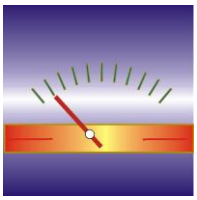
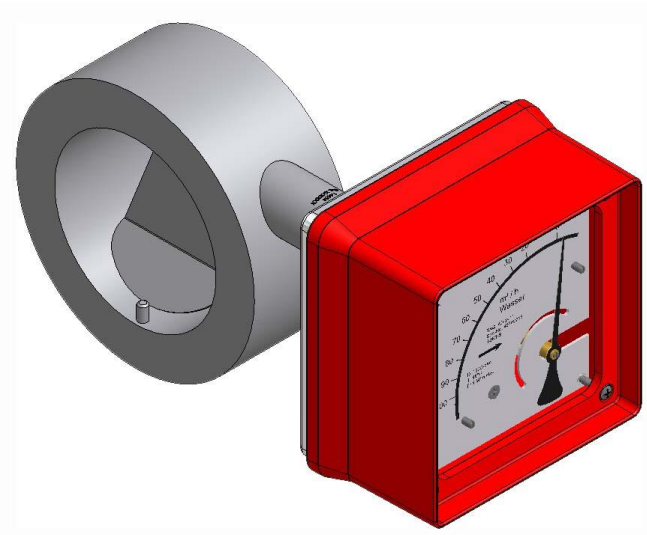
Operating manual for the electronic transmitter ES-PPA with PROFIBUS-PA interface





Supplement to the BGN/ES, BGF/ES, TSK/ES, BA/ES and DWF/ES manuals

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ES-PPA_BA_01-3_eng
Rev.-Nr. 1.3

Table of contents

1. Identification

1.1 Supplier/manufacturer

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1.2 Product

PROFIBUS-PA transmitter type "ES-M16C62-PPA" for converting the pointer position to a flow rate (BGN, BGF, TSK), a level indication (BA) or a density (DWF).

1.3 Issue date

5/17/2011

1.4 Version no. / File

1.3
File: ES-PPA_BA_01-3_eng

2 Applications

The ES-PPA transmitter is used as a volume flowmeter in BGN, BGF and TSK series flowmeters, in BA level meters or in DWF density meters. It is designed for installation in a housing with a degree of protection of at least IP 20.

3 Operational Mode and System Design

3.1 Measuring principle

The position of a float or a paddle is transmitted to the pointer axle by means of a magnetic system.
The ES-PPA transmitter measures the field of a magnet mounted on the pointer axle (sensor signals A, B) and generates a digitalized measured value. The scale, which is generally non-linear, is linearized in the process with a maximum of 16 interpolation points.

The earth's magnetic field and moderate homogeneous external magnetic fields are largely compensated by the applied differential measurement.

3.2 System design

The display unit prepared for integrating the ES transmitter consists of a base plate, a special bearing unit with a pointer and magnet mounted on it as well as the stud bolts for mounting the ES.

4 Input

4.1 Measured variable

Volume flow rate, alternative level or density.

5 Output

PROFIBUS BA interface for the digital output of the measured value.

6 Characteristic Values

6.1 Supply voltage

9 V to 25 V, terminals 7 and 8
Supply voltage influence: < 0.1% of measured value

6.2 Basic current

< 16.5 mA

6.3 Fault current

< 18 mA

6.4 Baud rate

31.25 kBaud

6.5 Accuracy

< +-0.2% of URV (upper range value) in the interpolation points

6.6 Repeatability

typically < 0.1% of URV

6.7 Resolution

typically 0.05% of URV

6.8 Environmental conditions

External magnetic fields (e.g. from adjacent fittings) must be avoided.

6.8.1 Degree of protection

The ES transmitter must be installed in a housing that offers a degree of protection of at least IP 20.

6.8.2 Ambient temperature limits

-20°C to +70°C
It must be ensured that the temperature in the display unit does not exceed a value of 70°C due to environmental influences such as hot medium, sunlight or heating of the meter tube. If necessary, a pulled-forward display unit must be used when the fluid temperature is high. Please also observe the tables of the section "Medium temperature limit" of the device description of the fitting.

6.9 Storage temperature

-40°C to +70°C

6.10 Influence of ambient temperature

< +-0.5% of URV/10°K;

6.11 Electromagnetic compatibility (EMC)

EN 61000-6-2:1999 Immunity industrial environment
EN 50081-1 Emitted interference residential environment
EN 55011:1998+A1:1999 Group 1, Class B (Limit values and methods of measurement)

In order to ensure electromagnetic compatibility, a shielded cable (type A, see PROFIBUS-PA User and Installation Guideline) must be used.

6.12 Safety data

EC Type Examination Certificate
DMT 00 ATEX E075

Type of protection: Ex ia IIC T6

PROFIBUS-PA communications circuit (terminals 7 and 8)
to be used as a field device in an intrinsically safe field bus system in accordance with FISCO (IEC 60079-27)

or to be connected to intrinsically safe electric circuits.

Parameters for the transmitter:

U_i = 32 V
I_i = 280 mA
P_i = 2W
C_i < 5nF
L_i < 10µH

The ambient temperature ranges from -40°C to +70°C.

7 Electrical connection

7.1 Shielding

The shield must be connected on both sides (Figure 1). Equipotential bonding in accordance with the explosion protection guidelines must be ensured in this case. The shield is connected in the special EMC cable gland (Figure 2).

7.2 Installation procedure

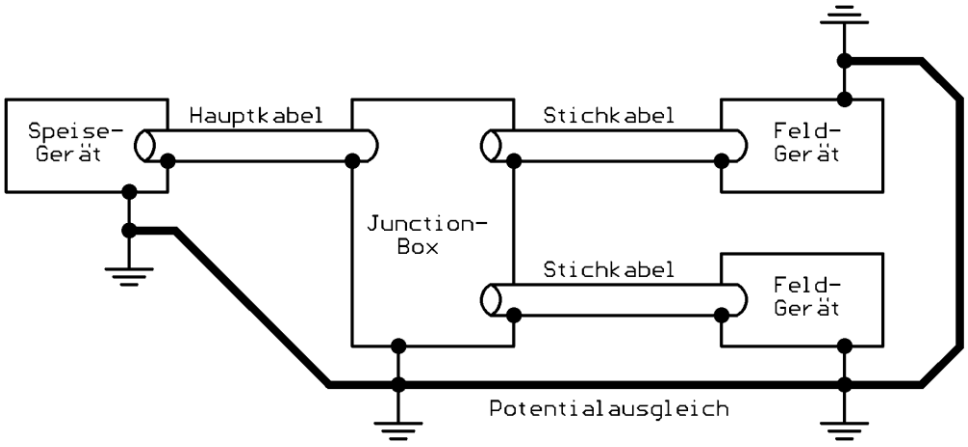
Remove the cover.

Connect the signal lines and shield. The outer shield (braid) is connected in the cable gland. The signal cores are connected to terminals 7 and 8. There is no need to observe polarity when making these connections. The unmarked terminals do not have an electrical function (Figure 3).

Reinstall the cover.

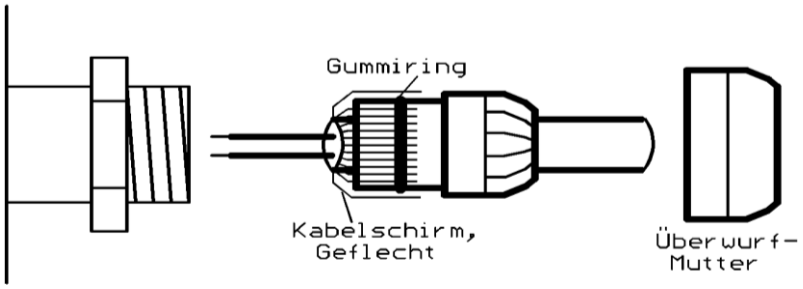
7.3 Checking the function

The measured value can be read out shortly after the supply voltage has been switched on. Due to the influence of the float magnet, the ES transmitter will only output the correct value if the pointer position is brought about by moving the float. Turning the pointer will cause deviating values, but makes possible checking of the tendency.

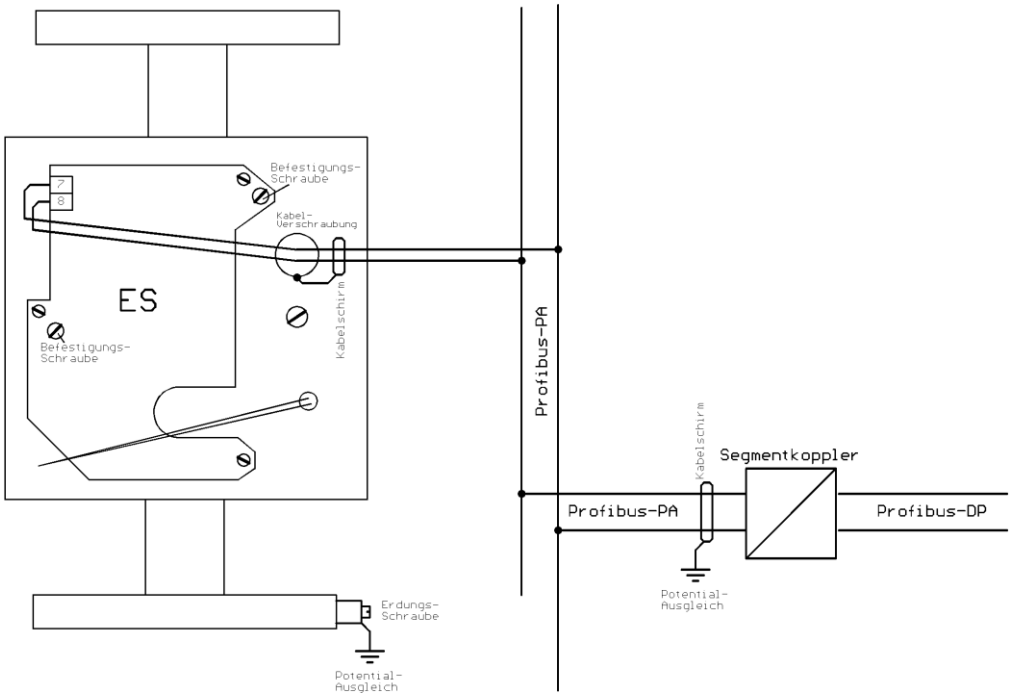


7.4 Figure 1: Combination of shielding and grounding

(Source: PNO Profibus-PA User and Installation Guideline Version 1.1, 9.1996)



7.5 Figure 2: Connecting the cable shield in the cable gland



7.6 Figure 3: Connecting the ES to the PROFIBUS-PA

8 Certificates and approvals

EX: EC Type Examination Certificate DMT 00 ATEX E075

CE: The ES-PPA transmitter complies with the EC Directives 94/9/EC (Explosion Protection) and 89/336/EEC (Electromagnetic Compatibility) including all changes and/or supplements published to date (04/24/2001). Conformity with the tested prototype is confirmed by applying the CE Mark.

9 Order Information

The ES transmitter is only supplied in conjunction with a fitting or a spare part. When ordering the device as a spare part, please specify the serial number of the fitting.

10 Maintenance

The ES transmitter is maintenance-free. In case of a malfunction, the ES transmitter can be replaced. A malfunction has occurred, for example, when the measured value differs considerably from the expected value (e.g. difference cannot be explained with a temperature drift). If there is a legitimate doubt as to the correct operation of the device, it must be returned to the manufacturer. The device must not be repaired by the user.

10.1 Replacing the ES transmitter

If an ES transmitter is to be replaced, the new transmitter will adopt all parameters of the old transmitter by importing the archived data record through the bus. An ES transmitter supplied as a spare part is generally parameterized by the manufacturer before delivery with the characteristic curve of the device to be replaced. The order/serial number of the fitting must be specified for this purpose.

Replacement procedure

- Disconnect the device from the bus
- Remove the cover and disconnect the signal cores
- Remove the scale (a screw in the center of the scale at the level of the pointer axle)
- Remove the ES transmitter (two M4 countersunk screws)
- Mount the new ES transmitter and reconnect the signal cores
- Remount scale and cover.

11 Profibus-PA interface

PROFIBUS-PA divides the parameters that are important for configuring the device in the system into function blocks. These parameters can only be accessed acyclically. The function and assignment of these blocks was defined by the PROFIBUS User Organization (PNO) in the "Profile for process control devices Rev. 3.0".
The transmitter ES-PPA uses exclusively only Profile 3.0 of area flow meters!

The "physical block" includes information about the device (e.g. type, profile or manufacturer). The “transducer block” contains transmitter-specific parameters (e.g. calibration factor, zero point or nominal size).

The "analog input function block" contains the parameters for forming the output value (e.g. limit values, measuring range or time constant). The output value of this block (OUT) can also be accessed cyclically.

The ES-PPA does <u>not</u> support any *Totalizer Function Block*.

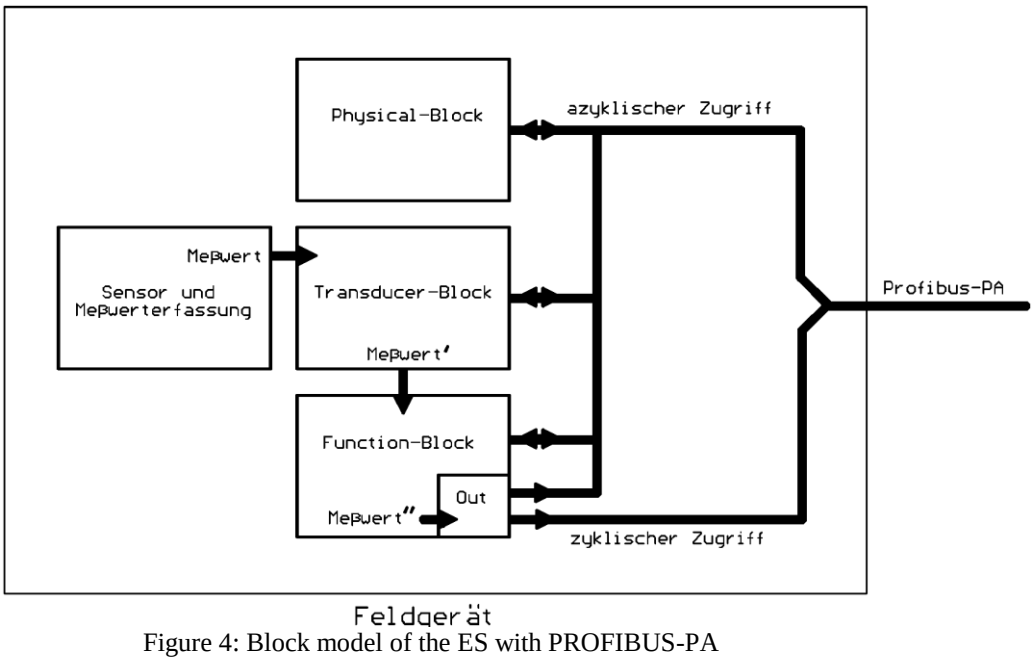


Figure 4: Block model of the ES with PROFIBUS-PA

11.1 GSD File

This file is shipped together with every device on a diskette or can be accessed from the internet at the PROFIBUS User Organization (PNO).

http://www.profibus.com/pall/applications/products/00074/pa139700.gsd

It contains information for the master (e.g. baud rate or response times). This file is needed for the integration of the device into the PROFIBUS-PA network and will be copied into the subdirectory defined by the programmable controller software.

Name of file: **PA139700.gsd**

The ES-PPA uses 1 *analogue input function block* without any **totalizer function block**. There is no vendor specific GSD-file used.

The profile GSD files already are included and available by many control systems (e.g. PCS7).
To avoid multiple installations, the GSD filed delivered by the control system should be used.
The transmitter ES- PPA does not use a manufacturer specific GSD file.

If a GSD file is needed with equipment picture, then the GSD "YPHM9700.gsd "together with the picture "BGN04.bmp" can be downloaded from our homepage www.heinrichs-mt.com.

If the SK2 from vendor Pepperl & Fuchs is used, the modified GSD file "YP009700.gsd" must be used.

11.2 Device address

The device address is used for selecting the device in the system. This address may only be assigned once. Note that devices with an identical address will collide during bus accesses. The device address can only be set via the bus.

When the device is shipped from the factory, the preset address is 126. Before commissioning the system, every new device must be assigned a new, unassigned address (< 126).

11.3 Cyclic communication

The master can cyclically read out the "OUT" measured value from the ES transmitter. The measured value is represented as a 32-bit floating-point number in accordance with IEEE-754; the corresponding status is represented as an 8-bit word. The unit of the measured value can be selected (see Acyclic communication/unit of measured value).

11.3.1 Assigning a meaning to the status word

The meaning of the status messages has been defined by the PROFIBUS User Organization (PNO). The device reports the following states:

Hex	Meaning	Quality of measured value
0x8A	Exceeding HI-LIM	"Good, warning value exceeded"
0x89	Falling below LO-LIM	"Good, measured value is falling below warning value"
0x8E	Exceeding HI-HI-LIM	"Good, alarm value exceeded"
0x8D	Falling below LO-LO-LIM	"Good, alarm value exceeded"
0x52	Exceeding upper sensor limit	"Uncertain, measured value is inaccurate, exceeding limit value"
0x51	Falling below lower sensor limit	"Uncertain, measured value is inaccurate, falling below limit value"

11.4 Acyclic communication

11.4.1 Parameters of the transducer block

Calculating the measured value:
Command "**Set Zero !**" (1=execute, 0=do nothing)
This command forces the ES-PPA to calibrate it's zeropoint.
The zero point can be shifted manually: The "**zero point**" parameter is set in the unit of flow/level/density and is continuously subtracted from the uncorrected measured value.
After executing the command "Set Zero !" this parameter will be reset to zero.

Calibration factor: The measured value is multiplied by the calibration factor. This factor is 1 when the device is shipped from the factory. The following formula is used:
Flow rate = (uncorrected flow rate – zero point) * calibration factor

Low-flow cutoff: The unit of the low-flow cutoff is identical to the unit of the flow rate. At level/density applications this parameter should be set to zero. If the flow drops below the low-flow cutoff, the measured value will be set to zero. Hysteresis is 3%, with an unilateral effect.

Flow direction:
The flow can be assigned a sign. If the sign is negative, reverse flow turns into forward flow.

Information:

Device mode: The ES transmitter measures unidirectional (only forward flow).

Nominal size: This parameter can be set via the bus. When shipping the device, the nominal size is factory-set.

The upper and the lower sensor limit define the range for the upper-range value. The unit is identical to flow/level/density. If these limits are exceeded, an alarm will be generated.

The **measured value** for the flow rate/level/density can be acyclically read from the transducer block.
The following units are available:

Units of measured value:	m3/h, m3/min, m3/s; l/h, l/min, l/s; USgal/h, USgal/min, USgal/s; IMPgal/h, IMPgal/min, IMPgal/s; (kg/h, t/h, g/h; cm, kg/m3)

11.4.2 Analog input function block

Filter time constant:
0 to 60 seconds, is used for damping the measured value. Damping is carried out during measured-value acquisition.

Simulation:
Instead of the measured value and the status from the transducer block, a simulation value and a simulation status can be defined. Simulation can be switched on or off (1 = ON, 0 = OFF). Caution: The simulation must be manually switched off. The simulation will be terminated when the device is switched off and on.
Be careful ! It is not indicated whether the cyclic output OUT is real or simulated.

Mapping the measured value to the output value:
Based on the measured value for the flow rate/level/density (see transducer block), the relative value is calculated first.
PVScale parameter [consisting of 100% = URV, 0% = LRV, unit of the measured value (PVScale)]
The measured value unit must be identical to the unit of the transducer block. Measured value, URV and LRV e.g. in l/h

$$(Q \text{ in } \%) = \frac{(Q \text{ in l/h}) - LRV}{URV - LRV} \quad (PVScale)$$

The absolute value for the output (OUT) is then calculated based on the relative value:
OUTScale parameter [consisting of 100% = URV, 0% = LRV, output unit (OUTScale)]
output value, URV and LRV in the unit of the output (e.g. l/min).

OUT in l/min = (Q in %) *(URV - LRV) + LRV (OUTScale)

It seems practical to use the same URV, LRV and unit for PVscale and OUTScale.

The OUT value can be retrieved using the cyclic services.

The units that can be set for PV scale and OUT scale are listed under Transducer block/units of measured value. The measured value unit of the transducer block is automatically equated with the unit of PVScale.

Monitoring the output value:

upper warning limit HI-LIM: if the limit is exceeded, a warning will be issued
upper alarm limit HI-HI-LIM: if the limit is exceeded, an alarm will be issued
lower warning limit LO-LIM: if the measured value falls below this limit, a warning will be issued
lower alarm limit LO-LO-LIM: if the measured value falls below this limit, an alarm will be issued
Hysteresis of limit values has a one-sided effect. The unit of these parameters is the OUTScale unit (see above).

The monitoring results can be accessed under the corresponding output values:
HI-ALM, HI-HI-ALM, LO-ALM, LO-LO-ALM

OUT output value:
Here the value "OUT" can be read acyclically.

11.4.3 Factory reset

The "factory reset" command resets several parameters to their default values. To select one of the listened options below, a parameter with the listened number has to be added.

2712	Device address is set to 126.
2506	Warm restart.
1	All parameters are reset to factory settings. All user specific settings are lost. The calibration itself is still untouched.