STÖBER

PROFINET

Operation manual

Installation

Set up

Commissioning

V 5.6-H or later

09/2013 en

STÖBER

Table of contents

1 Introduction

PROFINET® is an open industrial Ethernet standard that is supported by the PNO and PI organization. PROFINET® is a consistent further development of the well-known PROFIBUS standard and provides considerably higher performance and additional functions that were not possible with PROFIBUS. PROFINET® is available in the form of PROFINET CBA and PROFINET IO. Nowadays the CBA version is no longer relevant while PROFINET IO the logical further development of PROFIBUS.

Note that the PN 5000 accessory can be used for the following inverters:

Inverter	SDS 5000	SDS 5000A	MDS 5000	MDS 5000A	FDS 5000	FDS 5000A
HW status of the inverter	up to 190	start from 200	up to 190	start from 200	up to 190	start from 200
Compatibility with PN 5000	Yes	Yes	No	Yes	No	Yes

1.1 Purpose of the manual

This manual has information on the connection of the 5th generation of STÖBER inverters to PROFINET®. In addition, the structure of PROFINET® and the main procedures are explained.

1.2 Readers

This manual is intended for users who are familiar with setting up PROFINET® and who have knowledge about commissioning the inverter systems.

1.3 Other manuals

The documentation of the MDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442297	V 5.6-H
Projecting manual	Installation and connection	442273	V 5.6-H
Operating manual	Set up the inverter	442285	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

The documentation of the FDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442293	V 5.6-H
Projecting manual	Installation and connection	442269	V 5.6-H
Operating manual	Set up the inverter	442281	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

The documentation of the SDS 5000 includes the following manuals:

Manual	Contents	ID	Latest version[a)]
Commissioning Instructions	Reinstallation, replacement, function test	442301	V 5.6-H
Projecting manual	Installation and connection	442277	V 5.6-H
Operating manual	Set up the inverter	442289	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

You can find information on the POSITool software in the following manuals:

Manual	Contents	ID	Latest version[a)]
POSITool operating manual	Information on the basic functions of POSITool	442233	V 5.6-H
Programming manual	Information on programming with POSITool	441693	V 5.6-H

a) At the time of publication. You can find all versions at www.stoeber.de > Products > Doc Center.

Note that the programming functionality of POSITool can only be used after training by STÖBER ANTRIEBSTECHNIK. You can find information on training at www. stoeber.de

1.4 Further support

If you have technical questions that are not answered by this document, please contact:

- Phone: +49 7231 582-3060
- E-mail: applications@stoeber.de

If you have questions about the documentation, please contact:

- E-mail: electronics@stoeber.de

If you have questions about training sessions, please contact:

- E-mail: training@stoeber.de

2 Notes on Safety

The devices may cause risks. For these reasons, comply with the following:

- The safety notes listed in the following sections and points
- The technical rules and regulations.

In addition, always read the appropriate documentation. STÖBER ANTRIEBSTECHNIK GmbH + Co. KG accepts no liability for damages caused by non-adherence to the instructions or applicable regulations. Subject to technical changes to improve the devices without prior notice. This documentation is purely a product description. It does not represent promised properties in the sense of warranty law.

2.1 Component part of the product

The technical documentation is a component part of a product.

- Since the technical documentation contains important information, always keep it handy in the vicinity of the device until the machine is disposed of.
- If the product is sold, disposed of, or rented out, always include the technical documentation with the product.

2.2 Operation in accordance with its intended use

The PN 5000 accessory is only intended for establishing communication between devices from the 5th generation of STÖBER inverters and a PROFINET® network.
Improper use includes integration in other communication networks.

2.3 Qualified personnel

Since the devices may harbor residual risks, all configuration, transportation, installation and commissioning tasks including operation and disposal may only be performed by trained personnel who are aware of the possible risks. Personnel must have the qualifications required for the job. The following table lists examples of occupational qualifications for the jobs:

Activity	Possible occupational qualifications
Transportation and storage	Worker skilled in storage logistics or comparable training
Configuration	- Graduate engineer (electro-technology or electrical power technology) - Technician (m/f) (electro-technology)
Installation and connection	Electronics technician (m/f)
Commissioning (of a standard application)	- Technician (m/f) (electro-technology) - Master electro technician (m/f)
Programming	Graduate engineer (electro-technology or electrical power technology)
Operation	- Technician (m/f) (electro-technology) - Master electro technician (m/f)
Disposal	Electronics technician (m/f)

Tab. 2-1: examples of occupational qualifications

In addition, the valid regulations, the legal requirements, the reference books, this technical documentation and, in particular, the safety information contained therein must be carefully

- read
- understood and
- complied with

2.4 Transportation and storage

Inspect the delivery for any transport damage immediately after you receive it. Notify any damage to the transport company immediately. Do not operate the product if damaged. Store the device in a dry and dust-free room if you do not install it immediately

2.5 Installation and connection

The accessory installation instructions allow the following actions during the installation of accessories:

- The housing in the upper slot can be opened.

Opening the housing in another place or for other purposes is not permitted.

Installation and connection work are only permitted after the device has been isolated from the power!

Apply the 5 safety rules in the order stated before performing any work on the machine:

1. Enable. Also enable the auxiliary circuits.
2. Secure against restart.
3. Check that voltage is not present.
4. Earth and short circuit.
5. Cover adjacent live parts.

Information
Note that the discharge time of the DC link capacitors is 5 minutes. You can only determine the absence of voltage after this time period.

Afterwards you can carry out the work.

2.6 Service

Repairs must only be performed by STÖBER ANTRIEBSTECHNIK GmbH + Co. KG. Send faulty devices with a fault description to:
STÖBER ANTRIEBSTECHNIK GmbH + Co. KG
Abteilung VS-EL
Kieselbronner Str.12
75177 Pforzheim, Germany
GERMANY

2.7 Disposal

Please comply with the latest national and regional regulations! Dispose of the individual parts separately depending on their nature and currently valid regulations such as, for example:

- Electronic scrap (PCBs)
- Plastic
- Sheet metal
- Copper
- Aluminum

2.8 Presentation of notes on safety

NOTICE

Notice

means that property damage may occur

▶ if the stated precautionary measures are not taken.

⚠ CAUTION!

Caution

with warning triangle means that minor injury may occur

▶ if the stated precautionary measures are not taken.

⚠ WARNING!

Warning

means that there may be a serious danger of death

▶ if the stated precautionary measures are not taken.

⚠ DANGER!

Danger

means that serious danger of death exists

▶ if the stated precautionary measures are not taken.

Information
indicates important information about the product or a highlighted portion of the documentation which requires special attention.

3 Electrical installation

3.1 Terminal description

X200 and X201 terminal description
The terminal configuration is determined by T 568-B.

Pin		Designation	Function
	1	TxData +	PROFINET® communication
	2	TxData -	
	3	RecvData +	
	4	nc	Connect via RC-link with housing
	5	nc	
	6	RecvData -	PROFINET® communication
	7	nc	Connect via RC-link with housing
	8	nc	

3.2 Cable specification

Observe the PROFINET installation guideline for the cable specification (PROFINET Order No. 8.071, identification: TC2-08-0001); you can obtain the document at www.profibus.com.

3.3 Topology

Note that the devices from the 5th generation of STÖBER inverters can be integrated in bus and star topologies.

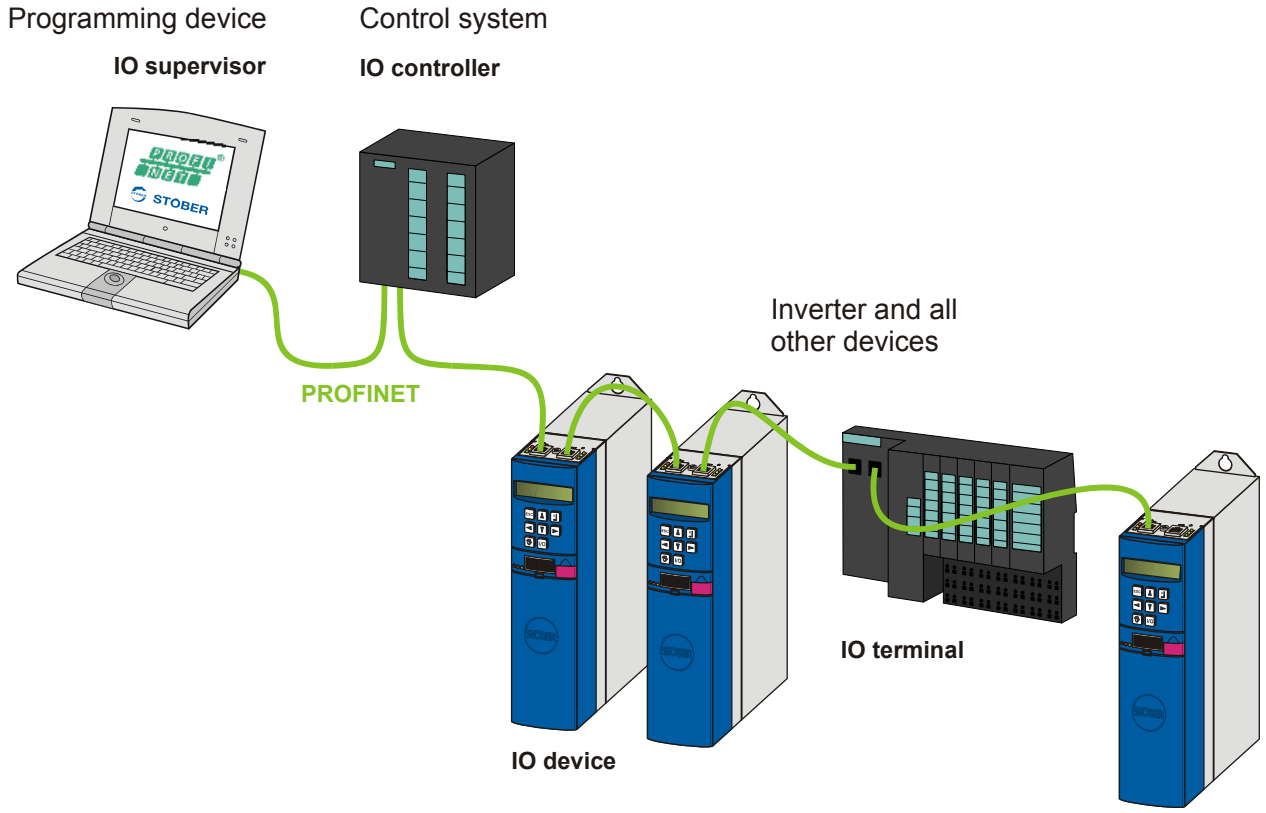


Fig. 3-1 PROFINET network with bus topology

Note that the inverter cannot be integrated in ring topologies.

4 Installation

Note that the PN 5000 accessory can be used for the following inverters:

Inverter	SDS 5000	SDS 5000A	MDS 5000	MDS 5000A	FDS 5000	FDS 5000A
HW status of the inverter	up to 190	start from 200	up to 190	start from 200	up to 190	start from 200
Compatibility with PN 5000	Yes	Yes	No	Yes	No	Yes

4.1 Install in MDS 5000 or SDS 5000

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

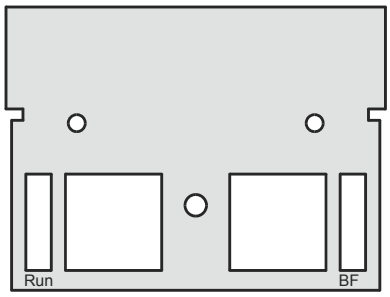
- ▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).
- ▶ Do not touch the contact surfaces.

To connect PROFINET®, you need the following accessory. The accessory is installed above the inverter display:

- PROFINET®: PN 5000

For installation you need:

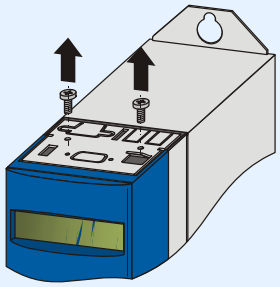
- A Torx screwdriver TX10; a Phillips screwdriver
- The cover plate shown below that is included with the accessory:



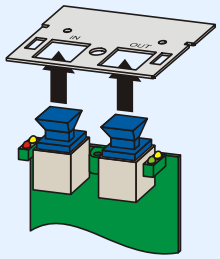
- The screw with the detent edge disk that is included with the accessory.

Installing the PN 5000 in a MDS 5000 or SDS 5000

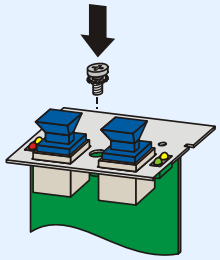
1. Undo the fastening screws and take off the cover plate:



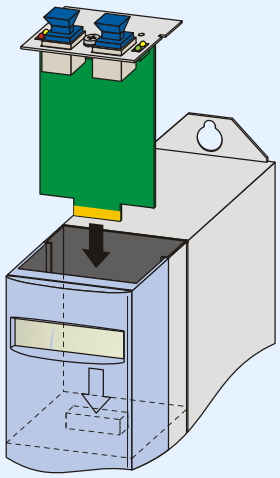
2. Guide the RJ45 connector of the circuit board from below through the plate that is included with the accessory:



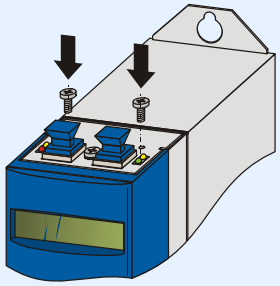
3. Fasten the plate on the circuit board with the screw with the detent edge disk that is included:



4. Guide the option board in the inverter so that the gold contacts are pushed in the black terminal block:



5. Fasten the plate to the inverter with the fastening screws:



⇨ You have now installed the accessory.

4.2 Installation in the FDS 5000

⚠ CAUTION!

Danger of property damage due to electrostatic discharge, among others!

▶ Provide suitable protective measures while handling open PCBs (e.g., ESD clothing, environment free of dirt and grease).

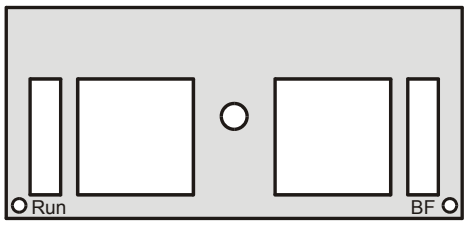
▶ Do not touch the contact surfaces.

To connect PROFINET®, you need the following accessory. The accessory is installed above the inverter display:

- PROFINET®: PN 5000

For installation you need:

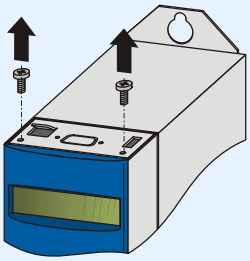
- A Torx screwdriver TX10; a Phillips screwdriver
- The cover plate shown below that is included with the accessory:



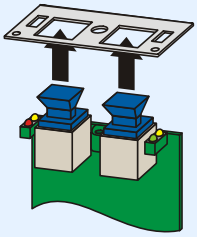
- The screw with the detent edge disk that is included with the accessory.

Installing the PN 5000 in a FDS 5000

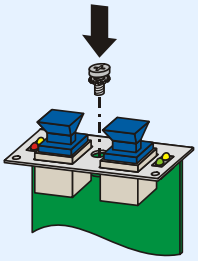
1. Undo the fastening screws and take off the cover plate:



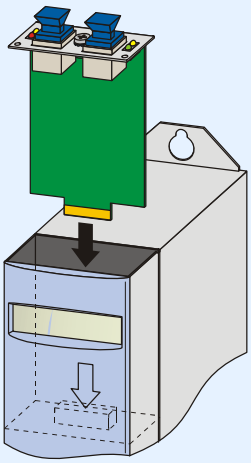
2. Guide the RJ45 connector of the circuit board from below through the plate that is included with the accessory:



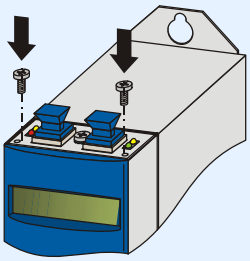
3. Fasten the plate on the circuit board with the screw with the detent edge disk that is included:



4. Guide the option board in the inverter so that the gold contacts are pushed in the black terminal block:



5. Fasten the plate to the inverter with the fastening screws:



⇨ You have now installed the accessory.

5 Commissioning

5.1 POSITool

5.1.1 Device controller

In order for the inverter to be able to communicate via a PROFINET network, a suitable device controller must be configured in POSITool. To do this, select either *26:PROFINET* or *27:DSP402 PROFINET* in the configuration assistant, step 4. For the *26:PROFINET* device controller, the standard device state machine is used. For the *27:DSP402 PROFINET* a state machine as per DSP 402 is used. You can find information on the device state machines in the operating manuals of the inverter (see section 1.3 Other manuals). STÖBER ANTRIEBSTECHNIK GmbH & CO. KG recommends using the *26:PROFINET*device controller.

5.1.2 Device Name

The device name is of central importance for addressing in PROFINET®. It replaces the bus address known from PROFIBUS and must be entered individually for every inverter in the parameter *A273*. Note that each device name in a PROFINET® network may only be assigned once.

Note the following conventions when defining device names:
- The device name is a text with a maximum of 80 characters.
- A component of the name can have a maximum of 63 characters. A component of the name is a character string between two periods.
- The device name must not start with the character "-" (hyphen) or "." (period).
- The device name must not start with numerals.
- The device name must not be formulated as n.n.n.n (n = 0...999).
- The device name must not start with the character sequence "port-xyz-" (x, y, z = 0...9).
- An underscore is a character that is not permitted.

The following requirements apply:
- Your POSITool project uses a device controller for PROFINET (see section5.1.1 Device controller).

Activating a device name

1. Open the PROFINET assistant in the inverter view (Global/Assistant/ PROFINET).

2. Enter the individual device names of the inverter in the assistant on the General page in parameter *A273*. When doing this, observe the conventions for assigning an address.
3. Transfer your project to the inverter.
4. Perform the *Save A00 values* action.
5. Switch the inverter off and back on again.

⇨ The device name is active when the system boots up.

5.1.3 Parameterization of Process Data

Incorporate the parameters the are to be transferred via the process data channel in POSITool in the parameters

- *A90.x* and *A91.x* (Setpoint Mapping, receiving direction as viewed by the inverter) and
- *A94.x* and *A95.x* (Actual Value Mapping, transmitting direction as viewed by the inverter)

You can access the parameters in the parameter list or on the relevant pages of the PROFINET assistant.

5.2 STEP7

5.2.1 Device description file

You must import the device description file so that the inverter from the 5th generation of STÖBER inverters is detected by the software STEP7.
You can find the file with a corresponding zipped Bitmap file at www.stoeber.de > Welcome > Products > Doc Center > electronic > 5th generation of Stober inverters > software.
The device description file in XML format is named as follows:
GSDML-V2.2-STOEBER-5th-Generation-yyyymmdd.xml,
where:

- yyyy: year, e.g. 2011
- mm: month, e.g. 04 for April
- dd: day, e.g. 21.

5.2.2 IP adress and subnet mask

Only the device name is significant for addressing the devices in the PROFINET network. If the device name is known to the PROFINET IO, it automatically assigns an IP address, subnet mask and gateway, sends it to the inverter and then activates the *Save A00 values* action. The values are entered in the *A274 PN IP address*, *A275 PN subnet mask* and *A276 PN gateway* parameters.
Note that these values cannot be assigned by you or a DHCP server.

Information
Note that this mechanism only functions if the *Assign IP address by IO controller* checkbox is active in the properties of the IO device (inverter). You can find the checkbox in the properties dialog of the IO device in the PROFINET configuration tool *HW config*.

5.2.3 Modules and submodules

The combination of module and submodule in PROFINET determines the extent to which data is transferred and whether you want to execute parameter communication as well as process data.
When configuring in the PROFINET IO supervisor, you have to select one of the following combinations of module and submodule and assign the inverter as an IO device.
Note that each module is precisely assigned a submodule for the 5th generation of STÖBER inverters.

For an explanation of terms such as IO supervisor, read section 3.3 Topology.

Designation	Module ID	Submodule ID	Input data length [byte]	Output data length [byte]	Description
M101 02W PZD all cons.	101	101	4	4	Process data: 2 words (inputs and outputs), all consistent
M102 04W PZD all cons.	102	102	8	8	Process data: 4 words (inputs and outputs), all consistent
M103 06W PZD all cons.	103	103	12	12	Process data: 6 words (inputs and outputs), all consistent
M104 12W PZD all cons.	104	104	24	24	Process data: 12 words (inputs and outputs), all consistent
M105 18W PZD all cons.	105	105	36	36	Process data: 18 words (inputs and outputs), all consistent
M106 24W PZD all cons.	106	106	48	48	Process data: 24 words (inputs and outputs), all consistent
M111 02W PZD item cons.	111	111	4	4	Process data: 2 words (inputs and outputs), items consistent
M112 04W PZD item cons.	112	112	8	8	Process data: 4 words (inputs and outputs), items consistent
M113 06W PZD item cons.	113	113	12	12	Process data: 6 words (inputs and outputs), items consistent
M114 12W PZD item cons.	114	114	24	24	Process data: 12 words (inputs and outputs), items consistent

Designation	Module ID	Submodule ID	Input data length [byte]	Output data length [byte]	Description
M115 18W PZD item cons.	115	115	36	36	Process data: 18 words (inputs and outputs), items consistent
M116 24W PZD item cons.	116	116	48	48	Process data: 24 words (inputs and outputs), items consistent
M121 PKW+02W PZD a con.	121	121	12	12	Parameter: 4 words + process data: 2 words (inputs and outputs), all consistent
M122 PKW+08W PZD a con.	122	122	24	24	Parameter: 4 words + process data: 8 words (inputs and outputs), all consistent
M123 PKW+14W PZD a con.	123	123	36	36	Parameter: 4 words + process data: 14 words (inputs and outputs), all consistent
M124 PKW+20W PZD a con.	124	124	48	48	Parameter: 4 words + process data: 20 words (inputs and outputs), all consistent

Note that the first 4 words of the address space are used for PKW0 for modules 121, 122, 123 and 124. The address space for the process data starts afterwards.

"All consistent" means that the process data packet can only be processed when the entire packet has been received. "Items consistent" means that individual parameters from the packet are processed when the parameter has been completely received.

6 Parameter communication

6.1 PKW0

If PPO type 1 or 2 is selected when configuring PROFINET®, the parameter identification value (PKW0) mechanism defined in PROFIDRIVE is available for parameter communication. However, not all parameters, displays and actions of the inverter can be accessed. Parameters with a number greater than 255, a length greater than 32 bit (text parameter) or indexed parameters with a an index greater than 19 are excluded. Axles 3 and 4 can only be accessed when *A11.1* = *2* is set.

In PROFIdrive profile version 2, 11 bits are made available for a parameter number. This limits the available address space. Fourth and fifth generation inverters from STÖBER Antriebstechnik map their parameters in the PNU range between 1000_{dec} to 1999_{dec}. The entire spectrum of the parameters with different data types available today cannot be mapped. The definition of the parameter number and subindex for access via PROFINET® can be formed from the coordinate of the respective parameter in the menu. The following principles apply:

PNU_{dec}	=	1000 + 20 * no. of the character of the menu coordinate + 500 for axle 2 or 4 (see following information) + 1 * index
$Subindex_{dec}$	=	Numerical value of the menu coordinate

The characters of the menu coordinates apply for the following numbers:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

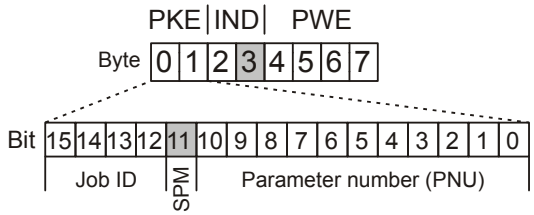
Information
The axle is selected with *A11.1* as follows.
A11.1 = 0 Axle 1 or 2 depending on PNU
A11.1 = 2 Axle 3 or 4 depending on PNU
A11.1 itself can be accessed via:
PNU_{dec} = 1000 + 20 * 0 + 1 = 1001
Subindex = 11

There are parameters from groups B.. to G.. once in axle 1 and once again in axle 2. There is only one coordinate for this in the menu. For access via PROFINET®, the parameter numbers for the parameters from axle 1 were selected between 1000 and 1499 and for axle 2 from 1500.

The bits for the parameter number, task identification and response identification are arranged within the two byte parameter identification. The SPM bit for spontaneous signal processing is not supported. The IO controller sends the task identification, parameter number, subindex and, when writing, the new value to the inverter. The inverter then responds with the response identification, parameter number, subindex and, when reading, the current value. All values are represented as a double word (4 bytes). As a result, it is no longer necessary for the master to know and distinguish the data size of the byte, word and double word. The task identification is used to differentiate between reset, write and read tasks. The IO controller must at least repeat the same task until the corresponding response from the IO device arrives.

For an explanation of terms such as IO controller and IO device, refer to section 3.3 Topology.

Bytes for parameter ID (PKW)



PKE : Parameter ID
IND : Subindex in byte 2. Byte 3 is reserved
PWE : Parameter value

Fig. 6-1 Structure of task identification and PNU

Task identification	Meaning
0	No task (reset task)
1	Request parameter value (read)
3	Change parameter value (write)
Rest	Do not use!

The devices of the 5th generation of STÖBER inverters respond to the same bit position with the response identification. The response identification remains unaltered until the current task has been completely processed. The task identification must be kept constant for this long.

Response identification	Meaning
0	No response or also: OK for "no task" task identification.
2	Transfer parameter value (sent to master)
7	Task cannot be executed

Together with the response identification 0, the inverter deletes all response bytes. For response identification 2, all parameter numbers and the subindex are copied from the task to the response. The inverter sends the complete response

until the master has formulated a new task. For read access to display values, the inverter always cyclically sends new current values until the master has formulated a new task. If the inverter responds with "*7:Task cannot be executed*", the appropriate error number for this is given in the least significant byte of the parameter value (PWE) (thus in byte 7).

- In order for the inverter with a PROFINET® interface connection to always stop with the response of the last task and be ready for the next task, the "no task" task identification must be sent for a short time.
- The bus transfer uses the Motorola format (big-endian): The high parameter value is first sent within a word and also with words within a double word.
- If no information is required by the PKW interface in cyclic operation, the task identification should be set to "no task".

In the following example for a controller, the transfer commands for the 16 bit format should be given and the parameter *D00 SW-Accel* from axle 1 should be changed to the value 300 ms/3000 rpm.
Find the values from the parameter list:

- PNU = $1000 + 20 \times 3 + 0 + 0 = 1060_{dec} = 424_{hex}$, subindex = 1
- Parameter value $300_{dec} = 12C_{hex}$.

Step	Set PLC output byte (xx = old content)	Explanation
1	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 xx xx xx xx	Delete parameter identification, subindex and reserved byte 3.
2	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 xx xx xx xx	Wait until the input bit of the inverter has the response identification 0. In addition, mask out bits 4 to 7 and check they are set to 0. The PNU of the last task could still occupy the other bits and byte 1. The waiting time depends on the bus cycle time (number of subscribers).
3	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 01 2C	Expand parameter value 12C to 4 byte and enter in bytes 4 to 7.
4	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 01 2C	Enter subindex 1 in byte 2.
6	Byte: 0 1 2 3 4 5 6 7 Hex value: 34 24 00 00 00 00 01 2C	Enter parameter number 424_{hex} in bits 0 … 10 of the PKE and enter task identification 3 in bits 12 … 15, bit 11 remains 0.
7	Byte: 0 1 2 3 4 5 6 7 Hex value: 34 24 00 00 00 00 01 2C	Wait until a response arrives in the input byte, e.g. Byte: 0 1 2 3 4 5 6 7 Hex value: 24 24 00 00 00 00 00 00 The 2 in byte 0 indicates the response identification *Transfer parameter value*. In this sway, the new value has been transferred from the inverter without errors.
8	Byte: 0 1 2 3 4 5 6 7 Hex value: 00 00 00 00 00 00 xx xx	Delete the parameter identification again to shorten the waiting time for the next PKW service.

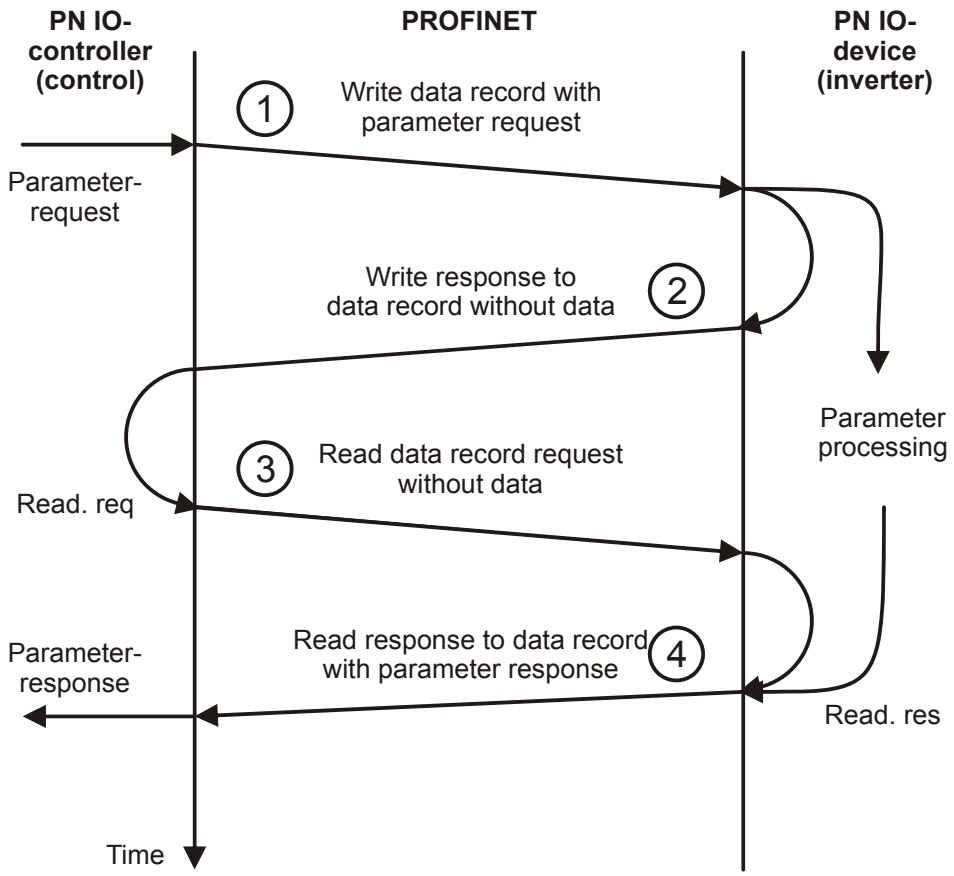
6.2 PKW1

PROFINET provides "Read data record" and "Write data record" services for acyclic data transfers (for STEP7 with SFB53 = WRREC = Write a Process Data Record and SFB52 = RDREC = Read a Process Data Record). When doing so, unspecified data is transferred to a data record.
The inverter from the 5th generation of STÖBER inverters provides the mechanism to write and read parameter values according to PROFIdrive profile V 4.1. When doing so, special content is transferred in data record no. $B02E_{hex}$.
The data record is uniquely addressed with the following specifications:

- API = $3A00_{hex}$
- Slot number = number that was selected in the HW config.
- Subslot number = number that was selected in the HW config.
- Index = $B02E_{hex}$

6.2.1 Sequence

PROFIdrive uses the PROFINET services *Read data record* and *Write data record* to transport parameter tasks and acknowledgements. PROFIdrive allows asynchronous transfer of the data records and asynchronous parameter service processing in the IO device.
With the first PROFINET service *Write data record*, a PROFIdrive parameter task is transferred to the IO device and the transfer acknowledged. Afterwards, processing is carried out in the inverter. Subsequently, the PROFIdrive response is read as a data record via the PROFINET service *Read data record*.



6.2.2 Structure of the parameter channel data

The bytes and words in the telegrams have the following meanings:

Abbreviation	Data type	Value, value range	Meaning
Req.Ref	U8	00_{hex}– FF_{hex}	Request Reference: Freely selectable number from controller. It is mirrored by the device in the Response Reference. For example, can be use by the controller to assign a Response Reference to the Request Reference.
Req.ID (designation of the task)	U8	01_{hex}	Read task (Request Parameter)
		02_{hex}	Write task (Change Parameter)
		All other values	Reserved, must not be used

Abbreviation	Data type	Value, value range	Meaning
Res.ID (designation of the response)	U8	01_{hex}	Positive response to read task
		02_{hex}	Positive response to write task
		81_{hex}	Negative response to read task (error)
		82_{hex}	Negative response to write task (error)
		All other values	Reserved, not used
Axis.No	U8	0 – 3	Axle addressing of the inverter parameter, global parameters are addressed with Axis.No = 0.
No of Par. (number of parameters)	U8	1	A parameter should be read or written
		2 – 39_{hex}	Multi-parameter service with up to 57 parameters
		All other values	Reserved, must not be used
Attributes	U8	10_{hex}	Value should be read or written
		All other values	Reserved for parameter description, must not be used
No of Elem. (number of elements of an array parameter)	U8	1	A parameter element should be read or written.
		2 – 39_{hex}	Reserved for parameter description, must not be used.
Parameter Number	U16	2000_{hex}– $5FFF_{hex}$	With this number, the group and line of the customary STÖBER parameter address are coded as follows: Parameter number = 0x2000 + 0x200 * group (A=0, B=1, …) + line
Subindex	U16	0 – $3E80_{hex}$	Number of the element of a record parameter or array parameter. Parameters that are neither a record nor an array are specified here with 0.
Format (format specification for the transfer of a parameter)	U8	43_{hex}	Double word: All STÖBER parameters are transferred via this parameter channel as an integer with a data length of 4 bytes. Note that the parameter *A100 = 0:integer* must be set.
		All other values	Reserved for parameter description, must not be used.
No. of Val.	U8	1	Number of values that should be processed. When reading a parameter, the inverter provides the number of the following values in its response. When writing a parameter, this value must either correspond with *No of Par.* or, in the case of a multi-element service, with *No of Elem.*.
Errorvalue	U16	see the following table	Error value with coding of a cause of error for a negative response

Error values used

Value	Meaning
00_{hex}	Parameter unknown or configuration stopped
01_{hex}	Access to parameter that may not be changed.
02_{hex}	Access to parameter with a value outside of the limit values
03_{hex}	Access to unavailable subindex (array parameter)
$0B_{hex}$	User level not reached
11_{hex}	In the current device state, this parameter must not be changed. Switch off enable.
14_{hex}	Invalid value within its maximum limits, only occurs for selection parameters with discontinuous definition range
16_{hex}	Inconsistent specification in the parameter addressing: One or more incorrect values in the *Attributes*, *No of Elem.*, *Parameter Number* and *Subindex* data.
17_{hex}	Invalid format specification (format specification is not 43_{hex}). Please compile all specifications completely in the task telegram according to the tables above.
18_{hex}	Specifications in NoOfElements and NoOfValues are contradictory.
21_{hex}	illegal Request ID = "Service not supported" applies for errors in the header of the task block.
$A5_{hex}$	unspecified error
$B0_{hex}$	Parameter service currently not possible, no valid parameter description available.
$B2_{hex}$	G5 parameter address unknown (parameter or element does not exist)
$B3_{hex}$	Read-Write access not possible on this G5 parameter address (no parameter, but type, or forbidden by hide function or ...)
$B9_{hex}$	Parameter service: Value in definition gap (observe ENUM list)
BA_{hex}	Parameter service: Clash with other values
$C0_{hex}$	Parameter service: Error in pre-read function
$C1_{hex}$	Parameter service: Error in post-write function, value has already arrived.

6.2.3 Reading parameters

The following table show the structure of the telegrams for the *Read parameter* service. The *Example* column shows the content that the data has when the parameter *E03 DC link voltage* in axle 1 is to be read.

For a description of the abbreviations in the "Content" column, refer to the table in section6.2.2 Structure of the parameter channel data.

The following table shows the parameter request telegram that the IO controller sends to the inverter:

Byte	Contents	Example	Explanation
0	Req. Ref.	01_{hex}	Freely selectable number from controller.
1	Req. ID	01_{hex}	Designation of the task: Read task
2	Axis No.	00_{hex}	Addressing the axle: Axle 1
3	No of Par.	01_{hex}	Number of parameters: one parameter
4	Attributes	10_{hex}	A value should be processed.
5	No of Elem.	01_{hex}	A parameter element should be read.
6 7	Parameter Number	2803_{hex}	PNU of the parameter *E03*, see parameter list
8 9	Subindex	0000_{hex}	Subindex of the parameter *E03*, see parameter list

If the parameter service could be positively answered, the IO controller reads this response telegram:

Byte	Contents	Example	Explanation
0	Req. Ref.	01_{hex}	Request Reference: The Request Reference mirrored by the inverter in the response.
1	Res. ID	01_{hex}	Designation of the task: Read task successful
2	Axis No.	00_{hex}	Addressing the axle: Axle 1
3	No of Par.	01_{hex}	Number of parameters: one parameter
4	Format	43_{hex}	Format specification: Integer, 4 byte data length
5	No of Val.	01_{hex}	A value was read.
6 7	MSW of Value	0000_{hex}	MSW of the parameter value, 0 in example
8 9	LSW of Value	1518_{hex}	LSW of the parameter value: $1518_{hex} = 5400_{dec}$. This parameter value corresponds to a DC link voltage of 540 V.

If the parameter service was answered negatively, the IO controller reads the following telegram:

Byte	Contents	Example	Explanation
0	Req. Ref.	01_{hex}	Request Reference: The Request Reference mirrored by the inverter in the response.
1	Res. ID	81_{hex}	Designation of the task: Read task unsuccessful
2	Axis No.	00_{hex}	Addressing the axle: Axle 1
3	No of Par.	01_{hex}	Number of parameters: one parameter
4	Format	43_{hex}	Format specification: Integer, 4 byte data length

Byte	Contents	Example	Explanation
5	No of Val.	01_{hex}	A value should be read.
6 7	Errorvalue	$00ee_{hex}$	ee = Errorvalue, see section 6.2.2 Structure of the parameter channel data
8 9	not defined	—	not defined

6.2.4 Writing parameters

The following tables show the structure of the telegrams for the *Write parameter* service. The *Example* column shows the content that the data has when the parameter *C230 M-Max* in axle 2 is to be described with the value 100 %.
The following table shows the parameter request telegram that the IO controller sends to the inverter:

For a description of the abbreviations in the "Content" column, refer to the table in section6.2.2 Structure of the parameter channel data.

Byte	Contents	Example	Explanation
0	Req. Ref.	05_{hex}	Freely selectable number from controller.
1	Req. ID	02_{hex}	Designation of the task: Write task
2	Axis No.	01_{hex}	Addressing the axle: Axle 2
3	No of Par.	01_{hex}	Number of parameters: one parameter
4	Attributes	10_{hex}	A value should be processed.
5	No of Elem.	01_{hex}	A parameter element should be written.
6 7	Parameter Number	$24E6_{hex}$	PNU of the parameter *C230*, see parameter list
8 9	Subindex	0000_{hex}	Subindex of the parameter *C230*, see parameter list
10	Format	43_{hex}	Format specification: Integer, 4 byte data length
11	No of Val.	01_{hex}	A value should be written.
12 13	MSW of Value	0000_{hex}	$00000064_{hex} = 100_{dec}$
14 	LSW of Value	0064_{hex} 16	

If the parameter service could be positively answered, the inverter provides the following data:

Byte	Contents	Example	Explanation
0	Req. Ref.	05_{hex}	Request Reference: The Request Reference mirrored by the inverter in the response.

Byte	Contents	Example	Explanation
1	Res. ID	02_{hex}	Designation of the task: Write task successful
2	Axis No.	01_{hex}	Addressing the axle: Axle 2
3	No of Par.	01_{hex}	Number of parameters: one parameter

If the parameter service was answered negatively, the inverter provides the following data:

Byte	Contents	Example	Explanation
0	Req. Ref.	05_{hex}	Request Reference: The Request Reference mirrored by the inverter in the response.
1	Res. ID	82_{hex}	Designation of the task: Write task unsuccessful
2	Axis No.	01_{hex}	Addressing the axle: Axle 1
3	No of Par.	01_{hex}	Number of parameters: one parameter
4	Format	43_{hex}	Format specification: Integer, 4 byte data length
5	No of Val.	01_{hex}	A value should be written.
6	Errorvalue	$00ee_{hex}$	ee = Errorvalue, see section 6.2.2 Structure of the parameter channel data
7			

7 Diagnosis

7.1 Connection monitoring

To prevent the drive reacting in an undesirable manner when the PROFINET connection is interrupted (cable break, etc.), you should monitor the arrival of the cyclic process data.
You can activate monitoring in parameter *A109 PZD-Timeout*. The factory setting is 200 (ms); the values 65535 and 0 mean that monitoring is inactive. This is useful for commissioning the inverter and for service and maintenance work. Activate monitoring by setting a time in milliseconds that is different to these values.
When you activate the timeout, the inverter behaves as follows when there is a fault:

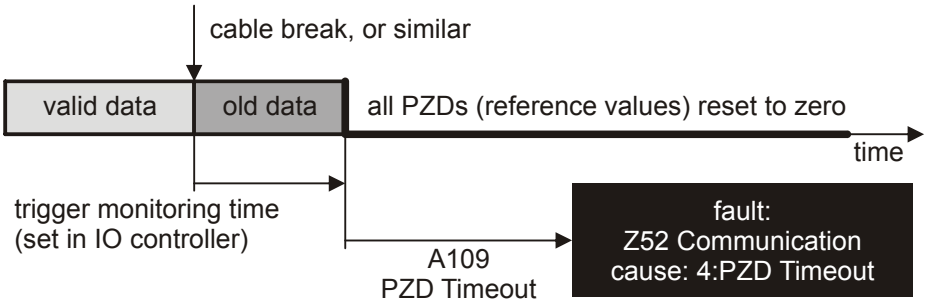


Fig. 7-1 Sequence of connection monitoring with *A109 PZD Timeout*

After the fault, the response monitoring time set in the IO controller elapses. After this time has elapsed, the timeout set in *A109* starts to run. When this time elapses, the inverter changes to the fault device state and shows the event *52: Communication* with the cause *4:PZD-Timeout* on the display. Note that the event from this time is triggered cyclically until the cause is rectified. The cycle does not depend on the time of acknowledgement.

Information
Note that after the response monitoring time set in the IO controller has elapsed, all process input data is set to 0. This can lead to undesirable movements.

7.2 Display of the inverter

During operation, the PN 5000 accessory is cyclically tested for correct functionality. If an error is identified, the *55:Optionsplat.* error is displayed on the inverter display. Different causes appear alternately on the display to enable detailed diagnostics:

Note that the operating manuals of the inverter include an extensive list of all events, see section 1.3 Other manuals.

Cause	Description	Measure
13:PN5000 fail 1	Hardware tests have found an error.	• Check whether the PN 5000 accessory was correctly installed. • Check whether suitable EMC measures were taken. • Check whether only PROFINET-certified components were connected to the inverter. • Check whether the cabling and connections correspond to the PROFINET standard. • Contact the service department, see section 1.4 Further support.
14:PN5000 fail 2	Software tests have found an error.	
15:PN5000 fail 3	Watchdog error	

7.3 LED of PN 5000

The PN 5000 accessory has 6 LEDs that are arranged in two groups each with 3 LEDs. Note that the LED for the FDS 5000 is turned by 180° when compared with the MDS 5000 and SDS 5000 because this accessory is turned when installed.

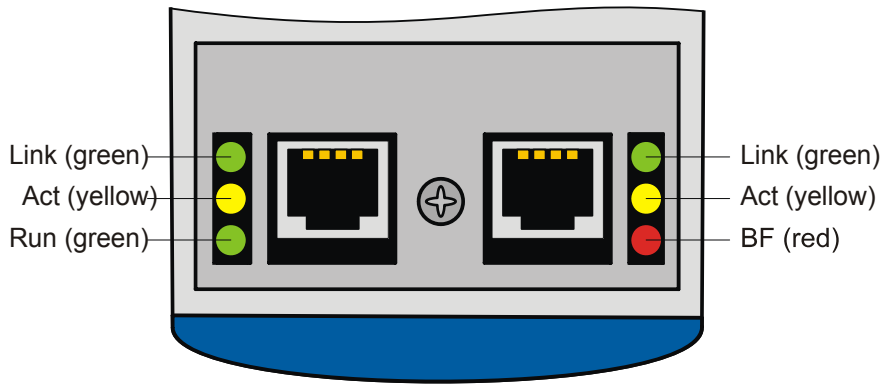


Fig. 7-2 Arrangement of the LEDs on the PN 5000 accessory for MDS 5000 and SDS 5000

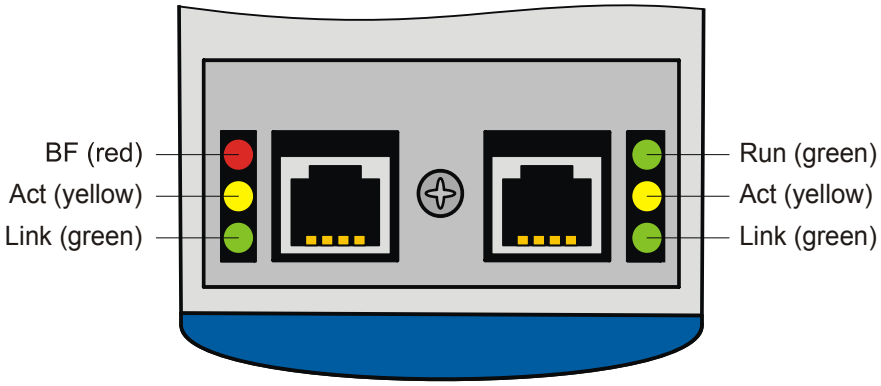


Fig. 7-3 Arrangement of the LEDs on the PN 5000 accessory for FDS 5000

The LED displays have the following meaning:

BF (bus error, red)

State	Description
On	• There is no physical connection to the PROFINET network. • An error in the communication controller was found.
Flashing at approx. 2 Hz	The cyclic data exchange is not active.
Off	No error

The exact cause for the constant illumination of the LED BF can be determined by the parameter *A279 PN Error History* and *A271 PN state*.

Run (green)

State	Description
On	The connection to the IO controller is OK.
Flash (10% on, 90% off)	The connection to the IO controller is being established.
Flash inverse (90% on, 10% off)	The DCP Signal Service was activated by the IO controller.
Flashing	The connection to the IO controller has been established. Wait for the start of the cyclic process data transfer.
Off	There is no connection to the IO controller

Act (left and right, yellow)

State	Description
Off	There is no data traffic.
Flashing at ≤ 20 Hz	There is no data traffic; the flash speed indicates the frequency of data exchange.

Link (left and right, green)

State	Description
On	There is a physical Ethernet connection. Note that this display does not give information about whether this connection is suitable for PROFINET communication.
Off	There is a physical Ethernet connection.

By evaluating the LED and the parameter *A279 PN Error History* and *A271 PN state*, you can take the following measures:

Measures for errors (X = state of the parameter/LED is irrelevant)

A279	A271	LED state	Measure
X	X	Link off	• Check the connection to the PROFINET network. • Check the infrastructure between the inverter and IO controller.
X	X	BF off Act off Link on	• Check whether there is a connection to the IO controller. • Check whether the inverter has been correctly parameterized in the IO controller. • Check whether the IO controller is active and in RUN mode. • Check whether a 100 Mbit Full Duplex Link has been detected.
X	X	BF on Act off Link on	Check the physical connection.
X	PHASE 0	X	The communication controller could not be parameterized. Switch the inverter off and back on again. Contact the service department, see section 1.4 Further support.
X	PHASE 1	Act flashes Link on	The IO controller did not assign an IP address. Check the settings in the IO controller.
bel. Value	> PHASE 1	Act flashes Link on	Check the value in *A279* and take measures as described in section 7.4 A279 PN Error History.
Empty	PHASE 3	Act flashes Link on	The IO controller does not start cyclic data traffic. Check the configuration of the IO controller.

7.4 A279 PN Error History

The *A279.x* array indicates an error history of the PROFINET communication in its four elements:

- Element 0: Last error
- Element 1: Second last error
- Element 2: Third last error
- Element 3: Oldest error

.

If the value entered in the elements is equal to zero, no error has occurred. All values that are not equal to zero represent a hexadecimal error code. The error codes are structured as follows:

Bits	Description
31 – 24	ErrorCode
23 – 16	ErrorDecode
15 – 8	ErrorCode1 consists of • ErrorClass (bit 15 – 13) • ErrorDecode (bit 11 – 8)
7 – 0	ErrorCode2, this value is currently always zero

The following example explains the structure:
A279.x = 3481402629_{dec} = $CF81FD05_{hex}$

Section of the error code	Value	Meaning
ErrorCode (bit 31 – 24)	CF_{hex}	RTA error (RTA = Real Time Acyclic Protocol)
ErrorDecode (bit 23 – 16)	81_{hex}	PNIO: Used in context with other services or internal e. g. RPC errors
ErrorCode1 (bit 15 – 8)	FD_{hex}	Used by RTA for protocol error (RTA_ERR_CLS_PROTOCOL)
ErrorCode2 (bit 7 – 0)	05_{hex}	AR consumer DHT/WDT expired (RTA_ERR_ABORT)
Summarized:		The PROFINET watchdog timer has elapsed. This occurs, for example, when the IO controller has failed but the physical connection to another Ethernet subscriber (e.g. switch) still exists.

If necessary, consult STÖBER ANTRIEBSTECHNIK GmbH & Co. KG for a detailed evaluation of your error history. For contact details, see section 1.4 Further Support.

8 Parameter list

Note the following list of the parameters relevant for PROFINET® communication.

- *A90 PZD Setpoint Mapping Rx*
- *A91 PZD Setpoint Mapping 2Rx*
- *A93 PZD Setpoint Len*
- *A94 PZD ActValue Mapping Rx*
- *A95 PZD ActValue Mapping 2Rx*
- *A97 PZD ActValue Len*
- *A100 Fieldbus Scaling*
- *A101 Dummy Byte*
- *A102 Dummy Word*
- *A103 Dummy Double Word*
- *A109 PZD Timeout*
- *A270.x PN Port X20x State*
- *A271 PN State*
- *A272.x PN Module/Submodule List*
- *A273 Device Name*
- *A274 PN IP Address*
- *A275 PN Subnetwork Mask*
- *A276 PN Gateway*
- *A277 PN Type Of Station*
- *A278.x PN Diagnostics*
- *A279.x PN Error History*

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