Profinet Interface

EXP-ETH-PN-ADV200

Expansion Card for ADV200

Instruction manual

Language: English

Information about this manual

This manual describes the EXP-ETH-PN-ADV200 option card aimed at connecting the ADV200 series Drives to Profinet networks. It is possible to use only one field bus expansion card per Drive.

This manual is intended for design engineers and technicians responsible for the maintenance, commissioning and operation of PROFINET systems.

Software version

Basic knowledge of PROFINET is required. The EXP-ETH-PN-ADV200 card is only suitable for use with drives running firmware version 7.0.1 or later, with keypad version 00.90 or later (required for DCP protocol signaling)

General information

Before using the product, read the safety instruction section carefully. Keep the manual in a safe place and available to engineering and installation personnel during the product functioning period.

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Thank you for choosing this WEG product.

We will be glad to receive any possible information which could help us improving this manual.

The e-mail address is the following: techdoc@weg.net.

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Symbols used in the manual

Warning!

Indicates a procedure, condition, or statement that, if not strictly observed, could result in personal injury or death.

Indique le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont passtrictement respectées, il y a des risques de blessures corporelles ou de mort.

Caution

Indicates a procedure, condition, or statement that, if not strictly observed, could result in damage to or destruction of equipment.

Indique le mode d'utilisation, la procédure et la condition d'exploitation. Si ces consignes ne sont pas strictement respectées, il y a des risques de détérioration ou de destruction des appareils.

Indicates that the presence of electrostatic discharge could damage the appliance. When handling the boards, always wear a grounded bracelet.

Indique que la présence de décharges électrostatiques est susceptible d'endommager l'appareil. Toujours porter un bracelet de mise à la terre lors de la manipulation des cartes.

Attention

Indicates a procedure, condition, or statement that should be strictly followed in order to optimize these applications.

Indique le mode d'utilisation, la procédure et la condition d'exploitation. Ces consignes doivent êtrerigoureusement respectées pour optimiser ces applications.

Note !

Indicates an essential or important procedure, condition, or statement.

Indique un mode d'utilisation, de procédure et de condition d'exploitation essentiels ou importants

1. Introduction

1.1. Reinforced insulation

PELV (Protective Extra Low Voltage) EN 61800-5-1.

1.2. Features

- Standard RJ45 with support for shielded twisted pair / full-duplex and 100Mbs connectivity
- Dual 100Mbps EtherNet interfaces for use in different topologies
- PROFINET “Real Time” class “RT Class1” and “conformance class B”
- Identification and Maintenance functions I&M0 to I&M4
- Profidrive Profile for “Application Class 1”
- Control cycle times down to 1ms
- Maximum input data length 64 bytes
- Maximum output data length 64 bytes

1.3. Safety

Before installing the card, read the safety instruction section carefully, see “ADV200 Quick Start-up guide, Chapter 1 - Safety Precautions.”

1.4. Mounting

Refer to ADV200 Quick Start up manual, chapter “Installation of optional cards”: the card must be inserted on slot 3.

1.5. Connections

Bus media: the Profinet option module EXP-ETH-PN-ADV200 incorporates two 100 BASE-TX RJ45 interfaces.

Pysical properties	Connection methods	Cable type / transmission medium	Transmission rate / mode	Max. segment lenght	Advantages
Electrical	RJ45 cable connector ISO 60603-7	100Base-Tx 2x2 twisted, symmetrical and shielded copper cable, CAT 5 transmission requirement IEEE 802.3	100 MBps / full duplex	100 m depending on the cable type, shorter lenghts as maximum lenghts are possible	Simple and cheap power connection

Cabling considerations

To ensure long-term reliability it is recommended that any cables used to connect a system together be tested using a suitable Ethernet cable tester, this is of particular importance when cables are constructed on site.

Cables should be shielded and as a minimum, meet TIA Cat 5e requirements.

Cabling issues are the single biggest cause of network downtime. Ensure cabling is correctly routed, wiring is correct, connectors are correctly installed and any switches or routers used are rated for industrial use. Office grade Ethernet equipment does not generally offer the same degree of noise immunity as equipment intended for industrial use.

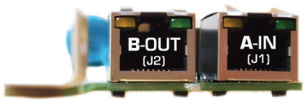
Maximum network length

The main restriction imposed on Ethernet cabling is the length of a single segment of cable.

The Profinet interface for ADV200 “EXP-ETH-PN-ADV200” has two 100BASE-TX Ethernet ports, which support segment lengths of up to 100m. This means that the maximum cable length which can be used between one EtherNet port and another 100BASE-TX port is 100m however it is not recommended that the full 100m cable length is used.

The total network length is not restricted by the Ethernet standard but depends on the number of devices on the network and the transmission media (copper, fiber optic, etc.).

Ethernet Connectors

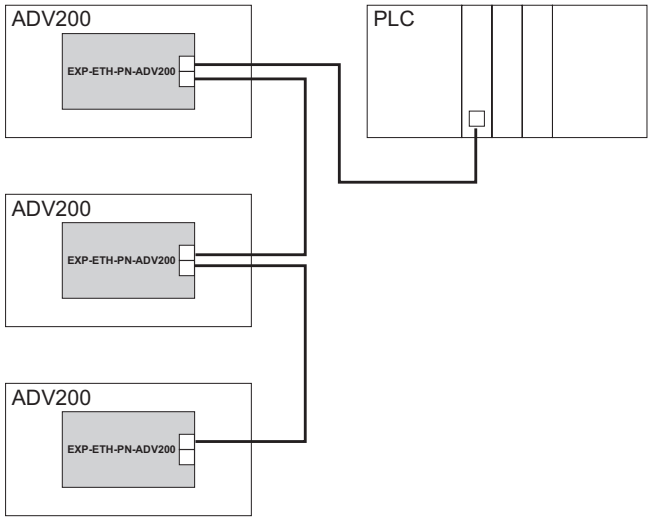


EtherNet terminal connections			
Pin	A - IN (J1(	Pin	B - OUT (J2)
1	Transmit +	1	Transmit +
2	Transmit -	2	Transmit -
3	Receive +	3	Receive +
4	Not used	4	Not used
5	Not used	5	Not used
6	Receive -	6	Receive -
7	Not used	7	Not used
8	Not used	8	Not used

Topology

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

Fig. 1.6.1: Line topology

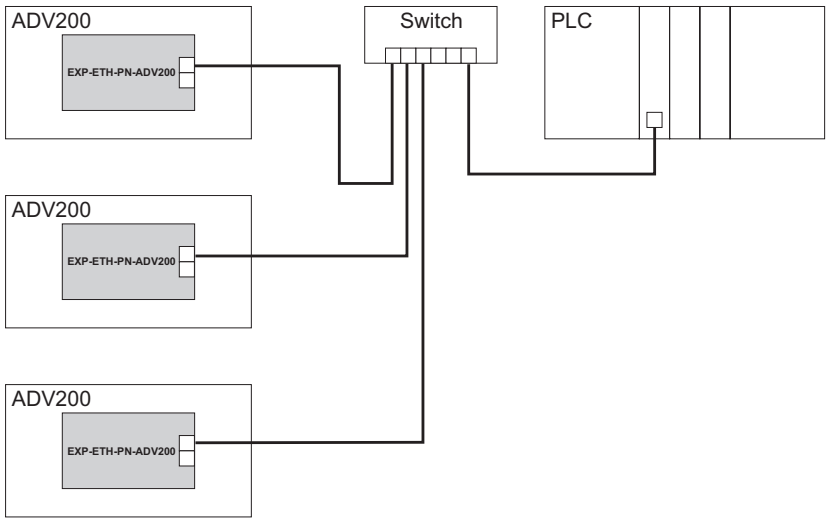


The two ports are equal, in the sense that they are transparent for the option.

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

Please observe that mounting drives of different power-sizes in a line topology may result in unwanted power-off behavior. It is recommended to mount the drives with the longest discharge time first in the line topology.

Fig. 1.6.2: Star topology



Recommended Design Rules

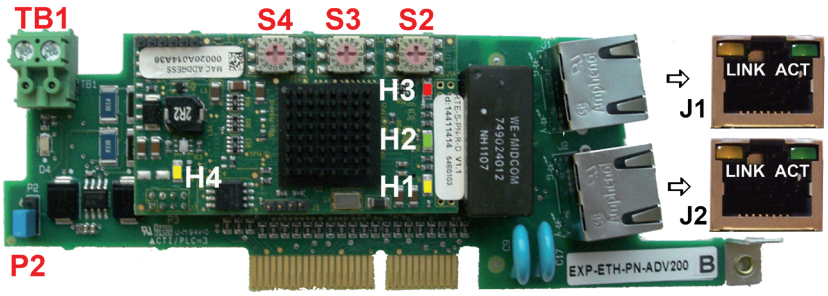
While designing Ethernet networks special attention and caution must be taken regarding active network components.

While designing a network for line topology it is important to notice that a small delay is added with each every switch in the line.

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

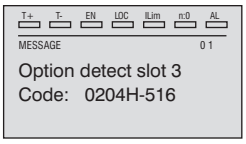
1.6. Leds, rotary switches, jumpers and terminals

Fig. 1.7.1: Leds, rotary switches, jumpers and terminals position on EXP-ETH-PN-ADV200 card

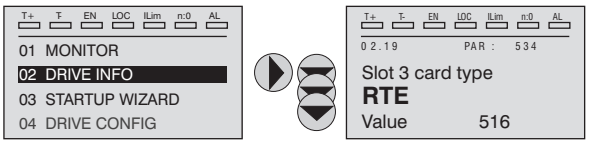


LEDS				
Connector	**Reference**	**Color**	**Display**	**Description**
J1 (Eth0)	DCP	Yellow	blinking	DCP Signaling
J1 (Eth0)	ACT	Green	On	Port is connected to other Ethernet device
			Off	Port is not connected
J2 (Eth1)	LINK	Yellow	blinking	Communication with Ethernet device
J2 (Eth1)	ACT	Green	On	Port is connected to other Ethernet device
			Off	Port is not connected
ROTARY SWITCH				
Reference	**Descriptions**			
S4-S3-S2	Rotary switch is not used, leave S2 S3 S4 to 0 position			
JUMPER				
P2	If terminals are mounted, the jumper must be installed in position 2-3.			
TERMINALS				
TB1	If contacts are mounted they must be left NOT CONNECTED.			

1.7. Option Card Recognition



At power-on, the drive recognizes the presence of optional card in the expansion slot 3, this message is shown on the display



On 02 DRIVE INFO menu, select the PAR 534 Slot 3 card type to read the recognized card, after saving the parameters and restarting the inverter (software reset or with a off/on power cycle).

Value	Description
0	None
516	RTE
255	Unknown

1.8. PROFINET interface identification

Each PROFINET interface is assigned:

- A MAC address (factory default)
- An IP address
- A device name (“NameOfStation”).

Each EXP-ETH-PN-ADV200 is assigned a unique MAC address, programmed on the board at manufacturing. It is used to identify the network interface of the board, and is unique worldwide for each board.

The MAC address is printed on a label on the board: 

This address is also listed when searching for the device with DCP protocol.

1.9. Start-up guide

IP address and name Configuration

Each Profinet device on a network is identified by an IP address and device name. The address can be configured using the DCP protocol, using the tools available on the Profinet master or on a external supervisor. It is important to configure each device with a unique IP address and name for a specific network, and the values must match the hardware configuration on the master.

It is possible to set IP address, “Netmask” and default “Gateway”, in addition to the device name. The values can be stored permanently on the board by the same tool (i.e. they are not saved or reset to default with the drive parameters).

The IP address can also be read on the drive, by checking P. 5608 “IP address” in menu COMMUNICATION\FIELDBUS CONFIG:

PAR	Description	Value
5608*	**IP address**	**192.168.0.2**

1.10. Configure the Controller

In order to configure a PROFINET Controller, the configuration tool needs a GSDML file for each type of slave on the network. The GSDML file is a PROFINETstandard text file in XML format, containing the necessary communications setup data for a slave. Download the GSDML file “GSDML-V2.3-WEG-ADV200-20140624.xml” from the website https://www.weg.net/catalog/weg/IT/en/p/MKT_WDC_GLOBAL_PRODUCT_INVERTER_ADV200

The GSDML file contains the information to identify the device, insert communication modules and report the diagnostic information.

When the ADV200 interface is added for the first time on a system, it is necessary to import the GSDML file on the master. The device can then be found under “Drives / ADV200 / WEG ADV200”.

When the device is added to the nework configuration, the module “ADV200 Standard Telegram 1” is pre-configured. To change the communication module it is possible to remove “ADV200 Standard Telegram 1” and replace it with one of the available modules.

The selection of the module must match the configuration of the drive, otherwise the communication is not possible and error messages may be generated. See “Drive mode selection: Profinet and Profidrive” for a detailed explanation of the different modules and the corresponding configurations of the drive.

1.11. Drive mode selection: Profinet and Profidrive

The drive can be configured to operate with the Profidrive profile, or operate in Profinet only mode, by changing P. “4000” “Fieldbus type” in menu COMMUNICATION\FIELDBUS CONFIG.

With the selection “RTE” Profinet mode is selected.

With the selection “Profidrive” Profidrive mode is active.

The active mode is visible P. 4398 “RTE Protocol” (only visible if “Access Level” must be set to “Expert” in menu DRIVE CONFIG).

The different modes require different configurations for data exchange on the drive and different modules to be selected on the Master.

2. Profidrive

2.1. “Cyclic data exchange”

Tha “Cyclic data exchange” is automatically configured according to “Standard Telegram 1”:

	Word 1	Word 2	Word 3	...	Word 16	MdPlc Word 1…MdPlcWord16
Input:	STW1	NSOLL_A	User defined	...	User defined	
Output:	ZSW1	NIST_A	User defined	...	User defined	

STW1: Control Word 1
NSOLL_A : Speed Setpoint A
ZSW1: Status Word 1
NIST_A: Speed actual value A

For a complete description, see “*Protocols -Standard Telegram 1*”

Input and output data is configured on the drive. With Profidrive, the “Standard Telegram 1 “is Preconfigured for data exchange, in menus FIELDBUS M->S for input data and menu FIELDBUS S->M for output data, while additional User Defined words can be selected by the user, in the same menus, to match the module selected on the master.

When working in “Profidrive mode” the ADV200 acts as a “Standard Drive” in “Application Class 1” with speed setpoint. Operation is executed according to the Profidrive state machine, cyclic data is exchanged accord to “Standard Telegram 1”, access to PNUs parameters is available and the diagnostic is reported according to the “Alarm Mechanism”. See “*Protocols –Base mode parameter access*”.

2.2. Quick Start with “Standard Telegram 1”

The configuration described in this paragraph matches the default module “Standard Telegram 1” on the master.

To activate “Profidrive mode” on the ADV200, set:

PAR	Description	Value
4000	**Fieldbus type**	**Profidrive**

in menu COMMUNICATION\FIELDBUS CONFIG

Save the parameters and restart the drive to apply the mode.

Upon restart, check the active RTE protocol in the same menu:

PAR	Description	Value
4398*	**RTE protocol**	**Profidrive**

The drive is now in Profidrive mode.

The following parameters are automatically set in menu COMMUNICATION/FIELDBUS M->S, corresponding to STW1 and NSOLL_A:

PAR	Description	Value
4020	**Fieldbus M-> S1 ipa**	**4346**
4022	**Fieldbus M-> S1 sys**	**Count 16**
4030	**Fieldbus M-> S2 ipa**	**610**
4032	**Fieldbus M-> S2 sys**	**Count 16**

In menu COMMUNICATION/FIELDBUS S->M ZSW1 and NIST_A are set:

PAR	Description	Value
4180	**Fieldbus S-> M1 ipa**	**4394**
4182	**Fieldbus S-> M1 sys**	**Count 16**
4190	**Fieldbus S-> M2 ipa**	**260**
4192	**Fieldbus S-> M2 sys**	**Count 16**

NIST_A is associated to P.260 “Motor speed”: this parameter contains a filtered value of the speed. If the filter should be adjusted for faster response, the value of P.30 “Display spd filter” can be changed from the default of 200ms:

PAR	Description	Value
30	**Display spd filter**	**200**

This parameter is in menu SERVICE/FIELDBUS SERV, Expert mode access and the service password are required to change it.
In menu COMMANDS, the control word is activated:

PAR	Description	Value
1000	**Commands remote sel**	**Digital**
1018	**Digital Enable src**	**--**
1020	**Digital Start src**	**--**
1022	**FastStop src**	**--**

The following parameter must be set manually to “Off”, to operate the drive remotely:

PAR	Description	Value
1004	**Enable/disable mode**	**Off**

If the hardware enable terminal is active when the drive is powered up, it is also necessary to set the following parameter to “Off “

PAR	Description	Value
1010	**Commands safe start**	**Off**

If the Jog functionality of Profidrive is necessary, please also enter a valid value:

PAR	Description	Value
910	**Jog setpoint**	**200 rpm**

In menu JOG FUNCTION. This values is used as reference for Profidrive:

- Jog 1 is “Jog Setpoint” with positive value
- Jog 2 is “Jog Setpoint” with negative value

When the configuration is complete, save the parameters on the drive. It is not necessary to restart the drive: the values are applied immediately.
When the module is applied on the master or the drive is powered-on, the “Cyclic Data Exchange” become available. This can be checked for the “Operational” state on the following parameter:

PAR	Description	Value
4014*	**Fieldbus state**	**Operational**

This table is an example of a sequence of commands to start the drive, with the responses, according to the State Machine for Application 1 (additional details available in “Protocols: Profidrive State Diagram”):

PLC		**Drive**		State
STW1	NSOLL_A	ZSW1	NIST_A	
0x400	0x4000	0x340	0	S1
0x406	0x4000	0x331	0	S2
0x407	0x4000	0x333	0	S3
0x47F	0x4000	0x337	0	S4
…				
0x47F	0x4000	0x737	0x4000	S4, speed reached

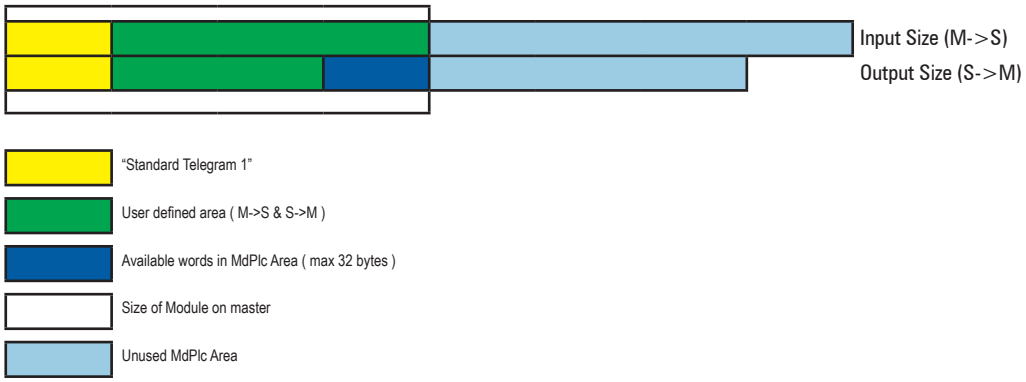
2.3. Modules with User Defined words

In addition to the default “Standard Telegram 1” module, It is possible to add additional words to the “Cyclic data exchange” area. On the master, 30 additional modules are available for Profidrive, from “ADV200 Standard Telegram +1word” to “ADV200 Standard Telegram 1 +30 words”.
The selection of the module must match the configuration of the drive, only some modules can be selected for a specific configuration of drive parameters. The input and output size on the drive is configured in menus “FIELDBUS M->S” and “FIELDBUS S->M”. Moreover, up to 16 additional words are available for a MdPlc application running on ADV200 (see “Data Exchange with MdPlc”).
The following rules must be taken into consideration:

- The size of the module must be greater or equal to the size of the User defined data configured on the drive in menus “FIELDBUS M->S” and “FIELDBUS S->M”
- However, the size of the module cannot exceed the size of the User defined data configured on the drive by more than 32 bytes.
- All the modules have symmetric input and output size. This is not requested on the drive, it is possible to use a different size for input parameters in “FIELDBUS M->S” and output parameters in “FIELDBUS S->M”, if the size of the module is greater or equal to the maximum of the two sizes.

This is a graphical representation of a valid configuration, with the size of the module equal to the maximum of the number of words pro-

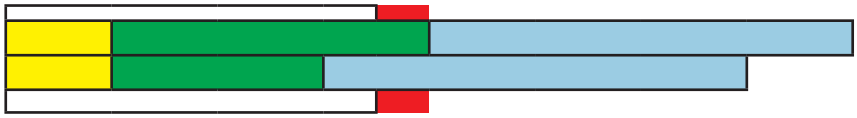
grammed on the drive (Module “Standard Telegram 1+6words”, 8 words in M->S, 6 words in S->M)



This is also a valid configuration, with the size of the module greater than the size available to the inverter:
(Module “Standard Telegram 1+22words”, 8 words in M->S, 6 words in S->M)

Another valid example, with only some words of the MdPlc is available.
(Module “Standard Telegram 1+8words”, 8 words in M->S, 6 words in S->M)

This configuration is not valid: the size of the module is less than the configuration of the drive:
(Module “Standard Telegram 1+4words”, 8 words in M->S, 4 words in S->M).



The missing part is in red.

This configuration is also not valid, the size of the module exceeds the data on the drive:
(Module “Standard Telegram 1+30words”, 8 words in M->S, 6 words in S->M)

If the size of the module does not match the configuration on the drive, the “Cyclic data exchange” state is not possible and the state is reported as “PreOperational”:

PAR	Description	Value
4014*	**Fieldbus state**	**PreOperational**

The error “Opt bus fault” with subcodes 0084h (for Output size mismatch) or 0074h (for Input size mismatch) is reported. However, if the configuration is allowed, the size of the module has been updated on the drive and can be stored on the drive with a “Save parameter” command. Upon the next restart of the drive, the stored size is used to match the size of the module, and the “Cyclic data exchange” is available, with state “Operational”.

Therefore it is always recommended to execute a “Save parameter” and restart the drive when a module is first configured on the master or when the parameters of the drive have been changed.

On the other end, if the configuration is not allowed, the drive will not go to “Cyclic data exchange” automatically after restart, even if the parameters are saved. The error “Opt bus fault” with Subcodes 0084h and 0074h are always reported after restart. In this situation it is still possible to force the exchange and Operational state by forcing the same module again on the master, or disconnecting and reconnecting the cable: the cyclic data is not correct, it is not recommended to operate the drive in this condition.

Example: Custom configuration with “Standard Telegram 1”, ramp time and motor current.
Select “Standard Telegram 1 + 1word” on the master. On the drive, set the following parameters:

FIELDBUS M->S

PAR	Description	Value
4020	**Fieldbus M-> S1 ipa**	**4346**
4022	**Fieldbus M-> S1 sys**	**Count 16**
4030	**Fieldbus M-> S2 ipa**	**610**
4032	**Fieldbus M-> S2 sys**	**Count 16**
4040	**Fieldbus M-> S3 ipa**	**700**
4042	**Fieldbus M-> S3 sys**	**Par 16**

FIELDBUS S->M

PAR	Description	Value
4180	**Fieldbus S-> M1 ipa**	**4394**
4182	**Fieldbus S-> M1 sys**	**Count 16**
4190	**Fieldbus S-> M2 ipa**	**260**
4192	**Fieldbus S-> M2 sys**	**Count 16**
4200	**Fieldbus S-> M3 ipa**	**250**
4202	**Fieldbus S-> M3 sys**	**Eu**

Save the parameters and restart.

On the master, by writing the word at address 6 it is possible to change the acceleration ramp time in Seconds. The value is written in parameter:

PAR	Description	Value
700	**Acceleration time 0**	**10.00 s**

In menu RAMPS.

By reading word at address 6, the current in A can be read, as in parameter:

PAR	Description	Value
250*	**Output current**	**0.00 A**

In menu MONITOR

2.4. Parameters

In this chapter the parameters available for “Acyclic Data Access”are defined.

“Base mode parameter access - local” is available with PAP 0xB02E.

Multiple parameters can be accessed, in read mode for “Request” for parameter values and description, and in write mode for “Change”, only for values. For details, see “*Protocols-Profidrive Base mode parameter Access*” .

The following standard PNUs are implemented:

<table>
<tr><th>PAR</th><th>Description</th><th>Data Type</th><th>Implementation</th><th colspan="3">Note</th></tr>
<tr><td>922</td><td>Telegram selection</td><td>Unsigned16</td><td>Mandatory, readable DO-specific</td><td colspan="3">Always displays the “Standard Telegram 1”</td></tr>
<tr><td>944</td><td>Fault message counter</td><td>Unsigned16</td><td>Mandatory DO-specific</td><td colspan="3">The fault message counter is incremented each time that the fault buffer changes. This means, that it may be guaranteed that the fault buffer may be consistently read-out.</td></tr>
<tr><td>947</td><td>Fault number</td><td>Array[n]
Unsigned16</td><td>Mandatory DO-specific</td><td colspan="3">The “Fault Number” is identical to the fault code. The first 8 indexes contain an image of the “Fault Situation”. Eight “Fault Situation”s are available in the “Fault Number” Array, for a total size of 64 elements.</td></tr>
<tr><td>952*</td><td>Fault situation counter</td><td>Unsigned16</td><td>DO-specific</td><td colspan="3">The parameter specifies the number of fault situations since the last reset. If this parameter is set to 0 (write), the complete fault buffer is deleted.</td></tr>
<tr><td rowspan="6">964</td><td rowspan="6">Drive Unit identification</td><td rowspan="6">Array[n]
Unsigned16</td><td rowspan="6">Indices 0-4 are mandatory</td><td>Subindex</td><td>Contents</td><td>Comments</td></tr>
<tr><td>0</td><td>Manufacturer</td><td>Unique manufacturer identifier</td></tr>
<tr><td>1</td><td>Drive Unit type</td><td>Manufacturer specific, 10 for ADV200</td></tr>
<tr><td>2</td><td>Version (Software)</td><td>xxyy (decimal)</td></tr>
<tr><td>3</td><td>Firmware date (year)</td><td>yyyy (decimal)</td></tr>
<tr><td>4</td><td>Firmware date (day/month)</td><td>ddmm (decimal)</td></tr>
<tr><td>965</td><td>Profile identification number</td><td>OctetString 2</td><td>Mandatory DO-specific (PROFINET IO)</td><td colspan="3">The profile identification is shown here.
Byte 1 includes the PNO Profile Number: 3
Byte 2 identifies the version: 41</td></tr>
<tr><td>972*</td><td>Drive reset</td><td>Unsigned16</td><td>Optional Global</td><td colspan="3"></td></tr>
</table>

PAR	Description	Data Type	Implementation	Note		
975	**DO identification**	Array[n] Unsigned16	Mandatory DO-specific	*Subindex*	*Contents*	*Comments*
				0	Manufacturer	Unique manufacturer identifier
				1	DO type	Manufacturer specific, 10 for ADV200
				2	Version (Software)	xxyy (decimal)
				3	Firmware date (year)	yyyy (decimal)
				4	Firmware date (day/month)	ddmm (decimal)
				5	PROFIdrive DO type class	1
				6	PROFIdrive DO sub class	1
				7	Drive Object ID (DO-ID)	1
976*	**Load device parameter set**	Unsigned16	Optional Global			
980	**Number list of defined parameter**	Array[n] Unsigned16	Mandatory DO-specific			

*: these PNUs are also writable

2.5. Device specific parameters

In addition to the standard Profidrive parameters,all the parameters of the drive (see drive manual) are available as “Device specific parameters” . Each parameter of the drive is associated to a specific PNU.

The number of the PNU to access a drive parameter can be calculated in the following way:

PNU = Drive Parameter Number + 8192

All drive parameters are single element (no arrays available): it is only possible to access Subindex 0 or requests with “NoOfElements “= 0.

The “Data type” of the parameter is derived from the definition of the parameter in the manual of the drive (column “Type”).The following table gives the corresponding types:

ADV200 Type	Data type	Coding(Decimal)	Description
BIT	Unsigned16	6	Boolean
ENUM	Unsigned16	6	Selection list
FLOAT	FloatingPoint	8	Real,
FBM->SIPA	Unsigned16	6	16-bit unsigned integer. Only PAR of existing parameters accepted.
FBS->MIPA	Unsigned16	6	16-bit unsigned integer. Only PAR of existing parameters accepted.
INT16	Integer16	3	Integer with sign 16 bits, from modbus seen as 16 bits
INT32	Integer32	4	Integer with sign 32 bits, from modbus seen as 32 bits
ILINK	Unsigned16	6	Selection list
LINK	Unsigned16	6	Selection list
UINT16	Unsigned16	6	Integer without sign 16 bits,
UINT32	Unsigned32	7	Integer without sign 32 bits
SINT	Integer8	2	Integer 8 bits

Example: For example, to access:

PAR	Description	Set to
700	**Acceleration time 0**	**10.00 s**

The PNU in the request should be 700 + 8192 = 8892

Since the parameter is writable, both read and change requests are available, with data type 8 “FloatingPoint”.

2.6. Diagnosis & alarms

The alarms generated by the drive are reported with the Profidrive “Alarm Mechanism”. Each time an alarm is generated, a Fault Code is saved in PNU 947 “Fault buffer” and PNU 944 “Fault message counter” is incremented (see ***Protocol Profidrve Alarm Mechanism***). Fault Codes correspond to ADV200 alarm numbers (see the manual of the drive for details).

In addition to the “Alarm Mechanism”, drive alarms are also reported by Profinet diagnostic as “Diagnosis information”, to be displayed by the master in the device state.

The following table shows the assignment of drive alarms to the “Channel ErrorType”.

Drive Alarm Description	Drive Alarm Code	“Channel Error Type“	Code
Overvoltage	1	DCLinkOvervoltage	0x9003;
Undervoltage	2	LowVoltageSupply	0x9002;
Ground_fault	3	EarthGroundFault	0x9006;
Motor_overload	14	MotorOverload	0x9007;
Heatsink_OT	9	Overtemp	0x9005;
HeatsinkS_OTUT	10		
Intakeair_OT	11		
Motor_OT	12		
Motor_pre_OT	30		
Overcurrent	4	Other	0x9012;
Bres_overload	15	BrakeResistor	0x900d;
Opt_Bus_fault	17	FieldbusSystem	0x9008;
External_fault	21	External	0x900F;

Drive Alarm Description	Drive Alarm Code	"Channel Error Type"	Code
Desaturation	5	PowerElectronic	0x9004;
MultiUndervolt	6		
Sovracc Mult	7		
MultiDesat	8		
Phaseloss	16		
Power_down	26		
Speed_fbk_loss	22	Feedback	0x900A;
Speed_ref_loss	24		
Opt_Enc_fault	20		
Encoder_error	50		
Opt_2_IO_fault	19	Technology	0x9010;
Opt_1_IO_fault	18		
ExtIO_fault	27		
FastLink_fault	28		
Watchdog	41	HWSW	0x9000;
Trap_error	42		
System_error	43		
User_error	44		
Param_error	45		
Opt_cfg_change	51		
All other alarms		Other	0x9012;

3. Profinet

3.1. “Cyclic data exchange”

The drive can also be operated with the Profidrive profile completely disabled. This allows full control of the state machine and the “Cyclic data exchange”.

Input and output data is configured on the drive. With Profinet, no data is configured for data exchange by default: the user must select the parameters to associate to the user defined words to exchange by configuring menus FIELDBUS M->S for input data and menu FIELDBUS S->M for output data, to match the module selected on the master.

When working in “Profinet mode”, the ADV200 operates with the drive state machine and setpoint: the user must configure the drive accordingly.

3.2. Quick Start with module “2 words”

The configuration described in this paragraph matches the module “ADV200 2 words” on the master , and allows control of the drive with user defined commands and reference.

To activate “Profinet mode” on the ADV200, set:

PAR	Description	Value
4000	**Fieldbus type**	**Rte**

In menu COMMUNICATION\FIELDBUS CONFIG.

Save the parameters and restart the drive to apply the mode.

Caution

Menus COMMANDS, REFERENCES and ALARMS CONFIG contain parameters automatically configured when Profidrive is enabled with this procedure.

If the configuration is altered at a later time, the profile may not work as expected. This may also happen after performing an autotuning, controlling the drive from terminals, selecting a different reference .

To restore the correct configuration and operate with the Profidrive profile, it is necessary to set 4000 “Fieldbus type” to “Off”, save the parameters and restart the drive, then set 4000 “Fieldbus type” to “Profidrive” again, save and restart.

The drive is now in Profinet mode. All the parameters in menus M->S and S->M can be configured by the user, there is no predefined set.

Caution

At least 1 parameter in M->S and 1 in S->M must be set, otherwise the size of Cyclic Data is 0 and cannot match the module on the master.

Il est nécessaire de configurer au moins un paramètre dans M->S et un dans in S->M ; dans le cas contraire, la taille des Données Cycliques sera égale à 0 et elle ne pourra être compatible avec le module sur le Maître.

In the following example, the drive will be operated by a custom control word, with speed reference in rpm, and returns a custom state word and the motor speed in rpm.

The following parameters must be set in menu COMMUNICATION/FIELDBUS M->S:

PAR	Description	Value
4020	**Fieldbus M-> S1 ipa**	**4452**
4022	**Fieldbus M-> S1 sys**	**Count 16**
4030	**Fieldbus M-> S2 ipa**	**610**
4032	**Fieldbus M-> S2 sys**	**Eu**

And in menu COMMUNICATION/FIELDBUS S->M:

PAR	Description	Value
4180	**Fieldbus S-> M1 ipa**	**4432**
4182	**Fieldbus S-> M1 sys**	**Count 16**
4190	**Fieldbus S-> M2 ipa**	**260**

4192	**Fieldbus S-> M2 sys**	**Eu**

In menu COMMUNICATION/WORD COMP a custom status word is defined:

PAR	Description	Value
4400	**Word bit0 src**	**Drive OK**
4402	**Word bit1 src**	**Drive ready**
4404	**Word bit2 src**	**Speed is 0**
4406	**Word bit3 src**	**Set speed**
4408	**Word bit4 src**	**Null**

While in menu COMMANDS the control word is connected:

PAR	Description	Value
1000	**Commands remote sel**	**Digital**
1018	**Digital Enable src**	**Bit0 decomp mon**
1020	**Digital Start src**	**Bit1 decomp mon**
1022	**FastStop src**	**Null**

When the configuration is complete, save the parameters and restart the drive.
The master can now send a custom control word in the first output word:

CONTROL WORD

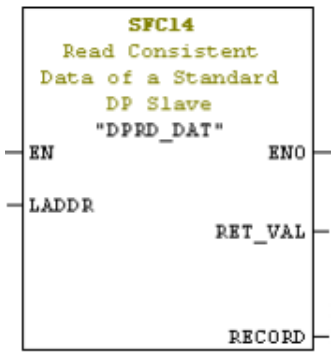
Bit	Description	Remarks
0	EnableCmd	Enable command from PLC
1	StartCmd	Start command from PLC

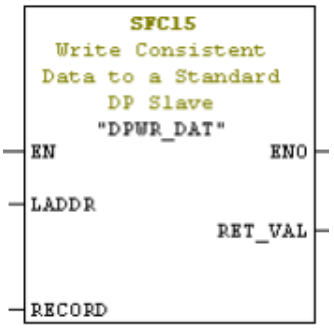
And the reference in rpm (with sign) in the second word.
The drive responds with the status word in the first input word:

STATUS WORD

Bit	Description	Remarks
0	EnableState	Drive enabled
1	Drive Ok	Drive Ok
2	Speed is zero	Zero speed threshold

And the motor speed will be available in the second input word.
On the master, the data exchange with the peripheral should use the standard blocks “DPRD_DAT” & “DPWR_DAT”





3.3. Additional configurations

It is possible to add additional words to the “Cyclic data exchange” area. On the master, up to 32 modules are available for Profinet, from “1 word” to “32 words”.

The selection of the module must match the configuration of the drive, only some modules can be selected for a specific configuration of drive parameters. The input and output size on the drive is configured in menus “FIELDBUS M->S” and “FIELDBUS S->M”. Moreover, up to 16 additional words are available for a MdPlc application running on ADV200 (see “Data Exchange with MdPlc”)

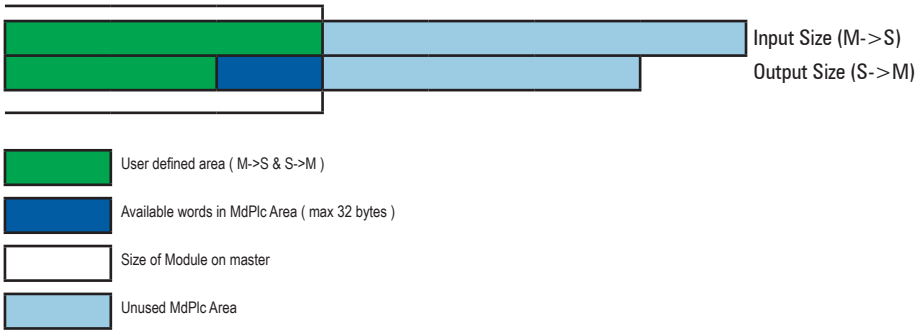
The following rules must be taken into consideration:

- The size of the module must be greater or equal to the size of the User defined data configured on the drive in menus “FIELDBUS M->S” and “FIELDBUS S->M”.

- However, the size of the module cannot exceed the size of the User defined data configured on the drive by more than 32 bytes.
- All the modules have symmetric input and output size. This is not requested on the drive, it is possible to use a different size for input parameters in “FIELDBUS M->S” and output parameters in “FIELDBUS S->M”, if the size of the module is greater or equal to the maximum of the two sizes.

This is a graphical representation of a valid configuration, with the size of the module equal to the maximum of the number of words programmed on the drive.

(Module “8words”, 8 words in M->S, 6 words in S->M)



This is also a valid configuration, with the size of the module greater than the size available to the inverter

(Module “24words”, 8 words in M->S, 6 words in S->M)

Another valid example, with only some words of the MdPlc are available

(Module “10 words”, 8 words in M->S, 6 words in S->M)

This configuration is not valid: the size of the module is less than the configuration of the drive

(Module “6 words”, 8 words in M->S, 4 words in S->M).

The missing part is in red.

This configuration is also not valid, the size of the module exceeds the data on the drive

(Module “32words”, 8 words in M->S, 6 words in S->M)

If the size of the module does not match the configuration on the drive, the “Cyclic data exchange” state is not possible and the state is reported as “PreOperational”

PAR	Description	Value
4014*	**Fieldbus state**	**Pre Operational**

The error “Opt bus fault” with subcodes 0084h (for Output size mismatch) or 0074h (for Input size mismatch) is reported. However, if the configuration is allowed, the size of the module has been updated on the drive and can be stored on the drive with a “Save parameter” command. Upon the next restart of the drive, the stored size is used to match the size of the module, and the “Cyclic data exchange” is available, with state “Operational”.

Therefore it is always recommended to execute a “Save parameter” and restart the drive when a module is first configured on the master or when the parameters of the drive have been changed.

On the other end, if the configuration is not allowed, the drive will not go to “Cyclic data exchange” automatically after restart, even if the parameters are saved. The error “Opt bus fault” with Subcodes 0084h and 0074h are always reported after restart. In this situation it is still possible to force the exchange and Operational state by forcing the same module again on the master, or disconnecting and reconnecting the cable: the cyclic data is not correct, it is not recommended to operate the drive in this condition.

3.4. Drive parameter access

In this chapter the parameters available for “Acyclic Data Access”are defined.

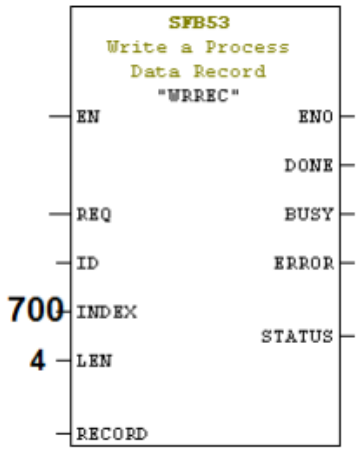
It is possible to send “WRREC” requests to change writable parameters or “RDREC” requests to read parameters. All the parameters of the drive can be accessed in this way.

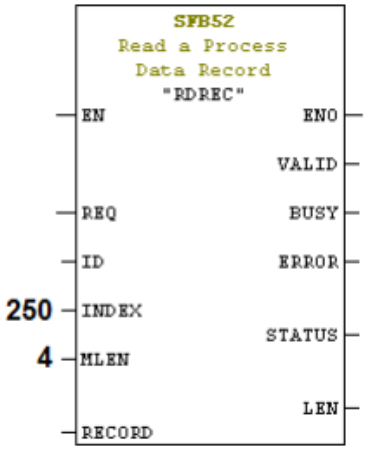
The “INDEX” in the request corresponds to the drive parameter IPA, Depending on the format of the parameter, requests must be issued with a length of 2 bytes for formats Short, Unsigned Short, Enum and 4 bytes for Integer, Unsigned Int, Float.

For example, to access:

PAR	Description	Value
700	**Acceleration time 0**	**10.00 s**

The “INDEX” in the “WRREC” must be 700, with a LEN of 4 bytes





To read P.250 “Output current”, the “INDEX” for block “RDREC” must 250, with MLEN of 4 bytes

For example, to access:

PAR	Description	Value
250	**Output current**	**--**

The following table lists all the available data type, with the number of bytes for each type.

ADV200 Type	Data type	Length(byte)	Description
BIT	Unsigned16	2	Boolean
ENUM	Unsigned16	2	Selection list
FLOAT	FloatingPoint	4	Real
FBM->SIPA	Unsigned16	2	16-bit unsigned integer. Only PAR of existing parameters accepted
FBS->MIPA	Unsigned16	2	16-bit unsigned integer. Only PAR of existing parameters accepted
INT16	Integer16	2	Integer with sign 16 bits, from modbus seen as 16 bits
INT32	Integer32	4	Integer with sign 32 bits, from modbus seen as 32 bits
ILINK	Unsigned16	2	Selection list
LINK	Unsigned16	2	Selection list
UINT16	Unsigned16	2	Integer without sign 16 bits
UINT32	Unsigned32	4	Integer without sign 32 bits
SINT	Integer8	1	Integer 8 bits

3.5. Diagnosis information

Drive alarms are reported by Profinet diagnostic as “Diagnosis information”, to be displayed by the master in the device state.

Each drive alarm is assigned a code and description in the GSDML file. For a list of drive alarms, check the manual of ADV200.

ADV200 Alarm code	Description	Profinet Diagnostic code
1	Overvoltage	256
2	Undervoltage	257
3	Ground fault	258
4	Overcurrent	259

ADV200 Alarm code	Description	Profinet Diagnostic code
5	Desaturation	260
6	MultiUndervolt	261
7	MultiOvercurr	262
8	MultiDesat	263
9	Heatsink OT	264
10	HeatsinkS OTUT	265
11	Intakeair OT	266
12	Motor OT	267
13	Drive overload	268
14	Motor overload	269
15	Bres overload	270
16	Phaseloss	271
17	Opt Bus fault	272
18	Opt 1 IO fault	273
19	Opt 2 IO fault	274
20	Opt Enc fault	275
21	External fault	276
22	Speed fbk loss	277
23	Overspeed	278
24	Speed ref loss	279
25	Emg stop alarm	280
26	Power down	281
27	ExtIO fault	282
28	FastLink fault	283
29	Brake fault	284
30	Motor pre OT	285
31	Mot phase loss	286
32	Not Used2	287
33	Plc1 fault	288
34	Plc2 fault	289
35	Plc3 fault	290
36	Plc4 fault	291
37	Plc5 fault	292
38	Plc6 fault	293
39	Plc7 fault	294
40	Plc8 fault	295
41	Watchdog	296
42	Trap error	297
43	System error	298
44	User error	299
45	Param error	300
46	Init Ld	301
47	Init LdPlcCnf	302
48	Init LdPlcPar	303
49	Key failed	304
50	Encoder error	305
51	Opt cfg change	306
52	Not Used3	307
53	Plc9 fault	308
54	Plc10 fault	309
55	Plc11 fault	310
56	Plc12 fault	311
57	Plc13 fault	312
58	Plc14 fault	313
59	Plc15 fault	314
60	Plc16 fault	315

3.6. Data Exchange with MdPlc

ADV200 supports “Cyclic data exchange” of up to 64 bytes for input and 64 bytes for output. Part of the data exchange area can be mapped to drive parameters, using menus “FIELDBUS M->S” and “FIELDBUS S->M”.

With these menus, it is possible to assign up to 16 parameters for read and 16 parameters for write, by assigning the corresponding drive parameter number. Each parameter can use 2 or 4 bytes ,depending on the format of the parameter and the setting in “sys”.

In addition to the data configured in the menus, up to 32 additional bytes are always available to an MdPlc application. The total available size depends on the selected module, and can be non-simmetrical for input and output. The area is automatically created when the module is assigned.

The data assigned to M->S and S->M parameters is available on the following variables:

Name	*Type*	*Address*	*Size*	*Group*	*Description*
di sysFBRxdw1	DINT	%ID240.0	1	FIELDBUS	Fieldbus Rx buff DW1
di sysFBRxdw10	DINT	%ID240.9	1	FIELDBUS	Fieldbus Rx buff DW10
di sysFBRxdw11	DINT	%ID240.10	1	FIELDBUS	Fieldbus Rx buff DW11
di sysFBRxdw12	DINT	%ID240.11	1	FIELDBUS	Fieldbus Rx buff DW12
di sysFBRxdw13	DINT	%ID240.12	1	FIELDBUS	Fieldbus Rx buff DW13

di sysFBRxdw14	DINT	%ID240.13	1	FIELDBUS	Fieldbus Rx buff DW14
di sysFBRxdw15	DINT	%ID240.14	1	FIELDBUS	Fieldbus Rx buff DW15
di sysFBRxdw16	DINT	%ID240.15	1	FIELDBUS	Fieldbus Rx buff DW16
di sysFBRxdw2	DINT	%ID240.1	1	FIELDBUS	Fieldbus Rx buff DW2
di sysFBRxdw3	DINT	%ID240.2	1	FIELDBUS	Fieldbus Rx buff DW3
di sysFBRxdw4	DINT	%ID240.3	1	FIELDBUS	Fieldbus Rx buff DW4
di sysFBRxdw5	DINT	%ID240.4	1	FIELDBUS	Fieldbus Rx buff DW5
di sysFBRxdw6	DINT	%ID240.5	1	FIELDBUS	Fieldbus Rx buff DW6
di sysFBRxdw7	DINT	%ID240.6	1	FIELDBUS	Fieldbus Rx buff DW7
di sysFBRxdw8	DINT	%ID240.7	1	FIELDBUS	Fieldbus Rx buff DW8
di sysFBRxdw9	DINT	%ID240.8	1	FIELDBUS	Fieldbus Rx buff DW9
di sysFBRxdwX	DINT	%ID240.0	1	FIELDBUS	Fieldbus Rx buff DWX
di sysFBTxdw1	DINT	%MD240.0	16	FIELDBUS	Fieldbus Tx buff DW1
di sysFBTxdw10	DINT	%MD240.9	1	FIELDBUS	Fieldbus Tx buff DW10
di sysFBTxdw11	DINT	%MD240.10	1	FIELDBUS	Fieldbus Tx buff DW11
di sysFBTxdw12	DINT	%MD240.11	1	FIELDBUS	Fieldbus Tx buff DW12
di sysFBTxdw13	DINT	%MD240.12	1	FIELDBUS	Fieldbus Tx buff DW13
di sysFBTxdw14	DINT	%MD240.13	1	FIELDBUS	Fieldbus Tx buff DW14
di sysFBTxdw15	DINT	%MD240.14	1	FIELDBUS	Fieldbus Tx buff DW15
di sysFBTxdw16	DINT	%MD240.15	1	FIELDBUS	Fieldbus Tx buff DW16
di sysFBTxdw2	DINT	%MD240.1	1	FIELDBUS	Fieldbus Tx buff DW2
di sysFBTxdw3	DINT	%MD240.2	1	FIELDBUS	Fieldbus Tx buff DW3
di sysFBTxdw4	DINT	%MD240.3	1	FIELDBUS	Fieldbus Tx buff DW4
di sysFBTxdw5	DINT	%MD240.4	1	FIELDBUS	Fieldbus Tx buff DW5
di sysFBTxdw6	DINT	%MD240.5	1	FIELDBUS	Fieldbus Tx buff DW6
di sysFBTxdw7	DINT	%MD240.6	1	FIELDBUS	Fieldbus Tx buff DW7
di sysFBTxdw8	DINT	%MD240.7	1	FIELDBUS	Fieldbus Tx buff DW8
di sysFBTxdw9	DINT	%MD240.8	1	FIELDBUS	Fieldbus Tx buff DW9
di sysFBTxdwX	DINT	%MD240.0	16	FIELDBUS	Fieldbus Tx buff DWX

Each FieldbusRx (or TX) word is only used if the corresponding channel in M->S (or S->M) is assigned. If the “sys” parameter is of type Count16, Eu, Par16, MdPlc16 only the lower word is used.

Es: Module “10words”, 8 words in M->S, 6 words in S->M

The first word after the word used by M->S and S->M parameter is assigned to the MdPlc area. When developing a MdPlc application, this is available in the following variables:

Name	*Type*	*Address*	*Size*	*Group*	*Description*
di sysFBMdPlcRxdw1	DINT	%ID250.0	1	FIELDBUS	Fieldbus MdPlc Rx buff DW1
di sysFBMdPlcRxdw2	DINT	%ID250.1	1	FIELDBUS	Fieldbus MdPlc Rx buff DW2
di sysFBMdPlcRxdw3	DINT	%ID250.2	1	FIELDBUS	Fieldbus MdPlc Rx buff DW3
di sysFBMdPlcRxdw4	DINT	%ID250.3	1	FIELDBUS	Fieldbus MdPlc Rx buff DW4
di sysFBMdPlcRxdw5	DINT	%ID250.4	1	FIELDBUS	Fieldbus MdPlc Rx buff DW5
di sysFBMdPlcRxdw6	DINT	%ID250.5	1	FIELDBUS	Fieldbus MdPlc Rx buff DW6
di sysFBMdPlcRxdw7	DINT	%ID250.6	1	FIELDBUS	Fieldbus MdPlc Rx buff DW7
di sysFBMdPlcRxdw8	DINT	%ID250.7	1	FIELDBUS	Fieldbus MdPlc Rx buff DW8
di sysFBMdPlcRxdwX	DINT	%ID250.0	8	FIELDBUS	Fieldbus MdPlc Rx buff DWX
di sysFBMdPlcTxdw1	DINT	%MD250.0	1	FIELDBUS	Fieldbus MdPlc Tx buff DW1
di sysFBMdPlcTxdw2	DINT	%MD250.1	1	FIELDBUS	Fieldbus MdPlc Tx buff DW2
di sysFBMdPlcTxdw3	DINT	%MD250.2	1	FIELDBUS	Fieldbus MdPlc Tx buff DW3
di sysFBMdPlcTxdw4	DINT	%MD250.3	1	FIELDBUS	Fieldbus MdPlc Tx buff DW4
di sysFBMdPlcTxdw5	DINT	%MD250.4	1	FIELDBUS	Fieldbus MdPlc Tx buff DW5
di sysFBMdPlcTxdw6	DINT	%MD250.5	1	FIELDBUS	Fieldbus MdPlc Tx buff DW6
di sysFBMdPlcTxdw7	DINT	%MD250.6	1	FIELDBUS	Fieldbus MdPlc Tx buff DW7
di sysFBMdPlcTxdw8	DINT	%MD250.7	1	FIELDBUS	Fieldbus MdPlc Tx buff DW8
di sysFBMdPlcTxdwX	DINT	%MD250.0	8	FIELDBUS	Fieldbus MdPlc Tx buff DWX

The sysFBMdPlc words are filled starting from the first byte of dw1. If the area is not a multiple of 4, only the lower word of the sysFbMdPlc word is used.

In the example, 4 MdPlc words are available in output (10 words in the module – 6 words in S->M) and 2 as input (10 words – 8 words in M->S).

The format of the data is always “DINT” (32-bit integer). If the format of the data on the master is different, the data must be converted by the application.

4. Protocols: “Profinet IO”

The following chapters describe details on the implementation of the Profinet protocols on ADV200 device.

Profinet is an open vendor-independent Real-Time Ethernet standard (IEC 61158/61784), based on industrial Ethernet technology for both hardware and software, using TCP/IP and IT Standards developed for Automation Technology.

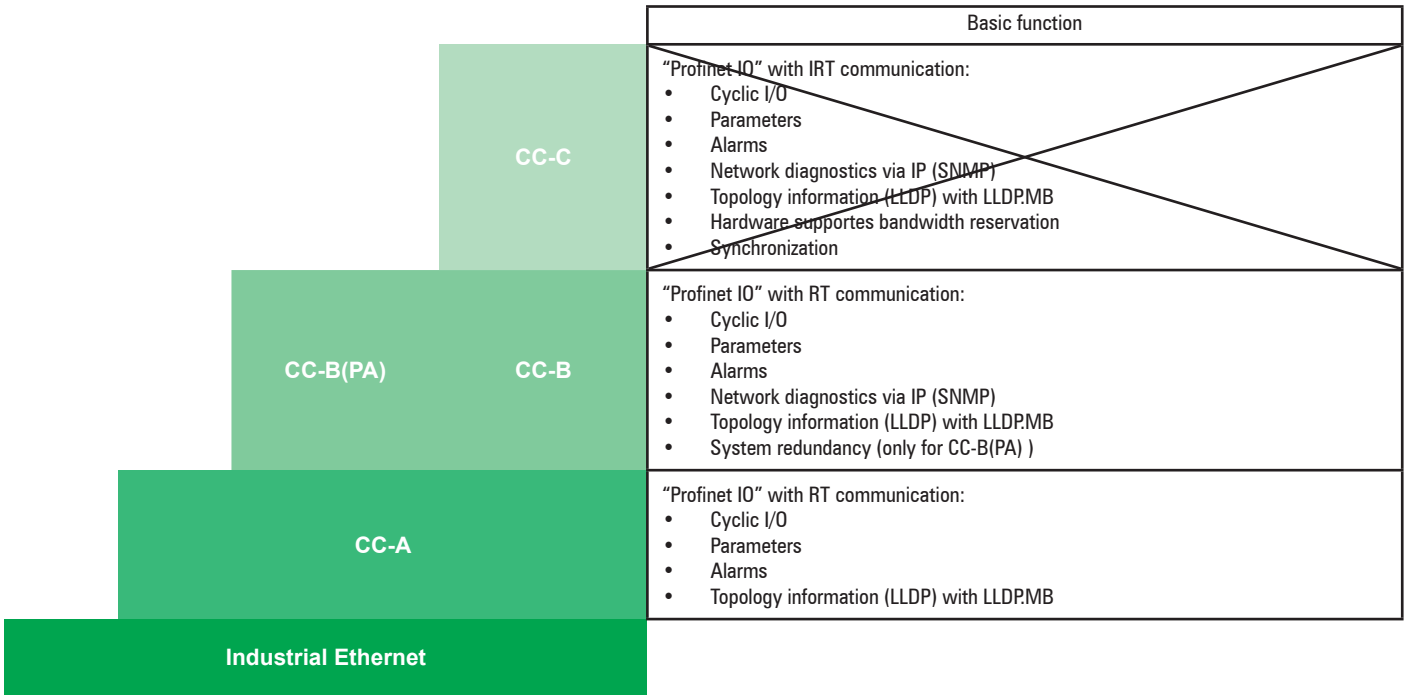
With PROFINET IO a switching technology is implemented that allows all stations to access the network at any time.

In this way, the network can be used much more efficiently through the simultaneous data transfer of several nodes. Simultaneous sending and receiving is enabled through the full-duplex operation of Switched Ethernet.

PROFINET IO is based on Switched Ethernet full-duplex operation and a bandwidth of 100 Mbit/s.

4.1. Conformance classes

“Profinet IO” defines “conformance classes” CC for the communication, built on one another:



ADV200 implements ProfinetRT CC-A & CC-B (Isochronous Mode is not supported) as “IO Device”.

An “IO Device” is identified by its station name. Connection establishment, parameterization and alarm handling is implemented with UDP. This requires that the “IO Device” also be assigned an IP (Internet Protocol) address in addition to the hardware address MAC (Media Access Control).

For allocation of the IP address, subnet mask and default “Gateway” two methods are defined:

- DCP: Discovery and Configuration Protocol
- DHCP: “Dynamic Host Configuration Protocol”

After identifying the “IO Device” by its station name, the “IO Controller” assigns the pre-configured IP address to the “IO Device”.

4.2. Connection establishment

Connection establishment starts with the “IO Controller” sending a connect request to the “IO Device”. The connect request establishes an “Application Relationship” (AR) containing a number of “Communication Relationships” (CRs) between the “IO Controller” and “IO Device”. The connect request defines some CRs within the AR. The following CRs are supported:

1. IO data CR’s support the point-to-point exchange of cyclic input and output process data between the “IO Controller” and “IO Device”.
2. A record data CR supports the exchange of log data.
3. An alarm CR supports the handling of alarms.
4. A multicast CR allows cyclic process data to be published by one node for consumption by any number of consumers.

In addition to the AR and CRs, the connect request specifies the modular configuration of the “IO Device”, the layout of the process IO data frames, the cyclic rate of IO data exchange and the watchdog factor.

Acknowledgement of the connect request by the “IO Device” allows parameterization to follow. From this point forward, both the “IO Device”

and “IO Controller” start exchanging cyclic process I/O data frames. The process I/O data frames don’t contain valid data at this point, but they start serving as keep-alive to keep the watchdog from expiring.

The “IO Controller” writes parameterization data to each “IO Device” sub-module in accordance with the “General Station Description Mark-up Language” (GSDML) file. Once all sub-modules have been configured, the “IO Controller” signals that parameterization has ended. The “IO Device” responds by signalling application readiness.

The “IO Device” followed by the “IO Controller” start to cyclically refresh valid process I/O data. The “IO Controller” processes the inputs and controls the outputs of the “IO Device”. Alarm notifications are exchanged acyclically between the “IO Controller” and “IO Device” as events and faults occur during this phase in the PROFINET IO connection life-cycle.

The connection between the “IO Device” and “IO Controller” terminates when the watchdog expires. Watchdog expiry is the result of a failure to refresh cyclic process I/O data by the “IO Controller” or the “IO Device”. Unless the connection was intentionally terminated at the “IO Controller”, the “IO Controller” will try to restart the PROFINET IO connection life-cycle.

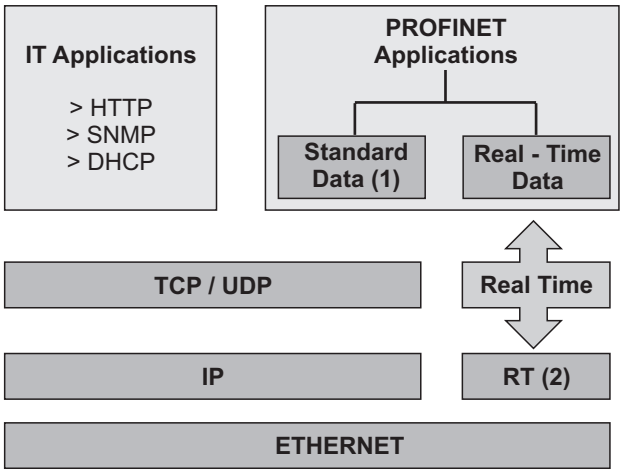
4.3. Real-time communication (RT)

The transmission of RT data is based on cyclical data exchange using a provider/consumer model. With the communication mechanisms of layer 2 (according to the ISO/OSI model) PROFINET IO message frames have priority over standard message frames in accordance with IEEE802.1Q (prioritization of data frames). This ensures the required determinism in the automation technology.

To enable enhanced scaling of communication options and, thus, also of determinism in PROFINET IO, real-time classes have been defined for data exchange.

The data is transferred via prioritized Ethernet message frames. Cyclic I/O data are transmitted unacknowledged as real-time data between provider and consumer in a parameterizable resolution.

Although you can realize update times from 250 µs with RT, the minimum updated time for data exchanged Cyclically with ADV200 is 1ms.



(1) Open channel for UDP /IP:
- Device parametrization and configuration;
- Reading of diagnostic data;
- Negotiation of the communication channel for the user data.

(2) “Real Time” channel RT
- Performance cyclic user data;
- Event controlled messages/alarms.

4.4. Acyclic data traffic

“Acyclic data exchange” can be used to parameterize and configure IO-Devices or to read out status information. This is accomplished with read/write frames via standard IT services using UDP/IP. In addition to the data records available for use by device manufacturers, the following system data records are also specially defined:

- Diagnostic information can be read out by the user from any device at any time.
- Error log entries (alarms and error messages), which can be used to determine detailed timing information about events within an IO-Device.
- Identification information as specified in PNO Guideline „I&M Functions“.
- Information functions regarding real and logical module structuring.
- Readback of I/O data.

An index is used to distinguish which service is tobe executed with the read/ write services.

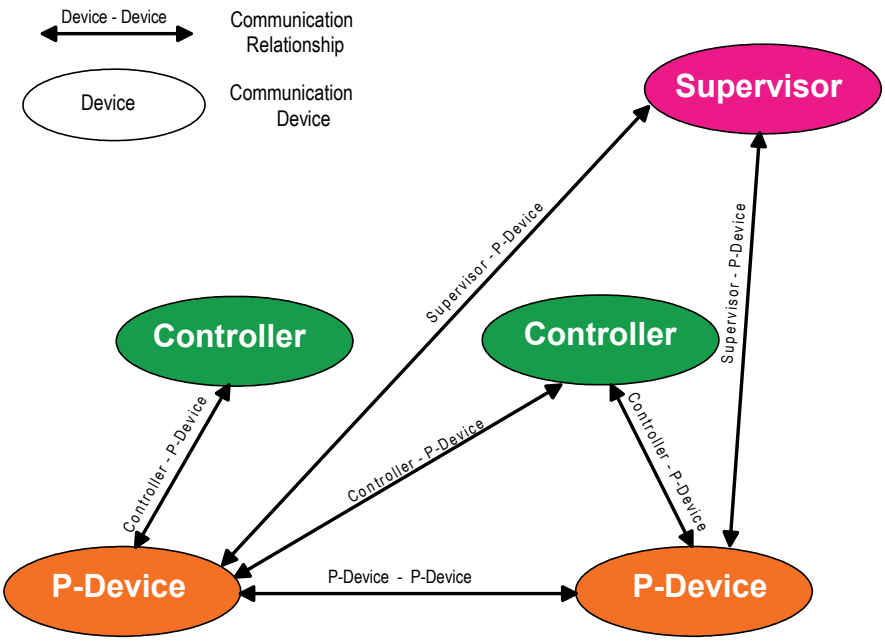
5. Protocols: Profidrive

5.1. General concepts

The following chapters describe details on the implementation of the Profidrive protocols on ADV200 device.

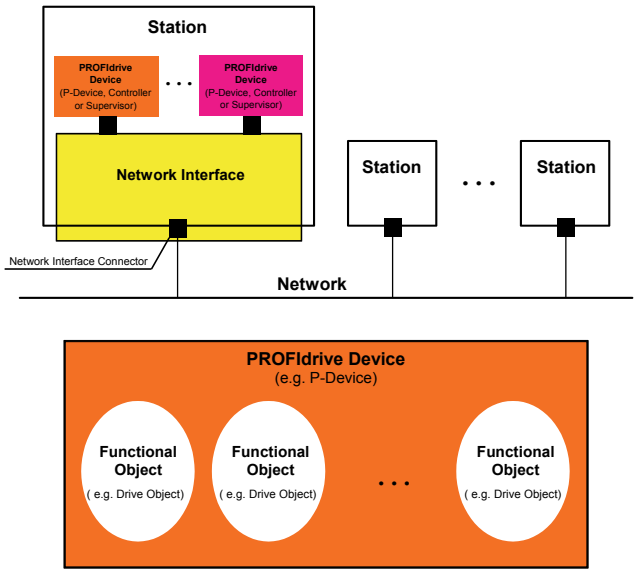
Profidrive is a profile for Drive Technology, mapped on “Profinet IO”. ADV200 acts as a “P-Device” (peripheral device), it is a field device and the host device for the drives. The “P-Device” typically can be associated with one or more Controller devices.

Fig. 5.1.1: PROFIdrive Devices and there relationship



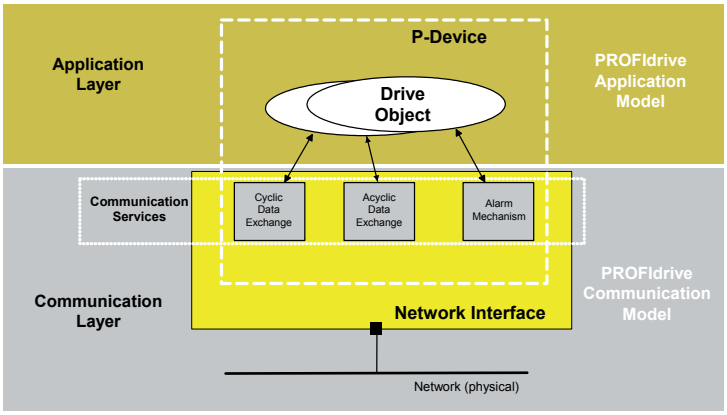
In a “P-Device”, the “Drive Unit” consists out of the drive device itself and a “Drive Objects” (DO).
ADV200 is a single drive axis, related to a “Axis type DO”s.

Fig. 5.1.2: General Communication Model of a PROFIdrive Automation System and “Functional Objects”



The typical functionality of the Drive Object is the drive functionality itself (motor, inverter stage, closed loop current and speed control, Input and output functionality).

Fig. 5.1.3: PROFIdrive Base Model contains the “Application Layer” and “Communication Layer”



5.1.1. Base Model State Machine

For the Base Model the following states, related to the communication and application run up process, are defined:

Offline There is generally no Communication Service working

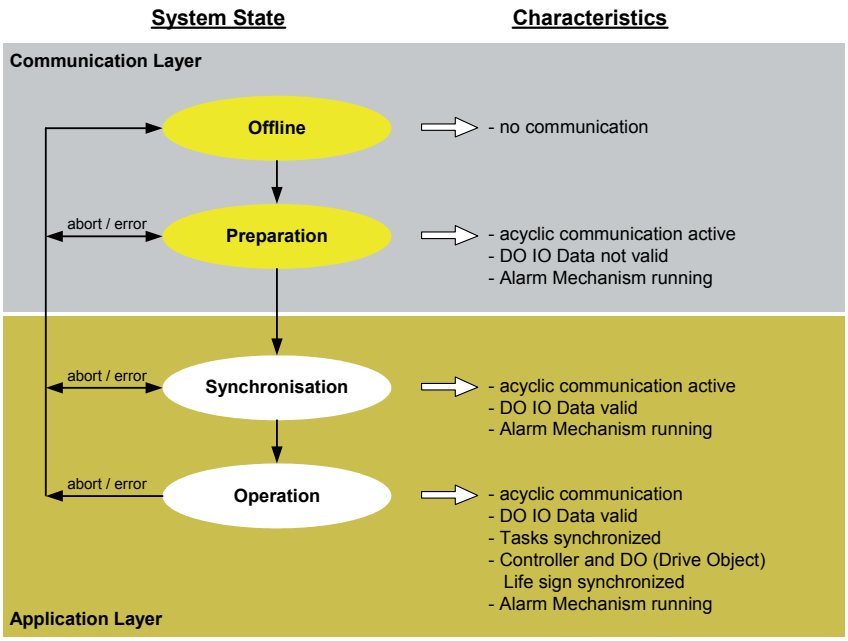
Preparation In this state the “Acyclic data exchange” service and the “Alarm Mechanism” is working. This means, that configuration information may be passed from the Controller to the Drive Unit and Parameter Access is possible. Also alarms will be forwarded. There may be no “Cyclic data exchange” service or the transmitted Data is not valid.

Synchronisation In this state the “Acyclic data exchange”, the “Cyclic data exchange” and the “Alarm Mechanism” are working and the transmitted cyclic data is valid.

Operation In this state also the application processes are synchronised and the whole application is ready to operate (productive work).

If in this states exceptions occur which drive the system to lose one or more of the characteristics related to the actual state, the related Devices will be forced to go back to a corresponding predecessor state, in order to proceed to switch forward to the next higher level again if possible and allowed.

Fig. 5.1.4: Base Model State Machine



Central element of the DO is the Process Control Task which is responsible for the automation functionality of the DO.

To access DO parameters, “Acyclic data exchange” service is used. For periodic transportation of setpoint values to the DO and actual values from the DO, the “Cyclic data exchange” service is used. The DO comprises a General State Machine, which controls and represents the states of the Drive Process Control Task. Exception situations out of the Process Control Task and the General State Machine are signalled by the “Alarm Mechanism” to the controlling device.

5.1.2. “Axis type Drive Object”

With ADV200, the DO is of “Axis” type and it is related to a motor (Drive Axis).

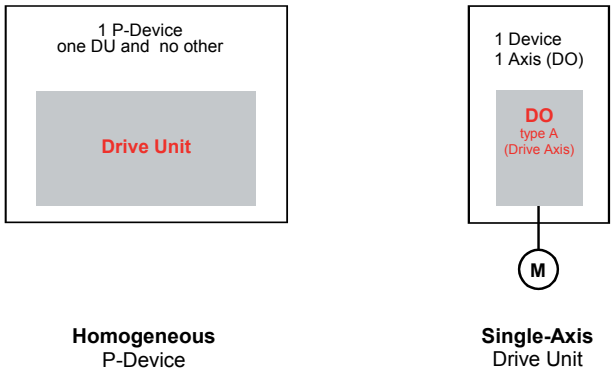
The Axis DO consists out of numerous function modules that work together internally, and therefore portray the intelligence of the “Axis type DO”.

The following logical objects are included in an Axis DO:

- Objects for DO identification
- Parameters for accessing information and settings of the individual function modules
- Objects for setting the communication interface (for example, PROFIdrive Interface)
- Objects for drive control (for example, control words and status words)
- Objects for setpoint processing (for example, setpoint values and actual values)
- Objects for diagnostics and monitoring (for example, messages, alarms, faults)
- Objects for integrated peripheral functions (integrated I/O)

The “P-Device” of ADV200 is of “Homogeneous” type, containing only one PROFIdrive Drive Unit .
Drive Unit classification: ADV200 is of “Single-Axis” type: one physical device with only one “Axis type DO”.

Fig. 5.1.5: Classes of PROFIdrive P-Devices

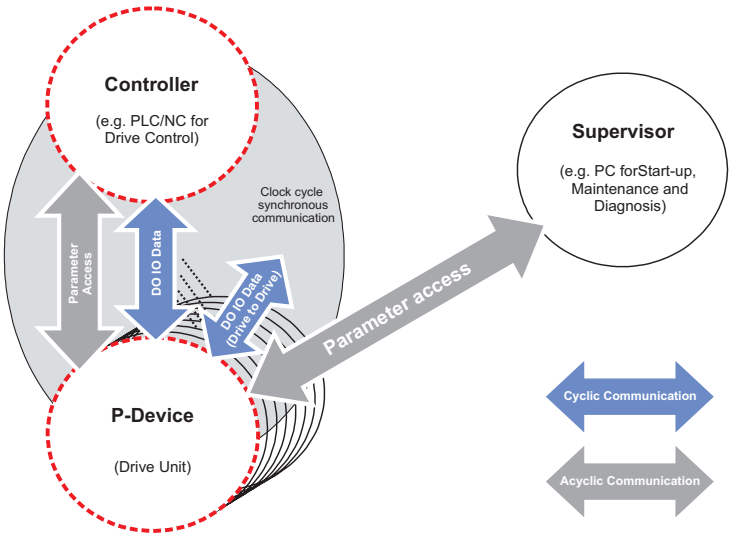


5.1.3. “P-Device” communication model

The figure shows the different communication channels which are available between the “P-Device” and the other Devices. The color shows the Communication Service related to this communication channel. DO IO Data transfer is available between “P-Device” and Controller. Parameter Access to the “P-Device” is available from all other Controller and Supervisor Devices.

5.1.4. Application Model and Application Classes

Fig. 5.1.6: Overview about the available Communication Services between the PROFIdrive Devices



The Application Model is part of the “Application Layer”, the type of “Application Class” predefines the contents of the “Functional Objects” and the type of data (Information) to be transported between the “Functional Objects”.

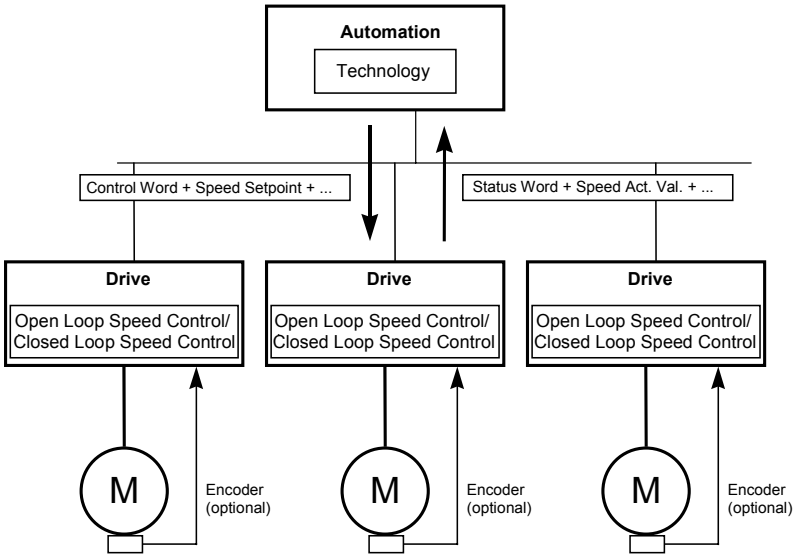
ADV200 implements the “Application Class 1 (AC 1) “Standard Drive”
(Interface).

No. “Application Class”	Interface	Functions b
1 Standard Drive	n-setpoint,	acyclic interface for parameters, diagnostics, identification Cyclic IO Data interface

The drive is controlled via a primary setpoint (speed setpoint) (see Figure). The speed control is governed completely in the drive.
The PLC includes all technological functions for the automation process. The field bus is merely the transmission medium between the

automation system and the drive controller. The “Cyclic data exchange” Communication Service is used. This type of application is used primarily in the field of classical drive engineering. “Clock Synchronous Operation” is not available.

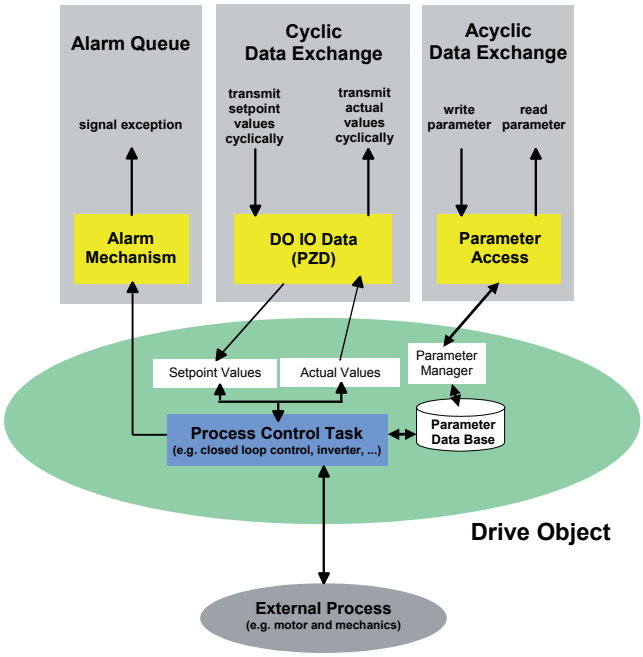
Fig.5.1.7: “Application Class 1



5.1.5. General “Axis type Drive Object” architecture

The Figure shows the functional elements of the “Axis type Drive Object” (DO). Central element of the “Axis type DO” is the “Axis Control Task” which is responsible for the control of the related Axis. Properties of the DO and the “Axis Control Task” are represented and controlled by parameters.

Fig. 5.1.8: General Drive Object architecture

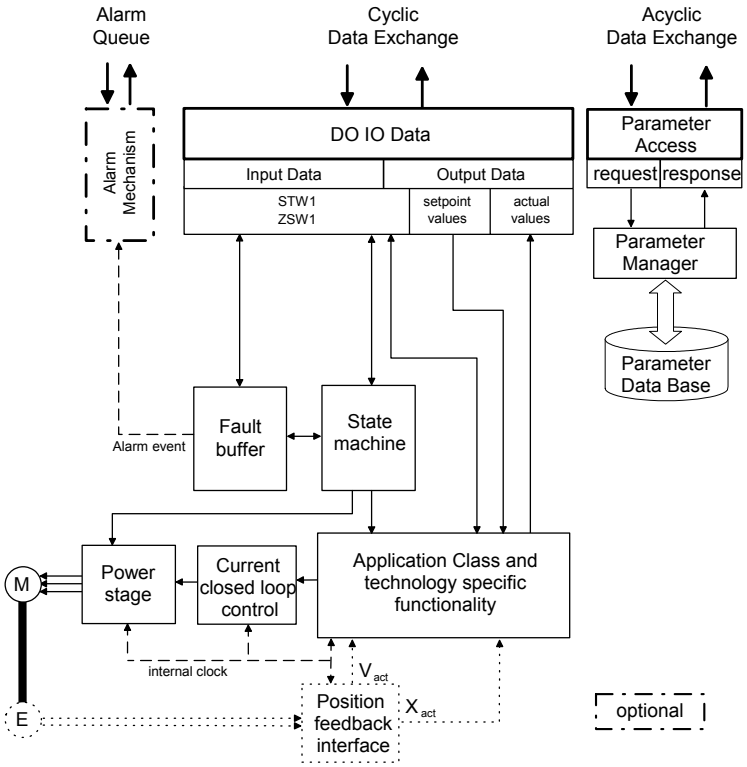


The parameters are administered in the Parameter Data Base. To access DO parameters, the “Acyclic data exchange” service is used by aid of the parameter manager.

The parameter manager receives parameter requests, does the access to the Parameter Data Base and answers to the parameter request with a related parameter response. For periodic transportation of setpoint values to the Axis and actual values from the Axis DO, the “Cyclic data exchange” service is used.

The “Axis type DO” comprises the General State Machine, which controls and represents the states of the “Axis Control Task”. Exception situations out of the “Axis Control Task” and the General State Machine may be signalled by the “Alarm Mechanism” to the controlling device.

Fig 5.1.9: Functional block diagram of the PROFIdrive “Axis type DO”



The “Axis type DO” comprise the functionalities:
- Parameters
- “Axis Control Task”
- General State Machine
- DO IO Data (setpoint values and actual values)
- Support of “Alarm Mechanism“.

The “Axis Control Task” is subdivided in the following elements:
- Fault buffer
- Position feedback interface
- Power stage
- Current closed loop control
- “Application Class” and technology specific functionality.

5.2. “Cyclic data exchange”

Cyclic communication means the simple transfer of IO data of predefined size in a reserved time slot. With cyclic communication, the IO data that is critical with respect to time is exchanged between the controller and device or between devices. Typical such data contains setpoint values and actual values, control- and status information. The “Cyclic data exchange” service is assigned to the “Controller – P-Device” and the “P-Device – P-Device” relationship, and it is related to a Communication Object at its end points.

ADV200 supports data exchange with “Standard Telegram 1”. In addition, up to 30 User Defined Words are supported.

The minimum update time of data exchanged cyclically for ADV200 is 1ms.

5.2.1. “Standard Telegram 1”

“Standard Telegram 1” is defined for speed setpoint interface operations (AC1 and AC4). The “Standard Telegram 1” have the following structure:

“Standard Telegram 1”: n set interface, 16 bit

Definition of “Standard Telegram 1”

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2	NSOLL_A	NIST_A

Fieldbus M->S 1 ipa = P.4346 “Profidrive Control Word”

Fieldbus M->S 2 ipa = P.610 “Ramp ref 1 src”

Fieldbus S->M 1 ipa = P.4394 “Profidrive Status Word”

Fieldbus S->M 2 ipa = P.260 “Motor speed”

Standard telegram 2: n set interface, 32 bit, without sensor

IO Data number	Setpoint	Actual value
1	STW1	ZSW1
2 3	NSOLL_B	NIST_B
4	STW2	ZSW2

Standard telegram 2 is not available as a module. It is possible to implement the functionality of ST2 with module “Standard Telegram + 1word” or greater and set

M->S 2 Sys = Count 32

M->S 3 ipa = P.4452 (“Word decomp src” as STW2, all bits are programmable)

S->M 2 Sys = Count 32

S->M 3 ipa = P.4432 (“Sorgente word decomp” as ZSW 2, all bits are programmable)

Control word 1 (STW1)

Bit Significance in Speed control mode

0 ON / OFF

1 No Coast Stop / Coast Stop

2 No Quick Stop / Quick Stop

Fast stop management of ADV200, 714 “Deceleration time 3”

3 Enable Operation / Disable Operation

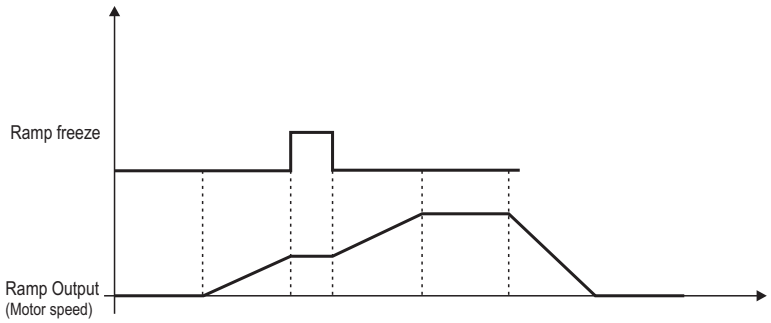
The selected ramp is used, default P.700 “Acceleration time 0” P.702 “Deceleration time 0”

4 Enable Ramp Generator / Reset Ramp Generator

P.750 “Ramp in zero” of ADV200

5 Unfreeze Ramp Generator / Freeze Ramp Generator

P.754 “Ramp freeze” of ADV200

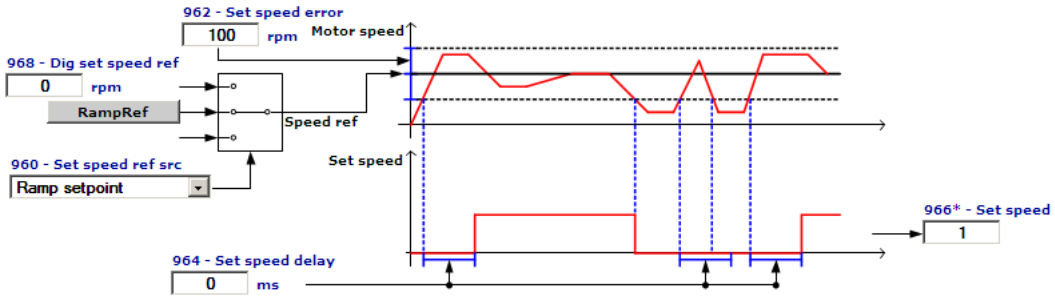


6 Enable Setpoint / Disable Setpoint
P.752 “Ramp out zero” of ADV200
7 Fault Acknowledge (0 -> 1)
8 Jog 1 ONa/ Jog 1 OFFa
P.916 “Jog cmd + src” command of ADV200, setpoint is P.910 “Jog setpoint” positive
9 Jog 2 ONa/ Jog 2 OFFa
P.918 “Jog cmd + src” command of ADV200, setpoint is P.910 “Jog setpoint” negative
10 Control By PLC / No Control By PLC
11 12 13 14 15 Not Used

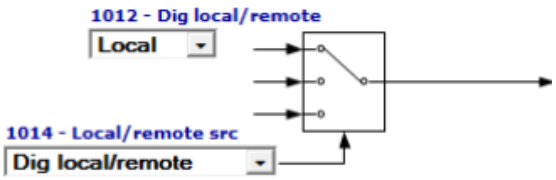
Status word 1 (ZSW1)
Bit Significance inSpeed control mode
0 Ready To Switch On /Not Ready To Switch On
1 Ready To Operate / Not Ready To Operate
2 Operation Enabled (drive follows setpoint) / Operation Disabled
3 Fault Present / No Fault

4 Coast Stop Not Activated / Coast Stop Activated
5 Quick Stop Not Activated / Quick Stop Activated
6 Switching On Inhibited / Switching On Not Inhibited
7 Warning Present / No Warning

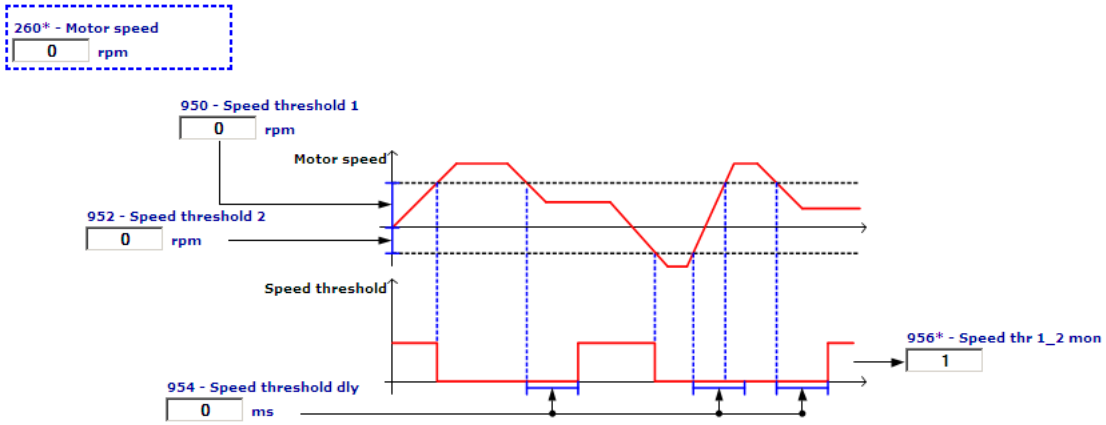
8 Speed Error Within Tolerance Range / Speed Error Out Of Tolerance Range
“Set speed” of ADV200



9 Control Requested / No Control Requested



10 f Or n Reached Or Exceeded / f Or n Not Reached
“Speed threshold 1-2” of ADV200



11 12 13 14-15 Not Used

Status bit "Pulses Enabled/Disabled"

PNU 924 is not supported. "P.E." bit not available

NSOLL_A Setpoint

"Ramp ref 1" of ADV200. Data type is N2.

Linear normalised value. 0% corresponds to 0 (0x0), 100% corresponds to 2^{14} (0x4000). 100% of setpoint is P.680 "Full scale speed" of ADV200.

NIST_A Actual value

P.260 "Motor speed" of ADV200. Data type is N2.

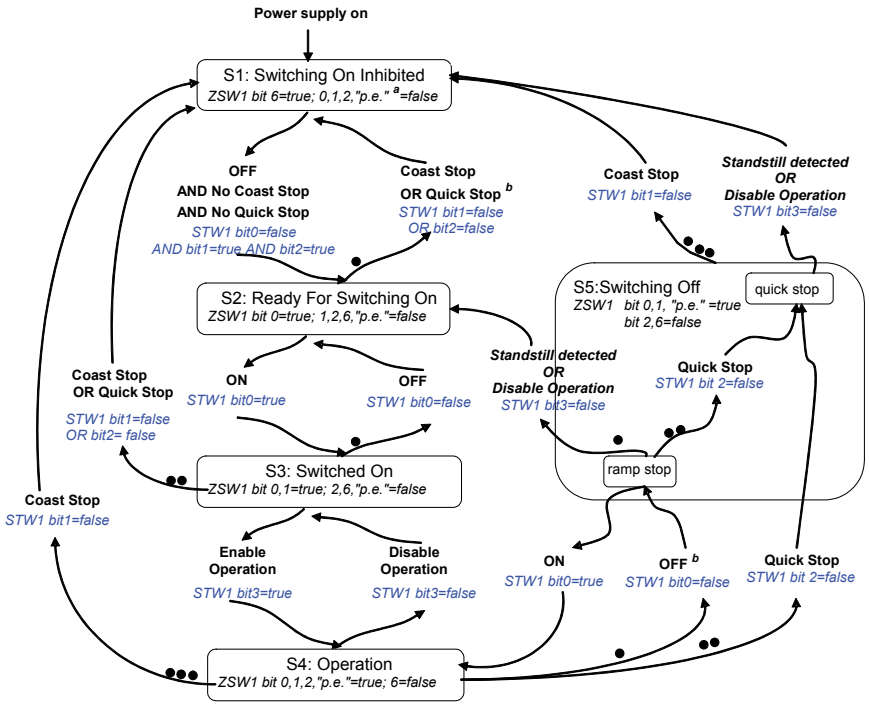
Linear normalised value. 0% corresponds to 0 (0x0), 100% corresponds to 2^{14} (0x4000). 100% of actual value is P.680 "Full scale speed" of ADV200.

5.2.2. State diagram

State diagrams are defined for the operating modes.

In order to simplify the diagram, the states, common for all operating modes, are combined in the general state. This state diagram corresponds with the function block "state machine" in the general Drive Object block diagram

Fig. 4.2.12: General state diagram for all operating modes



NOTE 1 STW1 bit x,y =: These control word bits shall be set by the control.
NOTE 2 ZSW1 bit x,y = These status word bits indicate the actual state.
NOTE 3 Standstill detected is an internal result of a stop operation.
a Abbr.:"p.e." = "Pulses enabled"

b The internal condition "fault with ramp stop" also activates this transition.

Information on the general state diagram:

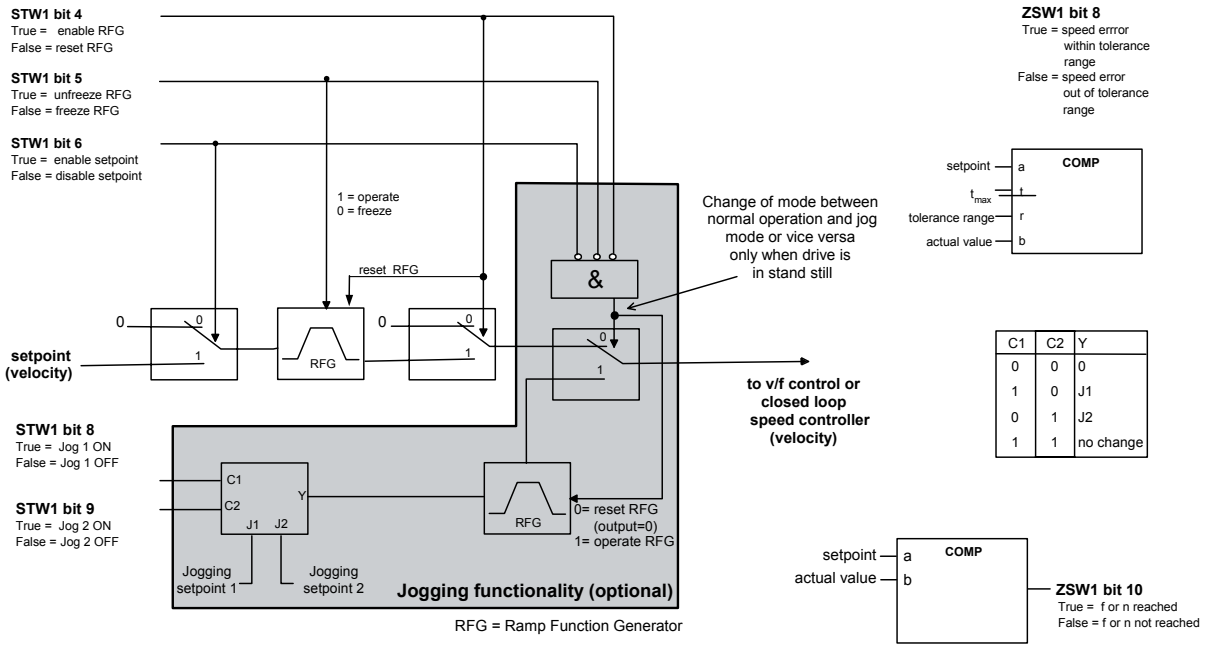
- From several states, several transitions are possible. In order to achieve standard device behaviour, the transitions are specified with assigned priorities in the particular state diagrams.
- In the general state diagram, internal conditions of the drive are not shown. Internal signals may have influence on the transitions.

All transitions in this general state machine may only be initiated by a controller, if it has the control priority. The following conditions shall be fulfilled to give the controller the control priority:

- the PROFINET interface between this controller and the DO has the control priority
- ZSW1 Bit 9 is set by the DO
- STW1 Bit 10 is set by the controller

Internal conditions of the drive or control priority of another interface may cause transitions independent of this controller.

Fig. 5.2.1: Speed setpoint channel for use in "Application Class 1 and 4



C1	C2	Y
0	0	0
1	0	J1
0	1	J2
1	1	no change

The following table lists a sequence of commands sent by the Controller and received by the drive, to start the motor according to the state machine on the previous page .Every line shows a transition started by the Controller or a state change in the drive.

PLC		Drive		State
STW1	NSOLL_A	ZSW1	NIST_A	
0x400	0x4000	0x340	0	S1
0x406	0x4000	0x331	0	S2
0x407	0x4000	0x333	0	S3
0x47F	0x4000	0x337	0	S4
		…		
0x47F	0x4000	0x737	0x4000	S4
…				
Now to issue a "ramp stop" command to state S5:				
0x47e	0x4000	0x633	0x4000	S5
		…		
0x47E	0x4000	0x331	0	S2
Or a "quick stop" command:				
0x47B	0x4000	0x613	0x4000	S5
		…		
0x47B	0x4000	0x350	0	S1

5.2.3. Jogging functionality in speed control mode

Prerequisite for the jog mode is that the drive is already switched to state S4 "operation". Switching of mode between normal operation and jog mode (drive follows selected jogging setpoint) is only possible when the drive is in a standstill. To enter the jog mode (drive shows effect on the jog bits (STW1, bits 8 and 9)) the standard setpoint channel shall be completely deactivated, Leaving the jog mode and switching back to normal operation requires first that the drive comes to a standstill in the jog mode (STW1, Bits 8, 9 ==0). STW1 bits 4, 5, 6 need not

force the drive to leave the jog mode if the drive is not already in a standstill. If in jog mode the speed setpoint from “jogging setpoint 1” is activated (STW1 bit 8=1) and afterward also “jogging setpoint 2” (STW1 bit 9=1) is activated, then the drive still keeps the former setpoint value “joggingsetpoint 1”. If both jog bits are activated at the same time then the jogging setpoint value is zero.

Jog Setpoint 1 is “Jog +”, positive value of Jog Ramp, Jog Setpoint 2 is “Jog -”.

PAR	Description	Value
910	**Jog setpoint**	**100 rpm**

This table contains the sequence to jog the motor, first at JogSetpoint1 and then at JogSetPoint2:

PLC		**Drive**		**State**
STW1	NSOLL_A	ZSW1	NIST_A	
0x400	0x4000	0x340	0	S1
0x406	0x4000	0x331	0	S2
0x407	0x4000	0x333	0	S3
0x40F	0	0x237	0	S4
0x50F	0	0x337	0	S4 Jog1
…				
0x50F	0	0x737	100 rpm	S4, jog1
…				
0x60F	0	0x737	100 rpm	S4, jog2
…				
0x60F	0	0x737	-100 rpm	S4, jog2

5.2.4. DO IO Data

The setpoints to the Axis and also the actual values from the Axis are transferred as DO IO Data. The DO IO Data is transferred using the “Cyclic data exchange” service. The representation of data is in big-endian format. The individual setpoints/actual values are included in the DO IO Data of the Axis, for interoperability and interchangeability of PROFIdrive Controllers and “Drive Objects”.

Assignment of IO Data in the data telegram is not available with Profile parameters.

Signals are assigned by setting drive parameters in menus “FIELDBUS M->S” and “FIELDBUS S->M”.

PNU922: “Telegram selection” P922 is only readable. The value cannot be set and is always equal to:

- 1 = “ Standard telegram 1”: n set interface, 16 bit
- P915 and P916 P923 are not available.

5.3. “Acyclic data exchange”

Compared to cyclic communication, data is exchanged acyclically only if necessary. Via acyclic communication, not time critical data is transferred, for example the download of parameter data. The “Acyclic data exchange” service is assigned to the “Controller - P-Device” and the “Supervisor - P-Device” relationship. An “Acyclic data exchange” channel is related to a Communication Object at its end points.

5.3.1. “Base Mode Parameter Access” model

A parameter represents an information memory that consists of the following elements:

- Parameter value (PWE) Includes the information variable(s)
- Parameter description (PBE) Specifies a parameter
- Text Text access not supported

A parameter number is assigned to each parameter. The number range of the parameters is specified for decimal 1-65535. The parameter 0 is not permitted. Profile-specific parameters are specified or reserved for the ranges decimal 900-999 and decimal 60000-65535 (refer to 6.4).

“Device specific” parameter are in the range 1000..59999: these range is used to define as PNUs all the parameters of ADV200, represented as: PNU number = ADV200 parameter number + 8192

5.3.2. Parameter value

The parameter value contains a single (simple variable) or several similar (array) information variables. An array consists of n elements of the same data type which may be individually addressed with sub-indices from 0 to n-1.

Manufacturer parameters (corresponding to drive parameters of AD200) are always single (simple variables). Array access is available only for PNU 947 and 980.

5.3.3. Parameter description

The parameter description contains relevant information about the respective parameter.

Subindex	Meaning	Data type
1	Identifier (ID)	V2
2	Number of array elements or length of string	Unsigned 16
3	Standardisation factor	Floating Point
4	Variable attribute	OctetString 2
5	Reserved	OctetString 4
6	Name	VisibleString 16
7	Low limit	OctetString 4
8	High limit	OctetString 4
9	Reserved	OctetString 2
10	ID extension	V2
11	DO IO DATA reference parameter	Unsigned 16
12	DO IO DATA normalisation	V2
0	Complete description	OctetString 46

5.3.4. Parameter Text

- Text Text access not supported

5.3.5. Global and Local Parameters

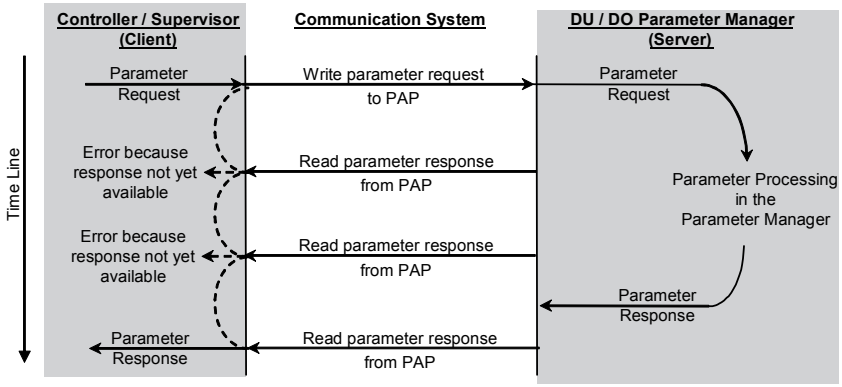
The Drive Unit consists out of the drive device itself and one “Drive Objects” (DO), the drive axes are related to one “Axis type DO”. All parameters are related to the complete device.

5.3.6. “Base Mode Parameter Access”

The “Base Mode Parameter Access” defines the requests and the replies transmitted acyclically by use of the “Acyclic Data Exchange” mechanism of the Communication System.

5.3.7. Data flow for “Base Mode Parameter Access”

Fig. 5.3.1: Data flow for “Base Mode Parameter Access”



5.3.8. General characteristics

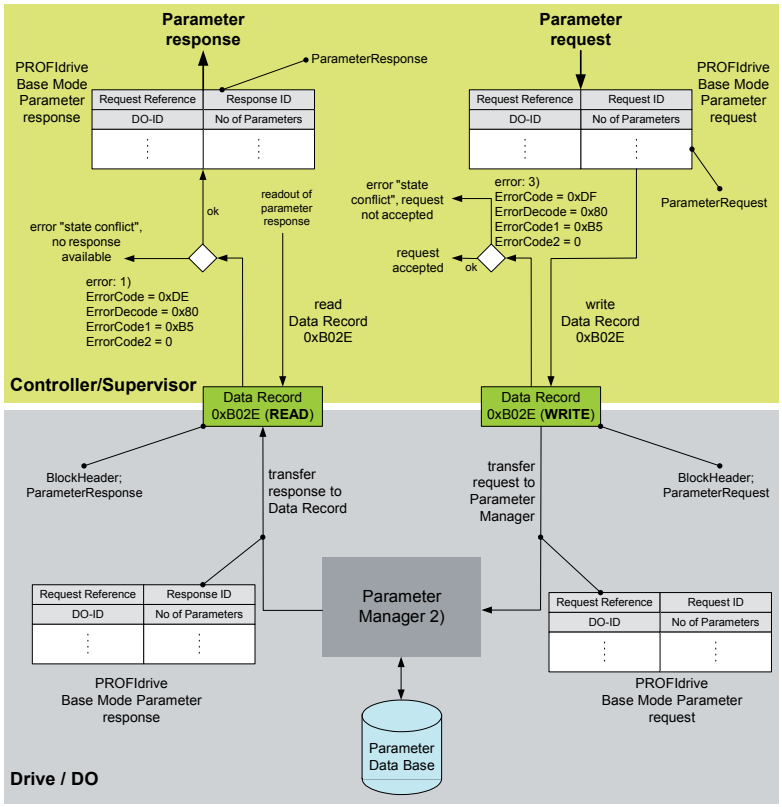
- 16-bit wide address each for parameter number and subindex.
- Transmission of complete arrays or parts of them, or the entire parameter description.
- Transmission of different parameters in one access (multi-parameter requests).
- Always just one parameter request is being processed at a time (no pipelining).
- A parameter request/parameter response shall fit in a data block (240 bytes default.) The requests/replies are not split-up over several data blocks. The maximum length of the data blocks may be less than 240 bytes depending on Device characteristics or bus configuration.
- No spontaneous messages will be transmitted.
- For optimised simultaneous access to different parameters (for example, operator interface screen contents), “multi-parameter” requests are defined.
- There are no cyclic parameter requests.
- After run-up, the profile-specific parameters are readable in every state.

5.3.9. DO addressing modes

- “Base Mode Parameter Access” – Local: In this address mode only the local parameters of the DO are accessable to which the CO, where the parameter access point is attached, is related. Also access of all global parameters is possible. The DO-ID in the parameter request header is “don’t care”.

5.3.10. Parameter requests and parameter responses

Fig. 5.3.2: Data flow for request and response for the “Base Mode Parameter Access”



A parameter request consists of three segments:

Request header: ID for the request and number of parameters which are accessed. Multi-Axis and Modular drives, Addressing of one DO.

Parameter address: Addressing of a parameter. If several parameters are accessed, there are correspondingly many parameter addresses. The parameter address appears only in the request, not in the response.

Parameter value: Per addressed parameter, there is a segment for the parameter values. Depending on the request ID, parameter values appear only either in the request or in the reply.

Base mode parameter request			
Block definition	**Byte n+1**	**Byte n**	**n**
Request Header	Request Reference	Request ID	0
	Axis-No. / DO-ID	No. of Parameters = n	2
1st Parameter Address	Attribute	No. of Elements	4
	Parameter Number (PNU)		
	Subindex		
nth Parameter Address	...		4 + 6 × (n-1)
1st Parameter Value(s) (only for request "Change parameter")	Format	No. of Values	4 + 6 × n
	Values		
	...		
nth Parameter Values	...		
			4 + 6 × n +...+ (Format_n × Qty_n)

Base mode parameter response			
Block definition	**Byte n+1**	**Byte n**	**n**
Response Header	Request Ref. mirrored	Response ID	0
	Axis-No. / DO-ID mirrored	No. of Parameters = n	2
1st Parameter Value(s) (only after request "Request")	Format	No. of Values	4
	Values or Error Values		
nth Parameter Values	...		
			4 + 6 × n +...+ (Format_n × Qty_n)

Permissible combinations consisting of attribute, number of elements and subindex			
Attribute	**No. of Elements**	**Subindex**	**=> Data**
Value (single parameter) (Indexed parameter)	0	0	The value
	1	0	The value
	1	0...n	One value, under subindex
	2...n a	0...n	Several values, starting with subindex
Description	0 (irrelevant)	0	The entire description
	1	1...n	One description element

5.3.11. Coding

Permissible combinations consisting of attribute, number of elements and subindex				
Field	**Data Type**	**Values**		**Comment**
Request Reference	Unsigned8	0x00 0x01..0xFF	reserved	
Request ID	Unsigned8	0x00 0x01 0x02 0x03..0x3F 0x40..0x7F 0x80..0xFF	reserved Request parameter Change parameter reserved manufacturer-specific reserved	
Response ID	Unsigned8	0x00 0x01 0x02 0x03..0x3F 0x40..0x7F 0x80 0x81 0x82 0x83..0xBF 0xC0..0xFF	reserved Request parameter(+) Change parameter(+) reserved manufacturer-specific reserved Request parameter(-) Change parameter(-) reserved manufacturer-specific	

Permissible combinations consisting of attribute, number of elements and subindex				
Field	**Data Type**	**Values**		**Comment**
Axis / DO-ID	Unsigned8	0x00 0x01..0xFE 0xFF	Device-Representative DO-ID-Number 1..254 reserved	Zero is not a DO but the access to the Drive Unit representative
No. of Parameters	Unsigned8	0x00 0x01..0x27 0x28..0xFF	reserved Quantity 1..39 reserved	There may be an additional limitation through the communication system (telegram length) or optional scalability according to 6.3.9.4
Attribute	Unsigned8	0x00 0x10 0x20 0x30 0x40..0x70 0x80..0xF0	reserved Value Description Text reserved manufacturer-specific	The four less significant bits are reserved for (future) expansion of “No. of elements” to 12bits
No. of Elements	Unsigned8	0x00 0x01..0xEA 0xEB..0xFF	Special Function Quantity 1..234 reserved	Limitation through compatibility with PROFIBUS Process data ASE telegram length
Parameter Number	Unsigned16	0x0000 0x0001 ... 0xFFFF	reserved Number 1.. 65535	
Subindex	Unsigned16	0x0000 ... 0xFFFE	Number 0..65534	
Format	Unsigned8	0x00 0x01..0x36 0x37..0x3F 0x40 0x41 0x42 0x43 0x44 0x45.. 0xFF	reserved Data types reserved Zero Byte Word Double word Error reserved	Every slave shall at least support the data types Byte, Word and Double Word (mandatory). Write requests by the master preferably use the “correct” data types (refer to 5). As substitute, Byte, Word or Double Word are also possible. The master shall be able to interpret all values/data types.
No. of Values	Unsigned8	0x00..0xEA 0xEB..0xFF	Quantity 0..234 reserved	Limitation because of 240 Bytes Datablock size (compatible with former PROFIdrive version 3.1.2)
Error Number	Unsigned16	0x0000... 0x00FF	Error Numbers (see next Table)	The more significant byte is reserved

The device shall output an error, if reserved values are accessed.

Error numbers in Base Mode parameter responses			
Error No.	**Meaning**	**Used at**	**Supplem. Info**
0x00	Impermissible parameter number	Access to unavailable parameter	0
0x01	Parameter value cannot be changed	Change access to a parameter value that cannot be changed	Subindex
0x02	Low or high limit exceeded	Change access with value outside the value limits	Subindex
0x03	Faulty subindex	Access to unavailable subindex of array parameter. Shall not be used for non array parameters	Subindex
0x04	No array Access with subindex to non-indexed parameter	0	
0x05	Incorrect data type	Change access with value that does not match the data type of the parameter	0
0x06	Setting not permitted (may only be reset)	Change access with value unequal to 0 where this is not permitted	Subindex
0x07	Description element cannot be changed	Change access to a description element that cannot be changed	Subindex
0x08	reserved	(PROFIdrive Profile V2: PPO-Write requested in IR not available)	-
0x09	No description data available Access to unavailable description (parameter value is available)	0	
0x0A	reserved	(PROFIdrive Profile V2: Access group wrong)	-
0x0B	No operation priority Change access without rights to change parameters	0	
0x0C	reserved	(PROFIdrive Profile V2: wrong password)	-
0x0D	reserved	(PROFIdrive Profile V2: Text cannot be read in cyclic data transfer)	-
0x0E	reserved	(PROFIdrive Profile V2: Name cannot be read in cyclic data transfer)	-
0x0F	No text array available	Access to text array that is not available (parameter value is available)	0
0x10	reserved	(PROFIdrive Profile V2: No PPO-Write)	-
0x11	Request cannot be executed because of operating state	Access is temporarily not possible for reasons that are not specified in detail	0
0x12	reserved	(PROFIdrive Profile V2: other error)	-
0x13	reserved	(PROFIdrive Profile V2: Data cannot be read in cyclic interchange)	-
0x14	Value impermissible	Change access with a value that is within the value limits but is not permissible for other long-term reasons (parameter with defined single values)	Subindex
0x15	Response too long	The length of the current response exceeds the maximum transmittable length	0
0x16	Parameter address impermissible	Illegal value or value which is not supported for the attribute, number of elements, parameter number or subindex or a combination	0

Error numbers in Base Mode parameter responses			
Error No.	**Meaning**	**Used at**	**Supplem. Info**
0x17	Illegal format	Write request: Illegal format or format of the parameter data which is not supported	0
0x18	Number of values are not consistent	Write request: Number of the values of the parameter data do not match the number of elements in the parameter address	0
0x19	Axis/DO nonexistent	Access to an Axis/DO which does not exist	0
0x20	Parameter text element cannot be changed	Change access to a parameter text element that cannot be changed	Subindex
...			
up to 0x64	reserved	-	-
0x65..0xFF	Manufacturer-specific	-	-

5.4. “Alarm Mechanism”

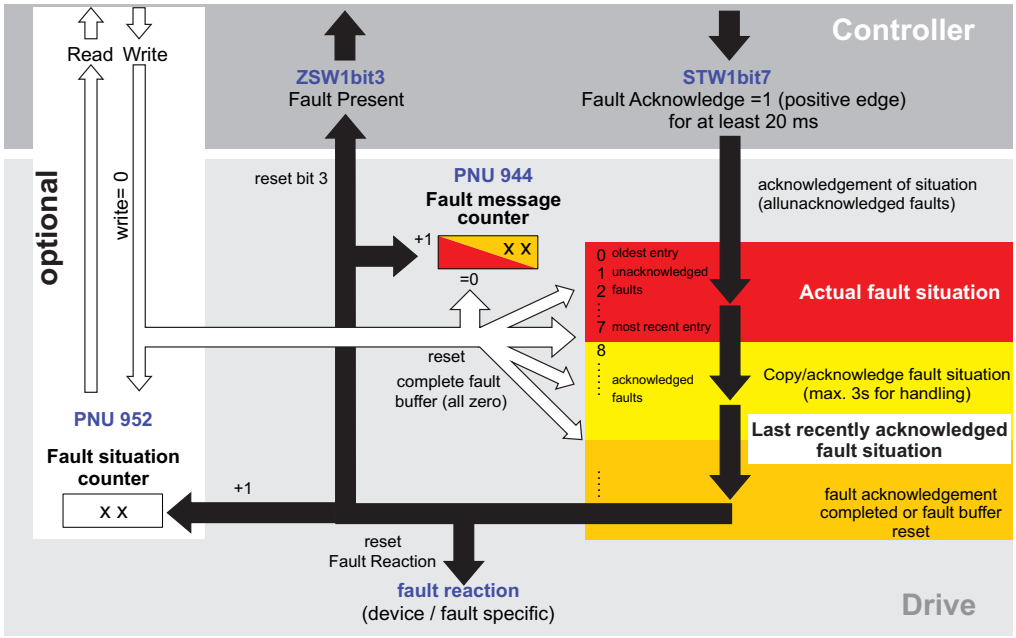
With the “Alarm Mechanism” service, alarm information and exception situations are signalled to the controlling device in real time. The service is working demand-oriented to keep the exception status image of the Functional Object in the Controller up to date. With this service the controller is able to respond on an occurring event in the drive as fast as possible without polling the drive status information permanently by its own. The “Alarm Mechanism” service is assigned to the “Controller - P-Device” relationship.

5.4.1. “Warning mechanism”

Warnings are not available, all diagnostic information is reported with the “Alarm Mechanism” and Fault Buffer.

5.4.2. “Fault buffer mechanism”

Fig. 5.4.1: Fault acknowledgement for the fault buffer mechanism



A fault situation, which may be associated with one or several fault messages (drive exceptions state changes), generates a device-specific fault reaction. E.g. it may cause the power converter to be powered-down. An unacknowledged fault situation is also indicated by ZSW1, bit3 (fault present). The fault buffer mechanism defines a fault tracking system in order to save the fault messages. This fault tracking system consists of the fault buffer (which consists at least out of the “Fault Number” list and the fault message counter,). The fault buffer contains the fault messages which have been generated during the fault situation; the “Fault Number” contains explanations and assignments to the various fault messages defined in the device.

The alarms generated by the drive are reported with the Profidrive “Alarm Mechanism”. Each time an alarm is generated, a Fault Code is saved in PNU 947 “Fault buffer” and PNU 944 “Fault message counter” is incremented. Fault Codes correspond to ADV200 alarm numbers (see the manual of the drive for details).

The first 8 elements in PNU 947 “Fault number” define the “Fault situation”. If more than 8 alarms are generated without clearing the situation, older alarms are overwritten: the “Fault Situation” only contains up to 8 fault codes.

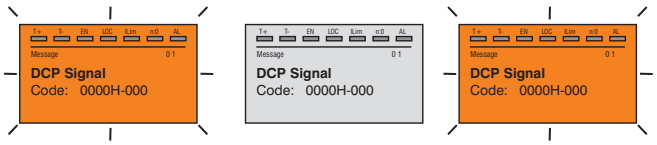
When the STW1 bit 7 “Fault acknowledge” has a positive edge, the “Fault Situation” is moved up to the next 8 elements and the current situation is cleared, The “Fault number” array can store up to 8 situations.

By writing a 0 to PNU 952 “Fault situation counter” clears the entire “Fault number” array.

The array and counters are also cleared upon restarting the drive.

6. Protocols - DCP Signaling

DCP protocol is supported. To signal DCP, the backlight of the keypad blinks according to the DCP signals.



When signaling is completed, the functionality of the keypad returns to normal (controlled by P.576 “Display Backlight”).

Caution

It is very important to use Profinet only with keypad with software v 0.09 or newer, previous version are not supported and will not be able to signal DCP correctly.

Il est très important d’utiliser Profinet uniquement avec un pavé doté de la version logicielle 0.09 ou d’une version plus récente ; les versions précédentes ne sont pas compatibles et ne seront pas en mesure de signaler correctement le DCP.

To check the software version of the keypad, connect the keypad (or power on the drive) while pressing the E button and check for the string “FW VERSION 009.B” or newer. If the string is “FW VERSION 008.B” or older, please contact WEG support to replace the keypad.

To return the keypad to normal operation, remove from the cover and re-insert (do not press the E button).

In addition to the backlight of the keypad, the yellow “LINK” LED of port A (J1) is used for DCP signaling. Please note that this LED is only visible when the front cover of ADV200 is removed, while the keypad is always visible.

7. Troubleshooting

If the drive detects a problem with the Profinet communication, it may generate the “Opt bus fault” alarm, which indicates the presence of a fault condition.

The “Opt bus fault” alarm may be generated for a series of reasons:

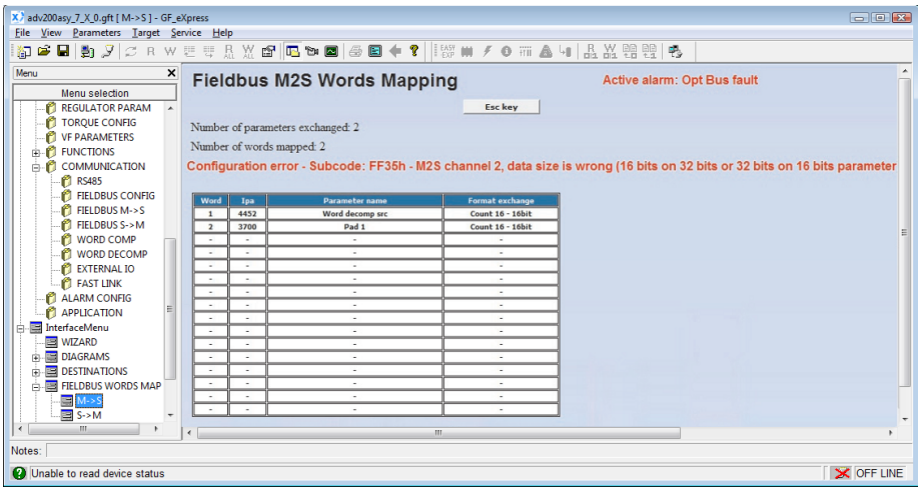
- Configuration alarm. This appears at drive start-up (press **Esc** to continue: however, Profinet communication will not be available).
  It indicates an unrecoverable problem in the configuration of the drive or EXP-ETH-PN-ADV200 card. Check the settings in the “Field-bus”, “FIELDBUS M->S” and “FIELDBUS S->M” menus. The alarm sub-code indicates the cause of the problem.
- Hardware alarm. This indicates an unrecoverable problem on the EXP-ETH-PN-ADV200 card, which occurred after start-up and during normal operation. If the problem persists, replace the card.
- Bus loss alarm, sub-code = 0. This indicates the loss of communication (passage from network Run to Off) when the drive is enabled, or P.4012 “Fieldbus alarm mode” = 1. Data exchange must be active (P.4014 “Fieldbus state” = Operational) when the drive is enabled.

Subcode	Description	Note
0	Bus Loss	Communication state is not Operational, connection with the master no longer present
0x74h	Input size mismatch	Configuration not allowed, check module on master and M->S channels
0x84h	Output size mismatch	Configuration not allowed, check module on master and S->M channels
0x8101	NetX system error	
0x8102,0x8104	DPRAM Error, after WarmStart	If not recoverable, replace the module
0x8110	Not Ready timeout, NetX not available	If not recoverable, replace the module
0xFF02	Communication with the module not available	DPRAM not recognized. Replace the module
0xFF04	Module software version not compatible	
FF01	Fieldbus type does not match expansion card	Verify if EXP-ETH-PN-ADV200 card is properly installed
FF14..FF23	Wrong object selected for mapping in channel M->S n	Check “Fieldbus M-> Sn Dest”
FF24..FF33	More than 1 Src pointing to M->S Channel n	Check for multiple destinations on “Fieldbus M-> Sn Dest”
FF34..FF43	M->S Channel n, data size is wrong (16 bits on 32 bits or 32 bits on 16 bits parameter)	Check “Fieldbus M-> Sn sys”
FF44..FF53	Invalid parameter in Channel S->M	Check “Fieldbus S-> Mn src”
FF54..FF63	S->M Channel n, data size is wrong (16 bits on 32 bits or 32 bits on 16 bits parameter)	Check “Fieldbus S-> Mn sys”
FF64..FF73	Wrong object selected for mapping in Channel S->M n	Check “Fieldbus S-> Mn src”
FF74..FF83	M->S Channel n: too many words in PDC	“Fieldbus M-> Sn Dest” & “Fieldbus M-> Sn sys” address more than 16 words in PDC
FF84..FF93	S->M Channel n: too many words in PDC	“Fieldbus S-> Mn src” & “Fieldbus S-> Mn sys” address more than 16 words in PDC
FFB4..FFC3	Internal database error on Channel n	Internal error, contact manufacturer

P.4670 **“Optionbus activity”** can be used to configure drive operation in the loss of communication condition.

The default setting is “Disable”, which indicates that the drive must be disabled. This parameter may also be set to “Warning”, in which case the drive can continue to operate, but an error message is displayed. For further details please consult the drive manual.

With WEG_eXpress you can obtain a description of what caused the “Opt bus fault” alarm, by logging on to the relative HTML page as shown in the figure below:



8. Glossary

LLDP “Low Level Discovery Protocol” is used to recognize its neighbor. Each station sends its own information, such as MAC address, device name, etc. as a frame to the direct neighbor.

DHCP “Dynamic Host Configuration Protocol” is used for assignment of the IP addresses and related parameters, if the corresponding infrastructure is available.

DNS “Domain Name Service” is used in order to manage the logic names.

SNMP “Simple Network Management Protocol” is used in order to monitor the network. With this protocol, one can read out the status, statistical information and detect communication errors.

ICMP “Internet Control Message Protocol” is used to forward error information.

IP “Internet Protocol”.

TCP “Trasmission control protocol”.

MAC “Media access control”.

ProfinetIO “Profinet for Input/Ouput”, protocol to control devices and exchange cyclic process data.

ProfinetRT “Profinet IO” with “Real Time” capability.

ProfinetCBA “Profinet Component Based Automation”, protocol for distributed industial automation.

DCP “Discovery and Configuration Protocol”.

Instruction Manual
Series: EXP-ETH-PN-ADV200
Revision: 0.4
Date: 20-2-2023
Code: 1S5L30E

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