OPTIBAR 5060 / 7060 SERIES

Pressure transmitter OPTIBAR PC 5060 / PM 5060
Differential pressure transmitter OPTIBAR DP 7060

Description of PROFIBUS PA interface
This document is only complete in conjunction with the operating manual of the device in question.

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CONTENTS

1.1 Installation

If the OPTIBAR 5060 or 7060 device file has not yet been installed on the PDM system, it must be installed manually via PDM device installation. The necessary installation files are located at www.krohne.com/dlc, or you can request an installation CD from us at any time.

1.2 Scope of the document

These supplementary instructions apply to the following PROFIBUS PA device versions:

• Hardware (HW) 1.0.0 and later
• Software (SW) 1.0.0 and later

Note: These supplementary instructions only cover the specific device features as regards PROFIBUS PA. All other information regarding the intended use of the device can be found in the operating manual included.

1.3 Scope of delivery

A device for PROFIBUS communication includes:
additional instructions for the PROFIBUS PA interface (this document)

2.1 Software history

Created	Transmitter		Application program		System integration	
Month/ Year	Hardware	Firmware	Hardware	Software	Driver	Version
07/12	PROFIBUS PA-module, Ident. No. 4000769602	V2.1.x / 120717	Simatic PCS7 or other SPS from a different manu-facturer	Hardware config. or other software from a different SPS manu-facturer	GSD (Device specific)	KR014531.GSD
					GSD (profile specific)	PA139740.GSD
			Laptop / PC	PDM (≥ 6.0 SP5)	DD (Ident No.)	
				PACTware	DTM ≥	

2.2 Technical data

Hardware

Type	PROFIBUS MBP interface according to IEC 61158-2 with 31.25 kbit/s; Voltage mode (MBP = Manchester Coded Bus Powered)
Polarity	Independent of polarity on the electrical connection
FDE	Separate disconnection available in case of error (FDE = Fault Disconnection Electronics)
Max. error current	23 mA
Boot-up current after 10 ms	Lower than base current

Electrical connections

Supply voltage V_S	Non-Ex, Ex-d-device)	9...32 VDC
	EEx-ia device - Supply FISCO model	9...17.5 VDC
	EEx-ia device - Supply ENTITY model	9...24 VDC
Supply voltage V_S illuminated display and adjustment module	Non-Ex, Ex-d-device)	13.5...32 VDC
	EEx-ia device - Supply ENTITY model	13.5...17.5 VDC
	EEx-ia device - Supply ENTITY model	13.5...24 V DC
Number of sensors per DP/PA segment coupler max.	Non-Ex	32
	Ex	10

Inputs and outputs

Output signal	digital output signal, format as per IEE-754	
Sensor address	126 (Factory setting)	
Damping (63% of input variable)	0...999 seconds, adjustable	
Profibus-PA-Profile	3.02	
Number of Fbs with Al (function blocks with analog input)	3	
Default values	1.FB	PV
	2.FB	SV 1
	3.FB	SV 2
Current value	10 mA, ±0.5 mA	

3.1 Topology of a PROFIBUS PA network

The following diagram illustrates a typical network configuration with PROFIBUS PA devices in hazardous and non-hazardous areas and the connection of conventional non-PROFIBUS devices (e. g. with 4 … 20 mA signals) to a PROFIBUS network.

The PROFIBUS PA segment is connected to a segment coupler, which is responsible for the transformation to the PROFIBUS DP bus line among other things. It also supplies power to the bus-operated PROFIBUS PA devices. Read the instructions for the segment coupler for information on the DP bus parameters such as the baud rates supported.
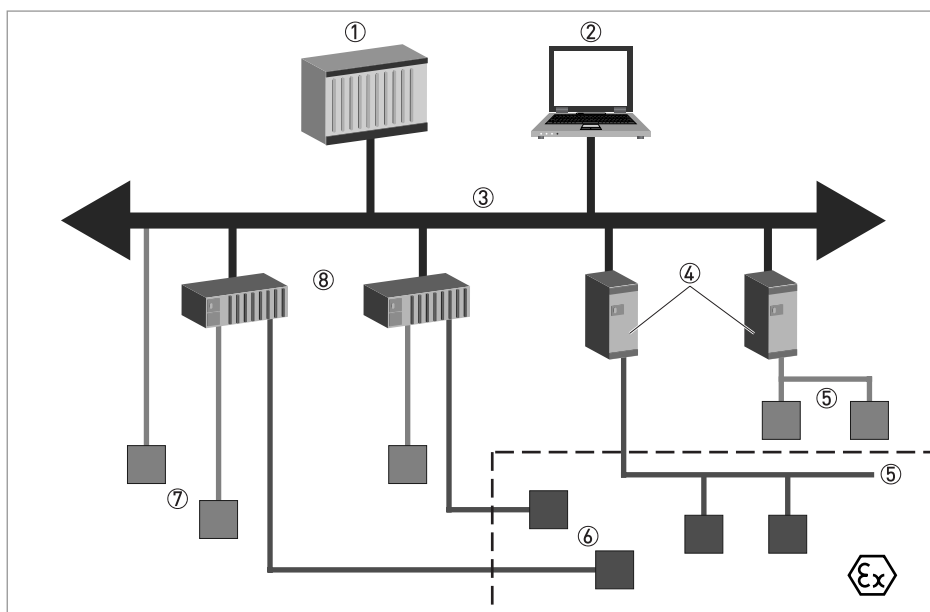

Figure 3-1: PROFIIBUS PA network

① 1 Control system (SPS) Class 1 master
② 2 process or operating control system tools, Class 2 master
③ PROFIBUS DP network with max. 12 Mbit/s
④ PROFIBUS PA segment coupler DP / PA
⑤ PROFIBUS PA network with 31.25 kbit/s
⑥ HART® device
⑦ Other devices with 4…20 mA
⑧ Analog I/O module

See also the PROFIBUS PA User and Installation Guideline (Version 2.2, February 2003, Order No. 2.092).

3.2 Electrical connection for converter

Bus cable – shielding and grounding

The data of the FISCO model only apply if the bus cable used fulfils the required specifications.

To guarantee optimal electromagnetic compatibility of the systems it is important to shield the system components, especially the bus cable. These shields must have as few gaps as possible.

Reversing the polarity has no effect on the function. The shortest possible length should be used to connect the cable shield to the functional earth (FE).
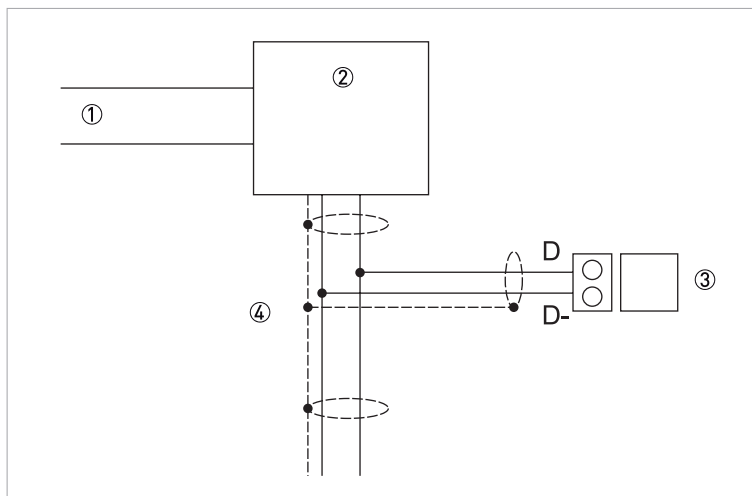

Figure 3-2: Electrical connection

① Profibus DP
② Linking device / barrier
③ Bus supply
④ Profibus PA / 2-core with shielding

OPTIBAR 5060 / 7060 series

• 2-core, bus supply

• Protection against polarity reversal

• Foundation Fieldbus

• Bus power supply 9...32 VDC

• Nominal current 16 mA

DANGER!
The converter must be properly grounded to protect users from electric shock. None of the directions, operating data or connection diagrams apply to devices used in hazardous areas; in such cases it is imperative to read the special "Ex" operating instructions!
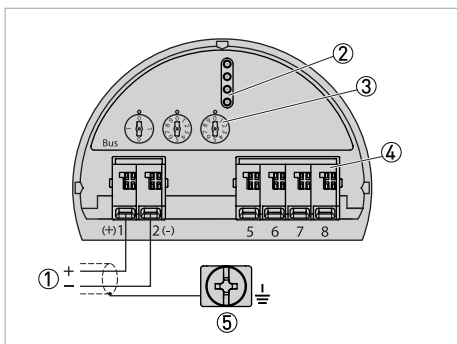
3.3 Single chamber housing

DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

The following illustration applies to both the non-Ex as well as the Ex ia, the Ex d and the Ex d ia version.

① Power supply / signal output
② Interface adapter for the display and adjustment module
③ Selector switch for bus address
④ Digital interface
⑤ Ground terminal for connection of the cable shield

3.4 Double chamber housing

DANGER!
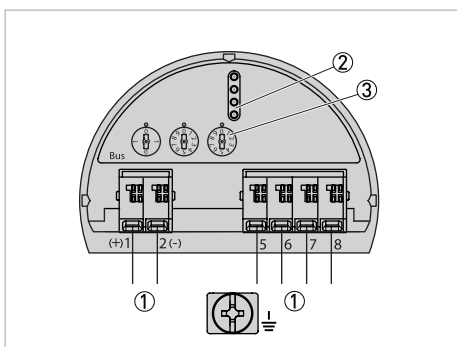*For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.*

Figure 3-3: Electronic compartment double chamber housing

① Internal connection to terminal compartment
② Interface adapter for the display and adjustment module
③ Selector switch for bus address

3.5 Start-up

The following menu items and settings have been added for converters with Profibus PA electronics:

Start-up - device address	Each Profibus PA device must be assigned one address. Each address may only be assigned once in a Profibus PA network. The sensor will only be detected by the control system when the address is set correctly The factory default setting for the address is 126. This address can only be used to test the function of the device and to connect to an existing Profibus PA network. This address must then be changed to include other devices. You can set the address in one of the following ways: • Using the address selector switch in the electronics compartment of the device (hardware address setting) • Using the display and adjustment module (software address setting) • PACTware /DTM (software address setting)
Start-up - AI FB1	As the parameterization of Function Block 1(FB1) is extensive, it has been categorised into individual sub-menu points. "Start-up" -> "Channel"
Start-up - AI FB1 - "Channel"	In the menu item "Channel" you specify the input signal for further processing in AI FB 1. The output values of the Transducer Blocks (TB) can be selected as input signals. "Channel" -> "PV (lin- Proz.)"
Start-up - AI FB1 - "scaling unit"	In the menu item "Scaling unit" you define the scaling variables and the scaling unit for the output value of FB 1. "Start-up" -> "Scaling unit" -> "Pressure" -> "mbar"
Start-up - AI FB1 - "Scaling"	In the menu item "Scaling" you assign the min. and max. values of the input signal (channel) to the respective values of the output (out scale). The units correspond to the selection previously made. "Start-up" -> "Scaling" -> "Out Scale Decimal Point" (XXX.XX) Min. values for "PV (lin Proz)". and "Out Scale process pressure" in bar: 000.00% or 000.00 bar Max. values for "PV (lin Proz.)" and "Out Scale process pressure" in bar: 100.00% or 100.00 bar
Start-up - AI FB1 - Damping	To absorb process-related measurement fluctuations set the time in this menu item between 0 ... 999 seconds. The damping applies to the level and separating layer measurement. "AI FB1" -> "Damping" -> "PV FTime" The factory default setting is damping of 0 seconds.
Info - Profibus - Ident. number	This menu item displays the Profibus Ident number of the sensor. "Info" -> "Profibus Ident Number" -> 3065

4.1 Device master file

The device master file contains the specifications of the Profibus PA device. Included in this data is the permissible transmission rates as well as information about diagnostic values and the format of the measurement provided by the PA device. A bitmap file is also provided for the projecting tool of the Profibus network. This is automatically installed with the inclusion of the device master file. The bitmap file symbolically displays the PA device in the configuration tool.

4.2 ID number

Each Profibus device receives a unique ID number as Ident Number from the Profibus User Organisation (PUO). This ID number is also contained in the name of the device master file. As an option to this manufacturer-specific device master file, the PUO also makes available a general so-called profile-specific device master file. If this general device master file is used, the sensor must be converted to the profile-specific Ident Number using DTM software. The sensor works by default with the manufacturer-specific ID number. When using the devices on a segment coupler SK-2 or SK-3, no special device master files are required. The following table indicates the device ID and the device master file names for the Optibar series.

Device name	Device ID		GSD-Filename	
	KROHNE	Device class in profile 3.02	KROHNE	Profile specific
OPTIBAR 5060	0x0045	0x45c9	KR010BF9.GSD	PA129702.GSD

4.3 Cyclical data

From the Master Class 1 (e. g. SPS), the measurement data is read cyclically from the sensor during operation. The data the SPS has access to can be seen in the block diagram below.
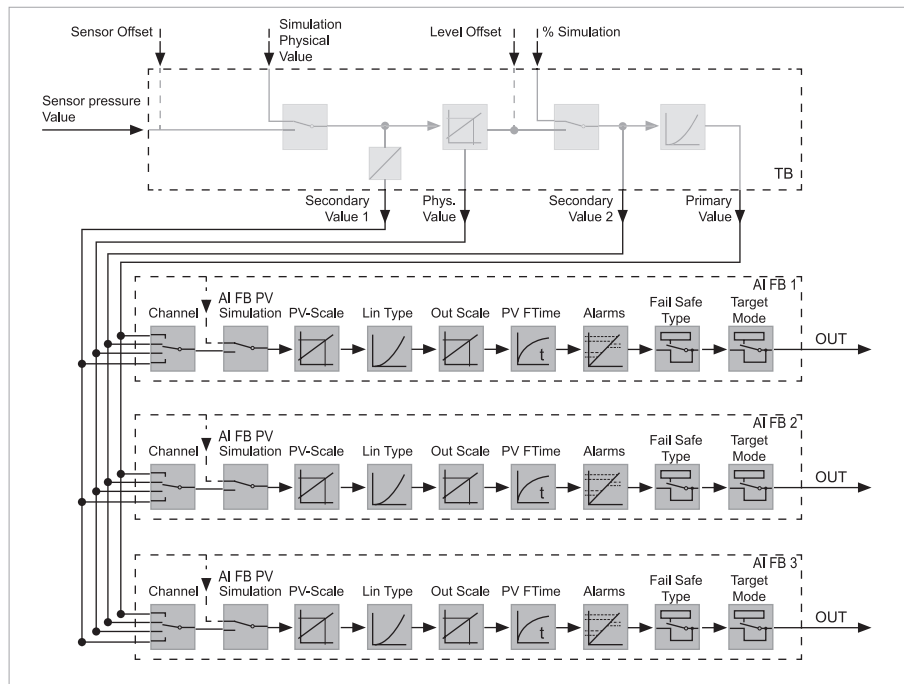
Figure 4-1: Block diagram with AI FB 1 ... AI FB 3 output values

TB - Transducer Block
FB - Function block
AI - Analogue Input

PA sensor modules

The following modules are available for cyclical data traffic:

- AI FB1 (OUT)
  Out-value of the AI FB1 after scaling

- AI FB2 (OUT)
  Out-value of the AI FB2 after scaling

- AI FB3 (OUT)
  Out-value of the AI FB3 after scaling

- Free Place
  This module must be used when a value in the data telegram of the cyclical data traffic is not to be used (e. g. Replacement of the temperature and Additional Cyclic Value)

A maximum of three modules may be active. With the help of the Profibus master configuration software you can determine the structure of the cyclical data telegram. The procedure depends on the respective configuration software.

INFORMATION!
There are two versions of the modules:
- *Short for Profibus master, which only support an "Identifier Format" byte, e. g. Allen Bradley*
- *Long for Profibus master, which only support the "Identifier Format" byte, e. g. Siemens S7-300/400*

4.4 Telegram structure

The following are some examples of how the modules can be combined and how the corresponding data telegram is built.

Example 1

- AI FB1 (OUT)
- AI FB2 (OUT)
- AI FB3 (OUT)

Byte no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Format	IEEE-754 Floating point value				Status	IEEE-754 Floating point value				Status	IEEE-754 Floating point value				Status
Value	AI FB1 (OUT)				AI FB1	AI FB2 (OUT)				AI FB2	AI FB3 (OUT)				AI FB3

Example 2

- AI FB1 (OUT)
- Free place
- Free place

Byte no.	1	2	3	4	5
Format	IEEE-754 Floating point value				Status
Value	AI FB1 (OUT)				AI FB1

INFORMATION!
Bytes 6-15 are not occupied in this example

Data format of the output signal

Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Status	Value IEEE-754			

The status byte corresponds to the profile 3.02 "Profibus PA Profile for Process Control Devices". The status "Measurement OK" is coded as 80 (hex) (Bit7 = 1, Bit6 ... 0 = 0). The measurement is transferred as 32 Bit floating point number in the IEEE-754 format.

Float format

Byte n									Byte n+1							
Bit 7	Bit6								Bit 7	Bit6						
VZ	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
	Exponent									Significant						

Byte n+2								Byte n+3							
Bit 7								Bit 7							
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Significant								Significant							

$$\text{Value} = (-1)^{VZ} \times 2^{(\text{Exponent} - 127)} \times (1 + \text{Significant})$$

4.5 Diagnosis

More information on coding the status bytes can be found in the device description 3.02 at www.profibus.com.

Status code	Description as per Profibus standard	Possible cause
0x00	bad - non-specific	Flash-update active
0x04	bad - configuration error	Adjustment error Configuration error on PV scale (PV span too small) Unit discrepancy Error in the linearizer table
0x0c	bad - sensor failure	Hardware error Converter error Leakage pulse error Trigger error
0x10	bad - sensor failure	Measurement retrieval error Temperature measurement error
0x1f	bad - out of service constant	"Out of Service" mode switched on
0x44	uncertain - last unstable value	Failsafe substitute value (Failsafe mode = "Last valid value" and already valid measurement since switched on)
0x48	uncertain substitute set	Switch on simulation Failsafe substitute value (Failsafe mode = "Fsafe value")
0x4c	uncertain - initial value	Failsafe substitute value (Failsafe mode = "Last valid value" and no valid measurement since switched on)
0x51	uncertain - sensor; conversion not accurate - low limited	Sensor value < lower limit
0x52	uncertain - sensor; conversion not accurate - high limited	Sensor value > upper limit
0x80	good (non cascade) - OK	OK
0x84	good (non cascade) - active block alarm	Static revision (FB, TB) changed (10 seconds long active, after parameters of the static category were written)
0x89	good (non cascade) - active advisory alarm - low limited	Lo-Alarm
0x8a	good (non cascade) - active advisory alarm - high limited	Hi-Alarm
0x8d	good (non cascade) - active advisory alarm - low limited	Lo-Lo-Alarm
0x8e	good (non cascade) - active advisory alarm - high limited	Hi-Hi-Alarm

KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature assemblies
- Pressure transmitters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

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