PS® AUTOMATION
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Operating Instructions

PS-AMS1x with Fieldbus-Interface Profibus-DP

Version 2023/05/03

Subject to changes!

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1. Description

The optional fieldbus-interface Profibus-DP (DPV0, DPV1 and Publisher Support of DPV2) allows operation of the actuator via Profibus-DP. This interface communicates to the actuator via the standard serial port. The actuator does then not use analogue set values. Feedback from a process sensor to the optionally available process controller PSIC integrated in the actuator is digitally transmitted as well. Command level allows on request to read out all parameters and diagnostics data.
Adjustment of parameterisation of the actuator is not possible via fieldbus.

Note: The actuator has a single communication port. This is used when the optional fieldbus interface is installed. For parameterisation of the actuator with the communication software PSCS or handheld unit PSC, the position of a switch on the main board of the actuator PS-AMS1x has to be changed, see chapter 2.3. After that, communication with PC is possible via the date cable. After parameterisation, the switch has to be placed to position “Fieldbus” again, to allow communication of the fieldbus module to the actuator.
-> See also Instruction Manual AMS-PSCS

Note: „Digital Set Value“ (in the communication software AMS-PSCS under Operate - Configuration - Set Value & Feedback) must be activated to control the actuator via the fieldbus interface!

Note: During PC communication there may unreasonable data appear in the (Profibus-based) process image.

2. Connecting the Fieldbus

Caution: When working at or on the actuator’s processor board, proper earthing of the worker has to be ensured. As a makeshift it will help to firmly touch the actuator housing with bare hands before working on the actuator, to create an equalisation of potential.

Wiring of the Fieldbus-Line is depending on the version of the PS-AMS-actuator, either to an internal terminal block on the main board, or to a socket at the outside of the actuator.

2.1 Wiring to terminal block

There are two specific metal cable glands for insertion of the Profibus cables. These allow connection of the shielding as shown in picture 1.

Figure 1 EMC cable gland with earthing cones

Wiring of the two Profibus cable is made to terminal blocks on the AMS main board. The two wires coming from the previous device go to terminals A1 and B1. Wiring to a subsequent device can be done from terminals A2 and B2.

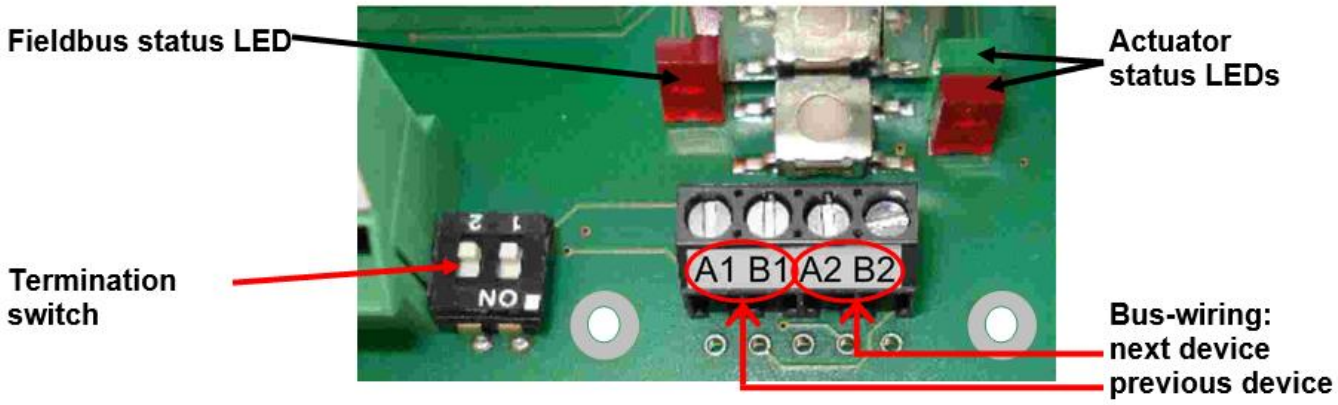
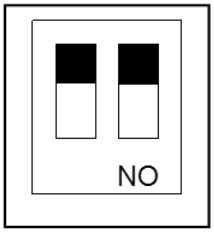


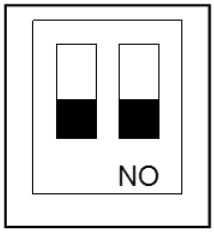
Figure 2 Terminal block on the main board of an actuator for Profibus DP

2.1.1. Termination

Termination of the bus is possible with the termination switch next to the terminal block, see picture 2. Both switches have to be put to the same position mandatorily.



Termination OFF



Termination ON
(end of bus)

2.2 Connection with Plug & Socket

At the outside of the actuator housing a socket is fitted to accept a standard Profibus plug of maker Phoenix Contact. Appropriate type is VS-09-PROFIBUS-SC, Order No. 16 54 54 9. The two Profibus wires coming from the previous device go to terminals A1 and B1. Wiring to the following device is made to terminals A2 and B2.

2.2.1. Termination

Termination is made inside the plug, if required.

2.3. Fieldbus status LED

There is one single red LED next to the terminal block for signalling the status of the fieldbus, see picture 2.
LED Off = Mode „data exchange“
LED On = No connection to the fieldbus

2.4. Slide switch for selecting the communication interface

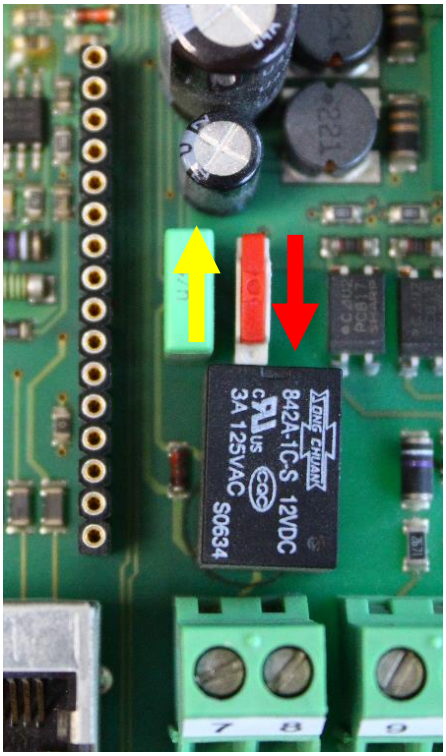


Figure 3 Slide switch for selecting the interface

On the main board inside the actuator there is a slide switch for selecting the interface, see picture 3.
For normal operation, i.e. when the actuator is controlled via the fieldbus, put the switch to lower position (red arrow).
For adjustment work, parameterisation, etc. the interface has to be put in upper position to allow PC-communication (yellow arrow).

Caution: After finishing adjustment work, make sure that the switch is in lower (red) position. In upper (yellow) position the interface does communicate to the bus, but not to the actuator's electronic!

yellow = PC-communication

red = fieldbus-communication

3. Fieldbus address

The actuator is supplied with address 0 adjusted. At commissioning the user can modify the address using the two turn-coding switches, see picture 4. After this modification switch the actuator off for a short period and on again to adopt the change.

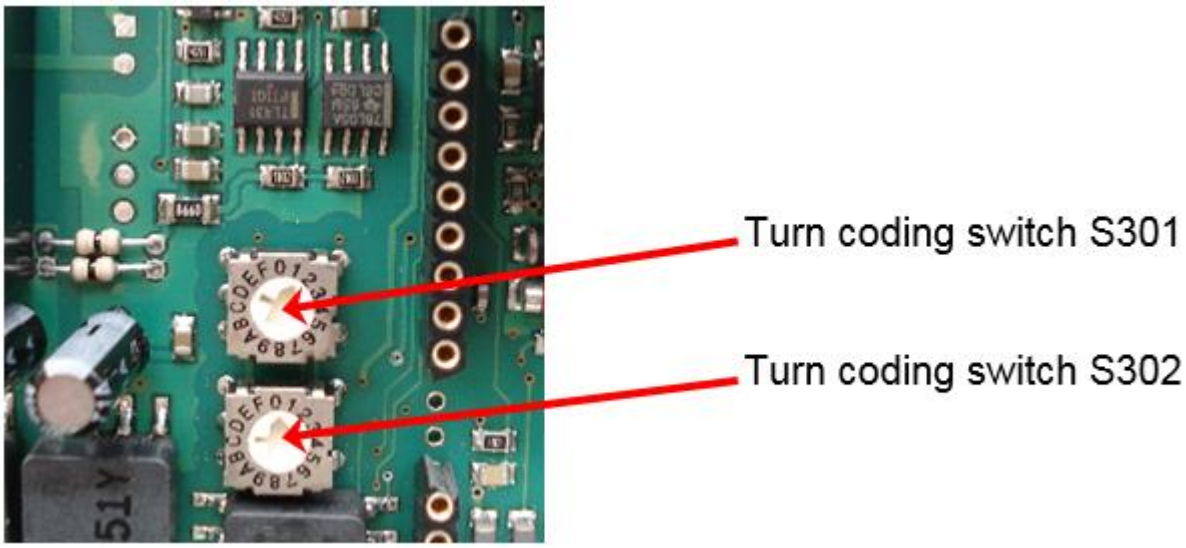


Figure 4 Turn coding switches for adjusting the fieldbus address

Adjustment of addresses 0 to 125 is possible as per the table below.

S302	S301	Profibus-address		S302	S301	Profibus-address		S302	S301	Profibus-address
0	0	0		2	A	42		5	4	84
0	1	1		2	B	43		5	5	85
0	2	2		2	C	44		5	6	86
0	3	3		2	D	45		5	7	87
0	4	4		2	E	46		5	8	88
0	5	5		2	F	47		5	9	89
0	6	6		3	0	48		5	A	90
0	7	7		3	1	49		5	B	91
0	8	8		3	2	50		5	C	92
0	9	9		3	3	51		5	D	93
0	A	10		3	4	52		5	E	94
0	B	11		3	5	53		5	F	95
0	C	12		3	6	54		6	0	96
0	D	13		3	7	55		6	1	97
0	E	14		3	8	56		6	2	98
0	F	15		3	9	57		6	3	99
1	0	16		3	A	58		6	4	100
1	1	17		3	B	59		6	5	101
1	2	18		3	C	60		6	6	102
1	3	19		3	D	61		6	7	103
1	4	20		3	E	62		6	8	104
1	5	21		3	F	63		6	9	105
1	6	22		4	0	64		6	A	106
1	7	23		4	1	65		6	B	107
1	8	24		4	2	66		6	C	108
1	9	25		4	3	67		6	D	109
1	A	26		4	4	68		6	E	110
1	B	27		4	5	69		6	F	111
1	C	28		4	6	70		7	0	112
1	D	29		4	7	71		7	1	113
1	E	30		4	8	72		7	2	114
1	F	31		4	9	73		7	3	115
2	0	32		4	A	74		7	4	116
2	1	33		4	B	75		7	5	117
2	2	34		4	C	76		7	6	118
2	3	35		4	D	77		7	7	119
2	4	36		4	E	78		7	8	120
2	5	37		4	F	79		7	9	121
2	6	38		5	0	80		7	A	122
2	7	39		5	1	81		7	B	123
2	8	40		5	2	82		7	C	124
2	9	41		5	3	83		7	D	125

4. Process Image

See table „Process Image AMS Profibus-DP“ in the annex

4.1. Process Image OUTPUT

The process image OUTPUT shows the details how control of the actuator (as slave) is done.

4.1.1. Byte 1 - Set Value High-Byte

Bit 7 of Byte 1 (MSB) defines the input to be in percent (MSB = 0) or in tenth of percent (MSB = 1).

4.1.2. Byte 2 - Set Value Low-Byte

Input has to be made as per MSB of Byte 1.

4.1.3. Byte 3 - Process Sensor High-Byte
Bit 7 of Byte 3 (MSB) defines the input to be in percent (MSB = 0) or in tenth of percent (MSB = 1).

Caution: When using an analogue process sensor, Byte 3 and Byte 4 have to be set to „0xFF“!

4.1.4. Byte 4 - Process Sensor Low-Byte
Input has to be made as per MSB of Byte 3.

Caution: When using an analogue process sensor, Byte 3 and Byte 4 have to be set to „0xFF“!

4.1.5. Byte 5 - Command
Use the command byte to read / write data from / to the memory of the actuator.

0x00 = no action

0x20 = send data for RAM
0x21 = read data from RAM

0x1D = send data for E²PROM
0x1E = read data from E²PROM

Caution: To ensure that a command is sent to the correct address with the correct data, follow this procedure when writing to the process image:

Write 0x00 to command Byte 5
Write address (Byte 6), Data-High (Byte 7) and Data-Low (Byte 8)
Write the actual command, e.g. 0x1E
As result the command will be sent to the actuator for one time. To send another command, the command byte 0x00 has to be sent again.

Note: At reading of data, these will be available at Byte 5 and Byte 6 of the process image INPUT after 250 msec.

4.1.6. Byte 6 - Address
Address for memory access

4.1.7. Byte 7 - Data-High
High-Byte of data to be written

4.1.8. Byte 8 - Data-Low
Low-Byte of data to be written

4.2. Process Image INPUT
The process image INPUT shows the details of the feedback of the actuator (as slave).

4.2.1. Byte 1 - Actual Value High-Byte
Feedback is scaled in line with the set value, as adjusted under 4.1.1.

4.2.2. Byte 2 - Actual Value Low-Byte
Feedback is scaled in line with the set value, as adjusted under 4.1.1.

4.2.3. Byte 3 - Working Condition / Error Code of the Actuator
The below table lists the messages that can appear during operation. Messages referring to the fieldbus interface will be covered under „5. Diagnosis“.

Error Nr. [dec]	Description of Status
Working condition	
0	Normal operation
1	Actuator doing auto-commissioning
2	Actuator not commissioned to the valve
14	Actuator not in AUTO mode (in conjunction with local control unit PSC.2)
Peripheral errors	
3	Set value error
4	Torque error
5	Fail Safe-action is started
6	Set value error of the process sensor
12	Position passed over
13	Position nor reached
11	Undervoltage at supply
Errors in actuator	
7	Mechanical / positioning error
8	Critical / maximum temperature reached
9	Electronics error / CRC
10	Limit of wear reached
Communication error	
32	No communication to actuator possible

Note: Error Nr. 32 may be displayed twice during commissioning of the actuator to the valve: when either end position is reached and the measured values are stored inside the actuator. During normal operation, this error signals a malfunction if it is displayed longer than 10 sec.

4.2.4. Byte 4 - Address

Address for memory access

4.2.5. Byte 5 - Data-High

High-Byte of data to be read

4.2.6. Byte 6 - Data-Low

Low-Byte of data to be read

5. Diagnosis

In the case of errors, the fieldbus interface of this actuator provides specific diagnosis data. These diagnosis data refer to the fieldbus interface only.

Error Nr. [dec]	Description of Error
0	Reserved
1	Error at initialising RS485/232 interface
2	Error at E^2PROM
3	Stack error
4	Hardware error of Fieldbus-ASIC
5	Configuration error of gateway (unknown protocol)
6	Reserved
7	RS485/RS232 transmit-buffer overflow
8	RS485/RS232 receive-buffer overflow
9	Time-out while receiving at RS485/RS232 interface
10	Transmission error of RS485/RS232 interface
11	Receiving error of RS485/RS232 interface
12	Address error of RS485/RS232 interface
13	Configuration error by Profibus-master
14	General error of RS485/RS232 interface
15	Internal error

Note: Information about operating condition and error codes are available at Byte 3 of the process image INPUT only.

6. Technical Data

In the case of errors, the fieldbus interface of this actuator provides specific diagnosis data. These diagnosis data refer to the fieldbus interface only.

Communication protocol	Profibus DP (DPV0, DPV1, Publisher Support of DPV2)	
Fieldbus baud rate	up to 12 MBaud (Autodetect)	
Baud rate / Wire length	kbit/s 9,6 19,2 45,45 93,75 187,5 500 1500 3000 6000 12000	Segment length [m] 1200 1200 1200 1200 1000 400 200 100 100 100
Cycle time for data refresh	250 ms	
Cycle time for data transfer	250 ms	
Process image OUTPUT	8 Byte	
Process image INPUT	6 Byte	

7. GSD-File

The GSD-file is the device data sheet describing the Profibus DP slave in detail. Use the file “Configuration File ProfibusDP V1.3” as provided on our homepage www.ps-automation.com in the section „Downloads“ under „Software“.

8. Parameter Storage Addresses

RAM-Parameter					
Address	Data high	Data low	Range	Unit	Description
000	x	x	0...1000	% / ‰	present digital set value
001	x	x	0...1023	digit	present set value
002	x	x	0...1023	digit	present feedback
005	x	x	0...1000	% / ‰	present digital feedback
Diagnosis data					
185	x	x	0...65536	starts x 50	Number of motor starts
186	x	x	0...65536	starts	Number of motor starts at excess temperature
187	x	x	0...65536	h x 2	Operation time of actuator
188	x	x	0...65536	min x 6	Operation time of motor
189	x	x	0...65536	min	Operation time of motor at excess temperature

Basically all data are accessible that are displayed in the communication software PSCS. The required addresses are available on request.

Note: The current layout does not allow writing parameters to the actuator via the fieldbus.

9. Simulation of Profibus-environment

PS Automation provides a simulation software PSAMS1xProfibusSim_V2_0 for the Profibus-DP-master simulator BW1131 made by Bihl & Widemann.

1.) Start PSAMS1xProfibusSim_V2_0.exe on the PC
2.) Adjust communication port and Profibus address
3.) Push the button "Open Profibus-DP" in the software
4.) Enter a set value in the range of 0...100%; pushing the button "Write Profibus-DP" will drive the actuator
5.) After testing press the button "Close Profibus-DP"
6.) Disconnect power from the actuator

10. Hints for Programming

To transmit consistent date of a length of 3 or more than 4 bytes in S7 / CPU 315-2, the SFC-calls (SFC14/15) have to be applied. The maximum number of consistent data is depending on the CPU used. Please refer to the respective manuals for CPU-data.

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Annex: Process Image Profibus-DP in PS-AMS

Process image OUTPUT

Byte 1							
MSB [% / ‰]	Set value High-Byte						
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 2							
Set value Low-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 3							
MSB [% / ‰]	Process sensor High-Byte						
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 4							
Process sensor Low-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 5							
Command							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 6							
Address							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 7							
Data High-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 8							
Data Low-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Process image INPUT

Byte 1							
Feedback High-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 2							
Feedback Low-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 3							
Operating condition/Error codes							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 4							
Address							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 5							
Data High-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte 6							
Data Low-Byte							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0