ENGINEERING TOMORROW

Programming Guide
PROFINET

VLT® AutomationDrive FC 360

vlt-drives.danfoss.com

Contents

1 Introduction

1.1 Purpose of the Manual

The *PROFINET Programming Guide* provides information about configuring the system, controlling the frequency converter, accessing parameters, programming, trouble-shooting, and some typical application examples.
The *programming guide* is intended for use by qualified personnel, who are familiar with the VLT® frequency converters, PROFINET technology, and 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 converter and optional equipment are:

- The *VLT® AutomationDrive FC 360 Quick Guide* provides the necessary information for getting the frequency converter up and running.
- The *VLT® AutomationDrive FC 360 Design Guide* provides detailed information about capabilities and functionality to design motor control systems.
- The *VLT® AutomationDrive FC 360 Programming Guide* provides more details on working with parameters and many application examples.

Supplementary publications and manuals are available from Danfoss. See *drives.danfoss.com/knowledge-center/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. The firmware version of the PROFINET interface can be read in *parameter 15-61 Option SW Version*.

Edition	Remarks	Software version
MG06G1xx	The first edition of this manual.	3.0x

Table 1.1 Document and Software Version

1.4 Product Overview

This *programming guide* relates to PROFINET interface for VLT® AutomationDrive FC 360.

The PROFINET interface is designed to communicate with any system complying with the PROFINET schema version 2.2 and 2.3 standards.
Since the introduction in 2001, PROFINET has been updated to handle low and medium performance requirements supported by PROFINET RT up to high-end servo performance in PROFINET IRT. PROFINET is the Ethernet-based fieldbus offering and is the most scalable and versatile technology today.
PROFINET provides the network tools to deploy standard Ethernet technology for manufacturing applications while enabling Internet and enterprise connectivity.

The PROFINET control cassette is intended for use with VLT® AutomationDrive FC 360.

Terminology
In this manual, several terms for Ethernet are used.

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

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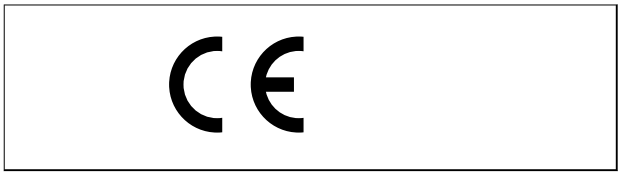
1.5 Approvals and Certifications



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

1.6 Symbols, Abbreviations, and Conventions

Abbreviation	Definition
CC	Control card
CTW	Control word
DCP	Discovery and configuration protocol
DHCP	Dynamic host configuration protocol
EMC	Electromagnetic compatibility
GSDML	General station description mark-up language
I/O	Input/output
IP	Internet protocol
IRT	Isochronous real time
LCP	Local control panel
LED	Light emitting diode
LSB	Least significant bit
MAV	Main actual value (actual speed)
MSB	Most significant bit
MRV	Main reference value
PC	Personal computer
PCD	Process control data
PLC	Programmable logic controller
PNU	Parameter number
PPO	Process parameter object
REF	Reference (= MRV)
RT	Real time
STW	Status word

Table 1.2 Symbols and Abbreviations

Conventions
Numbered lists indicate procedures.
Bullet lists indicate other information and description of illustrations.
Italicized text indicates:

- Cross reference.
- Link.
- Parameter name.
- Parameter group.
- Parameter option.

2 Safety

2.1 Safety Symbols

The following symbols are used in this guide:

⚠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 or operate this equipment.

Qualified personnel are defined as trained staff, who are authorized 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 this document.

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 can 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:

- **Press [Off/Reset] on the LCP before programming parameters.**
- **Disconnect the frequency converter from the mains.**
- **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, which can remain charged even when the frequency converter is not powered. High voltage can be present even when the warning LED indicator lights are off. 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 AC mains and remote DC-link supplies, including battery back-ups, UPS, and DC-link connections to other frequency converters.**
- **Disconnect or lock PM motor.**
- **Wait for the capacitors to discharge fully. The minimum waiting time is specified in the *chapter Safety* in the *operating guide* supplied with the frequency converter.**
- **Before performing any service or repair work, use an appropriate voltage measuring device to make sure that the capacitors are fully discharged.**

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⚠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.**

⚠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 document.**

⚠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 PROFINET Network

Ensure that all PROFINET devices connected to the same bus network have a unique station name (host name).

Set the PROFINET host name of the frequency converter via *parameter 12-08 Host Name*.

3.2 Configure the Controller

3.2.1 GSDML File

To configure a PROFINET controller, the configuration tool needs a GSDML file for each type of device on the network. The GSDML file is a PROFINET xml file containing the necessary communication set-up data for a device. Download the latest version of GSDML file at *www.danfoss.com/BusinessAreas/DrivesSolutions/profinet*. The name of the GSDML file may differ from what is described in this manual.
The following example shows how to configure the controller.

Frequency converter	GSDML file
VLT® AutomationDrive FC 360	GSDML-V2.3-Danfoss-FC360-20151212.xml

Table 3.1 GSDML file

When configuring the PROFINET controller, the first step is to import the GSDML file in the configuration tool. The following steps, outlined in *Illustration 3.1*, *Illustration 3.2*, and *Illustration 3.3*, show how to add a new GSDML file to the Simatic Manager software tool. For each frequency converter, a GSDML file is typically imported once only, following the initial installation of the software tool.

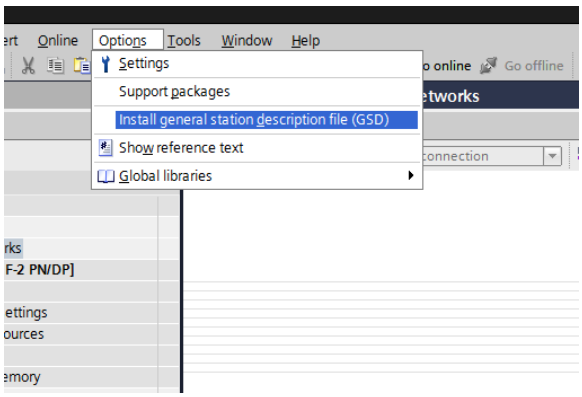

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Illustration 3.1 Import the GSDML File in the Configuration Tool

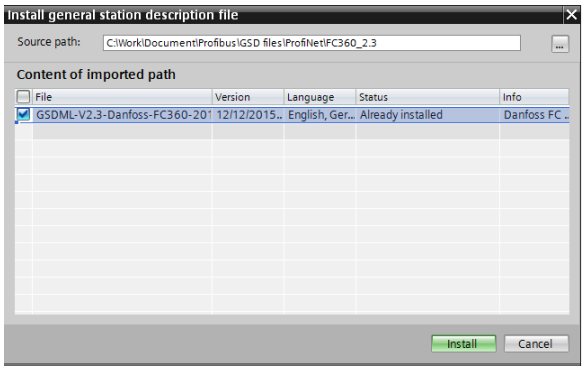

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Illustration 3.2 Add a New GSDML File to the Simatic Manager Software Tool

The GSDML file is now imported and is accessible via the following path in the hardware catalog:

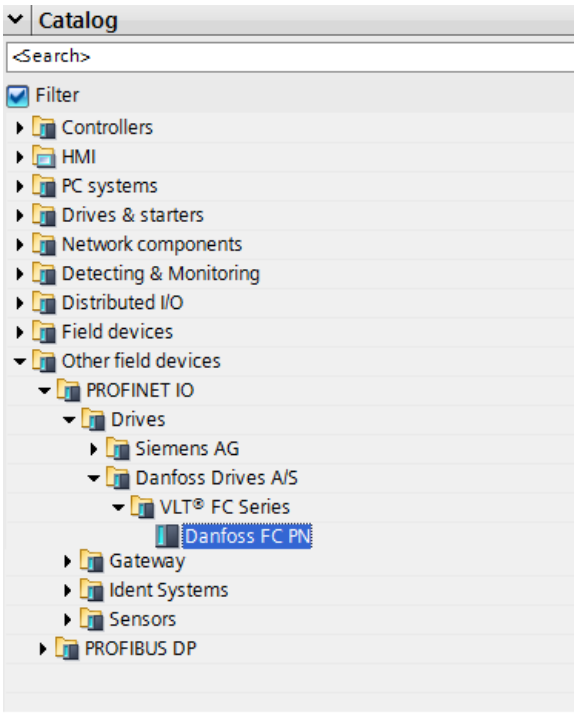

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Illustration 3.3 Path in the Hardware Catalog

Open a project, set up the hardware, and add a PROFINET master system. Select Danfoss FC PN, then drag and drop it onto the PROFINET IO system.

To enter the device name, open the properties for the inserted frequency converter. See *Illustration 3.4*.

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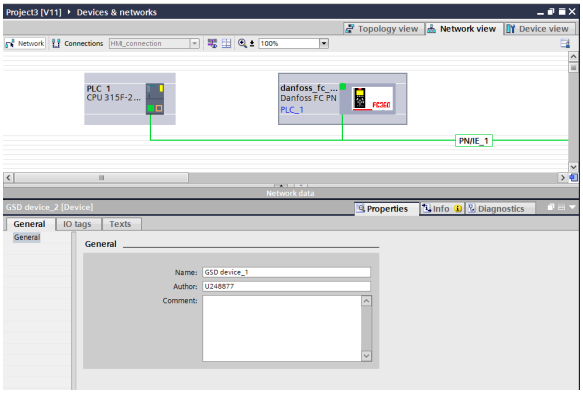

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Illustration 3.4 Open the Properties for the Inserted Frequency Converter to Enter the Device Name

NOTICE

The name must match the name in *parameter 12-08 Host Name*. If the check mark *Assign IP address via the IO controller* is set, the controller downloads the IP address to the IO device with the corresponding device name. The IP address is stored in the non-volatile memory of the frequency converter.

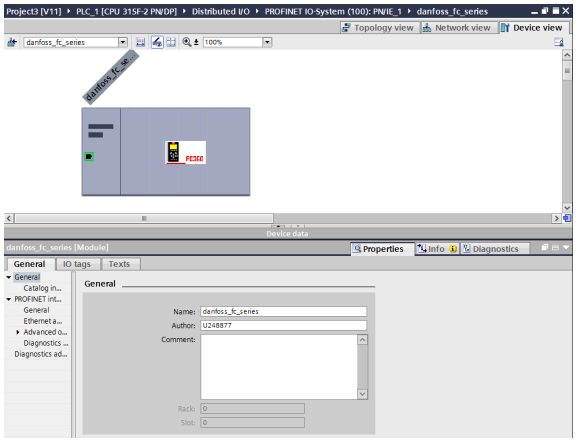

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Illustration 3.5 Set Up the Hardware and Add a PROFINET Master System

The next step is to set up the peripheral input and output data. Data set-up in the peripheral area is transmitted cyclically via telegrams/PPO types. In the example below, a PPO type 6 is dragged and dropped to slot 1.

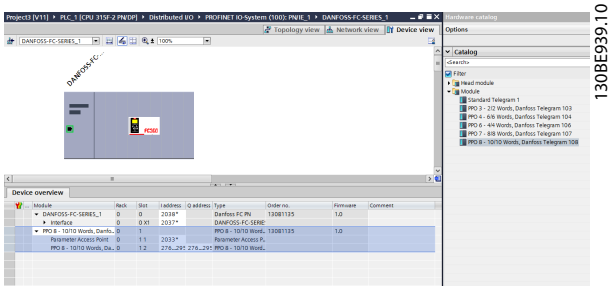

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Illustration 3.6 Set up the Peripheral Input and Output Data

The configuration tool automatically assigns addresses in the peripheral address area. In this example, the input and output area have the following configuration:

PPO type 6

PCD word number	0	1	2	3
Input address	256–257	258–259	260–261	262–263
Set-up	STW	MAV	*Parameter 9-16 PCD Read Configuration*	*Parameter 9-16 PCD Read Configuration*

Table 3.2 PCD Read (Frequency Converter to PLC)

PCD word number	0	1	2	3
Output address	256–257	258–259	260–261	262–263
Set-up	CTW	MRV	*Parameter 9-15 PCD Write Configuration*	*Parameter 9-15 PCD Write Configuration*

Table 3.3 PCD Write (PLC to Frequency Converter)

Assign the PCDs via *parameter 9-16 PCD Read Configuration* for inputs and *parameter 9-15 PCD Write Configuration* for outputs.

Download the configuration file to the PLC. The PROFINET system starts the data exchange when the PLC is set to Run mode.

3.3 Configure the Frequency Converter

3.3.1 VLT Parameters

The following parameters are important when configuring the frequency converter with a PROFINET interface:

- *Parameter 0-40 [Hand on] Key on LCP*. If [Hand On] is activated, control of the frequency converter via the PROFINET interface is disabled.
- After an initial power-up, the frequency converter automatically detects whether a fieldbus option is installed in slot A and sets *parameter 8-02 Control Source* to *[Option A]*. When an option is added, changed, or removed from an already commissioned frequency converter, it does not change *parameter 8-02 Control Source* but enters *Trip* mode, and the frequency converter shows an error.
- *Parameter 8-10 Control Word Profile*. Select between the Danfoss frequency converter profile and the PROFIdrive profile.
- *Parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select*. Select how to gate PROFINET control commands with the digital input command of the control card.

NOTICE

When *parameter 8-01 Control Site* is set to *[2] Control word only*, the settings from *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select* are overruled and only act on bus control.

4 Control

4.1 PPO Types

The PROFINET profile for frequency converters specifies a number of standard telegrams and provides space for vendor-specific telegrams. The PROFIdrive profile for frequency converters is suitable for data exchange between a process controller (for example PLC) and a frequency converter. All telegrams are defined for cyclic data transfer of high-priority data.

Pure process data objects
PPO types 3, 4, 6, 7, and 8 are pure process data objects for applications requiring no cyclic parameter access. The PLC sends out process control data, and the frequency converter then responds with a PPO of the same length, containing process status data.

Illustration 4.1 shows the available PPO types:

- PCD 1: The first 2 bytes of the process data area (PCD 1) comprise a fixed part present in all PPO types.
- PCD 2: The next 2 bytes are fixed for PCD write entries (see *parameter 9-15 PCD Write Configuration* [1]), but configurable for PCD read entries (see *parameter 9-16 PCD Read Configuration* [1]).
- PCD 3–10: In the remaining bytes, the process data can be parameterized with process signals, see *parameter 9-23 Parameters for Signals*.

The setting in *parameter 9-15 PCD Write Configuration* determines the signals for transmission (request) from the master to the frequency converter.

The setting in *parameter 9-16 PCD Read Configuration* determines the signals for transmission (response) from the frequency converter to the master.

Select the PPO type in the master configuration. The selection is automatically recorded in the frequency converter. No manual setting of PPO types in the frequency converter is required. Read the current PPO type in *parameter 9-22 Telegram Selection*. The setting *[1] Standard telegram 1* is equivalent to PPO type 3.

In addition, all PPO types can be set up as word-consistent or module-consistent. The process data area can be word-consistent or module-consistent, whereas the parameter channel must always be module-consistent.

- Word-consistent data is transmitted as individual, independent words between the PLC and the frequency converter.
- Module-consistent data is transmitted as sets of interrelated words transferred simultaneously between the PLC and the frequency converter.

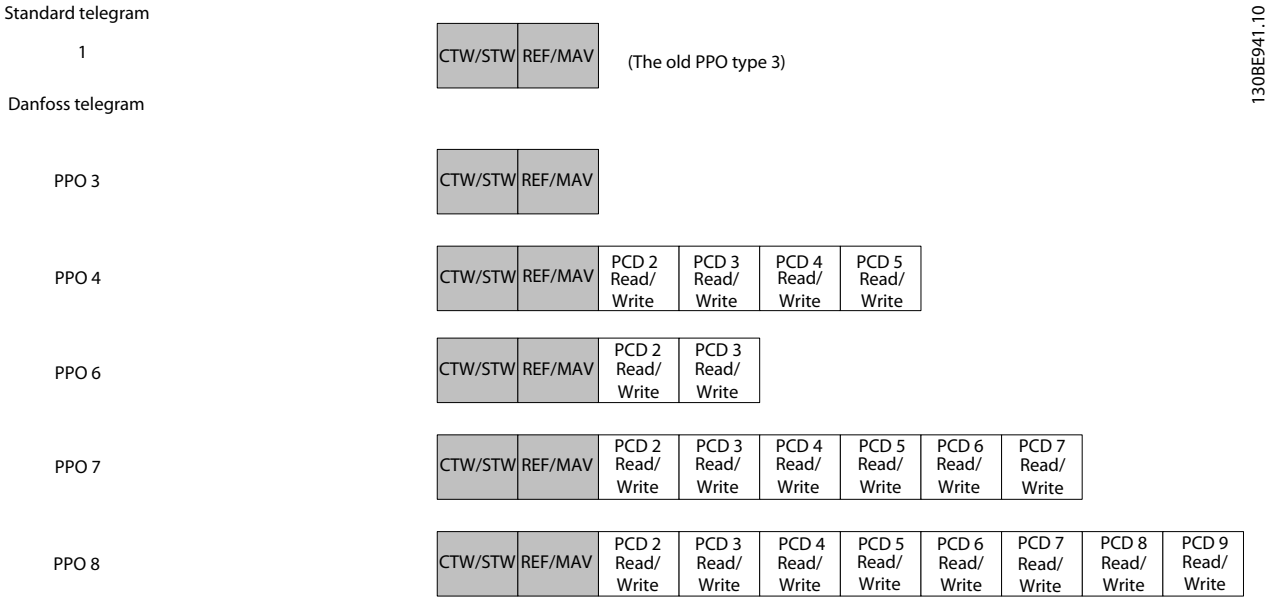

Illustration 4.1 Available PPO Types

4.2 Process Data

Use the process data part of the PPO to control and monitor the frequency converter via the PROFINET.

4.2.1 PCD

Control word (CTW) according to PROFIdrive profile:
Control words consist of 16 bits. The meaning of each bit is explained in and . The following bit pattern sets all necessary start commands:
0000 0100 0111 1111 = 047F hex.[1)]
0000 0100 0111 1110 = 047E hex.[1)]
0000 0100 0111 1111 = 047F hex.

1) For restart after power-up:

- *Set bits 1 and 2 of the CTW to 1.*
- *Toggle bit 0 0–1.*

These values are for bytes 9 and 10 in *Table 4.1*.
Quick stop: 0000 0100 0110 1111 = 046F hex.
Stop: 0000 0100 0011 1111 = 043F hex.

4.2.2 MRV

MRV is the speed reference with data format *Standardized value*. 0 hex = 0% and 4000 hex = 100%.
In the example, 2000 hex is used corresponding to 50% of the maximum frequency in *parameter 3-03 Maximum Reference*. See the values for bytes 11 and 12 in *Table 4.1*.
The whole PPO therefore has the following values in hex:

		Byte	Value
PCD	CTW	9	04
	CTW	10	7F
	MRV	11	20
	MVR	12	00

Table 4.1 Request Example: PPO Values in Hex

The process data within the PCD part acts immediately upon the frequency converter and can be updated from the master as quickly as possible.

Table 4.2 shows a positive response to the request example from *Table 4.1*.

		Byte	Value
PCD	STW	9	0F
	STW	10	07
	MAV	11	20
	MAR	12	00

Table 4.2 Response Example: Positive Response

The PCD part responds according to the state and parameterization of the frequency converter.

PCD part response:

- STW: 0F07 hex means that the motor is running and there are no warnings or faults.
- MAV: 2000 hex indicates that the output frequency is 50% of the maximum reference.

Table 4.3 shows a negative response to the request example from *Table 4.1*.

		Byte	Value
PCD	STW	9	0F
	STW	10	07
	MAV	11	20
	MAR	12	00

Table 4.3 Response Example: Negative Response

4.2.3 Process Control Data

Process control data (PCD) is the process data sent from the PLC to the frequency converter.

Master/slave				
1	2	3	.....	10
CTW	MRV	PCD	.....	PCD
		PCD write		

Table 4.4 Process Control Data

PCD 1 contains a 16-bit control word, and each bit controls a specific function of the frequency converter. See *chapter 4.3 Control Profile*.

PCD 2 contains a 16-bit speed setpoint in percentage format. See *chapter 4.2.5 Reference Handling*.

The settings in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration* define the content of PCD 3 to PCD 10.

4

4.2.4 Process Status Data

Process status data is the process data sent from the frequency converter and contains information about the current state.

Slave/master				
1	2	3	.....	10
STW	MAV	PCD	.....	PCD
		PCD read		

Table 4.5 Process Status Data

PCD 1 contains a 16-bit status word, and each bit contains information regarding a possible state of the frequency converter.

PCD 2 contains each default value of the frequency converter's current speed in percentage format (see *chapter 4.2.5 Reference Handling*). PCD 2 can be configured to contain other process signals.

The settings in *parameter 9-16 PCD Read Configuration* define the content of PCD 3–10.

4.2.5 Reference Handling

The reference handling is an advanced mechanism that sums up references from different sources as shown in *Illustration 4.2*.

For more information on reference handling, refer to the frequency converter's *design guide*.

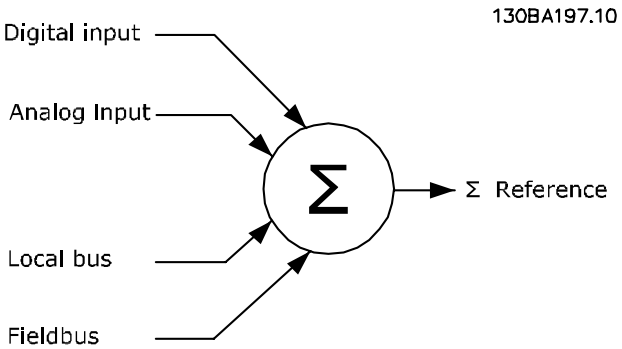

Illustration 4.2 Reference

The reference or speed setpoint is sent via PROFINET and is always transmitted to the frequency converter in percentage format as integers shown in hexadecimal (0–4000 hex).

The reference (MRV) and feedback (MAV) are always scaled equally. The setting of *parameter 3-00 Reference Range* determines the scaling of the reference and feedback (MAV), see *Illustration 4.3*.

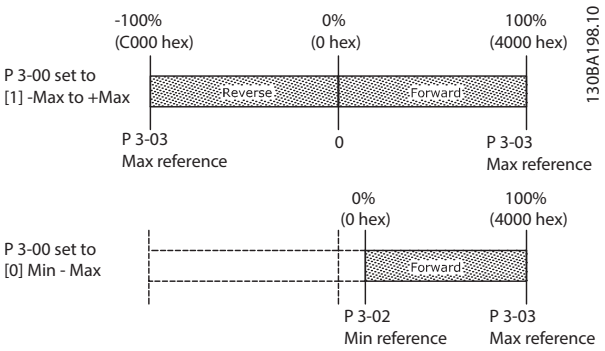

Illustration 4.3 Reference (MRV) and Feedback (MAV), Scaled

NOTICE

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

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

Table 4.6 lists the reference (MRV) and the feedback (MAV) formats.

MRV/MAV	Integer in hex	Integer in decimal
100%	4000	16384
75%	3000	12288
50%	2000	8192
25%	1000	4096
0%	0	0
-25%	F000	-4096
-50%	E000	-8192
-75%	D000	-12288
-100%	C000	-16384

Table 4.6 Reference/Feedback (MRV/MAV) Format

NOTICE

Negative numbers are formed as complement of 2.

NOTICE

The data type for MRV and MAV is an N2 16-bit standardized value, expressing a range from -200% to +200% (8001 to 7FFF).

Example

The following settings determine the speed as shown in *Table 4.7*:

- *Parameter 1-00 Configuration Mode* set to *[0] Speed open loop*.
- *Parameter 3-00 Reference Range* set to *[0] Min-Max*.
- *Parameter 3-02 Minimum Reference* set to 0 Hz.
- *Parameter 3-03 Maximum Reference* set to 50 Hz.

MRV/MAV		Actual speed [Hz]
0%	0 hex	0
25%	1000 hex	12.5
50%	2000 hex	25
75%	3000 hex	37.5
100%	4000 hex	50

Table 4.7 Actual Speed for MRV/MAV

4.2.6 Process Control Operation

In process control operation, *parameter 1-00 Configuration Mode* is set to *[3] Process*.
The reference range in *parameter 3-00 Reference Range* is always *[0] Min - Max*.

- MRV is the process setpoint.
- MAV expresses the actual process feedback (range ±200%).

4.2.7 Influence of the Digital Input Terminals on FC Control Mode

In *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select*, set the influence of the digital input terminals on the control of the frequency converter.

NOTICE

The setting of *parameter 8-01 Control Site* overrules the settings in *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select*.

Program each of the digital input signals to logic AND, logic OR, or to have no relation to the corresponding bit in the control word. In this way, the following signal sources initiate a specific control command, for example stop/coast:

- Fieldbus only.
- Fieldbus AND digital input.
- Either fieldbus OR digital input terminal.

NOTICE

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

For more detailed information and examples of logical relationship options, see *chapter 8 Troubleshooting*.

4.3 Control Profile

Control the frequency converter according to:

- The PROFIdrive profile, see *chapter 4.4 PROFIdrive Control Profile*, or
- The Danfoss FC control, see *chapter 4.5 FC Drive Control Profile*.

Select the control profile in *parameter 8-10 Control Word Profile*. The choice of profile affects the control word and status word only.

Chapter 4.4 PROFIdrive Control Profile and *chapter 4.5 FC Drive Control Profile* provide a detailed description of control and status data.

4.4 PROFIdrive Control Profile

This section describes the functionality of the control word and status word in the PROFIdrive profile.

4.4.1 Control Word According to PROFIdrive Profile (CTW)

The control word is used to send commands from a master (for example a PC) to a slave.

Bit	Bit = 0	Bit = 1
00	OFF 1	ON 1
01	OFF 2	ON 2
02	OFF 3	ON 3
03	Coasting	No coasting
04	Quick stop	Ramp
05	Hold frequency output	Use ramp
06	Ramp stop	Start
07	No function	Reset
08	Jog 1 OFF	Jog 1 ON
09	Jog 2 OFF	Jog 2 ON
10	Data invalid	Data valid
11	No function	Slow down
12	No function	Catch up
13	Parameter set-up	Selection lsb
14	No function	No function
15	Forward	Reverse

Table 4.8 Control Word Bits

Explanation of the control bits

Bit 00, OFF 1/ON 1

Normal ramp stops using the ramp times of the actual selected ramp.

Bit 00 = 0 stops and activates the output relay 1 or 2 if the output frequency is 0 Hz, and if *[31] Relay 123* is selected in *parameter 5-40 Function Relay*.

When bit 0 = 1, the frequency converter is in state 1, switching on inhibited.

Refer to *Illustration 4.4*.

Bit 01, OFF 2/ON 2

Coast stop.

Bit 01 = 0 coast stops and activates the output relay 1 or 2 if the output frequency is 0 Hz, and if *[31] Relay 123* is selected in *parameter 5-40 Function Relay*.

When bit 01 = 1, the frequency converter is in state 1, switching on inhibited. Refer to *Illustration 4.4*.

Bit 02, OFF 3/ON 3

Quick stop using the ramp time of *parameter 3-81 Quick Stop Ramp Time*.

Bit 02 = 0 quick stops and activates the output relay 1 or 2 if the output frequency is 0 Hz, and if *[31] Relay 123* is selected in *parameter 5-40 Function Relay*.

When bit 02 = 1, the frequency converter is in state 1, switching on inhibited.

Refer to *Illustration 4.4*.

Bit 03, coasting/no coasting

Bit 03 = 0 leads to a coast stop.

When bit 03 = 1, if the other start conditions are fulfilled, the frequency converter can start.

NOTICE

The selection in *parameter 8-50 Coasting Select* determines how bit 03 is linked with the corresponding function of the digital inputs.

Bit 04, quick stop/ramp

Quick stop using the ramp time of *parameter 3-81 Quick Stop Ramp Time*.

When bit 04 = 0, a quick stop occurs.

When bit 04 = 1, if the other start conditions are fulfilled, the frequency converter can start.

NOTICE

The selection in *parameter 8-51 Quick Stop Select* determines how bit 04 is linked with the corresponding function of the digital inputs.

Bit 05, hold frequency output/use ramp

When bit 05 = 0, the present output frequency is maintained, even if the reference value is modified.

When bit 05 = 1, the frequency converter can perform its regulating function again according to the respective reference value.

Bit 06, ramp stop/start

Normal ramp stop using the ramp times of the actual ramp selected. In addition, if *[31] Relay 123* is selected in *parameter 5-40 Function Relay*, and if the output frequency is 0 Hz, this bit activates output relay 01 or 04.

Bit 06 = 0 stops the frequency converter.

When bit 06 = 1, if the other start conditions are fulfilled, the frequency converter can start.

NOTICE

The selection in *parameter 8-53 Start Select* determines how bit 06 is linked with the corresponding function of the digital inputs.

Bit 07, no function/reset

Reset after switching off. Acknowledges event in fault buffer.

When bit 07 = 0, no reset occurs.

When there is a slope change of bit 07 to 1, a reset occurs after switching off.

Bit 08, jog 1 OFF/ON

Activation of the pre-programmed speed in *parameter 8-90 Bus Jog 1 Speed*. Jog 1 is only possible if bit 04 = 0 and bits 00–03 = 1.

Bit 09, jog 2 OFF/ON

Activation of the pre-programmed speed in *parameter 8-91 Bus Jog 2 Speed*. Jog 2 is only possible if bit 04 = 0 and bits 00–03 = 1.

Bit 10, data invalid/valid
Tells the frequency converter whether to use or ignore the control word.
Bit 10 = 0 ignores the control word, making it possible to turn off the control word when updating/reading parameters.
Bit 10 = 1 uses the control word. This function is relevant because the control word is always contained in the telegram, regardless of which type of telegram is used.

Bit 11, no function/slow down
Used to reduce the speed reference value by the amount given in *parameter 3-12 Catch up/slow Down Value*.
When bit 11 = 0, no modification of the reference value occurs.
When bit 11 = 1, the reference value is reduced.

Bit 12, no function/catch up
Used to increase the speed reference value by the amount given in *parameter 3-12 Catch up/slow Down Value*.
When bit 12 = 0, no modification of the reference value occurs.
When bit 12 = 1, the reference value is increased.
If both slowing down and accelerating are activated (bits 11 and 12 = 1), slowing down has priority, and the speed reference value is reduced.

Bits 13, set-up selection
Bits 13 is used to select between the 2 parameter set-ups according to *Table 4.9*.

The function is only possible if *[9] Multi Set-up* has been selected in *parameter 0-10 Active Set-up*. The selection in *parameter 8-55 Set-up Select* determines how bit 13 is linked with the corresponding function of the digital inputs. Changing set-up while the frequency converter is running is only possible if the set-ups have been linked in *parameter 0-12 This Set-up Linked to*.

Set-up	Bit 13
1	0
2	1

Table 4.9 Parameter Set-ups

Bit 14, not used
Bit 15, no function/reverse
Bit 15 = 0 causes no reversing.
Bit 15 = 1 causes reversing.

NOTICE

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

NOTICE

Bit 15 causes reversing only when *Ser. communication, Logic or*, or *Logic and* is selected.

4.4.2 Status Word According to PROFIdrive Profile (STW)

The status word is used to notify a master (for example a PC) about the status of a slave.

Bit	Bit = 0	Bit = 1
00	Control not ready	Control ready
01	Frequency converter not ready	Frequency converter ready
02	Coasting	Enable
03	No error	Trip
04	OFF 2	ON 2
05	OFF 3	ON 3
06	Start possible	Start not possible
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	Thermal OK	Limit exceeded

Table 4.10 Status Word Bits

Explanation of the status bits
Bit 00, control not ready/ready
When bit 00 = 0, bit 00, 01, or 02 of the control word is 0 (OFF 1, OFF 2, or OFF 3) - or the frequency converter is switched off (tripped).
When bit 00 = 1, the frequency converter control is ready, but power is not necessarily supplied to the unit (in case of a 24 V external supply of the control system).

Bit 01, VLT not ready/ready
Same significance as bit 00, however, power is supplied to the unit. The frequency converter is ready when it receives the necessary start signals.

Bit 02, coasting/enable
When bit 02 = 0, bit 00, 01, or 02 of the control word is 0 (OFF 1, OFF 2, OFF 3, or coasting) - or the frequency converter is switched off (trip).
When bit 02 = 1, bit 00, 01, or 02 of the control word is 1, and the frequency converter has not tripped.

Bit 03, no error/trip
When bit 03 = 0, no error condition exists in the frequency converter.
When bit 03 = 1, the frequency converter has tripped and requires a reset signal before it can start.

Bit 04, ON 2/OFF 2
When bit 01 of the control word is 0, bit 04 = 0.
When bit 01 of the control word is 1, bit 04 = 1.

Bit 05, ON 3/OFF 3
When bit 02 of the control word is 0, bit 05 = 0.
When bit 02 of the control word is 1, bit 05 = 1.

Bit 06, start possible/start not possible
If *[1] PROFIdrive* has been selected in *parameter 8-10 Control Word Profile*, bit 06 is 1 after a switch-off acknowledgement, after activation of OFF2 or OFF3, and after switching on the mains voltage. To reset *Start not possible*, set bit 00 of the control word to 0, and bits 01, 02, and 10 to 1.

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
When bit 08 = 0, the current speed of the motor deviates from the set speed reference value. The deviation may occur, for example, when the speed is being changed during start/stop through ramp up/down.
When bit 08 = 1, the current speed of the motor corresponds to the set speed reference value.

Bit 09, local operation/bus control
Bit 09 = 0 indicates that the frequency converter has been stopped with *[Stop]* on the LCP, or that *[0] Linked to hand* or *[2] Local* has been selected in *parameter 3-13 Reference Site*.
When bit 09 = 1, the frequency converter can be controlled through the serial interface.

Bit 10, out of frequency limit/frequency limit OK
When bit 10 = 0, the output frequency is outside the limits set in *parameter 4-52 Warning Speed Low* and *parameter 4-53 Warning Speed High*.
When bit 10 = 1, the output frequency is within the indicated limits.

Bit 11, no operation/operation
When bit 11 = 0, the motor does not turn.
When bit 11 = 1, the frequency converter has a start signal, or the output frequency is higher than 0 Hz.

Bit 12, drive OK/stopped, auto-start
When bit 12 = 0, there is no temporary overload of the inverter.
When bit 12 = 1, the frequency converter has stopped due to overload. However, the frequency converter has not switched off (tripped) and starts again after the overload has ended.

Bit 13, voltage OK/voltage exceeded
When bit 13 = 0, the voltage limits of the frequency converter are not exceeded.
When bit 13 = 1, the direct voltage in the DC link of the frequency converter is too low or too high.

Bit 14, torque OK/torque exceeded
When bit 14 = 0, the motor torque is below the limit selected in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode*.
When bit 14 = 1, the limit selected in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode* is exceeded.

Bit 15, thermal OK/limit exceeded
When bit 15 = 0, the timers for the motor thermal protection and thermal frequency converter protection have not exceeded 100%.
When bit 15 = 1, one of the limits has exceeded 100%.

4.4.3 PROFIdrive State Transition Diagram

In the PROFIdrive control profile, the control bits:

- 0–3 perform the basic start-up/power-down functions.
- 4–15 perform application-oriented control.

Illustration 4.4 shows the basic state transition diagram where control bits 0–3 control the transitions, and the corresponding status bit indicates the actual state. The black bullets indicate the priority of the control signals where fewer bullets indicate lower priority, and more bullets indicate higher priority.

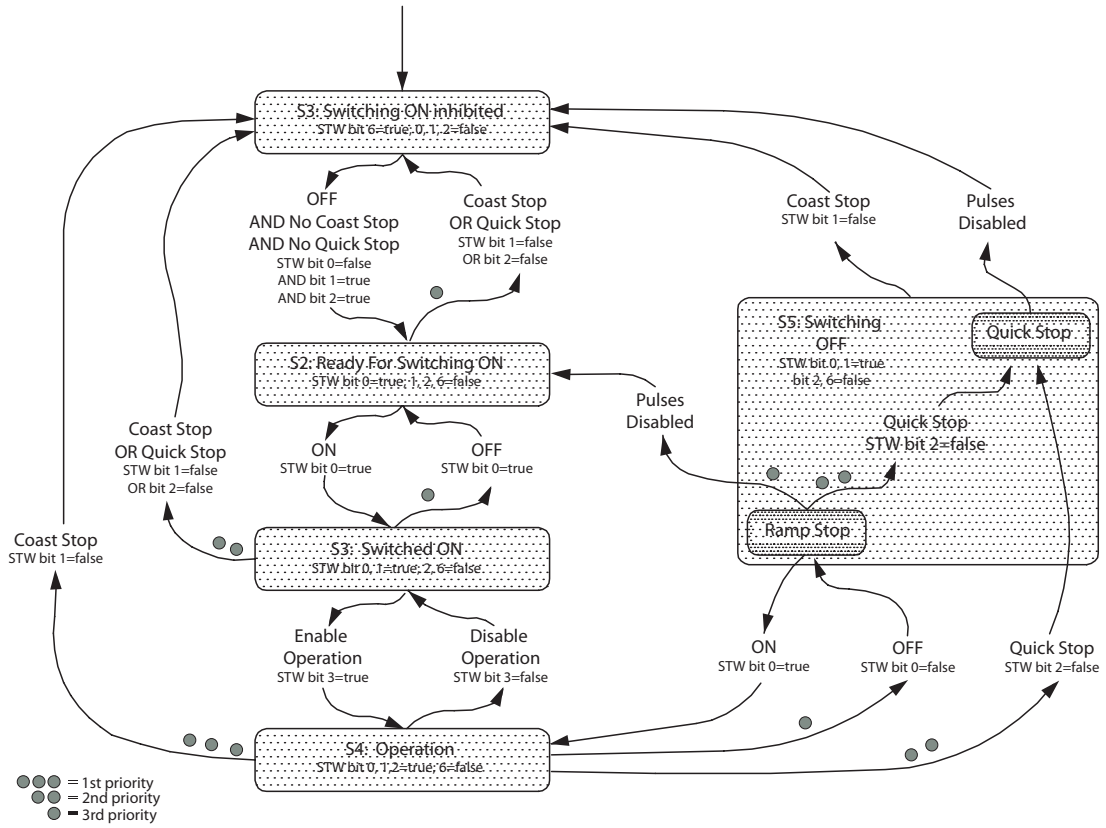

Illustration 4.4 PROFIdrive State Transition Diagram

4.5 FC Drive Control Profile

4.5.1 Control Word According to FC Profile (CTW)

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

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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 02 active
13	Parameter set-up	Selection lsb
14	No function	No function
15	Forward	Reverse

Table 4.11 Bit Values for FC Control Word

Explanation of the control bits

Bits 00/01, reference value

Use bits 00 and 01 to select between the 4 reference values, which are pre-programmed in *parameter 3-10 Preset Reference* according to *Table 4.12*.

NOTICE

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

Bit 01	Bit 00	Programmed reference value	Parameter
0	0	1	[0] *Parameter 3-10 Preset Reference*
0	1	2	[1] *Parameter 3-10 Preset Reference*
1	0	3	[2] *Parameter 3-10 Preset Reference*
1	1	4	[3] *Parameter 3-10 Preset Reference*

Table 4.12 Programmed Reference Values for Bits

Bit 02, DC brake

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

Bit 02 = 1 leads to ramping.

Bit 03, coasting

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

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

NOTICE

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

Bit 04, quick stop

Bit 04 = 0 quick stops the frequency converter and ramps the motor speed down to stop via *parameter 3-81 Quick Stop Ramp Time*.

Bit 04 = 1 makes the frequency converter ramp the motor speed down to stop via *parameter 3-42 Ramp 1 Ramp Down Time* or *parameter 3-52 Ramp 2 Ramp Down Time*.

Bit 05, hold output frequency

Bit 05 = 0 freezes the present output frequency (in Hz). The frozen output frequency can only be changed with the digital inputs (*parameter 5-10 Terminal 18 Digital Input* to *parameter 5-15 Terminal 33 Digital Input*) programmed to *[21] Speed up* and *[22] Speed down*.

Bit 05 = 1 uses ramp.

Bit 06, ramp stop/start

Bit 06 = 0 stops the frequency converter and the motor speed ramps down to stop via the selected ramp-down parameter.

Bit 06 = 1 allows the frequency converter to start the motor if the other starting conditions have been fulfilled.

NOTICE

In *parameter 8-53 Start Select*, 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 resets a trip. Reset is activated on the signal's leading edge, that is, when changing from logic 0 to logic 1.

Bit 08, jog

Bit 08 = 0, no function.

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

Bit 09, selection of ramp 1/2

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

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

Bit 10, data not valid/data valid
Tell the frequency converter to use or ignore the control word.
Bit 10 = 0 ignores the control word.
Bit 10 = 1 uses the control word. This function is relevant because the control word is always contained in the telegram, regardless of which type of telegram is used. Thus, it is possible to turn off the control word if it is not needed when updating or reading parameters.

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

Bit 12, relay 02
Bit 12 = 0, relay 02 is not activated.
Bit 12 = 1, relay 02 is activated, provided *[37] Control word bit 12* is selected in *parameter 5-40 Function Relay*.

Bits 13, set-up selection
Use bit 13 to select from the 2 set-ups according to *Table 4.13*.

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

Set-up	Bit 13
1	0
2	1

Table 4.13 Set-up selection

NOTICE

In *parameter 8-55 Set-up Select*, define how bit 13 gates with the corresponding function on the digital inputs.

Bit 14, not used
Bit 15, reverse
Bit 15 = 0 means no reversing.
Bit 15 = 1 means reversing.

4.5.2 Status Word According to FC Profile (STW)

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

Refer to *chapter 7 Application Examples* for an example of a status word telegram using PPO type 3.

Bit	Bit = 0	Bit = 1
00	Control not ready	Control ready
01	Frequency converter not ready	Frequency converter ready
02	Coasting	Enable
03	No error	Trip
04	No error	Error (no trip)
05	Reserved	–
06	No error	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	Thermal OK	Limit exceeded

Table 4.14 Definition of Status Bits

Explanation of the status bits
Bit 00, control not ready/ready
Bit 00 = 0, the frequency converter has tripped.
Bit 00 = 1, the frequency converter controls are ready, but the power component is not necessarily receiving any power (in case of a 24 V external supply to controls).

Bit 01, frequency converter ready
Bit 01 = 0, the frequency converter is not ready for operation.
Bit 01 = 1, the frequency converter is ready for operation, but there is an active coasting command via the digital inputs or via serial communication.

Bit 02, coasting stop
Bit 02 = 0, the frequency converter has released the motor.
Bit 02 = 1, the frequency converter can start the motor when a start command is given.

Bit 03, no error/trip
Bit 03 = 0, the frequency converter is not in fault mode.
Bit 03 = 1, the frequency converter is tripped, and a reset signal is required to re-establish operation.

Bit 04, no error/error (no trip)
Bit 04 = 0, the frequency converter is not in fault mode.
Bit 04 = 1, there is a frequency converter error but no trip.

Bit 05, not used
Bit 05 is not used in the status word.

Bit 06, no error/triplock
Bit 06 = 0, the frequency converter is not in fault mode.
Bit 06 = 1, the frequency converter is tripped and locked.

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

Bit 08, speed ≠ reference/speed = reference
Bit 08 = 0, the motor runs, but the present speed is different from the preset speed reference. It could, for example, be the case while the speed ramps up/down during start/stop.
Bit 08 = 1, the present motor speed matches the preset speed reference.

Bit 09, local operation/bus control
Bit 09 = 0, [Stop/Reset] is pressed on the LCP, or *[2] Local* is selected in *parameter 3-13 Reference Site*. It is not possible to control the frequency converter via serial communication.
Bit 09 = 1, it is possible to control the frequency converter via the fieldbus/serial communication.

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

Bit 11, no operation/in operation
Bit 11 = 0, the motor does not run.
Bit 11 = 1, the frequency converter has a start signal or the output frequency is higher than 0 Hz.

Bit 12, frequency converter OK/stopped, auto-start
Bit 12 = 0, there is no temporary overtemperature in the frequency converter.
Bit 12 = 1, the frequency converter has stopped because of overtemperature, but it has not tripped and resumes operation once the temperature is within the defined limits.

Bit 13, voltage OK/limit exceeded
Bit 13 = 0, there are no voltage warnings.
Bit 13 = 1, 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, the motor current is lower than the torque limit selected in *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.
Bit 14 = 1, the torque limits in *parameter 4-16 Torque Limit Motor Mode* and *parameter 4-17 Torque Limit Generator Mode* are exceeded.

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

5 Acyclic Communication (DP-V1)

PROFINET offers cyclic communication to enhance the cyclic data communication. This feature is possible via an IO controller (for example PLC), as well as an IO supervisor (for example PC Tool).

Cyclic communication means that data transfer takes place all the time at a certain update rate. It is a common function used for quick update of I/O process data. Acyclic communication means a one-time event, used mainly for read/write on parameters from process controllers, PC-based tools, or monitoring systems.

5.1 Features of an IO Controller System

Cyclic data exchange.

Acyclic read/write on parameters.

The acyclic connection is fixed and cannot be changed during operation.

In general, an IO controller is used as process controller, responsible for commands, speed reference, status of the application, and so on (PLC or PC-based controller).

In the IO controller, the acyclic connection can be used for general parameter access in the slaves.

5.2 Features of an IO Supervisor System

Initiate/abort acyclic connection.

Acyclic read/write on parameters.

The acyclic connection can be established dynamically (initiated) or removed (aborted) even though an IO controller is active on the network.

The acyclic connection is typically used for configuration or commissioning tools for easy access to each parameter in any slave in the system.

5.3 Addressing Scheme

The structure of a PROFINET IO device is shown in *Illustration 5.1*.

An IO device consists of a number of physical or virtual slots. Slot 0 is always present and represents the basic unit. Each slot contains a number of data blocks addressed by an index.

The master must address a variable in the slave as follows: /Slave address/Slot #/Index #

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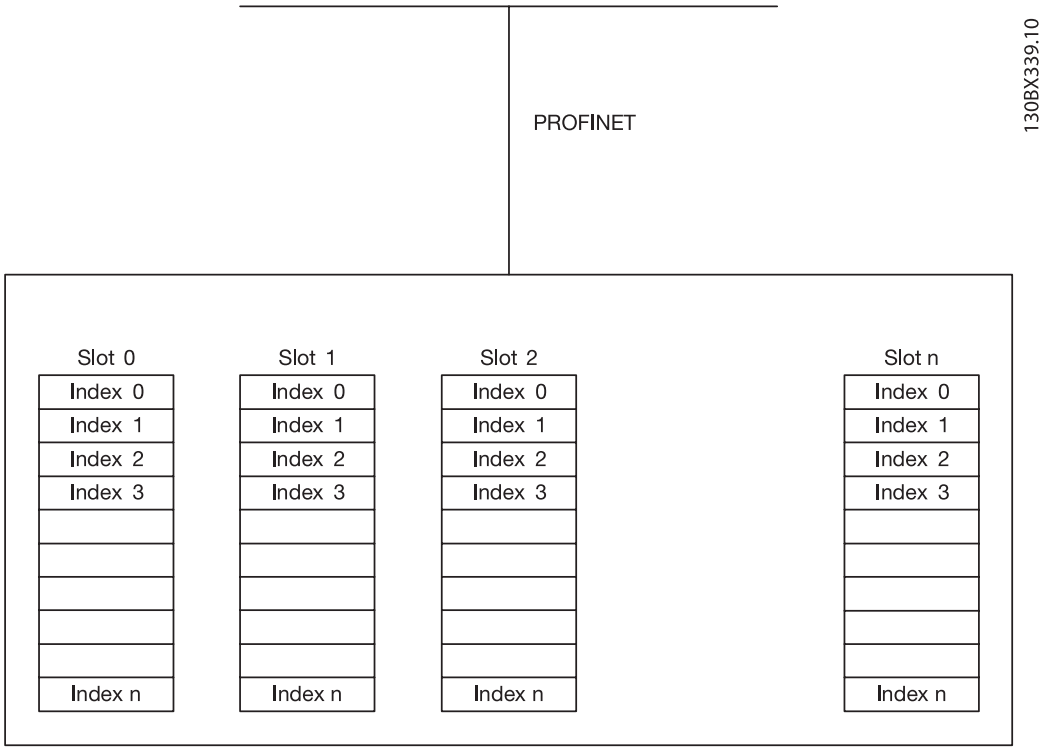

Illustration 5.1 PROFINET IO Device Structure

5.4 Acyclic Read/Write Request Sequence

A read or write service on a frequency converter parameter takes place as shown in *Illustration 5.2*.

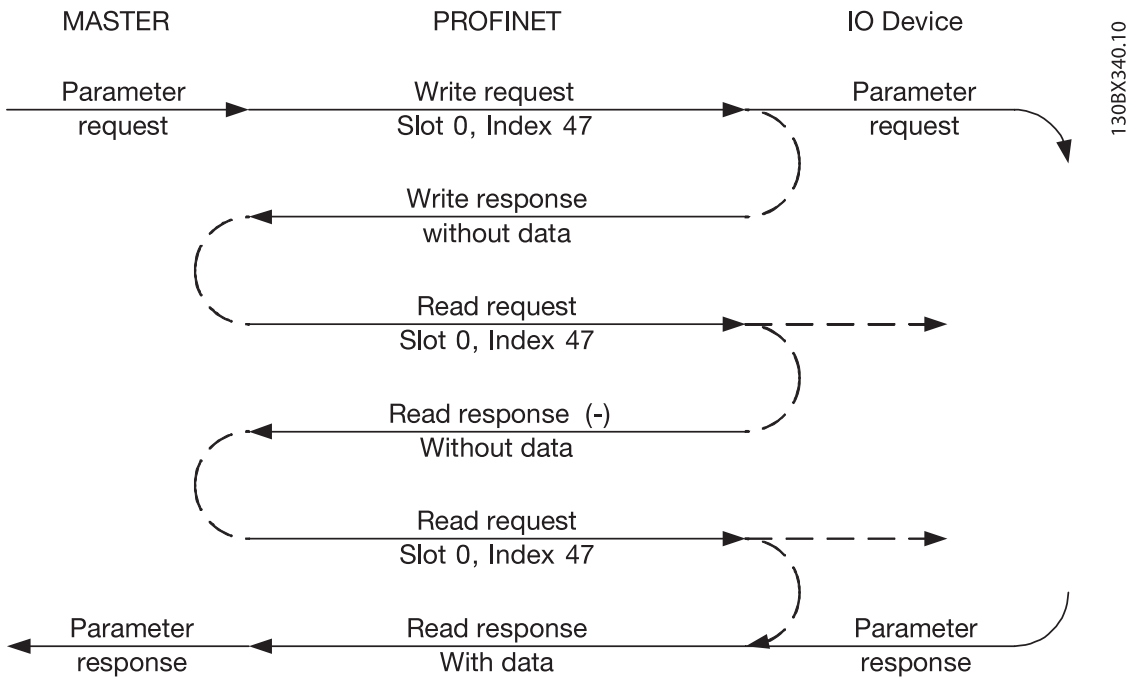

Illustration 5.2 Acyclic Read/Write Request Sequence

Initiate a read or write on a frequency converter parameter by an acyclic write service on slot 0, index 47. If this write request is valid, a positive write response without data is returned from the frequency converter immediately. If not, a negative write response is returned from the frequency converter.

The frequency converter now interprets the PROFIdrive parameter channel part of the data unit and starts to perform this command internally in the frequency converter.

As the next step, the master sends a read request. If the frequency converter is still busy performing the internal parameter request, a negative response without data is returned from the frequency converter. This request is repeated by the master, until the frequency converter has the response data ready for the frequency converter parameter request.

The following example shows the details of the telegrams needed for the read/write service.

5.5 Data Structure in the Acyclic Telegrams

The data structure for a write/read parameter request consists of 3 main blocks:

- Header block.
- Parameter block.
- Data block.

Arrange according to *Table 5.1*:

Word number		
1 Header	Request #	Request ID
2 Header	Axis	# Param.
3 (Param. 1)	Attribute	# Elements
4 (Param. 1)	Parameter number	
5 (Param. 1)	Subindex number	
6 (Param. 2)	Attribute	# Elements
7 (Param. 2)	Parameter number	
8 (Param. 2)	Subindex number	
9 (Param. 3)	Attribute	# Elements
10 (Param. 3)	Parameter number	
11 (Param. 3)	Subindex number	
...		
N (Data Param. 1)	Format	# Elements
N+1 (Data Param. 1)	Data	Data
N (Data Param. 2)	Format	# Elements
N+1 (Data Param. 2)	Data	Data
N (Data Param. 3)	Format	# Elements
N+1 (Data Param. 3)	Data	Data
N+1 (Data Param. 3)	Data	Data
N+1 (Data Param. 3)	Data	Data

Table 5.1 Request Telegram

5.6 Header

Request number
The master uses request # to handle the response from the IO device. The IO device mirrors this number in its response.

Request ID
1 = request parameter
2 = change parameter

Axis
Always leave this to 0 (zero).
Only used in multi-axis system.

Number of parameters
Number of parameters to read or write.

5.7 Parameter Block

Provide the following 5 values for each parameter to read.

Attribute
Attribute to be read
10 = Value
20 = Description
30 = Text

Number of elements
The number of elements to read when parameter is indexed.

Attribute
Read attribute.

Parameter number
The number of the parameter to read.

Subindex
Pointer to the index.

5.8 Data Block

The data block is only needed for write commands. Set up the data block information for each parameter to write.

Format
The format of the information to write:
2: Integer 8.
3: Integer 16.
4: Integer 32.
5: Unsigned 8.
6: Unsigned 16.
7: Unsigned 32.
9: Visible string.
33: Normalized value 2 bytes.
35: Bit sequence of 16 boolean variables.
54: Time difference without date.
Refer to the frequency converter's *programming guide* for a table with parameter number, format, and other relevant information.

Data
The actual value to transfer. The amount of data has to be exactly the size requested in the parameter block. If the size differs, the request generates an error.

On a successful transmission of a request command, the master can read the response from the frequency converter. The response does look very much like the request command. The response only consists of 2 blocks, the header and the data block.

1 Header	Request #	Request ID
2 Header	Axis	# Param.
3 (Data Param. 1)	Format	Error code
4 (Data Param. 1)	Data	Data
5 (Data Param. 2)	Format	Error code
6 (Data Param. 2)	Data	Data
7 (Data Param. 3)	Format	Error code
8 (Data Param. 3)	Data	Data
9 (Data Param. 3)	Data	Data
10 (Data Param. 3)	Data	Data

Table 5.2 Response Telegram

Error code

If the IO device discovers an error during the execution of the command, it sets the error code to the following values:

0x00	Unknown parameter.
0x01	Parameter is read-only.
0x02	Value out of range due to max/min value.
0x03	Wrong subindex.
0x04	Parameter is no array.
0x05	Wrong data type (wrong data length).
0x06	It is not allowed to set this parameter (only reset).
0x07	Descriptive element is read-only.
0x09	No description available (only value).
0x0b	Process control not possible.
0x0f	No text array available (only value).
0x11	Not possible in current state.
0x14	Value out of range due to the frequency converter state/ configuration.
0x15	Reply too long (more than 240 bytes).
0x16	Wrong parameter address (unknown or unsupported value for attribute, element, parameter number, subindex, or illegal combination).
0x17	Illegal format (for writing).
0x18	Value amount not consistent.
0x65	Wrong axis: Action not possible with this axis.
0x66	Unknown service request.
0x67	This service is not possible with multi-parameter access.
0x68	Parameter value cannot be read from bus.

Table 5.3 Error Code

6 Parameters

6.1 Parameter Group 0-** Operation/ Display

0-37 Display Text 1		
Range:		**Function:**
0*	[0 - 25]	In this parameter, it is possible to write an individual text string to be shown in the LCP or to be read via serial communication. To show the text permanently, select *[37] Display Text 1* in 1 of the following parameters: • *Parameter 0-20 Display Line 1.1 Small.* • *Parameter 0-21 Display Line 1.2 Small.* • *Parameter 0-22 Display Line 1.3 Small.* • *Parameter 0-23 Display Line 2 Large.* • *Parameter 0-24 Display Line 3 Large.* • *Parameter 0-37 Display Text 1.* Changing *parameter 12-08 Host Name* changes *parameter 0-37 Display Text 1* - but not the opposite way.

6.2 Parameter Group 8-** Communication and Option

6.2.1 8-0* General Settings

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

8-02 Control Source	
Option:	**Function:**
	NOTICE **This parameter cannot be adjusted while the motor is running.** Select the source of the control.
[0]	None
[1]	FC Port
[3]	Option A

8-03 Control Timeout Time		
Range:		**Function:**
1 s*	[0.5 - 6000 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 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:**
[0] *	Off	Resume control via fieldbus (fieldbus or standard), using the most recent control word.
[1]	Freeze output	Freeze output frequency until communication resumes.
[2]	Stop	Stop with auto restart until communication resumes.
[3]	Jogging	Run the motor at jog frequency until communication resumes.
[4]	Max. speed	Run the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stop the motor and trip, then reset the frequency converter to restart: • Via the fieldbus. • Via [Reset]. • Via a digital input.

8-07 Diagnosis Trigger		
Option:		**Function:**
		Enable and control the frequency converter diagnosis function.
[0] *	Disable	Extended diagnosis data is not sent even if the data appears in the frequency converter.
[1]	Trigger on alarms	Extended diagnosis data is sent when 1 or more alarms appear.
[2]	Trigger alarm/warn.	Extended diagnosis data is sent if 1 or more alarms/warnings appear.

6.2.2 8-1* Ctrl. Word Settings

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 are visible in the LCP display.
For guidelines in selection of *[0] Frequency converter profile* and *[1] PROFIdrive profile*, refer to the *design guide* for the frequency converter.

Option:		Function:
[0] *	FC profile	
[1]	PROFIdrive profile	

8-14 Configurable Control Word CTW

Option:		Function:
[0]	None	
[1] *	Profile default	
[2]	CTW Valid, active low	
[4]	PID error inverse	
[5]	PID reset I part	
[6]	PID enable	

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.

6.2.3 8-5* Digital/Bus

Parameters for configuring the control word merging.

NOTICE

These parameters are active only when *parameter 8-01 Control Site* is set to *[0] Digital and control word*.

8-50 Coasting Select

Select the trigger for the coasting function.

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

8-51 Quick Stop Select

Select the trigger for the quick stop function.

Option:		Function:
[0]	Digital input	A digital input triggers the quick stop function.
[1]	Bus	A serial communication port or the fieldbus triggers the quick stop function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the quick stop function.
[3] *	Logic OR	The fieldbus/serial communication port or a digital input triggers the quick stop function.

8-52 DC Brake Select

Select control of the DC brake via the terminals (digital input) and/or via the fieldbus.

Option:		Function:
		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	Activate a start command via a digital input.
[1]	Bus	Activate a start command via the serial communication port or fieldbus option.
[2]	Logic AND	Activate a start command via the fieldbus/serial communication port and also via 1 of the digital inputs.
[3]	Logic OR	Activate a start command via the fieldbus/serial communication port or via 1 of the digital inputs.

8-53 Start Select

Select the trigger for the start function.

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

8-54 Reversing Select

Select the trigger for the reversing function.

Option:		Function:
[0]	Digital input	A digital input triggers the reversing function.
[1]	Bus	A serial communication port or the fieldbus triggers the reversing function.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the reversing function.

8-54 Reversing Select		
Select the trigger for the reversing function.		
Option:		**Function:**
[3]	Logic OR	The fieldbus/serial communication port or a digital input triggers the reversing function.

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

8-56 Preset Reference Select		
Option:		**Function:**
		Select the trigger for the preset reference selection.
[0]	Digital input	A digital input triggers the preset reference selection.
[1]	Bus	A serial communication port or the fieldbus triggers the preset reference selection.
[2]	Logic AND	The fieldbus/serial communication port and a digital input trigger the preset reference selection.
[3] *	Logic OR	The fieldbus/serial communication port or a digital input triggers the preset reference selection.

8-57 Profidrive OFF2 Select		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

8-58 Profidrive OFF3 Select		
Option:		**Function:**
[0]	Digital input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

6.2.4 8-9* Bus Feedback

Use the parameter group to configure the bus feedback.

8-90 Bus Jog 1 Speed		
Range:		**Function:**
100 RPM*	[0 - 1500 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 - 1500 RPM]	Enter the jog speed. Activate this fixed jog speed via the serial port or fieldbus option.

6.3 Parameter Group 9-** PROFIdrive

9-07 Actual Value		
Range:		**Function:**
0*	[0 - 65535]	This parameter delivers the MAV for a Master Class 2. This parameter is valid if the control priority is set to Master Class 2.

9-15 PCD Write Configuration		
Array [10]		
Option:		**Function:**
		Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. The values in PCD 3–10 are then written to the selected parameters as data values. Alternatively, specify a standard PROFIBUS telegram in *parameter 9-22 Telegram Selection*.

9-16 PCD Read Configuration		
Array [10]		
Option:		**Function:**
		Select the parameters to be assigned to PCD 3–10 of the telegrams. The number of available PCDs depends on the telegram type. PCDs 3–10 contain the actual data values of the selected parameters. For standard PROFIBUS telegram, see *parameter 9-22 Telegram Selection*.

9-22 Telegram Selection		
Option:		**Function:**
		This parameter shows the selected standard PROFIBUS telegram that the PROFINET IO controller has sent to the frequency converter. At power-up, or if a non-supported telegram is sent from the IO controller, this parameter shows *None* in the display.
[1]	Standard telegram 1	

9-22 Telegram Selection		
Option:		**Function:**
[100] *	None	
[101]	PPO 1	
[102]	PPO 2	
[103]	PPO 3	
[104]	PPO 4	
[105]	PPO 5	
[106]	PPO 6	
[107]	PPO 7	
[108]	PPO 8	

9-23 Parameters for Signals		
Array [1000]		
Read only		
Option:		**Function:**
		This parameter contains a list of signals available for selection in *parameter 9-15 PCD Write Configuration* and *parameter 9-16 PCD Read Configuration*.
[0] *	None	
[302]	Minimum Reference	
[303]	Maximum Reference	
[311]	Jog Speed [Hz]	
[312]	Catch up/slow Down Value	
[341]	Ramp 1 Ramp Up Time	
[342]	Ramp 1 Ramp Down Time	
[351]	Ramp 2 Ramp Up Time	
[352]	Ramp 2 Ramp Down Time	
[380]	Jog Ramp Time	
[381]	Quick Stop Ramp Time	
[412]	Motor Speed Low Limit [Hz]	
[414]	Motor Speed High Limit [Hz]	
[416]	Torque Limit Motor Mode	
[417]	Torque Limit Generator Mode	
[553]	Term. 29 High Ref./Feedb. Value	
[558]	Term. 33 High Ref./Feedb. Value	
[590]	Digital & Relay Bus Control	
[593]	Pulse Out 27 Bus Control	
[595]	Pulse Out 29 Bus Control	
[615]	Terminal 53 High Ref./Feedb. Value	
[625]	Terminal 54 High Ref./Feedb. Value	
[676]	Terminal 45 Output Bus Control	
[696]	Terminal 42 Output Bus Control	
[733]	Process PID Proportional Gain	
[734]	Process PID Integral Time	
[735]	Process PID Differentiation Time	
[748]	PCD Feed Forward	
[890]	Bus Jog 1 Speed	

9-23 Parameters for Signals		
Array [1000]		
Read only		
Option:		**Function:**
[891]	Bus Jog 2 Speed	
[1500]	Operating hours	
[1501]	Running Hours	
[1502]	kWh Counter	
[1600]	Control Word	
[1601]	Reference [Unit]	
[1602]	Reference [%]	
[1603]	Status Word	
[1605]	Main Actual Value [%]	
[1609]	Custom Readout	
[1610]	Power [kW]	
[1611]	Power [hp]	
[1612]	Motor Voltage	
[1613]	Frequency	
[1614]	Motor current	
[1615]	Frequency [%]	
[1616]	Torque [Nm]	
[1617]	Speed [RPM]	
[1618]	Motor Thermal	
[1622]	Torque [%]	
[1630]	DC Link Voltage	
[1633]	Brake Energy /2 min	
[1634]	Heatsink Temp.	
[1635]	Inverter Thermal	
[1638]	SL Controller State	
[1639]	Control Card Temp.	
[1650]	External Reference	
[1652]	Feedback[Unit]	
[1653]	Digi Pot Reference	
[1657]	Feedback [RPM]	
[1660]	Digital Input	
[1661]	Terminal 53 Setting	
[1662]	Analog input 53	
[1663]	Terminal 54 Setting	
[1664]	Analog input 54	
[1665]	Analog output 42 [mA]	
[1667]	Pulse input 29 [Hz]	
[1668]	Pulse input 33 [Hz]	
[1669]	Pulse output 27 [Hz]	
[1670]	Pulse output 29 [Hz]	
[1671]	Relay output	
[1672]	Counter A	
[1673]	Counter B	
[1679]	Analog output 45 [mA]	
[1680]	Fieldbus CTW 1	
[1682]	Fieldbus REF 1	
[1684]	Comm. Option STW	
[1685]	FC Port CTW 1	
[1690]	Alarm Word	
[1691]	Alarm Word 2	

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9-23 Parameters for Signals

Array [1000]
Read only

Option:		Function:
[1692]	Warning Word	
[1693]	Warning Word 2	
[1694]	Ext. Status Word	
[1695]	Ext. Status Word 2	
[1697]	Alarm Word 3	
[3401]	PCD 1 Write For Application	
[3402]	PCD 2 Write For Application	
[3403]	PCD 3 Write For Application	
[3404]	PCD 4 Write For Application	
[3405]	PCD 5 Write For Application	
[3406]	PCD 6 Write For Application	
[3407]	PCD 7 Write For Application	
[3408]	PCD 8 Write For Application	
[3409]	PCD 9 Write For Application	
[3410]	PCD 10 Write For Application	
[3421]	PCD 1 Read For Application	
[3422]	PCD 2 Read For Application	
[3423]	PCD 3 Read For Application	
[3424]	PCD 4 Read For Application	
[3425]	PCD 5 Read For Application	
[3426]	PCD 6 Read For Application	
[3427]	PCD 7 Read For Application	
[3428]	PCD 8 Read For Application	
[3429]	PCD 9 Read For Application	
[3430]	PCD 10 Read For Application	
[3450]	Actual Position	
[3456]	Track Error	

9-27 Parameter Edit

Option:		Function:
		Parameters can be edited via PROFIBUS, the standard RS485 interface, or the LCP.
[0]	Disabled	Disable editing via PROFIBUS.
[1] *	Enabled	Enable editing via PROFIBUS.

9-28 Process Control

Option:		Function:
		Process control (setting of control word, speed reference, and process data) is possible via either PROFINET or standard fieldbus, but not both simultaneously. Local control is always possible via the LCP. Control via process control is possible via either terminals or fieldbus depending on the settings in *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select*.
[0]	Disable	Disable process control via PROFINET and enable process control via standard fieldbus or PROFINET IO supervisor.

9-28 Process Control

Option:		Function:
[1] *	Enable cyclic master	Enable process control via IO controller and disable process control via standard fieldbus or PROFINET IO supervisor.

9-53 Profibus Warning Word

Read only

Range:		Function:
0*	[0 - 65535]	This parameter shows PROFINET communication warnings.

Bit	Condition when bit is active
0	Connection with IO controller is not OK.
1	Reserved for status of connection with second IO controller.
2	Not used.
3	Clear data command received.
4	Actual value is not updated.
5	No link on both ports.
6	Not used.
7	Initializing of PROFINET is not OK.
8	Frequency converter is tripped.
9	Internal CAN error.
10	Wrong configuration data from IO controller.
11	Not used.
12	Internal error occurred.
13	Not configured.
14	Timeout active.
15	Warning 34 active.

Table 6.1 PROFINET Communication Warnings

9-65 Profile Number

Range:		Function:
0*	[0 - 0]	This parameter contains the profile identification. Byte 1 contains the profile number and byte 2 the version number of the profile.

9-70 Programming Set-up

This parameter is unique for LCP and fieldbus. See *parameter 0-11 Programming Set-up*.

Option:		Function:
		Select the set-up to edit.
[1]	Set-up 1	Edit set-up 1.
[2]	Set-up 2	Edit set-up 2.
[9] *	Active Set-up	Follow the active set-up selected in *parameter 0-10 Active Set-up*.

9-71 Profibus Save Data Values

Option:		Function:
		Parameter values changed via PROFINET are not automatically stored in the non-volatile memory. Use this parameter to activate a function that stores parameter values in the EEPROM non-volatile memory, so changed parameter values are retained at power-down.
[0] *	Off	Deactivate the non-volatile storage function.
[1]	Store all setups	Store all parameter values for all set-ups in the non-volatile memory. When all parameter values have been stored, the selection returns to *[0] Off*.

9-72 ProfibusDriveReset

Option:		Function:
[0] *	No action	
[1]	Power-on reset	Reset frequency converter upon power-up, as for power cycle.
[3]	Comm option reset	Reset the PROFINET option only, the PROFINET option goes through a power-up sequence. When reset, the frequency converter disappears from the fieldbus, which may cause a communication error from the master.

9-80 Defined Parameters (1)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-81 Defined Parameters (2)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-82 Defined Parameters (3)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-83 Defined Parameters (4)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-84 Defined Parameters (5)

Array [115]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-85 Defined Parameters (6)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the defined frequency converter parameters available for PROFINET.

9-90 Changed Parameters (1)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-91 Changed Parameters (2)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-92 Changed Parameters (3)

Array [116]
No LCP access
Read only

Range:		Function:
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

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9-93 Changed Parameters (4)		
Array [116] No LCP access Read only		
Range:	**Function:**	
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

9-94 Changed Parameters (5)		
Array [116] No LCP Address Read only		
Range:	**Function:**	
0*	[0 - 9999]	This parameter shows a list of all the frequency converter parameters deviating from default setting.

6.4 Parameter Group 12-** Ethernet

6.4.1 12-0* IP Settings

12-01 IP Address		
Range:	**Function:**	
0*	[0 - 4294967295]	Configure the IP address of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP.

12-02 Subnet Mask		
Range:	**Function:**	
0*	[0 - 4294967295]	Configure the IP subnet mask of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP.

12-03 Default Gateway		
Range:	**Function:**	
0*	[0 - 4294967295]	Configure the IP default gateway of the option. Read-only, if *parameter 12-00 IP Address Assignment* is set to DHCP or BOOTP. In a non-routed network, this address is set to the IP address of the I/O device.

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

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

12-06 Name Servers		
Range:	**Function:**	
0*	[0 - 4294967295]	IP addresses of domain name servers. Can be automatically assigned when using DHCP.

12-07 Domain Name		
Range:	**Function:**	
0	[0 - 48]	Domain name of the attached network. Can be automatically assigned when using DHCP network.

12-08 Host Name		
Range:	**Function:**	
0*	[0 - 48]	Logical (given) name of option. ***NOTICE*** **The display of the frequency converter only shows the first 19 characters, but the remaining characters are stored in the frequency converter. If hardware switches are different from all ON or all OFF, the switches have priority.**

12-09 Physical Address		
Range:	**Function:**	
0*	[0 - 17]	Read-only. Shows the physical (MAC) address of the option.

6.4.2 12-1* Ethernet Link Parameters

Apply to the whole parameter group.

Index [0] is used for port 1, and index [1] is used for port 2.

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

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

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

12-12 Auto Negotiation

Option:	Function:	
[1] *	On	

12-13 Link Speed

Force the link speed for each port in 10 Mbps or 100 Mbps. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only and shows the actual link speed. If no link is present, *[0] None* is shown.

Option:		Function:
[0] *	None	
[1]	10 Mbps	
[2]	100 Mbps	

12-14 Link Duplex

Force the duplex for each port to full or half duplex. If *parameter 12-12 Auto Negotiation* is set to *[1] On*, this parameter is read-only.

Option:		Function:
[0]	Half Duplex	
[1] *	Full Duplex	

6.4.3 12-8* Other Ethernet Services

12-80 FTP Server

Enables/disables the built-in FTP server.

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

12-81 HTTP Server

Enables/disables the built-in HTTP (web) server.

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

12-82 SMTP Service

Enables/disables the SMTP (e-mail) service on the option.

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

12-89 Transparent Socket Channel Port

Range:		Function:
4000*	[0 - 65535]	Configure the TCP port number for the transparent socket channel. This configuration enables FC telegrams to be sent transparently on Ethernet via TCP. Default value is 4000, 0 means disabled. The MCT 10 Set-up Software uses this port.

6.4.4 12-9* Advanced Ethernet Settings

12-90 Cable Diagnostic

Enable/disable advanced cable diagnosis function. If enabled, the distance to cable errors can be read out in *parameter 12-93 Cable Error Length*. The parameter resumes to the default setting of disable after the diagnostics have finished.

Option:		Function:
		NOTICE **The cable diagnostics function is only issued on ports where there is no link (see *parameter 12-10 Link Status*).**
[0] *	Disabled	Disable the cable diagnostic function.
[1]	Enabled	Enable the cable diagnostic function.

12-91 Auto Cross Over

Option:		Function:
[0]	Disabled	Disable the auto-crossover function.
[1] *	Enabled	Enable the auto-crossover function.

12-92 IGMP Snooping

This function prevents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are member of the multicast group.

Option:		Function:
[0]	Disabled	Disable the IGMP Snooping function.
[1] *	Enabled	Enable the IGMP Snooping function.

12-93 Cable Error Length

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

12-94 Broadcast Storm Protection

Range:		Function:
-1 % *	[-1 - 20 %]	The built-in switch is capable of protecting the switch system from receiving too many broadcast packages, which can use up network resources. The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example:

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12-94 Broadcast Storm Protection		
Range:	**Function:**	
		OFF means that the filter is disabled - all broadcast messages are passed through. The value 0% means that no broadcast messages are passed through. A value of 10% means that 10% of the total bandwidth is allowed for broadcast messages. If the amount of broadcast messages exceeds the 10% threshold, they are blocked.

12-95 Broadcast Storm Filter		
Applies to *parameter 12-94 Broadcast Storm Protection*, if the broadcast storm protection also includes multicast telegrams.		
Option:		**Function:**
[0] *	Broadcast only	
[1]	Broadcast & Multicast	

12-96 Port Config		
Enable/disable port-mirroring function. For troubleshooting with a network analyzer tool.		
Option:		**Function:**
[0] *	Normal	No port-mirroring.
[1]	Mirror Port 1 to 2	All network traffic on port 1 is mirrored to port 2.
[2]	Mirror Port 2 to 1	All network traffic on port 2 is mirrored to port 1.
[10]	Port 1 disabled	
[11]	Port 2 disabled	
[254]	Mirror Int. Port to 1	
[255]	Mirror Int. Port to 2	

12-98 Interface Counters		
Range:		**Function:**
4000*	[0 - 4294967295]	Read-only. Advanced interface counters from built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1+port 2.

12-99 Media Counters		
Range:		**Function:**
0*	[0 - 4294967295]	Read-only. Advanced interface counters from built-in switch can be used for low-level troubleshooting. The parameter shows a sum of port 1+port 2.

6.5 PROFINET-specific Parameters

6.5.1 Setting Communication Parameters

All basic communication parameters are located in *parameter group 12-0* IP Settings*. The parameters are all set to PROFINET standard values, so that only a minimum change is necessary.

- *Parameter 12-00 IP Address Assignment*.
- *Parameter 12-01 IP Address*.
- *Parameter 12-02 Subnet Mask*.
- *Parameter 12-03 Default Gateway*.
- *Parameter 12-04 DHCP Server*.
- *Parameter 12-05 Lease Expires*.
- *Parameter 12-06 Name Servers*.
- *Parameter 12-07 Domain Name*.
- *Parameter 12-08 Host Name*.
- *Parameter 12-09 Physical Address*.

The PROFINET interface offers several ways of address assignment. Typically, DCP is used, and then the PLC assigns the IP address, subnet mask, and other relevant parameters when the communication is established. The following examples show the settings if the PROFINET DCP assignment is used.

Parameter	Value
Parameter 12-00 IP Address Assignment	[10] DCP
Parameter 12-01 IP Address	0.0.0.0 (From PLC)
Parameter 12-02 Subnet Mask	0.0.0.0 (From PLC)
Parameter 12-03 Default Gateway	0.0.0.0 (From PLC)
Parameter 12-04 DHCP Server	*1)

Table 6.2 Setting up Frequency Converter with Manually Assigned IP Address

*1) * = Host name can be set via the LCP, through DCP command, or by setting the DIP switches on the PROFINET interface.*

Parameter	Value
Parameter 12-00 IP Address Assignment	[1] DHCP/[2] BOOTP
Parameter 12-01 IP Address	Read-only
Parameter 12-02 Subnet Mask	Read-only
Parameter 12-03 Default Gateway	Read-only

Table 6.3 Setting up the Frequency Converter with Automatically (BOOTP/DHCP) Assigned IP Address

By IP address assigned by DHCP/BOOTP/DCP server, the assigned IP address and subnet mask can be read out in *parameter 12-01 IP Address* and *parameter 12-02 Subnet Mask*. In *parameter 12-04 DHCP Server*, the IP address of the found DHCP or BOOTP server is shown. For DHCP only: The remaining lease time can be read out in

parameter 12-05 Lease Expires. If lease time is set to 0 (zero), the timer never expires.

Parameter 12-09 Physical Address reads out the MAC address of the option, which is also printed on the label of the option.

Parameter 12-03 Default Gateway is optional and only used in routed networks.

NOTICE

It is only possible to assign valid class A, B, and C IP addresses to the option. The valid ranges are shown in *Table 6.4*.

Class A	1.0.0.1-126.255.255.254
Class B	128.1.0.1-191.255.255.254
Class C	192.0.1.1-223.255.254.254

Table 6.4 Valid Ranges for IP Address to the Option

6.5.2 Ethernet Link Parameters

Parameter group 12-1 Ethernet Link parameters*:

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

Each port has unique Ethernet Link parameters.

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

Parameter 12-12 Auto Negotiation enables 2 connected Ethernet devices to select common transmission parameters, such as speed and duplex mode. In this process, the connected devices first share their capabilities and then select the fastest transmission mode they both support.
Incapability between the connected devices could lead to decreased communication performance.
To prevent this, auto negotiation can be disabled.
If *parameter 12-12 Auto Negotiation* is set to OFF, link speed and duplex mode can be configured manually in *parameter 12-13 Link Speed* and *parameter 12-12 Auto Negotiation*.

Parameter 12-13 Link Speed shows/sets the link speed for each port. If no link is present, none is shown.

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

6.5.3 Introduction

Changes during operation
True means that the parameter can be changed while the frequency converter is in operation. False means that the frequency converter must be stopped before a change can be made.

2 set-up
All set-ups: The parameter can be set individually in each of the 2 set-ups, for example, 1 single parameter can have 2 different data values.
1 set-up: The data value is same in all set-ups.

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

Table 6.5 Data Type

6.5.4 PROFINET-specific Parameter List

Parameter	Default value	2 set-up	Change during operation	Conversion index	Data type
Parameter 0-37 Display Text 1	0	1 set-up	TRUE	0	Visible string 21
Parameter 8-01 Control Site	[0] Dig. & ctrl. word	All set-ups	TRUE	–	Uint8
Parameter 8-02 Control Source	–	All set-ups	TRUE	–	Uint8
Parameter 8-03 Control Timeout Time	1	1 set-up	TRUE	-1	Uint16
Parameter 8-04 Control Timeout Function	[0] Off	1 set-up	TRUE	–	Uint8
Parameter 8-07 Diagnosis Trigger	[0] Disable	1 set-up	TRUE	–	Uint8
Parameter 8-10 Control Word Profile	[0] FC profile	All set-ups	TRUE	–	Uint8
Parameter 8-14 Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	–	Uint8
Parameter 8-19 Product Code	–	1 set-up	TRUE	0	Uint32
Parameter 8-50 Coasting Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-51 Quick Stop Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-52 DC Brake Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-53 Start Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-54 Reversing Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-55 Set-up Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-56 Preset Reference Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-57 Profidrive OFF2 Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-58 Profidrive OFF3 Select	[3] Logic OR	All set-ups	TRUE	–	Uint8
Parameter 8-90 Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	0	Uint16
Parameter 8-91 Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	0	Uint16
Parameter 9-07 Actual Value	0 N/A	All set-ups	FALSE	0	Uint16
Parameter 9-15 PCD Write Configuration	–	1 set-up	TRUE	–	Uint16
Parameter 9-16 PCD Read Configuration	–	1 set-up	TRUE	–	Uint16
Parameter 9-22 Telegram Selection	[100] None	1 set-up	TRUE	–	Uint8
Parameter 9-23 Parameters for Signals	[0]	All set-ups	TRUE	–	Uint16
Parameter 9-27 Parameter Edit	[1] Enabled	1 set-up	FALSE	–	Uint16
Parameter 9-28 Process Control	[1] Enable cyclic master	1 set-up	FALSE	–	Uint16
Parameter 9-53 Profibus Warning Word	0	All set-ups	TRUE	0	V2
Parameter 9-65 Profile Number	0	All set-ups	TRUE	0	Oct. string 2
Parameter 9-70 Edit Set-up	[9] Active set-up	1 set-up	TRUE	–	Uint8
Parameter 9-71 Profibus Save Data Values	[0] Off	All set-ups	TRUE	–	Uint8
Parameter 9-72 ProfibusDriveReset	[0] No action	1 set-up	FALSE	–	Uint8
Parameter 9-80 Defined Parameters (1)	0	All set-ups	FALSE	0	Uint16
Parameter 9-81 Defined Parameters (2)	0	All set-ups	FALSE	0	Uint16
Parameter 9-82 Defined Parameters (3)	0	All set-ups	FALSE	0	Uint16
Parameter 9-83 Defined Parameters (4)	0	All set-ups	FALSE	0	Uint16
Parameter 9-84 Defined Parameters (5)	0	All set-ups	FALSE	0	Uint16
Parameter 9-85 Defined Parameters (6)	0	All set-ups	FALSE	0	Uint16
Parameter 9-90 Changed Parameters (1)	0	All set-ups	FALSE	0	Uint16
Parameter 9-91 Changed Parameters (2)	0	All set-ups	FALSE	0	Uint16
Parameter 9-92 Changed Parameters (3)	0	All set-ups	FALSE	0	Uint16
Parameter 9-93 Changed Parameters (4)	0	All set-ups	FALSE	0	Uint16
Parameter 9-94 Changed Parameters (5)	0	All set-ups	FALSE	0	Uint16
Parameter 12-00 IP Address Assignment	[10] DCP	1 set-up	TRUE	–	Uint8
Parameter 12-01 IP Address	0	1 set-up	TRUE	–	Oct. string 4
Parameter 12-02 Subnet Mask	0	1 set-up	TRUE	–	Oct. string 4
Parameter 12-03 Default Gateway	0	1 set-up	TRUE	–	Oct. string 4
Parameter 12-04 DHCP Server	0	1 set-up	TRUE	–	Oct. string 4
Parameter 12-05 Lease Expires	–	All set-ups	TRUE	–	Time diff. w/date

Parameter	Default value	2 set-up	Change during operation	Conversion index	Data type
Parameter 12-06 Name Servers	0	1 set-up	TRUE	–	Oct. string 4
Parameter 12-07 Domain Name	0	1 set-up	TRUE	–	Visible string 48
Parameter 12-08 Host Name	0	1 set-up	TRUE	–	Visible string 48
Parameter 12-09 Physical Address	0	1 set-up	TRUE	–	Visible string 17
Parameter 12-10 Link Status	[0] No Link	All set-ups	TRUE	–	Uint8
Parameter 12-11 Link Duration	–	All set-ups	TRUE	–	Time diff. w/date
Parameter 12-12 Auto Negotiation	[1] On	1 set-up	TRUE	–	Uint8
Parameter 12-13 Link Speed	[0] None	1 set-up	TRUE	–	Uint8
Parameter 12-14 Link Duplex	[1] Full Duplex	1 set-up	TRUE	–	Uint8
Parameter 12-80 FTP Server	[0] Disabled	1 set-up	TRUE	–	Uint8
Parameter 12-81 HTTP Server	[0] Disabled	1 set-up	TRUE	–	Uint8
Parameter 12-82 SMTP Service	[0] Disabled	1 set-up	TRUE	–	Uint8
Parameter 12-89 Transparent Socket Channel Port	–	1 set-up	TRUE	0	Uint16
Parameter 12-90 Cable Diagnostic	[0] Disabled	1 set-up	TRUE	–	Uint8
Parameter 12-91 Auto Cross Over	[1] Enabled	1 set-up	TRUE	–	Uint8
Parameter 12-92 IGMP Snooping	[1] Enabled	1 set-up	TRUE	–	Uint8
Parameter 12-93 Cable Error Length	0	1 set-up	TRUE	0	Uint16
Parameter 12-94 Broadcast Storm Protection	-1%	1 set-up	TRUE	0	Int8
Parameter 12-95 Inactivity timeout	[0] Broadcast only	1 set-up	TRUE	–	Uint8
Parameter 12-96 Port Config	–	1 set-up	TRUE	–	Uint8
Parameter 12-98 Interface Counters	4000	All set-ups	TRUE	0	Uint32
Parameter 12-99 Media Counters	0	All set-ups	TRUE	0	Uint32

Table 6.6 PROFINET-specific Parameter List

6.5.5 Conversion

The various attributes of each parameter are shown in factory setting. Parameter values are transferred as whole numbers only. Conversion factors are therefore used to transfer decimals.

A conversion factor of 0.1 means that the value transferred is multiplied by 0.1. The value 100 is therefore read as 10.0.

Examples:
0 s ⇒ conversion index 0
0.00 s ⇒ conversion index -2
0 ms ⇒ conversion index -3
0.00 ms ⇒ conversion index -5

Conversion index	Conversion factor
100	1
75	3600000
74	3600
70	60
67	1/60
6	1000000
5	100000
4	10000
3	1000
2	100
1	10
0	1
-1	0.1
-2	0.01
-3	0.001
-4	0.0001
-5	0.00001
-6	0.000001

Table 6.7 Conversion Table

6.6 Supported Object and Data Types

6.6.1 Parameter Description

PROFINET has a number of describing attributes.

6.6.2 Size Attribute

The size index and the conversion index for each parameter can be taken from the parameter list in the *operating guide* for the frequency converter.

Physical unit	Size index	Measuring unit	Designation	Conversion index	Conversion factor
	0	No dimension			
Time	4	second	s	0	1
				-1	0.1
				-2	0.01
		millisecond	ms	-3	0.001
		minute	min	70	60
		hour	h	74	3600
		day	d	77	86400
Energy	8	watthour	Wh	0	1
		kilowatthour	kWh	3	1000
		megawatthour	MWh	6	10^6
Power	9	milliwatt	mW	-3	0.001
		watt	W	0	1
		kilowatt	kW	3	1000
		megawatt	MW	6	10^6
Rotation	11	rotation per minute	RPM	67	1
Torque	16	newtonmetre	Nm	0	1
		kilonewtonmetre	kNm	3	1000
Temperature	17	degree Celsius	°C	0	1
Voltage	21	millivolt	mV	-3	0.001
		volt	V	0	1
		kilovolt	kV	3	1000
Current	22	milliampere	mA	-3	0.001
		ampere	A	0	1
		kiloampere	kA	3	1000
Resistance	23	milliohm	mOhm	-3	0.001
		ohm	Ohm	0	1
		kiloohm	kOhm	3	1000
Ratio	24	per cent	%	0	1
Relative change	27	per cent	%	0	1
Frequency	28	hertz	Hz	0	1
		kilohertz	kHz	3	1000
		megahertz	MHz	6	10^6
		gigahertz	GHz	9	10^9

Table 6.8 Size Index and Conversion Index

6.6.3 Supported Object and Data Types

Data type	Short name	Description	Date type 2
3	I2	Integer 16	Int16
4	I4	Integer 32	Int32
5	–	Unsigned 8	Uint8
6	O2	Unsigned 16	Uint16
7	O4	Unsigned 32	Uint32
9	–	Visible string	VisStr
10	–	Byte string	–
33	N2	Standardized value (16 bit)	N2
35	V2	Bit sequence	V2
54	–	Time difference without date indication	TimD

Table 6.9 Supported Data Types

7 Application Examples

7.1 Example: Process Data with PPO Type 6

This example shows how to work with PPO type 6, which consists of control word/status word and reference/main actual value. The PPO also has 2 additional words, which can be programmed to monitor process signals, see *Table 7.1*:

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

Table 7.1 Example: Process Data with PPO Type 6

7

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

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

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

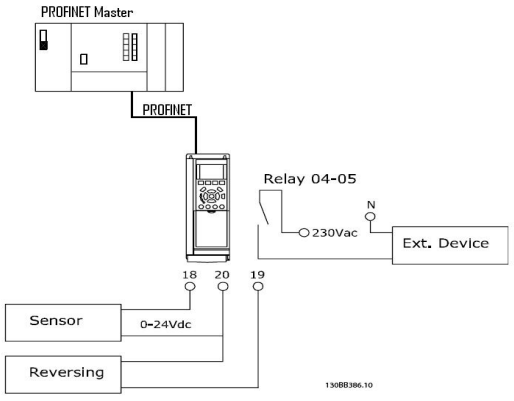

Illustration 7.1 Wiring Diagram

Program the frequency converter as shown in *Table 7.2*:

Parameter	Setting
Parameter 4-10 Motor Speed Direction	*[2] Both directions*
Parameter 5-10 Terminal 18 Digital Input	*[0] No operation*
Parameter 5-11 Terminal 19 Digital Input	*[10] Reversing*
Parameter 5-40 Function Relay	*[36/37] Control word bit 11/12*
Parameter 8-03 Control Word Timeout Time	*1 s*
Parameter 8-04 Control Word Timeout Function	*[2] Stop*
Parameter 8-10 Control Word Profile	*[0] FC Profile*
Parameter 8-50 Coasting Select	*[1] Bus*
Parameter 8-51 Quick Stop Select	*[1] Bus*
Parameter 8-52 DC Brake Select	*[1] Bus*
Parameter 8-53 Start Select	*[1] Bus*
Parameter 8-54 Reversing Select	*[2] Logic AND*
Parameter 8-55 Set-up Select	*[1] Bus*
Parameter 8-56 Preset Reference Select	*[1] Bus*
Parameter 9-16 PCD Read Configuration	*[2] Sub-index parameter 16-16 Torque [Nm]* *[3] Sub-index parameter 16-60 Digital Input*

Table 7.2 Parameter Settings

7.2 Example: Control Word Telegram Using Standard Telegram 1/PPO3

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

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

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

Table 7.3 PCD

Table 7.3 indicates the bits contained within the control word and how they are presented as process data in standard telegram 1 in this example.

Table 7.4 indicates which bit functions and which corresponding bit values are active in this example.

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

Table 7.4 Control Word Telegram Using Standard Telegram 1/PPO3

7.3 Example: Status Word Telegram Using Standard Telegram 1/PPO3

This example shows how the control word telegram relates to the PLC and the frequency converter, using FC control profile.

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

	0		1		2		3																									
	STW		MAV		PCD		PCD																									
	0F	07	20	00																												
PIW:	256		258		260		262																									
	STW		MAV																													
Bit no.:	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	0				F				0				7				2				0				0				0			

Table 7.5 PCD

7

Table 7.5 indicates the bits contained within the status word and how they are presented as process data in standard telegram 1 in this example.

Table 7.6 indicates which bit functions and which corresponding bit values are active in this example.

Bit	Bit value = 0	Bit value = 1	Bit value	
00	Control not ready	Control ready	1	**7**
01	Frequency converter not ready	Frequency converter ready	1	
02	Coasting	Enable	1	
03	No error	Trip	0	
04	No error	Error (no trip)	0	**0**
05	Reserved	–	0	
06	No error	Triplock	0	
07	No warning	Warning	0	
08	Speed reference	Speed ≠ reference	1	**F**
09	Local operation	Bus control	1	
10	Outside frequency range	Within frequency range	1	
11	No operation	In operation	1	
12	Frequency converter OK	Stopped, auto start	0	**0**
13	Voltage OK	Voltage exceeded	0	
14	Torque OK	Torque exceeded	0	
15	Timers OK	Timers exceeded	0	
Function active		–	–	–
Function inactive		–	–	–

Table 7.6 Status Word Telegram Using Standard Telegram 1/PPO3

7.4 Example: PLC Programming

In this example, PPO type 6 is placed in the following input/output address:

...	Module	Rack	Slot	I address	Q address	Type	Order no.	Firmware	Comment
	DANFOSS-FC-SERIES_1	0	0	2038*		Danfoss FC PN	130B1135	1.0	
	Interface	0	0 X1	2037*		DANFOSS-FC-SERIE			
	PPO 6 - 4/4 Words, Danfoss ...	0	1			PPO 6 - 4/4 Words, ...	130B1135	1.0	
	Parameter Access Point	0	1 1	2033*		Parameter Access P..			
	PPO 6 - 4/4 Words, Danf...	0	1 2	264...271	264...271	PPO 6 - 4/4 Words, ...			

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Input address	256–257	258–259	260–261	262–263		Output address	256–257	258–259	260–261	262–263
Set-up	Status word	MAV	Motor torque	Digital input		Set-up	Control word	Reference	Not used	Not used

Illustration 7.2 PPO Type 6 Placed in the Input/Output Address

This network sends a start command (047C hex) and a reference (2000 hex) of 50% to the frequency converter.

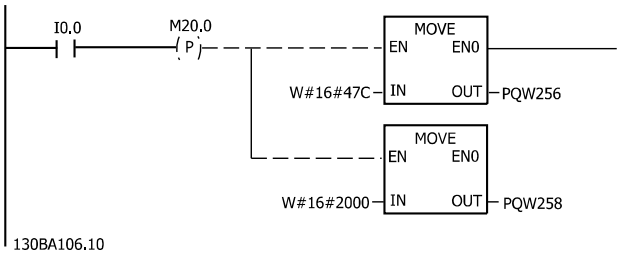

Illustration 7.3 Network Sends Start Command and Reference

This network reads the motor torque from the frequency converter. A new reference is sent to the frequency converter because the motor torque (86.0%) is higher than the compared value.

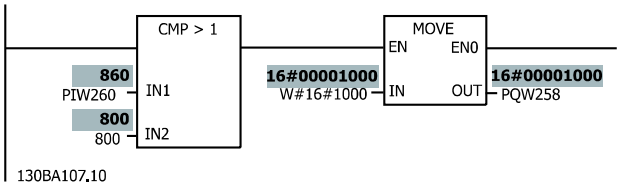

Illustration 7.4 Network Reads the Motor Torque

This network reads the status on the digital inputs from the frequency converter. If digital input 18 is ON, it stops the frequency converter.

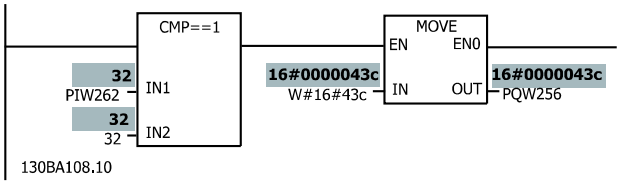

Illustration 7.5 Network Reads the Status on the Digital Inputs

This network reverses the motor when digital input 19 is ON, because *parameter 8-54 Reversing Select* is programmed to Logic AND.

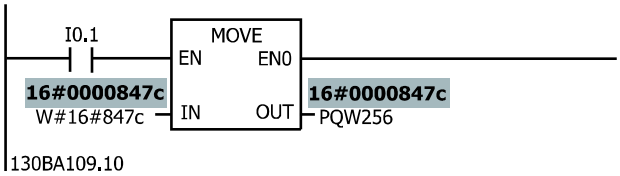

Illustration 7.6 Network Reverses the Motor

This network activates relay 02.

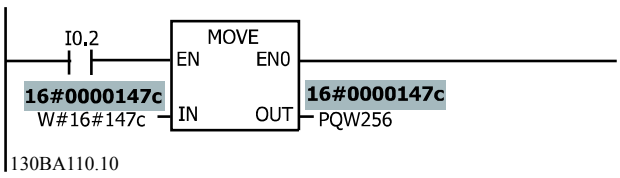

Illustration 7.7 Network Activates Relay 02

7.5 Example: PLC and Network Monitoring

In automation systems the correct working of the I/O controller (PLC) and network is of highest priority. The PROFINET interface is designed so that it can monitor the system for the availability of the I/O controller and the network.

The typical faults that the PROFINET interface can detect are:

- Power loss (I/O controller or network components).
- Cable faults (broken cable).
- Malfunction of networks components (partly).
- I/O controller program stopped execution.

The Danfoss FC series frequency converters have two separate functions to monitor and indicate communications faults:

- Warning 34, activated by the fieldbus interface to indicate a fault on the fieldbus.
- Alarm 17, activated by the frequency converter if the frequency converter has not received a control word for a user specified time.

The PROFINET Interface suppresses the warning 34 for the first 60 s after power-up, this is to allow the I/O controller to establish communication to the PROFINET interface and to avoid any sporadic faults while the network infrastructure is settling.

For monitoring communication from controllers (and the fieldbus interface) the frequency converter has a function that monitors the reception of I/O data to the control word. The monitor feature has a timer that can be set to a value from 0.5 s up to 6000 s (1.6 Hours). At power-up the timer is disabled until it receives a valid control word (CTW).

When the timer is armed, the timer must be retriggered within the time set in *parameter 8-03 Control Timeout Time*. Retriggering is done by receiving a new control word. If no control word is received within this time, the frequency converter issues alarm 17, and execute one or more commands:

- Set the motor into a well-defined state (for example, stop, trip).
- Set digital outputs into a well-defined state (for example, on, off, no change).

By this, the frequency converter reacts in a known way, if communication faults occur.

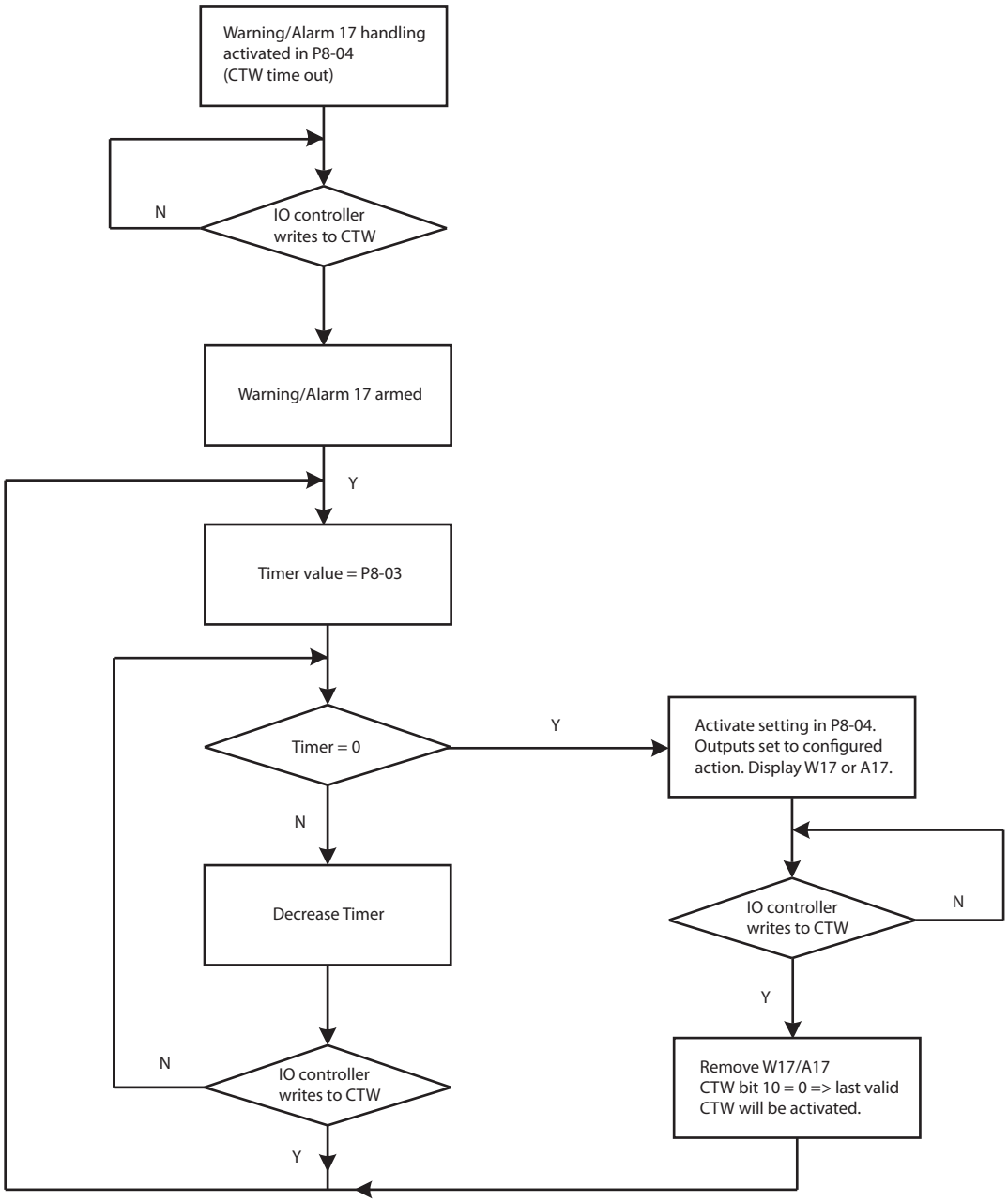

Illustration 7.8 CTW timeout State Machine – Warning 17 or Alarm 17

Example 1: conveyor application

The conveyor belt can accept to lose the communication for up to 1 s. When communication is lost, the conveyor has to stop.

ID	Name	Set-up 1
801	Control site	Digital and control word
802	Control source	FC port
803	Control timeout time	1.0
804	Control timeout function	Stop

Table 7.7 Configuration of Example 1

The I/O controller is programmed so that it is sending the CTW every 16 milliseconds, and that the I/O controller and PROFINET interface allows up to 3 I/O cycles to be lost before activating warnings, alarms, and so forth. For the PROFINET interface, this means that it issues the warning 34 if it does not receive I/O data for more than 48 milliseconds.

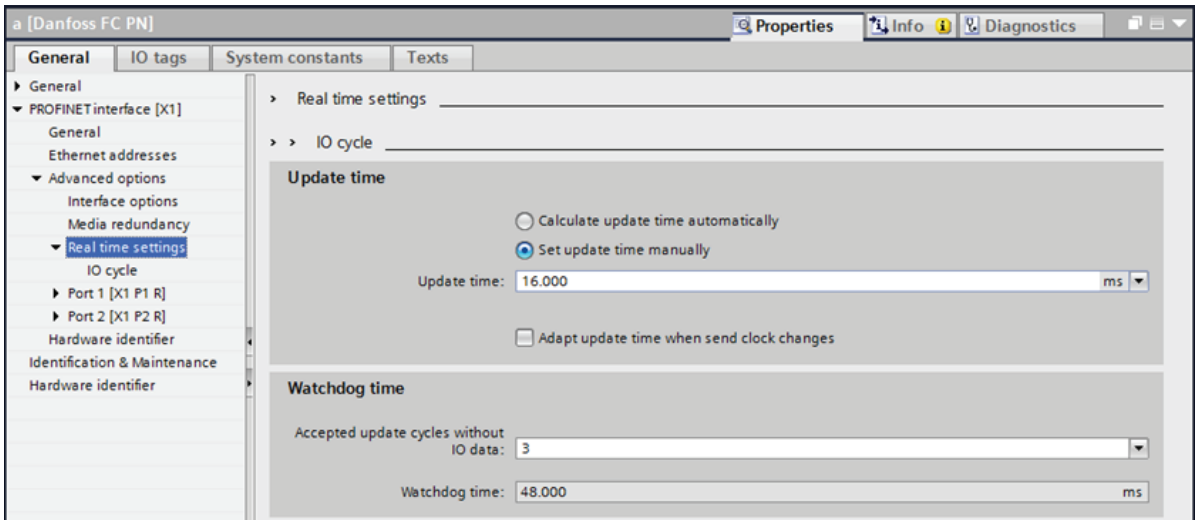

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Illustration 7.9 Example of Setting the Update Time and Number of Accepted Lost I/O Cycles

The PROFINET interface will issue the warning 34, 48 milliseconds after the communication is lost. The frequency converter issues warning 17, if the communication is still missing after 1.0 s. At this time the frequency converter commands the motor to stop via the setting in *parameter 8-04 Control Timeout Function*, the frequency converter ramps the motor down to stop. When the communication is re-established the frequency converter removes the warning 17, and execute the last valid control word it has received before timeout occurred. It is the PLC programs responsibility to regain control of the motor by sending an active control word with the desired command to control the motor.

Example 2: pump application

The pump can accept loss of communication for up to 3 s. Relay 1 is controlled via bit 11 in the control word to open/close a valve. When communication is lost, the pump has to stop, and it may not restart before a reset on the display or via the control word is activated. For the valve, relay 1 has to go into “off” state and close the valve.

ID	Name	Set-up 1
540	Function Relay	Bus control, timeout: off
801	Control site	Digital and control word
802	Control source	Option A
803	Control timeout time	3.0
804	Control timeout function	Stop and trip

Table 7.8 Configuration of Example 2

The I/O controller is programmed so that it is sending the CTW every 64 milliseconds, and that the I/O controller and PROFINET interface allows up to 6 I/O cycles to be lost before activating warnings, alarms, and so forth. For the PROFINET interface, this means that it issues the warning 34 if it does not receive I/O data for more than 384 milliseconds.

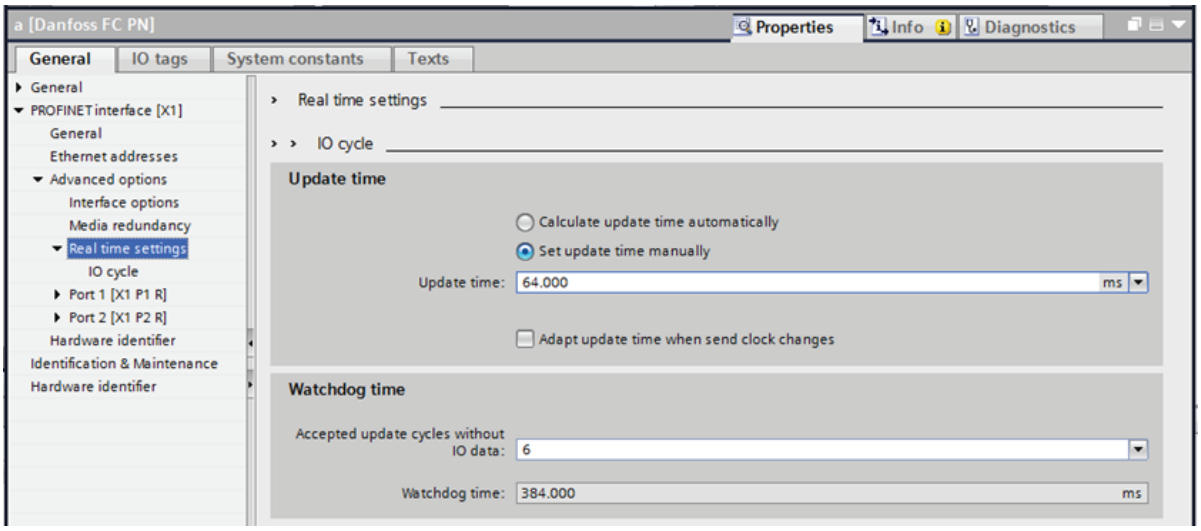

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Illustration 7.10 Example of Setting the Update Time and Number of Accepted Lost I/O Cycles

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The PROFINET interface issues warning 34, 384 milliseconds after the communication is lost. The frequency converter issues the alarm 17, if the communication is still missing after 3.0 s. At this time the relay 1 set to off (*parameter 5-40 Function Relay*) and command the motor to stop (*parameter 8-04 Control Timeout Function*), this will then cause the motor to ramp down to stop. When the motor is stopped the frequency converter goes into “TRIP” state. “TRIP" state needs a reset via control word, LCP or other sources, before the pump can be activated again.

8 Troubleshooting

8.1 No Response to Control Signals

Check 1: Is the control word valid?
If bit 10 = 0 in the control word, the frequency converter does not accept the control word.

Check 2: Is the relationship between bits in the control word and the terminal I/Os correct?
Check the logical relationship in the frequency converter.

Define the desired logical relationship in *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select* according to the following range of options. Select the FC control mode, digital input and/or serial communication, using *parameter 8-50 Coasting Select* to *parameter 8-58 Profidrive OFF3 Select*.

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

Table 8.1 to *Table 8.8* show a coast command's effect on the frequency converter for the full range of *parameter 8-50 Coasting Select* settings.

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

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

NOTICE

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

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

Table 8.1 [0] Digital Input

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

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

Table 8.2 [1] Serial Communication

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

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

Table 8.3 [2] Logic AND

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

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

Table 8.4 [3] Logic OR

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

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

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

Table 8.5 [0] Digital input

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

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

Table 8.6 [1] Serial Communication

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

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

Table 8.7 [2] Logic AND

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

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

Table 8.8 [3] Logic OR

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

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

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

Table 8.9 [0] Digital Input

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

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

Table 8.10 [1] Serial Communication

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

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

Table 8.11 [2] Logic AND

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

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

Table 8.12 [3] Logic OR

8.2 Warnings and Alarms

PROFINET alarm words and warning words are shown on the display in hex format. If there is more than 1 warning or alarm, a sum of all warnings or alarms is shown. Alarm word, warning word, and PROFINET warning word can also be shown using the serial bus in *parameter 16-90 Alarm Word*, *parameter 16-92 Warning Word*, and *parameter 9-53 Profibus Warning Word*.

Bit (hex)	Unit diagnose bit	Alarm word (*parameter 16-90 Alarm Word*)	Alarm number
00000001	48	Brake check	28
00000002	49	Power card overtemperature	69
00000004	50	Earth fault	14
00000008	51	Control card overtemperature	65
00000010	52	Control word timeout	18
00000020	53	Overcurrent	13
00000040	54	Torque limit	12
00000080	55	Motor thermistor overtemperature	11
00000100	40	Motor ETR overtemperature	10
00000200	41	Inverter overloaded	9
00000400	42	DC-link undervoltage	8
00000800	43	DC-link overvoltage	7
00001000	44	Short circuit	16
00004000	46	Mains phase loss	4
00008000	47	AMA not OK	52
00010000	32	Live zero error	2
00020000	33	Internal fault	38
00040000	34	Brake overload	26
00080000	35	Motor phase U is missing	30
00100000	36	Motor phase V is missing	31
00200000	37	Motor phase W is missing	32
00400000	38	Fieldbus comm. fault	34
00800000	39	24 V supply fault	47
01000000	24	Mains failure	36
04000000	26	Brake resistor short circuit	25
08000000	27	Brake chopper fault	27
10000000	28	Option change	67
20000000	29	Frequency converter initialization	80
80000000	31	Mechanical brake low	63

Table 8.13 Parameter 16-90 Alarm Word

Bit (hex)	Unit diagnose bit	Warning word (*parameter 16-92 Warning Word*)	Alarm number
00000001	112	Brake check	28
00000002	113	Power card overtemperature	69
00000004	114	Earth fault	14
00000008	115	Control card overtemperature	65
00000010	116	Control word timeout	18
00000020	117	Overcurrent	13
00000040	118	Torque limit	12
00000080	119	Motor thermistor overtemperature	11
00000100	104	Motor ETR overtemperature	10
00000200	105	Inverter overloaded	9
00000400	106	DC-link undervoltage	8
00000800	107	DC-link overvoltage	7
00004000	110	Mains phase loss	4
00008000	111	No motor	3
00010000	96	Live zero error	2
00040000	98	Brake overload	26
00080000	99	Brake resistor short circuit	25
00100000	100	Brake chopper fault	27
00400000	102	Fieldbus comm. fault	34
00800000	103	24 V supply fault	47
01000000	88	Mains failure	36
02000000	89	Current limit	59
10000000	92	Encoder loss	61
40000000	94	Unused	-

Table 8.14 Parameter 16-92 Warning Word

Bit (hex)	Bit	PROFIBUS warning word (*parameter 9-53 Profibus Warning Word*)
00000001	0	Connection with IO controller is not ok
00000002	1	Unused
00000004	2	Unused
00000008	3	Clear data command received
00000010	4	Actual value is not updated
00000020	5	No Link on both port
00000040	6	Unused
00000080	7	Initializing of PROFINET is not OK
00000100	8	Frequency converter is tripped
00000200	9	Internal CAN error
00000400	10	Wrong configuration data from IO controller
00000800	11	Unused
00001000	12	Internal error occurred
00002000	13	Not configured
00004000	14	Timeout active
00008000	15	Warning 34 active

Table 8.15 Parameter 9-53 Profibus Warning Word

Bit (Hex)	Comm. option STW (*parameter 16-84 Comm. Option STW*)
00000001	Parameterization OK
00000002	Configuration OK
00000004	Clearmode active
00000008	Baudrate search
00000010	Waiting for parameterization
00000020	Waiting for configuration
00000040	In data exchange
00000080	Not used
00000100	Not used
00000200	Not used
00000400	Not used
00000800	MCL2/1 connected
00001000	MCL2/2 connected
00002000	MCL2/3 connected
00004000	Data transport active
00008000	Not used

Table 8.16 Parameter 16-84 Comm. Option STW

NOTICE

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

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8.2.1 Warning/Alarm Messages

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

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

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

3 ways of resetting alarms

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

NOTICE

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

If an alarm cannot be reset, the reason could be that its cause has not been rectified, or that the alarm is trip lock (see also *Table 8.17*).

Trip lock alarms offer extra protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and can be reset as described once the cause has been rectified.

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

When a warning or alarm is marked against a code in *Table 8.17*, either a warning occurs before an alarm, or it is possible to specify whether a warning or an alarm shows for a given fault.

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

8.2.2 Alarm and Warning List

An (X) marked in *Table 8.17* indicates that the warning or alarm has occurred. A warning precedes an alarm.

Number	Description	Warning	Alarm	Trip lock	Cause
2	Live zero error	X	X	–	Signal on terminal 53 or 54 is less than 50% of value set in *parameter 6-10 Terminal 53 Low Voltage*, *parameter 6-12 Terminal 53 Low Current*, *parameter 6-20 Terminal 54 Low Voltage*, and *parameter 6-22 Terminal 54 Low Current*.
3	No motor	X	–	–	No motor has been connected to the output of the frequency converter, or 1 motor phase is missing.
4	Mains phase loss[1)]	X	X	X	Missing phase on supply side, or the voltage imbalance is too high. Check the supply voltage.
7	DC overvoltage[1)]	X	X	–	Intermediate circuit voltage exceeds limit.
8	DC undervoltage[1)]	X	X	–	Intermediate circuit voltage drops below the voltage warning low limit.
9	Inverter overloaded	X	X	–	More than 100% load for too long.
10	Motor ETR overtemperature	X	X	–	Motor is too hot due to more than 100% load for too long.
11	Motor thermistor overtemperature	X	X	–	Thermistor or thermistor connection is disconnected.
12	Torque limit	X	X	–	Torque exceeds value set in either *parameter 4-16 Torque Limit Motor Mode* or *parameter 4-17 Torque Limit Generator Mode*.

Number	Description	Warning	Alarm	Trip lock	Cause
13	Overcurrent	X	X	X	Inverter peak current limit is exceeded. For J1–J6 units, if this alarm occurs on power-up, check whether power cables are mistakenly connected to the motor terminals.
14	Earth fault	–	X	X	Discharge from output phases to ground.
16	Short circuit	–	X	X	Short circuit in motor or on motor terminals. For J7 units, if this alarm occurs on power-up, check whether power cables are mistakenly connected to the motor terminals.
17	Control word timeout	X	X	–	No communication to frequency converter.
18	Start failed	–	X	–	–
25	Brake resistor short-circuited	–	X	X	Brake resistor is short-circuited, thus the brake function is disconnected.
26	Brake overload	X	X	–	The power transmitted to the brake resistor over the last 120 s exceeds the limit. Possible corrections: Decrease brake energy via lower speed or longer ramp time.
27	Brake IGBT/Brake chopper short-circuited	–	X	X	Brake transistor is short-circuited, thus brake function is disconnected.
28	Brake check	–	X	–	Brake resistor is not connected/working.
30	U phase loss	–	X	X	Motor phase U is missing. Check the phase.
31	V phase loss	–	X	X	Motor phase V is missing. Check the phase.
32	W phase loss	–	X	X	Motor phase W is missing. Check the phase.
34	Fieldbus fault	X	X	–	PROFIBUS communication issues have occurred.
35	Option fault	–	X	–	Fieldbus or option B detects internal faults.
36	Mains failure	X	X	–	This warning/alarm is only active if the supply voltage to the frequency converter is lost and *parameter 14-10 Mains Failure* is NOT set to *[0] No Function*.
38	Internal fault	–	X	X	Contact the local Danfoss supplier.
40	Overload T27	X	–	–	Check the load connected to terminal 27 or remove short-circuit connection.
41	Overload T29	X	–	–	Check the load connected to terminal 29 or remove short-circuit connection.
46	Gate drive voltage fault	–	X	X	–
47	24 V supply low	X	X	X	24 V DC may be overloaded.
50	AMA calibration	–	X	–	–
51	AMA check U_{nom} and I_{nom}	–	X	–	Wrong setting for motor voltage and/or motor current.
52	AMA low I_{nom}	–	X	–	Motor current is too low. Check the settings.
53	AMA big motor	–	X	–	The power size of the motor is too large for the AMA to operate.
54	AMA small motor	–	X	–	The power size of the motor is too small for the AMA to operate.
55	AMA parameter range	–	X	–	The parameter values of the motor are outside of the acceptable range. AMA does not run.
56	AMA interrupt	–	X	–	The AMA is interrupted.
57	AMA timeout	–	X	–	–
58	AMA internal	–	X	–	Contact Danfoss.
59	Current limit	X	X	–	Frequency converter overload.
60	External Interlock	–	X	–	–
61	Encoder loss	X	X	–	–
63	Mechanical brake low	–	X	–	Actual motor current has not exceeded release brake current within start delay time window.
65	Control card temp	X	X	X	The cutout temperature of the control card is 80 °C (176 °F).
69	Power card temp	X	X	X	–

Number	Description	Warning	Alarm	Trip lock	Cause
70	Illegal FC config	–	X	X	–
80	Frequency converter initialized to default value	–	X	–	All parameter settings are initialized to default settings.
87	Auto DC brake	X	–	–	Occurs in IT mains when the frequency converter coasts and the DC voltage are higher than 830 V. Energy on DC-link is consumed by the motor. This function can be enabled/disabled in *parameter 0-07 Auto DC Braking*.
90	Feedback monitor	X	X	–	A feedback fault is detected by option B.
95	Broken belt	X	X	–	–
99	Locked rotor	–	X	–	–
101	Flow/pressure information missing	–	X	X	–
120	Position control fault	–	X	–	–
124	Tension limit	–	X	–	–
126	Motor rotating	–	X	–	–
127	Back EMF too high[2)]	X	–	–	Try to start PM motor which is rotating in an abnormal high speed.
250	New spare part	–	X	X	–
251	New type code	–	X	X	–

Table 8.17 Warnings and Alarms Code List

1) These faults may be caused by mains distortions. Installing a Danfoss line filter may rectify this problem.

2) For enclosure size J7, the warning can also be caused by high UDC voltage.

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

Warning	Yellow
Alarm	Flashing red
Trip locked	Yellow and red

Table 8.18 LED Indication

Bit	Hex	Dec	Alarm word (*parameter 16-90 Alarm Word*)	Alarm word 2 (*parameter 16-91 Alarm Word 2*)	Alarm word 3 (*parameter 16-97 Alarm Word 3*)	Warning word (*parameter 16-92 Warning Word*)	Warning word 2 (*parameter 16-93 Warning Word 2*)	Extended status word (*parameter 16-94 Ext. Status Word*)	Extended status word 2 (*parameter 16-95 Ext. Status Word 2*)
0	00000001	1	Brake check	Reserved	Reserved	Reserved	Reserved	Ramping	Off
1	00000002	2	Pwr. card temp	Gate drive voltage fault	Reserved	Pwr. card temp	Reserved	AMA tuning	Hand/Auto
2	00000004	4	Earth fault	Reserved	Reserved	Reserved	Reserved	Start CW/CCW	PROFIBUS OFF1 active
3	00000008	8	Ctrl. card temp	Reserved	Reserved	Ctrl. card temp	Reserved	Slowdown	PROFIBUS OFF2 active
4	00000010	16	Ctrl. word TO	Illegal FC config	Reserved	Ctrl. word TO	Reserved	Catch up	PROFIBUS OFF3 active
5	00000020	32	Overcurrent	Reserved	Reserved	Overcurrent	Reserved	Feedback high	Reserved

Bit	Hex	Dec	Alarm word (*parameter 16-90 Alarm Word*)	Alarm word 2 (*parameter 16-91 Alarm Word 2*)	Alarm word 3 (*parameter 16-97 Alarm Word 3*)	Warning word (*parameter 16-92 Warning Word*)	Warning word 2 (*parameter 16-93 Warning Word 2*)	Extended status word (*parameter 16-94 Ext. Status Word*)	Extended status word 2 (*parameter 16-95 Ext. Status Word 2*)
6	00000040	64	Torque limit	Reserved	Reserved	Torque limit	Reserved	Feedback low	Reserved
7	00000080	128	Motor Th. over	Reserved	Reserved	Motor Th. over	Reserved	Output current high	Control ready
8	00000100	256	Motor ETR over	Broken belt	Reserved	Motor ETR over	Broken belt	Output current low	Frequency converter ready
9	00000200	512	Inverter overld.	Reserved	Reserved	Inverter overld.	Reserved	Output freq. high	Quick stop
10	00000400	1024	DC undervolt.	Start failed	Reserved	DC undervolt.	Reserved	Output freq. low	DC brake
11	00000800	2048	DC overvolt.	Reserved	Reserved	DC overvolt.	Reserved	Brake check OK	Stop
12	00001000	4096	Short circuit	External interlock	Reserved	Reserved	Reserved	Braking max	Latched
13	00002000	8192	Reserved	Reserved	Reserved	Reserved	Reserved	Braking	Reserved
14	00004000	16384	Mains ph. loss	Reserved	Reserved	Mains ph. loss	Reserved	Reserved	Freeze output
15	00008000	32768	AMA not OK	Reserved	Reserved	No motor	Auto DC brake	OVC active	Reserved
16	00010000	65536	Live zero error	Reserved	Reserved	Live zero error	Reserved	AC brake	Jog
17	00020000	131072	Internal fault	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
18	00040000	262144	Brake overload	Reserved	Reserved	Brake resistor power limit	Reserved	Reserved	Start
19	00080000	524288	U phase loss	Reserved	Reserved	Reserved	Reserved	Reference high	Reserved
20	00100000	1048576	V phase loss	Option detection	Reserved	Reserved	Overload T27	Reference low	Start delay
21	00200000	2097152	W phase loss	Option fault	Reserved	Reserved	Reserved	Reserved	Sleep
22	00400000	4194304	Fieldbus fault	Locked rotor	Reserved	Fieldbus fault	Reserved	Reserved	Sleep boost
23	00800000	8388608	24 V supply low	Position ctrl. fault	Reserved	24 V supply low	Reserved	Reserved	Running
24	01000000	16777216	Mains failure	Tension Limit	Reserved	Mains failure	Reserved	Reserved	Bypass
25	02000000	33554432	Reserved	Current limit	Reserved	Current limit	Reserved	Reserved	Reserved
26	04000000	67108864	Brake resistor	Reserved	Reserved	Reserved	Reserved	Reserved	External interlock
27	08000000	134217728	Brake IGBT	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
28	10000000	268435456	Option change	Feedback fault	Reserved	Encoder loss	Reserved	Reserved	FlyStart active

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Bit	Hex	Dec	Alarm word (*parameter 16-90 Alarm Word*)	Alarm word 2 (*parameter 16-91 Alarm Word 2*)	Alarm word 3 (*parameter 16-97 Alarm Word 3*)	Warning word (*parameter 16-92 Warning Word*)	Warning word 2 (*parameter 16-93 Warning Word 2*)	Extended status word (*parameter 16-94 Ext. Status Word*)	Extended status word 2 (*parameter 16-95 Ext. Status Word 2*)
29	20000000	536870912	Frequency converter initialized	Encoder loss	Reserved	Reserved	Back EMF too high	Reserved	Heat sink clean warning
30	40000000	1073741824	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
31	80000000	2147483648	Mech. brake low	Reserved	Reserved	Reserved	Reserved	Database busy	Reserved

Table 8.19 Description of Alarm Word, Warning Word, and Extended Status Word

The alarm words, warning words, and extended status words can be read out via serial bus or optional fieldbus for diagnosis.

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130R0704 MG06G102 04/2017