Interface Description

COM/FEX300/FEX500/PB-EN

Electromagnetic Flowmeter ProcessMaster, HygienicMaster FEX300, FEX500

PROFIBUS PA

Valid from software version 00.01.00

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COM/FEX300/FEX500/PB-EN

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Translation of the original instruction

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1 Preamble

1.1 General

The present document contains information about the PROFIBUS PA functionalities and gives hints about the configuration.

The document is valid for ProcessMaster / HygienicMaster electromagnetic flowmeters (FEX300 / FEX500 series).

Both device variants have the same ID number and refer to the same GSD file (equipment master data).

Transmitters of the FEX500 series have additional functions for process diagnostics and for the control of fill processes.

The differences between the models regarding the parameters in the Transducer Blocks are marked accordingly.

1.2 System integration

The transmitter meets the criteria of PA Profile 3.01 incl. Condensed Status (Classic Status optional). For commissioning purposes, you will need a device driver in EDD (Electronic Device Description) or DTM (Device Type Manager) format plus a GSD file.

ABB provides three different GSD files which can be integrated in the system.

Users decide at system integration whether to install the full range of functions or only part.

The change-over occurs via the "**IDENT_NUMBER_SELECTOR**" parameter.

The GSD files can also be downloaded from www.abb.com/flow.

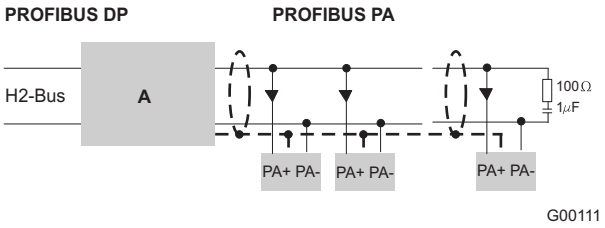
The files required for operation can be downloaded from www.profibus.com.

2 Specifications

PROFIBUS PA protocol

The interface conforms to Profile 3.01 (PROFIBUS standard, EN 50170, DIN 19245 [PRO91]).

PROFIBUS PA ID No.:	0x3430
Alternative standard ID No.:	0x9700 or 0x9740
Configuration	Directly on the device Software DAT200 Asset Vision Basic (+ PROFIBUS PA-DTM)
Transmission signal	in accordance with IEC 61158-2, 31.25 kbit/s
Cable	Shielded, twisted cable (acc. to IEC 61158-2, types A or B are preferred)
Address range	0 ... 126 (configurable via the software or using a switch on the device)



A = Segment coupler (incl. bus supply and termination)

Fig. 1: Example for PROFIBUS PA interface connection

Bus topology

- Tree and / or line structure.
- Bus termination: Passive at both ends of the main bus line (RC element R = 100 Ω, C = 1 µF).

Voltage / current consumption

- Average current consumption: 10 mA
- In the event of an error, the FDE function (=Fault Disconnection Electronic) integrated in the device ensures that the current consumption cannot exceed a maximum of 13 mA.
- The upper current limit is restricted electronically.
- The voltage on the bus line must lie in the range of 9 ... 32 V DC.

3 Configuration

3.1 ID number

A unique identification number (ID No.) is assigned to each PROFIBUS device by the PROFIBUS Nutzerorganisation e. V. (PNO, PROFIBUS User Organization) (see the "Technical data" chapter).

The corresponding equipment master data file is called ABB_3430.GSD. When using this ID No, all the device functions are available: four AI Blocks, two Totalizer Blocks, and one AO Block, DI Block and DO Block, each.

Additionally, the PNO has defined general, manufacturer-independent profiles. The transmitter supports the profiles 0x9740 (one AI Block and one Totalizer Block) and 0x9700 (one AI Block, only).

The advantage of the general profile is the manufacturer-independent exchangeability of all devices that support these profiles. The drawback is that not all of the manufacturer-specific functions can be used.

The used ID No. is selected by the **IDENT_NUMBER_SELECTOR (Index 24)** parameter included in the Physical Block.

Parameter value	Profile / GSD file	Functions
0	0x9740 / PA139740.GSD (general profile of the PNO)	AI, TOT
1	0x3430 / ABB_3430.GSD (manufacturer-specific profile)	AI, 2 TOT, 3 AI, 1AO, 1DI, 1DO
128	0x9700 / PA139700.GSD (general profile of the PNO)	AI

The GSD files can also be downloaded from www.abb.com/flow.

The files required for operation can be downloaded from www.profibus.com.

3.2 Parameterization

Before a PROFIBUS master can communicate with a device, the device must be configured. For this purpose, the master transmits a **SET_PARAMTER** telegram with standard and device-specific parameters to the device.

The **SET_PARAMTER** telegram is made up of at least 7 and a maximum of 244 bytes of user data. The first 7 bytes are firmly defined in the standard and transmit information like the watchdog activation, the ID No., and so on. Bytes 8 ... 10 transmit enhancements for PROFIBUS DPV1.. All other bytes transmit device-specific functions.

In the transmitter's GSD file(ABB_3430.GSD), the manufacturer-specific parameter **CONDENSED_STATUS** is defined. This parameter permits to toggle between the Classic Status and the Condensed Status.

Parameter	
CONDENSED_STATUS	0 Disabled, classic status byte encoded in accordance with PA Profile 3.0 1 Enabled, condensed status byte encoded in accordance with PA Profile 3.01, Amendment 2

For more information about the Condensed Status refer to the "PA Profile 3.01, Amendment 2".

3.3 Configuration string

3.3.1 Modules and slots

During configuration, a configuration string is sent to the PA slave. It defines the data for the cyclic data exchange. The configuration string is written by means of various modules.

Every module has a configuration string. The string defines in coded form how many bytes are cyclically transferred from the master to the slave, and vice versa from the slave to the master. 0 x 94 means, e.g., 5 bytes slave -> master, 0 bytes master -> slave. The transported data content is given by the function block specification.

The following supported modules with their configuration strings are defined in the GSD file:

No.	Model name	Configuration string	Module description
1	Not used (Empty Module)	0x00	This module does not transmit any data.
2	Analog Input (AI)	0x42, 0x84, 0x08, 0x05	Cyclic transmission of the OUT parameters of the AI Block from the slave to the master. 5 bytes: Value(float,4 bytes) & status (1 byte)
3	Totalizer (TOTAL)	0x41, 0x84, 0x85	Cyclic transmission of the TOTAL parameters of the Totalizer Block from the slave to the master. 5 bytes: Value(float,4 bytes) & status (1 byte)
4	Totalizer (TOTAL, SET)	0xC1, 0x80, 0x84, 0x85	Cyclic transmission of the TOTAL parameters of the Totalizer Block from the slave to the master (5 bytes). Transmission of the SET_TOT parameters of the Totalizer Block (1 byte) from the master to the slave.
5	Totalizer (TOTAL, SET, MODE)	0xC1, 0x81, 0x84, 0x85	Cyclic transmission of the TOTAL parameters of the Totalizer Block from the slave to the master (5 bytes). Transmission of the SET_TOT and MODE_TOT parameters of the Totalizer Block (2 bytes) from the master to the slave.
6	Analog Output (AO)	0x82, 0x84, 0x08, 0x05	Cyclic transmission of the SP parameters of the AO Block from the master to the slave. 5 bytes: Value(float,4 bytes) & status (1 byte)
7	Discrete Input (DI)	0x91	Cyclic transmission of the OUT_D parameters of the DI Block from the slave to the master. 2 bytes: Value,(1 byte) & status, (1 byte)
8	Discrete Output (D0)	0xA1	Cyclic transmission of the OUT_D parameters of the DO Block from the master to the slave. 2 bytes: Value,(1 byte) & status, (1 byte)

The modules are assigned to specific slots, i.e. the order in which specific data are transmitted is fixed. One slot can support several modules.

The transmitter with the ID No. 0x3430 supports 9 communication slots. They are defined in the GSD file as follows.

Slot No.	Slot name	Default module	Supported modules
1	AI1 Q Flowrate	2	1,2
2	TOT1 Q Flowrate	3	1,3,4,5
3	TOT2 Q Flowrate	3	1,3,4,5
4	AI2 Int. Totalizer >F	2	1,2
5	AI3 Int. Totalizer <R	2	1,2
6	AI4 Diagnostics	2	1,2
7	AO Density Adjust	6	1,6
8	DI Alarm Info	7	1,7
9	DO Cyclic Control	8	1,8

If configuration data should be transmitted that do not comply with the supported module order, the device returns a "**Cgf_Fault“** to the control system (e.g., slot 1 is configured with the totalizer module (TOTAL)).

3.3.2 Configuration string examples

The configuration string 0x42, 0x84, 0x08, 0x05, 0x41, 0x84, 0x85, 0x41, 0x84, 0x85 cyclically transmits the OUT values of the AI Block and the TOTAL value of both Totalizer Blocks from the slave to the master. A total of 15 data bytes are transferred from the slave to the master.

	Slot 1 (AI1 Q Flowrate)	Slot 2 (TOT1 Q Flowrate)	Slot 3 (TOT2 Q Flowrate)
Config. string	0x42, 0x84, 0x08, 0x05	0x41, 0x84, 0x85	0x41, 0x84, 0x85
Selected module	Module 2: Analog Input (AI)	Module 3: Totalizer (TOTAL)	Module 3: Totalizer (TOTAL)
Data master -> slave	0	0	0
Data slave -> master	5	5	5

The configuration string 0x42, 0x84, 0x08, 0x05, 0x00, 0xC1, 0x80, 0x84, 0x85 cyclically transmits the OUT value of the AI Block and the TOTAL value of the second Totalizer Block from the slave to the master. A total of 10 data bytes are transferred from the slave to the master. Nothing is transferred from the first totalizer block (empty module).

SET_TOT of the second Totalizer Block is cyclically transported from the master to the slave. This is 1 byte.

	Slot 1 (AI1 Q Flowrate)	**Slot 2 (TOT1 Q Flowrate)**	**Slot 3 (TOT2 Q Flowrate)**
Config. string	0x42, 0x84, 0x08, 0x05	0x00	0xC1, 0x80, 0x84, 0x85
Selected module	Module 2: Analog Input (AI)	Module 1: Not used (Empty)	Module 3: Totalizer (TOTAL,SET)
Data master -> slave	0	0	1
Data slave -> master	5	0	5

Important (Notice)

These examples apply to ID No 0x3430. For other ID numbers another number of slots may be defined. As a result, the configuration string may be different.

"Empty modules" (0x00) attached at the end can be omitted. 0x42, 0x84, 0x08, 0x05 is a valid configuration string for reading only the AI block. "Empty modules" at the beginning must be entered; e.g., 0x00, 0x41, 0x84, 0x85 is the configuration string for the Totalizer 1 block, only (slot 1 with the AI is "empty").

3.3.3 Additional configuration strings

In accordance with the PA Profile, a short configuration string and a long configuration string (Extended Identifier Format) are available for the AI and AO function blocks. The transmitter accepts both variants.

3.4 Address setting

There are three ways to set the PROFIBUS-PA address:

- Setting via DIP switch
- Setting via the parameter "PA Addr. (BUS)" (menu Communication -> Profibus) directly on the transmitter.
- Setting via the fieldbus

The DIP switch has highest priority. An address specified by a DIP switch is fixed and cannot be changed. If the DIP switch address setting is not active (switch 8 off), the address can be changed via the bus or via the menu, however, only (as specified with PROFIBUS PA) when no cyclic communication is running.

3.4.1 Address setting via DIP switch

Attention - Potential damage to device!

Damage to the device due to improper handling.
Before opening the transmitter, read and observe the safety information in the operating instructions.

Devices in remote mount or integral mount design have an eight-fold DIP switch on the transmitter backplane.

For devices in remote mount design the switch can be operated when the transmitter housing cover is open. For devices in integral mount design the transmitter electronic unit must be removed from the backplane in order to be able to operate the switch.

The address set via the DIP switch is indicated on the device in the Communication-> Profibus menu. It can also be read via the PROFIBUS-PA in the Physical Block (relative index 35).

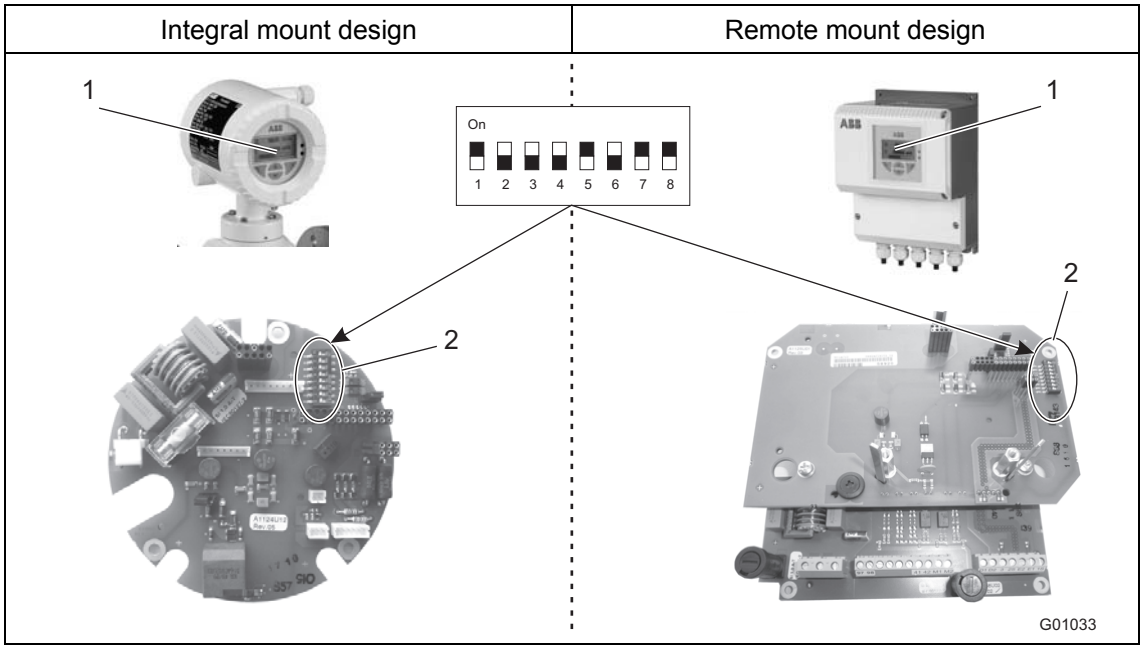


Fig. 2: DIP switch

Switch	1	2	3	4	5	6	7	8
Status	Device address							Address mode
Off	0	0	0	0	0	0	0	Bus
On	1	2	4	8	16	32	64	Local

Switch assignments

Switch	Assignment
1 … 7	PROFIBUS address
8	Defines the addressing mode: Off = Set address via bus (factory setting) On = Set address via DIP switches 1 ... 7 (local)

Switch 8 determines whether the address is set by switch:

- On: The address is set using the switches 1-7. It cannot be changed via the bus.
- Off: The address is set via the bus or the menu. Switches 1-7 have no significance.

Switches 1-7: Address setting, binary coded. Valid address range 0 ... 125.

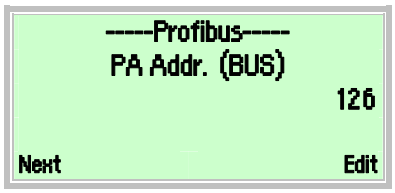
The address switch setting is only adopted when the device is restarted, not during running operation. A restart can be triggered by switching on/off the power supply or through a software reset (Factory_Reset in the Physical Block).

The factory setting of the switch is: 00000000

Important (Notice)

If address setting via the DIP switch is disabled (last new start was with switch 8 to “on”, then new start with switch 8 to “off”), then according to the PROFIBUS PA specifications, the address is reset to the default value 126 and NO_ADDRESS_CHANGE to FALSE.

3.4.2 Address setting via the transmitter menu



The current address is shown here and can be edited. Addresses from 0 to 126 can be entered.

It is not possible to enter an address when cyclic communication is running or when DIP 8 ON (address setting via DIP switch).

3.4.3 Address setting via the fieldbus (PROFIBUS PA)

In accordance with the PA specifications only addresses between 0 and 125 can be set via the bus. It is not permissible to reset the address to its default value 126 by the Set_Slave_Address telegram. The address cannot be changed under the following conditions:

- When cyclic communication is running.
- When the address is set by the DIP switch.
- When NO_ADDRESS_CHANGE is TRUE.

3.4.4 Resetting the address to the factory setting

There are the following ways to reset the address to its factory setting (126):

- By writing "Reset Bus Address" (2712 decimal, 0A98 hex) into Factory_Reset (Physical Block, relative index 19).
- By entering the address 126 via the transmitter menu.
- By a new start with DIP switch 8 to ON and then a new start with DIP switch 8 to OFF.

3.4.5 **Parameter** NO_ADDRESS_CHANGE

Address setting via the bus is done by means of the **Set_Slave_Address** telegram. It contains the Boolean variable **NO_ADDRESS_CHANGE**. It this variable is TRUE, no further address changes can be made with **Set_Slave_Address**.

Changing the address via the bus is then only possible by writing 2712 decimal (= 0A98 hex) into Factory Reset (Physical Block, rel. index 19). This resets the address to the default value 126 and sets**NO_ADDRESS_CHANGE** to FALSE.

It is also possible to set the address via the menu "PA Address" when **NO_ADDRESS_CHANGE** = TRUE. With this, **NO_ADDRESS_CHANGE** is reset to FALSE.

4 Block overview

The transmitter contains the following blocks, depending on the ID number:

Block	Supported PA ID number		
	0x3430 FEX300 / FEX500 PA 3.01	0x9740 Profile Specific (1AI + 1TOT)	0x9700 Profile Specific (1AI)
Physical Block	Slot 0	Slot 0	Slot 0
Analog Input Block - Q Flowrate	Slot 1	Slot 1	Slot 1
Totalizer Block - Q Flowrate	Slot 2	Slot 2	-
Totalizer Block - Q Flowrate	Slot 3	-	-
Analog Input Block - Int. Totalizer Fwd	Slot 4	-	-
Analog Input Block - Int. Totalizer Rev	Slot 5	-	-
Analog Input Block - Diagnostics	Slot 6	-	-
Analog Output Block - Density Adjust	Slot 7	-	-
Discrete Input Block - Diag Info	Slot 8	-	-
Discrete Output Block - Cyclic Control	Slot 9	-	-
Tranducer Block - Flow	Slot 10	Slot 10	Slot 10
Tranducer Block - DeviceInfo	Slot 11	Slot 11	Slot 11
Tranducer Block - Special Function	Slot 12	Slot 12	Slot 12
Tranducer Block - Display	Slot 13	Slot 13	Slot 13
Tranducer Block - Diagnostics	Slot 14	Slot 14	Slot 14

The Physical -Block, the Tranducer Block - Flow and all integrated function blocks comply with the Profibus PA Profil 3.01. Manufacturer-specific enhancements were made on the Physical Block and the Transducer Block - Flow. The following table provides a short description of the supported manufacturer-specific Tranducer blocks:

Block	Description
Tranducer Block - Flow	Up to index 53 one “Flow Transducer Block”. The parameters comply with the profile of the electromagnetic flowmeters. From index 54 on the manufacturer-specific parameters are added.
Tranducer Block - DeviceInfo	Provides detailed information about the device.
Tranducer Block - Special Function	Contains parameters for configuring the switch / pulse output and the internal device totalizer.
Tranducer Block - Display	Contains parameters for configuring the device display.
Tranducer Block - Diagnostics	Contains parameters for configuring and recording process and device diagnoses.

4.1 Block table legend

The following tables list, among other things, the following attributes:

Rel. Index / Abs. Slot Index:

Relative index of the parameter within the block and absolute Slot-Index.
In accordance with the PA profile, all blocks begin with the absolute index 16.
BLOCK_OBJECT, e.g., is on the relative index 0 in every block and, thus, on Slot-Index 16.

Data Type:

Data type of the parameter. Some parameters are structures (DS-xx). The structures are described in chapter 4.14 "Data structures".
For detailed information on the standard data types refer to the PA Profile.

Bytes:

Size of the parameter in bytes.

Storage Type:

Cst	=	Constant parameter. The parameter never changes.
S	=	Static parameters are stored permanently (in the non-volatile memory). When writing a static parameter, the Static Revision Counter ST_REV of the corresponding block (index 1 in each block) is incremented by 1.
N	=	Nonvolatile parameters are stored permanently (in the non-volatile memory). When writing a non-volatile parameter, ST_REV remains unchanged.
D	=	Dynamic parameters are lost when the device is switched off.

Access:

r	=	The parameter can be read.
w	=	The parameter can be written.

Parameter Usage:

C	=	Contained: The parameter is for internal use within the block, only, and cannot be communicated cyclically.
I	=	Input: The parameter is anInput parameter for cyclic communication.
O		Output: The parameter is anOutput parameter for cyclic communication.

Data Transport:

a	=	Only acyclic access to the parameter is possible.
cyc		Cyclic and acyclic access to the parameter is possible.

Default Values:

Default settings of the parameters.
The parameter FACTORY_RESET (index 19 in the Physical Block), selection "Restart with defaults", can be used to reset the Resource Block, the function blocks and some of the Transducer-Block parameters to their default settings.

4.2 Standard block parameters:

The following section describes the standard block parameters. Every block, whether a Physical-, Transducer block or a Function-Block, must contain the following parameters. For a detailed description of the standard block parameters refer to the Profibus PA - Profil 3.01.

Relative Index	Parameter Name	Object Type	Data Type	Store	Bytes	Access	Default Value
0	BLOCK_OBJECT	Record	DS-32	Cst	20	r	-
1	ST_REV	Simple	Unsigned16	N	2	r	0
2	TAG_DESC	Simple	OctetString	S	32	r, w	”
3	STRATEGY	Simple	Unsigned16	S	2	r, w	0
4	ALERT_KEY	Simple	Unsigned8	S	1	r, w	0
5	TARGET_MODE	Simple	Unsigned8	S	1	r, w	Auto
6	MODE_BLK	Record	DS-37	D	3	r	8,8,8
7	ALARM_SUM	Record	DS-42	D	8	r	0,0,0,0

Parameter	Beschreibung
BLOCK_OBJECT	This structure contains general information about the block, e.g., the block type, profile number, and so on.
ST_REV	Revision counter for static variables. Each time when a static variable changes, the revision counter is incremented by one.
TAG_DESC	A text description of this block. It must be unique within a fieldbus.
STRATEGY	This parameter can be used to group blocks by assigning the same code number to each block of the group.
ALERT_KEY	This parameter is used as an identification number for a plant part.
TARGET_MODE	The wanted operating mode of the block. 0x08: Auto 0x10: Man 0x80: Out Of Service
MODE_BLK	The current, allowed and normal operating modes of the block.
ALARM_SUM	This parameter contains a summary of the block alarms.

4.3 Physical Block - Slot 0

The Physical Block contains general specifications of the fieldbus device, e.g., the manufacturer, device type, version number and information about manufacturer-specific enhancements for advanced alarm management.

4.3.1 Physical Block – Parameters

Relative Index	Parameter name	Objekt Type	Data Type	Store	Bytes	Access	Default Value
0...7	Standard block parameter						
8	SOFTWARE_REVISION	Simple	VisibleString	Cst	16	r	-
9	HARDWARE_REVISION				16		-
10	DEVICE_MAN_ID		Unsigned16		2		26 (ABB)
11	DEVICE_ID		VisibleString		16		0x3430
12	DEVICE_SER_NUM				16		-
13	DIAGNOSIS		OctetString	D	4		-
14	DIAGNOSIS_EXTENSION				6		-
15	DIAGNOSIS_MASK			Cst	4		-
16	DIAGNOSIS_MASK_EXTENSION				6		-
17	DEVICE_CERTIFICATION		VisibleString		32		-
18	WRITE_LOCKING		Unsigned16	N	2	r,w	-
19	FACTORY_RESET			S	2		-
20	DESCRIPTOR		OctetString		32		-
21	DEVICE_MESSAGE				32		-
22	DEVICE_INSTAL_DATE				16		-
23	LOCAL_OP_ENA - nicht vorhanden						
24	IDENT_NUMBER_SELECTOR	Simple	Unsigned8	S	1	r,w	-
25	HW_WRITE_PROTECTION			D	1	r	-
26	FEATURE	Record	DS-68	N	8		-
27	COND_STATUS_DIAG	Simple	Unsigned8	S	1	r,w	1
28...32	Reserved by PNO						
33	DIAG_WORST_COND	Simple	Unsigned16	D	2	r	0
34	DIAG_EXT_HISTORY		OctetString		6		0
35	HW_SWITCH_SETTING		Unsigned8		1		0
36	DIAG_SIMUL_STATUS				1	r,w	0
37	DP_ENABLED_FEAT_PROT			S	1		0
38	DIAG_CONDITION_IDX			D	1		0
39	DIAG_DETAILS	Record	Diag_Detail_ History	D	14		0
40	DIAG_ALARM_SIMULATION	Simple	Unsigned8	D	1		0
41	DIAG_CLEAR_ALARM_HISTORY				1		0
42	DIAG_MASK_MAINTENANCE			S	1		0
43	DIAG_MASK_CHECK_FUNCTION				1		0
44	DIAG_MASK_OFF_SPECIFICATION				1		0
45	DIAG_MASK_MIN_ALARM				1		0
46	DIAG_MASK_MAX_ALARM				1		0
47	DIAG_MASK_OVERFLOW_103				1		0
48	DIAG_MASK_EMPTY_PIPE				1		0
49	DIAG_MASK_TFE				1		0

4.3.2 Physical Block – Parameter description

Parameter	Description
SOFTWARE_REVISION	Software revision of the device.
HARDWARE_REVISION	Hardware revision of the device.
DEVICE_MAN_ID	Identification code for the device manufacturer. (26 = ABB).
DEVICE_ID	Manufacturer name for the device (0x3430).
DEVICE_SER_NUM	Serial number of the device as a string.
DIAGNOSIS	Current alarm information for the device, coded bitwise.
DIAGNOSIS_EXTENSION	Additional manufacturer-specific alarm information for the device.
DIAGNOSIS_MASK	Mask with the supported DIAGNOSIS bits: 0: Bit is not used. 1: Bit is used.
DIAGNOSIS_MASK_EXTENSION	Mask with the supported DIAGNOSIS_EXTENSION bits: 0: Bit is not used. 1: Bit is used.
DEVICE_CERTIFICATION	Certifications, etc.
WRITE_LOCKING	Software write protection 0: No acyclic writing allowed, except on WRITE_LOCKING. 2457: All writable parameters can be written.
FACTORY_RESET	Reset command: 1: Reset to default values. The address is not changed. 2506: Warm start. 2712: Reset the bus address, only.
DESCRIPTOR	A user-definable description of the application.
DEVICE_MESSAGE	A user-definable message.
DEVICE_INSTAL_DATE	Installation date of the device.
IDENT_NUMBER_SELECTOR	The supported Profibus ID numbers. 0: 0x9740 - Profile-specific (1AI + 2TOTs). 1: 0x3430 - Manufacturer-specific ID number. 128: 0x9700 - Manufacturer-specific: Device complies with Profile 0x9700.
HW_WRITE_PROTECTION	Status of the hardware write protection switch. When the switch is set, no write access is possible via the bus.
FEATURE	Indication of optionally supported device properties.
COND_STATUS_DIAG	Mode of the status and diagnostic output of the device: 0: Extended Diagnosis Status is used. 1: Condensed Status is used.
DIAG_WORST_COND	When several alarms are active, additional alarm information is shown here for the alarm with the highest priority. **1 byte: Worst Condition** • 1 - Check Function • 2 - Out of Specification • 4 - Maintenance • 8 - Failure **2 bytes: Condition Group** • 1 - HW Status of Electronic Unit • 2 - HW Status of Sensor • 4 - Configuration State • 8 - Operating Condition
DIAG_EXT_HISTORY	Provides device information in manufacturer-specific alarm histories.
HW_SWITCH_SETTING	Status of the DIP switch (hardware address setting).
DIAG_SIMUL_STATUS	Information about the device simulation status.
DP_ENABLED_FEAT_PROT	Activates / deactivates DP features.

Parameter	Description
DIAG_CONDITION_IDX	Setting of the alarm number in order to get additional alarm information via DIAG_DETAIL. Refer to chapter 5.3 "Transducer block status".
DIAG_DETAILS	Provides additional alarm information about the selected DIAG_CONDITION_IDX. (For a description of the DS_HistoryDetails data structure refer to chapter 4.14 "Data structures").
DIAG_ALARM_SIMULATION	Various alarm messages and output states can be simulated. Refer to chapter 5.3 "Transducer block status".
DIAG_CLEAR_ALARM_HISTORY	Deletes the alarm history information.
DIAG_MASK_MAINTENANCE	Masking of the alarm groups: • Maintenance • Check Function • Out Of Specification With active masking there is no alarm signaling from the corresponding group. Alarms from the Failure group cannot be masked. Single alarm masking With activated masking there is no alarm signaling.
DIAG_MASK_CHECK_FUNCTION	
DIAG_MASK_OFF_SPECIFICATION	
DIAG_MASK_MIN_ALARM	
DIAG_MASK_MAX_ALARM	
DIAG_MASK_OVERFLOW_103	
DIAG_MASK_EMPTY_PIPE	
DIAG_MASK_TFE	

4.4 Analog Input Function Block - Slot 1,4,5,6

The measured value calculation occurs in the Transducer-Block. The Transducer-Block internally provides the measured values. Cyclic outward measured value output is realized via the Analog Input Function Block (AI-Block).

The transmitter supports 4 AI Blocks. The first three AI Blocks are firmly connected to measured values from the Transducer Blocks. Only for the fourth AI Block it is possible to output different measured values via the Channel Parameter. The channel can be selected either via the transmitter menu or via the bus.

For AI4 the channel is selected via the bus by:

- Channel - Sensor Temperature = 0x0521 (dec. 1313)
- Channel - Flow Conductivity = 0x0539 (dec. 1337)

For the FEX300 zero is returned for both channels, as the FEX300 does not support these functions.

In order to obtain useful measured values for the FEX500, the corresponding diagnostic functionality must be switched on.

For a detailed description of the supported diagnostic functions of the FEX500 refer to the operating instructions „OI/FEX300 / FEX500“.

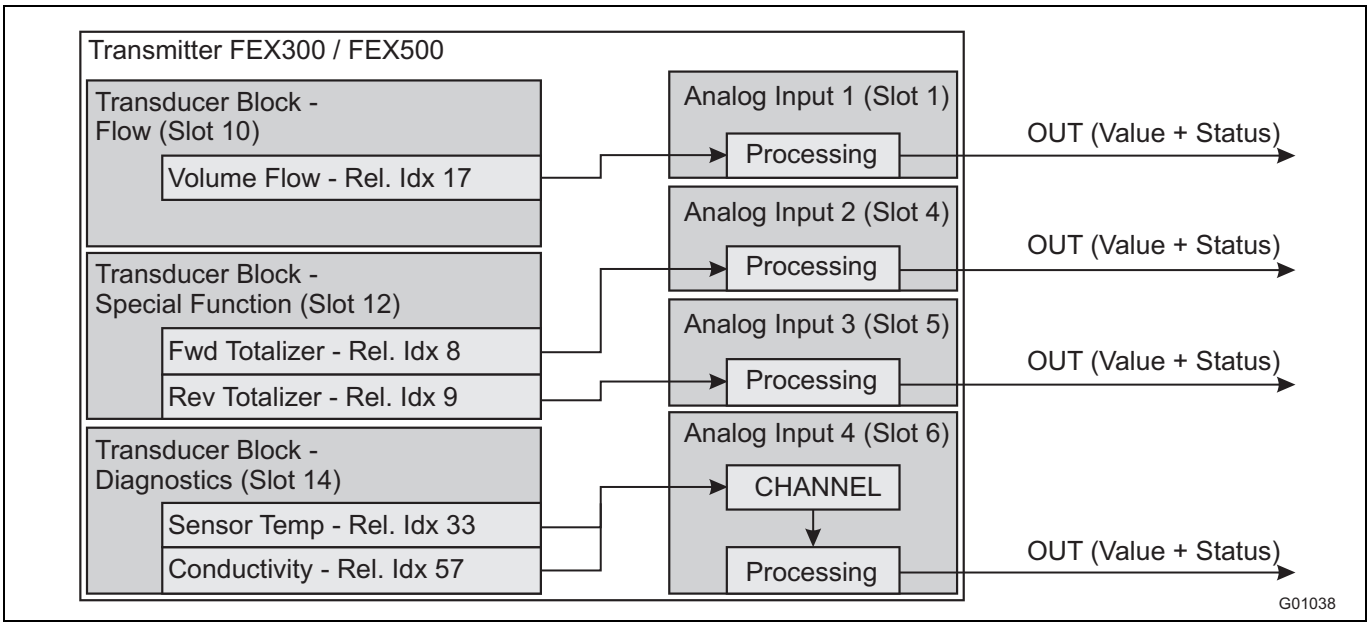


Fig. 3 Analog Input Function Block

All AI Blocks receive their measured values from the above-shown Transducer Blocks.

It is possible to select different units for the volume flow and for the internal forward/reverse totalizer (see the description of the Transducer Blocks). If the unit is changed, the AI Blocks receive the measured value in the selected unit.

The unit conversion can also take place in the AI Block itself. This is done via the input and output scaling (PV_SCALE & OUT_SCALE).

4.4.1 Analog Input Block Diagram

An AI Block performs various tasks, such as rescaling, alarm handling, simulation, and so on. This is described in the following.

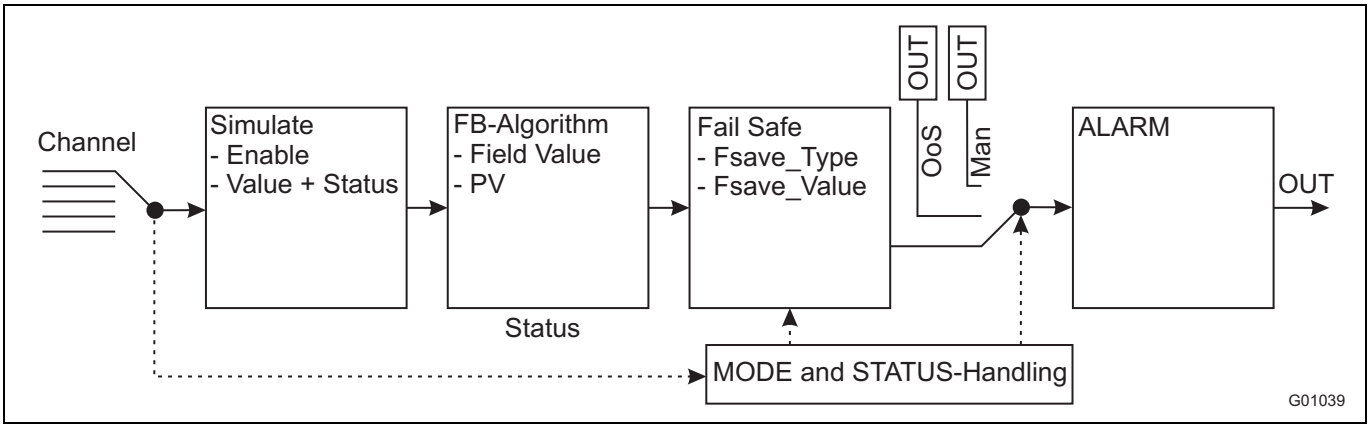


Fig. 4: Analog Input Block

Channel: The Channel Parameter (index 14) is used to select which measured value is to be transmitted from the Transducer Block. See also chapter 4.4 Analog Input Function Block - Slot 1,4,5,6

Simulate: The Simulate Parameter is a structure. The “Simulate Enable” sub-parameter can be used to activate the simulation. The “Simulate Value” sub-parameter will then generate the simulation value that will be processed instead of the channel value.

FB-Algorithm: The input value is scaled to a percentage using the PV_SCALE structure. This percentage is called the FIELD_VALUE and only exists internally within the block. It cannot be accessed by communication:

$$FIELD\_VALUE = \frac{100 \times (Channel\_Value - PV\_SCALE.EU0\%)}{(PV\_SCALE.EU100\% - PV\_SCALE.EU0\%)}$$

This percentage is scaled to the PV value by the OUT_SCALEstructure:

$$PV = \left(\frac{FIELD\_VALUE}{100} \times (OUT\_SCALE.EU100\% - OUT\_SCALE.EU0\%) + OUT\_SCALEEU0\% \right)$$

The PV_FTIME parameter (index 16) permits to define a damping time in seconds. The filtered measured value is called OUT.

OUT = Filter (PV)

Fail-Safe: FSAFE_TYPE (index 17) defines the behavior in the event of a fault. If FSAFE_TYPE = 0, then FSAVE_VALUE (index 18) is output in the event of a fault. If = 1, the last "usable" value is output. If = 2, the faulty values are output.

Mode: If Mode = Auto, the value determined so far is output.

If Mode = Man, the OUT parameter is output. The OUT parameter can be written cyclically in Man mode.

If Mode = Out of Service, then the OUT parameter is output.

Alarm:

There are four alarm thresholds (index 21,23,25,27)

- High-High-Limit
- High-Limit
- Low-Limit
- Low-Low-Limit

An alarm message (index 30-33) is available for each of these thresholds and will be tripped when the alarm threshold is exceeded or undershot.

- High-High-Alarm
- High Alarm
- Low Alarm
- Low-Low-Alarm

ALARM_HYS (index 19) can be used to define a hysteresis for the alarm thresholds.

For a detailed description of the functions and parameters of an Analog Input Block refer to the PA Profile 3.01.

4.5 Totalizer Function Block - Slot 2,3

In the Totalizer Block, the measured flow values are totalized (integrated) in order to determine the flowrate. The Totalizer Block receives the measured value from the Transducer Block. Both Totalizer Blocks are firmly connected to the Volume Flow parameter in the Transducer Block.

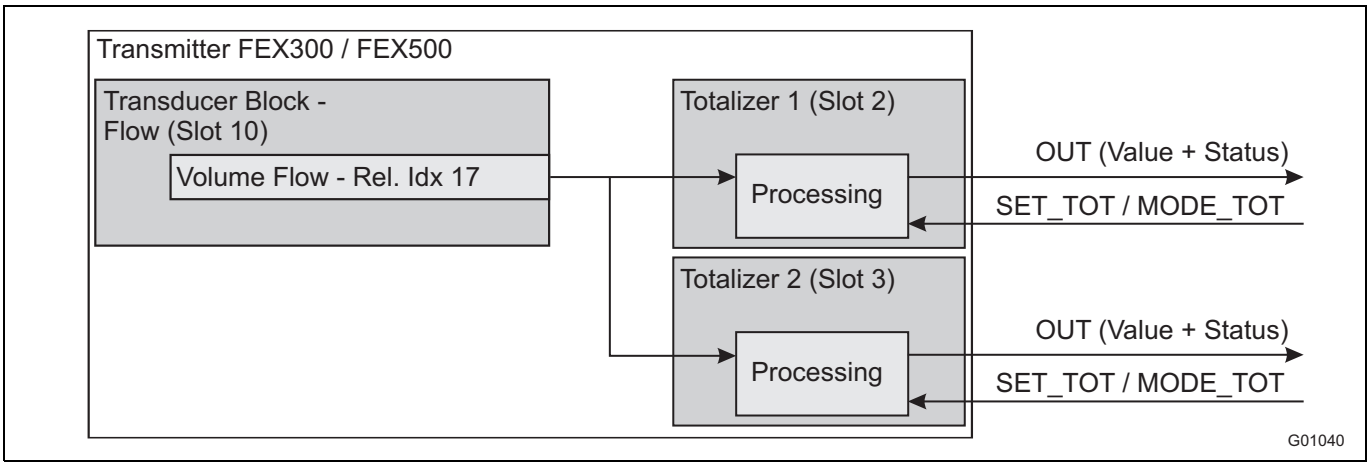


Fig. 5: Totalizer Function Block

The totalizers integrate the value delivered by the Transducer Block, depending on the block configuration. The flow value from the Transducer Block is with units. If the flow unit of the volume flow is changed in the Transducer Block, the Totalizer Blocks receive the measured value in the newly set unit.

As both totalizers integrate the same measured value, a forward / reverse flow totalizer can be realized, e.g. by using the MODE_TOT parameter.

Depending on the configuration string, the totalizer can cyclically communicate the following parameters:

- TOTAL
- SET_TOT
- MODE_TOT

4.5.1 Totalizer blocks and internal totalizers of the transmitter

The transmitter is also available as a standard device without PA communication, i.e. without Totalizer Blocks. For this reason, the transmitter contains own internal totalizers that have nothing to do with the Totalizer Blocks. These internal totalizers are also provided in the PA device and can be read e.g. from the LCD display in the "Totalizer" submenu.

The internal totalizers (forward / reverse flow) are firmly connected to the AI Blocks 2 and 3 and can also be read out cyclically.

Only the Volume Flow (index 17) can be used as a channel for the Totalizer Blocks, not the internal totalizers! The totalizer totalize the volume flow to obtain the totalizer status. It would not make any sense to totalize the internal totalizers a second time. The internal totalizers and the Totalizer Blocks are independent of each other, can be configured differently (units, mode, ...) and can be reset at different times. As a result, the totalizer values may differ.

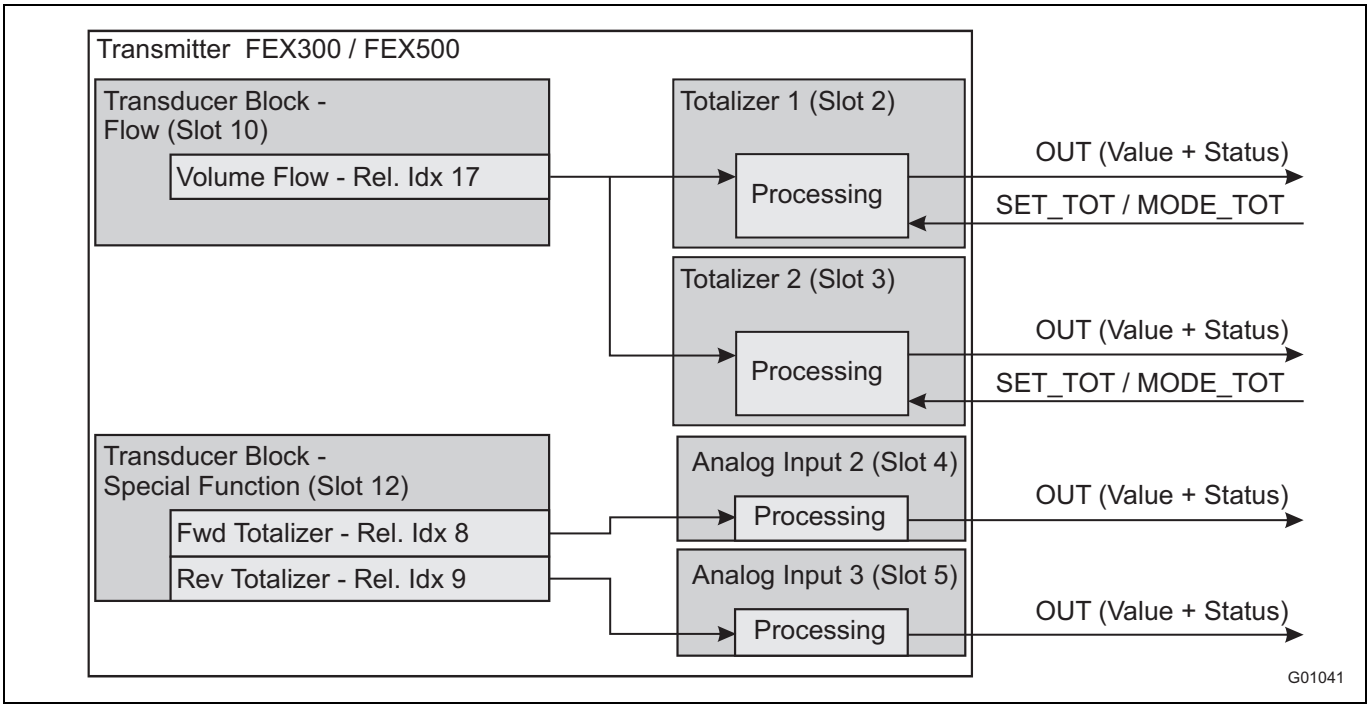


Fig. 6: Totalizer Blocks / Internal Totalizers

As the Totalizer Block totalizes the volume flow, the totalizer unit corresponds to the flow unit, but without the time. Example: Flowrate m³/h, totalizer m³.

The transmitter does not automatically set the totalizer unit UNIT_TOT (index 11) to the corresponding unit value, e.g., when the flow unit is changed.

4.5.2 Totalizer Block Diagram

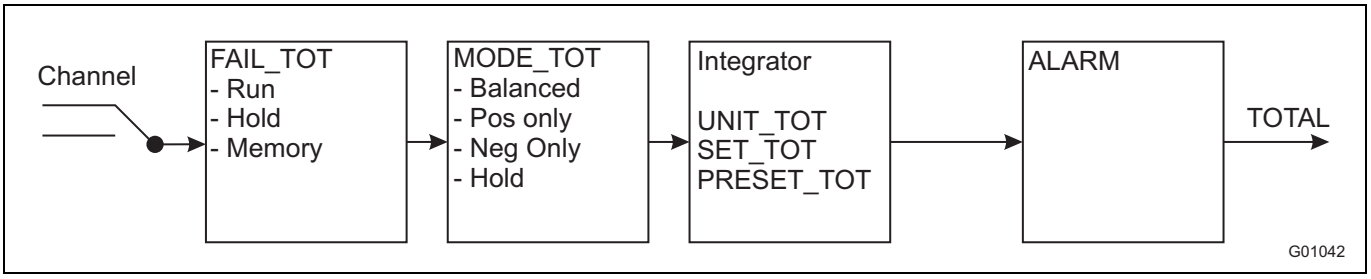


Fig. 7: Totalizer Block

Channel: The Channel Parameter (index 12) is used to select the measured value to be processed from the Transducer Block.

FAIL_TOT: (Index 15) determines the behavior in the event of channel values with “BAD” status. In this case, it is possible to let the totalizer continue to Run and ignore the bad values, to stop the totalizer or to add the last good value (from memory).

MODE_TOT: (Index 14) determines, whether both flow directions, only positive or only negative flow values are to be totalized. With "Hold" the totalizer can be stopped.

Integrator: The flow values are continuously added to the TOTAL value (index 10) to calculate the totalizer status.

UNIT_TOT (index 11) specifies the unit. It is not checked, and UNIT_TOT is not considered for the calculation.

SET_TOT (index 13) allows for resetting or presetting of the TOTAL value:

0: Totalize means that the totalizer is operating "normally" and totalizes values.

1: Reset Resets the totalizer to 0.

2: Preset Sets the totalizer to PRESET_TOT (index 16).

As long as SET_TOT_ is set to 1 or 2, the reset or preset status is maintained. Only when SET_TOT is reset to 0, "normal" totalizing starts again.

Alarm: There are four alarm thresholds (index 18-21)

- High-High-Limit
- High-Limit
- Low-Limit
- Low-Low-Limit

An alarm message (indices 22-25) is available for each of these thresholds and will be tripped when the alarm threshold is exceeded or undershot.

- High-High-Alarm
- High Alarm
- Low Alarm
- Low-Low-Alarm

ALARM_HYS (index 17) can be used to define a hysteresis for the alarm thresholds.

4.6 Analog Output Function Block - Slot 7

In the manufacturer-specific profile the transmitter supports an Analog Output Function Block. As a result, a measured value (Float Variable) can be fed cyclically to the transmitter.

This allows for cyclic adjustment of the density value in the device in order calculate the mass flow corresponding to the fluid. The mass flow is calculated from the measured volume flow and the set density.

The density value in the Transducer Block is only accepted in the range 0.01g/cm^3 ... 5.0 g/cm^3.

Before writing the density value, the Transducer Block verifies whether the value status is good or higher. Should the measured value status be bad or uncertain, the Transducer Block will discard the measured value.

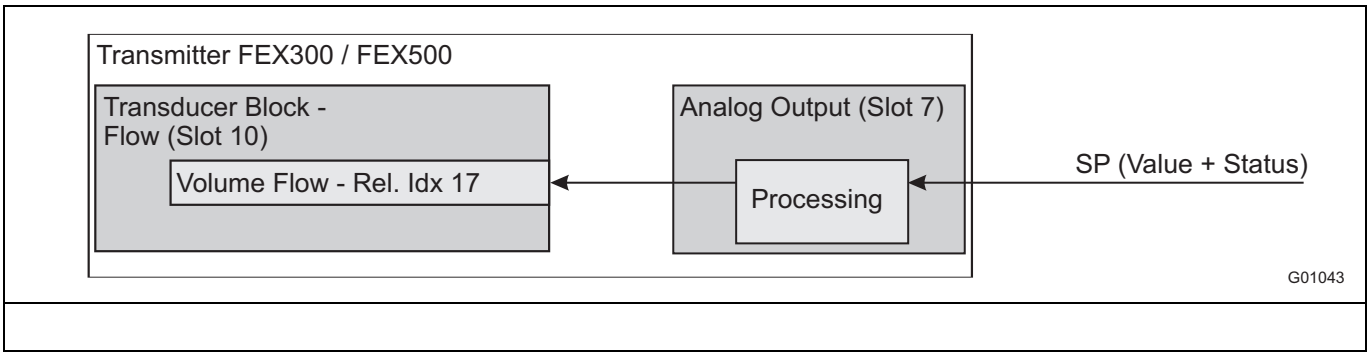


Fig. 8: Analog Output Function Block

In order to be able to output the mass flow, the unit of the parameter VOLUME_FLOW (TB1 rel. idx. 17) must be set to a mass flow unit. The mass flow is then cyclically transferred via the first Analog Input Function Block.

The VOLUME_FLOW_UNITS parameter is used to set or change the volume flow unit. The transmitter supports the following volume flow units:

Unit	PROFIBUS unit code
g/s	1318
g/min	1319
g/h	1320
kg/s	1322
kg/min	1323
kg/h	1324
kg/d	1325
t/min	1327
t/h	1328
t/d	1329
lb/s	1330
lb/min	1331
lb/h	1333

If this should be insufficient, the units can be converted using the scaling of the Analog Input Block. Alternatively, a user-specific unit can be defined in the transmitter.

For detailed information, please refer to the operating instructions.

4.7 Discrete Input Function Block - Slot 8

A Discrete Input Function Block (DI) is considered as a switch by the control system. It is used for cyclic transfer of binary signals to the control system. The DI Block in the transmitter allows for cyclic transfer of device-specific alarm information to the control system.

This is done in addition to the alarm options already specified in the PROFIBUS, e.g. Get_Diag or status messages.

The following choice of channels is available for the DI Block.

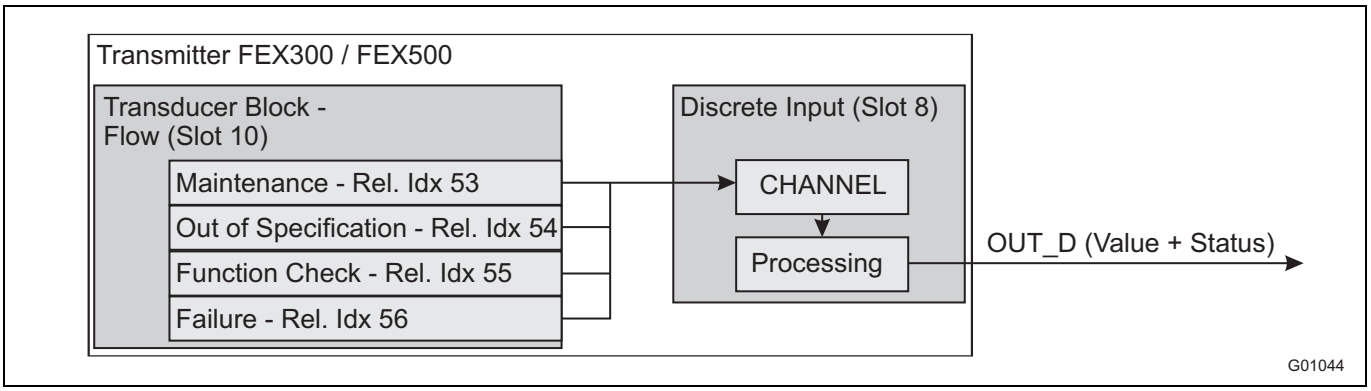


Fig. 9: Discrete Input Function Block

The channel can be selected either via the transmitter menu or via the bus.

For the DI the channel is selected via the bus by:

- Channel - Maintenance = 0x0135 (dec. 309)
- Channel - Out of Specification = 0x0136 (dec. 310)
- Channel - Function Check = 0x0137 (dec. 311)
- Channel - Failure = 0x0138 (dec. 312)

Every device-specific alarm message of the transmitter is allocated to an alarm group. This means that each channel represents one alarm group. If an alarm is set in one of the groups, cyclic signaling to the control system occurs when the corresponding channel is selected.

The following table lists the output value of the DI Block (OUT_D.value) in dependence of the selected channel and a set alarm in the alarm groups:

		Alarm in group			
		Maintenance	**Out of Spec**	**Function Check**	**Failure**
Channel	**DI_PV_DIAG_MAINTENANCE**	1	1	1	1
	DI_PV_DIAG_OUT_SPEC	0	1	1	1
	DI_PV_DIAG_FUNC_CHECK	0	0	1	1
	DI_PV_DIAG_FAILURE	0	0	0	1

As can be seen, there is a hierarchy within the groups. A set alarm in the Failure group is signaled outward via any selected channel, whereas a Maintenance Alarm reaches the control system only via the selected Maintenance Channel.

For more detailed information about the alarm messages refer to Chapter **5.2 "DIAGNOSIS_EXTENSION and DIAG_EXT_HISTORY"**.

Independent of any alarm messages existing in the transmitter, the status message of the above-shown channel parameters always returns the value good.

4.8 Discrete Output Function Block - Slot 9

In the manufacturer-specific profile the transmitter supports a Discrete Output Function Block (DO).

It is used for cyclic transfer of binary switching operations from the control system to the transmitter. These start / stop specific functions in the transmitter (e.g. adjustments, totalizer stop, etc.)

The Transducer Block verifies whether the status of the value is good or higher. Should the status of the DI switch be bad or uncertain, the Transducer Block will discard it.

The following choice of channels is available for the DO Block.

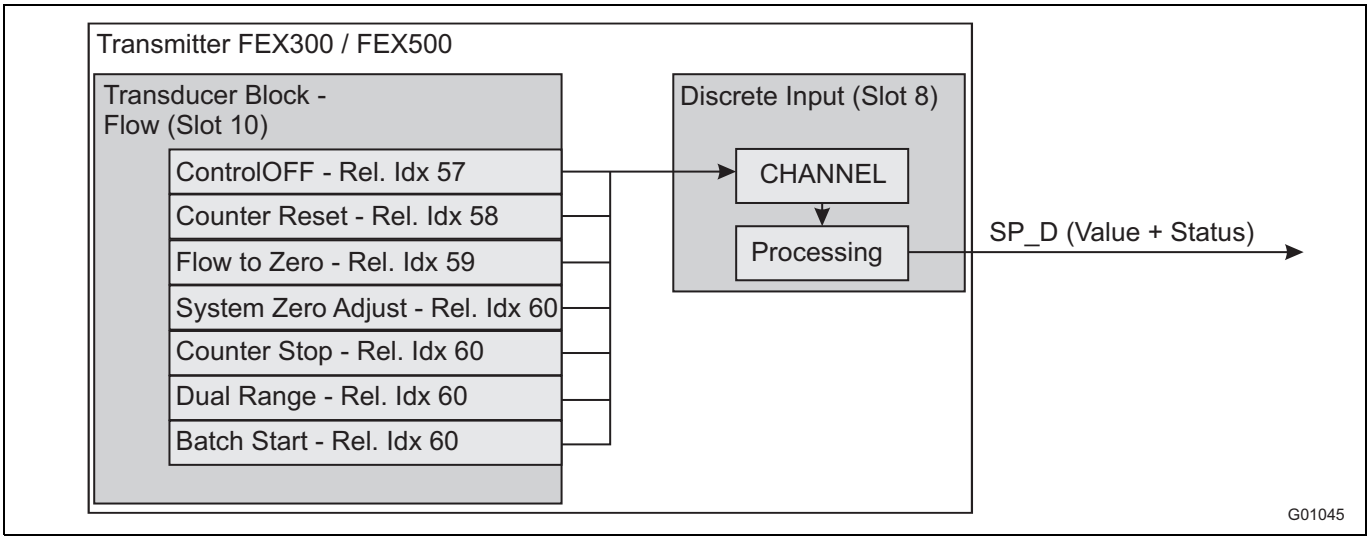


Fig. 10: Discrete Output Function Block

The operating mode of the DO block of the channel can be selected either via the transmitter menu or via the bus. For the DO the channel is selected via the bus by:

- Channel - Control Off = 0x0139 (dec. 313)
- Channel - Counter Reset = 0x013A (dec. 314)
- Channel - Flow to Zero = 0x013B (dec. 315)
- Channel - System Zero Adjust = 0x013C (dec. 316)
- Channel - Counter Stop = 0x013D (dec. 317)
- Channel - Dual Range = 0x013E (dec. 318) (only FEX500)
- Channel - Batch Start = 0x013F (dec. 319) (only FEX500)

The Transducer Block in the transmitter expects to receive a binary signal from the control system as an input variable:

- "0" - Stops device functionalities
- "1" - Starts device functionalities

The following table describes the functions of the selectable DO Block channels.

Channel	Description
DO_PV_CONTROL_OFF	No function.
DO_PV_COUNTER_RESET	Reset of all internal totalizers to zero. This does not reset the Totalizer Blocks.
DO_PV_FLOW_TO_ZERO	The flow signal is set to zero.
DO_PV_SYSTEM_ZERO_ADJUST	Start of system zero adjustment.
DO_PV_COUNTER_STOP	Stops the integration of the internal totalizers. This does not stop the Totalizer Blocks.
DO_PV_DUAL_RANGE	This function is only available for the FEX500. Change-over between two measuring ranges (Qmax and Qmax2).
DO_PV_BATCH_START	This function is only available for the FEX500. Starts a fill operation.

4.9 Transducer Block Flow - Slot 10

The Flow Transducer Block contains all device-specific parameters and functions that are required for flow measurement and flow calculation. The values that are measured and calculated are available as Transducer Block output values, and are called by the function blocks.

It is only possible to read out measured values cyclically via function blocks. It is, however, also possible to read the Transducer Block values acyclically from the corresponding index.

Up to the index 52 the "Flow" Transducer Block is a "Flow Transducer Block". The parameters comply with the profile of the electromagnetic flowmeters. From the index 53 on, the manufacturer-specific parameters are added to the Transducer Block. The manufacturer-specific parameters apply to standard measurement operation.

4.9.1 Transducer Block Flow - Parameter

Relativel ndex	Parameter name	Object type	Data Type	Store	Byte s	Access
0…7	Standard block parameter					
8	CALIBR_FACTOR	Simple	Float	S	4	r,w
9	LOW_FLOW_CUTOFF			S	4	r,w
10	MEASUREMENT_MODE		Unsigned8	S	1	r,w
11	FLOW_DIRECTION			S	1	r,w
12	ZERO_POINT		Float	S	4	r,w
13	ZERO_POINT_ADJUST		Unsigned8	N	1	r,w
14	ZERO_POINT_UNIT		Unsigned16	S	2	r,w
15	NOMINAL_SIZE		Float	S	4	r,w
16	NOMINAL_SIZE_UNITS		Unsigned16	S	2	r,w
17	VOLUME_FLOW	Record	DS-101	D	5	r
18	VOLUME_FLOW_UNITS	Simple	Unsigned16	S	2	r,w
19	VOLUME_FLOW_LO_LIMIT		Float	S	4	r,w
20	VOLUME_FLOW_HI_LIMIT			S	4	r,w
21…40	Not included in the electromagnetic Transducer Block profile					
41	SAMPLING_FREQ	Record	DS-101	D	5	r
42	SAMPLING_FREQ_UNITS	Simple	Unsigned16	S	2	r,w
43…52	Reserved by PNO					
53	DI_PV_DIAG_MAINTENANCE	Record	DS-102	D	2	r
54	DI_PV_DIAG_OUT_SPEC			D	2	r
55	DI_PV_DIAG_FUNC_CHECK			D	2	r
56	DI_PV_DIAG_FAILURE			D	2	r
57	DO_PV_CONTROL_OFF			D	2	r

Relative index	Parameter name	Object type	Data Type	Store	Bytes	Access
58	DO_PV_COUNTER_RESET	Record	DS-102	D	2	r
59	DO_PV_FLOW_TO_ZERO			D	2	r
60	DO_PV_SYSTEM_ZERO_ADJUST			D	2	r
61	DO_PV_COUNTER_STOP			D	2	r
62	DO_PV_DUAL_RANGE			D	2	r
63	DO_PV_BATCH_START			D	2	r
64	FLOW_RATIO		Float	D	4	r
65	FLOW_VELOCITY			D	4	r
66	FLOW_VELOCITY_UNITS	Simple	Unsigned16	S	2	r,w
67	VOLUME_FLOW_USER_UNIT_FACTOR		Float	S	4	r,w
68	VOLUME_FLOW_USER_UNIT_TYPE		Unsigned8	S	1	r,w
69	VOLUME_FLOW_USER_UNIT_STRING		VisibleString	S	8	r,w
70	SENSOR_LOCATION_TAG			S	20	r,w
71	SENSOR_TAG			S	20	r,w
72	TX_LOCATION_TAG			S	20	r,w
73	TX_TAG			S	20	r,w
74	Q_MAX		Float	S	4	r,w
75	Q_MAX2			S	4	r,w
76	DUAL_RANGE_SELECTION		Unsigned8	S	1	r,w
77	DAMPING		Float	S	4	r,w
78	DENSITY			S	4	r,w
79	LOW_FLOW_CUTOFF_HYSTERESIS			S	4	r,w
80	METER_MODE		Unsigned8	S	1	r,w
81	NOISE_REDUCTION			S	1	r,w
82	READ_ONLY_SWITCH			S	1	r,w
83	UZA_ADJ_PROGRESS			D	1	r
84	UZA_ADJ_FAIL_INFO			D	1	r

4.9.2 Transducer Block Flow - Parameter description

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>CALIBR_FACTOR</td><td>Unused</td></tr>
<tr><td>LOW_FLOW_CUTOFF</td><td>Flow cut-off of the sensor. If the flowrate is below the low flow cut-off setting, the flow is not measured.
Limits: 0 … 10 % of the set Qmax
Factory setting: 1 %</td></tr>
<tr><td>MEASUREMENT_MODE</td><td>Setting of the measurement direction for the sensor:
0: Forward (device measures and totalizes only in forward direction).
1: Forward / Reverse (device measures and totalizes in both directions).
2: Reverse (device measures and totalizes only in reverse direction).
Factory setting: 1 - Forward / Reverse.</td></tr>
<tr><td>FLOW_DIRECTION</td><td>Assignment of a positive or negative sign to the measured value
0: positive
1: negative
Factory setting: positive.</td></tr>
<tr><td>ZERO_POINT</td><td>This is system zero.
Limits: -50.0 … +50 mm/s
Factory setting: 0 mm/s.</td></tr>
<tr><td>ZERO_POINT_ADJUST</td><td>Adjust the system zero. The valve must be closed, the fluid must be at standstill. The sensor must be filled completely with fluid.
0: cancel
1: start (starts the adjustment)
2: execute (read-only – adjustment in progress)
3: ready (read-only – adjustment completed successfully)
4: failed (read-only – adjustment failed)</td></tr>
<tr><td>ZERO_POINT_UNIT</td><td>The unit of system zero is mm/s (unit code 1062).</td></tr>
<tr><td>NOMINAL_SIZE</td><td>Nominal size of the sensor in mm or inch. The PA profile requires writing of the parameters. As it makes no sense to change the nominal size, only the value already in is accepted when writing.</td></tr>
<tr><td>NOMINAL_SIZE_UNITS</td><td>Unit for NOMINAL_SIZE:
1013: mm
1019. inch
Factory setting: 1013 mm.</td></tr>
<tr><td>VOLUME_FLOW</td><td>Measured volume flow in set unit.</td></tr>
<tr><td>VOLUME_FLOW_UNITS</td><td>Unit of VOLUME_FLOW, VOLUME_FLOW_LO_LIMIT and VOLUME_FLOW_HI_LIMIT. The transmitter supports the following units, factory setting: m³/h
<table>
<tr><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th></tr>
<tr><td>ml/s</td><td>1577</td><td>ft³/min</td><td>1357</td><td>igal/d</td><td>1370</td><td>kg/h</td><td>1324</td></tr>
<tr><td>ml/min</td><td>1563</td><td>ft³/h</td><td>1358</td><td>bls/s</td><td>1371</td><td>kg/d</td><td>1325</td></tr>
<tr><td>l/s</td><td>1351</td><td>ft³/d</td><td>1359</td><td>bls/min</td><td>1372</td><td>t/min</td><td>1327</td></tr>
<tr><td>l/min</td><td>1352</td><td>ugal/s</td><td>1362</td><td>bls/h</td><td>1373</td><td>t/h</td><td>1328</td></tr>
<tr><td>l/h</td><td>1353</td><td>ugal/min</td><td>1363</td><td>bls/d</td><td>1374</td><td>t/d</td><td>1329</td></tr>
<tr><td>Ml/d</td><td>1355</td><td>ugal/h</td><td>1364</td><td>hl/h</td><td>1635</td><td>lb/s</td><td>1330</td></tr>
<tr><td>m³/s</td><td>1347</td><td>ugal/d</td><td>1365</td><td>g/s</td><td>1318</td><td>lb/min</td><td>1331</td></tr>
<tr><td>m³/min</td><td>1348</td><td>Mugal/d</td><td>1366</td><td>g/min</td><td>1319</td><td>lb/h</td><td>1332</td></tr>
<tr><td>m³/h</td><td>1349</td><td>igal/s</td><td>1367</td><td>g/h</td><td>1320</td><td>lb/d</td><td>1333</td></tr>
<tr><td>m³/d</td><td>1350</td><td>igal/min</td><td>1368</td><td>kg/s</td><td>1322</td><td>custom</td><td>1521</td></tr>
<tr><td>ft³/s</td><td>1356</td><td>igal/h</td><td>1369</td><td>kg/min</td><td>1323</td><td></td><td></td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>VOLUME_FLOW_LO_LIMIT</td><td>Lower end of the sensor's flow measurement range. This parameter is always 0.</td></tr>
<tr><td>VOLUME_FLOW_HI_LIMIT</td><td>Upper end of the sensor's flow measurement range.
The PA Profile requires that this parameter is writable. However, only the value that is already in it can be written.</td></tr>
<tr><td>SAMPLING_FREQ</td><td>Sensor excitation frequency.</td></tr>
<tr><td>SAMPLING_FREQ_UNITS</td><td>The unit is always Hz (1077). No other unit than Hz can be written.</td></tr>
<tr><td>DI_PV_DIAG_MAINTENANCE</td><td rowspan="4">Channel selection for the DI Function Block.
For more detailed information read and observe chapter 4.7 “Discrete Input Function Block - Slot 8”.</td></tr>
<tr><td>DI_PV_DIAG_OUT_SPEC</td></tr>
<tr><td>DI_PV_DIAG_FUNC_CHECK</td></tr>
<tr><td>DI_PV_DIAG_FAILURE</td></tr>
<tr><td>DO_PV_CONTROL_OFF</td><td rowspan="7">Channel selection for the DI Function Block.
For more detailed information read and observe chapter 4.8 “Discrete Output Function Block - Slot 9”.</td></tr>
<tr><td>DO_PV_COUNTER_RESET</td></tr>
<tr><td>DO_PV_FLOW_TO_ZERO</td></tr>
<tr><td>DO_PV_SYSTEM_ZERO_ADJUST</td></tr>
<tr><td>DO_PV_COUNTER_STOP</td></tr>
<tr><td>DO_PV_DUAL_RANGE
(Only FEX500)</td></tr>
<tr><td>DO_PV_BATCH_START
(Only FEX500)</td></tr>
<tr><td>FLOW_RATIO</td><td>Measured flow in percent. Refers to the value of Qmax or Qmax2.</td></tr>
<tr><td>FLOW_VELOCITY</td><td>Measured flow velocity in set unit.</td></tr>
<tr><td>FLOW_VELOCITY_UNITS</td><td>Unit of FLOW_VELOCITY. The transmitter supports the following units:
Factory setting: m/s
<table>
<tr><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th></tr>
<tr><td>m/s</td><td>1061</td><td>cm/s</td><td>1523</td><td>feet/s</td><td>1067</td><td>inch/s</td><td>1066</td></tr>
<tr><td>m/min</td><td>1522</td><td>cm/min</td><td>1524</td><td>feet/min</td><td>1070</td><td>inch/min</td><td>1069</td></tr>
</table></td></tr>
<tr><td>VOLUME_FLOW_USER_UNIT_FACTOR</td><td>Factor for the user-specific flow unit. The input is in l/s.
Limits: 0,0001 … 100000,0
Factory setting: 1.</td></tr>
<tr><td>VOLUME_FLOW_USER_UNIT_TYPE</td><td>Type of the user-specific flow unit.
6: Volume flow
4: Mass flow
Factory setting: Volume flow.</td></tr>
<tr><td>VOLUME_FLOW_USER_UNIT_STRING</td><td>The designation of the user-specific flow unit.</td></tr>
<tr><td>SENSOR_LOCATION_TAG</td><td>Enter the tag name for the sensor.
(The tag name is shown in the process display.)</td></tr>
<tr><td>SENSOR_TAG</td><td>Enter the TAG number of the sensor.</td></tr>
<tr><td>TX_LOCATION_TAG</td><td>Enter the tag name for the transmitter.</td></tr>
<tr><td>TX_TAG</td><td>Enter the TAG number for the transmitter.</td></tr>
</table>

Parameter	Description
Q_MAX	Select the flow range for forward and reverse flow. Min. 0 ... 0.2 m/s (0 ... 0.02 x Qmax DN). Max. 0 ... 20 m/s (0 ... 2xQmax DN) Factory setting: 1 x Qmax DN
Q_MAX2 (Only FEX500)	Same configuration as Qmax.
DUAL_RANGE_SELECTION (Only FEX500)	Change-over between Qmax and Qmax2. Can also be done cyclically via the DO Function Block.
DAMPING	Set the damping. The time constant for damping is 1 T (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value. Limits: 0.02 s ... 60 s Factory setting: 30 s.
DENSITY	Density of the fluid. The parameter is used only if a mass flow unit has been selected for VOLUME_FLOW. It is also possible to write this parameter cyclically via the AO Function Block. Limits: 0.01 g/cm³ … 5.0 g/cm³ Factory setting: 1 g/cm³ For more detailed information read and observe chapter **4.6** “**Analog Output Function** Block - Slot 7”.
LOW_FLOW_CUTOFF_HYSTERESIS	This is the hysteresis for low flow cut-off (LOW_FLOW_CUTOFF). Limits: 0 … 50 % Factory setting: 20 %.
METER_MODE	Setting of the measurement direction for the sensor: 0: Forward / Reverse (device measures and totalizes in both directions). 1: Forward (device measures and totalizes only in forward direction). 2: Reverse (device measures and totalizes only in reverse direction). Factory setting: Forward / Reverse.
NOISE_REDUCTION	Activates noise reduction in case of unstable flow signal. Activating noise reduction increases the response time. 0: Off 1: Mean filter 2: Notch filter 3: Lowpass V=Auto 4: Lowpass V=1 Factory setting: Off.
READ_ONLY_SWITCH	Display of the write protection setting for calibrated devices.
UZA_ADJ_PROGRESS	Totalizer for system zero adjustment.
UZA_ADJ_FAIL_INFO	Status information for system zero adjustment.

4.10 Transducer Block DeviceInfo - Slot 11

The "DeviceInfo" transducer block is a manufacturer-specific transducer block. It contains additional information about the transmitter. All parameters in this block are read-only.

Relative Index	Parameter name	Object Type	Data Type	Store	Bytes	Access
0…7	Standard block parameter					
8	SENSOR_TYPE	Simple	Unsigned8	N	1	r
9	SENSOR_SIZE			N	1	r
10	SENSOR_MODEL		VisibleString	N	20	r
11	SPECIAL_SENSOR_SIZE		Float	N	4	r
12	Q_MAX_DN			N	4	r
13	SENSOR_SPAN			N	4	r
14	SENSOR_ZERO			N	4	r
15	SENSOR_SPAN_TRIM			N	4	r
16	MAINS_FREQUENCY		Unsigned8	N	1	r
17	EXCITATION_FREQUENCY			N	1	r
18	COIL_CURRENT			N	1	r
19	PRE_AMPLIFIER			N	1	r
20	SENSOR_ID		VisibleString	N	8	r
21	SENSOR_SAP_ERP_NO			N	20	r
22	TERM_BOARD_SW			N	20	r
23	SENSOR_RUN_HOURS			N	20	r
24	ELECTRODE_MATERIAL		Unsigned8	N	1	r
25	LINING_MATERIAL			N	1	r
26	SENSOR_FIRST_CAL_DATE		VisibleString	N	20	r
27	SENSOR_LAST_CAL_DATE			N	20	r
28	SENSOR_CAL_CERT_NO			N	20	r
29	SENSOR_FIRST_CAL_LOCATION		Unsigned8	N	1	r
30	SENSOR_LAST_CAL_LOCATION			N	1	r
31	SENSOR_CAL_MODUS			N	1	r
32	SENSOR_CAL_STATUS			N	1	r
33	DEVICE_SW_VERSION			N	1	r
34	SCAN_MASTER_OPTION			N	1	r
35	TX_TYPE			N	1	r
36	TX_SPAN		Float	N	4	r
37	TX_ZERO			N	4	r
38	SIMULATOR		Unsigned8	N	1	r
39	TX_ID		VisibleString	N	8	r

Relative Index	Parameter name	Object Type	Data Type	Store	Bytes	Access
40	TX_SAP_ERP_NO	Simple		N	20	r
41	FIRMWARE_VERSION			N	20	r
42	SOM_FIRMWARE_VERSION			N	8	r
43	BOOTLOADER_VERSION			N	20	r
44	TX_RUN_HOURS			N	20	r
45	TX_FIRST_CAL_DATE			N	20	r
46	TX_LAST_CAL_DATE			N	20	r
47	TX_CAL_CERT_NO			N	20	r
48	TX_FIRST_CAL_LOCATION		Unsigned8	N	1	r
49	TX_LAST_CAL_LOCATION			N	1	r
50	MAKER		VisibleString	N	20	r
51	STREET			N	20	r
52	CITY			N	20	r
53	PHONE			N	20	r
54	RATE_ADC		Unsigned8	N	1	r
55	NOISE_RESET_ON		Unsigned16	N	2	r
56	NOISE_RESET_MAX		Unsigned8	N	1	r
57	DRIVER_DAC			N	1	r
58	LOOP_CONTROL_MODE			N	1	r
59	DIFF_CURRENT_MODE			N	1	r
60	CONTROL_TIMER		Unsigned16	N	2	r
61	AMPLIFIER		Unsigned8	N	1	r
62	CM_REJECT_VALUE			N	1	r
63	GAIN_1_VALUE		Float	N	4	r
64	GAIN_8_VALUE			N	4	r
65	GAIN_16_VALUE			N	4	r
66	GAIN_32_VALUE			N	4	r

4.10.1 Transducer Block DeviceInfo - Parameter description

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>SENSOR_TYPE</td><td>Display the sensor type (ProcessMaster, HygienicMaster).
1: Process 300 series
2: Hygienic 300 series
5: DE4
6: DE2
10:Process 500 series
11:Hygienic 500 series</td></tr>
<tr><td>SENSOR_SIZE</td><td>Size of sensor.
<table>
<tr><th>Value</th><th>Size</th><th>Value</th><th>Size</th><th>Value</th><th>Size</th><th>Value</th><th>Size</th></tr>
<tr><td>0</td><td>DN 1</td><td>11</td><td>DN 32</td><td>22</td><td>DN 350</td><td>33</td><td>DN 1100</td></tr>
<tr><td>1</td><td>DN 1.5</td><td>12</td><td>DN 40</td><td>23</td><td>DN 400</td><td>34</td><td>DN 1200</td></tr>
<tr><td>2</td><td>DN 2</td><td>13</td><td>DN 50</td><td>24</td><td>DN 450</td><td>35</td><td>DN 1400</td></tr>
<tr><td>3</td><td>DN 3</td><td>14</td><td>DN 65</td><td>25</td><td>DN 500</td><td>36</td><td>DN 1500</td></tr>
<tr><td>4</td><td>DN 4</td><td>15</td><td>DN 80</td><td>26</td><td>DN 600</td><td>37</td><td>DN 1600</td></tr>
<tr><td>5</td><td>DN 6</td><td>16</td><td>DN 100</td><td>27</td><td>DN 700</td><td>38</td><td>DN 1800</td></tr>
<tr><td>6</td><td>DN 8</td><td>17</td><td>DN 125</td><td>28</td><td>DN 760</td><td>39</td><td>DN 2000</td></tr>
<tr><td>7</td><td>DN 10</td><td>18</td><td>DN 150</td><td>29</td><td>DN 800</td><td>40</td><td>Special</td></tr>
<tr><td>8</td><td>DN 15</td><td>19</td><td>DN 200</td><td>30</td><td>DN 900</td><td></td><td></td></tr>
<tr><td>9</td><td>DN 20</td><td>20</td><td>DN 250</td><td>31</td><td>DN 1000</td><td></td><td></td></tr>
<tr><td>10</td><td>DN 25</td><td>21</td><td>DN 300</td><td>32</td><td>DN 1050</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>SENSOR_MODEL</td><td>Information about the sensor model.</td></tr>
<tr><td>SPECIAL_SENSOR_SIZE</td><td>Sensor size specifications for special sensors.</td></tr>
<tr><td>Q_MAX_DN</td><td>This value is the maximum flow at a velocity of 10 m/s.
The value is set automatically via the selected flowmeter size.</td></tr>
<tr><td>SENSOR_SPAN</td><td>Calibration value for the sensor (span [%]).</td></tr>
<tr><td>SENSOR_ZERO</td><td>Calibration value for the sensor (zero [mm/s]).</td></tr>
<tr><td>SENSOR_SPAN_TRIM</td><td>Additional adjustment of the sensor span [%].</td></tr>
<tr><td>MAINS_FREQUENCY</td><td>Display the mains frequency for the supply power.</td></tr>
<tr><td>EXCITATION_FREQUENCY</td><td>Display of the frequency used to operate the magnet coils for the sensor.</td></tr>
<tr><td>COIL_CURRENT</td><td>Display of the current used to operate the magnet coils for the sensor.</td></tr>
<tr><td>PRE_AMPLIFIER</td><td>Display whether the sensor is operating with or without preamplifier.</td></tr>
<tr><td>SENSOR_ID</td><td>ID number of the sensor.</td></tr>
<tr><td>SENSOR_SAP_ERP_NO</td><td>Order number of the sensor.</td></tr>
<tr><td>TERM_BOARD_SW</td><td>Software version of the SensorMemory integrated in the sensor.</td></tr>
<tr><td>SENSOR_RUN_HOURS</td><td>Operating hours for the sensor.</td></tr>
<tr><td>ELECTRODE_MATERIAL</td><td>Electrode material of the sensor.</td></tr>
<tr><td>LINING_MATERIAL</td><td>Liner material of the sensor.</td></tr>
<tr><td>SENSOR_FIRST_CAL_DATE</td><td>Date of the first calibration of the sensor (calibration of new device).</td></tr>
<tr><td>SENSOR_LAST_CAL_DATE</td><td>Date of last calibration of sensor.</td></tr>
</table>

Parameter	Description
SENSOR_CAL_CERT_NO	Identification (no.) of the relevant calibration certificate.
SENSOR_FIRST_CAL_LOCATION	Place of first calibration of the sensor.
SENSOR_LAST_CAL_LOCATION	Place of last calibration of sensor.
SENSOR_CAL_MODUS	Calibration mode of the sensor.
SENSOR_CAL_STATUS	Calibration status of the sensor.
DEVICE_SW_VERSION	Indicates whether the transmitter is of type FEX300 or FEX500. 1: Series 300 PA 4: Series 500 PA
SCAN_MASTER_OPTION	Indicates whether the transmitter can be operated with ScanMaster. 0: ScanMaster support is disabled. 1: ScanMaster support is enabled.
TX_TYPE	Display of the transmitter type.
TX_SPAN	Calibration value for the transmitter (span)
TX_ZERO	Calibration value for the transmitter (zero)
SIMULATOR	Indicates whether the transmitter is operated on the simulator.
TX_ID	ID number of transmitter.
TX_SAP_ERP_NO	Order number of transmitter.
FIRMWARE_VERSION	Software version of the transmitter.
SOM_FIRMWARE_VERSION	Software version of the communication controller.
BOOTLOADER_VERSION	Software version of the bootloader.
TX_RUN_HOURS	Operating hours of transmitter
TX_FIRST_CAL_DATE	Date of the first calibration of transmitter (of new device).
TX_LAST_CAL_DATE	Date of last calibration of transmitter.
TX_CAL_CERT_NO	Identification (no.) of the relevant calibration certificate.
TX_FIRST_CAL_LOCATION	Place of first calibration of transmitter.
TX_LAST_CAL_LOCATION	Place of last calibration of transmitter.
MAKER	Name of manufacturer
STREET	Street of manufacturer.
CITY	City of manufacturer
PHONE	Phone number of manufacturer
RATE_ADC	Sample rate of measuring signal.
NOISE_RESET_ON	DC reset threshold.
NOISE_RESET_MAX	Max. number of DC resets per second.
DRIVER_DAC	Setpoint for driver control.
LOOP_CONTROL_MODE	Switch for driver control.
DIFF_CURRENT_MODE	Increment for driver control.
CONTROL_TIMER	Time between two control points.
AMPLIFIER	Display of the settings for the pre-amplifier.
CM_REJECT_VALUE	Display of the adjustment value for common mode adjustment.
GAIN_1_VALUE	Display of the adjustment values for the pre-amplifier stages.
GAIN_8_VALUE	
GAIN_16_VALUE	
GAIN_32_VALUE	

4.11 Transducer Block Special Function - Slot 12

The Transducer Block Special Function is a manufacturer-specific transducer block. It contains parameters for configuring the pulse output or switch output and the internal totalizers.

Relative index	Parameter name	Object Type	Data Type	Store	Bytes	Access
0…7	Standard block parameter					
8	FWD_TOTALIZER	Record	DS-101	D	5	r,w
9	REV_TOTALIZER			D	5	r,w
10	NET_TOTALIZER	Simple	Float	D	4	r,w
11	FWD_TOTALIZER_RESET		Unsigned8	D	1	w
12	REV_TOTALIZER_RESET			D	1	w
13	NET_TOTALIZER_RESET			D	1	w
14	ALL_TOTALIZER_RESET			D	1	w
15	TOTALIZER_PULSE_UNITS		Unsigned16	S	2	r,w
16	TOTALIZER_PULSE_USER_UNIT_TYPE		Unsigned8	S	1	r,w
17	TOTALIZER_PULSE_USER_UNIT_FACTOR		Float	S	4	r,w
18	TOTALIZER_PULSE_USER_UNIT_STRING		VisibleString	S	8	r,w
19	TOTALIZER_BATCH_START		Unsigned8	D	1	w
20	TOTALIZER_BATCH_STOP			D	1	w
21	TOTALIZER_BATCH_COUNTER_RESET			D	1	w
22	TOTALIZER_BATCH_COUNTER		Unsigned16	S	2	r
23	TOTALIZER_BATCH_ACTUAL		Float	S	4	r
24	TOTALIZER_BATCH_PRESET			S	4	r,w
25	DIGITAL_OUTPUT_FUNCTION		Unsigned8	S	1	r,w
26	LOGIC_SIGNAL_SOURCE			S	1	r,w
27	LOGIC_ACTION			S	1	r,w
28	LOGIC_GENERAL_ALARM			S	1	r,w
29	LOGIC_EMPTY_PIPE_ALARM			S	1	r,w
30	LOGIC_MIN_ALARM			S	1	r,w
31	LOGIC_MAX_ALARM			S	1	r,w
32	LOGIC_TFE_ALARM			S	1	r,w
33	LOGIC_GAS_BUBBLE_ALARM			S	1	r,w
34	LOGIC_ELECTRODE_COATED_ALARM			S	1	r,w
35	LOGIC_CONDUCTIVITY_LOW_ALARM			S	1	r,w
36	LOGIC_SENSOR_TEMP_ALARM			S	1	r,w
37	PULSE_MODE			S	1	r,w
38	FULLSCALE_FREQUENCY		Float	S	4	r,w
39	PULSES_PER_UNIT			S	4	r,w
40	PULSES_PER_UNIT_RANGE_MAX			N	4	r
41	PULSES_PER_UNIT_RANGE_MIN			N	4	r
42	PULSE_WIDTH			S	4	r,w
43	PULSE_WIDTH_RANGE_MAX			N	4	r
44	PULSE_WIDTH_RANGE_MIN			N	4	r
45	LIMIT_FREQUENCY			N	4	r
46	LIMIT_FREQUENCY_RANGE_MAX			N	4	r
47	LIMIT_FREQUENCY_RANGE_MIN			N	4	r

4.11.1 Transducer Block Special Function - Parameter description

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>FWD_TOTALIZER</td><td>The internal forward totalizer with status information.</td></tr>
<tr><td>REV_TOTALIZER</td><td>The internal reverse totalizer with status information.</td></tr>
<tr><td>NET_TOTALIZER</td><td>The internal differential totalizer.</td></tr>
<tr><td>FWD_TOTALIZER_RESET</td><td>Resets forward totalizer to zero.</td></tr>
<tr><td>REV_TOTALIZER_RESET</td><td>Resets reverse totalizer to zero.</td></tr>
<tr><td>NET_TOTALIZER_RESET</td><td>Resets differential totalizer to zero.</td></tr>
<tr><td>ALL_TOTALIZER_RESET</td><td>Resets all totalizers to zero.</td></tr>
<tr><td>TOTALIZER_PULSE_UNITS</td><td>Selection of the unit for the internal totalizers and fill totalizers.
<table>
<tr><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th><th>Name</th><th>Code</th></tr>
<tr><td>m³</td><td>1034</td><td>hl</td><td>1041</td><td>lb</td><td>1094</td><td>Ml</td><td>1526</td></tr>
<tr><td>l</td><td>1038</td><td>g</td><td>1089</td><td>igal</td><td>1049</td><td>Mugal</td><td>1527</td></tr>
<tr><td>ml</td><td>1040</td><td>kg</td><td>1088</td><td>ugal</td><td>1048</td><td>custom</td><td>1528</td></tr>
<tr><td>ft³</td><td>1043</td><td>t</td><td>1092</td><td>bls</td><td>1052</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>TOTALIZER_PULSE_USER_UNIT_TYPE</td><td>Factor for the user-specific totalizer unit. The input is in liters.
Limits: 0,0001 … 100000,0
Factory setting: 1.</td></tr>
<tr><td>TOTALIZER_PULSE_USER_UNIT_FACTOR</td><td>Type of the user-specific totalizer unit.
0: Volume flow
1: Mass flow
Factory setting: Volume flow.</td></tr>
<tr><td>TOTALIZER_PULSE_USER_UNIT_STRING</td><td>The name of the user-specific totalizer unit.</td></tr>
<tr><td>TOTALIZER_BATCH_START
(Only FEX500)</td><td>Starts the fill process.</td></tr>
<tr><td>TOTALIZER_BATCH_STOP
(Only FEX500)</td><td>Stops the fill process.</td></tr>
<tr><td>TOTALIZER_BATCH_COUNTER_RESET
(Only FEX500)</td><td>Resets the fill totalizers.</td></tr>
<tr><td>TOTALIZER_BATCH_COUNTER
(Only FEX500)</td><td>Number of fill processes.</td></tr>
<tr><td>TOTALIZER_BATCH_ACTUAL
(Only FEX500)</td><td>Quantity already filled.</td></tr>
<tr><td>TOTALIZER_BATCH_PRESET
(Only FEX500)</td><td>Presetting counter for the fill process.
Factory setting: 0 m³.</td></tr>
<tr><td>DIGITAL_OUTPUT_FUNCTION</td><td>Selection of functions for digital output DO2.
0: Pulse output, forward direction
1: Pulse output, reverse direction
2: Pulse output, forward and reverse direction
3: Digital output. The function of the digital output is specified by the LOGIC_SIGNAL_SOURCE parameter.
Factory setting: Pulse output, forward direction.</td></tr>
</table>

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>LOGIC_SIGNAL_SOURCE</td><td>Selection of the digital output function:
0: No function (DO2 as digital output has no function)
1: Forward / Reverse signal (DO2 signals the flow direction)
2: Alarm signal (DO2 as alarm output)
3: Dual range (only FEX500)
4: Batch mode (only FEX500)
Factory setting: Forward / Reverse signal</td></tr>
<tr><td>LOGIC_ACTION</td><td>Select the switching behavior for the digital output.
Factory setting: Normally open</td></tr>
<tr><td>LOGIC_GENERAL_ALARM
LOGIC_EMPTY_PIPE_ALARM
LOGIC_MIN_ALARM
LOGIC_MAX_ALARM
LOGIC_TFE_ALARM
LOGIC_GAS_BUBBLE_ALARM
LOGIC_ELECTRODE_COATED_ALARM
LOGIC_CONDUCTIVITY_LOW_ALARM
LOGIC_SENSOR_TEMP_ALARM</td><td>Configuration of alarms that can be signaled via DO2.
The prerequisite is, that DIGTAL_OUTPUT_FUNCTION is set to digital output and LOGIC_SIGNAL_SOURCE to alarm signaling.
<table>
<tr><th>Alarm</th><th>Description</th></tr>
<tr><td>General</td><td>All alarms that cannot be added individually.</td></tr>
<tr><td>Empty pipe</td><td>Empty pipe detection.</td></tr>
<tr><td>Min.</td><td>Flow is smaller than low limit.</td></tr>
<tr><td>Max.</td><td>Flow is greater than high limit.</td></tr>
<tr><td>TFE</td><td>Pipe is only partially filled.
(only when TFE electrode is present).</td></tr>
<tr><td>Gas bubbles
(Only FEX500)</td><td>Fluid contains gas bubbles.</td></tr>
<tr><td>Electrode deposits
(Only FEX500)</td><td>Electrode deposits exceed specified limit values.</td></tr>
<tr><td>Low conductivity
(Only FEX500)</td><td>Conductivity is outside the specified limit values.</td></tr>
<tr><td>Sensor temperature
(Only FEX500)</td><td>The sensor temperature is out of the specified range.</td></tr>
</table>
0: On
1: Off
Factory setting: Off.</td></tr>
</table>

Parameter	Description
PULSE_MODE	Selection of the operating mode for DO2 in pulse mode. There are two operating modes available: 0: Pulse mode: In pulse mode, pulses per unit are output. (e.g., 1 pulse per m3). 1: Frequency mode: In frequency mode, a frequency proportional to the flowrate is output. The maximum frequency can be configured according to the flow measurement range. Factory setting: Pulse mode
FULLSCALE_FREQUENCY	In frequency mode, the flow range end value corresponding to the frequency is set here. Range: 0.025 ... 5250 Hz
PULSES_PER_UNIT	Select the number of counting pulses transmitted by the digital output. The max. possible number of pulses is 5250 per second.
PULSES_PER_UNIT_RANGE_MAX	The maximum pulse input limit per unit.
PULSES_PER_UNIT_RANGE_MIN	The minimum pulse input limit per unit.
PULSE_WIDTH	Set the pulse width. The pulse factor and pulse width are interdependent and are calculated dynamically. Range 0.09 … 2000 ms Factory setting: 30 ms
PULSE_WIDTH_RANGE_MAX	The maximum input limit for the pulse width
PULSE_WIDTH_RANGE_MIN	The minimum input limit for the pulse width
LIMIT_FREQUENCY	Display the limiting frequency, option unavailable
LIMIT_FREQUENCY_RANGE_MAX	The maximum limiting frequency
LIMIT_FREQUENCY_RANGE_MIN	The minimum limiting frequency

4.12 Transducer Block Display - Slot 13

The "Display" Transducer Block is a manufacturer-specific Transducer Block. It contains the parameters related to the configuration of the transmitter display.

Relative index	Parameter name	Object Type	Data Type	Store	Bytes	Access
0…7	Standard block parameter					
8	LANGUAGE	Simple	Unsigned8	S	1	r,w
9	PAGE_1_DISPLAY_MODE			S	1	r,w
10	PAGE_1_LINE_1			S	1	r,w
11	PAGE_1_LINE_2			S	1	r,w
12	PAGE_1_LINE_3			S	1	r,w
13	PAGE_1_BARGRAPH			S	1	r,w
14	PAGE_2_DISPLAY_MODE			S	1	r,w
15	PAGE_2_LINE_1			S	1	r,w
16	PAGE_2_LINE_2			S	1	r,w
17	PAGE_2_LINE_3			S	1	r,w
18	PAGE_2_BARGRAPH			S	1	r,w
19	PAGE_3_DISPLAY_MODE			S	1	r,w
20	PAGE_3_LINE_1			S	1	r,w
21	PAGE_3_LINE_2			S	1	r,w
22	PAGE_3_LINE_3			S	1	r,w
23	PAGE_3_BARGRAPH			S	1	r,w
24	PAGE_4_DISPLAY_MODE			S	1	r,w
25	PAGE_4_LINE_1			S	1	r,w
26	PAGE_4_LINE_2			S	1	r,w
27	PAGE_4_LINE_3			S	1	r,w
28	PAGE_4_BARGRAPH			S	1	r,w
29	CONTRAST			S	1	r,w
30	DECIMAL_PLACES_FLOWRATE			S	1	r,w
31	DECIMAL_PLACES_VOLUME			S	1	r,w
32	AUTOSCROLL			S	1	r,w
33	DATE_FORMAT			S	1	r,w

4.12.1 Transducer Block Display - Parameter description

Parameter	Description
LANGUAGE	Selection of the display language for the transmitter LCD menus 0: English 1: German 2: French 3: Spanish 4: Italian 6: Danish 7: Swedish 9: Polish 10:Russian 11:Chinese 13:Turkish Factory setting: English
PAGE_1_DISPLAY_MODE	User-defined setup for process display. Four individually configurable process displays are possible. For each process display, up to 4 display lines can be configured. 1: Progress display 5: 1x6 6: 1x6 + bargraph 7: 1x9 8: 1x9 + bargraph 9: 2x9 10:2x9 + bargraph 11:3x9 Factory setting: 3x9
PAGE_1_LINE_1	Configuration of the signal that is to be displayed. 0: Flowrate [%] 2: Current output [mA] 3: Flow velocity [unit] 4: Flowrate [unit] 5: Totalizer forward 6: Totalizer reverse 7: Differential totalizer 8: Signal ratio 9: Reference 10:Signal max. 11:Signal min. 12:Signal gain 13:DC resets 14:Number of fill operations 15:Fill totalizer 16:Conductivity 17:Sensor temperature

Parameter	Description
PAGE_2_DISPLAY_MODE	Refer to the description "PAGE_1_DISPLAY_MODE".
PAGE_2_LINE_1	Refer to PAGE_1_LINE_1.
PAGE_2_LINE_2	Refer to PAGE_1_LINE_1.
PAGE_2_LINE_3	Refer to PAGE_1_LINE_1.
PAGE_2_BARGRAPH	The bargraph configuration for PA is fixed to Q in %.
PAGE_3_DISPLAY_MODE	Refer to the description "PAGE_1_DISPLAY_MODE".
PAGE_3_LINE_1	Refer to PAGE_1_LINE_1.
PAGE_3_LINE_2	Refer to PAGE_1_LINE_1.
PAGE_3_LINE_3	Refer to PAGE_1_LINE_1.
PAGE_3_BARGRAPH	The bargraph configuration for PA is fixed to Q in %.
PAGE_4_DISPLAY_MODE	Refer to the description "PAGE_1_DISPLAY_MODE".
PAGE_4_LINE_1	Refer to PAGE_1_LINE_1.
PAGE_4_LINE_2	Refer to PAGE_1_LINE_1.
PAGE_4_LINE_3	Refer to PAGE_1_LINE_1.
PAGE_4_BARGRAPH	The bargraph configuration for PA is fixed to Q in %.
CONTRAST	Contrast adjustment of the LCD display. 0 ... 100 Factory setting: 50.
DECIMAL_PLACES_FLOWRATE	Setting of the decimal places for the flow indicator and flow totalizer: 0: x 1: x.x 2: x.xx 3: x.xxx 4: x.xxxx Factory setting: x.xx.
DECIMAL_PLACES_VOLUME	
AUTOSCROLL	If Multiplex mode is on, you can also activate the "Autoscroll" function in the information level. In this function, operator pages of the process display appear on the LCD window in ten-second intervals. 0: On 1: Off Factory setting: On.
DATE_FORMAT	Setting of the display format for the date and time. 0: DD-MM-YYYY 1: MM-DDYYYY 2: YYYY-MM-DD Factory setting: YYYY-MM-DD.

4.13 Transducer Block Diagnostics - Slot 14

The transmitter has functions for process diagnostics. The functions are incorporated in the "Diagnositics" transducer block.

Relative index	Parameter name	Object Type	Data Type	Store	Bytes	Access
0…7	Standard block parameter					
8	SNR_VALUE	Simple	Float	D	4	r
9	REFERENCE		Unsigned32	D	4	r
10	SIGNAL_RATIO		Unsigned16	D	2	r
11	SIGNAL_MAX			D	2	r
12	SIGNAL_MIN			D	2	r
13	SIGNAL_ERROR			D	2	r
14	NV_RESETS			D	2	r
15	AMPLIFICATION_INTERNAL		Unsigned8	D	1	r
16	EMPTY_PIPE_ON_OFF			S	1	r,w
17	EMPTY_PIPE_THRESHOLD		Unsigned16	S	2	r,w
18	EMPTY_PIPE_DETECTOR		Float	D	4	r
19	EMPTY_PIPE_ADJ_START		Unsigned8	D	1	w
20	EMPTY_PIPE_ADJ_PROGRESS			D	1	r
21	EMPTY_PIPE_ADJ_FAIL_INFO			D	1	r
22	EMPTY_PIPE_MAN_ADJ_FULL			D	1	r,w
23	TFE_ELECTRODE_AVAILABLE			N	1	r
24	TFE_DETECTION_ON_OFF			S	1	r,w
25	TFE_THRESHOLD		Unsigned16	S	2	r,w
26	TFE_ADJ_START		Unsigned8	D	1	w
27	TFE_ADJ_PROGRESS			D	1	r
28	TFE_ADJ_FAIL_INFO			D	1	r
29	TFE_DETECTOR		Unsigned16	D	2	r
30	SIL_DIAG_ON_OFF		Unsigned8	S	1	r,w
31	SENSOR_MEASURE_ON_OFF			S	1	r,w
32	SENSOR_TEMP_CALIB		Float	S	4	r,w
33	SENSOR_TEMPERATURE		DS-101	D	5	r
34	SENSOR_CABLE_LENGTH		Float	S	4	r,w
35	SENSOR_TEMP_MAX_ALARM			S	4	r,w
36	SENSOR_TEMP_MIN_ALARM			S	4	r,w
37	COIL_CURRENT_VALUE			D	4	r
38	COIL_RESISTOR			D	4	r
39	COIL_VOLTAGE			D	4	r
40	COIL_RESISTOR_MAX_ALARM			S	4	r,w
41	COIL_RESISTOR_MIN_ALARM			S	4	r,w
42	GAS_BUBBLE_ON_OFF		Unsigned8	S	1	r,w

Relative Index	Parameter name	Object Type	Data Type	Store	Bytes	Access
43	GAS_BUBBLE_VALUE	Record	Float	D	4	r
44	GAS_BUBBLE_THRESHOLD	Simple		S	4	r,w
45	GAS_BUBBLE_ADJ_START		Unsigned8	D	1	w
46	GAS_BUBBLE_ADJ_PROGRESS			D	1	r
47	GAS_BUBBLE_ADJ_FAIL_INFO			D	1	r
48	COATING_ON_OFF			S	1	r,w
49	COATING_INFORMATION			D	1	r
50	COATING_VALUE_QE1		Float	D	4	r
51	COATING_VALUE_AE1			D	4	r
52	COATING_VALUE_QE2			D	4	r
53	COATING_VALUE_AE2			D	4	r
54	COATING_QE_MAX_ALARM			S	4	r,w
55	COATING_QE_MIN_ALARM	Simple	Float	S	4	r,w
56	CONDUCTIVITY_ON_OFF		Unsigned8	S	1	r,w
57	CONDUCTIVITY_VALUE	Record	DS-101	D	5	r
58	CONDUCTIVITY_ADJ_VALUE	Simple	Float	S	4	r,w
59	CONDUCTIVITY_MAX_ALARM			S	4	r,w
60	CONDUCTIVITY_MIN_ALARM			S	4	r,w
61	ELEC_IMP_E1_GND			D	4	r
62	ELEC_IMP_E2_GND			D	4	r
63	ELEC_IMP_MAX_ALARM			S	4	r,w
64	ELEC_IMP_MIN_ALARM			S	4	r,w
65	GROUND_CHECK_START		Unsigned8	D	1	w
66	GROUND_CHECK_PROGRESS			D	1	r
67	GROUND_CHECK_FREQ1		Float	D	4	r
68	GROUND_CHECK_FREQ2			D	4	r
69	GROUND_CHECK_FREQ3			D	4	r
70	GROUND_CHECK_FREQ4			D	4	r
71	GROUND_CHECK_AMP1			D	4	r
72	GROUND_CHECK_AMP2			D	4	r
73	GROUND_CHECK_AMP3			D	4	r
74	GROUND_CHECK_AMP4			D	4	r
75	GROUND_CHECK_POW_SPEC			D	4	r
76	LOGGER_CONDUCTIVITY	Array	Unsigned16	N	24	r
77	LOGGER_COATING_QE1		Integer16	N	24	r
78	LOGGER_COATING_QE2			N	24	r
79	LOGGER_ON_OFF	Simple	Unsigned8	S	1	r,w

Relative Index	Parameter name	Object Type	Data Type	Store	Bytes	Access
80	LOGGER_LOG_TIME	Simple	Unsigned16	S	2	r,w
81	SIMULATION_MODE		Unsigned8	D	1	r,w
82	SIM_FLOW_VELOCITY		Float	D	4	r,w
83	SIM_VOLUME_FLOW			D	4	r,w
84	SIM_FLOW_RATIO			D	4	r,w
85	SIM_PULSE_FREQ			D	4	r,w
86	SIM_LOGIC_COMMAND		Unsigned8	D	1	r,w
87	OUTPUT_FREQ		Float	D	4	r
88	OUTPUT_LOGIC		Unsigned8	D	1	r
89	SIM_FLOW_VELOCITY_RANGE_MAX		Float	N	4	r
90	SIM_FLOW_VELOCITY_RANGE_MIN			N	4	r
91	FLOW_VELOCITY_RANGE_MAX			N	4	r
92	FLOW_VELOCITY_RANGE_MIN			N	4	r
93	SIM_VOLUME_FLOW_RANGE_MAX			N	4	r
94	SIM_VOLUME_FLOW_RANGE_MIN			N	4	r
95	VOLUME_FLOW_RANGE_MAX			N	4	r
96	VOLUME_FLOW_RANGE_MIN			N	4	r
97	MAX_FLOWRATE_ALARM			S	4	r,w
98	MAX_FLOWRATE_ALARM_RANGE_MAX			N	4	r
99	MAX_FLOWRATE_ALARM_RANGE_MIN			N	4	r
100	MIN_FLOWRATE_ALARM			S	4	r,w
101	MIN_FLOWRATE_ALARM_RANGE_MAX			N	4	r
102	MIN_FLOWRATE_ALARM_RANGE_MIN			N	4	r

4.13.1 Transducer Block Diagnostics - Parameter description

Parameter	Description
SNR_VALUE	Signal-to-noise ratio.
REFERENCE	The measured reference.
SIGNAL_RATIO	The ratio between the maximum and minimum of the measured signal.
SIGNAL_MAX	The upper signal value.
SIGNAL_MIN	The lower signal value.
SIGNAL_ERROR	Number of signal errors.
NV_RESETS	Display of DC resets.
AMPLIFICATION_INTERNAL	Display of the current gain.
EMPTY_PIPE_ON_OFF	Selection of the "Empty Pipe Detection" function (only for sizes ≥ DN 10 and without preamplifier). An entirely full measuring tube is essential for an accurate measurement. The "Empty Pipe Detection" function detects the empty pipe. 0: Off 1: On Factory setting: Off.
EMPTY_PIPE_THRESHOLD	Setting of the threshold for tripping the empty pipe alarm. Limits: 100 ... 60000 Hz Factory setting: 4000 Hz.
EMPTY_PIPE_DETECTOR	Display of the measured empty pipe frequency.
EMPTY_PIPE_ADJ_START	Adjustment of the Empty Pipe Detection function. The sensor must be full. Start the adjustment with 1.
EMPTY_PIPE_ADJ_PROGRESS	Progress information about the adjustment of the Empty Pipe Detection function.
EMPTY_PIPE_ADJ_FAIL_INFO	Status information about the adjustment of the Empty Pipe Detection function.
EMPTY_PIPE_MAN_ADJ_FULL	Manually adjust the Empty Pipe Detection function.
TFE_ELECTRODE_AVAILABLE	Information about the presence of the TFE electrode. 0 - Sensor without TFE electrode 1 - Sensor with TFE electrode.
TFE_DETECTION_ON_OFF	Selection of the "Partially Filled Pipe Detection" function The presence of a TFE electrode in the sensor is mandatory: 0: Off 1: On Factory setting: Off.
TFE_THRESHOLD	Setting of the threshold for tripping the TFE alarm (partially filled pipe). Limits: 1 ... 10000 Factory setting: 5000.
TFE_ADJ_START	Automatic adjustment of the Partially Filled Pipe Detection function. Start the adjustment with 1.
TFE_ADJ_PROGRESS	Progress information about the adjustment of the Partially Filled Pipe Detection function.
TFE_ADJ_FAIL_INFO	Status information about the adjustment of the Partially Filled Pipe Detection function.
TFE_DETECTOR	Currently measured value of the Partially Filled Pipe Detection function.

Parameter	Description
SIL_DIAG_ON_OFF (Only FEX500)	Switch-on of the Input Circuit Check function. 0: Off 1: On Factory setting: Off.
SENSOR_MEASURE_ON_OFF	Switch-on of the sensor check functions, e.g., for the coil voltage, resistance and sensor temperature. 0: Off 1: On Factory setting: Off.
SENSOR_TEMP_CALIB (Only FEX500)	Calibration value for the coil temperature measurement.
SENSOR_TEMPERATURE (Only FEX500)	Measured sensor temperature value.
SENSOR_CABLE_LENGTH (Only FEX500)	Cable length between sensor and transmitter.
SENSOR_TEMP_MAX_ALARM (Only FEX500)	High limit for the sensor temperature alarm.
SENSOR_TEMP_MIN_ALARM (Only FEX500)	Low limit for the sensor temperature alarm.
COIL_CURRENT_VALUE	Currently measured coil current.
COIL_RESISTOR	Only with enabled sensor check function. Currently measured coil resistance.
COIL_VOLTAGE	Only with enabled sensor check function. Currently measured coil voltage.
COIL_RESISTOR_MAX_ALARM	High limit for the coil resistance alarm.
COIL_RESISTOR_MIN_ALARM	Low limit for the coil resistance alarm.
GAS_BUBBLE_ON_OFF (Only FEX500)	Switch-on of the Gas Bubble Detection function. 0: Off 1: On Factory setting: Off.
GAS_BUBBLE_VALUE (Only FEX500)	Measured gas bubble value.
GAS_BUBBLE_THRESHOLD (Only FEX500)	Setting of the threshold for tripping the gas bubble alarm. Limits: 0,01 ... 100000 Factory setting: 200.
GAS_BUBBLE_ADJ_START (Only FEX500)	Automatic adjustment of the Gas Bubble Detection function. Start the adjustment with 1.
GAS_BUBBLE_ADJ_PROGRESS (Only FEX500)	Progress information about the adjustment of the Gas Bubble Detection function.
GAS_BUBBLE_ADJ_FAIL_INFO (Only FEX500)	Status information about the adjustment of the Gas Bubble Detection function.

Parameter	Description
COATING_ON_OFF (Only FEX500)	Switch-on of the Deposit Detection function 0: Off 1: On Factory setting: Off.
COATING_INFORMATION (Only FEX500)	Information about the properties of the electrode deposits. 0: Not relevant 1: Insulating 2: Non-insulating
COATING_VALUE_QE1 (Only FEX500)	Measured value of the Deposit Detection function for electrode E1.
COATING_VALUE_AE1 (Only FEX500)	Measured value of the Deposit Detection function for electrode E1.
COATING_VALUE_QE2 (Only FEX500)	Measured value of the Deposit Detection function for electrode E2.
COATING_VALUE_AE2 (Only FEX500)	Measured value of the Deposit Detection function for electrode E2.
COATING_QE_MAX_ALARM (Only FEX500)	High limit for the deposit detection alarm.
COATING_QE_MIN_ALARM (Only FEX500)	Low limit for the deposit detection alarm.
CONDUCTIVITY_ON_OFF (Only FEX500)	Switch-on of the Fluid Conductivity Measurement function. 0: Off 1: On Factory setting: Off.
CONDUCTIVITY_VALUE (Only FEX500)	Fluid conductivity in µS.
CONDUCTIVITY_ADJ_VALUE (Only FEX500)	Adjustment value for the Fluid Conductivity Measurement function.
CONDUCTIVITY_MAX_ALARM (Only FEX500)	High limit for the conductivity measurement alarm.
CONDUCTIVITY_MIN_ALARM (Only FEX500)	Low limit for the conductivity measurement alarm.
ELEC_IMP_E1_GND (Only FEX500)	Only with enabled sensor check function. Impedance measured between electrode E1 and ground.
ELEC_IMP_E2_GND (Only FEX500)	Only with enabled sensor check function. Impedance measured between electrode E2 and ground.
ELEC_IMP_MAX_ALARM (Only FEX500)	High limit for the electrode impedance measurement alarm.
ELEC_IMP_MIN_ALARM (Nur bei FEX500)	Low limit for the electrode impedance measurement alarm.

Parameter	Description
GROUND_CHECK_START	Start of the grounding check.
GROUND_CHECK_PROGRESS	Progress information for the grounding check.
GROUND_CHECK_FREQ1	The determined FFT spectrum with the 4 highest frequency amplitudes, and the FFT power spectrum.
GROUND_CHECK_FREQ2	
GROUND_CHECK_FREQ3	
GROUND_CHECK_FREQ4	
GROUND_CHECK_AMP1	
GROUND_CHECK_AMP2	
GROUND_CHECK_AMP3	
GROUND_CHECK_AMP4	
GROUND_CHECK_POW_SPEC	
LOGGER_CONDUCTIVITY (Only FEX500)	Logger for the fluid conductivity. (up to 12 measured values).
LOGGER_COATING_QE1 (Only FEX500)	Logger for deposit detection on electrode E1 (up to 12 measured values).
LOGGER_COATING_QE2 (Only FEX500)	Logger for deposit detection on electrode E1 (up to 12 measured values).
LOGGER_ON_OFF (Only FEX500)	Switch-on of measured value logger. Up to 12 measured values can be stored. 0: Off 1: On Factory setting: Off.
LOGGER_LOG_TIME (Only FEX500)	Configuration of the logging time Limits: 0 … 1460 h Factory setting: 1 h
SIMULATION_MODE	Setting of the device simulation. 0: Off 1: Flow velocity 2: Flowrate (Q) in unit 3: Flowrate (Q) in % 6: Frequency on DO2 8: Switch output on DO2

Parameter	Description
SIM_FLOW_VELOCITY	Simulation value for the flow velocity. Limits: SIM_FLOW_VELOCITY_RANGE_MIN … SIM_FLOW_VELOCITY_RANGE_MAX Factory setting: 0 m/s.
SIM_VOLUME_FLOW	Simulation value for the flowrate (Q) in unit. Limits: SIM_FLOW_VOLUME_RANGE_MIN … SIM_FLOW_VOLUME_RANGE_MAX Factory setting: 0 m3/h.
SIM_FLOW_RATIO	Simulation value for the flowrate (Q) in %. Limits: -200 … +200 % Factory setting: 0%.
SIM_PULSE_FREQ	Simulation value for the frequency on DO2. Limits: 0 .. 5250 Hz. (The maximum limit depends on the pulse width). Factory setting: 0 Hz.
SIM_LOGIC_COMMAND	Simulation value for the switch output. 0: Off 1: On Factory setting: 0 – Off.
OUTPUT_FREQ	Current frequency on output DO2 (depending on the configuration).
OUTPUT_LOGIC	Current switching state on output DO2 (depending on the configuration).
SIM_FLOW_VELOCITY_RANGE_MAX	Minimum and maximum values for the flow velocity and the flowrate in unit.
SIM_FLOW_VELOCITY_RANGE_MIN	
FLOW_VELOCITY_RANGE_MAX	
FLOW_VELOCITY_RANGE_MIN	
SIM_VOLUME_FLOW_RANGE_MAX	
SIM_VOLUME_FLOW_RANGE_MIN	
VOLUME_FLOW_RANGE_MAX	
VOLUME_FLOW_RANGE_MIN	
MAX_FLOWRATE_ALARM	High limit for the High alarm.
MAX_FLOWRATE_ALARM_RANGE_MAX	Range for the High alarm.
MAX_FLOWRATE_ALARM_RANGE_MIN	
MIN_FLOWRATE_ALARM	Low limit for the Low alarm.
MIN_FLOWRATE_ALARM_RANGE_MAX	Range for the Low alarm.
MIN_FLOWRATE_ALARM_RANGE_MIN	

4.14 Data structures

In the following, the used internal data structures are listed. For a detailed description of the Profibus data structures refer to the PROFIBUS PA Profile 3.01.

Type: Block
Size: 14 bytes
Name: Diag_Detail_History
Number of elements: 5
Structure: See the following table

Element No.	Element name	Data Type	Store	Size	Access	Description
1	alarmCounter	Unsigned16	N	2	r	Number of occurred alarms.
2	alarmTimeCounterMsec	Unsigned32	N	4	r	Information about how long the alarm was active in total.
3	alarmTimeCounterDay	Unsigned16	N	2	r	
4	timeStampLastAlarmMsec	Unsigned32	N	4	r	Information about the last occurrence of the alarm.
5	timeStampLastAlarmDay	Unsigned16	N	2	r	

5 Alarm handling

The transmitter has several error registers and parameters for configuring the alarm handling. All registers and parameters are included in the Physical Block. For test purposes, you can simulate all existing device errors and the corresponding reactions.

It is also possible to mask specific alarms or alarm groups.

The following Physical Block parameters describe the alarm handling of the transmitter:

Relative Index	Parameter name	Object Type	Data Type	Store	Bytes	Access
13	DIAGNOSIS	Simple	OctetString	D	4	r
14	DIAGNOSIS_EXTENSION			D	6	r
15	DIAGNOSIS_MASK			Cst	4	r
16	DIAGNOSIS_MASK_EXTENSION			Cst	6	r
33	DIAG_WORST_COND		Unsigned16	D	2	r
34	DIAG_EXT_HISTORY		OctetString	D	6	r
38	DIAG_CONDITION_IDX		Unsigned8	D	1	r,w
39	DIAG_DETAILS	Record	Diag_Detail_History	D	14	r,w
40	DIAG_ALARM_SIMULATION	Simple	Unsigned8	D	1	r,w
41	DIAG_CLEAR_ALARM_HISTORY			D	1	r,w
42	DIAG_MASK_MAINTENANCE			S	1	r,w
43	DIAG_MASK_CHECK_FUNCTION			S	1	r,w
44	DIAG_MASK_OFF_SPECIFICATION			S	1	r,w
45	DIAG_MASK_MIN_ALARM			S	1	r,w
46	DIAG_MASK_MAX_ALARM			S	1	r,w
47	DIAG_MASK_OVERFLOW_103			S	1	r,w
48	DIAG_MASK_EMPTY_PIPE			S	1	r,w
49	DIAG_MASK_TFE			S	1	r,w

The meaning of all bits in the DIAGNOSIS is already defined in the PA Profile 3.01, and the bits are reserved accordingly. It depends on the used status (Extended or Condensed). The eighth bit in the fourth byte indicates whether manufacturer-specific alarm information is present. The information is provided in the DIAGNOSIS_EXTENSION parameter.

DIAGNOSIS_MASK and DIAGNOSIS_MASK_EXTENSION specify, which bits in DIAGNOSIS and DIAGNOSIS_EXTENSION are used (0 = not used, 1 = used). In accordance with the PA specification, this mask is a constant and read-only.

For several active manufacturer-specific alarms, the DIAG_WORST_COND parameter specifies the Namur alarm group and the class of the alarm with the highest priority.

DIAG_EXT_HISTORY contains all history information of the manufacturer-specific alarms. The bit size and arrangement exactly correspond to the DIAGNOSIS_EXTENSION parameter (0 = alarm has never been active, 1 = alarm has been active).

With the DIAG_CONDITION_IDX parameter you can call additional history information for an alarm. Every manufacturer-specific alarm has a unique alarm ID (see the FEX300 / FEX500 alarm overview). This alarm ID is written in the DIAG_CONDITION_IDX parameter, thus allowing you to retrieve additional information like the number of occurrences, alarm duration and last occurrence of the alarm by means of DIAG_DETAILS.

All history information can be deleted with the DIAG_CLEAR_ALARM_HISTORY parameter.

The DIAG_ALARM_SIMULATION parameter is used to specify, which manufacturer-specific alarm is to be simulated. The system will react on this simulated alarm in the same way as on a real alarm, with the difference that simulated alarms are not logged in the alarm history.

In order to enable the user to decide which alarm bits are used or not, dedicated parameters for masking single alarms or alarm groups were created in the Physical Block (rel. indices 42 to 49).

Note: The profiles 0 x 9740 and 0 x 9700 do not transmit the DIAGNOSIS_EXTENSION in the GetDiag telegram. As a result, the master cannot read from the GetDiag telegram whether a simulation is running in the transmitter or not. This information can be obtained e.g. by acyclic reading of the DIAGNOSIS_EXTENSION from the Physical Block.

5.1 Get Diag

The DIAGNOSIS and DIAGNOSIS_EXTENSION parameters can be used to poll the transmitter status. These parameters are located on the relative indices 13 and 14 in the Physical Block where they can be read acyclically. Cyclic reading via the DDLM_SLAVE_DIAG service is also possible.

The DDLM_SLAVE_DIAG service provides for the general PA profiles 9740 and 9700 only the DIAGNOSIS, as this parameter is defined in the PA profile, but the DIAGNOSIS_EXTENSION is manufacturer-specific.

For the manufacturer-specific profile 0 x 3430 the DDLM_SLAVE_DIAG service has been enhanced to additionally transmit the DIAGNOSIS_EXTENSION parameter in bytes 15 to 20 and the DIAG_WORST_COND parameter in bytes 21 and 22.

5.1.1 Procedure

During cyclic communication, the master regularly requests input data from the slave via "**Request Data Exchange**". The slave responds with "**Response Data Exchange**". The slave's response contains a bit (Diagnostic Flag) which states whether new diagnostics information is available in the slave.

If something changes in Diagnosis or Diagnosis Extension in the slave (one or more bits set / deleted), then the slave sets the diagnostic flag in the „Response Data Exchange“ to True. Then the master requests diagnostics data from the slave with „Request Get Diag“. The slave responds with "„Response Get Diag“". Therefore, the "Get Diag" service only takes place when the diagnostics data in the slave changes.

Master		Slave
Master recognizes diagnostic flag "true" and requests diagnostics data.	req. DataExchange →	
	← res. DataExchange	Diagnostics data unchanged. Diagnostic Flag: False
	req. DataExchange →	
	← res. DataExchange	Diagnostics data changed. Diagnostic Flag: true
	req. SlaveGetDiag →	
	← res.SlaveGetDiag	Slave responds with diagnostics data
	req. DataExchange →	
	← res. DataExchange	Diagnostics data unchanged. Diagnostic Flag: False

5.1.2 Get Diag telegram

Byte No.	DPV1 name	Bit No.	Value	“long” telegram 0x9740 or 0x9700	“long” telegram 0x3430	"short" telegram 0x3430
1	Station Status 1	Bit 7	Diag Master Lock	0	0	0
		Bit 6	Diag Frame Fault	0	0	0
		Bit 5	Diag Invalid Slave Response	0	0	0
		Bit 4	Diag not supported	0	0	0
		Bit 3	Diag Ext Diag	1	1	0
		Bit 2	Diag Config Fault	0	0	0
		Bit 1	Diag Station Not Ready	0	0	0
		Bit 0	Diag Station Non Existent	0	0	0
2	Station Status 2	Bit 7	Diag deactivated	0	0	0
		Bit 6	reserved	0	0	0
		Bit 5	Diag Sync Mode	0	0	0
		Bit 4	Diag Freeze Mode	0	0	0
		Bit 3	Diag Watchdog on	x	x	x
		Bit 2	set to 1 by DP slave	1	1	1
		Bit 1	Diag static Diagnostics	0	0	0
		Bit 0	Diag parameterization request	0	0	0
3	Station Status 3	Bit 7	Ext. Diag Overflow	0	0	0
		Bit 6	reserved	0	0	0
		Bit 5	reserved	0	0	0
		Bit 4	reserved	0	0	0
		Bit 3	reserved	0	0	0
		Bit 2	reserved	0	0	0
		Bit 1	reserved	0	0	0
		Bit 0	reserved	0	0	0
4	Master address			0x00	0x00	0x00
5 - 6	ID number			0x9740/ 0x9700	0x3430	0x3430

Byte No.	DPV1 name	Bit No.	Value	“long” telegram 0x9740 or 0x9700	“long” telegram 0x3430	"short" telegram 0x3430
7	Header	Bit 7-6	fixed to 0	0x08	0x0E	
		Bit 5-0	Block length			
8	Status_Type	Bit 7	Status	0xFE	0xFE	
		Bit 6-0	Not used			
9	Slot No. of PB			0x00	0x00	
10	Specifier	Bit 2-7	reserved	0x01	0x01	
		Bit 0+1	1: Status appears 2: Status disappears			
11-14			DIAGNOSIS	0x20 0x00 0x00 0x00	0x00 0x00 0x00 0x80	
15-20			DIAGNOSIS_EXTENSION		0x80 0x00 0x00 0x00 0x00 0x00	
21-22			DIAG_WORST_COND Byte 21: Worst Condition 1: Check Function 2: Out off Specification 4: Maintenance 8: Failure Byte 22: Condition Group 1: HW Status Elektronik 2: HW Status Sensor 4: Configuration State 8: Operating Condition		0x01 0x01	

If no errors or warnings are present, the transmitter responds with a "short" telegram (only bytes 1-6). Otherwise, the transmitter responds with a "long" telegram (14 bytes for 0 x 9740 and 0 x 9700, 22 bytes for 0 x 3430).

The example shows a telegram for 0 x 3430 with errors / warnings:

Bytes 1-6:	0x08, 0x0C, 0x00, 0x00, 0x07, 0x8C	
Bytes 7-10:	0x0E, 0xFE, 0x00, 0x01	
Bytes 11-14:	0x00, 0x00, 0x00, 0x80	(Diagnosis)
Bytes 15-20:	0x80, 0x00, 0x00, 0x00, 0x00, 0x00	(DiagnosisExtension)

Bit 7 in octet 1 of the Diagnosis Extension (=byte 15) indicates an alarm.
Bit 7 in octet 4 of the Diagnosis (byte 14), indicates that the Diagnosis Extension exists.
Bit 3 in byte 1 indicates that diagnostics data exist.

The example shows the "short" diagram that comes when the last error / warning disappears.

Bytes 1-6:	0x00, 0x0C, 0x00, 0x00, 0x07, 0x8C

Bit 3 in byte 1 is 0, as no further diagnostics data are available.

5.2 DIAGNOSIS_EXTENSION and DIAG_EXT_HISTORY

The following table provides an overview of the manufacturer-specific alarms and their maskability. When masking is active, the corresponding bits are not set in the DIAGNOSIS_EXTENSION and have no effect on the status information of the cyclic output values of the AI and TOT Blocks.

The structure of the DIAG_EXT_HISTORY parameter is the same as that of the DIAGNOSIS_EXTENSION.

Octet	Bit	Alarm designation	Alarm ID	Masked with	Rel. Idx. PB
0	3	Simulation of contact output DO2	3	DIAG_MASK_CHECK_FUNCTION	43
	4	Simulation of pulse output DO2	4	DIAG_MASK_CHECK_FUNCTION	43
	5	Min. flowrate alarm	5	DIAG_MASK_MIN_ALARM	45
	6	Max. flowrate alarm	6	DIAG_MASK_MAX_ALARM	46
	7	Flow > 103 %	7	DIAG_MASK_OVERFLOW_103	47
1	0	Flowrate simulation active	8	DIAG_MASK_CHECK_FUNCTION	43
	1	Transmitter is on the simulator	9	DIAG_MASK_CHECK_FUNCTION	43
	2	External output switch-off active	10	DIAG_MASK_CHECK_FUNCTION	43
	3	External totalizer stop	11	DIAG_MASK_CHECK_FUNCTION	43
	4	Display value < 1600 h for Qmax	12	DIAG_MASK_MAINTENANCE	42
	5	External totalizer reset	13	DIAG_MASK_CHECK_FUNCTION	43
	6	Distorted communication to SensorMemory	14	DIAG_MASK_MAINTENANCE	42
2	0	FRAM error in the transmitter	16	Not maskable	x
	1	Sensor memory not detected	17	Not maskable	x
	3	AD converter overloaded	19	Not maskable	x
	4	Error in coil circuit	20	Not maskable	x
	5	Coil resistance outside of limits	21	DIAG_MASK_OFF_SPECIFICATION	44
	6	Reference voltage Uref = 0	22	Not maskable	x
	7	Noise signal too high	23	DIAG_MASK_OFF_SPECIFICATION	44
3	0	DC too high. Many NV resets	24	Not maskable	x
	1	Empty pipe	25	DIAG_MASK_EMPTY_PIPE	48
	2	Electrical voltage outside of limits	26	DIAG_MASK_OFF_SPECIFICATION	44
	3	NV corrupt	27	DIAG_MASK_MAINTENANCE	42
	5	Electrical impedance too high	29	DIAG_MASK_OFF_SPECIFICATION	44
	6	Last valid value is retained.	30	DIAG_MASK_CHECK_FUNCTION	43

Octet	Bit	Alarm designation	Alarm ID	Masked with	Rel. Idx. PB
4	0	Digital potentiometer error	32	Not maskable	x
	1	Partially filled pipe (TFE)	33	DIAG_MASK_TFE	49
	2	Communication controller defective	34	DIAG_MASK_MAINTENANCE	42
	3	Sensor setup. Cal. status	35	DIAG_MASK_OFF_SPECIFICATION	44
	4	Sensor & Tx series are incompatible	36	Not maskable	x
	5	ROM error in transmitter	37	Not maskable	x
	6	RAM error in transmitter	38	Not maskable	x
5	0	SIL	40	Not maskable	x
	1	Conductivity alarm	41	DIAG_MASK_OFF_SPECIFICATION	44
	2	Electrode deposit alarm	42	DIAG_MASK_OFF_SPECIFICATION	44
	3	Gas bubble alarm	43	DIAG_MASK_OFF_SPECIFICATION	44
	4	Pulse output overshot	44	DIAG_MASK_OFF_SPECIFICATION	44
	5	An alarm is being simulated	45	DIAG_MASK_CHECK_FUNCTION	43
	6	Sensor temperature alarm	46	DIAG_MASK_OFF_SPECIFICATION	44
	7	NV stack corrupt	47	Not maskable	x

5.3 Transducer block status

The transducer blocks provide the measured values for the function blocks. They consist of a data structure with value and status. The status reaches the function blocks (AI Blocks or Totalizer Blocks) which react according to their settings and PA specifications.

The function blocks calculate the value and the status and cyclically transfer them outward.

The status calculation depends on whether the Condensed Status has been activated or not.

The following alarm messages are mapped to the status of the VOLUME_FLOW (Transducer Block 1, Relative Index 17):

Alarm designation	Classic Status - VOLUME_FLOW	Condensed Status - VOLUME_FLOW
Simulation of contact output DO2	GOOD(NC)	Good(G)
Simulation of pulse output DO2	GOOD(NC)	Good(G)
Min. flowrate alarm	GOOD(NC),low limited	GOOD-critical alarm,low limit
Max. flowrate alarm	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flow > 103 %	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flowrate simulation active	UNCERTAIN, simulated value	Check(C)
Transmitter is on the simulator	UNCERTAIN, simulated value	Check(C)
External output switch-off active.	UNCERTAIN, simulated value	Check(C)
External totalizer stop	UNCERTAIN	Check(C)
Display value < 1600 h for Qmax	GOOD(NC)	Good(G)
External totalizer reset	GOOD(NC)	Good(G)
Distorted communication to SensorMemory	GOOD(NC), maintenance required	Maintenance(M)
FRAM error in the transmitter	BAD, device failure	Failure(F)
Sensor memory not detected	BAD, device failure	Failure(F)
AD converter overloaded	BAD, device failure	Failure(F)
Error in coil circuit	BAD, device failure	Failure(F)
Coil resistance outside of limits	UNCERTAIN, engineering unit violation	Out of Specification(S)
Reference voltage Uref = 0	BAD, device failure	Failure(F)
Noise signal too high	UNCERTAIN, engineering unit violation	Out of Specification(S)
DC too high. Many NV resets	BAD, device failure	Failure(F)
Empty pipe	UNCERTAIN, non specific	Out of Specification(S)
Electrical voltage outside of limits	UNCERTAIN, non specific	Out of Specification(S)
NV corrupt	GOOD(NC), maintenance required	Maintenance(M)
Electrical impedance too high	UNCERTAIN, non specific	Out of Specification(S)
Last valid value is retained.	UNCERTAIN, last usable value	Check(C)
Digital potentiometer error	BAD, device failure	Failure(F)
Partially filled pipe (TFE)	UNCERTAIN, non specific	Out of Specification(S)
Sensor setup. Cal. status	UNCERTAIN, non specific	Out of Specification(S)
Sensor & Tx series are incompatible	BAD, device failure	Failure(F)
ROM error in transmitter	BAD, device failure	Failure(F)
RAM error in transmitter	BAD, device failure	Failure(F)
SIL	BAD, device failure	Failure(F)
Conductivity alarm	BAD, device failure	Failure(F)
Electrode deposit alarm	BAD, device failure	Failure(F)
Gas bubble alarm	BAD, device failure	Failure(F)
Pulse output overshot	GOOD(NC)	Good(G)
An alarm is being simulated	GOOD(NC)	Good(G)
Sensor temperature alarm	UNCERTAIN, non specific	Out of Specification(S)
NV stack corrupt	BAD, device failure	Failure(F)

The following alarm messages are mapped to the status of the FWD_TOTALIZER & REV_TOTALIZER (Transducer Block 3, Relative Index 8 & 9):

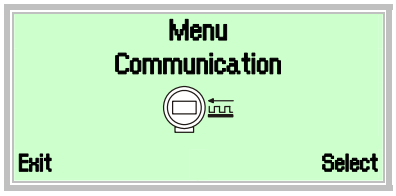
Alarm designation	Classic Status - VOLUME_FLOW	Condensed Status - VOLUME_FLOW
Simulation of contact output DO2	GOOD(NC)	Good(G)
Simulation of pulse output DO2	GOOD(NC)	Good(G)
Min. flowrate alarm	GOOD(NC),low limited	GOOD-critical alarm,low limit
Max. flowrate alarm	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flow > 103 %	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flowrate simulation active	UNCERTAIN, simulated value	Check(C)
Transmitter is on the simulator	UNCERTAIN, simulated value	Check(C)
External output switch-off active.	UNCERTAIN, simulated value	Check(C)
External totalizer stop	UNCERTAIN, last usable value	Check(C)
Display value < 1600 h for Qmax	GOOD(NC), maintenance required	Maintenance(M)
External totalizer reset	UNCERTAIN, initial value	Check(C)
Distorted communication to SensorMemory	GOOD(NC), maintenance required	Maintenance(M)
FRAM error in the transmitter	BAD, device failure	Failure(F)
Sensor memory not detected	BAD, device failure	Failure(F)
AD converter overloaded	BAD, device failure	Failure(F)
Error in coil circuit	BAD, device failure	Failure(F)
Coil resistance outside of limits	UNCERTAIN, engineering unit violation	Out of Specification(S)
Reference voltage Uref = 0	BAD, device failure	Failure(F)
Noise signal too high	UNCERTAIN, engineering unit violation	Out of Specification(S)
DC too high. Many NV resets	BAD, device failure	Failure(F)
Empty pipe	UNCERTAIN, non specific	Out of Specification(S)
Electrical voltage outside of limits	UNCERTAIN, non specific	Out of Specification(S)
NV corrupt	GOOD(NC), maintenance required	Maintenance(M)
Electrical impedance too high	UNCERTAIN, non specific	Out of Specification(S)
Last valid value is retained.	UNCERTAIN, last usable value	Check(C)
Digital potentiometer error	BAD, device failure	Failure(F)
Partially filled pipe (TFE)	UNCERTAIN, non specific	Out of Specification(S)
Sensor setup. Cal. status	UNCERTAIN, non specific	Out of Specification(S)
Sensor & Tx series are incompatible	BAD, device failure	Failure(F)
ROM error in transmitter	BAD, device failure	Failure(F)
RAM error in transmitter	BAD, device failure	Failure(F)
SIL	BAD, device failure	Failure(F)
Conductivity alarm	BAD, device failure	Failure(F)
Electrode deposit alarm	BAD, device failure	Failure(F)
Gas bubble alarm	BAD, device failure	Failure(F)
Pulse output overshot	GOOD(NC)	Good(G)
An alarm is being simulated	GOOD(NC)	Good(G)
Sensor temperature alarm	UNCERTAIN, non specific	Out of Specification(S)
NV stack corrupt	BAD, device failure	Failure(F)

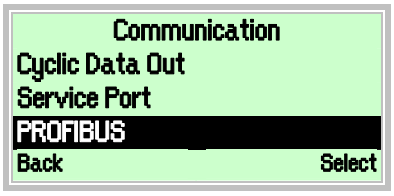
The following alarm messages are mapped to the status of the CONDUCTIVITY_VALUE & SENSOR_TEMPERATURE (Transducer Block 5, Relative Index 57 & 33):

Alarm designation	Classic Status - VOLUME_FLOW	Condensed Status - VOLUME_FLOW
Simulation of contact output DO2	GOOD(NC)	Good(G)
Simulation of pulse output DO2	GOOD(NC)	Good(G)
Min. flowrate alarm	GOOD(NC),low limited	GOOD-critical alarm,low limit
Max. flowrate alarm	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flow > 103 %	GOOD(NC),high limited	GOOD-critical alarm,high limit
Flowrate simulation active	GOOD(NC)	Good(G)
Transmitter is on the simulator	GOOD(NC)	Good(G)
External output switch-off active.	UNCERTAIN, simulated value	Check(C)
External totalizer stop	GOOD(NC)	Good(G)
Display value < 1600 h for Qmax	GOOD(NC)	Good(G)
External totalizer reset	GOOD(NC)	Good(G)
Distorted communication to SensorMemory	GOOD(NC), maintenance required	Maintenance(M)
FRAM error in the transmitter	BAD, device failure	Failure(F)
Sensor memory not detected	BAD, device failure	Failure(F)
AD converter overloaded	BAD, device failure	Failure(F)
Error in coil circuit	BAD, device failure	Failure(F)
Coil resistance outside of limits	UNCERTAIN, engineering unit violation	Out of Specification(S)
Reference voltage Uref = 0	BAD, device failure	Failure(F)
Noise signal too high	UNCERTAIN, engineering unit violation	Out of Specification(S)
DC too high. Many NV resets	BAD, device failure	Failure(F)
Empty pipe	UNCERTAIN, non specific	Out of Specification(S)
Electrical voltage outside of limits	UNCERTAIN, non specific	Out of Specification(S)
NV corrupt	GOOD(NC), maintenance required	Maintenance(M)
Electrical impedance too high	UNCERTAIN, non specific	Out of Specification(S)
Last valid value is retained.	UNCERTAIN, last usable value	Check(C)
Digital potentiometer error	BAD, device failure	Failure(F)
Partially filled pipe (TFE)	UNCERTAIN, non specific	Out of Specification(S)
Sensor & Tx series are incompatible	UNCERTAIN, non specific	Out of Specification(S)
ROM error in transmitter	BAD, device failure	Failure(F)
RAM error in transmitter	BAD, device failure	Failure(F)
SIL	BAD, device failure	Failure(F)
Conductivity alarm	BAD, device failure	Failure(F)
Electrode deposit alarm	BAD, device failure	Failure(F)
Gas bubble alarm	BAD, device failure	Failure(F)
Pulse output overshot	BAD, device failure	Failure(F)
An alarm is being simulated	GOOD(NC)	Good(G)
Sensor temperature alarm	GOOD(NC)	Good(G)
NV stack corrupt	UNCERTAIN, non specific	Out of Specification(S)

6 Configuration on the transmitter

Under the main menu item "Communication" you can find, among others, the "PROFIBUS" menu item.





Here you can find some important PROFIBUS parameters. Many of them are read-only in the transmitter menu or can be written only when specific requirements are fulfilled.

For a description of the function blocks and their setting options, the channels selection for the AI4, DI and DO Blocks and the functionality of the AO Block refer to the "Block overview" chapter.

The following section is a detailed description of all the setting options provided under the "PROFIBUS" menu item.

Menu / Parameter	Value range	Description
Communication / PROFIBUS		
PA Address (BUS)	0 ... 126	Display and setting of the PROFIBUS PA address. The address can be set via the bus, via the DIP switch or directly by using this parameter. Setting the address via the bus or this parameter is only possible when the DIP switch 8 is off. When the address is assigned via the bus, the display shows the extension (BUS). For further information refer to the "Commissioning PROFIBUS PA devices" chapter.
ID No. Selector	0x9700, 0x9740, 0x3430	Selection of the ID No. Selector. The parameter can be changed only when cyclic communication is stopped (Com State = OFF). Default setting: 0x3430
Com State	Offline, Operate, Clear, Stop	Display of the communication status. • Offline: BUS communication is deactivated. • Operate: Cyclic communication is running. • Clear: Device is being initialized. • Stop: Cyclic communication is stopped, BUS communication remains active.
AI-Q Flowrate	Display only	Current flow in the selected unit from the Transducer Block Flow, including status.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

Menu / Parameter	Value range	Description
Communication / PROFIBUS (continued)		
Tot1-Q Flowrate	Display only	Current totalizer status in the selected unit from the Transducer Block Flow, including status.
Tot2-Q Flowrate	Display only	Current totalizer status in the selected unit from the Transducer Block Flow, including status.
AI2 Internal Forw. Tot.	Display only	Current totalizer status of the forward totalizer in the selected unit from the Transducer Block Flow, including status.
AI3 Internal Rev. Tot.	Display only	Current totalizer status of the reverse totalizer in the selected unit from the Transducer Block Flow, including status.
AI4 Diagnostics	Display only	Current output value, including status. The channel can be selected using the "AI4 Channel" parameter.
AI4 Channel	Sensor temperature, conductivity	Selection of the channel output by AI4. The PV_SCALE and OUT_SCALE structure is not adapted.
AO Density	Display only	Current density output value from the Transducer Block Flow, including status.
DI Alarm Info	Display only	Current output value, including status. The channel can be selected using the "DI Channel" parameter.
DI Channel	Maintenance, Out of Spec, Function Check, Failure	Selection of the channel output by the DI Alarm Info.
DO Cyclic Control	Display only	Current function, including status. The function can be selected using the "DO Channel" parameter.
DO Channel	Off, totalizer reset (all), external output switch-off, external zero adjustment, external totalizer stop (all), 2 measuring ranges, start / stop batching	Selection of the function of DO Cyclic Control.

italics = Parameter can only be viewed at the "Advanced" password level.

1) Parameter / menu only available for FEP500 / FEH500.

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