-51 Process Data Config Read.* [0])			
		2	2nd mapped object (60440010h control effort, fixed) (*parameter 10-51 Process Data Config Read.* [1])			
1A02h	3rd transmit PDO mapping (PDO 3) COB-ID 381h–3FFh	0	Number of entries.			
		1	1st mapped object (60410010h status word, fixed) (*parameter 10-51 Process Data Config Read.* [0])			
		2	2nd mapped object (60440010h control effort, fixed) (*parameter 10-51 Process Data Config Read.* [1])			
		3	3rd mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [2])			
		4	4th mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [3])			
1A03h	4th transmit PDO mapping (PDO 4) COB-ID 481h–4FFh	0	Number of entries.			
		1	5th mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [4])			
		2	6th mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [5])			
		3	7th mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [6])			
		4	8th mapped object (2000h + parameter number) (*parameter 10-51 Process Data Config Read.* [7])			

Table 4.2 Transmit PDO Configuration

4.1.2 PDO Mapping Syntax

Sub-index 1–4 contains the mapped objects.
Example: Object 6041 status word is fixed in PDO 1 and PDO 2 as the first transmit-word.
That is, OD 1A00h and 1A01h sub-index 1 holds the value of 60410010 (6041 = object number, 00 = sub-index, 10 = length of data = 16 bits)

Example: To map *parameter 16-14 Motor current* (32-bit data) in PDO 3, it must be mapped in 2 PDO-words.
Parameter 16-14 Motor current is according to manufacturer object 264E.
1A02h [3] = 264E0020 (264E = object number, 00 = sub-index, 20 = length of data = 32 bits)
1A02h [4] = 264E0020 (264E = object number, 00 = sub-index, 20 = length of data = 32 bits)

4.1.3 PDO Transmission Modes

Sub-index 2 contains the setting of the transmission mode.

The following PDO transmission modes are distinguished:

- Synchronous transmission.
- Asynchronous transmission.

4.1.4 PDO Triggering Modes

The CANopen communication profile distinguishes 2 message triggering modes:

- Event driven.
- Remotely requested.

Event driven
Message transmission is triggered by the occurrence of an object-specific event.
For synchronous PDOs, this is the expiration of the specified transmission period, synchronised by the reception of the SYNC object.

For acyclically transmitted synchronous PDOs and asynchronous PDO's, the triggering of a message transmission is an application-specific event specified in the device profile.

Remotely requested
The transmission of asynchronous PDO's may be initiated on receipt of a remote request initiated by another device.

Transmission type	PDO transmission				
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only
0		x	x		
1–240	x		x		
241–251	Reserved				
252	Not supported				
253					
254				x	
255				x	

Table 4.3 PDO Transmission

4.1.5 Inhibit Time

Sub-index 3 contains the inhibit time.
This time defines a minimum interval for PDO transmission.
The value is defined as multiple of 0.1 ms.
Default value is 300 = 30 ms.
Minimum value is 0.
Maximum value is 32767 = 3.2 s.
Data length = 2 bytes.

4.1.6 Event Timer

Sub-index 5 contains the inhibit time for transmit PDOs.
If an event timer is configured for a TPDO (value not equal to 0), the elapsed timer causes the transmission of this TPDO.
The event timer can be configured as multiple of 1 ms.
Default value is 0.
Maximum value is 32767 = 32 s.
Data length = 2 bytes.

4.2 Control Profile

4.2.1 Control Word Profile 8–10

8–10 Control Profile

In *parameter 8-10 Control Word Profile*, it is possible to select:

Option:		Function:
[0] *	FC profile	

8–10 Control Profile

In *parameter 8-10 Control Word Profile*, it is possible to select:

Option:		Function:
[5]	CANopen DSP	

[0] FC Profile is the default control profile for VLT frequency converters, whereas *[5] CANopen DSP 402* is the CiA standardised control profile, featuring the special DSP 402 transition state machine.

4.2.2 DSP 402 State Transitions

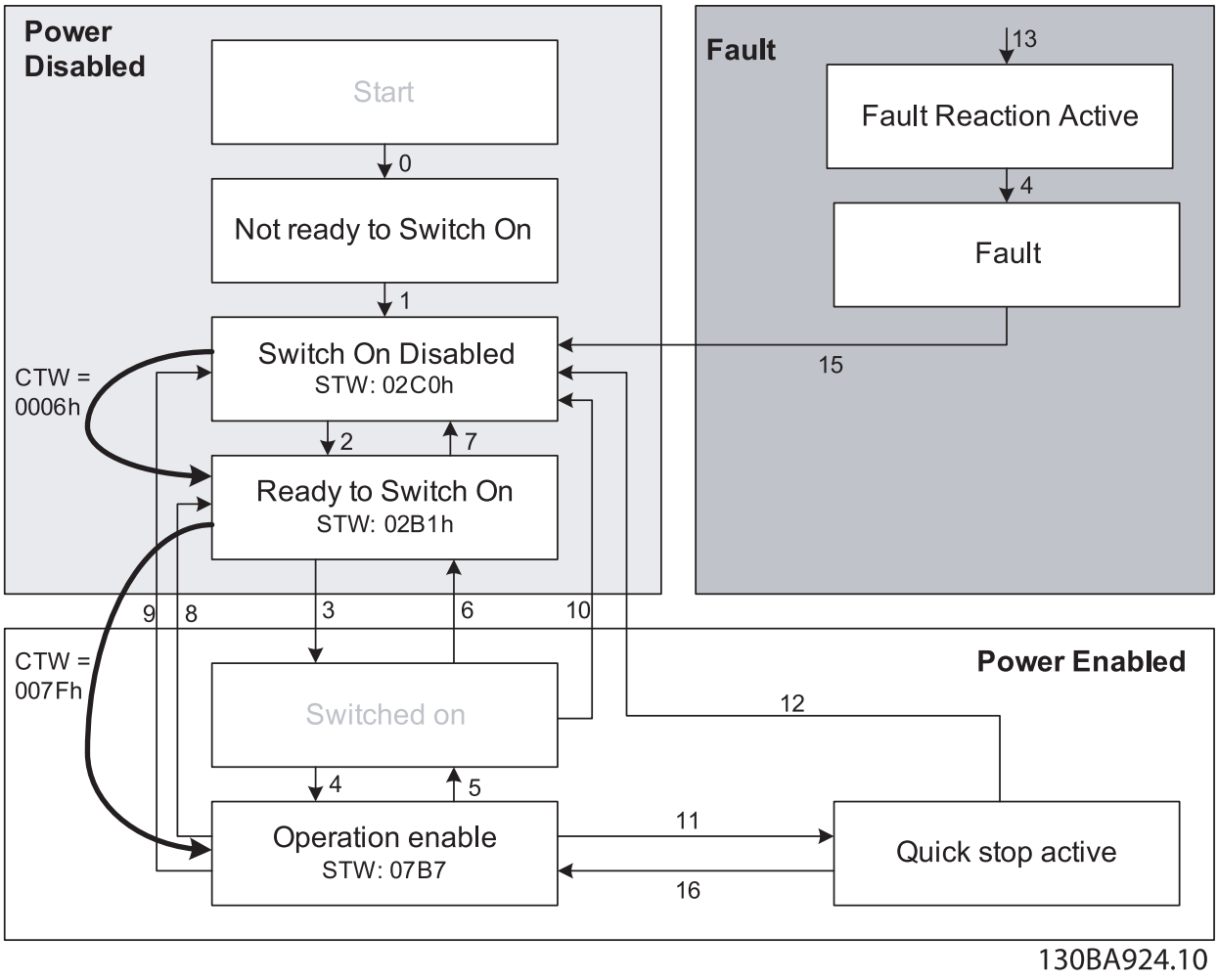

Illustration 4.2 DSP 402 State Machine

Transition	State	Control word	Status word	Action
–	Start condition	0000	0000	
0	Start-up⇒Not ready to switch on	0000	0200	
1	Not ready to switch on⇒ Switch on disabled	0000, 0001	0240	
2	Switch on disable⇒Ready to switched on	0006	0231	
3	Ready to switch on⇒Switched on	0007	0233	
4	Switched on⇒Operation enabled	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	The power section is switched off immediately, and the motor is free to rotate if unbraked.
9	Operation enable⇒Switch on disable	0001, 0000	0240	The power section is switched off immediately, and the motor is free to rotate if unbraked.
10	Switched on⇒Switched on disable	0001, 0000	0240	The power section is switched off immediately, and the motor is free to rotate if unbraked.
11	Operation enabled⇒Quick stop active	0002	0207	The motor ramps to 0 RPM with programmed quick-ramp parameter.
12	Quick stop activ⇒Switch on disabled	0001, 0000	0240	The power section is switched off immediately, and the motor is free to rotate if unbraked.
13	All states⇒Fault reaction active	xxxx	023F	
14	Fault reaction active⇒Fault	xxxx	023F (0238 by InterBus)	
15	Fault⇒Switch on disabled	0000	0240	
16	Quick stop active⇒Operation enable (not supported)			

Table 4.4 DSP 402 State Transitions

4.3 DSP 402 Control Profile

4.3.1 Control Word According to DSP 402 Profile (parameter 8-10 = DSP 402 profile)

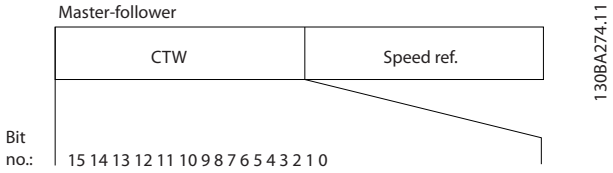

Illustration 4.3 Control Word

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 4.5 Control Bits

Explanation of the control bits

Bit 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 execute 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 means that the given output frequency is maintained even if the reference is changed.
Bit 05 = 1 means that 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 A start command to the frequency converter is given.

Bit 07, No function/reset:
Reset of trip.
Bit 07 = 0 means that there is no reset.
Bit 07 = 1 means that a trip is reset.

Bit 08, 09, and 10:
DSP402 reserved.

Bit 11, Jog 1 OFF/ON:
Activation of pre-programmed speed in *parameter 8-90 Bus Jog 1 Speed* (bus jog 1).
Jog 1 is only possible if bit 04 = 0, and bits 00–03 = 1.

Bit 12:
Danfoss reserved.

Bits 13/14, Selection of setup:
Bits 13 and 14 are used for selecting among the 4 menu set-ups in accordance with *Table 4.6*.

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

Table 4.6 4 Menu Set-ups

Bit 15, Forward/reversing:
Bit 15 = "0" leads to no reversing.
Bit 15 = "1" leads to reversing.

NOTICE

In factory setting, reversing is set to *[0] Digital input* in *parameter 8-54 Reversing Select*.

4.3.2 Status Word According to DSP 402 Profile

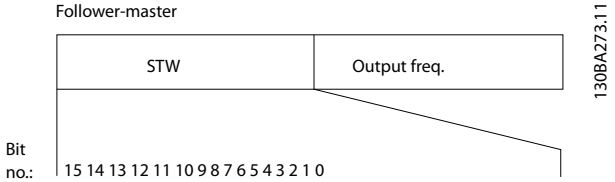

Illustration 4.4 Status Word

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

Table 4.7 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 means that the frequency converter is not in a fault condition.
Bit 03 = 1 means that the frequency converter has tripped and needs a reset signal to run.

Bit 04, Voltage disable/voltage enable:
Bit 04 = 0 means that control word bit 01 = 1.
Bit 04 = 1 means that control word bit 01 = 0.

Bit 05, Quick stop/run:
Bit 05 = 0 means that control word bit 02 = 1.
Bit 05 = 1 means that control word bit 02 = 0.

Bit 06, Start enable/start disable:
Bit 06 = 0 state is not switch on disable.
Bit 06 = 1 state is switch on enable.

Bit 07, No warning/warning:
Bit 07 = 0 means that there is no warning. situation.
Bit 07 = 1 means that a warning has occurred.

Bit 08
Danfoss reserved.

Bit 09, Remote disable/remote enable:
Bit 09 = 0 means that the frequency converter has been stopped with the [stop] key on the LCP, or that [Local] has been selected in *parameter 3-13 Reference Site*.
Bit 09 = 1 means that it is possible to control the frequency converter via the serial port.

Bit 10, Setpoint not reached/setpoint reached:
Bit 10 = 0 means that the actual motor speed is different from the speed reference set. This can be the case while the speed is ramped up/down during start/stop.
Bit 10 = 1 means that the present motor speed equals the speed reference set.

Bit 11, Speed limit not active/speed limit active:
Bit 11 = 0 means that the output frequency is out of the range set in *parameter 4-11 Motor Speed Low Limit [RPM]*/ *parameter 4-12 Motor Speed Low Limit [Hz]* or *parameter 4-13 Motor Speed High Limit [RPM]*/ *parameter 4-14 Motor Speed High Limit [Hz]*.
Bit 11 = 1 means that 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 means that the motor is not running.
Bit 14 = 1 means that the frequency converter has a valid start signal or that the output frequency is greater than 0 Hz.

Bit 15
Danfoss reserved.

4.4 Danfoss FC control profile

4.4.1 Control Word according to FC Profile (parameter 8-10 = FC profile)

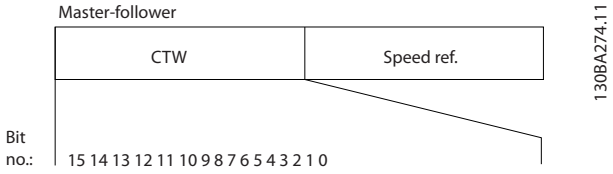

Illustration 4.5 Control Word

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 4.8 Control Bits

Explanation of the control bits
Bits 00/01
Bits 00 and 01 are used to select between the 4 reference values, which are pre-programmed in *parameter 3-10 Preset Reference* according to *Table 4.9*.

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

Table 4.9 Set-up

NOTICE

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

Bit 02, DC brake:
Bit 02 = 0 leads to DC brake and stop. Braking current and duration are set in *parameter 2-01 DC Brake Current* and *parameter 2-02 DC Braking Time*.
Bit 02 = 1 leads to ramping.

Bit 03, Coasting:
Bit 03 = 0 causes the frequency converter to immediately release the motor (the output transistors are "shut off"), so that it coasts to a standstill.
Bit 03 = 1 enables the frequency converter to start the motor if the other starting conditions are fulfilled.

NOTICE

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

Bit 04, Quick stop:
Bit 04 = 0 causes a stop, in which the motor speed is ramped down to stop via *parameter 3-81 Quick Stop Ramp Time*.

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

NOTICE

If freeze output is active, the frequency converter can only be stopped by the following:

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

Bit 06, Ramp stop/start:
Bit 06 = 0 causes a stop, in which the motor speed is ramped down to stop via the selected ramp-down parameter.
Bit 06 = 1 permits the frequency converter to start the motor, if the other starting conditions are fulfilled.

NOTICE

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

Bit 07, Reset:
Bit 07 = 0 does not cause a reset.
Bit 07 = 1 causes the reset of a trip. Reset is activated on the signal's leading edge, for example, when changing from logic 0 to logic 1.

Bit 08, Jog:
Bit 08 = 1 causes the output frequency to be determined by *parameter 3-19 Jog Speed [RPM]*.

Bit 09, Selection of ramp 1/2:
Bit 09 = 0 means that ramp 1 is active (*parameter 3-40 Ramp 1 Type* to *parameter 3-47 Ramp 1 S-ramp Ratio at Decel. Start*).
Bit 09 = 1 means that ramp 2 (*parameter 3-50 Ramp 2 Type* to *parameter 3-57 Ramp 2 S-ramp Ratio at Decel. Start*) is active.

Bit 10, Data not valid/data valid:
Is used to tell the frequency converter whether the control word is to be used or ignored.
Bit 10 = 0 causes the control word to be ignored.
Bit 10 = 1 causes the control word to be used. This function is relevant, because the control word is always contained in the telegram, regardless of which type of telegram is used, for example, it is possible to turn off the control word if it is not to be used it with updating or reading parameters.

Bit 11, Relay 01:
Bit 11 = 0 Relay 01 is not activated.
Bit 11 = 1 Relay 01 activated, provided control word bit 11 is selected in *parameter 5-40 Function Relay*.

Bit 12, Relay 04:
Bit 12 = 0 Relay 04 is not activated.
Bit 12 = 1 Relay 04 is activated, provided control word bit 12 has been selected in *parameter 5-40 Function Relay*.

Bit 13/14, Selection of set-up:
Bits 13 and 14 are used to select from the four menu set-ups according to *Table 4.10*.

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

Table 4.10 Selection of Set-up

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

NOTICE

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

Bit 15 Reverse:
Bit 15 = 0 causes no reversing.
Bit 15 = 1 causes reversing.

NOTICE

In the factory setting reversing is set to digital in *parameter 8-54 Reversing Select*.
Bit 15 causes reversing only when *Ser. communication*, *Logic or*, or *Logic and* is selected.

4.4.2 Status Word according to FC Profile (parameter 8-10 = FC profile)

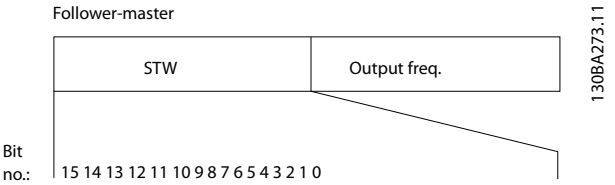

Illustration 4.6 Status Word

'Bit	Bit value = 0	Bit value = 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	Trip lock
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, auto start
13	Voltage ok	Voltage exceeded
14	Torque ok	Torque exceeded
15	Timer ok	Timer exceeded

Table 4.11 Status Bits

4

Explanation of the status bits

Bit 00, Control not ready/ready:
Bit 00 = 0 means that the frequency converter has tripped.
Bit 00 = 1 means that the frequency converter controls are ready, but that the power component is not necessarily receiving any power supply (in case of 24 V external supply to controls).

Bit 01, Frequency converter ready:
Bit 01 = 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 means that the frequency converter is not in fault mode.
Bit 03 = 1 means that 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 means that the frequency converter is not in fault mode.
Bit 04 = 1 means that 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 means that the frequency converter is not in fault mode.
Bit 06 = 1 means that the frequency converter is tripped, and locked.

Bit 07, No warning/warning:
Bit 07 = 0 means that there are no warnings.
Bit 07 = 1 means that a warning has occurred.

Bit 08, Speed ≠ reference/speed = reference:
Bit 08 = 0 means that the motor is running, but that the present speed is different from the preset speed reference. It might, for example, be the case while the speed is being ramped up/down during start/stop.
Bit 08 = 1 means that the present motor present speed matches the preset speed reference.

Bit 09, Local operation/bus control:
Bit 09 = 0 means that [STOP/RESET] is pressed on the control unit, or that local control in *parameter 3-13 Reference Site* is selected. It is not possible to control the frequency converter via serial communication.
Bit 09 = 1 means that it is possible to control the frequency converter via the fieldbus/ serial communication.

Bit 10, Out of frequency limit:
Bit 10 = 0 if the output frequency has reached the value in *parameter 4-11 Motor Speed Low Limit [RPM]* or *parameter 4-13 Motor Speed High Limit [RPM]*.
Bit 10 = 1 means that the output frequency is within the defined limits.

Bit 11, No operation/in operation:
Bit 11 = 0 means that the motor is not running.
Bit 11 = 1 means that the frequency converter has a start signal or that the output frequency is greater than 0 Hz.

Bit 12, Frequency converter OK/stopped, auto start:
Bit 12 = 0 means that there is no temporary overtemperature on the inverter.
Bit 12 = 1 means that the inverter has stopped because of overtemperature, but that the unit has not tripped and will resume operation once the overtemperature stops.

Bit 13, Voltage OK/limit exceeded:
Bit 13 = 0 means that there are no voltage warnings.
Bit 13 = 1 means that the DC voltage in the frequency converter's DC link is too low or too high.

Bit 14, Torque OK/limit exceeded:
Bit 14 = 0 means that the motor current is lower than the torque limit selected in *parameter 4-18 Current Limit*.
Bit 14 = 1 means that the torque limit in *parameter 4-18 Current Limit* has been exceeded.

Bit 15, Timer OK/limit exceeded:
Bit 15 = 0 means that the timers for motor thermal protection and frequency converter thermal protection, respectively, have not exceeded 100%.
Bit 15 = 1 means that 1 of the timers has exceeded 100%.

4.5 Reference Handling

In both FC profile and CANopen DSP 402, the reference is scaled as a normalised relative value in percent. The value is transmitted in hexadecimal:

- 0% = 0 hex.
- 100% = 4000 hex.
- -100% = C000 hex.

Depending of the setting of *parameter 3-00 Reference Range*, the reference is scaled from – Maximum to + Maximum or from Minimum to Maximum.

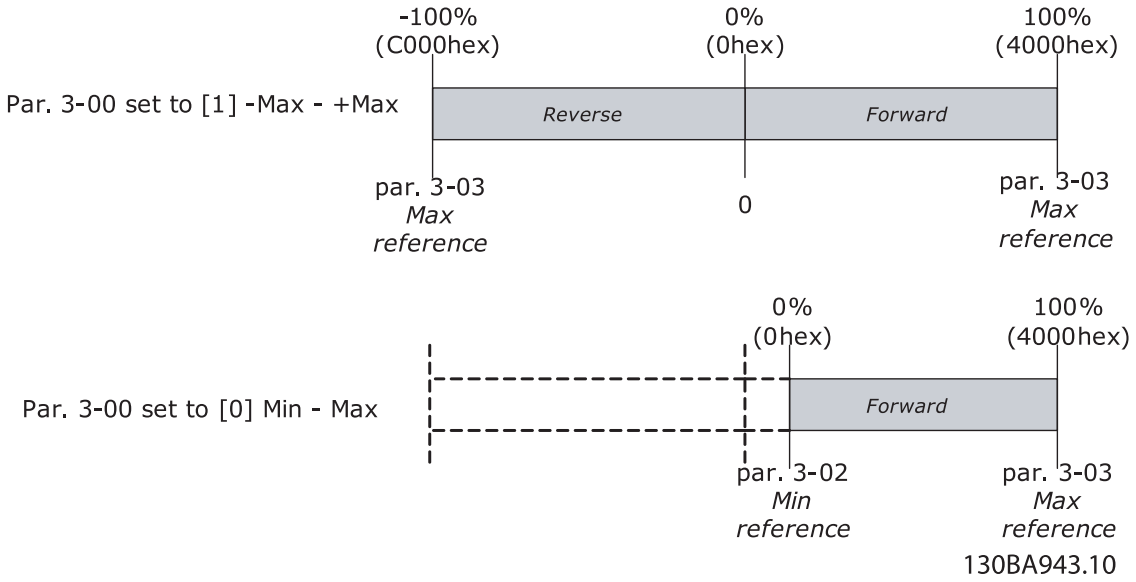

Illustration 4.7 Reference Handling

The actual reference [Ref. %] in the frequency converter depends on the settings in the following parameters:

- *Parameter 1-23 Motor Frequency*.
- *Parameter 1-25 Motor Nominal Speed*.
- *Parameter 3-02 Minimum Reference*.
- *Parameter 3-03 Maximum Reference*.

All references provided to the frequency converter are added to the total reference value.
If a reference is to be controlled by the fieldbus only, ensure that all other reference inputs are 0.

This means that digital and analog input terminals should not be used for reference signals.
Maintain the default setting (0%) for preset references in *parameter 3-10 Preset Reference*.

If the bus speed reference is negative, and the control word contains a run reverse signal, the frequency converter runs clockwise (- - is +).

MAV is scaled in the same way as the reference.

5 Parameter Access

5.1 Danfoss Specific Objects (2000h-5FFFh)

All frequency converter parameters are accessible as OD-entries:
OD index = Frequency converter parameter + 2000h.

Frequency converter parameter	CANopen OD index
1	2001h
2	2002h
...	...
0-10	200Ah
0-11	200Bh
...	...
1-00	2064h
1-01	2065h
...	...
10-00	23E8h
10-01	23E9h
...	...

Table 5.1 Example of Converting of Frequency Converter Parameters

Access the indexed parameters by accessing the appropriate subindex of the OD index.

6 Parameters

8-01 Control Site

Option:		Function:
		The setting in this parameter overrides the settings in *parameter 8-50 Coasting Select* to *parameter 8-56 Preset Reference Select*.
[0]	Digital and ctrl.word	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

Option:		Function:
		NOTICE **This parameter cannot be adjusted while the motor runs.** Select the source of the control word: 1 of 2 serial interfaces or 4 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. When the option is removed, the frequency converter detects a configuration change, sets *parameter 8-02 Control Word Source* to default setting RS485, and trips. If an option is installed after initial power-up, the setting of *parameter 8-02 Control Word Source* does not change, but the frequency converter trips and shows: *Alarm 67, Option Changed*. When retrofitting a bus option into a frequency converter that did not have a bus option installed earlier, change the control to bus-based. This change is required for safety reasons to avoid an unintended change.
[0]	None	
[1]	FC RS485	
[2]	FC USB	
[3]	Option A	
[4]	Option B	
[5]	Option C0	
[6]	Option C1	
[30]	External Can	

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 2 consecutive telegrams. If this time is exceeded, it indicates that the telegram communication has stopped. The function selected in *parameter 8-04 Control Word Timeout Function* is then carried out. A valid control word triggers the timeout counter.

8-04 Control Word Timeout Function

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

Option:		Function:
		NOTICE **To change the set-up after a timeout, configure as follows:** **Set *parameter 0-10 Active Set-up* to *[9] Multi set-up* and select the relevant link in *parameter 0-12 This Set-up Linked to*.**
[0]	Off	Resumes control via fieldbus (fieldbus or standard), using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at jog frequency until communication resumes.
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the frequency converter to restart: • Via the fieldbus. • Via [Reset]. • Via a digital input.
[7]	Select setup 1	Changes the set-up after reestablishment of communication following a control word timeout. If communication resumes after a timeout, *parameter 8-05 End-of-Timeout Function* defines whether to resume the set-up used before the timeout, or to retain the set-up endorsed by the time-out function.
[8]	Select setup 2	See *[7] Select set-up 1*.
[9]	Select setup 3	See *[7] Select set-up 1*.

8-04 Control Word Timeout Function

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

Option:		Function:
[10]	Select setup 4	See *[7] Select set-up 1*.
[26]	Trip	

8-05 End-of-Timeout Function

Option:		Function:
		Select the action after receiving a valid control word following a timeout. This parameter is active only when *parameter 8-04 Control Timeout Function* is set to: • *[7] Set-up 1*. • *[8] Set-up 2*. • *[9] Set-up 3*. • *[10] Set-up 4*.
[0]	Hold set-up	Retains the set-up selected in *parameter 8-04 Control Timeout Function* and shows a warning until *parameter 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 timeout.

8-06 Reset Control Word Timeout

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

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

8-07 Diagnosis Trigger

Option:		Function:
		This parameter enables and controls the frequency converter diagnosis function and permits expansion of the diagnosis data to 24 byte. ***NOTICE*** **This is only valid for Profibus.**

8-07 Diagnosis Trigger

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

Byte	Content	Description
0 - 5	Standard DP Diagnose Data	Standard DP Diagnose Data
6	PDU length xx	Header of extended diagnostic data
7	Status type = 0x81	Header of extended diagnostic data
8	Slot = 0	Header of extended diagnostic data
9	Status info = 0	Header of extended diagnostic data
10 - 13	VLT *parameter 16-92 Warning Word*	VLT warning word
14 - 17	VLT *parameter 16-03 Status Word*	VLT status word
18 - 21	VLT *parameter 16-90 Alarm Word*	VLT alarm word
22 - 23	VLT *parameter 9-53 Profibus Warning Word*	Communication warning word (Profibus)

Table 6.1

Enabling diagnosis may cause increased bus traffic. Diagnosis functions are not supported by all fieldbus types.

[0] *	Disable	

8-07 Diagnosis Trigger

Option:		Function:
[1]	Trigger on alarms	
[2]	Trigger alarm/ warn.	

8-08 Readout Filtering

If the speed feedback value readouts on fieldbus are fluctuating, this function is used. Select filtered, if the function is required. A power cycle is required for changes to take effect.

Option:		Function:
[0]	Motor Data Std-Filt.	Normal fieldbus readouts.
[1]	Motor Data LP-Filter	Filtered fieldbus readouts of the following parameters: • *Parameter 16-10 Power [kW]*. • *Parameter 16-11 Power [hp]*. • *Parameter 16-12 Motor Voltage*. • *Parameter 16-14 Motor current*. • *Parameter 16-16 Torque [Nm]*. • *Parameter 16-17 Speed [RPM]*. • *Parameter 16-22 Torque [%]*. • *Parameter 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. For guidelines in selection of *[0] Frequency converter profile* and *[1] PROFIdrive profile*, refer to the *design guide* of the related product.

For more guidelines in the selection of *[1] PROFIdrive profile*, *[5] ODVA* and *[7] CANopen DSP 402*, see the *installation guide* for the installed fieldbus.

Option:		Function:
[0] *	FC profile	
[1]	PROFIdrive profile	
[5]	ODVA	
[7]	CANopen DSP 402	
[8]	MCO	

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 *parameter 8-10 Control Profile*.

8-13 Configurable Status Word STW

Option:		Function:
[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. 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 terminal 37 is low (Safe Torque stop). 1 indicates terminal 37 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]	Comparator 0	See parameter group *13-1* Comparators*. If comparator 0 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[61]	Comparator 1	See parameter group *13-1* Comparators*. If comparator 1 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[62]	Comparator 2	See parameter group *13-1* Comparators*. If comparator 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[63]	Comparator 3	See parameter group *13-1* Comparators*. If comparator 3 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[64]	Comparator 4	See parameter group *13-1* Comparators*. If comparator 4 is evaluated as TRUE, the output goes high. Otherwise, it is low.

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8-13 Configurable Status Word STW

Option:		Function:
[65]	Comparator 5	See parameter group *13-1* Comparators*. If comparator 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[70]	Logic Rule 0	See parameter group *13-4* Logic 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* Logic 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* Logic Rules*. If logic rule 2 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[73]	Logic Rule 3	See parameter group *13-4* Logic Rules*. 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* Logic 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* Logic Rules*. If logic rule 5 is evaluated as TRUE, the output goes high. Otherwise, it is low.
[80]	SL Digital Output A	See *parameter 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 *parameter 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 *parameter 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 *parameter 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 *parameter 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 *parameter 13-52 SL Controller Action*. The input goes high whenever the smart logic action *[43] Set digital out F high* is executed.

8-13 Configurable Status Word STW

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

8-17 Configurable Alarm and Warningword

The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.

Option:		Function:
[0] *	Off	
[1]	10 Volts low warning	
[2]	Live zero warning	
[3]	No motor warning	
[4]	Mains phase loss warning	
[5]	DC link voltage high warning	
[6]	DC link voltage low warning	
[7]	DC overvoltage warning	

8-17 Configurable Alarm and Warningword		
The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.		
Option:		**Function:**
[8]	DC undervoltage warning	
[9]	Inverter overloaded warning	
[10]	Motor ETR overtemp warning	
[11]	Motor thermistor overtemp warning	
[12]	Torque limit warning	
[13]	Over current warning	
[14]	Earth fault warning	
[17]	Controlword timeout warning	
[19]	Discharge temp high warning	
[22]	Hoist mech brake warning	
[23]	Internal fans warning	
[24]	External fans warning	
[25]	Brake resistor short circuit warning	
[26]	Brake powerlimit warning	
[27]	Brake chopper short circuit warning	
[28]	Brake check warning	
[29]	Heatsink temperature warning	
[30]	Motor phase U warning	
[31]	Motor phase V warning	
[32]	Motor phase W warning	
[34]	Fieldbus communication warning	
[36]	Mains failure warning	
[40]	T27 overload warning	
[41]	T29 overload warning	
[45]	Earth fault 2 warning	
[47]	24V supply low warning	
[58]	AMA internal fault warning	
[59]	Current limit warning	
[60]	External interlock warning	
[61]	Feedback error warning	
[62]	Frequency max warning	
[64]	Voltage limit warning	
[65]	Controlboard overtemp warning	
[66]	Heatsink temp low warning	
[68]	Safe stop warning	
[73]	Safe stop autorestart warning	
[76]	Power unit setup warning	
[77]	Reduced powermode warning	
[78]	Tracking error warning	
[89]	Mech brake sliding warning	
[163]	ATEX ETR cur limit warning	
[165]	ATEX ETR freq limit warning	
[10002]	Live zero error alarm	
[10004]	Mains phase loss alarm	
[10007]	DC overvoltage alarm	
[10008]	DC undervoltage alarm	
[10009]	Inverter overload alarm	
[10010]	ETR overtemperature alarm	
[10011]	Thermistor overtemp alarm	

8-17 Configurable Alarm and Warningword		
The configurable alarm and warning word has 16 bits (0-15). Each of those bits can be configured to any of the following options.		
Option:		**Function:**
[10012]	Torque limit alarm	
[10013]	Overcurrent alarm	
[10014]	Earth fault alarm	
[10016]	Short circuit alarm	
[10017]	CTW timeout alarm	
[10022]	Hoist brake alarm	
[10026]	Brake powerlimit alarm	
[10027]	Brakechopper shortcircuit alarm	
[10028]	Brake check alarm	
[10029]	Heatsink temp alarm	
[10030]	Phase U missing alarm	
[10031]	Phase V missing alarm	
[10032]	Phase W missing alarm	
[10033]	Inrush fault alarm	
[10034]	Fieldbus com faul alarm	
[10036]	Mains failure alarm	
[10037]	Phase imbalance alarm	
[10038]	Internal fault	
[10039]	Heatsink sensor alarm	
[10045]	Earth fault 2 alarm	
[10046]	Powercard supply alarm	
[10047]	24V supply low alarm	
[10048]	1.8V supply low alarm	
[10049]	Speed limit alarm	
[10060]	Ext interlock alarm	
[10061]	Feedback error alarm	
[10063]	Mech brake low alarm	
[10065]	Controlboard overtemp alarm	
[10067]	Option config changed alarm	
[10068]	Safe stop alarm	
[10069]	Powercard temp alarm	
[10073]	Safestop auto restart alarm	
[10074]	PTC thermistor alarm	
[10075]	Illegal profile alarm	
[10078]	Tracking error alarm	
[10079]	Illegal PS config alarm	
[10081]	CSIV corrupt alarm	
[10082]	CSIV param error alarm	
[10084]	No safety option alarm	
[10090]	Feedback monitor alarm	
[10091]	AI54 settings alarm	
[10164]	ATEX ETR current lim alarm	
[10166]	ATEX ETR freq limit alarm	

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8-19 Product Code

Range:		Function:
Size related*	[0 - 2147483647]	Select 0 to read out the actual fieldbus product code according to the mounted fieldbus option. Select 1 to read out the actual vendor ID.

8-46 BTM Transaction Status

Option:		Function:
[0] *	Off	
[1]	Transaction Started	
[2]	Transaction Comitting	
[3]	Transaction Timeout	
[4]	Err. Non-existing Par.	
[5]	Err. Par. Out of Range	
[6]	Transaction Failed	

8-47 BTM Timeout

Range:		Function:
60 s*	[1 - 360 s]	Select the BTM timeout after a BTM transaction has been started.

8-48 BTM Maximum Errors

Range:		Function:
21*	[0 - 21]	Selects the maximum allowed number of bulk transfer mode errors before aborting. If it is set to maximum, there is no abort.

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 1 extra digital input.
[3] *	Logic OR	Activates start command via the fieldbus/serial communication port, or via 1 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. ***NOTICE*** **When *parameter 1-10 Motor Construction* is set to *[1] PM non-salient SPM*, only selection *[0] Digital input* is available.**
[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 1 of the digital inputs.
[3]	Logic OR	Activates start command via the fieldbus/serial communication port, or via 1 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 a start command via a digital input.
[1]	Bus	Activates a start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activates a start command via the fieldbus/serial communication port, and additionally via 1 of the digital inputs.
[3] *	Logic OR	Activates a start command via the fieldbus/serial communication port, or via 1 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 1 of the digital inputs.
[3]	Logic OR	Activates the reverse command via the fieldbus/serial communication port, or via 1 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.
[2]	Logic AND	Activates the set-up selection via the fieldbus/ serial communication port, and via 1 of the digital inputs.
[3] *	Logic OR	Activates the set-up selection via the fieldbus/ serial communication port, or via 1 of the digital inputs.

8-56 Preset Reference Select

Option:		Function:
		Select control of the preset reference selection via the terminals (digital input) and/or via the fieldbus.
[0]	Digital input	Activates preset reference selection via a digital input.
[1]	Bus	Activates preset reference selection via the serial communication port or fieldbus option.
[2]	Logic AND	Activates preset reference selection via the fieldbus/serial communication port, and via 1 of the digital inputs.
[3] *	Logic OR	Activates the preset reference selection via the fieldbus/serial communication port, or via 1 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.

10-00 CAN Protocol

Option:		Function:
		NOTICE **The options depend on installed option.**
[0]	CANopen	
[1]	DeviceNet	View the active CAN protocol.

10-01 Baud Rate Select

Select the fieldbus transmission speed. The selection must correspond to the transmission speed of the master and the other fieldbus nodes.

Option:		Function:
[16]	10 Kbps	
[17]	20 Kbps	
[18]	50 Kbps	
[19]	100 Kbps	
[20]	125 Kbps	
[21]	250 Kbps	
[22]	500 Kbps	

10-02 MAC ID

Range:		Function:
Size related*	[0 - 127]	Selection of station address. Every station connected to the same network must have an unambiguous address.

10-05 Readout Transmit Error Counter

Range:		Function:
0*	[0 - 255]	View the number of CAN control transmission errors since the last power-up.

10-06 Readout Receive Error Counter

Range:		Function:
0*	[0 - 255]	View the number of CAN control receipt errors since the last power-up.

10-33 Store Always

Option:		Function:
[0] *	Off	Deactivates non-volatile storage of data.
[1]	On	Stores parameter data received via VLT® DeviceNet MCA 104 in EEPROM non-volatile memory as default.

10-50 Process Data Config. Write

Only elements [2] and [3] of this array can be selected ([0] and [1] are fixed).

Option:		Function:
[0] *	None	
[1]	16-80 Fieldbus CTW 1	
[2]	16-82 Fieldbus REF 1	
[3]	3-02 Minimum Reference	
[4]	3-03 Maximum Reference	
[5]	3-12 Catch Up/Slow Down Value	
[6]	3-41 Ramp 1 Ramp Up Time	
[7]	3-42 Ramp 1 Ramp Down Time	
[8]	3-51 Ramp 2 Ramp Up Time	
[9]	3-52 Ramp 2 Ramp Down Time	
[10]	3-80 Jog Ramp Time	
[11]	3-81 Quick Stop RampTime	
[12]	4-11 Motor Speed Low Limit (RPM)	
[13]	4-13 Motor Speed High Limit (RPM)	

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10-50 Process Data Config. Write

Only elements [2] and [3] of this array can be selected ([0] and [1] are fixed).

Option:		Function:
[14]	4-16 Torque Limit Motor Mode	
[15]	4-17 Torque Limit Generator Mode	
[16]	8-90 Bus Jog 1 Speed	
[17]	8-91 Bus Jog 2 Speed	

10-51 Process Data Config. Read

Only elements [2] and [3] of this array can be selected ([0] and [1] are fixed.

*0	None
16-03	Status Word
16-05	Main Actual Value (%)
16-00	Control Word
16-01	Reference (Unit)
16-02	Reference (%)
16-04	Main Actual Value (Unit)
16-91	Alarm Word 2
16-92	Warning Word
16-90	Alarm Word
16-93	Warning Word 2
16-94	Ext. Status Word
16-95	Ext. Status Word 2
16-10	Power (kW)
16-11	Power (hp)
16-12	Motor Voltage
16-13	Frequency
16-14	Motor Current
16-16	Torque
16-17	Speed (RPM)
16-18	Motor Thermal
16-19	KTY Sensor Temperature
16-20	Phase Angle
16-30	DC Link Voltage
16-32	Brake Energy/s
16-33	Brake Energy/2 min
16-34	Heatsink Temp.
16-35	Inverter Thermal
16-38	SL Controller State
16-39	Control Card Temp.
16-50	External Reference
16-51	Pulse Reference
16-52	Feedback (Unit)
16-53	Digi Pot Reference
16-60	Digital Input
16-61	Terminal 53 Switch Setting
16-62	Analog Input 53
16-63	Terminal 54 Switch Setting
16-64	Analog Input 54
16-65	Analog Output 42 (mA)
16-66	Digital Output (bin)
16-67	Freq. Input #29 (Hz)
16-68	Freq. Input #33 (Hz)
16-69	Pulse Output #27 (Hz)
16-70	Pulse Output #29 (Hz)
16-84	Comm. Option STW
16-85	FC Port CTW 1
16-09	Custom Readout

Table 6.2 Parameter List

15-60 Option Mounted

Range:		Function:
0*	[0 - 30]	View the installed option type.

16-84 Comm. Option STW

Range:		Function:
0*	[0 - 65535]	View the extended fieldbus communication option status word. For more information, refer to the relevant fieldbus manual.

16-90 Alarm Word

Range:		Function:
0*	[0 - 4294967295]	View the alarm word sent via the serial communication port in hex code.

16-92 Warning Word

Range:		Function:
0*	[0 - 4294967295]	View the warning word sent via the serial communication port in hex code.

6.1 Parameter List

Parameter number	Parameter description	Default value	Range	Conversion index	Data type
8-0* Communication and Options					
8-01	Control Site	Dig. and ctrl. word [0]	[0–2]	–	Unsigned 8
8-02	Control Word Source	FC RS485 [1]	[0 –6]	–	Unsigned 8
8-03	Control Word Timeout Time	1.0 s	0.1–18.000	-1	Unsigned 32
8-04	Control Word Timeout Func.	Off [0]	[0–10]	–	Unsigned 8
8-05	End-of-Timeout Function	Hold set-up [0]	[0–1]	–	Unsigned 8
8-06	Reset Control Word Timeout	Do not reset [0]	[0–1]	–	Unsigned 8
8-07	Diagnosis Trigger	Disable [0]	[0–3]	–	Unsigned 8
8-08	Readout Filtering	Motor Data Std- Filt. [0]	[0–1]	–	Unsigned 8
8-10	Control Word Profile	FC profile [0]	[0–x]	–	Unsigned 8
8-13	Configurable Status Word STW	[0]	[83–85]	–	Unsigned 8
8-14	Configurable Control Word CTW	None [0]	[0–6]	–	Unsigned 8
8-17	Configurable Alarm and Warning Word	Off [0]	[0–10091]	–	Unsigned 8
8-19	Product Code	0	[0–2147483647]	–	Unsigned 8
8-46	BTM Transaction Status	Off [0]	[0–6]	–	Unsigned 8
8-47	BTM Timeout	1	[1–360s]	–	Unsigned 8
8-48	BTM Maximum Errors	0	[0–21]	–	Unsigned 8
8-49	BTM Error Log	Digital input [0]	[0–3]	–	Unsigned 8
8-50	Coasting Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-51	Quick Stop Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-52	DC Brake Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-53	Start Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-54	Reversing Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-55	Set-up Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-56	Preset Reference Select	Logic OR [3]	[0–3]	–	Unsigned 8
8-90	Bus Jog 1 Speed	100 rpm	0–parameter 4-13	67	Unsigned 16
8-91	Bus Jog 2 Speed	200 rpm	0–parameter 4-13	67	Unsigned 16
10- CAN Fieldbus**					
10-00	CAN Protocol	CANopen [0]	[0]	–	Unsigned 8
10-01	Baud Rate Select	125 Kbps [20]	[16–22]	–	Unsigned 8
10-02	Drive Node ID	127	0–127	–	Unsigned 8
10-05	Transmit Error Counter	0	0–255	0	Unsigned 8
10-06	Receive Error Counter	0	0–255	0	Unsigned 8
10-31	Store Data Values	Off [0]	[0–2]	–	Unsigned 8
10-33	Store Always	Off [0]	[0–1]	–	Unsigned 8
10-50	CANopen Process Data Config. Write	None [0]	[0–17]	–	Unsigned 16
10-51	CANopen Process Data Config. Read	None [0]	[0–48]	–	Unsigned 16
15- Drive Information**					
15-60	Option Mounted	MCA105 CANopen	-	–	VisibleString 30
16- Data Readouts**					
16-84	Comm. Option STW	0	0–FF		Unsigned 16
16-90	Alarm Word	0	0–FFFF	–	Unsigned 32
16-92	Warning Word	0	0–FFFF	–	Unsigned 32

Table 6.3 Parameter List

6.1.1 Conversion Index

This number refers to a conversion figure used when writing or reading to parameters.

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

Table 6.4 Conversion Index

7 Object Directory

7.1 Communication Profile Area (1000h-1FFFh)

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

7.1.1 Communication Object Overview

OD index (hex)	Name	Type	Access
1000	Device type	UNSIGNED32	Read only
1001	Error register	UNSIGNED8	Read only
1002	Manufacturer status register	UNSIGNED32	Read only
1003	Pre-defined error field	UNSIGNED32	Read only
1005	COB-ID SYNC	UNSIGNED32	Read/write
1008	Manufacturer device name	VISIBLE_STRING	Read only
1009	Manufacturer hardware version	VISIBLE_STRING	Read only
100A	Manufacturer software version	VISIBLE_STRING	Read only
100C	Guard time	UNSIGNED16	Read/write
100D	Life time factor	UNSIGNED8	Read/write
1010	Store parameters	UNSIGNED32	Read/write
1011	Restore default parameters	UNSIGNED32	Read/write
1014	COB-ID EMCY	UNSIGNED32	Read only
1017	Producer heartbeat time	UNSIGNED16	Read/write
1018	Identity Object	Identity (23h)	Read only
1400	1st Receive PDO description	PDO communication parameter	Read/write
1401	2nd Receive PDO description	PDO communication parameter	Read/write
1402	3rd Receive PDO description	PDO communication parameter	Read/write
1403	4th Receive PDO description	PDO communication parameter	Read/write
1600	1st Receive PDO mapping	PDO Mapping	Read/write
1601	2nd Receive PDO mapping	PDO Mapping	Read/write
1602	3rd Receive PDO mapping	PDO Mapping	Read/write
1603	4th Receive PDO mapping	PDO Mapping	Read/write
1800	1st Transmit PDO description	PDO communication parameter	Read/write
1801	2nd Transmit PDO description	PDO communication parameter	Read/write
1802	3rd Transmit PDO description	PDO communication parameter	Read/write
1803	4th Transmit PDO description	PDO communication parameter	Read/write
1A00	1st Transmit PDO mapping	PDO Mapping	Read/write
1A01	2nd Transmit PDO mapping	PDO Mapping	Read/write
1A02	3rd Transmit PDO mapping	PDO Mapping	Read/write
1A03	4th Transmit PDO mapping	PDO Mapping	Read/write

Table 7.1 Communication Object Overview

7.1.2 1000h Device Type

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

Additional information		Device profile number
Mode bits	Type bits	Bits
31.. 24	23.. 16	15.. 0
0	1 (frequency converters)	402 (dec.)

Table 7.2 1000h Device Type

7.1.3 1001h Error Register

This object is the error register of the device. The device can map internal errors in this byte. This entry is mandatory for all devices, and is a part of the emergency object. Each bit of the error register is reserved for a specified group of errors (alarms). Only bit 0 is supported. The other error information can be read with object 603Fh, error code.

Bit	Meaning
0	generic error

Table 7.3 Content of Error Register

7.1.4 1002h Manufacturer Status Register

The contents of this object are completely manufacturer-specific, and inform of the state of the frequency converter network.

Value	Meaning
2	Stopped
3	Pre-operational
4	Operational

Table 7.4 1002h Manufacturer Status Register

7.1.5 1003h Predefined Error Field

Holds errors/alarms that has occurred on the frequency converter. Setting index 0 to 0 erases the field. Disabling the diagnosis trigger (*parameter 8-07 Diagnosis Trigger*) also disables the display of values in this object.

Sub-index	Meaning
0	Number of stored errors
1	Current error
2	Last error

Table 7.5 1003h Predefined Error Field

Byte 3	Byte 2	Byte 1	Byte 0
Byte 4 of EMCY object	Byte 3 of EMCY object	Byte 1of EMCY object	Byte 0 of EMCY object

Table 7.6 Values

7.1.6 1005h COB-ID Sync Message Object

This index defines the COB-ID of the synchronisation object (SYNC). It also defines whether the device generates the SYNC.

Bit	Value	Meaning
31 (MSB)	X	Do not care
30	0 1	Device does not generate SYNC message. Device generates SYNC message (not supported).
29	0 1	11-bit ID (CAN 2.0A) 29-bit ID (CAN 2.0B)
28 - 11	0 X	if bit 29=0 if bit 29=1: bits 28-11 of 29-bit COB-ID
10 - 0 (LSB)	X	Bits 10-0 of COB-ID

Table 7.7 Structure of the SYNC COB-ID

Bits 29 and 30 must be static (not changeable). If a device is not able to generate SYNC messages, an attempt to set bit 30 generates an abort message (abort code: 0609 0030h).
Devices supporting the standard CAN frame type only either ignore attempts to change bit 29 or respond with an abort message (abort code: 0609 0030h).
The first transmission of SYNC object starts within 1 sync cycle after setting bit 30 to 1.

7.1.7 1008h Manufacturer Device Name

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

7.1.8 1009h Manufacturer Hardware Version

This object contains the MCB 105 hardware version.

7.1.9 100Ah Manufacturer Software Version

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

7.1.10 100Ch Guard Time

This object is used in node guarding, an error control service used in addition to the heartbeat mechanism to detect failure in the CAN network.
Node guarding provides the only possible verification of the master's availability on the bus, for the frequency converter's timeout functionality.
This object contains the gap between 2 master requests in ms.

7.1.11 100Dh Life Time Factor

This object contains the lifetime factor used in node guarding. This factor multiply by the contents of 100Ch defines the time after which the slave has to be polled by the master's node guarding request. If this time has elapsed without the slave being polled by a guard telegram, the slave issues warning 34.

7.1.12 1010h Store Parameters

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

Sub-index	Meaning
0	Number of entries
1	Save all parameters + OD entries
2	Save all communication parameters + OD entries (All set-ups)
3	Reserved
4	Save "edit set-up" (Danfoss specific)

Table 7.8 1010h Store Parameters

Writing the value "save" (0x65766c173) to subindex 1 saves all frequency converter parameters of all set-ups into non-volatile memory. Sub-index 4 does the same for the edit set-up. This is handled via *parameter 10-31 Store Data Values*.

7.1.13 1011h Restore Default Parameters

Use this object to set the frequency converter to factory default, by writing the value load (0x64616F6C) to subindexes.

The parameters is set to default after the next power cycle, which has to be initiated manually.

Sub-index	Meaning
0	Number of entries
1	Restore all default parameters
2	Restore all default parameters + restart

Table 7.9 1011h Restore Default Parameters

7.1.14 1014h COB ID Emergency Object

This object defines the COB-ID under which the emergency object (EMCY) is sent.

7.1.15 1017h Producer Heartbeat Time

The heartbeat acts as an error control service to detect a failure in the CAN network. The heartbeat mechanism for a device is established through cyclically transmitting a message by a heartbeat producer. 1 or more devices in the network are aware of this heartbeat message. If the heartbeat cycle fails for the heartbeat producer, the local application on the heartbeat consumer is informed about that event.
The producer heartbeat time defines the cycle time of the heartbeat. The producer heartbeat time remains at default 0 if it is not used.

7.1.16 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.

Sub-index	Meaning
0	Number of entries
1	Vendor ID (200008 dec.)
2	Product code
3	Revision number (major revision number and minor revision number)
4	Serial number

Table 7.10 1018h Identity Object

8 Troubleshooting

8.1 Warnings and Alarms

NOTICE

Refer to the relevant *operating instructions* for an overview of warning and alarm types and for the full list of warnings and alarms.

Alarm word, warning word, and CANopen warning word are shown on the frequency converter display in hex format. When there is more than 1 warning or alarm, the sum of all warnings or alarms is shown. Alarm word, warning word, and DeviceNet warning word can also be displayed using the serial bus in:

- *Parameter 16-90 Alarm Word*.
- *Parameter 16-91 Alarm Word 2*.
- *Parameter 16-92 Warning Word*.
- *Parameter 16-93 Warning Word 2*.

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Bit (Hex)	Alarm word (*parameter 16-90 Alarm Word*)
00000001	Brake check
00000002	Power card overtemperature
00000004	Ground fault
00000008	Ctrl. card overtemperature
00000010	Control word timeout
00000020	Overcurrent
00000040	Torque limit
00000080	Motor thermistor overtemperature
00000100	Motor ETR overtemperature
00000200	Inverter overloaded
00000400	DC link undervoltage
00000800	DC link overvoltage
00001000	Short circuit
00002000	Inrush fault
00004000	Mains phase loss
00008000	AMA not OK
00010000	Live zero error
00020000	Internal fault
00040000	Brake overload
00080000	Motor phase U is missing
00100000	Motor phase V is missing
00200000	Motor phase W is missing
00400000	Fieldbus fault
00800000	24 V supply fault
01000000	Mains failure
02000000	1.8 V supply fault
04000000	Brake resistor short circuit
08000000	Brake chopper fault
10000000	Option change
20000000	Frequency converter initialised
40000000	Safe torque off
80000000	Mech. brake low

Table 8.1 ***Parameter 16-90 Alarm Word***

Bit (Hex)	Alarm word 2 (*parameter 16-91 Alarm Word 2*)
00000001	Service Trip, read/write
00000002	Reserved
00000004	Service trip, typecode/sparepart
00000008	Reserved
00000010	Reserved
00000020	Noflow
00000040	Dry pump
00000080	End of curve
00000100	Broken belt
00000200	Discharge high
00000400	Start failed
00000800	Speed limit
00001000	Reserved
00002000	Reserved
00004000	Reserved
00008000	Reserved
00010000	Reserved
00020000	KTY error
00040000	Fans error
00080000	ECB error
00100000	Reserved
00200000	Reserved
00400000	Reserved
00800000	Reserved
01000000	Reserved
02000000	Reserved
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	PTC thermistor
80000000	Dangerous failure

Table 8.2 *Parameter 16-91 Alarm Word 2*

Bit (Hex)	Warning word (*parameter 16-92 Warning Word*)
00000001	Brake check
00000002	Power card overtemperature
00000004	Ground fault
00000008	Control card overtemperature
00000010	Control word timeout
00000020	Overcurrent
00000040	Torque limit
00000080	Motor thermistor overtemperature
00000100	Motor ETR overtemperature
00000200	Inverter overloaded
00000400	DC link undervoltage
00000800	DC link overvoltage
00001000	DC-link voltage low
00002000	DC-link voltage high
00004000	Mains phase loss
00008000	No motor
00010000	Live zero error
00020000	10 V low
00040000	Brake resistor power low
00080000	Brake resistor short circuit
00100000	Brake chopper fault
00200000	Speed limit
00400000	Fieldbus comm. fault
00800000	24 V supply fault
01000000	Mains failure
02000000	Current limit
04000000	Low temperature
08000000	Voltage limit
10000000	Encoder loss
20000000	Output frequency limit
40000000	Safe torque off
80000000	Extended status word

Table 8.3 *Parameter 16-92 Warning Word*

Bit (Hex)	Warning word 2 (*parameter 16-93 Warning Word 2*)
00000001	Start delayed
00000002	Stop delayed
00000004	Clock failure
00000008	Fire mode was active
00000010	Reserved
00000020	No flow
00000040	Dry pump
00000080	End of curve
00000100	Broken belt
00000200	Discharge high
00000400	Reserved
00000800	Reserved
00001000	Reserved
00002000	Reserved
00004000	Reserved
00008000	Reserved
00010000	Reserved
00020000	KTY error
00040000	Fans warning
00080000	ECB error
00100000	Reserved
00200000	Reserved
00400000	Reserved
00800000	Reserved
01000000	Reserved
02000000	Reserved
04000000	Reserved
08000000	Reserved
10000000	Reserved
20000000	Reserved
40000000	PTC thermistor
80000000	Reserved

Table 8.4 *Parameter 16-93 Warning Word 2*

8.2 Troubleshooting

8.2.1 Check 1: LED Status

The 2 bi-colour LEDs on the CANopen card indicate the status of CANopen communication:

- The lower LED (NS) indicates the net status.
- The upper LED (MS) indicates the module status.

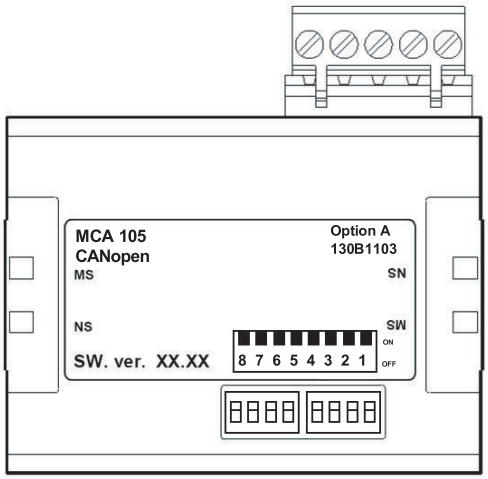

Illustration 8.1 LED Panel CANopen MCA 105

State	Red LED		Status
No error	130BT249.10	Off	No error.
Warning limit reached	130BT250.10	Single flash	CAN error counter has reached/ exceeded warning level.
Error control event	130BT251.10	Double flash	Node guard event has occurred.
Sync error	130BT252.10	Triple flash	Sync message has not been received within configured timeout (object 0x1006).
Bus Off	130BT253.10	On	Device in bus off-state.

Table 8.5 LED: Module Status (MS)

State	**Green LED**		**Status**
Stopped	130BT250.10	Single flash	Device in stopped state.
Pre-operational	130BT252.10	Flashing	Device in pre-operational state.
Operational	130BT253.10	On	Device in operational state.

Table 8.6 LED: Network Status (NS)

8.2.2 Check 2: Error Counters

Check the values of the TEC and REC in *parameter 10-05 Readout Transmit Error Counter* and *parameter 10-06 Readout Receive Error Counter*.

8.2.3 No Communication with the frequency converter?

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

8.2.4 Check 3: Is the Cabling Correct?

Check that the cables are connected to the correct terminals as shown in the diagram.

Pin number	Terminal	Colour	Name
1	–	–	Reserved
2	CAN_L	Blue	CAN LOW
3	Drain	(bare)	Screen
4	CAN_H	White	CAN HIGH
5	–	–	Reserved

Table 8.7 Cabling

8.2.5 Check 4: Is the Correct EDS File Installed?

Download the correct EDS file from *www.danfoss.com/drives* and *www.danfoss.com/BusinessAreas/DrivesSolutions/Softwaredownload/DDFieldbus_Setup_Files.htm*.

8.2.6 Check 5: Is the bus connection terminated at both ends?

If not, terminate the bus connection with termination resistors at the initial and final nodes. Termination is performed between terminal 2 (CAN_L) and 4 (CAN_H) with a resistor:

- 121 Ω.
- 1% metal film.
- ¼ W.

8.2.7 SDO Abort Codes

The abort code describes the error code when an SDO generates a failure.

Abort code	Description
0503 0000h	Toggle bit not alternated.
0504 0000h	SDO protocol timed out.
0504 0001h	Client/server command specifier not valid or unknown.
0504 0002h	Invalid block size (block mode only).
0504 0003h	Invalid sequence number (block mode only).
0504 0004h	CRC error (block mode only).
0504 0005h	Out of memory.
0601 0000h	Unsupported access to an object.
0601 0001h	Attempt to read a write-only object.
0601 0002h	Attempt to write a read-only object.
0602 0000h	Object does not exist in the object dictionary.
0604 0041h	Object cannot be mapped to the PDO.
0604 0042h	The number and length of the objects to be mapped would exceed PDO length.
0604 0043h	General parameter incompatibility reason.
0604 0047h	General internal incompatibility in the device.
0606 0000h	Access failed due to a hardware error.
0607 0010h	Data type does not match, length of service parameter does not match.
0607 0012h	Data type does not match, length of service parameter too high.
0607 0013h	Data type does not match, length of service parameter too low.
0609 0011h	Subindex does not exist.
0609 0030h	Value range of parameter exceeded (only for write access).
0609 0031h	Value of parameter written too high.
0609 0032h	Value of parameter written too low.
0609 0036h	Maximum value is less than minimum value.
0800 0000h	General error.
0800 0020h	Data cannot be transferred or stored to the application.
0800 0021h	Data cannot be transferred or stored to the application because of local control.
0800 0022h	Data cannot be transferred or stored to the application because of the present device state.
0800 0023h	Object dictionary dynamic generation fails or no object dictionary is present (e.g. object dictionary is generated from file and generation fails because of a file error).

Table 8.8 SDO Abort Codes

8.2.8 EMCY Error Code

(OD: 1003)

Code (hex)	Description
0	No fault.
1000	General fault.
2130	Short circuit.
2213	Overcurrent during start-up.
2240	Short to ground.
2310	Continuous overcurrent.
2311	Current inside the device.
3100	Mains voltage.
3130	Phase failure.
3210	Overvoltage inside the device.
3220	Undervoltage inside the device.
3300	Output voltage.
4210	Exceed device temperature.
4310	Excess frequency converter temperature.
5110	Low voltage power supply.
5112	+24 V power supply.
5210	Measurement circuit.
6100	Internal software fault.
7110	Brake chopper.
8100	Communication.
8110	CAN overrun (objects lost).
8120	CAN in error (passive mode).
8130	Life Guard error or heartbeat error.
8140	Recovered from Bus Off.
8150	Transmit COB-ID collision.
8210	PDO not processed due to length error.
8220	PDO length exceeded.
8302	Torque limiting.
FFxx	Vendor specific.

Table 8.9 EMCY Error Code

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