Nidec ASI S.p.A.

AD3000

Communication manual

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AD3000

Answer Drives 3000
Voltage Source Drive

Communication manual

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Contact us for information and comments at: nidec-answerdrives.com

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CONTENTS

1 SCOPE

The purpose of this manual is to provide instructions about the installation and programming of the optional fieldbuses available on the AD3000 drive series.

The Modbus RTU fieldbus is available as a standard on AD3000 drive without any optional board and it is described in the Programming Manual and in the User and Maintenance Manual.

To provide an optional fieldbus it is necessary to insert an optional board on the drive control board (BASIS). The hardware characteristics and necessary configuration of these optional boards are described in this manual.

The optional fieldbuses available for the AD3000 drive are:

- PROFIBUS DP by inserting the PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board)
- Modbus TCP by inserting the PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board)
- PROFINET IO by inserting the PROFINET IO communication module (GB40A-PROFINET board)
- EtherNet/IP by inserting the EtherNet/IP communication module (GB40A-EtherNet/IP board)

This manual, together with the Programming Manual and the User and Maintenance Manual, is part of the equipment and has to be stored in a safe and easily accessible place for the whole lifetime of the AD3000 drive.

The manuals are identical and apply to all models and types, electrical schematic diagrams and mechanical drawings are specific for each size.

Only actions described in these manuals shall be performed on equipment. Neither any other action, measurement nor change of any type shall be carried out.

This Communication Manual is updated in line with the **software release: 3.16.2.0_0000-3G1602B1**.

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2 OPTIONAL BOARDS

2.1 Introduction

Because only the Modbus RTU fieldbus is available as a standard on the AD3000 drive, to use the other optional fieldbuses it is necessary to insert an optional board whose hardware and setup are described in this manual.

The optional fieldbuses available for the AD3000 drive are:

- PROFIBUS DP by inserting the PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board)
- Modbus TCP by inserting the PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board)
- PROFINET IO by inserting the PROFINET IO communication module (GB40A-PROFINET board)
- EtherNet/IP by inserting the EtherNet/IP communication module (GB40A-EtherNet/IP board)

2.2 PROFIBUS DP and Modbus TCP communication module

The PROFIBUS DP and Modbus TCP communication module (ETH-PROFI expansion board, code 8000003690) provides the PROFIBUS DP and Modbus TCP slave communication buses; it is connected to the BASIS control board via J7 and J8.

Technical data
Operating temperature, -20°C - +50°C
Storage and transport temperature, -20°C - +70°C

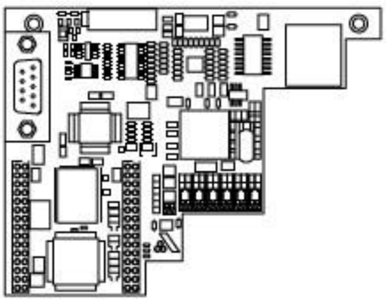
LED

Abbreviation	Colour	Function	Description	
DL1	Green	PROFIBUS	PROFIBUS communication	On = Communication active
DL2	Green	Modbus TCP	Line activity	Blinking = Communication active
DL3	Green	Modbus TCP	Line status	On = connection OK

The ETH-PROFI expansion board is an option indicated by the letter P in the 13th character of the identification code (see chapter 2 of the User and Maintenance Manual):

AD3	A	XXX	F	B	N	F	H	P	C	N	00	NN

ETH-PROFI board:



ETHI-PROFI board installed on the BASIS control board:

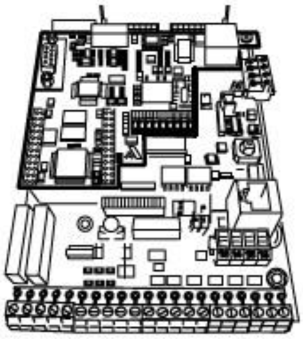


Figure 2.2.1: PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board), on its own and mounted on the BASIS control board

2.3 Mounting instructions for the ETH-PROFI optional board, frame I ÷ IIIL

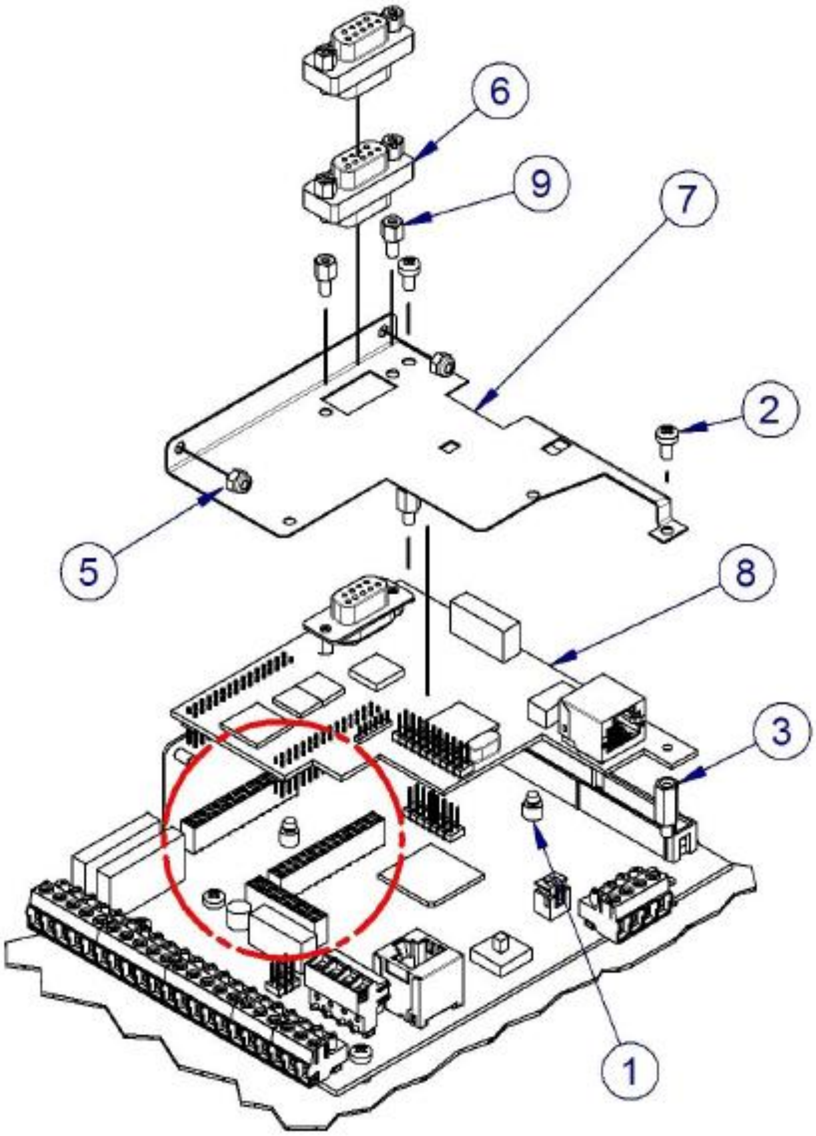


Figure 2.3.1: Assembly of each element available in the kit

Object number	Description	Quantity
1	Neoprene board support foot	2
2	Screw TCX M3x6 4.8 UNI 7687	5
3	Spacer M3x12 M/F	2
4	Spacer M3x7 M/F	1
5	Self-blocking nut M3 6S UNI 7473	2
6	Serial adapter D-SUB 9 ways M-F	2
7	ETH-PROFI RDP expansion board shield	1
8	ETH-PROFI expansion board	1
9	Spacer M3x5 M/F	2

Table 2.3.1: Assembly of each element available in the kit

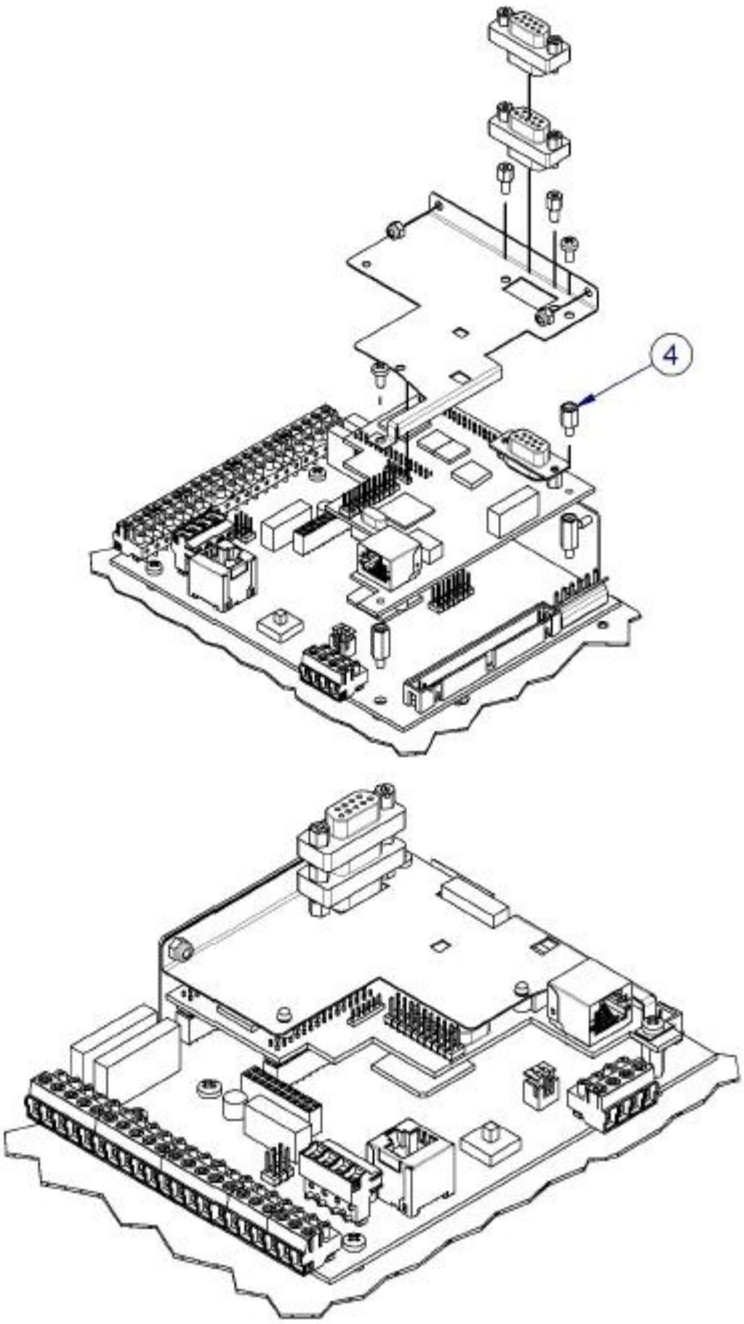


Figure 2.3.2: Assembly of each element available in the kit

2.4 Mounting instructions for ETH-PROFI optional board, frame IIIN ÷ VIII

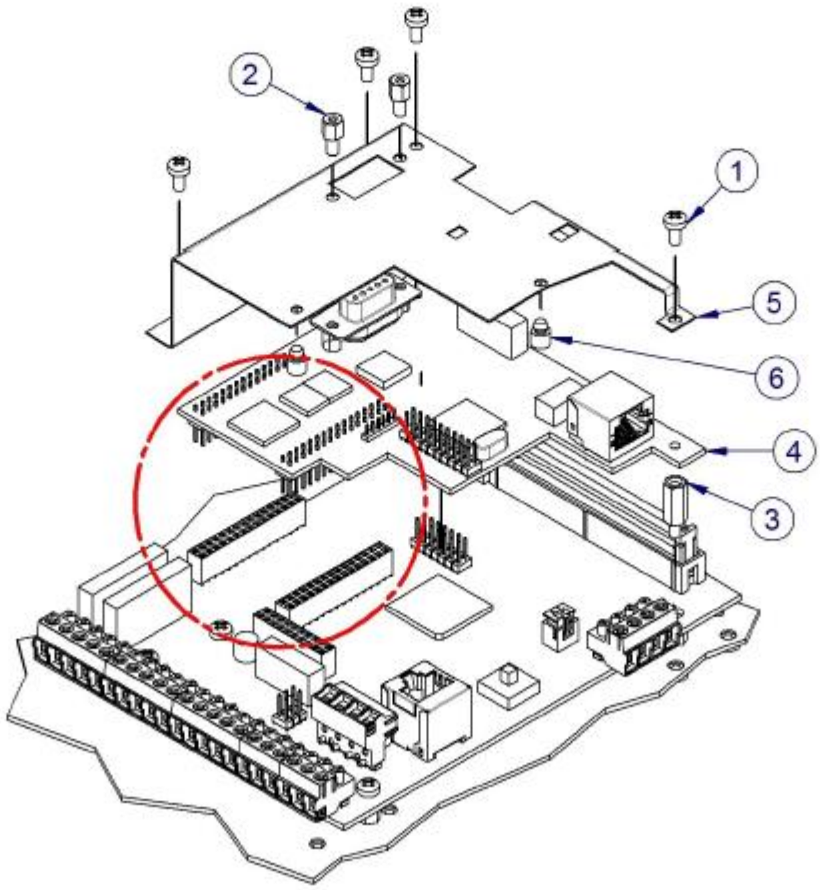


Figure 2.4.1: Assembly of each element available in the kit

Object number	Description	Quantity
1	Screw TCX M3x6 4.8 UNI 7687	4
2	Spacer M3x5 M/F	2
3	Spacer M3x12 M/F	2
4	ETH-PROFI expansion board	1
5	ETH-PROFI RDP expansion board shield	1
6	Neoprene board support foot	2
7	Spacer M3x7 M/F	1

Table 2.4.1: Assembly of each element available in the kit

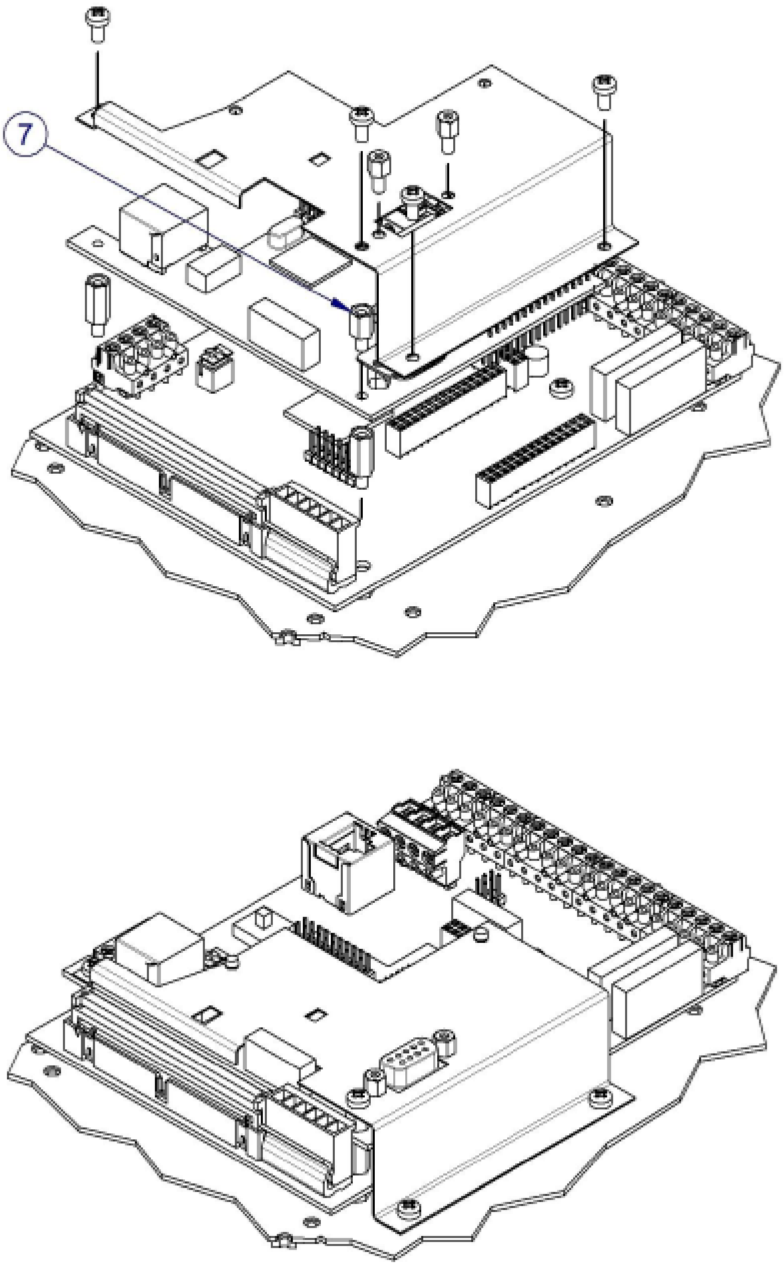


Figure 2.4.2: Assembly of each element available in the kit

2.5 PROFINET IO communication module

The PROFINET IO communication module (GB40A-PROFINET expansion board, code 1000256531) provides the PROFINET communication bus; it is connected to the BASIS control board via J7 and J8.

The physical interfaces are 2 RJ45 connectors to connect Ethernet cables.

Technical data
Operating temperature, -20°C - +50°C
Storage and transport temperature, -20°C - +70°C

LED

Abbreviation	Colour	Function
DL 1	Green	Vcc Power
DL 2	Green	Network status
DL 3	Red	Error
DL 4	Green	Module configured
DL 5	Red	Fault
DL 6	Green	Port A Eth Link Activity 100Mb
DL 7	Red	Port A Eth Link Activity 10Mb
DL 8	Green	Port B Eth Link Activity 100Mb
DL 9	Red	Port B Eth Link Activity 10Mb

The GB40A-PROFINET expansion board is an option indicated by the letter I in the 13th character of the identification code (see chapter 2 of the User and Maintenance Manual):

AD3	**A**	**XXX**	**F**	**B**	**N**	**F**	**H**	**I**	**C**	**N**	**00**	**NN**

2.6 EtherNet/IP communication module

The EtherNet/IP communication module (GB40A-EtherNet/IP expansion board, code 1000256532) provides the EtherNet/IP communication bus; it is connected to the BASIS control board via J7 and J8.

The physical interfaces are 2 RJ45 connectors to connect Ethernet cables.

Technical data
Operating temperature, -20°C - +50°C
Storage and transport temperature, -20°C - +70°C

LED

Abbreviation		Colour	Function
DL 1		Green	Vcc Power
DL 2		Green	Network status
DL 3		Red	Error
DL 4		Green	Mudule configured
DL 5		Red	Fault
DL 6		Green	Port A Eth Link Activity 100Mb
DL 7		Red	Port A Eth Link Activity 10Mb
DL 8		Green	Port B Eth Link Activity 100Mb
DL 9		Red	Port B Eth Link Activity 10Mb

Two examples in the case of EtherNet/IP:

- DL2 and DL4 On with PLC connected and running
- DL3 Blinking + DL2 off + DL4 blinking network cable disconnected

The GB40A-EtherNet/IP expansion board is an option indicated by the letter E in the 13th character of the identification code (see chapter 2 of the User and Maintenance Manual):

AD3	**A**	**XXX**	**F**	**B**	**N**	**F**	**H**	**E**	**C**	**N**	**00**	**NN**

2.7 Mounting instructions for GB40A-PROFINET and GB40A-EtherNet/IP optional boards

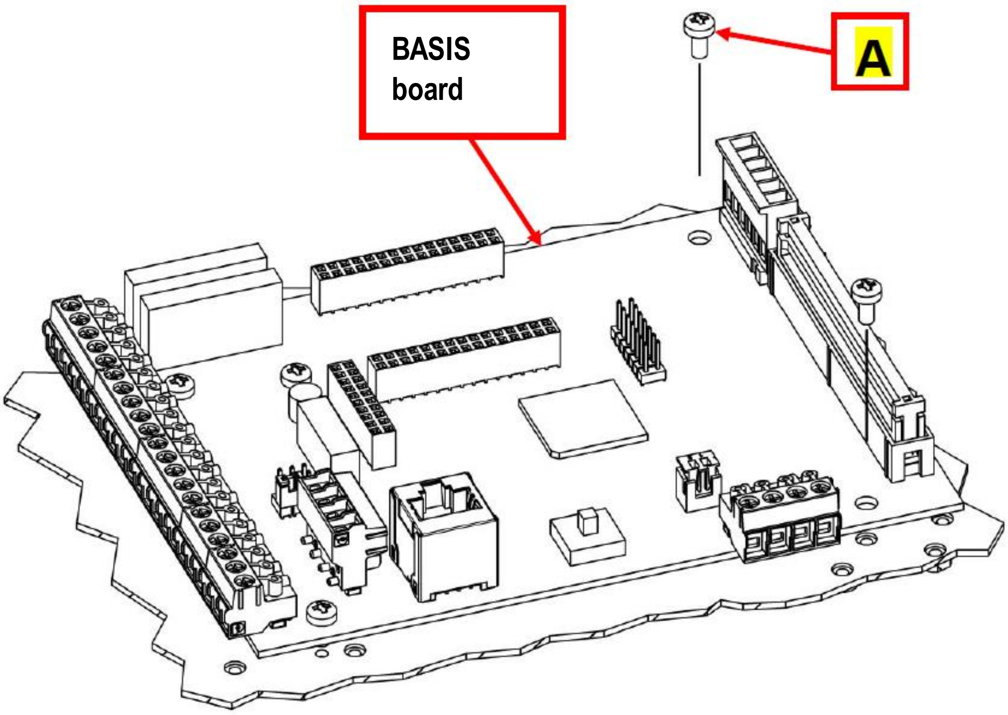


Figure 2.7.1: Unscrew the M3 screws (A)

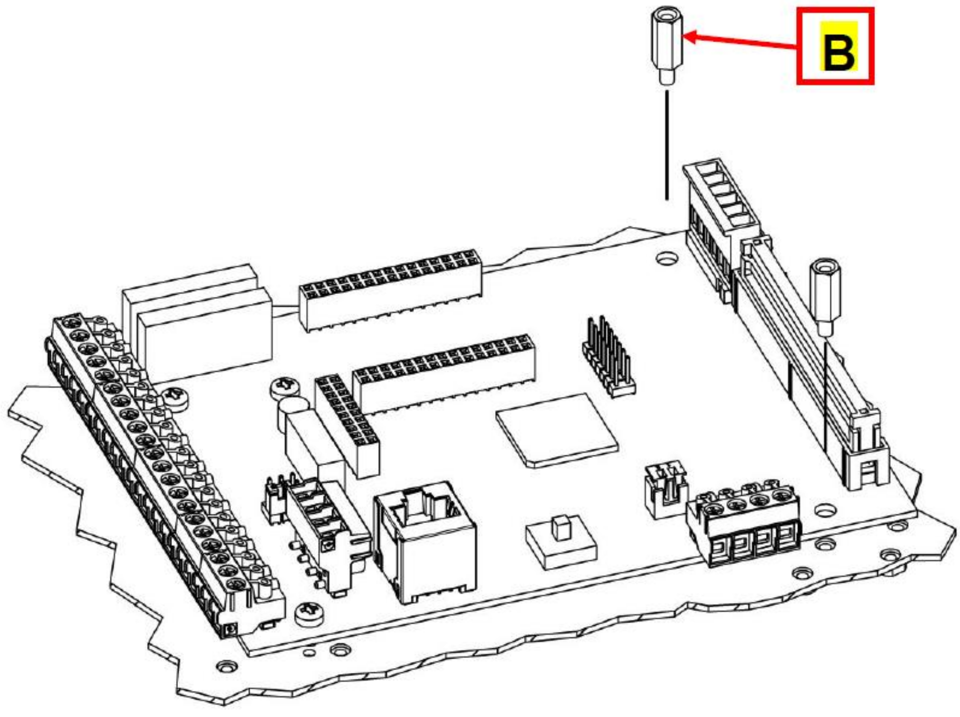


Figure 2.7.2: Screw the M3x12 spacers (B) available in the kit

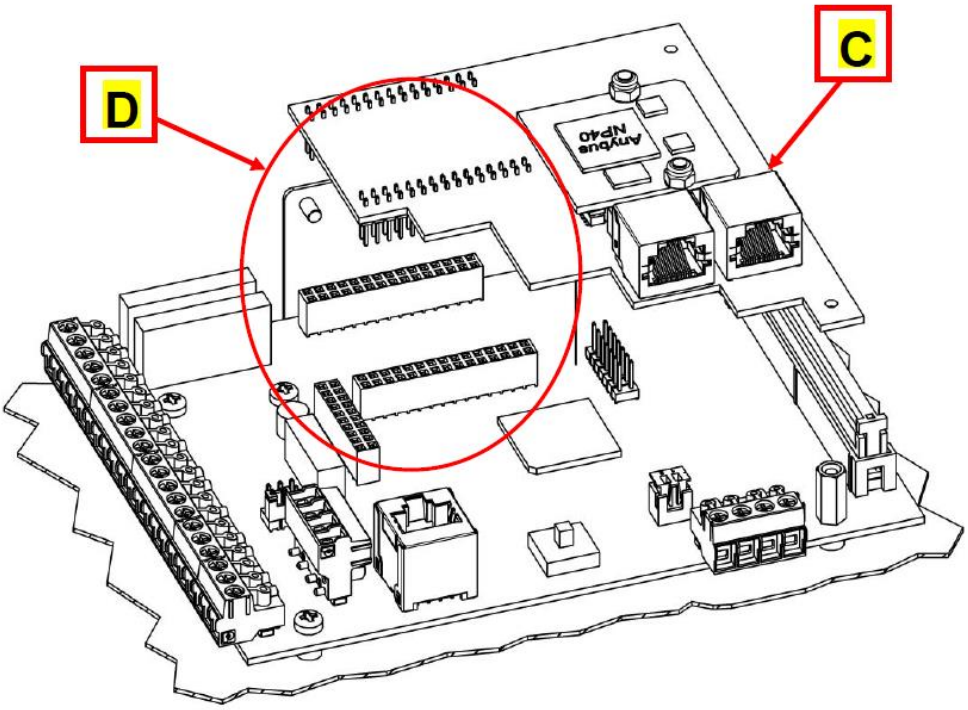


Figure 2.7.3: Position the board (C); carefully insert the pins in the connectors (D)

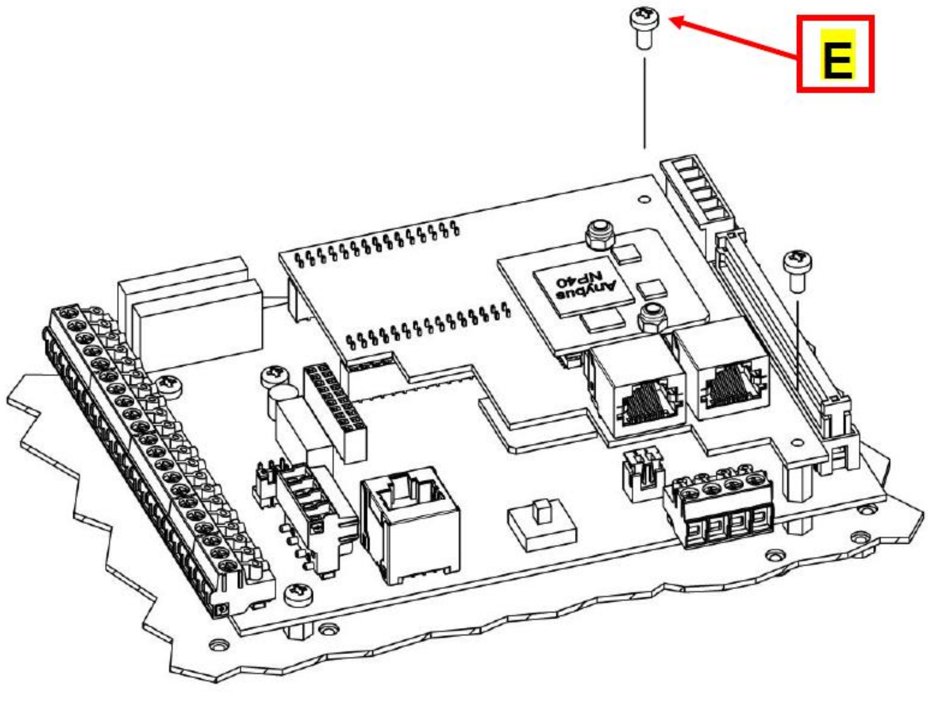


Figure 2.7.4: Screw the M3 screws (E) previously removed

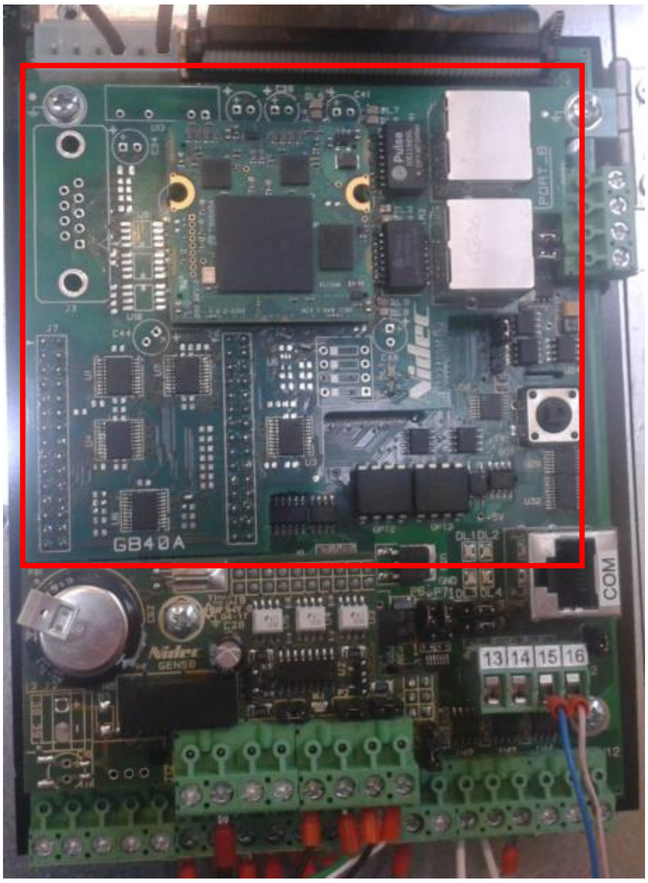


Figure 2.7.5: GB40A-PROFINET - GB40A-EtherNet/IP optional board mounted on BASIS control board

3 Ethernet network parameters configuration

3.1 Introduction

The Ethernet network is not a fieldbus but it is at a lower level in the OSI model, where the fieldbuses are at a higher level.
The Ethernet network is a common part that manages basic functions for many of the fieldbuses described in this Communication Manual.
The BASIS control board can be connected to a fieldbus that uses the Ethernet network as a physical medium by inserting an optional board as specified below:

- Modbus TCP by inserting the PROFIBUS DP and Modbus TCP communication module (ETH-PROFI board)
- PROFINET IO by inserting the PROFINET IO communication module (GB40A-PROFINET board)
- EtherNet/IP by inserting the EtherNet/IP communication module (GB40A-EtherNet/IP board)

For the use of each one of these boards, see the specific paragraph.

The configuration of the parameters of the Ethernet network it is necessary for all fieldbuses that use it, i.e. Modbus TCP, PROFINET IO and EtherNet/IP. In all these cases it is necessary to configure the Ethernet parameters: IP address, Mask and Gateway.

3.2 Physical interface

Every optional board of the fieldbuses that use Ethernet network has one or more RJ45 connectors to connect cables.

WARNING
In order to avoid any possible failure to the PC Ethernet port connected to the drive, PAY ATTENTION to the label on the ports of the board.

3.3 Network interface configuration

The Ethernet TCP/IP configuration parameters f fall under the **ETHERNET TCP/IP [88.00]** family.

The default IP address of the board is 192.168.1.1 and the subnet mask is 255.255.255.0.
While connecting the board to a network, the IP address and subnet mask must be modified according to the network configuration.

The IP and subnet mask can be changed both with the DVM and the keypad by modifying the following parameters:

For the IP address:

- **IP Address-Octet 1 [88.11]**
- **IP Address-Octet 2 [88.12]**
- **IP Address-Octet 3 [88.13]**
- **IP Address-Octet 4 [88.14]**

The IP address is modified only after parameter **IP Address-Octet 4 [88.14]** has been changed.

For the subnet mask:

- **Subnet mask-Octet 1 [88.15]**
- **Subnet mask-Octet 2 [88.16]**
- **Subnet mask-Octet 3 [88.17]**
- **Subnet mask-Octet 4 [88.18]**

The subnet mask is modified only after parameter **Subnet mask-Octet 4 [88.18]** has been changed.

For the default gateway:

- **Default Gateway-Octet 1 [88.21]**
- **Default Gateway-Octet 2 [88.22]**
- **Default Gateway-Octet 3 [88.23]**
- **Default Gateway-Octet 4 [88.24]**

The default gateway is modified only after parameter **Default Gateway-Octet 4 [88.24]** has been changed.

To check the IP address of the board see parameter **IP Address [88.01]**.

The parameters family for the setup and visualisation of the addresses is **ETHERNET – TCP/IP [88.00]**.

4 PROFIBUS DP

4.1 Introduction

PROFIBUS DP is a fieldbus initially defined by standard DIN 19245, later incorporated in EN 50170. From 1999 it is standardised in standards IEC 61158 (“Digital data communications for measurement and control - Fieldbus for use in industrial control systems”) and IEC 61784 (“Digital data communications for measurement and control”).
PROFIBUS DP has a wide range of applicability, especially in factory and process automation, and can be used when high speed communications and/or complex applications are required.
It provides a wide range of communication technologies, protocols and profiles. Among them, communication protocol PROFIBUS DP implements a simple, quick, cyclic and deterministic data exchange between a master device and one or more slave devices.
AD3000 is equipped with a PROFIBUS DP interface based on the PROFIdrive communication profile for class 1 applications (“Standard Drive”).

4.2 Physical interface: ETH-PROFI optional board

To use the PROFIBUS DP fieldbus it is necessary to install the ETH-PROFI optional board described in paragraph Modbus TCP and PROFIBUS DP communication module (ETH-PROFI).

4.3 General characteristics

Table 4.1 sums up the main characteristics of the AD3000 PROFIBUS DP interface available with the ETH-PROFI optional board.

Transmission technology	**RS 485**	Connector	Sub D 9-pin female
		Cable	Shielded pair
		Transmission speed	From 9.6 kbit/s to 12 Mb/s
Communication protocol	**PROFIBUS DP**	Managed PPO’s	1, 2, 3, 4, 5

Table 4.1 - Main characteristics of the PROFIBUS DP interface

Table 4.2 contains the main characteristics of a PROFIBUS DP network with a RS485 physical interface.
Table 4.3 contains the parameters of the cables used for communication.
For the choice of the connectors to be used refer to Table 4.4.

Topology	Linear with termination resistances at the ends
Access control to the bus	Token passing between masters, polling between a master and its slaves
Transmission speed	From 9.6 kbit/s to 12 Mb/s
Maximum length of a segment	From 100 to 1,200 m, based on the transmission speed adopted
Cable	Twisted pair
Maximum number of devices	32 per segment with no repeater, 126 with repeater (maximum 9 repeaters)

Table 4.2 - Main characteristics of PROFIBUS DP

Parameter	Type A cable	Type B cable
Impedance	135 … 165 Ω (3 to 20 MHz)	100 … 130 Ω (f > 100kHz)
Capacity	< 30 pF/m	< 60 pF/m
Resistance	< 110 Ω/ km	-
Conductor diameter	> 0.64 mm	> 0.53 mm
Conductor cross-section	> 0.34 mm^2	> 0.22 mm^2

Table 4.3 - Electric parameters of PROFIBUS DP cables

Type	Order code
9P connector for networks	ELC226056
Cable	ELC226058 or 229306
E.g. The following cables can be used	Belden PROFIBUS DP Data Cable 3079A

	Siemens SINEC L2 LAN cable for PROFIBUS DP 6XV1 830-0AH10

Table 4.4 - PROFIBUS DP cables and connectors

NOTE

Strictly use the above-mentioned connector.

For further information on PROFIBUS DP refer to the above-mentioned standards.

4.4 Connections

The PROFIBUS DP connector, located on the BASIS control board and identified with code **J2** is a sub D 9-pin female connector; the pin configuration can be seen in Table 4.5.

Signal	Connector (pin)	Description
Shield	1	Cable shield
VP	6	Power supply voltage (+5V)
RxD/TxD-P	3	Receive/Transmit data – positive (B)
RxD/TxD-N	8	Receive/Transmit data – negative (A)
DGND	5	0V (reference potential for VP)

Table 4.5 - PROFIBUS DP connector signals

Figure 4.1 represents the PROFIBUS DP network connector, highlighting the switch for the insertion of the termination resistance in the last slave line.

Special care shall be put in ensuring shield continuity, which can be achieved by laying the bare cable braiding on the metal connector (ref. 2 of the figure); moreover, the slave connection cable shall always be connected to the left, following the colour sequence for the connection to the screw terminal board inside the connector.

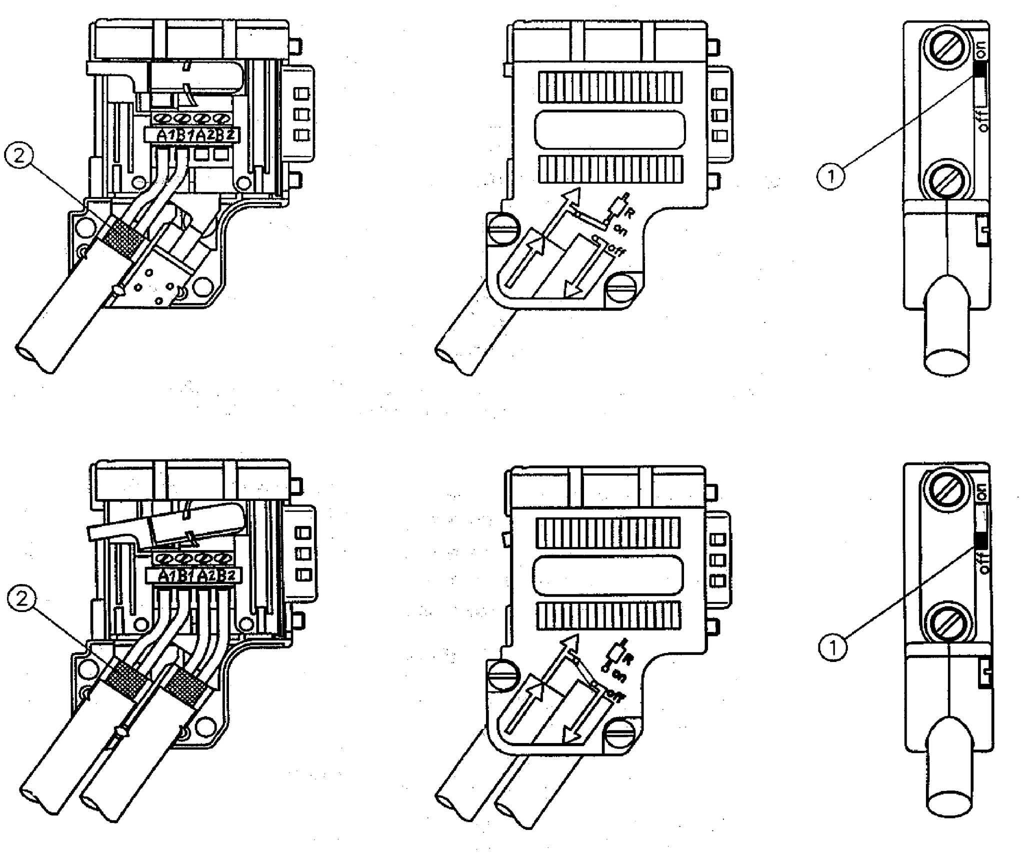


Figure 4.1 - PROFIBUS DP connector

4.5 LED

The communication status is indicated by LED DL1 on the ETH-PROFI board, see Table 4.6.

LED	Status	Meaning
DL1 - Green	On	Normal communication between Master and AD3000. The PROFIBUS DP interface is exchanging data with the Master.
	Off	Communication not working between Master and AD3000. No data exchange underway.

Table 4.6 - LED meaning

4.6 Protocol

The AD3000 is presented to the PROFIBUS DP network as a slave, enabled for data exchange functions. Data exchange is implemented according to the PROFIdrive communication profile.

The protocol used is PROFIBUS DP-DP; with this standard, the message exchanged between master and slave can have five structure types, identified with the following codes: PPO1, PPO2, PPO3, PPO4 and PPO5.

The above-mentioned codes univocally define , for the messages received and sent from the Drive protocol, both the message size (number of words) and the position and typology of all the data in the message.

The types of data present in the messages are divided into two categories:

- parameterisation data (PKW);
- process data (PZD).

The drive control is able to manage both PKW parameterisation data and PZD process data.

4.7 Structure of messages sent and received through the PROFIBUS DP network

The following tables report the structure of every message received or sent by the AD3000 control according to the PPO used, the typology and meaning of every word:

STRUCTURE OF RECEIVED MESSAGE							
Word	**Mnemonic**	**Typology and meaning**	**PPO1**	**PPO2**	**PPO3**	**PPO4**	**PPO5**
1	PKW1	PKW - Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Command Word [1]	PZD - Bitword for commands from network	•	•	•	•	•
6	Speed Reference [2]	PZD – Speed reference	•	•	•	•	•
7	IPZD3	PZD - Configurable meaning		•		•	•
8	IPZD4	PZD - Configurable meaning		•		•	•
9	IPZD5	PZD - Configurable meaning		•		•	•
10	IPZD6	PZD - Configurable meaning		•		•	•
11	IPZD7	PZD - Configurable meaning					•
12	IPZD8	PZD - Configurable meaning					•
13	IPZD9	PZD - Configurable meaning					•
14	IPZD0	PZD - Configurable meaning					•

Table 4.7 - Structure of received message

1: The meaning of every bit of the command word is reported in paragraph 8..4.1 of the Programming Manual.

2: The speed reference is normalised to ±1 pu, equal to ±16384. 1 pu is the maximum motor speed.

STRUCTURE OF SENT MESSAGE							
Word	**Mnemonic**	**Typology and meaning**	**PPO1**	**PPO2**	**PPO3**	**PPO4**	**PPO5**
1	PKW1	PKW - Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Status Word [3]	PZD - Bitword for Drive status	•	•	•	•	•
6	Feedback speed [4]	PZD - Speed feedback	•	•	•	•	•
7	OPZD3	PZD - Configurable meaning		•		•	•
8	OPZD4	PZD - Configurable meaning		•		•	•
9	OPZD5	PZD - Configurable meaning		•		•	•
10	OPZD6	PZD - Configurable meaning		•		•	•
11	OPZD7	PZD - Configurable meaning					•
12	OPZD8	PZD - Configurable meaning					•
13	OPZD9	PZD - Configurable meaning					•

Table 4.8 - Structure of sent message

[3]: The meaning of every bit of status word 1 is reported in paragraph 8.4.2 of the Programming Manual.

[4]: The speed feedback is normalised to ±1 pu equal to ±16384. 1 pu is the maximum motor speed.

The meaning of configurable words, present in both messages, is selected with the parameters described in the next paragraph.

4.8 PROFIBUS DP configuration parameters

The parameters for the communication configuration with the PROFIBUS DP network belong to the **FIELDBUS [81.00]** family.
The communication is enabled on the PROFIBUS DP network through the **Fieldbus Sel [81.01]** parameter.
The selection of the structure of the message to be adopted is carried out through the **PPO Type [81.20]** parameter; the possible settings and respective meanings are reported in the following table:

PPO setting	Meaning
PPO1	PROFIBUS DP communication enabled with PPO1 type message
PPO2	PROFIBUS DP communication enabled with PPO2 type message
PPO3	PROFIBUS DP communication enabled with PPO3 type message
PPO4	PROFIBUS DP communication enabled with PPO4 type message
PPO5	PROFIBUS DP communication enabled with PPO5 type message

Table 4.9 - PPO types

Once the message type has been selected, it is necessary to assign to every drive the PROFIBUS DP address univocally identifying it as a node of the PROFIBUS DP network; such PROFIBUS DP address is assigned through the **Slave Address [81.02]** parameter.

4.9 Word setting for received message configuration

Parameters **IPZ03 Sel [81.21], IPZ04 Sel [81.22], IPZ05 Sel [81.23], IPZ06 Sel [81.24], IPZ07 Sel [81.25], IPZ08 Sel [81.26], IPZ09 Sel [81.27], IPZ10 Sel [81.28]** are used to assign the meaning of the configurable words of the received message; these words can be used to:

- Receive references;
- Receive commands for the command words.

The values that can be set for such parameters are contained in the following table, with the relevant meaning and resulting typology of received data:

IPZx PARAMETER SETTINGS			
Setting	**Meaning**	**Data type**	**Normalisation**
0	Off, Data not used	--	--
1	Auxiliary speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogue	-32768@ - 2pu; 32767@ 2 pu
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
8	Negative torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogue	-32768@ - 4pu; 32767@ 4 pu
13	Analogue output 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
65	Process PID Reference 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
66	Process PID Feedback 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
67	Process PID Reference 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
68	Process PID Feedback 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
12	Analogue output 1	Analogue	-32768@ - 2pu; 32767@ 2 pu

Table 4.10 - IPZ code

4.10 Word setting for sent message configuration

Parameters **OPZ03 Sel [81.31], OPZ04 Sel [81.32], OPZ05 Sel [81.33], OPZ06 Sel [81.34], OPZ07 Sel [81.35], OPZ08 Sel [81.36], OPZ09 Sel [81.37] OPZ10 Sel [81.38]** are used to assign the meaning of configurable words of the sent message; these words can be used to:

- Send the signals that can normally be displayed through analogue outputs;
- Send bit significant information for the identification of any tripped hardware and/or software protections;
- Send bit significant information concerning Drive status;
- Send bit significant information concerning the status of the microprocessor card digital inputs and outputs;
- Send bit significant information concerning status of the DO expansion digital inputs.

Each one of these parameters can be associated to any process data ID, with the limitation that they shall correspond to the Word size. For the data normalisation see paragraph 8.3 of the Programming Manual.

4.11 Management of loss of communication with the PROFIBUS DP master

In case of loss of communication with the PROFIBUS DP master, the drive control can operate with different modes established through the **Timeout [81.03]**, **Freeze En [81.04]** and **Delay Com Restore [81.05]** parameters.

The **Timeout [81.03]** parameter is used to set the waiting time on restoring communication with the master; it is possible to set a value between 0.01 s. and 10 s. The default value is 0.01 s.
In case of loss of communication with the master, when the timeout expires an alarm is generated and the alarm behaviour is defined by the **Fieldbus Error [36.49]** parameter; for the management of this alarm refer to paragraph 12.3 of the Programming Manual.

During the waiting time for restoring communication, it is possible to freeze the reference and Command Word 1 received via PROFIBUS DP by using the values received before loss of communication; this can be achieved by setting the **Freeze En [81.04]** parameter to On.
The parameter **Fieldbus Cycle Timeout [81.39]** sets the limit communication loss time after which the control considers the communication no more active and the freeze is activated, if enabled.
Once the freeze has been enabled, it intervenes based on the status of bit 10 of Command Word 1. If the latter is ON, Command Word 1 and reference are considered to be valid; if the latter is OFF, the Command Word 1 and reference are not considered to be valid and the valid ones previously stored are used.

4.11.1 Function for commands/references update delay via PROFIBUS DP in case of serial tear-off

The **Delay Com Restore [81.05]** parameter sets a delay in the command/reference update after restoring communication. During such delay the previously stored commands/references are maintained.

4.12 Command word, status word, alarm word

Command words are used to send commands to the AD3000 through the PROFIBUS DP network; for the meaning of every command word bit see paragraph 8.4.1 of the Programming Manual.
Status words are used by the control to provide information concerning the drive status; for the type of information transmitted and the meaning of the relevant logic states see paragraph 8.4.2 of the Programming Manual.
Through the alarm status words, the control provides information concerning the drive alarm status; for the decoding of the alarm words bits see paragraph 8.4.3 of the Programming Manual.

4.13 Control parameterisation via PROFIBUS DP

The drive configuration parameter setting can be implemented via PROFIBUS DP by using the PKW parameterisation data of messages exchanged between the master and slave (drive). Said data is used by the PROFIBUS DP master to transmit or receive slave configuration parameter values; through PKW data the chosen parameterisation is automatically stored.
The PKW parameterisation data are supported only with PPO1, PPO2 and PPO5 type messages; each one of them has 4 PKW data available both in the message sent by the master to the slave and in the message sent by the slave to the master.

4.13.1 Parameterisation message sent by the master to the slave

Such message consists of 4 words.

Word	Meaning
1st word (PKW1)	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration data on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed data (MSW). Only for operation code 3 and 4.
4th word (PKW4)	Least significant part of the processed data (LSW). Only for operation code 3 and 4.

Table 4.11 - Structure of PKW message from master to slave

WARNING

For proper operation of the Drive parameterisation protocol, it is recommended that the master continues to send the message until it receives the reply from the slave. After that, the master can avoid sending the message again.

NOTE

For the parameters in the list, the parameter value to indicate the selection is given in the relevant parameter tables in Annex A; namely, it is the value appearing to the side of the description of the selection.

4.13.2 Parameterisation message sent by the slave to the master

This message consists of 4 words as well.

Word	Meaning
1st word (PKW1)	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1) is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration data on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed data (MSW). If the operation requested by the master cannot be admitted (most significant bit of word 1 = 1), the error code is written in this word:

	- PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4)	Least significant part of the processed data (LSW).

Table 4.12 - Structure of PKW message from slave to master

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5 MODBUS TCP

Modbus TCP uses the Ethernet network; so it is also necessary to configure all the parameters relating to it, as described in the chapter Ethernet network parameters configuration.

NOTE: the AD3000 drive manages also the serial version Modbus RTU as a standard, without any optional card.
More information is available on the other product manuals.

5.1 Introduction

Modbus TCP is a communication protocol for a wide range of industrial and automation applications.

The AD3000 drive can be considered by Modbus communication as a slave (server). Data exchange is implemented through the Modicom Modbus Reference Guide (PI-MBUS-300 Rev.J).
The communication type is master-slave (client-server) in which only the master (client) can start the transaction (by sending "queries"). The slave (server) responds either by providing the data requested by the master (client) or by implementing the requested command.

AD3000 drive supports the MODBUS TCP protocol (on optional ETH-PROFI board).

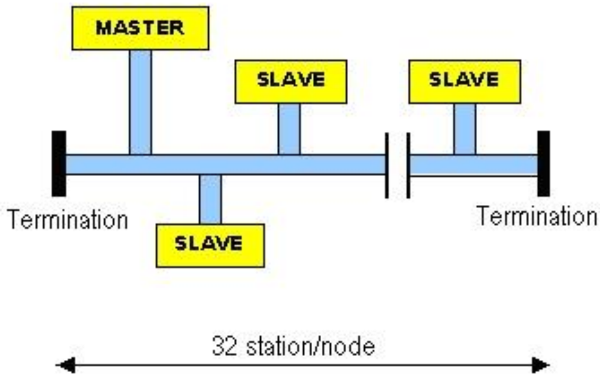


Figure 5.1 - Modbus network

5.2 Physical interface: ETH-PROFI optional board

To use the Modbus TCP fieldbus it is necessary to install the ETH-PROFI optional board described in paragraph Modbus TCP and the PROFIBUS DP communication module (ETH-PROFI).

5.3 General characteristics

The table below shows the main features of the AD3000 drive Modbus TCP interface.

Transmission technology TCP	
Connector	RJ45, connector J6 on optional card
Data transmission method	TCP/IP
Cable	Standard Ethernet network
Transmission speed	10/100 Mbps
Slave address	1 ÷ 247

Table 5.1 - Modbus TCP

NOTE Modbus TCP is available with ETH-PROFI optional board only.

5.4 Modbus functions

Unless otherwise specified, numeric values (such as addresses, codes or data) are expressed as decimal values in the text of this section. They are expressed as hexadecimal values in the message fields of the figures.

5.4.1 Function codes

The table below shows the function codes available on the AD3000 drive.

Code (decimal)	Function	Description
01	Reads Coils	Reading of one or more contiguous bits
03	Read Holding Registers	Reading of one or more contiguous Holding Registers
05	Write Single Coil	Writing of one bit
06	Write Holding Registers	Writing of only one Holding Register (single)
15	Write Multiple Coil	Writing of one contiguous group of bits
16	Write Holding Registers	Writing of one group of Holding Registers (multiple)
20	Read File Record	Reading of string parameter
21	Write File Record	Writing of string parameter

Table 5.2 - Available function codes

5.4.2 Read holding register

The function code “Read Holding Register” reads the binary contents of maintenance registers (4XXXX references) in the slave (server). The broadcast message is not supported.
All process data can be read by using 4+ID number as a Modbus address.
For example, to read **Status Wd 1 [52.01]** process data**,** the address will be 45201. For the data scaling refer to chapter 8 of the Programming Manual.
Note: for some types of masters (client) it may not be necessary to place the number 4 before the ID and/or it may be necessary to set an address incremented or decremented by 1 with respect to the value of the ID.

5.4.3 Write holding register

The function code “Write Holding Register” writes the binary contents of maintenance registers (4XXXX references) in the slave. The broadcast message is not supported.
The process data that can be written is listed in the following table, where the addresses are number 4+ID.
For example, to write **Ext Cmd Wd 1 [51.02]** process data, the address will be 45102. For the data scaling refer to chapter 8 of the Programming Manual.
Note: for some types of masters (client) it may not be necessary to place the number 4 before the ID and/or it may be necessary to set an address incremented or decremented by 1 with respect to the value of the ID.

Write Holding Register					
Modbus Register	**Parameter**	**Description**	**Unit**	**Minimum Value**	**Maximum Value**
45102	Ext Cmd Wd 1	Command word 1	-	-	-
45103	Ext Cmd Wd 2	Command word 2	-	-	-
45105	Ext Cmd Wd 4	Command word 4	-	-	-
45301	Torque Ffw	Torque feedforward	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45302	Torque Ref	Torque reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45303	PosTrq Lim Ref	Positive limit of torque reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
45304	NegTrq Lim Ref	Negative limit of torque reference	pu	-32768 @ -4.0 pu;	32767 @ 4.0 pu
46001	ExtMain Spd Ref	Main speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46002	ExtAux Spd Ref	Auxiliary speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46004	Add Spd Ref	Additional speed reference	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46005	Spd Ffw	Speed feedforward	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46316	PrsPID Ref 1	Reference 1 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46317	PrsPID Fdb 1	Feedback 1 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu
46318	PrsPID Ref 2	Reference 2 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu

Write Holding Register					
Modbus Register	Parameter	Description	Unit	Minimum Value	Maximum Value
46319	PrsPID Fdb 2	Feedback 2 for Process PID	pu	-32768 @ -2.0 pu	32767 @ 2.0 pu

Table 5.3 - Write Holding Register

5.4.4 Coil list

Coil Id (max.512)	Parameter Id	Bit
1	5201	SW1.b00
2	5201	SW1.b01
3	5201	SW1.b02
4	5201	SW1.b03
5	5201	SW1.b04
6	5201	SW1.b05
7	5201	SW1.b06
8	5201	SW1.b07
9	5201	SW1.b08
10	5201	SW1.b09
11	5201	SW1.b10
12	5201	SW1.b11
13	5201	SW1.b12
14	5201	SW1.b13
15	5201	SW1.b14
16	5201	SW1.b15
17	5202	SW2.b00
18	5202	SW2.b01
19	5202	SW2.b02
20	5202	SW2.b03
21	5202	SW2.b04
22	5202	SW2.b05
23	5202	SW2.b06
24	5202	SW2.b07
25	5202	SW2.b08
26	5202	SW2.b09
27	5202	SW2.b10
28	5202	SW2.b11
29	5202	SW2.b12
30	5202	SW2.b13
31	5202	SW2.b14
32	5202	SW2.b15
33	5203	SW3.b00
34	5203	SW3.b01
35	5203	SW3.b02
36	5203	SW3.b03
37	5203	SW3.b04
38	5203	SW3.b05
39	5203	SW3.b06
40	5203	SW3.b07
41	5203	SW3.b08
42	5203	SW3.b09
43	5203	SW3.b10
44	5203	SW3.b11
45	5203	SW3.b12
46	5203	SW3.b13
47	5203	SW3.b14
48	5203	SW3.b15
49	5204	SW4.b00
50	5204	SW4.b01
51	5204	SW4.b02
52	5204	SW4.b03
53	5204	SW4.b04
54	5204	SW4.b05

Coil Id (max.512)	Parameter Id	Bit
65	5106	CW1.b00
66	5106	CW1.b01
67	5106	CW1.b02
68	5106	CW1.b03
69	5106	CW1.b04
70	5106	CW1.b05
71	5106	CW1.b06
72	5106	CW1.b07
73	5106	CW1.b08
74	5106	CW1.b09
75	5106	CW1.b10
76	5106	CW1.b11
77	5106	CW1.b12
78	5106	CW1.b13
79	5106	CW1.b14
80	5106	CW1.b15
81	5107	CW2.b00
82	5107	CW2.b01
83	5107	CW2.b02
84	5107	CW2.b03
85	5107	CW2.b04
86	5107	CW2.b05
87	5107	CW2.b06
88	5107	CW2.b07
89	5107	CW2.b08
90	5107	CW2.b09
91	5107	CW2.b10
92	5107	CW2.b11
93	5107	CW2.b12
94	5107	CW2.b13
95	5107	CW2.b14
96	5107	CW2.b15
97	5108	CW3.b00
98	5108	CW3.b01
99	5108	CW3.b02
100	5108	CW3.b03
101	5108	CW3.b04
102	5108	CW3.b05
103	5108	CW3.b06
104	5108	CW3.b07
105	5108	CW3.b08
106	5108	CW3.b09
107	5108	CW3.b10
108	5108	CW3.b11
109	5108	CW3.b12
110	5108	CW3.b13
111	5108	CW3.b14
112	5108	CW3.b15
113	5109	CW4.b00
114	5109	CW4.b01
115	5109	CW4.b02
116	5109	CW4.b03
117	5109	CW4.b04
118	5109	CW4.b05

55	5204	SW4.b06
56	5204	SW4.b07
57	5204	SW4.b08
58	5204	SW4.b09
59	5204	SW4.b10
60	5204	SW4.b11
61	5204	SW4.b12
62	5204	SW4.b13
63	5204	SW4.b14
64	5204	SW4.b15

119	5109	CW4.b06
120	5109	CW4.b07
121	5109	CW4.b08
122	5109	CW4.b09
123	5109	CW4.b10
124	5109	CW4.b11
125	5109	CW4.b12
126	5109	CW4.b13
127	5109	CW4.b14
128	5109	CW4.b15

Table 5.4 - Coil List

5.5 Errors returned in the Modbus protocol (Modbus exception code)

Except for broadcast messages, when a master (client) device sends a query to a slave (server) device, it expects a response.
If a transmission is not successful, the response contains a code indicating the type of error detected. The codes are listed in the following table.

Code	Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an action allowed for the slave (server). If a Poll Program Complete command has been issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an acceptable address for the slave (server).
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an acceptable value for the slave (server).
04	SLAVE DEVICE FAILURE	An irreversible error occurred while the slave (server) was trying to perform the requested action.

Table 5.5 - Error codes

5.6 Modbus TCP configuration parameters

Remember that it is necessary to configure all the Ethernet network parameters, **ETHERNET - TCP/IP [88.00]** family.
The Modbus TCP communication enabling is performed by setting the **Modbus En [82.01]** parameter.
All the important parameters of the **MODBUS [82.00]** family are:

82 - Modbus								
Id	**Name**	**Description**	**Unit**	**Range**	**Access Type**	**Control Type**	**Visibility Level**	**Download**
82.01	Modbus En	Modbus enable - Off [0] - RTU [1] - TCP [2] - RTU & TCP [3]	#	Def: Off	Read and Write	All	2	Yes
82.02	Slave Address	Slave address	#	Min: 1 Def: 3 Max: 247	Read and Write	All	2	Yes
82.05	Timeout	Timeout for alarm 53 (0 = disabled)	s	Min: 0 Def: 3 Max: 250	Read and Write	All	2	Yes
82.07	Mod Exchange Area In	Selection of input auxiliary exchange area (from Modbus to Drive) - Off [0] - 1 Data Exchange Area [1] - 2 Data Exchange Area [2]	#	Def: Off	Read and Write	All	2	Yes

5.7 Loss of Modbus communication

If the “RTU” communication mode has been chosen, if the communication fails, the system generates the ModbusEr alarm.
The action that shall generate such error is determined by the setting chosen in the **Modbus Slave Error [36.53]** parameter.

5.8 Control parameterisation via Modbus

The drive configuration parameter setting can be implemented via the Modbus using the PKW parameterisation data of messages exchanged between master (client) and slave (server) (drive). Such data are used by the Modbus master to transmit or receive slave configuration parameter values; through PKW data the chosen parameterisation is automatically stored.

5.8.1 Modbus parameterisation message sent by the master to the slave

This message consists of 4 words.

Word	Meaning
1st word (PKW1) **Mdb PKW1 In [67.02]**	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2) **Mdb PKW2 In [67.03]**	Parameter ID of the configuration data on which to perform the operation defined by the PKW1 word.
3rd word (PKW3) **Mdb PKW3 In [67.04]**	Most significant part of the processed data (MSW). Only for operation code 3 and 4.
4th word (PKW4) **Mdb PKW4 In [67.05]**	Least significant part of the processed data (LSW). Only for operation code 3 and 4.

Table 5.6 - Structure of PKW message from master (client) to slave (server)

WARNING

To ensure correct operation of the drive parameterisation protocol, it is recommended that the master (client) continues to send the message until it receives the reply from the slave (server). After that, the master (client) can avoid sending the message again.

NOTE

For the listed parameters, the parameter value to indicate the choice is given in the relevant parameter tables in Annex A; namely, it is the value appearing to the side of the description of the selection.

5.8.2 Modbus parameterisation message requested by the master and sent to the slave

This message consists of 4 words as well.

Word	Meaning
1st word (PKW1) **Mdb PKW1 Out [67.06]**	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1) is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2) **Mdb PKW2 Out [67.07]**	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3) **Mdb PKW3 Out [67.08]**	Most significant part of the processed datum (MSW). If the operation requested by the master (client) cannot be admitted (most significant bit of word 1 = 1), the error code is written in this word: - PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4) **Mdb PKW4 Out [67.09]**	Least significant part of the processed data (LSW).

Table 5.7 - Structure of PKW message from slave to master

5.9 Data exchange area

5.9.1 Data exchange area configuration parameters

The Data Exchange Area allows you to access 16 configurable input words and 16 configurable output words in order to save Modbus bandwidth. The parameters for the communication configuration of the data exchange area belong to the **EXCH AREA 1/2 CONFIG [87.00]** family. The communication is enabled on the Modbus network through the En **Exch Area 1/2 Config [87.01]** parameter.
It is possible to enable the input area only, the output only or both. Once the area has been selected, it is necessary to assign the input area to Modbus by setting the **Mod Exchange Area In [82.07]** parameter to "1 Data Exchange Area". After the configuration of the Exchange Area it is possible to access the input area using the address 46711 and the output area using the address 46712 reading and writing 1 to 16 words.
Note: For some type of master (client) it may not be necessary to place the number 4 before the ID and/or it may be necessary to set an address incremented or decremented by 1 with respect to the value of the ID.

5.9.2 Word setting for received message configuration

Parameters from **Area 1 Input Wd 01 Sel [87.04]** to **Area 1 Input Wd 16 Sel [87.19]** are used to assign the meaning of configurable words of the received message; these words can be used to:

- Receive references;
- Receive commands for the digital outputs of the microprocessor card;
- Receive values to be sent on the analogue outputs of the microprocessor card.

The values that can be set for such parameters are contained in the following table, with the relevant meaning and resulting typology of received datum:

DATA EXCHANGE AREA PARAMETER SETTINGS			
Setting	**Meaning**	**Data type**	**Normalisation**
0	Off, Data not used	-	--
98	Main speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
1	Auxiliary speed feedback	Analogue	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogue	-32768@ - 2pu; 32767@ 2 pu
99	Command word 1	Bit significant	--
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
8	Negative torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogue	-32768@ - 4pu; 32767@ 4 pu
12	Analogue output 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
13	Analogue output 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
65	Process PID reference 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
66	Process PID feedback 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
67	Process PID reference 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
68	Process PID feedback 2	Analogue	-32768@ - 2pu; 32767@ 2 pu

Table 5.8 - Data exchange area parameter settings

5.9.3 Word setting for sent message configuration

The parameters from **Area 2 Output Wd 01 Sel [87.52]** to **Area 2 Output Wd 16 Sel [87.67]** are used to assign the meaning of configurable words of the sent message; these words can be used to:

- Send the signals that can normally be displayed through analogue outputs;
- Send bit significant information for identification of any tripped hardware and/or software protections;
- Send bit significant information concerning Drive status;

- Send bit significant information concerning status of the control card (BASIS board) digital inputs and outputs;

Any of these parameters can be associated to any process data ID, with the limitation that they shall correspond to the Word size.
For the data normalisation see paragraph 8.3 of the Programming Manual.

6 PROFINET IO

PROFINET IO uses the Ethernet network; so it is also necessary to configure all the parameters relating to it, as described in the chapter Ethernet network parameter configuration.

6.1 Introduction

PROFINET IO is an industrial standard fieldbus to exchange data. It is able to exchange data also in short time and in real-time.
The reference standard is supported by "PROFIBUS & PROFINET International" and is IEC 61158 and IEC 61784.

The use of this protocol covers the following 2 levels, of the 3 possible ones (IRT, Isochronous Real-Time, is excluded):

- TCP/IP for non-critical data and commissioning with reaction times in the range of 100 ms
- RT (Real-Time) protocol for PROFINET IO applications with cycle times up to 1 ms (usually 5 ms)

The protocols can be monitored and analysed by using the normal Ethernet analysis tools.

In a PROFINET IO network the data exchange is managed by a master (IO Controller) interfaced with one or more slaves (IO Device).

The peripheral interfacing is implemented in the PROFINET IO. This defines the communication with peripheral devices connected to the field.

In PROFINET IO the process data and the alarms are always transmitted in real-time (RT).

PROFINET IO Systems means:

- **PROFINET IO-Supervisor** (comparable to a PROFIBUS DP Master Class II): HMI and diagnostics
- **PROFINET IO-Controller** (comparable to a PROFIBUS DP Master Class I): it exchanges data with connected IO-Devices, contains the application program (for example: PLC)
- **PROFINET IO-Device** (comparable to a PROFIBUS DP Slave device): field device connected to the IO-Controller (for example: sensors, actuators, drives, …)

6.2 Physical interface: GB40A-PROFINET optional board

To use the PROFINET IO fieldbus it is necessary to install the GB40A-PROFINET optional board described in paragraph PROFINET IO communication module (GB40A-PROFINET).

6.3 General features

The table below summarises the main features of the AD3000 drive PROFINET IO interface available with the GB40A-PROFINET board.

Transmission technology	**Ethernet**	Connector	RJ45
		Cable	Cat 5
		Transmission speed	10, 100 Mbps, 1 Gbps
Communication protocol	**PROFINET IO**	Managed PPO	1, 2, 3, 4, 5

Table 6.1 - PROFINET IO interface main features

For more PROFINET IO info see the above standards.

6.4 Connections

PROFINET IO connectors are standard RJ45 used for the Ethernet communication.
The cables are standard Ethernet cables. Their category must be higher than Cat. 5e.
For the possible topologies refer to standard information for PROFINET IO.

6.5 LED

Every port communication status is monitored by LED on the GB40A-PROFINET for the network and the module status.
For the LED meaning see the paragraph PROFINET IO communication module (GB40A-PROFINET).

6.6 Protocol

AD3000 drive is a slave for the PROFINET IO network, enabled to exchange data. The data exchange is implemented by following a custom user-configurable communication profile .

The protocol used is PROFINET IO; with this standard the message exchanged between the master and the slave can have five structure types, identified with codes: PPO1, PPO2, PPO3, PPO4 and PPO5.

The above codes define uniquely, for the sent and received messages, the message size (word number) and the position and type of all data in the message.

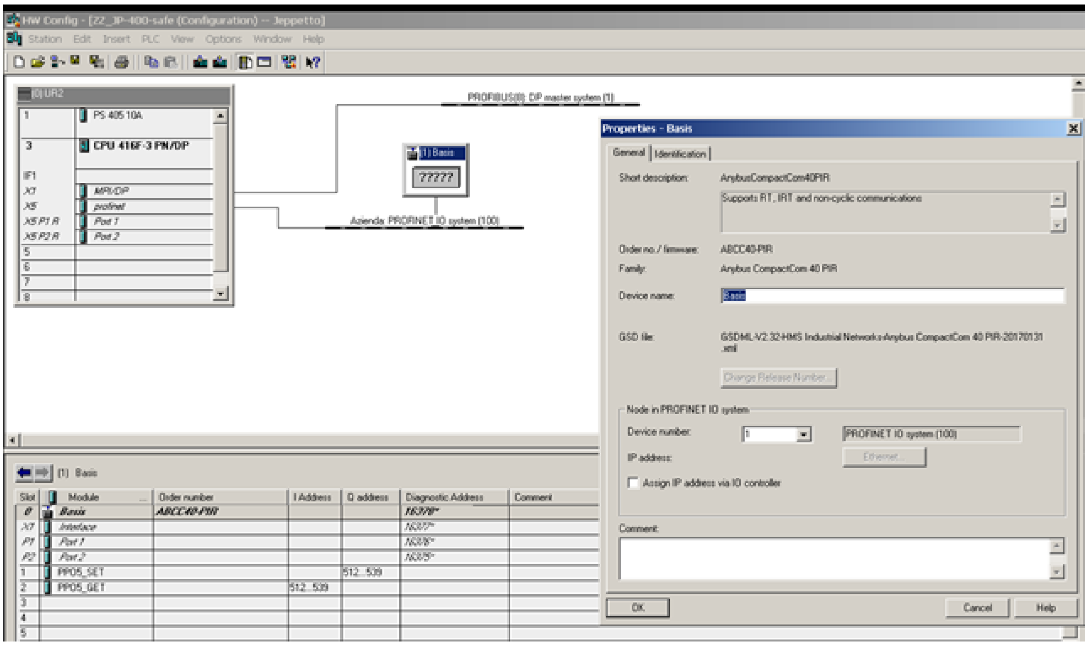
Data types in the messages are divided in two categories;

- parameter data (PKW)
- process data (PZD)

The drive control is able to manage parameter data, PKW, and process data, PZD.

To interface an AD3000 drive on a PROFINET IO network it is necessary to define its configuration as network node, by specifying the information needed by the PLC to exchange data. Instead of a configuration file it is possible to simply configure the exchanged data number and type by using a PLC programming tool.

Here below is a sample screen from tests done with a Siemens PLC.



With other PLCs it is possible to configure the characteristics of a Generic Ethernet Module in a similar mode to interface the AD3000 drive.

6.7 Structure of sent and received messages via PROFINET IO network

The following tables refer to every received or sent message of the AD3000 control depending on the PPO used, the word type and meaning:

RECEIVED MESSAGE STRUCTURE							
Word	Mnemonic	Type and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW - Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Command Word [1]	PZD – Network command Bitword	•	•	•	•	•
6	Speed Reference [2]	PZD – Speed reference	•	•	•	•	•
7	IPZD3	PZD - Configurable meaning		•		•	•
8	IPZD4	PZD - Configurable meaning		•		•	•
9	IPZD5	PZD - Configurable meaning		•		•	•
10	IPZD6	PZD - Configurable meaning		•		•	•
11	IPZD7	PZD - Configurable meaning					•
12	IPZD8	PZD - Configurable meaning					•
13	IPZD9	PZD - Configurable meaning					•
14	IPZD0	PZD - Configurable meaning					•

Table 6.2 – Received message structure

1: The meaning of every bit of command word is reported in paragraph 8..4.1 of the Programming Manual.

2: The speed reference is normalised to ±1 pu, equal to ±16384. 1 pu is the maximum motor speed.

SENT MESSAGE STRUCTURE							
Word	Mnemonic	Type and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW - Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Status Word [3]	PZD – Drive status bitword	•	•	•	•	•
6	Feedback speed [4]	PZD – Speed feedback	•	•	•	•	•
7	OPZD3	PZD - Configurable meaning		•		•	•
8	OPZD4	PZD - Configurable meaning		•		•	•
9	OPZD5	PZD - Configurable meaning		•		•	•
10	OPZD6	PZD - Configurable meaning		•		•	•
11	OPZD7	PZD - Configurable meaning					•
12	OPZD8	PZD - Configurable meaning					•
13	OPZD9	PZD - Configurable meaning					•

Table 6.3 – Sent message structure

3: The meaning of every bit of status word 1 is reported in paragraph 8.4.2 of the Programming Manual.

4: Speed feedback is normalised to ±1 pu equal to ±16384. 1 pu is the maximum motor speed.

The meaning of configurable words, present in both messages, is selected with the parameters described in the next paragraph.

6.8 PROFINET IO configuration parameters

The parameters for communication configuration with the PROFINET IO network belong to the **FIELDBUS [81.00]** family.
The communication is enabled on the PROFINET IO network through the **Fieldbus Sel [81.01]** parameter.
The selection of the structure of the message to be adopted is carried out through the **PPO Type [81.20]** parameter; the possible settings and relevant meanings are contained in the following table:

PPO setting	Meaning
PPO1	PROFINET IO communication enabled with PPO1 type message
PPO2	PROFINET IO communication enabled with PPO2 type message
PPO3	PROFINET IO communication enabled with PPO3 type message
PPO4	PROFINET IO communication enabled with PPO4 type message
PPO5	PROFINET IO communication enabled with PPO5 type message

Table 6.4 – PPO types

Once the message type has been selected, it is necessary to assign to every drive the PROFINET IO address univocally identifying it as a node of the PROFINET IO network; this PROFINET IO address is set using the parameters of the **ETHERNET - TCP/IP [88.00]** family.

6.9 Word setting for received message configuration

Parameters **IPZ03 Sel [81.21], IPZ04 Sel [81.22], IPZ05 Sel [81.23], IPZ06 Sel [81.24], IPZ07 Sel [81.25], IPZ08 Sel [81.26], IPZ09 Sel [81.27], IPZ10 Sel [81.28]** are used to assign the meaning of configurable words of the received message; these words can be used to:

- Receive references;
- Receive commands for the command words;

The values that can be set for such parameters are contained in the following table, with the relevant meaning and resulting typology of received data:

IPZx PARAMETER SETTINGS			
Setting	**Meaning**	**Data type**	**Normalisation**
0	Off, Data not used	--	--
1	Auxiliary speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogue	-32768@ - 2pu; 32767@ 2 pu
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
8	Negative torque limit reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogue	-32768@ - 4pu; 32767@ 4 pu
13	Analogue output 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
65	Process PID Reference 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
66	Process PID Feedback 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
67	Process PID Reference 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
68	Process PID Feedback 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
12	Analogue output 1	Analogue	-32768@ - 2pu; 32767@ 2 pu

Table 6.5 – IPZ code

6.10 Word setting for sent message configuration

Parameters **OPZ03 Sel [81.31], OPZ04 Sel [81.32], OPZ05 Sel [81.33], OPZ06 Sel [81.34], OPZ07 Sel [81.35], OPZ08 Sel [81.36], OPZ09 Sel [81.37] OPZ10 Sel [81.38]** are used to assign the meaning of configurable words of the sent message; these words can be used to:

- Send the signals that can normally be displayed through analogue outputs;
- Send bit significant information for identification of any intervened hardware and/or software protections;
- Send bit significant information concerning Drive status;
- Send bit significant information concerning status of the microprocessor card (BASIS board) digital inputs and outputs;
- Send bit significant information concerning status of the DO expansion digital inputs.

All these parameters can be associated to any process data ID, with the limitation that they shall correspond to the word size. For the data normalisation see paragraph 8.3 of the Programming Manual.

6.11 Management of loss of communication with the PROFINET IO master

In case of loss of communication with the PROFINET IO master, drive control can act with different modes established through the **Timeout [81.03]**, **Freeze En [81.04]** and **Delay Com Restore [81.05]** parameters.

The **Timeout [81.03]** parameter is used to set the waiting time to restore communication with the master; it is possible to set a value between 0.01 s. and 10 s. The default value is 0.01 s.
In case of loss of communication with the master, when the timeout expires an alarm is generated, that behaviour is defined by the **Fieldbus Error [36.49] parameter**; for the management of this alarm refer to paragraph 12.3 of the Programming Manual.

During the waiting time for restoring communication, it is possible to freeze the reference and Command Word 1 received via PROFINET IO using the values received before loss of communication; this can be achieved by setting the **Freeze En [81.04]** parameter to On.
The **Fieldbus Cycle Timeout [81.39]** parameter sets the limit time of communication loss after that the control considers the communication no more active and the freeze is activated, if enabled.
Once the freeze has been enabled, it intervenes based on the status of bit 10 of Command Word 1. If the latter is ON, the Command Word 1 and reference are considered to be valid; if the latter is OFF, the Command Word 1 and reference are not considered to be valid and the valid ones previously stored are used.

6.11.1 Function for commands/references update delay via PROFINET IO in case of serial tear-off

Parameter **Delay Com Restore [81.05]** sets a delay in the command/reference update after restoring communication. During such delay the previously stored commands/references are maintained.

6.12 Command word, status word, alarm word

Command words are used to send commands to the AD3000 drive through the PROFINET IO network; for the meaning of every command word bit see paragraph 8.4.1 of the Programming Manual.
Status words are used by the control to provide information concerning drive status; for the type of information transmitted and the meaning of the relevant logic states see paragraph 8.4.2 of the Programming Manual.
Through the alarm status words the control provides information concerning drive alarm status; for the decoding of the alarm words bits see paragraph 8.4.3 of the Programming Manual.

6.13 Control parameterisation via PROFINET IO

The drive configuration parameter setting can be implemented via PROFINET IO by using the PKW parameterisation data of messages exchanged between master and slave (drive). Such data is used by the PROFINET IO master to transmit or receive slave configuration parameter values; through PKW data the chosen parameterisation is automatically stored.
PKW parameterisation data is supported only with PPO1, PPO2 and PPO5 type messages; each of them has 4 PKW data available both in the message sent by the master to the slave and in the message sent by the slave to the master.

6.13.1 Parameterisation message sent by the master to the slave

Such message consists of 4 words.

Word	Meaning
1st word (PKW1)	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed datum (MSW). Only for operation code 3 and 4.
4th word (PKW4)	Least significant part of the processed datum (LSW). Only for operation code 3 and 4.

Table 6.6 - Structure of PKW message from master to slave

WARNING
To ensure the correct operation of the Drive parameterisation protocol, it is recommended that the master continues to send the message until it receives the reply from the slave. After that, the master can avoid sending the message again.

NOTE

For listed parameters, the parameter value to indicate the selection is given in the relevant parameter tables in Annex A; namely, it is the value appearing to the side of the description of the choice

6.13.2 Parameterisation message sent by the slave to the master

This message consists of 4 words as well.

Word	Meaning
1st word (PKW1)	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1) is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed data (MSW). If the operation requested by the master cannot be admitted (most significant bit of word 1 = 1), the error code is written in this word: - PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4)	Least significant part of the processed datum (LSW).

Table 6.7 - Structure of PKW message from slave to master

7 EtherNet/IP

EtherNet/IP uses the Ethernet network, which means that it is also necessary to configure all the parameters relating to it, as described in the chapter Ethernet network parameter configuration.

7.1 Introduction

EtherNet/IP is a fieldbus communication protocol that adapts the Common Industrial Protocol (CIP) to the Ethernet standard.

The reference standards are:

- IEC 61158: Industrial communication networks – Fieldbus specifications
- IEC 61784-1: Industrial communication networks – Profiles – Part 1: Fieldbus profiles
- IEC 61784-1: Industrial communication networks – Profiles – Part 2: Additional fieldbus profiles for real-time networks based on ISO/IEC 8802-3

All the protocols can be monitored and analyzed by using normal Ethernet analysis tools.

In an EtherNet/IP network the data exchange is managed by a master (SCANNER) that interfaces one or more slaves (ADAPTER).

7.2 Physical interface: GB40A-EtherNet/IP optional board

To use the EtherNet/IP fieldbus it is necessary to install the GB40A-EtherNet/IP optional board described in the paragraph EtherNet/IP communication module (GB40A-EtherNet/IP).

7.3 General characteristics

The table below shows the main features of the AD3000 drive EtherNet/IP interface, available with the GB40A-EtherNet/IP optional board.

Transmission technology	**Ethernet**	Connector	RJ45
		Cable	Cat 5e
		Transmission speed	10, 100 Mbps, 1 Gbps
Communication protocol	EtherNet/IP	Managed PPO	1, 2, 3, 4, 5

Table 7.1 - EtherNet/IP interface main characteristics

For more information about EtherNet/IP see the above mentioned standards.

7.4 Connections

The EtherNet/IP connectors are standard RJ45 connections used for Ethernet communication.
The cables are standard Ethernet cables with features as in the previous table.
The possible topologies, following the EtherNet/IP standards, also include:

- Star topology with Ethernet standard infrastructural devices
- Ring (Device Lele Ring, DLR) with appropriately enabled devices

Compliance with the IEEE Ethernet standard allows the user to select different communication speeds (10, 100 Mbps, 1 Gbps) and also a flexible network architecture, compatible with the commercially available Ethernet options (copper, fiber optics, wireless).

7.5 LED

The communication status is shown by LEDs on the GB40A-EtherNet/IP for the network and module status.
For the LED meaning see the paragraph EtherNet/IP communication module (GB40A-EtherNet/IP).

7.6 Protocol

The AD3000 drive is an adapter (slave) for the EtherNet/IP network, enabled for data exchange functions. The data exchange is implemented using a custom communication profile user configurable.

The message exchanged between the master and the slave can have five structure types, identified with codes: PPO1, PPO2, PPO3, PPO4 and PPO5.

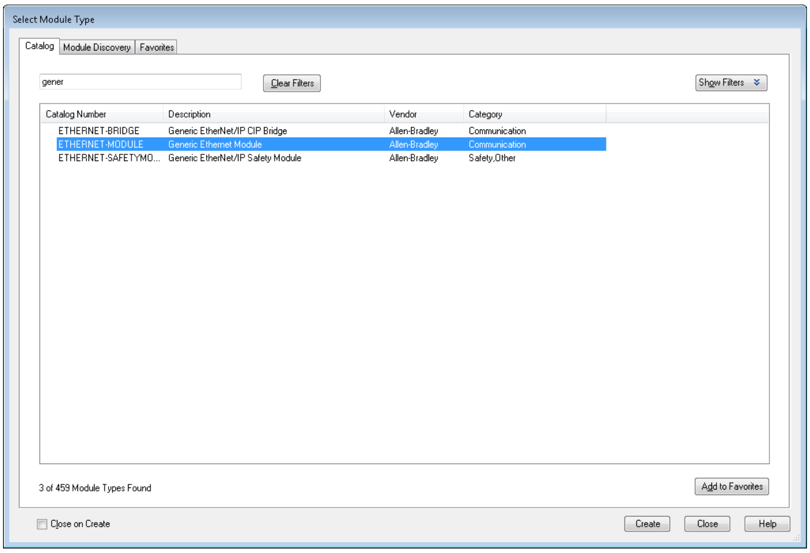
For the received and sent messages from the drive protocol the above codes uniquely define the message size (word number) and the position and type of all message data.

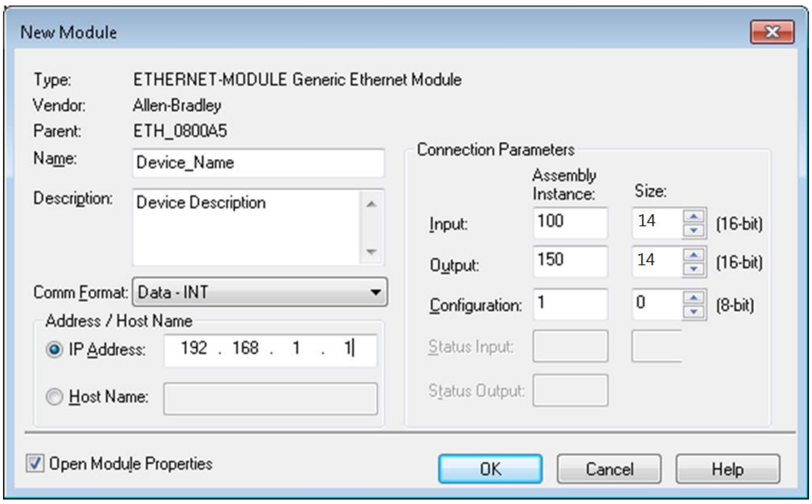
The data types in the messages are divided in two categories:

- parameterisation data (PKW);
- process data (PZD).

To interface an AD3000 drive on an EtherNet/IP network it is necessary to define its configuration as a network node, specifying the information needed by the PLC to exchange data. Instead of a configuration file it is possible to simply configure the exchanged data number and type using a PLC programming tool.

Here below is a sample screen from tests done with an Allen Bradley PLC.





With other PLCs it is possible to configure the characteristics of a Generic Ethernet Module in a similar mode to interface the AD3000 drive.

7.7 Structure of sent and received messages via EtherNet/IP network

The following tables contain the structure of every message sent or received by the AD3000 control, with type and meaning of every word, depending on the PPO used.

RECEIVED MESSAGE STRUCTURE							
Word	Mnemonic	Type and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW – Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Command Word [1]	PZD - Bitword for commands from network	•	•	•	•	•
6	Speed Reference [2]	PZD – Speed reference	•	•	•	•	•
7	IPZD3	PZD – Configurable meaning		•		•	•
8	IPZD4	PZD - Configurable meaning		•		•	•
9	IPZD5	PZD - Configurable meaning		•		•	•
10	IPZD6	PZD - Configurable meaning		•		•	•
11	IPZD7	PZD - Configurable meaning					•
12	IPZD8	PZD - Configurable meaning					•
13	IPZD9	PZD - Configurable meaning					•
14	IPZD0	PZD - Configurable meaning					•

Table 7.2 – Received message structure

1: The meaning of every bit of the command word 1 is in the paragraph 8.4.1 of the Programming Manual.

2: The speed reference is normalised to ±1 pu, equal to ±16384. 1pu is the maximum motor speed.

SENT MESSAGE STRUCTURE							
Word	Mnemonic	Type and meaning	PPO1	PPO2	PPO3	PPO4	PPO5
1	PKW1	PKW - Parameterisation data	•	•			•
2	PKW2	PKW - Parameterisation data	•	•			•
3	PKW3	PKW - Parameterisation data	•	•			•
4	PKW4	PKW - Parameterisation data	•	•			•
5	Status Word [3]	PZD – Drive status bitword	•	•	•	•	•
6	Feedback speed [4]	PZD – Speed feedback	•	•	•	•	•
7	OPZD3	PZD - Configurable meaning		•		•	•
8	OPZD4	PZD - Configurable meaning		•		•	•
9	OPZD5	PZD - Configurable meaning		•		•	•
10	OPZD6	PZD - Configurable meaning		•		•	•
11	OPZD7	PZD - Configurable meaning					•
12	OPZD8	PZD - Configurable meaning					•
13	OPZD9	PZD - Configurable meaning					•

Table 7.3 – Sent message structure

3: The meaning of every bit of the status word 1 is in the paragraph 8.4.2 of the Programming Manual.

4: The speed feedback is normalised to ±1 pu, equal to ±16384. 1pu is the maximum motor speed.

The meaning of the configurable words in both messages is selected with the parameters in the following paragraph.

7.8 EtherNet/IP configuration parameters

The parameters for EtherNet/IP communication configuration are in the **FIELDBUS [81.00]** family.
The EtherNet/IP network communication is enabled by the **Fieldbus Sel [81.01]** parameter.
Parameter **PPO Type [81.20]** selects the message structure; possible selections and meanings are in the following table.

PPO selection	meaning
PPO1	EtherNet/IP communication enabled with message type PPO1
PPO2	EtherNet/IP communication enabled with message type PPO2
PPO3	EtherNet/IP communication enabled with message type PPO3
PPO4	EtherNet/IP communication enabled with message type PPO4
PPO5	EtherNet/IP communication enabled with message type PPO5

Table 7.4 – PPO types

After selecting the type of message, it is necessary to assign the EtherNet/IP address for every drive to identify it uniquely as an EtherNet/IP network node; this EtherNet/IP address is set by using the parameters of the **ETHERNET - TCP/IP [88.00]** family.

7.9 Words configuration setting to configure received message

The parameters **IPZ03 Sel [81.21], IPZ04 Sel [81.22], IPZ05 Sel [81.23], IPZ06 Sel [81.24], IPZ07 Sel [81.25], IPZ08 Sel [81.26], IPZ09 Sel [81.27], IPZ10 Sel [81.28]** assign the meaning to the configurable words of the received message; these words can be used to:

- Receive references;
- Receive commands for command word.

The possible values for the parameters are reported in the following table, with the received data meaning and type.

PARAMETERS IPZx SETTINGS			
Setting	**Meaning**	**Data type**	**Normalisation**
0	Off, not used	--	--
1	Auxiliary speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
2	Additional speed reference	Analogue	-32768@ - 2pu; 32767@ 2 pu
3	Speed feedforward	Analogue	-32768@ - 2pu; 32767@ 2 pu
4	Command word 2	Bit significant	--
5	Command word 3	Bit significant	--
6	Command word 4	Bit significant	--
7	Positive torque reference limit	Analogue	-32768@ - 4pu; 32767@ 4 pu
8	negative torque reference limit	Analogue	-32768@ - 4pu; 32767@ 4 pu
9	Torque reference	Analogue	-32768@ - 4pu; 32767@ 4 pu
21	Torque feedforward	Analogue	-32768@ - 4pu; 32767@ 4 pu
13	Analogue output 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
65	Process PID reference 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
66	Process PID Feedback 1	Analogue	-32768@ - 2pu; 32767@ 2 pu
67	Process PID reference 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
68	Process PID Feedback 2	Analogue	-32768@ - 2pu; 32767@ 2 pu
12	Analogue output 1	Analogue	-32768@ - 2pu; 32767@ 2 pu

Table 7.5 – IPZ code

7.10 Words configuration setting to configure sent message

The parameters **OPZ03 Sel [81.31], OPZ04 Sel [81.32], OPZ05 Sel [81.33], OPZ06 Sel [81.34], OPZ07 Sel [81.35], OPZ08 Sel [81.36], OPZ09 Sel [81.37] OPZ10 Sel [81.38]** assign the meaning to the configurable words of the sent message; these words can be used to:

- Send signals that normally can be visualised via analogue outputs;
- Send bit significant information to identify tripped hardware and/or software protections;
- Send bit significant information about the drive status;
- Send bit significant information about the microprocessor board digital I/O;
- Send bit significant information about the DO expansion board digital inputs.

Each one of these parameters can be associated to any data process ID, with the limitation that they must correspond to the word size. For the data normalisation see paragraph 8.3 of the Programming Manual.

7.11 EtherNet/IP master communication loss management

In case of loss of communication with the EtherNet/IP master, the drive control can operate with different modes established through the **Timeout [81.03]**, **Freeze En [81.04]** and **Delay Com Restore [81.05]** parameters.

The **Timeout [81.03]** parameter is used to set the waiting time to restore communication with the master; it is possible to set a value between 0.01 s. and 10 s. The default value is 0.01 s.
In case of loss of communication with the master, when the timeout expires an alarm is generated and the alarm behaviour is defined by the **Fieldbus Error [36.49]** parameter; for the management of this alarm refer to paragraph 12.3 of the Programming Manual.

During the waiting time for restoring communication, it is possible to freeze the reference and Command Word 1 received via EtherNet/IP by using the values received before the loss of communication; this can be achieved by setting the **Freeze En [81.04]** parameter to On.
The **Fieldbus Cycle Timeout [81.39]** parameter sets the limit time of communication loss after which the control considers the communication no more active and the freeze is activated, if enabled.
Once the freeze has been enabled, it intervenes based on the status of bit 10 of Command Word 1. If the latter is ON, the Command Word 1 and reference are considered to be valid; if the latter is OFF, the Command Word 1 and reference are not considered to be valid and the valid ones previously stored are used.

7.11.1 Function for commands/references update delay via EtherNet/IP in case of serial tear-off

The **Delay Com Restore [81.05] parameter** sets a delay in command/reference update after restoring communication. During such delay the previously stored commands/references are maintained.

7.12 Command word, status word, alarm word

Command words are used to send commands to the AD3000 drive through the EtherNet/IP network; for the meaning of each command word bit see paragraph 8.4.1 of the Programming Manual.
Status words are used by the control to provide information concerning the drive status; for the type of information transmitted and the meaning of the relevant logic states see paragraph 8.4.2 of the Programming Manual.
Through the alarm status words the control provides information concerning drive alarm status; for the decoding of the alarm words bits see paragraph 8.4.3 of the Programming Manual.

7.13 Control parameterisation via EtherNet/IP

The drive configuration parameter setting can be implemented via EtherNet/IP using the PKW parameterisation data of messages exchanged between master and slave (drive). Such data is used by the EtherNet/IP master to transmit or receive slave configuration parameter values; through PKW data the chosen parameterisation is automatically stored.
PKW parameterisation data is supported only with PPO1, PPO2 and PPO5 type messages; each one of them has 4 PKW data available both in the message sent by the master to the slave and in the message sent by the slave to the master.

7.13.1 Parameterisation message sent by the master to the slave

Such message consists of 4 words.

Word	Meaning
1st word (PKW1)	Type of operation code: - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed datum (MSW). Only for operation code 3 and 4.
4th word (PKW4)	Least significant part of the processed datum (LSW). Only for operation code 3 and 4.

Table 7.6 - Structure of PKW message from master to slave

WARNING

To ensure correct of the Drive parameterisation protocol, it is recommended that the master continues to send the message until it receives the reply from the slave. After that, the master can avoid sending the message again.

NOTE

For listed parameters, the parameter value to indicate the choice is given in the relevant parameter tables in Annex A; namely, it is the value appearing to the side of the description of the choice

7.13.2 Parameterisation message sent by the slave to the master

This message consists of 4 words as well.

Word	Meaning
1st word (PKW1)	Type of operation code: If the operation requested by the master cannot be admitted, the most significant bit of word 1 (PKW1) is set to 1. The error code is written on word 3 (PKW3) - PKW1 = 1 Reading of required value parameter in 32 bit integer format - PKW1 = 2 Reading of required value parameter in 32 bit float format - PKW1 = 3 Writing of required value parameter in 32 bit integer format - PKW1 = 4 Writing of required value parameter in 32 bit float format
2nd word (PKW2)	Parameter ID of the configuration datum on which to perform the operation defined by the PKW1 word.
3rd word (PKW3)	Most significant part of the processed data (MSW). If the operation requested by the master cannot be admitted (most significant bit of word 1 = 1), the error code is written in this word: - PKW3 = 2: Non-existent parameter - PKW3 = 3: Non-existent operation code - PKW3 = 4: Non-writable parameter - PKW3 = 7: Writing attempt of single value on buffer parameter - PKW3 = 10: Value out of range
4th word (PKW4)	Least significant part of the processed datum (LSW).

Table 7.7 - Structure of PKW message from slave to master

ANNEX A PARAMETERS LIST

This annex describes the necessary parameters to use and set the optional fieldbus boards.

Because fieldbus protocols Modbus TCP, PROFINET IO and EtherNet/IP use the Ethernet network as a physical medium, it is necessary to configure the Ethernet TCP/IP parameters (**ETHERNET – TCP/IP [88.00] family**): IP address, Mask and Gateway.

For the PROFIBUS DP, PROFINET IO and EtherNet/IP fieldbus protocols, the parameters are common and are reported in the **FIELDBUS [81.00]** family.

In the case of the Modbus TCP protocol, a configuration parameter of the **MODBUS [82.00]** family enables Modbus TCP; some parameters of Modbus protocol are not reported in the following table because they refer only to Modbus RTU protocol; for this reason, due to the fact that Modbus RTU is a standard feature on AD3000 drive, dedicated parameters are reported only in the Programming Manual.

MODBUS

82 - Modbus								
Id	**Name**	**Description**	**Unit**	**Range**	**Access Type**	**Control Type**	**Visibility Level**	**Download**
82.01	Modbus En	Modbus enable - Off [0] - RTU [1] - TCP [2] - RTU & TCP [3]	#	Def: Off	Read and Write	All	2	Yes
82.02	Slave Address	Slave address	#	Min: 1 Def: 3 Max: 247	Read and Write	All	2	Yes
82.05	Timeout	Timeout for alarm 53 (0 = disabled)	s	Min: 0 Def: 3 Max: 250	Read and Write	All	2	Yes
82.07	Mod Exchange Area In	Selection of input auxiliary exchange area (from Modbus to Drive) - Off [0] - 1 Data Exchange Area [1] - 2 Data Exchange Area [2]	#	Def: Off	Read and Write	All	2	Yes

FIELDBUS

81 - FIELDBUS								
Id	**Name**	**Description**	**Unit**	**Range**	**Access Type**	**Control type**	**Visibility Level**	**Download**
81.01	Fieldbus Sel	Fieldbus selection - Off [0] - PROFIBUS DP [1] - PROFINET IO [2] - EtherNet/IP [3]	#	Def: Off	Read and Write	All	2	Yes
81.02	Slave Address	Slave address	#	Min: 3 Def: 3 Max: 127	Read and Write	All	2	Yes
81.03	Timeout	Timeout	s	Min: 0.01 Def: 0.01 Max: 10	Read and Write	All	2	Yes
81.04	Freeze En	Enable freeze of Speed Ref/Cmd Wd - Off [0] - On [1]	#	Def: Off	Read and Write	All	2	Yes
81.05	Delay Com Restore	Delay when communication is resumed	s	Min: 0 Def: 0 Max: 10	Read and Write	All	2	Yes
81.20	PPO Type	Selection of PPO type - PPO1 [1] - PPO2 [2] - PPO3 [3] - PPO4 [4] - PPO5 [5]	#	Def: PPO5	Read and Write	All	2	Yes
81.21	IPZ03 Sel	IPZ03 selection - Off [0] - Aux Spd Ref [1] - Add Spd Ref [2] - Spd Ffw [3] - Cmd Wd 2 [4] - Cmd Wd 3 [5] - Cmd Wd 4 [6] - Trq Lim Ref Pos [7] - Trq Lim Ref Neg [8] - Trq Ref [9] - Trq Ffw [21] - PrsPID Ref1 [65] - PrsPID Fdb1 [66] - PrsPID Ref2 [67] - PrsPID Fdb2 [68]	#	Def: Off	Read and Write	All	2	Yes
81.22	IPZ04 Sel	IPZ04 selection	#	Def: Off	Read and Write	All	2	Yes
81.23	IPZ05 Sel	IPZ05 selection	#	Def: Off	Read and Write	All	2	Yes

81.24	IPZ06 Sel	IPZ06 selection	#	Def: Off	Read and Write	All	2	Yes
81.25	IPZ07 Sel	IPZ07 selection	#	Def: Off	Read and Write	All	2	Yes
81.26	IPZ08 Sel	IPZ08 selection	#	Def: Off	Read and Write	All	2	Yes
81.27	IPZ09 Sel	IPZ09 selection	#	Def: Off	Read and Write	All	2	Yes
81.28	IPZ10 Sel	IPZ10 selection	#	Def: Off	Read and Write	All	2	Yes
81.31	OPZ03 Sel	OPZ03 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.32	OPZ04 Sel	OPZ04 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.33	OPZ05 Sel	OPZ05 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.34	OPZ06 Sel	OPZ06 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.35	OPZ07 Sel	OPZ07 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.36	OPZ08 Sel	OPZ08 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.37	OPZ09 Sel	OPZ09 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.38	OPZ10 Sel	OPZ10 selection	#	Min: 0 Def: 0 Max: 9999	Read and Write	All	2	Yes
81.39	Fieldbus Cycle Timeout	Fieldbus communication cycle timeout to start freeze	s	Min: 0.01 Def: 0.01 Max: 10	Read and Write	All	2	Yes
81.40	Fieldbus Cycle	Fieldbus communication cycle (Not used for PROFIBUS DP) - 1 ms [1] - 5 ms [5]	#	Def: 5 ms	Read and Write	All	2	Yes

ETHERNET - TCP/IP

88 - ETHERNET - TCP/IP								
Id	Name	Description	Unit	Range	Access Type	Control Type	Visibility Level	Download
88.01	IP Address	IP address	#	Min: 0 Def: 192.168.1.1 Max: 20	Write at Stop Only	All	1	Yes
88.02	Subnet Mask	Subnet mask	#	Min: 0 Def: 255.255.255.0 Max: 20	Write at Stop Only	All	1	Yes
88.03	Default Gateway	Default Gateway	#	Min: 0 Def: 0.0.0.0 Max: 20	Write at Stop Only	All	2	Yes
88.11	IP Address-Octet1	IP address - Octet 1	#	Min: 0 Def: 192 Max: 255	Write at Stop Only	All	2	Yes
88.12	IP Address-Octet2	IP address - Octet 2	#	Min: 0 Def: 168 Max: 255	Write at Stop Only	All	2	Yes
88.13	IP Address-Octet3	IP address - Octet 3	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes
88.14	IP Address-Octet4	IP address - Octet 4	#	Min: 0 Def: 1 Max: 255	Write at Stop Only	All	2	Yes
88.15	Subnet mask-Octet1	Subnet mask - Octet 1	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.16	Subnet mask-Octet2	Subnet mask - Octet 2	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.17	Subnet mask-Octet3	Subnet mask - Octet 3	#	Min: 0 Def: 255 Max: 255	Write at Stop Only	All	2	Yes
88.18	Subnet mask-Octet4	Subnet mask - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.20	Host Name	Host Name	#	Min: 0 Def: Drive Max: 16	Read and Write	All	2	Yes
88.21	Default Gateway-Octet1	Default Gateway - Octet 1	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.22	Default Gateway-Octet2	Default Gateway - Octet 2	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.23	Default Gateway-Octet3	Default Gateway - Octet 3	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
88.24	Default Gateway-Octet4	Default Gateway - Octet 4	#	Min: 0 Def: 0 Max: 255	Write at Stop Only	All	2	Yes
99.17	MAC Address	MAC address	#	Min: 0 Def: 0 Max: 17	Read Only	All	2	No