

GE

AF-650 GP & AF-600 FP™ PROFINET

Operating Instructions



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**Contents**

1 Safety	3
1.1.2 Safety Note	3
1.1.3 Safety Regulations	3
1.1.4 Warning against Unintended Start	4
2 Introduction	5
2.1.1 About this Manual	5
2.1.2 Technical Overview	5
2.1.3 Assumptions	5
2.1.4 Hardware	5
2.1.5 Background Knowledge	5
2.1.6 Abbreviations	5
3 How to Install	6
3.1.1 How to Install Option in Frequency Converter	6
3.1.2 Network	7
3.1.3 PROFINET Cables	8
3.1.4 LED Behaviour	9
3.1.5 Topology	11
3.1.6 Recommended Design Rules	13
3.1.7 EMC Precautions	14
4 How to Configure	15
4.1.1 IP Settings	15
4.1.2 Ethernet Link Parameters	16
5 How to Configure the System	17
5.1 Configure the PROFINET Network	17
5.2 Configure the Controller	17
5.2.1 GSD File	17
5.3 Configure the Frequency Converter	21
5.3.1 Drive Parameters	21
6 How to Control the Frequency Converter	22
6.1 PPO Types	22
6.2 Process Data	23
6.2.3 Reference Handling	23
6.2.4 Process Control Operation	24
6.3 Control Profile	25
6.4 PROFIdrive Control Profile	25
6.5 GE Drive Control Profile	29



7 PROFINET Acyclic Communication	33
7.1.1 Features of an IO Controller System	33
7.1.2 Features of an IO-Supervisor System	33
7.1.3 Addressing Scheme	34
7.1.4 Acyclic Read/Write Request Sequence	35
7.1.5 Data Structure in the Acyclic Telegrams	36
7.1.6 Header	36
7.1.7 Parameter Block	36
7.1.8 Data Block	36
7.1.9 Header	37
7.1.10 Data Block	37
8 Parameters	38
8.1 Parameter Group O-## Communication and Option	38
8.2 Parameter Group PB-## PROFIdrive	40
8.3 Parameter Group EN-## Ethernet	42
8.4 PROFINET-specific Parameter List	45
8.5 Object and Data Types Supported	47
9 Application Examples	49
9.1 E.g.: Process Data with PPO Type 6	49
9.2 E.g.: Control Word Network using Standard Telegram 1 / PPO3	51
9.3 E.g.: Status Word Network using Standard Telegram 1 / PPO3	52
9.4 E.g.: PLC Programming	53
10 Troubleshooting	55
10.1 Troubleshooting	55
10.1.1 LED Status	55
10.1.2 No Communication with the Drive	56
10.1.3 Warning 34 Appears even though Communication is Established	56
10.1.4 Will Not Respond to Control Signals	56
10.1.5 Alarm and Warning Words	60
11 Warnings and Alarms	63
11.1 Status Messages	63
11.1.1 Warnings/Alarm Messages	63
11.1.2 Alarm List	63
Index	66



1 Safety

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

1.1.2 Safety Note

▲WARNING

HIGH VOLTAGE

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

1.1.3 Safety Regulations

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



1.1.4 Warning against Unintended Start

1. The motor can be brought to a stop by means of bus commands while the drive is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
2. While parameters are being changed, the motor may start.
3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.

⚠ WARNING

ELECTRICAL HAZARD

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



2 Introduction

2.1.1 About this Manual

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

Introduction

How to Install

How to Configure the System

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

How to Configure the System

How to Control the AF-600 FP/AF-650 GP

How to Access AF-600 FP/AF-650 GP Parameters

Parameters

Troubleshooting

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.

2.1.2 Technical Overview

Since its introduction in 2001, PROFINET has been updated to handle low and medium performance requirement supported by PROFINET RT (Real Time) up to High end servo performance in PROFINET IRT (Isochronous Real Time). With this, PROFINET is the Ethernet Based Fieldbus offering the most scalable and versatile technology today.

PROFINET provides users with the network tools to deploy standard Ethernet technology for manufacturing applications while enabling Internet and enterprise connectivity.

2.1.3 Assumptions

These operating instructions are under the conditions that the GE PROFINET option is used in conjunction with a GE AF-600 FP or AF-650 GP frequency converter. It is also assumed that the installed controller supports the interfaces described in this document and that all the requirements stipulated in the controller, as well as the frequency converter, are strictly observed along with all limitations herein.

2.1.4 Hardware

This manual relates to the PROFINET option OPCPRT.

2.1.5 Background Knowledge

The GE PROFINET Option Card is designed to communicate with any system complying with the PROFINET schema version 2.2 standard. For earlier versions of PROFINET, which support schema version 2.1 and earlier, GE recommends an upgrade of the master and other devices connected to the PROFINET network to schema version 2.2. Familiarity with this technology is assumed. Issues regarding hardware or software produced by other manufacturers, including commissioning tools, are beyond the scope of this manual, and are not the responsibility of GE.

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

2.1.6 Abbreviations

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

Table 2.1

3 How to Install

3.1.1 How to Install Option in Frequency Converter

3

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

- The network option
- Network option adaptor frame for the AF-600 FP/ AF-650 GP. This frame is deeper than the standard frame, to allow space for the network option beneath
- Strain relief (only for unit sizes 11 and 12)

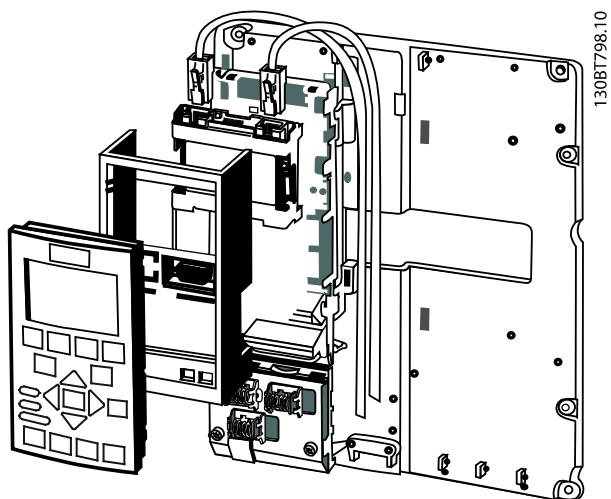


Illustration 3.1

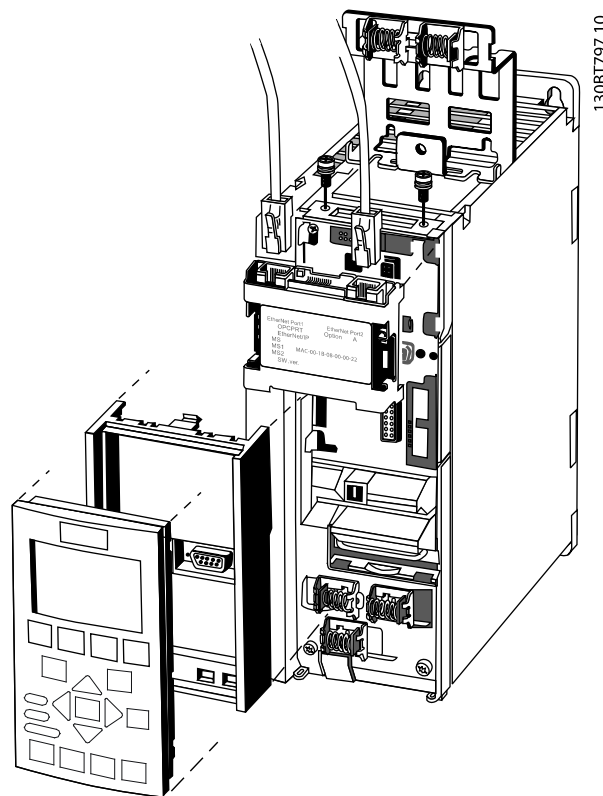


Illustration 3.2

Instructions:

- Remove keypad panel from the AF-600 FP/AF-650 GP.
- Remove the frame located beneath and discard it.
- Push the option into place. The Ethernet connectors must be facing upwards.
- Remove both knock-outs on the network option adaptor frame.
- Push the network option adaptor frame for the AF-600 FP/AF-650 GP into place.
- Replace the keypad and attach cable

NOTE

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

NOTE

After installing the OPCRT option, be aware of the following parameter settings:
O-01 Control Site: [2] *Controlword only* or [0] *Digital and ctrl. word*
O-02 Control Word Source: [3] *Option A*



3.1.2 Network

It is of high importance that the media chosen for Ethernet data transmission are suitable. Usually CAT 5e and 6 cables are recommended for industrial applications. Both types are available as Unshielded Twisted Pair and Shielded Twisted Pair. Generally shielded cables are recommended for use in industrial environments and with frequency converters.

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

Optical fibres can be used for gapping longer distances and providing galvanic isolation.

For connecting PROFINET devices both hubs and switches can be used. It is, however, recommended always to use suitable industrial graded Ethernet switches. GE recommends always to use PROFINET compliant switches



3.1.3 PROFINET Cables

PROFINET cables used are based electrically on category 5 balanced LAN cables according to ISO/IEC 11801 Edition 2.0, Class D.

Type C cables can be used in special applications (e.g. the use of trailing cables and frequently moved machine parts) even though their design and mechanical parameters can deviate from the specifications of type A and type B cables. Still most of the electrical parameters (impedance levels etc.) are retained. Highly flexible copper cables generally have the finest stranded conductors and, for example, a highly resistant polyurethane outer sheath.

Various outer sheath materials are permitted in order to meet the various demands with regard to resistance of industrial environments and exterior/underground laying (natural and synthetic oil, grease, coolants/lubricants, chemicals, high and low temperatures, UV radiation).

All balanced cables used shall comply with the following parameters:

Cable Type	Application Type A	Application Type B	Application Type C
Design	Data Cable	Data Cable	Data Cable
Cable Installation Type	Stationary, no movement after installation	Flexible, occasional movement or vibration	Special Applications (e.g. highly flexible, permanent movement, vibration or torsion)
Cable Marking	PROFINET Type A	PROFINET Type B	PROFINET Type C
Core Cross Section	AWG 22/1	AWG 22/7	AWG 22/..
Outer Diameter	5,5 - 8,0 mm		Application
Core Diameter	1,5 +/- 0,1 mm		Application
Colour (Outer Sheath)	Green RAL6018		Application
Core Identification (colours) star quad 2 pair	white, yellow, blue, orange Pair 1: white (RXD+), blue (RXD-) Pair 2: yellow(TXD+), orange(TXT-)		
Number of Cores	4		
Cable Design	2 pairs or 1 star quad		
Shielding Design Type	Aluminum Foil + Cu braiding		Application
Which Plug for which Cable Type	RJ45 (IP 20 or IP 65/67) / M12		

Table 3.1

Transmission Performance Requirements:

Relevant Standard	ISO/IEC 11801 Edition 2.0, IEC 61156 (minimum Category 5)
Delay Skew	<=20ns/100m
Transfer Impedance	<=50mOhm/m at 10MHz

Table 3.2

3.1.4 LED Behaviour

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

LED Label	Description
MS	Module Status, reflects the activity on the PROFINET stack
NS1	Network Status 1, reflects the activity on port 1
NS2	Network Status 2, reflects the activity on port 2

Table 3.3

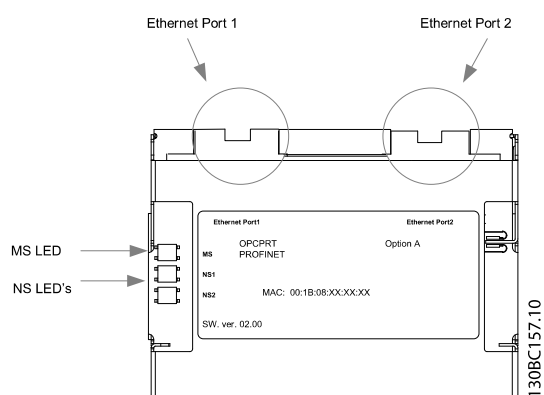


Illustration 3.3 Overview of the Option



Module Status

Status	Tri-colour LED
No IP Address assigned	Off
No Communication to PROFINET module. Module is waiting for configuration telegram from Controller.	Green:
IO AR established	Green:
Supervisor AR established, No IO AR.	Green:
Internal Error	Red:
Wink	Yellow:

Table 3.4 MS: Module Status

Network Status

Phases	Status	Tri-colour LED
Power Off	No Power or No Link on the corresponding port	Off
Power On	IP Address Conflict	Red:
	Waiting for configuration	Green:
Running	In Data Exchange Mode	Green:
	Wrong Configuration	Red:
Data exchange	No increment in "In Octets" counter of corresponding port in last 60 secs.	Yellow:

Table 3.5 Indication on Network Status LED

During normal operation the MS and at least one NS LED will show a constant green light.

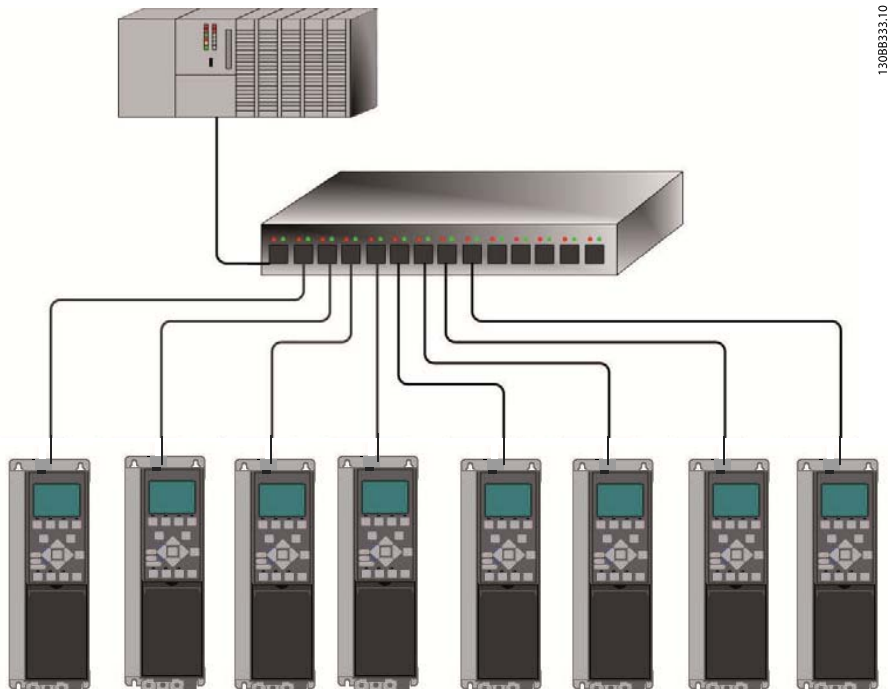
Wink command

The option will responds to a Wink command from the network by yellow flashing of all three LEDs simultaneously.

3.1.5 Topology

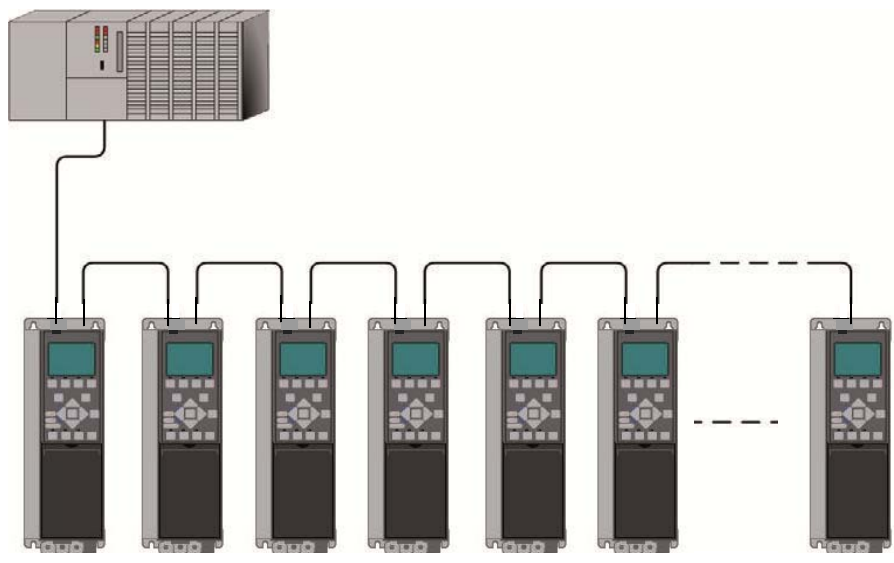
The PROFINET module features a built-in Ethernet-switch, thus having two Ethernet RJ-45 connectors. This enables the possibility for connecting several PROFINET options in a line topology as an alternative to the typical star-topology.

The two ports are equal, in the sense that they are transparent for the option. If only one connector is used, both ports can be used.



1308B333.10

Illustration 3.4 Star Topology



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Illustration 3.5 Line Topology



NOTE

In a line topology all drives must be powered, either by mains or by their 24V DC option cards, for the built-in switch to work.

Please observe that mounting drive of different power-sizes in a line topology may result in unwanted power-off behavior, while using controlword timeout (*O-02 Control Word Source* to *O-06 Reset Control Word Timeout*). It is recommended to mount the drives with the longest discharge time first in the line topology.

3

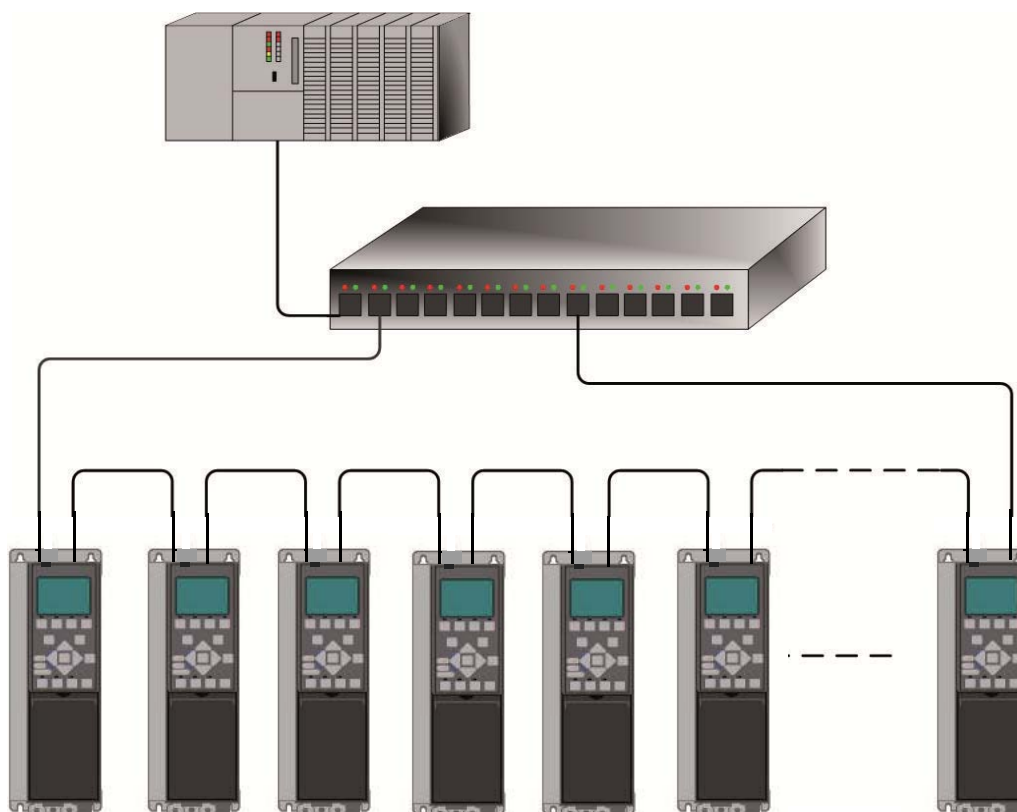


Illustration 3.6 Ring/Redundant Line Topology

CAUTION

For this type of topology it is crucial that the network switch supports detection of loss of line topology. In some cases the detection. The switch inside the PROFINET option does not support this, but it must be supported in the switch that connects the ring to the controller/network Please consult the manual of the switch for more information.

3.1.6 Recommended Design Rules

While designing Ethernet networks special attention and caution must be taken regarding active network components. While designing a network for line topology it is important to notice that a small delay is added with each switch in the line.

It is not recommended to connect more than 32 drive in a line. Exceeding the recommended design rules, may result in unstable or faulted communication.

3

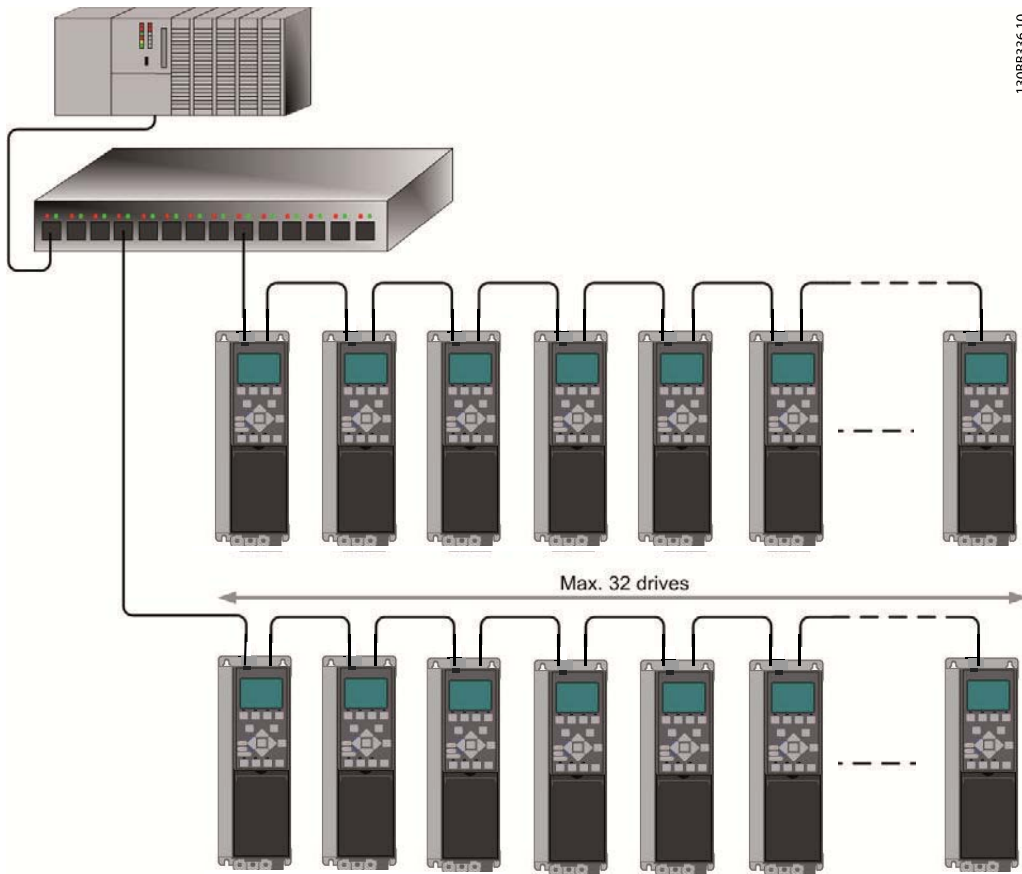


Illustration 3.7

3.1.7 EMC Precautions

The following EMC precautions are recommended in order to achieve interference-free operation of the Ethernet network. Additional EMC information is available in the AF-600 FP/AF-650 GP series Design Guide.

3

NOTE

Relevant national and local regulations, for example regarding protective earth connection, must be observed.

The Ethernet communication cable must be kept away from motor and brake resistor cables to avoid coupling of high frequency noise from one cable to the other. Normally a distance of 200mm (8 inches) is sufficient, but maintaining the greatest possible distance between the cables is recommended, especially where cables run in parallel over long distances. When crossing is unavoidable, the Ethernet cable must cross motor and brake resistor cables at an angle of 90°.

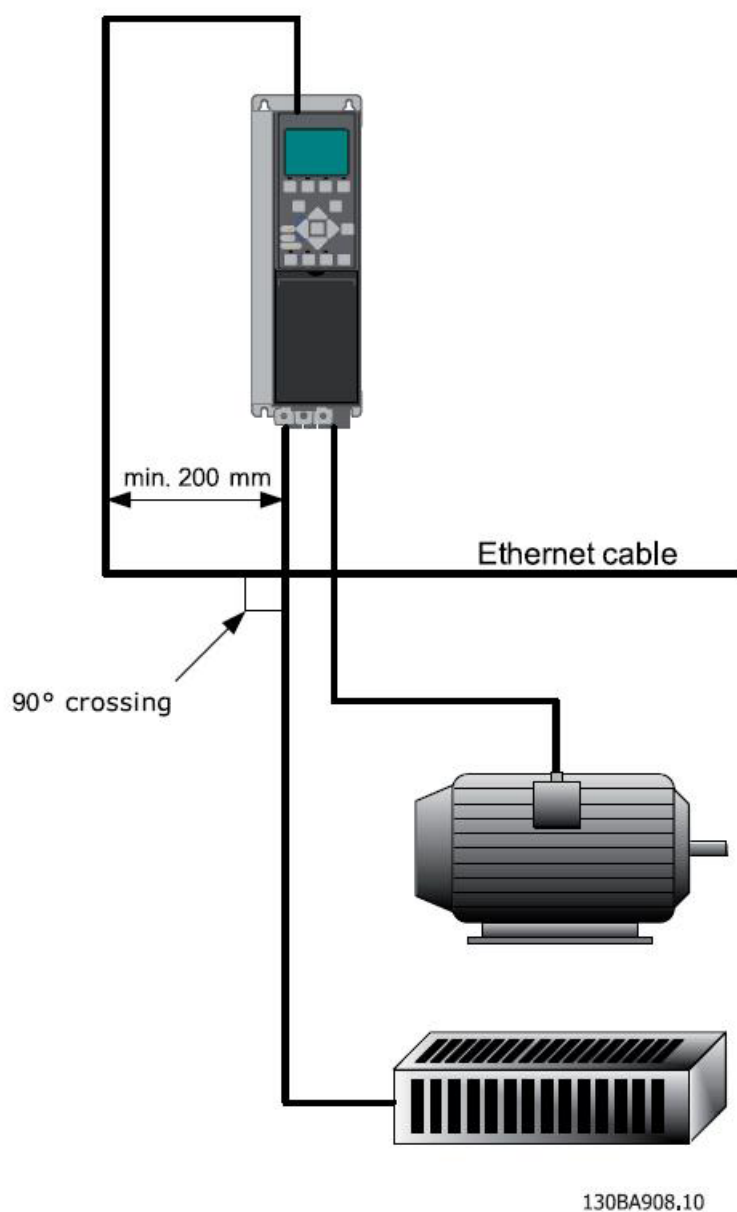


Illustration 3.8



4 How to Configure

4.1.1 IP Settings

All IP-related parameters are located in parameter group EN-#: The parameters are all set to PROFINET standard values, so that only a minimum change is necessary.

EN-00 IP Address Assignment

EN-01 IP Address

EN-02 Subnet Mask

EN-03 Default Gateway

EN-04 DHCP Server

EN-05 Lease Expires

EN-06 Name Servers

EN-07 Domain Name

EN-08 Host Name

EN-09 Physical Address

The PROFINET option offers several ways of IP address assignment.

Setting up drive with manual assigned IP address:

Parameter	Value
<i>EN-00 IP Address Assignment</i>	[0] MANUAL
<i>EN-01 IP Address</i>	192.168.0.003*
<i>EN-02 Subnet Mask</i>	255.255.255.0*
<i>EN-03 Default Gateway</i>	optional

Table 4.1

*= Class C IP address example. Any valid IP address can be entered.

Setting up drive with automatic (BOOTP/DHCP) assigned IP address:

Parameter	Value
<i>EN-00 IP Address Assignment</i>	[0] MANUAL/[1] DHCP/[2] BOOTP/[10] DCP
<i>EN-01 IP Address</i>	Read only
<i>EN-02 Subnet Mask</i>	Read only
<i>EN-03 Default Gateway</i>	Read only

Table 4.2

By IP address assigned by DHCP/BOOTP/DCP server, the assigned *IP Address* and *Subnet Mask* can be read out in *EN-01 IP Address* and *EN-02 Subnet Mask*. In *EN-04 DHCP Server* the IP address of the found DHCP or BOOTP server is displayed. For DHCP only: The remaining lease-time can be read-out in *EN-05 Lease Expires*. If lease time is set to 0 (zero) the timer will never expire.

EN-09 Physical Address reads out the MAC address of option, which is also printed on the label of the option. If using fixed leases together with DHCP or BOOTP, the physical MAC address is linked with a fixed IP address.

NOTE

If no DHCP or BOOTP reply has been received after 4 attempts (e.g. if the DHCP/BOOTP server has been powered off), the option will fallback to the last functioning IP address.

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

EN-06 Name Servers

EN-07 Domain Name

EN-08 Host Name

are used with Domain Name Server systems and are all optional. If DHCP or BOOTP is selected as IP address assignment, these parameters are read only.

NOTE

It is only possible to assign valid class A, B and C IP address to the option. The valid ranges are shown in **Table 4.3:**

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 4.3



4.1.2 Ethernet Link Parameters

Parameter group EN-1# holds information Ethernet Link information:

EN-10 Link Status

EN-11 Link Duration

EN-12 Auto Negotiation

EN-13 Link Speed

EN-14 Link Duplex

Please note the Ethernet Link Parameters are unique per port.

EN-10 Link Status and *EN-11 Link Duration* displays information on the link status, per port.

EN-10 Link Status will display Link or No Link according to the status of the present port.

EN-11 Link Duration will display the duration of the link on the present port. If the link is broken the counter will be reset.

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

Incapability between the connected devices, may lead to decreased communication performance.

To prevent this, Auto Negotiation can be disabled.

If *EN-12 Auto Negotiation* is set to OFF, link speed and duplex mode can be configured manually in *EN-13 Link Speed* and *EN-14 Link Duplex*.

EN-13 Link Speed - displays/sets the link speed per port. "None" is displayed if no link is present.

EN-14 Link Duplex - displays/sets the duplex mode per port. Half-duplex provides communication in both directions, but only in one direction at a time (not simultaneously). Full-duplex allows communication in both directions, and unlike half-duplex, allows for this to happen simultaneously.

5 How to Configure the System

5.1 Configure the PROFINET Network

All PROFINET devices that are connected to the same network must have a unique device name.

The PROFINET device name of the frequency converter can be set via:

EN-08 Host Name

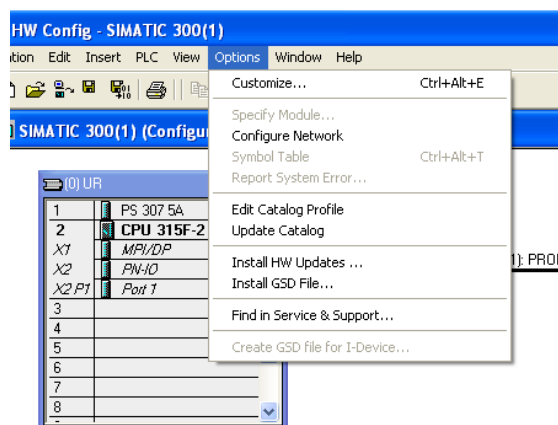
5.2 Configure the Controller

5.2.1 GSD File

In order to configure a PROFINET Controller, the configuration tool needs a GSD file for each type of slave on the network. The GSD file is a PROFINET standard text file containing the necessary communication setup data for a slave. Download the GSD file for the AF-6 Series drives at www.geelectrical.com/drives. The name of the GSD file may vary compared to this manual. Please download the latest version from the above website.

The first step in configuration of the PROFINET Controller is to import the GSD file in the configuration tool. The steps

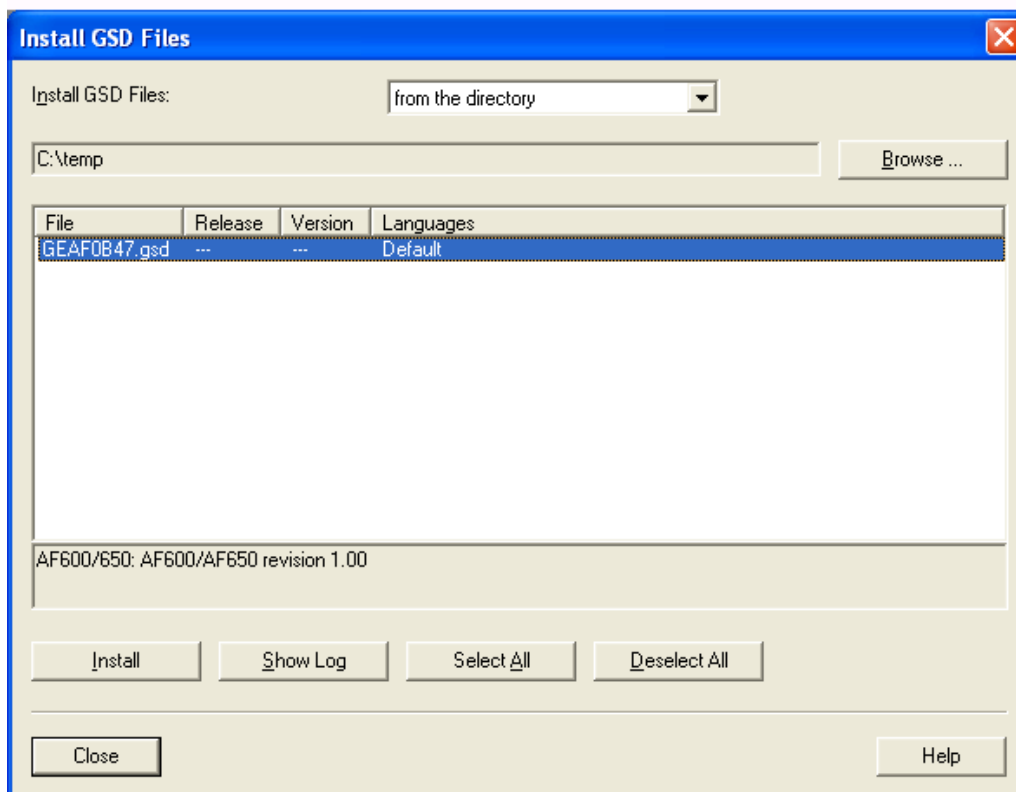
outlined below show how to add a new GSD file to the Simatic Manager software tool. For each drive series, a GSD file is typically imported once only, following the initial installation of the software tool.



1308A114.11

Illustration 5.1

5



130BA567.10

Illustration 5.2

The GSD file is now imported and will be accessible via the following path in the Hardware catalogue:

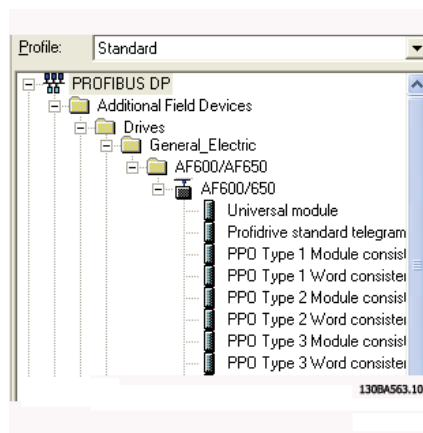
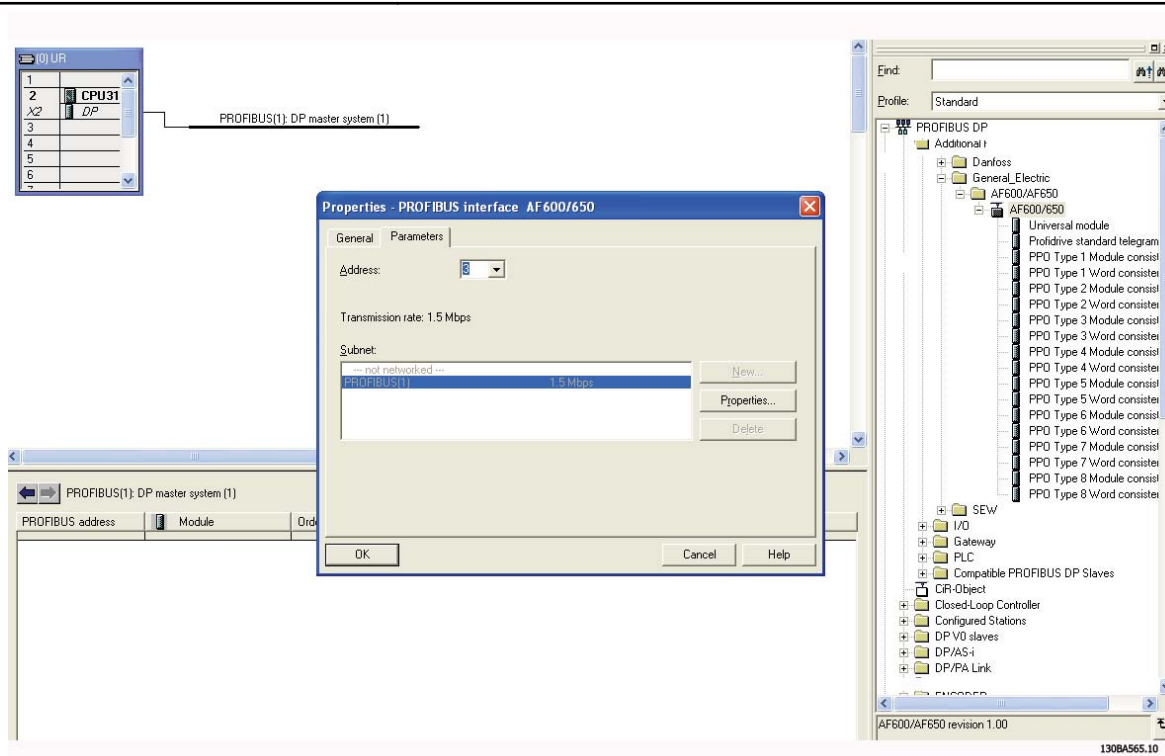


Illustration 5.3

Open a Project, set up the Hardware and add a PROFINET Master system. Select GE FC PN then drag and drop it onto the PROFINET IO system.

A window for the Device name of the now appears. Type the name into the field. Note that the name must match the name in *EN-08 Host Name*. If the checkmark *Assign IP address via the IO controller* is set, the controller will download the IP address to the IO device that has the corresponding device name. The IP address is stored in the non volatile memory of the .



5

Illustration 5.4

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.

See the PPO types section in *How to Control the Frequency Converter* for more information.

5

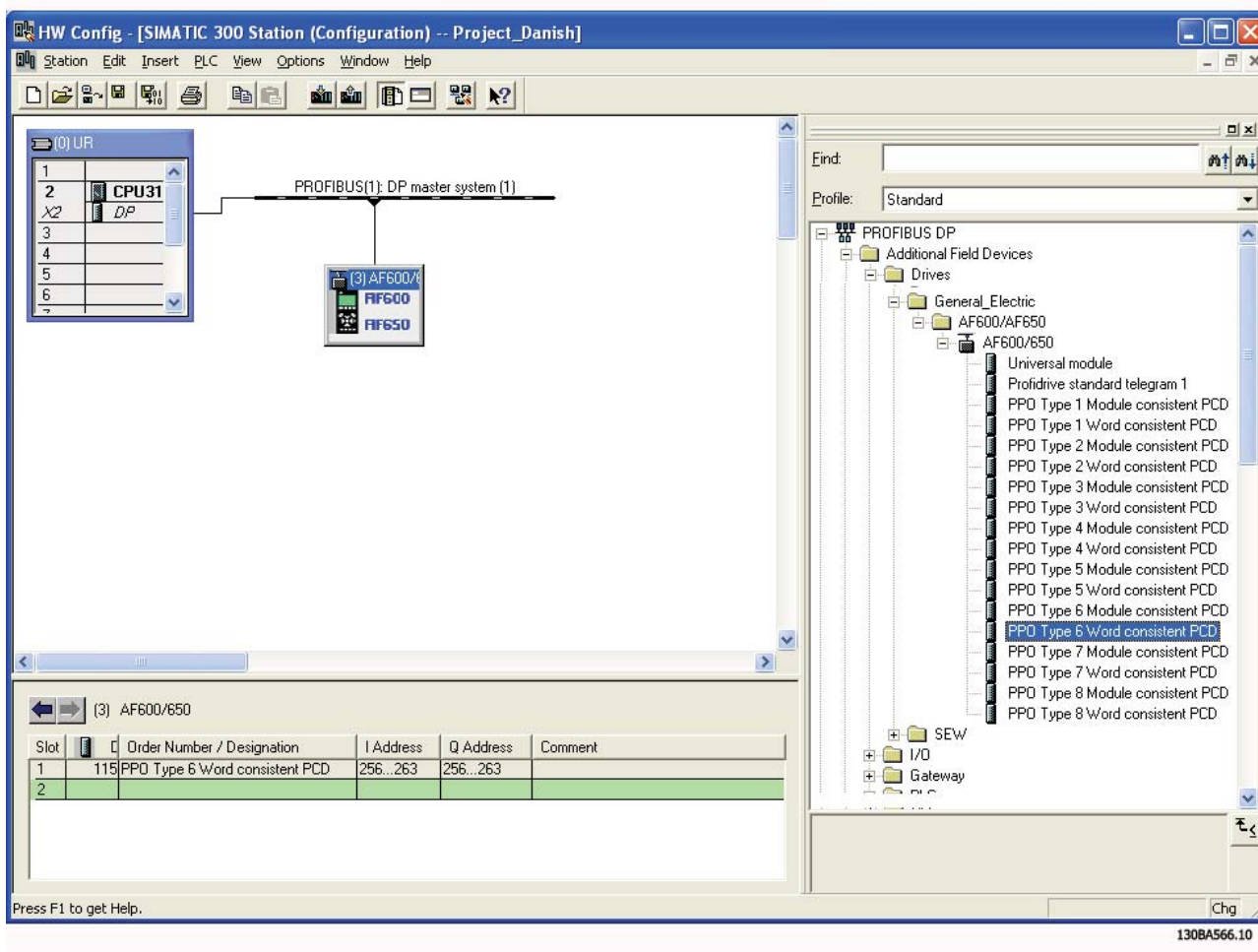


Illustration 5.5

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	PB-16 PCD Read Configuration.2	PB-16 PCD Read Configuration.3

Table 5.1 PCD Read (Drive to PLC)

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

Table 5.2 PCD Write (PLC to Drive)

The PCDs have to be assigned via *PB-16 PCD Read Configuration* for inputs and *PB-15 PCD Write Configuration* for outputs.

Download the configuration file to the PLC. The PROFINET system should be able to go online and it will start to exchange data when the PLC is set to Run mode.



5.3 Configure the Frequency Converter

5.3.1 Drive Parameters

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

- *K-40 [Hand] Button on Keypad*. If the Hand button on the frequency converter is activated, control of the drive via the PROFINET interface is disabled
- After an initial power up the frequency converter will automatically detect whether a network option is installed in slot A, and set *O-02 Control Word Source* to [Option A]. If an option is added, changed or removed from an already commissioned drive, it will not change *O-02 Control Word Source* but enter Trip Mode, and the drive will display an error
- *O-10 Control Word Profile*. Choose between the GE Drive Profile and the PROFIdrive profile
- *O-50 Coasting Select* to *O-56 Preset Reference Select*. Selection of how to gate PROFINET control commands with digital input command of the control module.

NOTE

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

- *O-03 Control Word Timeout Time* to *O-05 End-of-Timeout Function*. The reaction in the event of a network time out is set via these parameters
- *EN-00 IP Address Assignment*
- *EN-08 Host Name*



6 How to Control the Frequency Converter

6.1 PPO Types

The PROFIdrive profile for frequency converters specifies a number of communication objects (Parameter Process data Objects, PPO), which are suitable for data exchange between a process controller, such as a PLC, and frequency converters. All PPOs are defined for cyclic data transfer, so that process data (PCD) can be transferred from the controller to the slave and vice versa. *Table 6.1* shows the PPO types available for the GE AF-650 GP & AF-600 FP drives..

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. The first two bytes of the process data area (PCD 1) comprise a fixed part present in all PPO types. The first two words of the process data area (PCD 0 and PCD1) comprise a fixed part present in all PPO types. The following data (PCD 2 to PCD 9) are flexible for PCD write entries (*PB-15 PCD Write Configuration*, and for PCD read entries (*PB-16 PCD Read Configuration*). The parameters can be parameterised with process signals from the list on *PB-23 Parameters for Signals*.

Select the signals for transmission from the master to the frequency converter in *PB-15 PCD Write Configuration* (request from master to the frequency converter). Select the signals for transmission from the frequency converter to the master in *PB-16 PCD Read Configuration* (response: Drive → master).

The choice of PPO type is made in the master configuration, and is then automatically recorded in the frequency converter. No manual setting of PPO types in the frequency converter is required. The current PPO type can be read in *PB-22 Telegram Selection*.

Selection [1] *Standard telegram 1* is equivalent to PPO type 3.

		PCD									
		0	1	2	3	4	5	6	7	8	9
		[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
PB-15 PCD Write Configuration + PB-16 PCD Read Configuration index. no.:											
		CTW	MRV	PCD	PCD	PCD	PCD	PCD	PCD	PCD	PCD
		STW	MAV								
Type 3:											
Type 4:											
Type 6:											
Type 7:											
Type 8:											

CTW: Control word
 STW: Status word
 MRV: Main reference value
 MAV: Main actual value (Actual output frequency)

Table 6.1

6.2 Process Data

Use the process data part of the PPO for controlling and monitoring the frequency converter via the PROFINET.

6.2.1 Process Control Data

Process data sent from the PLC to the frequency converter are defined as Process Control Data (PCD).

Master slave				
0	1	2	9
CTW	MRV	PCD	PCD
PCD write				

Table 6.2

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

The content of PCD 2 to PCD 9 is programmed in *PB-15 PCD Write Configuration* and *PB-16 PCD Read Configuration*.

6.2.2 Process Status Data

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

Slave master				
0	1	2	9
STW	MAV	PCD	PCD
PCD read				

Table 6.3

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

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

The content of PCD 2 to PCD 9 is programmed in *PB-16 PCD Read Configuration*.

6.2.3 Reference Handling

The reference handling in the GE AF-650 GP & AF-600 FP drives is an advanced mechanism that sums up references from different sources.

For more information on reference handling, please refer to the AF-650 GP or AF-600 FP Design Guides.

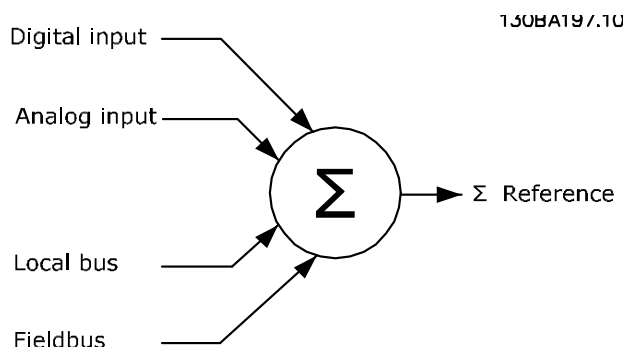


Illustration 6.1

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



Depending on the setting of *F-50 Reference Range* the reference and MAV are scaled accordingly:

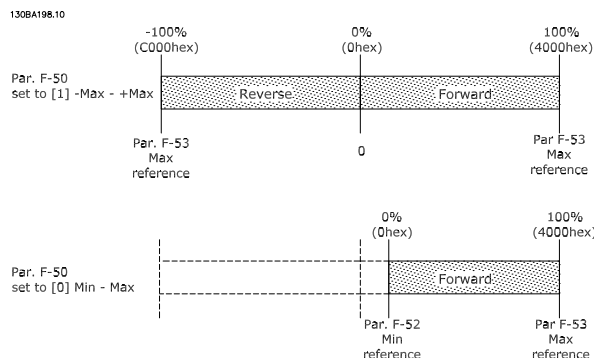


Illustration 6.2

6

NOTE

If *F-50 Reference Range* is set to [0] *Min - Max*, a negative reference will be handled as 0%.

The actual output of the frequency converter is limited by the speed limit parameters in *F-18 Motor Speed Low Limit [RPM]* to *F-15 Motor Speed High Limit [Hz]*.

The final speed limit is set by *F-03 Max Output Frequency 1*.

The reference and the MAV have the format which appears from the table

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

Table 6.4

NOTE

Negative numbers are formed as two's complement.

NOTE

The data type for MRV and MAV is a N2 16 bit standardised value, meaning it can express a range from -200% to +200% (8001 to 7FFF).

- H-40 Configuration Mode* set to [0] *Speed open loop*.
- F-50 Reference Range* set to [0] *Min - Max*.
- F-52 Minimum Reference* set to 100 RPM.
- F-53 Maximum Reference* set to 3000 RPM.

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

Table 6.5

6.2.4 Process Control Operation

In process control operation *H-40 Configuration Mode* is set to [3] *Process*.

The reference range in *F-50 Reference Range* is always [0] *Min - Max*.

- MRV represents the process setpoint.
- MAV expresses the actual process feedback (range +/- 200%).



6.2.5 Influence of the Digital Input Terminals upon Drive Control Mode, O-50 Coasting Select to O-56 Preset Reference Select

The influence of the digital input terminals upon control of the frequency converter can be programmed in O-50 Coasting Select to O-56 Preset Reference Select. Please note the O-01 Control Site overrules the settings in O-50 Coasting Select to O-56 Preset Reference Select, and Terminal 37 Coasting Stop (safe) overrules any parameter. Terminal 37 Safe Stop is standard on the AF-650 GP only.

Each of the digital input signals can be programmed to logic AND, logic OR, or to have no relation to the corresponding bit in the control word. In this way a specific control command i.e. stop / coast, can be initiated by network only, network AND Digital Input, or Ether Network OR Digital input terminal.

CAUTION

In order to control the frequency converter via PROFINET, O-50 Coasting Select must be set to either Bus [1], or to Logic AND [2], and O-01 Control Site must be set to [0] or [2].

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

6.3 Control Profile

The frequency converter can be controlled according to the GE Drive protocol. Select the desired control profile in O-10 Control Word Profile. The choice of profile affects the control and status word only.

6.4 PROFIdrive Control Profile and 6.5 GE Drive Control Profile provide a detailed description of control and status data.

6.4 PROFIdrive Control Profile

This section describes the functionality of the control word and status word in the PROFIdrive profile. Select this profile by setting O-10 Control Word Profile.

6.4.1 Control Word according to PROFIdrive Profile (CTW)

The Control word is used to send commands from a master (e.g. 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	Accel/Decel
05	Hold frequency output	Use Accel/Decel
06	Accel/Decel 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	Parameter set-up	Selection msb
15	No function	Reverse

Table 6.6

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" leads to the stop and activation of the output relay 1 or 2 if the output frequency is 0Hz and if [Relay 123] has been selected in E-24 Function Relay.

When bit 00 = "1", the frequency converter is in State 1: "Switching on inhibited".

Please refer to *Illustration 6.3*, at the end of this section.

Bit 01, OFF 2/ON 2

Coasting stop

When bit 01 = "0", a coasting stop and activation of the output relay 1 or 2 occurs if the output frequency is 0Hz and if [Relay 123] has been selected in E-24 Function Relay.

When bit 01 = "1", the frequency converter is in State 1: "Switching on inhibited". Please refer to *Illustration 6.3*, at the end of this section.

Bit 02, OFF 3/ON 3

Quick stop using the ramp time of C-23 Quick Stop Decel Time. When bit 02 = "0", a quick stop and activation of the output relay 1 or 2 occurs if the output frequency is 0Hz and if [Relay 123] has been selected in E-24 Function Relay.

When bit 02 = "1", the frequency converter is in State 1: "Switching on inhibited".

Please refer to *Illustration 6.3*, at the end of this section.

Bit 03, Coasting/No coasting

Coasting stop Bit 03 = "0" leads to a stop. When bit 03 = "1", the frequency converter can start if the other start conditions are satisfied.

NOTE

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

Bit 04, Quick stop/Accel/Decel

Quick stop using the ramp time of *C-23 Quick Stop Decel Time*.

When bit 04 = "0", a quick stop occurs.

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

NOTE

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

Bit 05, Hold frequency output/Use Accel/Decel

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

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

Bit 06, Decel stop/Start

Normal ramp stop using the ramp times of the actual ramp as selected. In addition, activation of the output relay 01 or 04 if the output frequency is 0Hz if Relay 123 has been selected in *E-24 Function Relay*. Bit 06 = "0" leads to a stop. When bit 06 = "1", the frequency converter can start if the other start conditions are satisfied.

NOTE

The selection in *O-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 *O-90 Bus Jog 1 Speed*. JOG 1 is only possible if bit 04 = "0" and bit 00 - 03 = "1".

Bit 09, Jog 2 OFF/ON

Activation of the pre-programmed speed in *O-91 Bus Jog 2 Speed*. JOG 2 is only possible if bit 04 = "0" and bit 00 - 03 = "1".

Bit 10, Data invalid/valid

Is used to tell the frequency converter whether the control word is to be used or ignored. Bit 10 = "0" causes the control word to be ignored, Bit 10 = "1" causes the control word to be used. This function is relevant, because the control word is always contained in the message, regardless of which type of message is used, i.e. it is possible to turn off the control word if you do not wish to use it in connection with updating or reading parameters.

Bit 11, No function/Slow down

Is used to reduce the speed reference value by the amount given in *F-62 Catch up/slow Down Value* 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

Is used to increase the speed reference value by the amount given in *F-62 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 (bit 11 and 12 = "1"), slowing down has priority, i.e. the speed reference value will be reduced.

Bits 13/14, Set-up selection

Bits 13 and 14 are used to choose between the four parameter set-ups according to *Table 6.7*:

The function is only possible if *Multi Set-up* has been chosen in *K-10 Active Set-up*. The selection in *O-55 Set-up Select* determines how bits 13 and 14 are linked with the corresponding function of the digital inputs. Changing set-up while running is only possible if the set-ups have been linked in *K-12 This Set-up Linked to*.

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

Table 6.7

Bit 15, No function/Reverse

Bit 15 = "0" causes no reversing.

Bit 15 = "1" causes reversing.

Note: In the factory setting reversing is set to *digital* in *O-54 Reversing Select*.

**NOTE**

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

6.4.2 Status Word according to PROFIdrive Profile (STW)

The Status word is used to notify a master (e.g. a PC) about the status of a slave.

Bit	Bit = 0	Bit = 1
00	Control not ready	Control ready
01	Drive not ready	Drive 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 \neq reference	Speed = reference
09	Local operation	Bus control
10	Out of frequency limit	Frequency limit ok
11	No operation	In operation
12	Drive OK	Stopped, autostart
13	Voltage OK	Voltage exceeded
14	Torque OK	Torque exceeded
15	Timer OK	Timer exceeded

Table 6.8

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 (trip).

When bit 00 = "1", the frequency converter control is ready, but there is not necessarily power supply to the unit present (in the event of external 24 V supply of the control system).

Bit 01, Drive not ready/ready

Same significance as bit 00, however, there is a supply of the power 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 or 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"; the frequency converter has not tripped.

Bit 03, No error/Trip

When bit 03 = "0", no error condition of the frequency converter exists.

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", then bit 04 = "0".

When bit 01 of the Control word is "1", then bit 04 = "1".

Bit 05, ON 3/OFF 3

When bit 02 of the Control word is "0", then bit 05 = "0".

When bit 02 of the Control word is "1", then bit 05 = "1".

Bit 06, Start possible/Start not possible

If PROFIdrive has been selected in *O-10 Control Word Profile*, bit 06 will be "1" after a switch-off acknowledgement, after activation of OFF2 or OFF3, and after switching on the mains voltage. Start not possible will be reset, with bit 00 of the Control word being set to "0" and bit 01, 02 and 10 being set 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 \neq reference / Speed = reference

When bit 08 = "0", the current speed of the motor deviates from the set speed reference value. This may occur, for example, when the speed is being changed during start/stop through accel/decel.

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 by means of the stop button on the keypad, or that [Linked to hand] or [Local] has been selected in *F-02 Operation Method*.

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 *H-72 Warning Speed Low* and *H-73 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, autostart

When bit 12 = "0", there is no temporary overloading of the inverter. When bit 12 = "1", the inverter has stopped due to overloading. However, the frequency converter has not switched off (trip) and will start again after the overloading 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 intermediate circuit 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 F-40 Torque Limiter (Driving) and F-41 Torque Limiter (Braking). When bit 14 = "1", the limit selected in F-40 Torque Limiter (Driving) or F-41 Torque Limiter (Braking) is exceeded.

Bit 15, Timer OK/Timer exceeded

When bit 15 = "0", the timers for the thermal motor protection and electronic overload protection have not exceeded 100%. When bit 15 = "1", one of the timers has exceeded 100%.

6

6.4.3 PROFIdrive State - Transition Diagram

In the PROFIdrive Control profile, the control bits 0 to 3 perform the basic start-up/power down functions, whereas the control bits 4 to 15 perform application-oriented control.

Illustration 6.3 shows the basic state-transition diagram, where control bits 0 to 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.

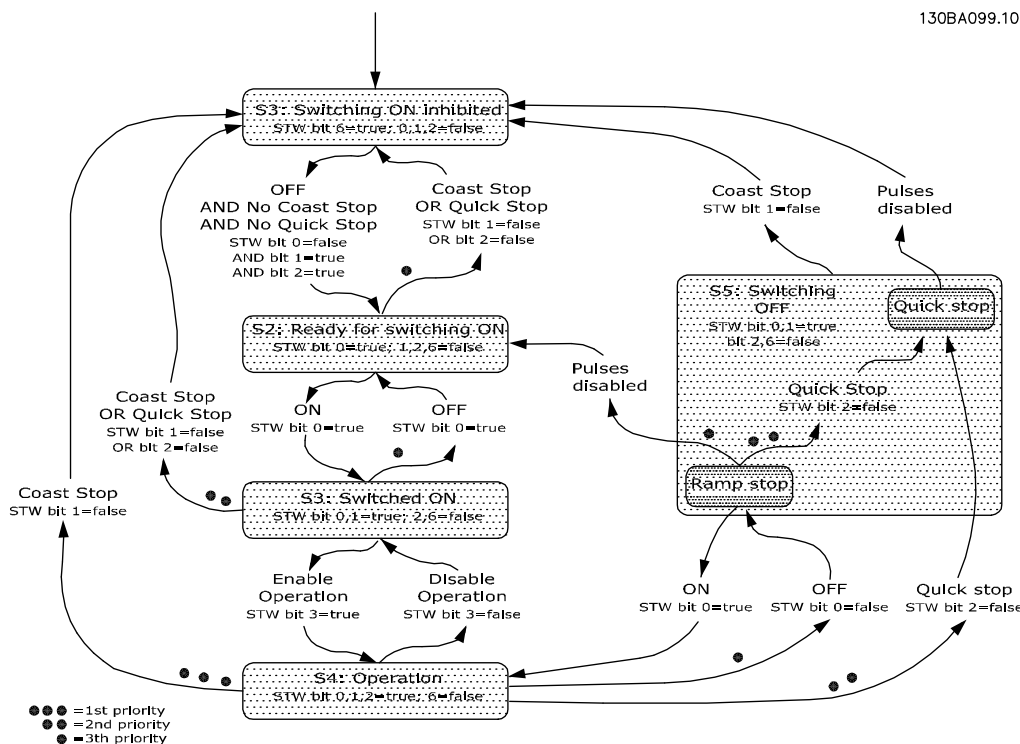


Illustration 6.3 PROFIdrive State Transition Diagram



6.5 GE Drive Control Profile

6.5.1 Control Word according to Drive Profile (CTW)

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

Please refer to *9 Application Examples* for an example of a control word message using PPO type 3.

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

Table 6.9

Explanation of the Control Bits

Bits 00/01 Reference value

Bits 00 and 01 are used to choose between the four reference values, which are pre-programmed in *C-05 Multi-step Frequency 1 - 8* according to *Table 6.10*:

NOTE

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

Programmed ref. value	Parameter	Bit 01	Bit 00
1	<i>C-05 Multi-step Frequency 1 - 8</i> [0]	0	0
2	<i>C-05 Multi-step Frequency 1 - 8</i> [1]	0	1
3	<i>C-05 Multi-step Frequency 1 - 8</i> [2]	1	0
4	<i>C-05 Multi-step Frequency 1 - 8</i> [3]	1	1

Table 6.10

Bit 02, DC brake

Bit 02 = 0 leads to DC braking and stop. Braking current and duration are set in *B-01 DC Brake Current* and *B-02 DC Braking Time*. Bit 02 = 1 leads to ramping.

Bit 03, Coasting

Bit 03 = 0 causes the frequency converter to immediately "let go" of the motor (the output transistors are "shut off"), so that it coasts to a standstill.

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

NOTE

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

Bit 04, Quick stop

Bit 04 = 0 causes a stop, in which the motor speed is ramped down to stop via *C-23 Quick Stop Decel Time*.

Bit 05, Hold output frequency

Bit 05 = 0 causes the present output frequency (in Hz) to freeze. The frozen output frequency can then be changed only by means of the digital inputs (*E-01 Terminal 18 Digital Input* to *E-06 Terminal 33 Digital Input*) programmed to *Speed up* and *Speed down*.

NOTE

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

- Bit 03 Coasting stop
- Bit 02 DC braking
- Digital input (*E-01 Terminal 18 Digital Input* to *E-06 Terminal 33 Digital Input*) programmed to *DC braking*, *Coasting stop* or *Reset and coasting stop*.

Bit 06, Ramp stop/start:

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

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

NOTE

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

Bit 07, Reset

Bit 07 = "0" does not cause a reset. Bit 07 = "1" causes the reset of a trip. Reset is activated on the signals leading edge, i.e. when changing from logic "0" to logic "1".

Bit 08, Jog

Bit 08 = "1" causes the output frequency to be determined by *C-21 Jog Speed [RPM]*.

Bit 09, Selection of ramp 1/2

Bit 09 = "0" means that ramp 1 is active

Bit 09 = "1" means that ramp 2 is active.

Bit 10, Data not valid/Data valid

Is used to tell the frequency converter whether the control word is to be used or ignored. Bit 10 = "0" causes the control word to be ignored.

Bit 10 = "1" causes the control word to be used. This function is relevant, because the control word is always contained in the message, regardless of which type of message is used, i.e. it is possible to turn off the control word if you do not wish to use it in connection with updating or reading parameters.

Bit 11, Relay 01

Bit 11 = "0" Relay not activated.

Bit 11 = "1" Relay 01 activated, provided Control word bit 11 has been chosen in *E-24 Function Relay*.

Bit 12, Relay 04

Bit 12 = "0" Relay 04 has not been activated.

Bit 12 = "1" Relay 04 has been activated, provided *Control word bit 12* has been chosen in *E-24 Function Relay*.

Bit 13/14, Selection of set-up

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

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

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

Table 6.11

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

Bit 15 Reverse

Bit 15 = "0" causes no reversing.

Bit 15 = "1" causes reversing.



6.5.2 Status Word according to GE Drive Profile (STW)

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

Please refer to *9 Application Examples* for an example of a status word message using PPO type 3.

Explanation of the Status Bits

Bit 00, Control not ready/ready

Bit 00 = "0" means that the frequency converter has tripped.

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

Bit 01, Drive ready

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

Bit 02, Coasting stop

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

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

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

Table 6.12

Bit 03, No error/trip

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

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

Bit 04, No error/error (no trip)

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

Bit 04 = 1 means that there is a frequency converter error but no trip.

Bit 05, Not used

Bit 05 is not used in the status word.

Bit 06, No error/triplock

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

Bit 06 = 1 means that the frequency converter is tripped, and locked.

Bit 07, No warning/warning

Bit 07 = "0" means that there are no warnings.

Bit 07 = "1" means that a warning has occurred.

Bit 08, Speed reference/speed = reference

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

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

Bit 09, Local operation/bus control

Bit 09 = "0" means that [STOP/RESET] is activated on the control unit, or that *Local control* in *F-02 Operation Method* is selected. It is not possible to control the frequency converter via serial communication.

Bit 09 = "1" means that it is possible to control the frequency converter via the network/ serial communication.

Bit 10, Out of frequency limit

Bit 10 = "0", if the output frequency has reached the value in *F-18 Motor Speed Low Limit [RPM]* or *F-17 Motor Speed High Limit [RPM]*.

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

Bit 11, No operation/in operation

Bit 11 = "0" means that the motor is not running.

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

Bit 12, Drive OK/stopped, autostart

Bit 12 = "0" means that there is no temporary over temperature on the inverter.

Bit 12 = "1" means that the inverter has stopped because of over temperature, but that the unit has not tripped and will resume operation once the over temperature stops.



Bit 13, Voltage OK/limit exceeded

Bit 13 = "0" means that there are no voltage warnings.

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

Bit 14, Torque OK/limit exceeded

Bit 14 = "0" means that the motor current is lower than the torque limit selected in *F-40 Torque Limiter (Driving)* or *F-41 Torque Limiter (Braking)*.

Bit 14 = "1" means that the torque limit in *F-40 Torque Limiter (Driving)* and *F-41 Torque Limiter (Braking)* has been exceeded.

Bit 15, Timer OK/limit exceeded

Bit 15 = "0" means that the timers for motor thermal protection and electronic overload protection, respectively, have not exceeded 100%.

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



7 PROFINET Acyclic Communication

PROFINET offers additional to the cyclical data communication, an acyclic communication. This feature is possible by an IO controller (e.g. PLC), as well as an IO Supervisor (e.g. PC Tool).

Cyclical communication means that data transfer takes place all the time with a certain update rate. This is the known function normally used for quick update of I/O Process Data. A-cyclical communication means a one time event, mainly used for Read/Write on parameters from Process controllers, PC based tools or monitoring systems.

7.1.1 Features of an IO Controller System

- Cyclical data exchange.
- A-cyclical read/write on parameters.

The a-cyclical connection is fixed and can not be changed during operation.

In general an IO controller is used as Process controller, responsible for commands, speed reference, status of the application etc. (PLC or PC based controller.)

The IO controller, a-cyclical connection might be used for general parameter access in the slaves.

7.1.2 Features of an IO-Supervisor System

- Initiate/Abort a-cyclical connection.
- A-cyclical read/write on parameters.

The a-cyclical connection can be established dynamically (Initiate) or removed (Abort) even though an IO controller is active on the network.

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



7.1.3 Addressing Scheme

The structure of a PROFINET IO Device is shown in *Illustration 7.1*.

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 #

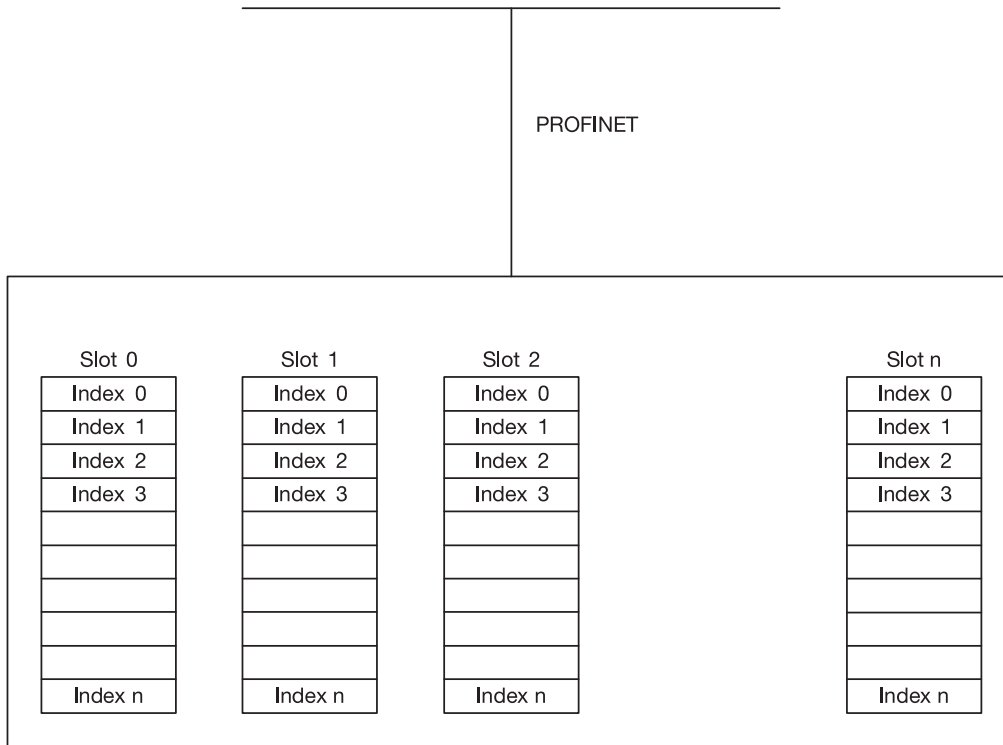


Illustration 7.1 PROFINET IO Device Structure

7



7.1.4 Acyclic Read/Write Request Sequence

A Read or Write service on a drive parameter will take place as illustrated in *Illustration 7.2*.

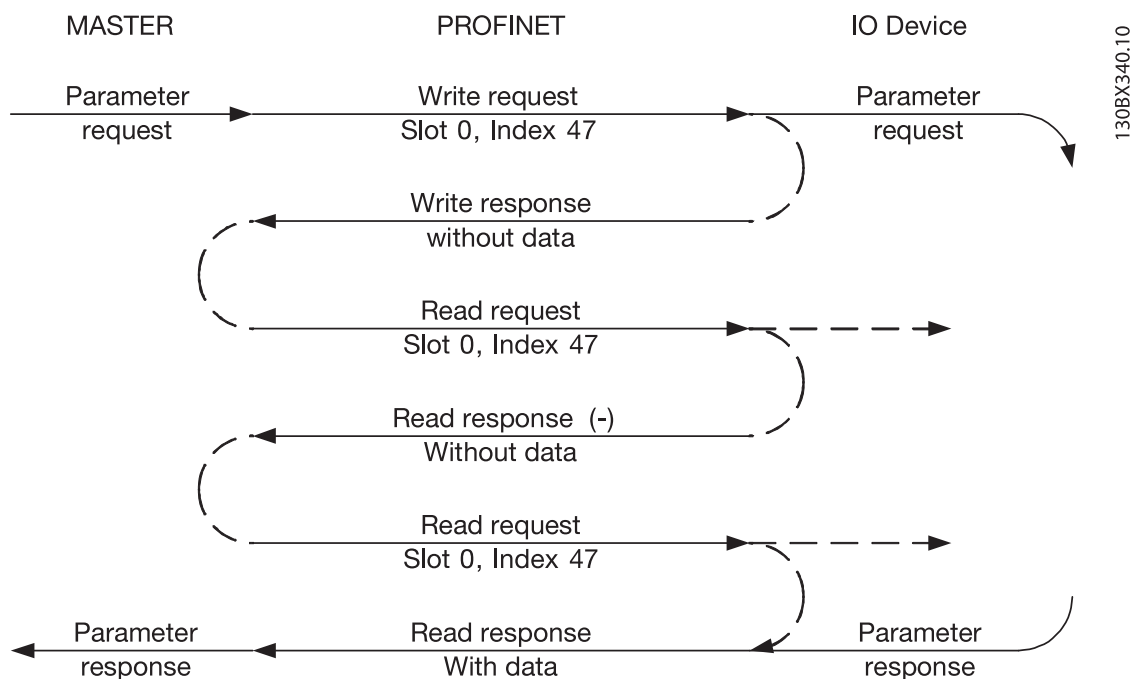


Illustration 7.2 Acyclic Read/Write Request Sequence

A Read or Write on a drive parameter must be initiated 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 drive immediately. If not, a negative write response is returned from the drive.

The drive will now interpret the "Profidrive parameter channel" part of the Data Unit, and start to perform this command internal in the drive.

As the next step, the master will send a Read request. If the drive is still busy performing the internal parameter request, a negative response without data is returned from the drive. This request will be repeated by the master, until the drive has the response data ready for the drive parameter request.

The following example shows the details of the telegrams needed for the Read/Write service.



7.1.5 Data Structure in the Acyclic Telegrams

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

- Header block
- Parameter block
- Data block

They have to be arranged as in *Table 7.1*:

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 7.1 Request Telegram

7.1.6 Header

Request number:

Request # is used by the Master 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.

7.1.7 Parameter Block

The following 5 values have to be provided 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, if parameter is indexed.

Attribute:

Attribute to be read.

Parameter number:

The number of the parameter to read.

Subindex:

Pointer to the index.

7.1.8 Data Block

The Datablock is only needed for write commands. For each parameter to write this information has to be setup.

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

For the individual drive series, the programming guide contains a table with parameter number, format and other relevant information and will not be further explained in this document.

Number of elements:

The number of elements to read if parameter is indexed.

**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 will generate an error.

On a successful transmission of a request command, the master can read the response from the drive. The response does look very much like the request command. The response only consists of two 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 7.2 Response Telegram

7.1.9 Header

Request number:

Request # is used by the Master to handle the response from the IO device. The IO device does mirror 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 transferred.

7.1.10 Data Block

The Datablock is only needed for write commands. For each parameter to write, This information has to be setup.

Format:

See under the request telegram.

Error code:

If the IO device does discover an error during the execution of the command, it will set 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 datatype (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 drive state/configuration
 - 0x15 reply too long (more than 240 bytes)
 - 0x16 wrong parameter address (unknown or unsupported value for attribute, element, parameter number or 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 can not be read from bus
- Note: all values if Hex numbers

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 will generate an error.



8 Parameters

8.1 Parameter Group O-## Communication and Option

8

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

O-03 Control Word Timeout Time		
Range:	Function:	
1.0 s*	[0.1 - 18000.0 s]	Enter the maximum time expected to pass between the reception of two consecutive messages. If this time is exceeded, it indicates that the serial communication has stopped. The function selected in <i>O-04 Control Word Timeout Function</i> will then be carried out. The time-out counter is triggered by a valid control word.

O-04 Control Word Timeout Function		
Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in <i>O-03 Control Word Timeout Time</i> .		
Option:	Function:	
[0] *	Off	Resumes control via serial bus (network or standard) using the most recent control word.
[1]	Freeze output	Freezes output frequency until communication resumes.
[2]	Stop	Stops with auto restart when communication resumes.
[3]	Jogging	Runs the motor at JOG frequency until communication resumes.
[4]	Max. speed	Runs the motor at maximum frequency until communication resumes.
[5]	Stop and trip	Stops the motor, then resets the drive in order to restart: via the network, via the reset button on the keypad or via a digital input.
[7]	Select setup 1	Changes the set-up upon reestablishment of communication following a control word time-out. If communication resumes causing the time-out situation to disappear, <i>O-05 End-of-Timeout Function</i> defines whether to resume the set-up used before

O-04 Control Word Timeout Function		
Select the time-out function. The time-out function activates when the control word fails to be updated within the time period specified in <i>O-03 Control Word Timeout Time</i> .		
Option:	Function:	
		the time-out or to retain the set-up endorsed by the time-out function.
[8]	Select setup 2	See [7] <i>Select setup 1</i>
[9]	Select setup 3	See [7] <i>Select setup 1</i>
[10]	Select setup 4	See [7] <i>Select setup 1</i>
[26]	Trip	

NOTE

The following configuration is required in order to change the set-up after a time-out:

Set *K-10 Active Set-up* to [9] *Multi set-up* and select the relevant link in *K-12 This Set-up Linked to*.

O-05 End-of-Timeout Function		
Option:	Function:	
		Select the action after receiving a valid control word following a time-out. This parameter is active only when <i>O-04 Control Word Timeout Function</i> is set to [Set-up 1-4].
[0]	Hold set-up	Retains the set-up selected in <i>O-04 Control Word Timeout Function</i> and displays a warning, until <i>O-06 Reset Control Word Timeout</i> toggles. Then the drive resumes its original set-up.
[1] *	Resume set-up	Resumes the set-up active prior to the time-out.

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



O-10 Control Word Profile

Select the interpretation of the control and status words corresponding to the installed network. Only the selections valid for the network installed in slot A will be visible in the keypad display.

Option: **Function:**

[0] *	Drive Profile	
[1]	PROFIdrive profile	
[5]	ODVA	

O-13 Configurable Status Word STW

Option:		Function:
		This parameter enables configuration of bits 12 – 15 in the status word.
[0]	No function	
[1] *	Profile Default	Function corresponds to the profile default selected in <i>O-10 Control Word Profile</i> .

O-50 Coasting Select

Option:		Function:
		Select control of the coasting function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Coast command via a digital input.
[1]	Bus	Activates Coast command via the serial communication port or network option module.
[2]	Logic AND	Activates Coast command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Coast command via the network/serial communication port OR via one of the digital inputs.

O-51 Quick Stop Select

Select control of the Quick Stop function via the terminals (digital input) and/or via the network.

Option: **Function:**

[0]	Digital Input	
[1]	Bus	
[2]	Logic AND	
[3] *	Logic OR	

O-52 DC Brake Select

Option:		Function:
		Select control of the DC brake via the terminals (digital input) and/or via the network.
[0]	Digit Input	ActivatesDC Brake command via a digital input.
[1]	Bus	ActivatesDC Brake command via the serial communication port or network option module.
[2]	Logic AND	ActivatesDC Brake command via the network/serial communication port, AND additionally via one of the digital inputs.

O-52 DC Brake Select

Option:		Function:
[3] *	Logic OR	ActivatesDC Brake command via the network/serial communication port OR via one of the digital inputs.

O-53 Start Select

Option:		Function:
		Select control of the drive start function via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates Start command via a digital input.
[1]	Bus	Activates Start command via the serial communication port or network option module.
[2]	Logic AND	Activates Start command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates Start command via the network/serial communication port OR via one of the digital inputs.

O-54 Reversing Select

Option:		Function:
[0]	Digital Input	Select control of the drive reverse function via the terminals (digital input) and/or via the network.
[1]	Bus	Activates the Reverse command via the serial communication port or network option module.
[2]	Logic AND	Activates the Reverse command via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activates the Reverse command via the network/serial communication port OR via one of the digital inputs.

O-55 Set-up Select

Option:		Function:
		Select control of the drive set-up selection via the terminals (digital input) and/or via the network.
[0]	Digit Input	Activates the set-up selection via a digital input.
[1]	Bus	Activates the set-up selection via the serial communication port or network option module.
[2]	Logic AND	Activates the set-up selection via the network/serial communication port, AND additionally via one of the digital inputs.
[3] *	Logic OR	Activate the set-up selection via the network/serial communication port OR via one of the digital inputs.



O-90 Bus Jog 1 Speed		
Range:	Function:	
100 RPM* [0 - par. F-17 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or network option.	

O-91 Bus Jog 2 Speed		
Range:	Function:	
200 RPM* [0 - par. F-17 RPM]	Enter the jog speed. This is a fixed jog speed activated via the serial port or network option.	

8.2 Parameter Group PB-## PROFIdrive

PB-15 PCD Write Configuration

Array [10]

Option: Function:

	Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the telegram type. The values in PCD 3 to 10 will then be written to the selected parameters as data values. Alternatively, specify a standard Profibus message in <i>PB-22 Telegram Selection</i> .
--	---

PB-16 PCD Read Configuration

Array [10]

Option: Function:

	Select the parameters to be assigned to PCD 3 to 10 of the messages. The number of available PCDs depends on the telegram type. PCDs 3 to 10 contain the actual data values of the selected parameters. For standard Profibus message, see <i>PB-22 Telegram Selection</i> .
--	--

PB-22 Telegram Selection

Option:	Function:	
	Select a standard Profibus telegram configuration for the frequency converter, as an alternative to using the freely configurable telegrams in <i>PB-15 PCD Write Configuration</i> and <i>PB-16 PCD Read Configuration</i> .	
[1]	Standard telegram 1	
[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	
[200]	Custom telegram 1	
[202]	Custom telegram 3	

PB-23 Parameters for Signals

Array [1000]

Option: Function:

	This parameter contains a list of signals available for selection in <i>PB-15 PCD Write Configuration</i> and <i>PB-16 PCD Read Configuration</i> .	
--	---	--

PB-27 Parameter Edit

Option: Function:

	Parameters can be edited via PROFINET, the standard RS485 interface, or the keypad.	
[0]	Disabled	Disables editing via PROFINET.
[1] *	Enabled	Enables editing via PROFINET.

PB-28 Process Control

Option: Function:

	Process control (setting of Control Word, speed reference, and process data) is possible via either PROFINET or standard Network but not both simultaneously. Local control is always possible via the keypad. Control via process control is possible via either terminals or Network depending on the settings in <i>O-50 Coasting Select</i> to <i>O-56 Preset Reference Select</i> .	
[0]	Disable	Disables process control via PROFINET, and enables process control via standard Network or PROFINET IO-Supervisor.
[1] *	Enable cyclic master	Enables process control via IO Controller, and disables process control via standard Network or PROFINET IO-Supervisor..

PB-53 Profibus Warning Word

Range: Function:

0 N/A*	[0 - 65535 N/A]	This parameter displays PROFINET communication warnings. Please refer to the <i>PROFINET Operating Instructions</i> for further information.
--------	-----------------	--

Read only



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 port
6	Not used
7	Initializing of PROFINET is not ok
8	Drive 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 8.1

PB-65 Profile Number		
Range:	Function:	
0 N/A* [0 - 0 N/A]	This parameter contains the profile identification. Byte 1 contains the profile number and byte 2 the version number of the profile.	

NOTE

This parameter is not visible via keypad.

PB-70 Edit Set-up		
Option:	Function:	
	Select the set-up to be edited.	
[0]	Factory setup	Uses default data. This option can be used as a data source to return the other set-ups to a known state.
[1]	Set-up 1	Edits Set-up 1.
[2]	Set-up 2	Edits Set-up 2.
[3]	Set-up 3	Edits Set-up 3.
[4]	Set-up 4	Edits Set-up 4.
[9] *	Active Set-up	Follows the active set-up selected in <i>K-10 Active Set-up</i> .

This parameter is unique to keypad and fieldbuses. See also *K-11 Edit Set-up*.

PB-71 Profibus Save Data Values		
Option:	Function:	
	Parameter values changed via PROFINET are not automatically stored in non-volatile memory. Use this parameter to activate a function that stores parameter values in the	

PB-71 Profibus Save Data Values		
Option:	Function:	
	EEPROM non-volatile memory, so changed parameter values will be retained at power-down.	
[0] *	Off	Deactivates the non-volatile storage function.
[1]	Store all setups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to <i>Off</i> [0] when all parameter values have been stored.
[2]	Store all setups	Stores all parameter values for all set-ups in the non-volatile memory. The selection returns to <i>Off</i> [0] when all parameter values have been stored.

PB-72 ProfibusDriveReset		
Option:	Function:	
[0] *	No action	
[1]	Power-on reset	Resets frequency converter upon power-up, as for power-cycle.
[2]	Power-on reset prep	
[3]	Comm option reset	Resets the PROFINET option only, the PROFINET option will go through a power-up sequence. When reset, the frequency converter disappears from the Network, which may cause a communication error from the master.

PB-80 Defined Parameters (1)		
Range:	Function:	
0 N/A* [0 - 9999 N/A]	This parameter displays a list of all the defined frequency converter parameters available for PROFINET.	

PB-81 Defined Parameters (2)		
Range:	Function:	
0 N/A* [0 - 9999 N/A]	This parameter displays a list of all the defined frequency converter parameters available for PROFINET.	



PB-82 Defined Parameters (3)		
Array [116] No keypad access Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the defined frequency converter parameters available for PROFINET.

PB-83 Defined Parameters (4)		
Array [116] No keypad access Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the defined frequency converter parameters available for PROFINET.

PB-84 Defined Parameters (5)		
Array [115] No keypad access Read only		
Range:		Function:
0 *	[0 - 9999]	This parameter displays a list of all the defined frequency converter parameters available for PROFINET.

PB-90 Changed Parameters (1)		
Array [116] No keypad access Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the drive parameters deviating from default setting.

PB-91 Changed Parameters (2)		
Array [116] No keypad access Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the drive parameters deviating from default setting.

PB-92 Changed Parameters (3)		
Array [116] No keypad access Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the drive parameters deviating from default setting.

PB-94 Changed Parameters (5)		
Array [116] No keypad Address Read only		
Range:		Function:
0 N/A*	[0 - 9999 N/A]	This parameter displays a list of all the drive parameters deviating from default setting.

8.3 Parameter Group EN-## Ethernet

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

EN-01 IP Address		
Range:	Function:	
0 N/A*	[0 - 2147483647 N/A]	Configure the IP address of the option. Read-only if <i>EN-00 IP Address Assignment</i> set to DHCP or BOOTP.

EN-02 Subnet Mask		
Range:	Function:	
0 *	[0 - 2147483647]	Configure the IP subnet mask of the option. Read-only if <i>EN-00 IP Address Assignment</i> set to DHCP or BOOTP.

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

EN-04 DHCP Server		
Range:	Function:	
0 N/A*	[0 - 2147483647 N/A]	Read only. Displays the IP address of the found DHCP or BOOTP server.

EN-05 Lease Expires		
Range:	Function:	
0 N/A*	[0 - 0 N/A]	Read only. Displays the lease-time left for the current DHCP-assigned IP address.



EN-06 Name Servers		
Range:	Function:	
0 N/A* [0 - 2147483647 N/A]	IP addresses of Domain Name Servers. Can be automatically assigned when using DHCP.	

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

EN-08 Host Name		
Range:	Function:	
0 N/A [0 - 0 N/A]	Logical (given) name of option.	

NOTE

Please note that the display of the drive will only show the first 19 characters, but the remaining characters are stored in the drive.

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

EN-1# Ethernet Link parameters		
Option:	Function:	
	Applies for whole parameter group.	
[0]	Port 1	
[1]	Port 2	

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

EN-11 Link Duration		
Range:	Function:	
0 N/A* [0 - 0 N/A]	Read only. Displays the duration of the present link on each port in dd:hh:mm:ss.	

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

NOTE

It is recommended to set EN-12 Auto Negotiation to OFF [0] for the PROFINET option and for the connected port. This will ensure that the connected ports will be set to an optimized Link Speed with Link Duplex setting. If only one of the ports in a link is set to Auto Negotiation ON, it can cause the ports to switch to half duplex, resulting in poor network performance. Most switches today have Auto negotiation set, but this can lead to a longer time to establish a connection.

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

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

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

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

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

EN-89 Transparent Socket Channel Port		
Range:	Function:	
4000 N/A* [0 - 65535 N/A]	Configures the TCP port number for the transparent socket channel. This enables Drive messages to be sent transparently on Ethernet via TCP. Default value is 4000, 0 means	



EN-89 Transparent Socket Channel Port		
Range:	Function:	
		disabled. This port is used by the DCT-10.

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

NOTE

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

EN-91 MDI-X		
Option:	Function:	
[0]	Disabled	Disables the auto cross-over function.
[1] *	Enabled	Enables the auto cross-over function.

EN-92 IGMP Snooping		
Option:	Function:	
		This prevents flooding of the Ethernet protocol stack by only forwarding multicast packets to ports that are member of the multicast group. In PROFINET this function is disabled.
[0]	Disabled	Disables the IGMP snooping function.
[1] *	Enabled	Enables the IGMP snooping function.

EN-93 Cable Error Length		
Range:	Function:	
0 N/A*	[0 - 65535 N/A]	If Cable Diagnostics is enabled in <i>EN-90 Cable Diagnostic</i> , the built-in switch is possible via Time Domain Reflectometry (TDR). This is a measurement technique which detects common cabling problems such as open circuits, short circuits and impedance mismatches or breaks in transmission cables. The distance from the option to the error is displayed in metres with an accuracy of +/- 2m. The value 0 means no errors detected.

EN-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.

EN-94 Broadcast Storm Protection		
Range:	Function:	
		The value indicates a percentage of the total bandwidth that is allowed for broadcast messages. Example: The "OFF" means that the filter is disabled - all broadcast messages will be passed through. The value "0%" means that no broadcast messages will be passed through. A value of "10%" means that 10% of the total bandwidth is allowed for broadcast messages, if the amount of broadcast messages increases above the 10% threshold, they will be blocked.

EN-95 Broadcast Storm Filter		
Option:	Function:	
		Applies to <i>EN-94 Broadcast Storm Protection</i> ; if the Broadcast Storm Protection should also include Multicast messages.
[0] *	Broadcast only	
[1]	Broadcast & Multicast	

EN-96 Port Mirroring		
Option:	Function:	
		Enables/disables port-mirroring function. For troubleshooting with a network analyzer tool.
[0] *	Disable	No port-mirroring
[1]	Port 1 to Port 2	All network traffic on port 1 will be mirrored to port 2.
[2]	Port 2 to Port 1	All network traffic on port 2 will be mirrored to port 1.
[254]	Int. Port to Port 1	
[255]	Int. Port to Port 2	

EN-98 Interface Counters		
Range:	Function:	
4000 N/A*	[0 - 65535 N/A]	Read only. Advanced Interface counters, from built-in switch, can be used for low-level trouble-shooting, The parameter shows a sum of port 1 + port 2.

EN-99 Media Counters		
Range:	Function:	
0 N/A*	[0 - 65535 N/A]	Read only. Advanced Interface counters, from built-in switch, can be used for low-level trouble-shooting, The parameter shows a sum of port 1 + port 2.



8.4 PROFINET-specific Parameter List

Parameter	Default value	Range	Conversion index	Data type
O-01 Control Site	Dig. & ctrl. word [0]	[0 - 2]	-	UInt8
O-02 Control Word Source	Drive RS485 [0]	[0 - 4]	-	UInt8
O-03 Control Word Timeout Time	1	0.1-18000	-1	UInt32
O-04 Control Word Timeout Function	Off [0]	[0 - 10]	-	UInt8
O-05 End-of-Timeout Function	Hold set-up [0]	[0 - 1]	-	UInt8
O-06 Reset Control Word Timeout	Do not reset [0]	[0 - 1]	-	UInt8
O-07 Diagnosis Trigger	Disable [0]	[0 - 3]	-	UInt8
O-10 Control Word Profile	GE Drive profile [0]	[0 - x]	-	UInt8
O-13 Configurable Status Word STW				
O-50 Coasting Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-51 Quick Stop Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-52 DC Brake Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-53 Start Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-54 Reversing Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-55 Set-up Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-56 Preset Reference Select	*Logic OR [3]	[0 - 3]	-	UInt8
O-90 Bus Jog 1 Speed	100 rpm	0 - F-17 Motor Speed High Limit [RPM]	67	UInt16
O-91 Bus Jog 2 Speed	200 rpm	0 - F-17 Motor Speed High Limit [RPM]	67	UInt16
PB-15 PCD Write Configuration	-	-	-	UInt16
PB-16 PCD Read Configuration	-	-	-	UInt16
PB-22 Telegram Selection	-	[0 - 108]	-	UInt8
PB-23 Parameters for Signals	-	0 - 573	-	UInt16
PB-27 Parameter Edit	Enabled [1]	[0 - 1]	-	UInt16
PB-28 Process Control	Enable cyclic master [1]	[0 - 1]	-	UInt16
PB-44 Fault Message Counter	0	[0 - 8]	0	UInt16
PB-45 Fault Code	0	-	-	UInt16
PB-47 Fault Number	0	-	-	UInt16
PB-52 Fault Situation Counter	0	0 - 1000	0	UInt16
PB-53 Profibus Warning Word	0	16 bits	0	V2
PB-64 Device Identification	0	[0 - 10]	0	UInt16
PB-65 Profile Number	0	8 bits	0	UInt8
PB-70 Edit Set-up	Active set-up [9]	[0 - 9]	-	UInt8
PB-71 Profibus Save Data Values	Off [0]	[0 - 2]	-	UInt8
PB-72 ProfibusDriveReset	No action [0]	[0 - 2]	-	UInt8
PB-80 Defined Parameters (1)	-	0-115	0	UInt16
PB-81 Defined Parameters (2)		0-115	0	UInt16
PB-82 Defined Parameters (3)	-	0-115	0	UInt16
PB-83 Defined Parameters (4)	-	0-115	0	UInt16
PB-90 Changed Parameters (1)	-	0-115	0	UInt16
PB-91 Changed Parameters (2)	-	0-115	0	UInt16
PB-92 Changed Parameters (3)	-	0-115	0	UInt16
PB-93 Changed parameters (4)	-	0-115	0	UInt16
EN-00 IP Address Assignment	0.0.0.0	0 - 255	-	Unsigned 8
EN-01 IP Address	0.0.0.0	0 - 255	-	Oct. string 4
EN-02 Subnet Mask	0.0.0.0	0 - 255	-	Oct. string 4
EN-03 Default Gateway	0.0.0.0	0 - 255	-	Oct. string 4-
EN-04 DHCP Server	0.0.0.0	0 - 255	-	Oct. string 4



Parameters **PROFINET Operating Instruction**

Parameter	Default value	Range	Conversion index	Data type
EN-05 Lease Expires	00:00:00:00	-	-	Time diff. w/ date
EN-06 Name Servers	0.0.0.0	0 - 255	-	Oct. string 4
EN-07 Domain Name	-	max. 19 ch.	-	Visible string 48
EN-08 Host Name	-	max. 19 ch.	-	Visible string 48
EN-09 Physical Address	00:1B:08:00:00:00	-	-	Visible string 17
EN-10 Link Status	No Link [0]	[0 - 1]	-	Unsigned 8
EN-11 Link Duration	00:00:00:00	-	-	Time diff. w/ date
EN-12 Auto Negotiation	On [1]	[0 - 1]	-	Unsigned 8
EN-13 Link Speed	None [0]	[0 - 2]	-	Unsigned 8
EN-14 Link Duplex	Full Duplex [1]	[0 - 1]	-	Unsigned 8[
EN-80 FTP Server	Disable [0]	[0 - 1]	-	Unsigned 8
EN-81 HTTP Server	Disable [0]	[0 - 1]	-	Unsigned 8
EN-82 SMTP Service	Disable [0]	[0 - 1]	-	Unsigned 8
EN-89 Transparent Socket Channel Port	Disable [0]	[0 - 1]	-	Unsigned 8
EN-90 Cable Diagnostic	Disable [0]	[0 - 1]	-	Unsigned 8
EN-91 MDI-X	Enable [0]	[0 - 1]	-	Unsigned 8
EN-92 IGMP Snooping	Enable [0]	[0 - 1]	-	Unsigned 8
EN-93 Cable Error Length	0	0 - 200	0	Unsigned 16
EN-94 Broadcast Storm Protection	0	Off - 20%	-	Unsigned 16
EN-95 Broadcast Storm Filter	Enable [1]	[0 - 1]	-	Unsigned 8
EN-98 Interface Counters	0	0 - 65535	-	Unsigned 16
EN-99 Media Counters	0	0 - 65535	-	Unsigned 16
DR-84 Comm. Option STW	0	0 - FFFF	0	V2
DR-90 Alarm Word	0	0 - FFFF	0	Uint32
DR-92 Warning Word	0	0 - FFFF	0	Uint32

Table 8.2

Please refer to the relevant Operating Instructions for a comprehensive parameter list.



8.5 Object and Data Types Supported

8.5.1 Parameter and Data Type Structure Description

8.5.2 Parameter Description

PROFINET has a number of describing attributes.

8.5.3 Size Attribute

The size index and the conversion index for each parameter can be taken from the parameter list in the respective Operating Instructions.

Physical unit	Size index	Measuring unit	Designation	Conversion index	Conversion factor
	0	No dimension			
Time	4	second	s	0	1
		millisecond	ms	-1	0.1
		minute	min	-2	0.01
		hour	h	-3	0.001
		day	d	70	60
Energy	8	watthour	Wh	74	3600
		kilowatthour	kWh	77	86400
		megawatthour	MWh	0	1
Power	9	milliwatt	mW	3	1000
		watt	W	6	10 ⁶
		kilowatt	kW	-3	0.001
		megawatt	MW	0	1
Rotation	11	rotation per minute	RPM	3	1000
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 8.3



8.5.4 Object and Data Types Supported

Data types supported

Data type	Short name	Description
3	I2	Integer 16
4	I4	Integer 32
5	-	Unsigned 8
6	O2	Unsigned 16
7	O4	Unsigned 32
9	-	Visible string
10	-	Byte string
33	N2	Standardized value (16 bit)
35	V2	Bit sequence
54	-	Time difference without date indication

Table 8.4



9 Application Examples

9.1 E.g.: 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 two additional words, which can be programmed to monitor process signals:

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

Table 9.1

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 will stop the motor if the PROFINET cable is broken, the master has a system failure, or the PLC is in stop mode.

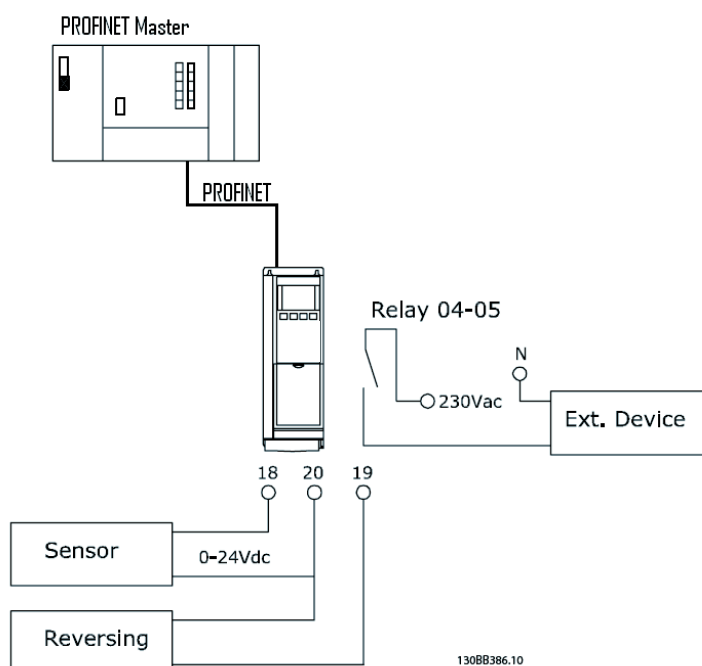


Illustration 9.1



Program the frequency converter as follows:

Parameter	Setting
<i>H-08 Reverse Lock</i>	Both directions [2]
<i>E-01 Terminal 18 Digital Input</i>	No operation [0]
<i>E-02 Terminal 19 Digital Input</i>	Reversing [10]
<i>E-24 Function Relay</i>	Control word bit 11/12 [36/37]
<i>O-03 Control Word Timeout Time</i>	1 sec
<i>O-04 Control Word Timeout Function</i>	Stop [2]
<i>O-10 Control Word Profile</i>	GE Drive Profile [0]
<i>O-50 Coasting Select</i>	Network [1]
<i>O-51 Quick Stop Select</i>	Network [1]
<i>O-52 DC Brake Select</i>	Network [1]
<i>O-53 Start Select</i>	Network [1]
<i>O-54 Reversing Select</i>	Logic AND [2]
<i>O-55 Set-up Select</i>	Network [1]
<i>O-56 Preset Reference Select</i>	Network [1]
<i>PB-16 PCD Read Configuration</i>	Sub index [2] <i>DR-16 Torque [Nm]</i> Sub index [3] <i>DR-60 Digital Input</i>

Table 9.2



9.3 E.g.: Status Word Network using Standard Telegram 1 / PPO3

This example shows how the control word network relates to the PLC and the frequency converter, using GE Drive Control Profile.

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

		PCD																																
		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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
		0		F				0				7				2				0				0				0						

Table 9.5

Table 9.5 indicates the bits contained within the status word, and how they are presented as process data in Standard Telegram 1 for this example.

Table 9.6 indicates which bit functions, and which corresponding bit values are active for this example.

9

Bit	Bit value = 0	Bit value = 1	Bit value	
00	Control not ready	Control ready	1	7
01	Drive not ready	Drive ready	1	
02	Coasting	Enable	1	
03	No error	Trip	0	0
04	No error	Error (no trip)	0	
05	Reserved	-	0	
06	No error	Triplock	0	F
07	No warning	Warning	0	
08	Speed reference	Speed = reference	1	
09	Local operation	Network control	1	0
10	Outside frequency range	Within frequency range	1	
11	No operation	In operation	1	
12	Drive ok	Stopped, autostart	0	0
13	Voltage ok	Voltage exceeded	0	
14	Torque ok	Torque exceeded	0	
15	Timers ok	Timers exceeded	0	

Function active	<input type="checkbox"/>
Function inactive	<input type="checkbox"/>

Table 9.6



9.4 E.g.: PLC Programming

In this example PPO type 6 is placed in the following Input/Output address:

Slot	D...	Order Number / Designation	I Address	Q Address	Comment
1	115	PPO Type 6 Word consistent PCD	256...263	256...263	
2					

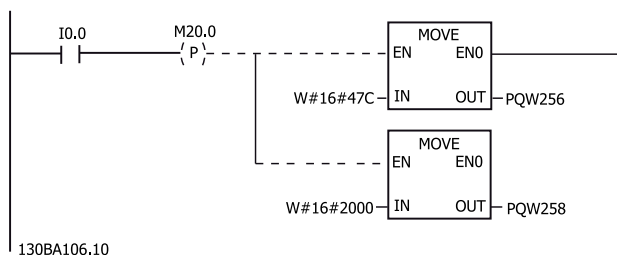
130BA111.10

Illustration 9.2

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

Table 9.7

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



130BA106.10

Illustration 9.3

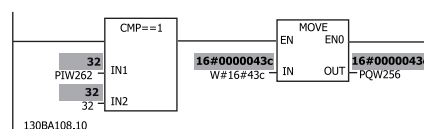
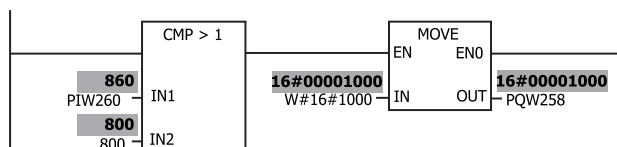


Illustration 9.5

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



130BA107.10

Illustration 9.4

This network reads the status on the digital inputs from the frequency converter. If digital input 18 is On it will stop the frequency converter.



This network will reverse the motor when digital input 19 is ON, because *O-54 Reversing Select* is programmed to Logic AND.

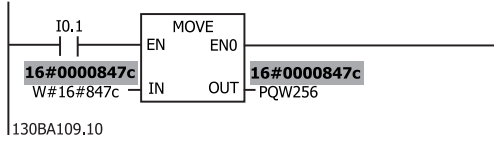


Illustration 9.6

This network will activate the relay 02.

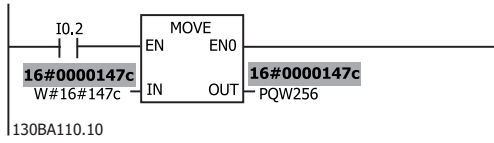


Illustration 9.7



10 Troubleshooting

10.1 Troubleshooting

10.1.1 LED Status

Status	Tri-colour LED	
No IP Address assigned	Off	
No Communication to PROFINET module. Module is waiting for configuration telegram from Controller.	Green:	
IO AR established	Green:	
Supervisor AR established, No IO AR.	Green:	
Internal Error	Red:	
Wink	Yellow:	

Table 10.1 MS: Module Status

Network Status

Phases	Status	Tri-colour LED	
Power Off	No Power or No Link on the corresponding port	Off	
Power On	IP Address Conflict	Red:	
	Waiting for configuration	Green:	
Running	In Data Exchange Mode	Green:	
	Wrong Configuration	Red:	
Data exchange	No increment in "In Octets" counter of corresponding port in last 60 secs	Yellow:	

Table 10.2 Indication on Network Status LED

10.1.2 No Communication with the Drive

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

Check 1: Is the cabling correct?

Check that the cable is mounted correctly. Check if the corresponding Network LED shows link activity. NS1 or NS2

Check 2: Does the hardware config match?

Check that the Hardware config match the value in *EN-08 Host Name*

Check 3: Is the correct GSD file installed?

Download the correct GSD file from www.geelectrical.com/drives.

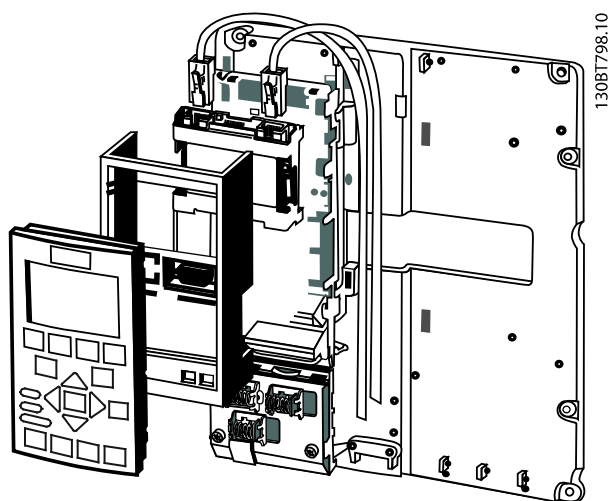


Illustration 10.1

ID-61 Option SW Version	GSDML File
1.x	GEAF6SeriesV2-X.GSD

Table 10.3

10.1.3 Warning 34 Appears even though Communication is Established

If the master is in stop mode Warning 34 will appear. Check that the master is in run mode.

10.1.4 Will Not Respond to Control Signals

Check 1: Is the Control word valid?

If bit 10=0 in the Control word, the drive will 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 drive.

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

The tables below show the effect upon the frequency converter of a coast command for the full range of *O-50 Coasting Select* settings.

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

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

NOTE

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

Digital input [0]		
Terminal	Bit 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	Coast/DC brake/Q-Stop
1	0	No Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.4



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

Serial communication [1]		
Terminal	Bit 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	No Coast/DC brake/Q-Stop
1	0	Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.5

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

Logic AND [2]		
Terminal	Bit 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	No Coast/DC brake/Q-Stop
1	0	No Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.6

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

Logic OR [3]		
Terminal	Bit 02/03/04	Function
0	0	Coast/DC brake/Q-Stop
0	1	Coast/DC brake/Q-Stop
1	0	Coast/DC brake/Q-Stop
1	1	No Coast/DC brake/Q-Stop

Table 10.7

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

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

Digital input [0]		
Terminal	Bit 06/15	Function
0	0	Stop/Anti-clockwise
0	1	Stop/Anti-clockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 10.8

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

Serial communication [1]		
Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Start/Clockwise
1	0	Stop/Anti-clockwise
1	1	Start/Clockwise

Table 10.9

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

Logic AND [2]		
Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Stop/Anti-clockwise
1	0	Stop/Anti-clockwise
1	1	Start/Clockwise

Table 10.10

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

Logic OR [3]		
Terminal	Bit 02/03/04	Function
0	0	Stop/Anti-clockwise
0	1	Start/Clockwise
1	0	Start/Clockwise
1	1	Start/Clockwise

Table 10.11

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



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

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

Digital input [0]				
Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref., Set-up no.
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	2
0	1	0	1	2
0	1	1	0	2
0	1	1	1	2
1	0	0	0	3
1	0	0	1	3
1	0	1	0	3
1	0	1	1	3
1	1	0	0	4
1	1	0	1	4
1	1	1	0	4
1	1	1	1	4

Table 10.12

Serial communication [1]				
Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref., Set-up no.
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	1
0	1	0	1	2
0	1	1	0	3
0	1	1	1	4
1	0	0	0	1
1	0	0	1	2
1	0	1	0	3
1	0	1	1	4
1	1	0	0	1
1	1	0	1	2
1	1	1	0	3
1	1	1	1	4

Table 10.13

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

Logic AND [2]				
Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref., Set-up no.
0	0	0	0	1
0	0	0	1	1
0	0	1	0	1
0	0	1	1	1
0	1	0	0	1
0	1	0	1	2
0	1	1	0	1
0	1	1	1	2
1	0	0	0	1
1	0	0	1	1
1	0	1	0	3
1	0	1	1	3
1	1	0	0	1
1	1	0	1	2
1	1	1	0	3
1	1	1	1	4

Table 10.14



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

Logic OR [3]				
Terminal		Bit 00/01, 13/14		Function
Msb	Lsb	Msb	Lsb	Preset ref., Set-up no.
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4
0	1	0	0	2
0	1	0	1	2
0	1	1	0	4
0	1	1	1	4
1	0	0	0	3
1	0	0	1	4
1	0	1	0	3
1	0	1	1	4
1	1	0	0	4
1	1	0	1	4
1	1	1	0	4

Table 10.15



10.1.5 Alarm and Warning Words

Alarm word, Warning word and PROFINET warning word are shown on the display in Hex format. If there is more than one warning or alarm, a sum of all warnings or alarms will be shown. Alarm word, warning word and PROFINET warning word can also be displayed using the serial network in *DR-90 Alarm Word*, *DR-92 Warning Word* and *PB-53 Profibus Warning Word*.

AF-650 GP & AF-600 FP			
Bit (Hex)	Unit diagnose bit	Alarm word (<i>DR-90 Alarm Word</i>)	Alarm no.
00000001	48	Brake check	28
00000002	49	Power card over temperature	29
00000004	50	Earth fault	14
00000008	51	Control card over temperature	65
00000010	52	Control word timeout	18
00000020	53	Over current	13
00000040	54	Torque limit	12
00000080	55	Motor thermistor over temp.	11
00000100	40	Motor Electronic Overload over temperature	10
00000200	41	Drive overloaded	9
00000400	42	DC link under voltage	8
00000800	43	DC link over voltage	7
00001000	44	Short circuit	16
00002000	45	Inrush fault	33
00004000	46	Mains phase loss	4
00008000	47	Auto Tune not OK	50
00010000	32	Live zero error	2
00020000	33	Internal fault	38
00040000	34	Brake overload	26
00080000	35	Motor phase U is missing	30
00100000	36	Motor phase V is missing	31
00200000	37	Motor phase W is missing	32
00400000	38	Network comm. fault	34
00800000	39	24 V supply fault	47
01000000	24	Mains failure	36
02000000	25	1.8 V supply fault	48
04000000	26	Brake resistor short circuit	25
08000000	27	Brake chopper fault	27
10000000	28	Option change	67
20000000	29	Drive Initialized	80
40000000	30	Safe stop	68
80000000	31	Mechanical brake low	63

Table 10.16

AF-650 GP & AF-600 FP			
Bit (Hex)	Unit diagnose bit	Warning word (<i>DR-92 Warning Word</i>)	Alarm no.
00000001	112	Brake check	28
00000002	113	Power card over temperature	29
00000004	114	Earth fault	14
00000008	115	Control card	65
00000010	116	Control word timeout	18
00000020	117	Over current	13
00000040	118	Torque limit	12
00000080	119	Motor thermistor over temp.	11
00000100	104	Motor Electronic Overload over temperature	10
00000200	105	Drive overloaded	9
00000400	106	DC link under voltage	8
00000800	107	DC link over voltage	7
00001000	108	DC link voltage low	6
00002000	109	DC link voltage high	5
00004000	110	Mains phase loss	4
00008000	111	No motor	3
00010000	96	Live zero error	2
00020000	97	10 V low	1
00040000	98	Brake overload	26
00080000	99	Brake resistor short circuit	25
00100000	100	Brake chopper fault	27
00200000	101	Speed limit	49
00400000	102	Network comm. fault	34
00800000	103	24 V supply fault	47
01000000	88	Mains failure	36
02000000	89	Current limit	59
04000000	90	Low temperature	66
08000000	91	Voltage limit	64
10000000	92	Encoder loss	61
20000000	93	Output frequency limit	62
40000000	94	Unused	-
80000000	95	Warning word 2 (ext. stat. word)	-

Table 10.17



AF-650 GP & AF-600 FP		
Bit (Hex)	Unit diagnose bit	PROFIBUS warning word (PB-53 Profibus Warning Word)
00000001	160	Connection with DP-master is not ok
00000002	161	Unused
00000004	162	NDL (Network Data link Layer) is not ok
00000008	163	Clear data command received
00000010	164	Actual value is not updated
00000020	165	Baudrate search
00000040	166	PROFIBUS ASIC is not transmitting
00000080	167	Initialising of PROFIBUS is not ok
00000100	152	Drive is tripped
00000200	153	Internal CAN error
00000400	154	Wrong configuration data from PLC
00000800	155	Wrong ID sent by PLC
00001000	156	Internal error occurred
00002000	157	Not configured
00004000	158	Timeout active
00008000	159	Warning 34 active

Table 10.18

AF-650 GP & AF-600 FP	
Bit (Hex)	Comm. option STW (DR-84 Comm. Option STW)
00000001	parameters ok
00000002	configuration ok
00000004	clearmode active
00000008	baudrate search
00000010	waiting for parameterization
00000020	waiting for configuration
00000040	in data exchange
00000080	not used
00000100	not used
00000200	not used
00000400	not used
00000800	MCL2/1 connected
00001000	MCL2/2 connected
00002000	MCL2/3 connected
00004000	data transport active
00008000	not used

Table 10.19

NOTE

DR-84 Comm. Option STW is not part of extended diagnostics.



10.1.6 Warning and Alarm Messages

There is a clear distinction between alarms and warnings. When there is an alarm, the frequency converter will enter a fault condition. After the cause for the alarm has been cleared, the master will have to acknowledge the alarm message before the frequency converter can start operating again. A warning, on the other hand, may come when a warning condition appears, then disappear when conditions return to normal, without interfering with the process.

Warnings

Warnings within the frequency converter are represented by a single bit within a warning word. Bit status FALSE [0] means no warning, while bit status TRUE [1] means warning. Any bit change in the warning word will be notified by a change of bit 7 in the status word.

Alarms

Following an alarm message the frequency converter will enter Fault condition. Only after the fault has been alleviated and the controller has acknowledged the alarm message by setting bit 7 in the control word, the frequency converter will resume operation. Alarms within the frequency converter are represented by a single bit within an alarm word. Bit status FALSE [0] means no fault, while bit status TRUE [1] means fault.



11 Warnings and Alarms

11.1 Status Messages

11.1.1 Warnings/Alarm Messages

A warning or an alarm is signalled by the relevant LED on the front of the frequency converter and indicated by a code on the display.

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

In the event of an alarm, the frequency converter will trip. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in three ways:

- By using the [RESET] control button on the keypad control panel
- Via a digital input with the "Reset" function
- Via serial communication/optional network

NOTE

After a manual reset using the [RESET] button on the keypad, the [AUTO] button must be pressed to restart the motor.

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

Alarms that are trip-locked offer additional protection, meaning that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in *H-04 Auto-Reset (Times)* (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in *Table 11.1*, this means that either a warning occurs before an alarm, or that you can specify whether it is a warning or an alarm that will be displayed for a given fault.

This is possible, for instance, in *F-10 Electronic Overload*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash. Once the problem has been rectified, only the alarm continues flashing until the frequency converter is reset.

11.1.2 Alarm List

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		AN-01 Live Zero Timeout Function
3	No motor	(X)			H-80 Function at Stop
4	Mains phase loss	(X)	(X)	(X)	SP-12 Function at Line Imbalance
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over-voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor Electronic OL over temperature	(X)	(X)		F-10 Electronic Overload
11	Motor thermistor over temperature	(X)	(X)		F-10 Electronic Overload
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth Fault	X	X	X	
15	Hardware mismatch		X	X	
16	Short Circuit		X	X	
17	Control word time-out	(X)	(X)		O-04 Control Word Timeout Function
22	Hoist Mech. Brake				


Warnings and Alarms
PROFINET Operating Instruction

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
23	Internal Fan Fault	X			
24	External Fan Fault	X			<i>SP-53 Fan Monitor</i>
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		<i>B-13 Braking Thermal Overload</i>
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		<i>B-15 Brake Check</i>
29	Heatsink temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	<i>H-78 Missing Motor Phase Function</i>
31	Motor phase V missing	(X)	(X)	(X)	<i>H-78 Missing Motor Phase Function</i>
32	Motor phase W missing	(X)	(X)	(X)	<i>H-78 Missing Motor Phase Function</i>
33	Inrush Fault		X	X	
34	Network communication fault	X	X		
36	Mains failure	X	X		
38	Internal Fault		X	X	
39	Heatsink sensor		X	X	
40	Overload of Digital Output Terminal 27	(X)			<i>E-00 Digital I/O Mode, E-51 Terminal 27 Mode</i>
41	Overload of Digital Output Terminal 29	(X)			<i>E-00 Digital I/O Mode, E-52 Terminal 29 Mode</i>
42	Overload of Digital Output On X30/6	(X)			<i>E-56 Term X30/6 Digi Out (OPCGPIO)</i>
42	Overload of Digital Output On X30/7	(X)			<i>E-57 Term X30/7 Digi Out (OPCGPIO)</i>
46	Pwr. card supply		X	X	
47	24V supply low	X	X	X	
48	1.8 V supply low		X	X	
49	Speed limit	X			
50	Auto Tune calibration failed		X		
51	Auto Tune check U_{nom} and I_{nom}		X		
52	Auto Tune low I_{nom}		X		
53	Auto Tune motor too big		X		
54	Auto Tune motor too small		X		
55	Auto Tune parameter out of range		X		
56	Auto Tune interrupted by user		X		
57	Auto Tune time-out		X		
58	Auto Tune internal fault	X	X		
59	Current limit	X			
61	Tracking Error	(X)	(X)		<i>H-20 Motor Feedback Loss Function</i>
62	Output Frequency at Maximum Limit	X			
63	Mechanical Brake Low		(X)		<i>B-20 Release Brake Current</i>
64	Voltage Limit	X			
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Module Configuration has Changed		X		
68	Safe Stop	(X)	(X) ¹⁾		<i>E-07 Terminal 37 Safe Stop</i>
69	Pwr. Card Temp		X	X	
70	Illegal Drive configuration			X	
71	Safe Stop	X	X ¹⁾		<i>E-07 Terminal 37 Safe Stop</i>
72	Dangerous Failure			X ¹⁾	<i>E-07 Terminal 37 Safe Stop</i>
73	Safe Stop Auto Restart				
77	Reduced power mode	X			<i>SP-59 Actual Number of Inverter Units</i>



Warnings and Alarms **PROFINET Operating Instruction**

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
79	Illegal PS config		X	X	
80	Drive Restored to Factory Settings		X		
81	CSIV corrupt				
82	CSIV parameter error				
85	Profibus/Profisafe Error				
90	Encoder Loss	(X)	(X)		<i>EC-61 Feedback Signal Monitoring</i>
91	Analog input 54 wrong settings			X	S202
243	Brake IGBT	X	X		
244	Heatsink temp	X	X	X	
245	Heatsink sensor		X	X	
246	Pwr.card supply		X	X	
247	Pwr.card temp		X	X	
248	Illegal PS config		X	X	
250	New spare part			X	
251	New Model Number		X	X	

Table 11.1 Alarm/Warning Code List

(X) *Dependent on parameter*

1) *Can not be Auto reset via H-04 Auto-Reset (Times)*

A trip is the action when an alarm has appeared. The trip will coast the motor and can be reset by pressing the reset button or make a reset by a digital input (Parameter group E-1# [1]). The origin event that caused an alarm cannot damage the frequency converter or cause dangerous conditions. A trip lock is an action when an alarm occurs, which may cause damage to frequency converter or connected parts. A Trip Lock situation can only be reset by a power cycling.

LED indication	
Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

Table 11.2



Index

A	
Abbreviations.....	5
Acyclic.....	33
Alarm	
Messages.....	63
Word.....	60
Assumptions.....	5
B	
Background Knowledge.....	5
C	
Cabling.....	44
Configuration.....	39, 5
Control	
Profile.....	25
Word According To Drive Profile (CTW).....	29
Word According To PROFIdrive Profile (CTW).....	25
D	
Data Types Supported.....	48
Drive Parameters.....	21
E	
EMC Precautions.....	14
Ethernet.....	14, 16, 43, 44
G	
GSD File.....	17
H	
Hardware.....	3, 5
I	
I/O.....	5
Influence Of The Digital Input Terminals Upon Drive Control Mode.....	25
Installation.....	3, 5, 6
IP Settings.....	15
L	
LED	
LED.....	5
Status.....	55
M	
Multicast.....	44

N	
Network	
Network.....	5, 14, 43, 44, 7, 9
Switch.....	12
No Communication With The Drive.....	56
O	
Overview.....	9
P	
Parameters.....	4, 15, 16
PPO Types.....	22
Process	
Control Data.....	23
Control Operation.....	24
Data.....	23
Status Data.....	23
PROFIdrive State - Transition Diagram.....	28
PROFINET.....	5
R	
Reference	
Reference.....	5
Handling.....	23
S	
Safety.....	3
Size Attribute.....	47
Spanning Tree.....	5
Status Word According To PROFIdrive Profile (STW).....	27
T	
Topology.....	13, 11
W	
Warning	
34.....	56
Word.....	60
Warnings.....	63
Will Not Respond To Control Signals.....	56

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