Interface Description

COM/FEX300/FEX500-FF-EN

# Electromagnetic Flowmeter ProcessMaster, HygienicMaster FEX300, FEX500

FOUNDATION Fieldbus

Valid from software version 00.01.00

# Electromagnetic Flowmeter
# ProcessMaster, HygienicMaster
# FEX300, FEX500

Valid from software version 00.01.00

## Interface Description

COM/FEX300/FEX500-FF-EN

10.2010

Translation of the original instruction

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# 1 Preamble

This interface description is a supplement to the operating instructions and the commissioning instructions for ProcessMaster, HygienicMaster FEX300, FEX500. The safety instructions in the operating instructions remain valid and must be complied with. The present interface description provides additional information about the supported FOUNDATION Fieldbus functionalities and gives hints about the configuration. Both device variants have the same DEV_TYPE and, thus, the same device description files.

# 2 Specifications

The bus interface connection has the following technical data:

| Description | Value |
|---|---|
| Physics | IEC 61158-2; 31,25 kbit/s |
| Voltage range | U = 9 … 32 V |
| Basic current (normal operation) | I = 10 mA |
| Basic current (error, FDE) | $I_{Max}$ = 13 mA |

# 3 Configuration

## 3.1 Hardware switch

### 3.1.1 Function

**Jumper**

The hardware is provided with the following jumpers:

- Write Protect

The following functions can be set:

- Write Protect disabled
- Write Protect enabled

**DIP switch 1**

The hardware is provided with the following DIP switches:

- Simulation Mode

The following functions can be set:

- Off (Simulation Mode disabled)
- On (Simulation Mode enabled)

### 3.1.2 Location

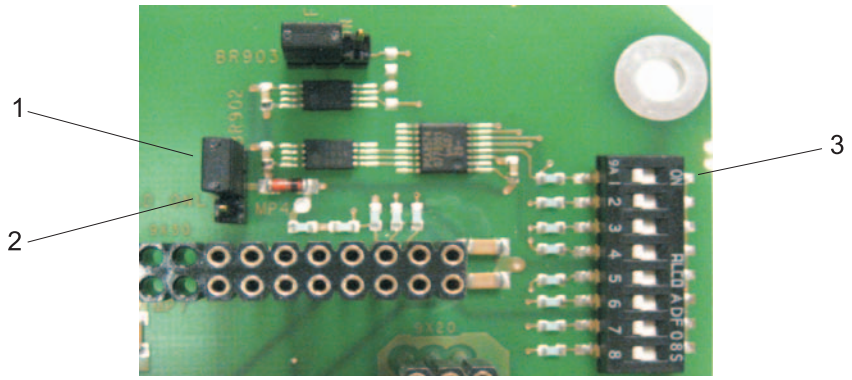


Fig. 1: Backplane of the filed housing

1 Position / Setting of the "Write Protect disabled" jumper
2 Position / Setting of the "Write Protect enabled" jumper
3 Position of DIP switch 1 "Simulation Mode"

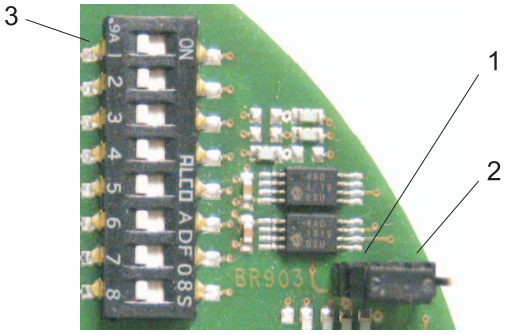


Fig. 2: Backplane of the transmitter housing

1 Position / Setting of the "Write Protect disabled" jumper
2 Position / Setting of the "Write Protect enabled" jumper
3 Position of DIP switch 1 "Simulation Mode"

# 4 Transmitter blocks

## 4.1 Block overview

| Block | Function | Type |
|---|---|---|
| Resource Block | - | - |
| Transducer Block | Flow | Manufacturer-specific |
| Transducer Block | DeviceInfo | Manufacturer-specific |
| Transducer Block | Special Function | Manufacturer-specific |
| Transducer Block | Display | Manufacturer-specific |
| Transducer Block | Diagnostics | Manufacturer-specific |
| Analog Input Function Block 1 | Q Flowrate | Enhanced block [2] |
| Analog Input Function Block 2 | Int. Totalizer Fwd | Enhanced block [2] |
| Analog Input Function Block 3 | Int. Totalizer Rev | Enhanced block [2] |
| Analog Input Function Block 4 | Diagnostics | Enhanced block [2] |
| Analog Output Block | Density Adjust | Standard block [1] |
| PID Block | - | Enhanced block [2] |
| Integrator Block | - | Standard block [1] |
| Discrete Input Block | Diag Info | Standard block [1] |
| Discrete Output Block | Cyclic Control | Standard block [1] |

1) Standard block: This block exactly complies with the FF specification.
2) Enhanced block: This block has been enhanced with some parameters as compared to the specification.

## 4.2 Resource Block

### 4.2.1 Contents

The Resource Block contains general information about the fieldbus device, such as the manufacturer, device type, version number, and so on.

### 4.2.2 Table legend

**Index**

Index of the parameter within the block.

**Parameter name**

Name of the parameter.

**Data Type**

Data type of the parameter. Some parameters are structures (DS-xx).

**Size**

Size of the parameter in bytes.

**Storage Type**

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 Non-volatile 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.

**Write in Target Mode**

Parameters can sometimes only be written in specific operating modes (MODE_BLK, Index 5, Subparameter Target).

OOS: The parameter can be written in the "Out of Service" target mode.

Man: The parameter can be written in the "Manual" target mode.

Auto. The parameter can be written in the "Auto" target mode.

Cas: The parameter can be written in the "Cascade" target mode.

RCas: The parameter can be written in the "Remote Cascade" target mode.

ROut: The parameter can be written in the "Remote Out" target mode.

**Default Values**

Default settings of the parameters.

When the RESTART parameter (Index 16 in the Resource Block), is set to "Restart with defaults", the resource and function block parameters are reset to their default settings.

### 4.2.3 Parameter overview

| Index | Parameter name | Data Type | Size | Storage Type | Write in Target Mode | Default Values |
|---|---|---|---|---|---|---|
| 1 | ST_REV | Unsigned 16 | 2 | S | - | 0 |
| 2 | TAG_DESC | OctetString | 32 | S | OOS, Auto | Space character |
| 3 | STRATEGY | Unsigned 16 | 2 | S | OOS, Auto | 0 |
| 4 | ALERT_KEY | Unsigned 8 | 1 | S | OOS, Auto | 0 |
| 5 | MODE_BLK | DS-69 | 4 | N,D,S,S | OOS, Auto | Target: OOS<br>Actual: OOS<br>Permitted: Auto, OOS<br>Normal: Auto |
| 6 | BLOCK_ERR | Bit String | 2 | D | Read only | 0 |
| 7 | RS_STATE | Unsigned 8 | 1 | D | Read only | 0 |
| 8 | TEST_RW | DS-85 | 112 | D | OOS, Auto | 0 |
| 9 | DD_RESOURCE | Octet String | 32 | S | Read only | |
| 10 | MANUFAC_ID | Unsigned 32 | 4 | S | Read only | 0x320 = ABB |
| 11 | DEV_TYPE | Unsigned 16 | 2 | S | Read only | 0x124 = ProcessMaster |
| 12 | DEV_REV | Unsigned 8 | 1 | S | Read only | |
| 13 | DD_REV | Unsigned 8 | 1 | S | Read only | |
| 14 | GRANT_DENY | DS-70 | 2 | D | OOS, Auto | 0 |
| 15 | HARD_TYPES | Bit String | 2 | S | Read only | Scalar Input, Scalar Output, Discrete |
| 16 | RESTART | Unsigned 8 | 1 | D | OOS, Auto | 1 |
| 17 | FEATURES | Bit String | 2 | S | Read only | Reports, Faultstate, Hard Write Lock, Out Readback |
| 18 | FEATURE_SEL | Bit String | 2 | S | OOS, Auto | Reports, Faultstate, Hard Write Lock, Out Readback |
| 19 | CYCLE_TYPE | Bit String | 2 | S | Read only | Scheduled, Block Execution |
| 20 | CYCLE_SEL | Bit String | 2 | S | OOS, Auto | Scheduled, Block Execution |
| 21 | MIN_CYCLE_T | Unsigned 32 | 4 | S | Read only | 3200 1/32 ms |
| 22 | MEMORY_SIZE | Unsigned 16 | 2 | S | Read only | 0 |
| 23 | NV_CYCLE_T | Unsigned 32 | 4 | S | Read only | 0 |
| 24 | FREE_SPACE | Float | 4 | D | Read only | 0.0 % |
| 25 | FREE_TIME | Float | 4 | D | Read only | 0.0 % |
| 26 | SHED_RCAS | Unsigned 32 | 4 | S | OOS, Auto | 640000 1/32 ms |

| Index | Parameter name | Data Type | Size | Storage Type | Write in Target Mode | Default Values |
|---|---|---|---|---|---|---|
| 27 | SHED_ROUT | Unsigned 32 | 4 | S | OOS, Auto | 640000 1/32 ms |
| 28 | FAULT_STATE | Unsigned 8 | 1 | N | Read only | 1 |
| 29 | SET_FSTATE | Unsigned 8 | 1 | D | OOS, Auto | 1 |
| 30 | CLR_FSTATE | Unsigned 8 | 1 | D | OOS, Auto | 1 |
| 31 | MAX_NOTIFY | Unsigned 8 | 1 | S | Read only | 20 |
| 32 | LIM_NOTIFY | Unsigned 8 | 1 | S | OOS, Auto | 20 |
| 33 | CONFIRM_TIME | Unsigned 32 | 4 | S | OOS, Auto | 640000 1/32 ms |
| 34 | WRITE_LOCK | Unsigned 8 | 1 | S | OOS, Auto | 1 (= Default switch position) |
| 35 | UPDATE_EVT | DS-73 | 14 | D | Read only | 0;0;0;0;0;0;9;0 |
| 36 | BLOCK_ALM | DS-72 | 13 | D | OOS, Auto | 0;0;0;0;0;0;0;8;0;0 |
| 37 | ALARM_SUM | DS-74 | 8 | D,D,D,S | OOS, Auto | 0;0;0;0 |
| 38 | ACK_OPTION | Bit String | 2 | S | OOS, Auto | 0 |
| 39 | WRITE_PRI | Unsigned 8 | 1 | S | OOS, Auto | 0 |
| 40 | WRITE_ALM | DS-72 | 13 | D | OOS, Auto | 0,0,0,0,0 |
| 41 | ITK_VER | Unsigned 16 | 2 | S | Read only | 5 |
| 42 | FD_FAIL_ACTIVE | Bit String | 4 | D | Read only | 0 |
| 43 | FD_OFFSPEC_ACTIVE | Bit String | 4 | D | Read only | 0 |
| 44 | FD_MAINT_ACTIVE | Bit String | 4 | D | Read only | 0 |
| 45 | FD_CHECK_ACTIVE | Bit String | 4 | D | Read only | 0 |
| 46 | FD_FAIL_MAP | Bit String | 4 | | OOS, Auto | 0xFFFC0000 |
| 47 | FD_OFFSPEC_MAP | Bit String | 4 | | OOS, Auto | 0x0003FFFC |
| 48 | FD_MAINT_MAP | Bit String | 4 | | OOS, Auto | 0x00000001 |
| 49 | FD_CHECK_MAP | Bit String | 4 | | OOS, Auto | 0x00000002 |
| 50 | FD_RECOMMEN_ACT | Unsigned 16 | 2 | | OOS, Auto | 0 |
| 51 | FD_EXTENDED_ACTIVE_1 | Bit String | 4 | D | Read only | |
| 52 | FD_EXTENDED_MAP_1 | Bit String | 4 | | OOS, Auto | 0xFFFFFFFF |
| 53 | DIAGNOSIS_HISTORY | Bit String | 4 | | Read only | 0 |
| 54 | DIAGNOSIS_HISTORY_EXT | Bit String | 4 | | Read only | 0 |
| 55 | DIAGNOSIS_CONDITION_IDX | Unsigned 8 | 1 | | Read only | 0xFF |
| 56 | DIAGNOSIS_DETAILS | Diag_Detail_History | 14 | | OOS, Auto | 0 |
| 57 | DIAG_ALARM_SIMULATION | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 58 | DIAG_CLEAR_ALARM_HISTORY | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 59 | DIAG_MASK_MAINTENANCE | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 60 | DIAG_MASK_CHECK_FUNCTION | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 61 | DIAG_MASK_OFF_SPECIFICATION | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 62 | DIAG_MASK_MIN_ALARM | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 63 | DIAG_MASK_MAX_ALARM | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 64 | DIAG_MASK_OVERFLOW_103 | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 65 | DIAG_MASK_EMPTY_PIPE | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 66 | DIAG_MASK_TFE | Unsigned 8 | 1 | | OOS, Auto | 0 |
| 67 | SW_VERSION | Octet String | 16 | | Read only | |
| 68 | HW_VERSION | Octet String | 16 | | Read only | |

### 4.2.4 Parameter description

| Index | Parameter name | Description |
|---|---|---|
| 1 | ST_REV | Revision counter for static variables. Each time when a static variable changes, the revision counter is incremented by one. |
| 2 | TAG_DESC | A user-defined text description of the application of this block. |
| 3 | STRATEGY | This parameter can be used to group blocks by assigning the same code number to each block of the group. This parameter is neither verified nor processed. |
| 4 | ALERT_KEY | This parameter is used as an identification number for a plant part. It can be used in a control system, e.g. for sorting alarms. |
| 5 | MODE_BLK | The current, wanted, allowed and normal operating modes of the block. |
| 6 | BLOCK_ERR | This parameter contains a summary of the block alarms. |
| 7 | RS_STATE | State of the "Function block state machine". |
| 8 | TEST_RW | „Read / write“ Test parameter, only needed for "Test". |
| 9 | DD_RESOURCE | A description of the "Device Description" for the device. |
| 10 | MANUFAC_ID | Identification code for the device manufacturer. |
| 11 | DEV_TYPE | Manufacturer name for the device. |
| 12 | DEV_REV | Device revision. |
| 13 | DD_REV | Revision of the "Device Description" for the device. |
| 14 | GRANT_DENY | Options for the access from the control system to the device parameters. |
| 15 | HARD_TYPES | The hardware types available for the "Channels" of the device.<br>0x8000 = Scalar Input |
| 16 | RESTART | There are the following restart options:<br>1: Run<br>2: Restart resource<br>3: Restart with defaults<br>4: Restart processor |
| 17 | FEATURES | Indicates the Resource Block options:<br>0x4800 = Reports supported, Hard Write Lock supported |
| 18 | FEATURE_SEL | Selection of the Resource Block options:<br>0x4800 = Reports supported, Hard Write Lock supported |
| 19 | CYCLE_TYPE | Describes the block processing method:<br>0xC000 = Scheduled, Completion of block execution |
| 20 | CYCLE_SEL | Selection of the block processing method:<br>0xC000 = Scheduled, Completion of block execution |
| 21 | MIN_CYCLE_T | Indication of the shortest possible cycle time of the device in 1/32 ms. |
| 22 | MEMORY_SIZE | Available device memory. |
| 23 | NV_CYCLE_T | Interval, at which non-volatile parameters are stored in the non-volatile memory of the device.<br>0 means "never". |
| 24 | FREE_SPACE | Percent of the available memory for further configurations. |

| Index | Parameter name | Description |
|---|---|---|
| 25 | FREE_TIME | Percent of the processing time still available for additional blocks. |
| 26 | SHED_RCAS | Monitoring time (watchdog) for communication with the control system in "Rcas" operating mode. |
| 27 | SHED_ROUT | Monitoring time (watchdog) for communication with the control system in "Rout" operating mode. |
| 28 | FAULT_STATE | Output block behavior in the event of communication errors. |
| 29 | SET_FSTATE | Allows for manual setting of the fault state condition. |
| 30 | CLR_FSTATE | Allows for manual deletion of the fault state condition. |
| 31 | MAX_NOTIFY | Maximum possible number of non-acknowledged messages. |
| 32 | LIM_NOTIFY | Maximum permissible number of non-acknowledged messages. |
| 33 | CONFIRM_TIME | Time for which the device waits for the confirmation of a report before transmitting the report again. If CONFIRM_TIME = 0 the report is not re-transmitted. |
| 34 | WRITE_LOCK | If set, writing is disabled. Cannot be deleted via the software.<br>**Note**<br>This parameter is determined by the "Write_Lock" hardware switch. See the "Configuration" chapter.<br>1: Unlocked<br>2: Locked |
| 35 | UPDATE_EVT | This messages is generated on each change of static data. |
| 36 | BLOCK_ALM | Indicates the alarms that are relevant to the block. |
| 37 | ALARM_SUM | This parameter contains a summary of the block alarms. |
| 38 | ACK_OPTION | Determines whether block alarms are acknowledged automatically or not. |
| 39 | WRITE_PRI | Priority of the alarm that is tripped when the write protection (WRITE_LOCK) is disabled. |
| 40 | WRITE_ALM | This alarm is tripped when the write protection (WRITE_LOCK) is disabled. |
| 41 | ITK_VER | Version of the interoperability test kits with which this device has been tested. |
| 42 | FD_FAIL_ACTIVE | These are the currently present error messages in the four NAMUR error categories. See the "Alarm handling" chapter. |
| 43 | FD_OFFSPEC_ACTIVE | |
| 44 | FD_MAINT_ACTIVE | |
| 45 | FD_CHECK_ACTIVE | |
| 46 | FD_FAIL_MAP | These masks determine whether the corresponding error is copied into the _ACTIVE register (1 = is copied). See the "Alarm handling" chapter. |
| 47 | FD_OFFSPEC_MAP | |
| 48 | FD_MAINT_MAP | |
| 49 | FD_CHECK_MAP | |
| 50 | FD_RECOMMEN_ACT | This enumeration value shows the recommended action to be taken against errors with the currently highest priority. |

| Index | Parameter name | Description |
|---|---|---|
| 51 | FD_EXTENDED_ACTIVE_1 | Indicates active errors. See the "Alarm handling" chapter. |
| 52 | FD_EXTENDED_MAP_1 | These masks determine whether the corresponding error is copied into the FD_EXTENDED_ ACTIVE_1 register (1 = is copied). See the "Alarm handling" chapter. |
| 53 | DIAGNOSIS_HISTORY | This 32-bit register indicates errors that were set in the past or are still set. |
| 54 | DIAGNOSIS_HISTORY_EXT | This 32-bit register indicates additional errors that were set in the past or are still set. |
| 55 | DIAGNOSIS_CONDITION_IDX | Setting the alarm No. in order to get additional alarm information via DIAGNOSIS_DETAILS. The "Alarm handling" chapter contains valid alarm numbers. |
| 56 | DIAGNOSIS_DETAILS | Provides additional alarm information for the selected DIAG_CONDITION_IDX. |
| 57 | DIAG_ALARM_SIMULATION | A variety of alarm messages and output conditions can be simulated. Observe the "Alarm handling" chapter. |
| 58 | DIAG_CLEAR_ALARM_HISTORY | Deletes the alarm history information. |
| 59 | DIAG_MASK_MAINTENANCE | Masking of the alarm groups:<br>- Maintenance<br>- Check Function<br>- Out Of Specification<br>With active masking there is no alarm signaling from the corresponding group. Alarms from the "Failure" group cannot be masked. |
| 60 | DIAG_MASK_CHECK_FUNCTION | |
| 61 | DIAG_MASK_OFF_SPECIFICATION | |
| 62 | DIAG_MASK_MIN_ALARM | Masking of single alarms.<br>With activated masking there is no alarm signaling. |
| 63 | DIAG_MASK_MAX_ALARM | |
| 64 | DIAG_MASK_OVERFLOW_103 | |
| 65 | DIAG_MASK_EMPTY_PIPE | |
| 66 | DIAG_MASK_TFE | |
| 67 | SW_VERSION | Software revision of the device. |
| 68 | HW_VERSION | Hardware revision of the device. |

### 4.3 Analog Input Function Block

Measured value calculation is done 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 has four AI blocks  The channels of the AI blocks are configured with default values for various measured values.

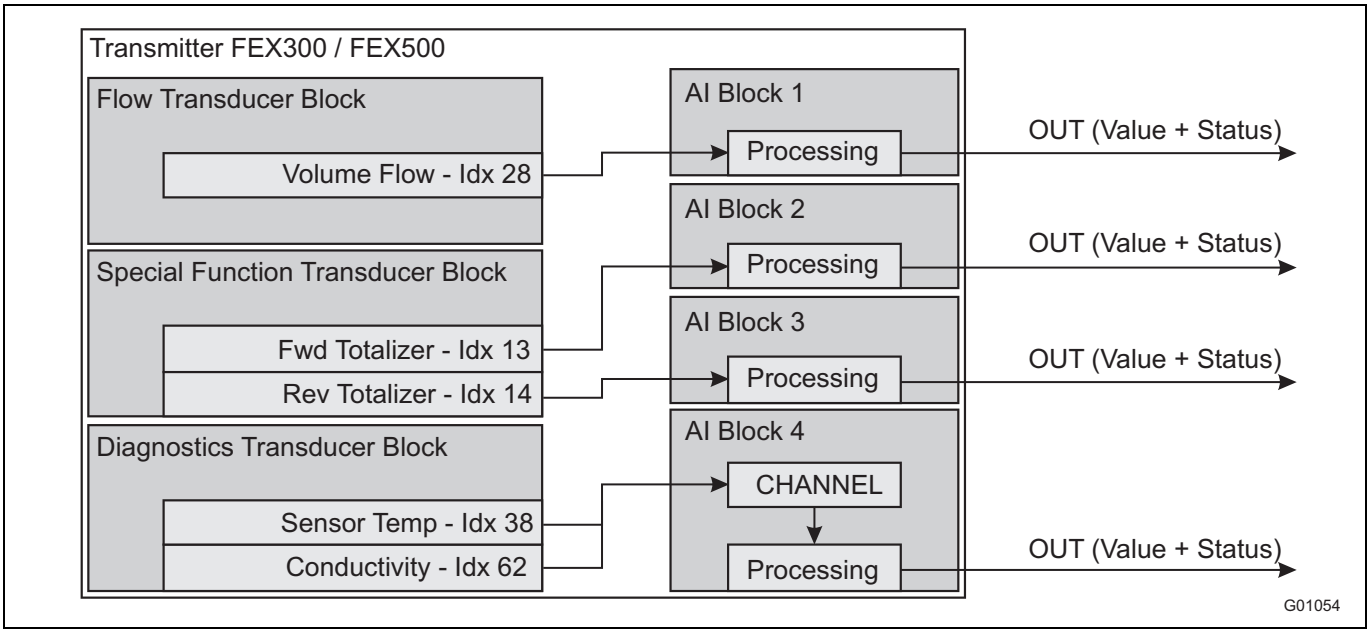


Fig. 3: Analog Input Function Blocks of the transmitter

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 (XD_SCALE & OUT_SCALE).

### 4.4 Analog Output Function Block

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 capability is used for cyclic adjustment of the density value in the device in order to obtain a mass flow corresponding to the medium. The mass flow is calculated from the measured volume flow and the set density.

The density value in the Transducer Block has the unit g/cm$^3$ and will be accepted if it is within the range from 0.01 g/cm$^3$ to 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.

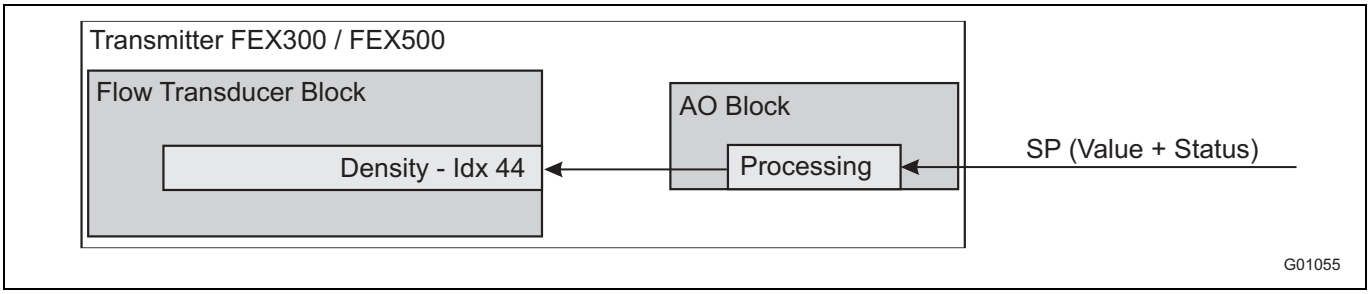


Fig. 4:

In order to be able to output the mass flow, the unit of the VOLUME_FLOW (TB1 Idx. 28) parameter must be set to a mass unit. The mass flow is then cyclically transferred via the first Analog Input Function Block.

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

| Unit | FF 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 |
| g/s | 1318 |
| g/min | 1319 |
| g/h | 1320 |

If this should not be sufficient, the scaling function of the Analog Input Function Block can be used to convert the units or to select a user-specific unit in the transmitter. For more detailed information please refer to the operating instructions.

## 4.5 PID Function Block

### 4.5.1 Contents

The PID Function Block contains a proportional-integral-differential controller, as well as all the components required for scaling, limiting, alarm handling, disturbance variable feedforward control, cascading, and so on. For details refer to the FF specification FF-891.

### 4.5.2 Block diagram

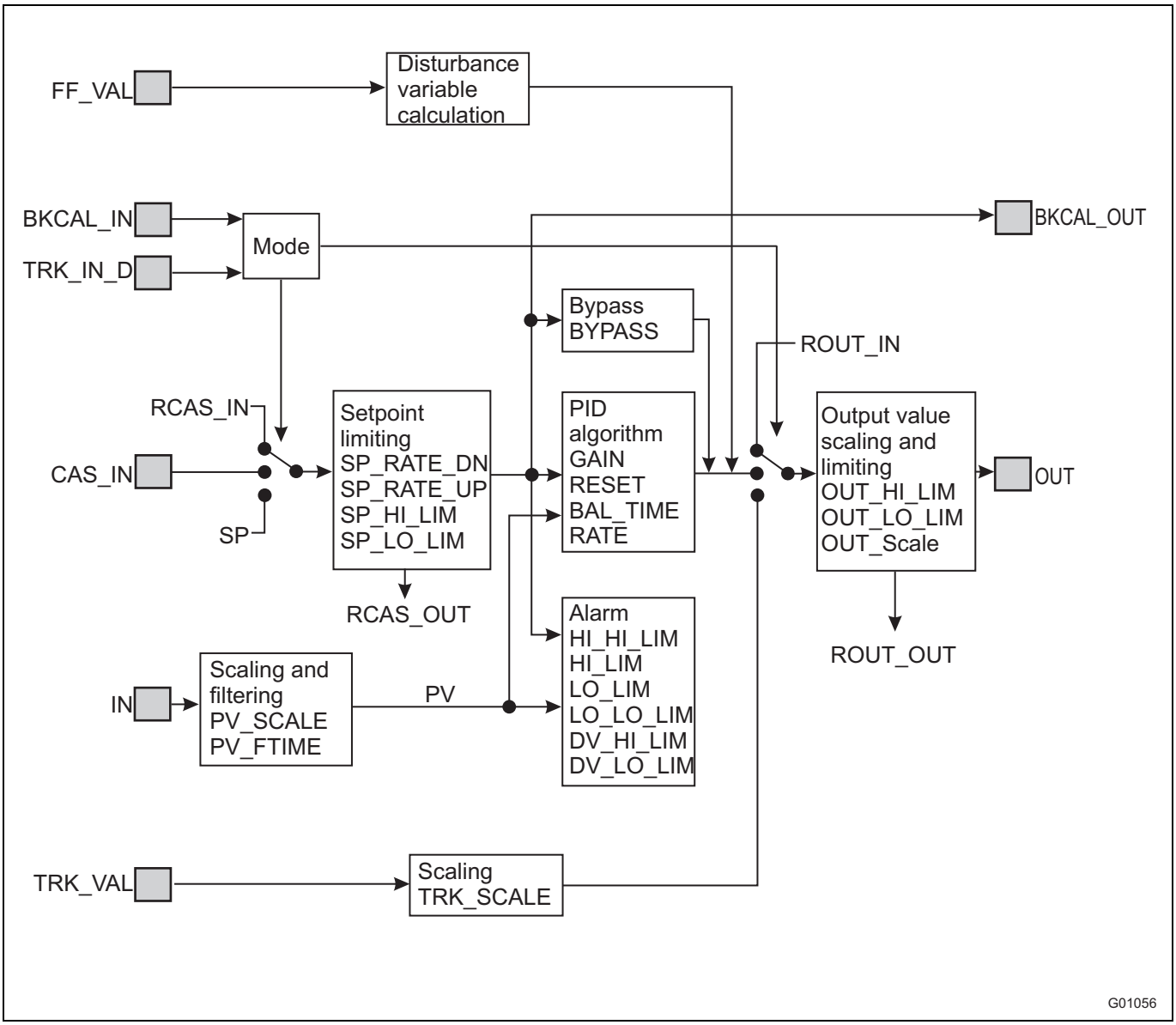


Fig. 5: Structure of the PID Function Block

The controlled variable (actual value) is sent to the IN input. It is scaled using the PV_SCALE parameter and is routed via a filter with the time constant PV_FTIME. The value processed in this way is called the PV (primary analog value). The mode determines the way in which the setpoint is specified.

- **Automatic mode**
  In automatic mode (AUTO), the setpoint is specified by the "SP" parameter.

- **Cascade**
  In "Cascade" mode (CAS), the setpoint is specified by a different function block via the "CAS_IN" input.

- **Remote Cascade**
  In "Remote Cascade" (RCAS) mode, the setpoint is specified by a control system in the RCAS_IN parameter.
  The setpoint range is limited by parameters SP_HI_LIM and SP_LO_LIM, while the maximum rate of change (only applies to AUTO mode) is limited by parameters SP_RATE_DN and SP_RATE_UP. The setpoint limited in this way is called RCAS_OUT and is available for use as a feedback value by control systems (this is necessary for "Remote Cascade" mode).

The PID algorithm is composed of the following:

- **Proportional component**
  The output value (manipulated variable) is proportional to the control deviation (= difference between setpoint and actual value). The proportionality factor is the "Gain" parameter. The drawback of using a purely P controller is its persistent control deviation. An I component can compensate for this, however.

- **Integral component**
  The control deviation is integrated in this. The time constant used here is the "Reset" parameter. The manipulated variable is the value of the integral.

- **Differential component**

  In this case, the control deviation changes are taken as the manipulated variable. The time constant is called the "Rate".

  The manipulated variable for the PID algorithm is the total of the manipulated variables from all three components.

  A bypass is available at the same point as the PID algorithm: This allows the PID algorithm to be bypassed. In this case, the setpoint is immediately taken as the manipulated variable.

  A known disturbance variable can be fed forward to the input FF_VAL; it is scaled using FF_SCALE and FF_GAIN. The disturbance variable scaled in this way is added to the PID algorithm's manipulated variable.

  The manipulated variable is scaled using OUT_SCALE, limited by OUT_LO_LIM and OUT_HI_LIM, and output via OUT.

  In AUTO, CAS, and RCAS modes, the value from the PID algorithm (or bypass) is taken as the output value. In ROUT (Remote Out) mode, the ROUT_IN value specified by a control system is taken instead. Tracking is active in LO (Local Overwrite) mode, which means that the tracking value is taken as the output value. The user can set the output value in MAN or OOS mode.

  The value for a tracking procedure is specified via the TRK_VAL input and scaled using TRK_SCALE. In order to use the tracking function, "Track enable" or "Track in Manual" must be activated in parameter CONTROL_OPTS. Tracking can then be activated using TRK_IN_D. The mode will change to LO (Local Overwrite) when you do this.

### 4.5.3 Operating modes

| Priority | Operating mode | | Meaning |
|---|---|---|---|
| 7 | OOS | Out of Service | Out of service. |
| 6 | IMan | Initialization Manual | Intermediate step to Cascade mode, OUT follows BKCAL_IN. |
| 5 | LO | Local Override | Tracking mode:<br>Output OUT follows the input TRK_VAL. |
| 4 | Man | Manual | Manual mode |
| 3 | Auto | Automatic | The PID algorithm is being processed:<br>Setpoint: Parameter SP<br>Actual value: Input IN<br>Manipulated variable: Output OUT |
| 2 | Cas | Cascade | The PID algorithm is being processed:<br>Setpoint: Input CAS_IN<br>Actual value Input IN<br>Manipulated variable: Output OUT |
| 1 | RCas | Remote Cascade | The PID algorithm is being processed:<br>Setpoint: Parameter RCAS_IN<br>Actual value: Input IN<br>Manipulated variable: Output OUT |
| 0 | ROut | Remote Output | The PID algorithm is not processed. The PID function block receives the manipulated variable from a super-ordinate control system via ROUT_IN and outputs it via ROUT_OUT. |

### 4.5.4 Application examples

**Straightforward control loop, constant setpoint**

The flow in a pipeline is to be controlled by a butterfly valve. A permanent setpoint has been specified.

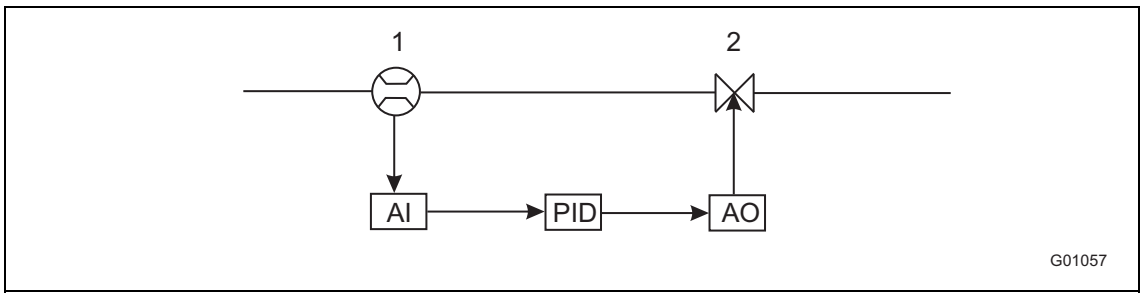


Fig. 6:

1 Flowmeter 2 Butterfly valve

The actual value is measured by the flowmeter and made available as an AI block. The setpoint is set in parameter SP in the PID block. The manipulated variable is sent to the AO block of the butterfly valve. It is absolutely essential for a feedback value to be sent from the AO block to the PID block so that the system can switch between modes smoothly. The PID block is in AUTO mode.

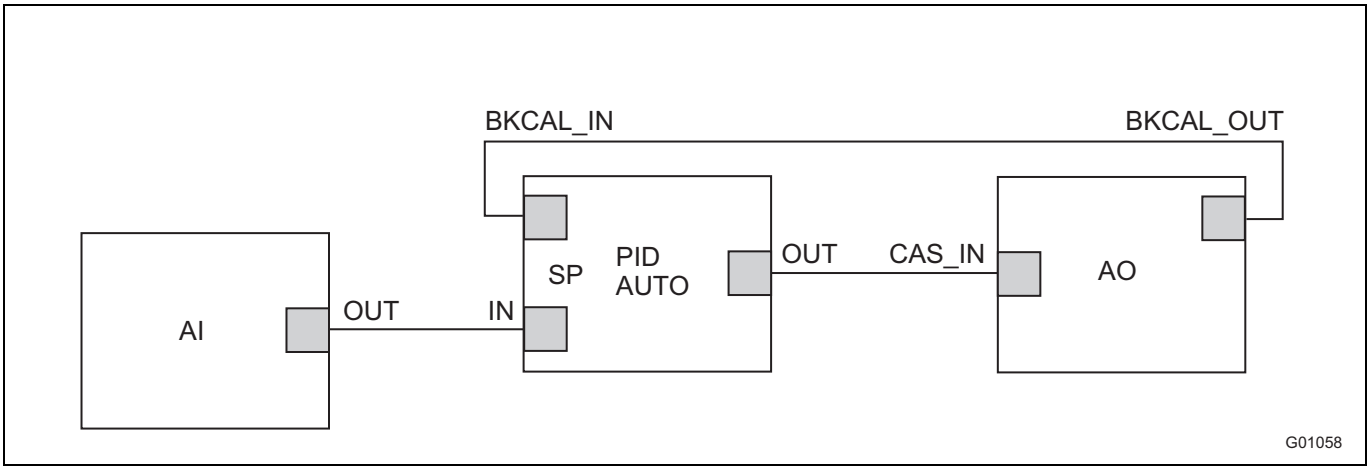


Fig. 7:

**Straightforward control loop, external setpoint specification**

An external setpoint from a different function block (here, AI 1) is sent to the CAS_IN input of the PID block. To enable it to be used, the PID block enters CAS mode.

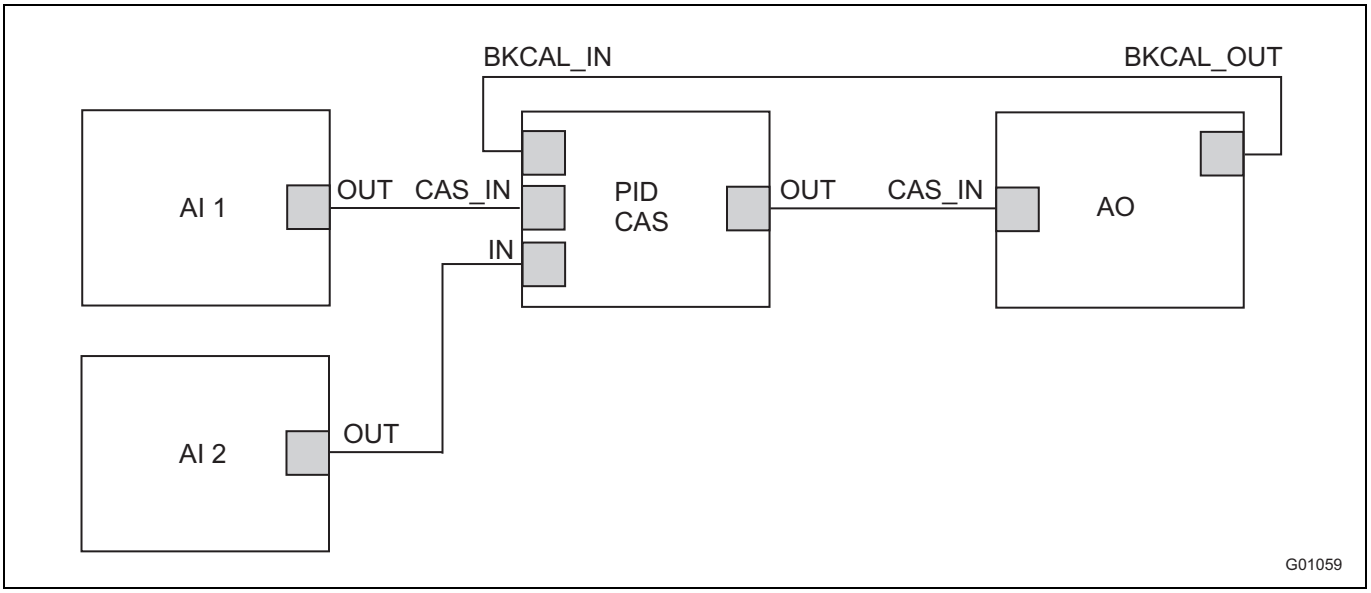


Fig. 8:

## 4.6 Integrator Block

### 4.6.1 Contents

In the Integrator Block (IB) the flow values are totalized to give the totalizer statuses. An Analog Input Block (AI) internally fetches its inputs values from the Transducer Block. An Integrator Block, however, can obtain its input values from other function blocks, only.

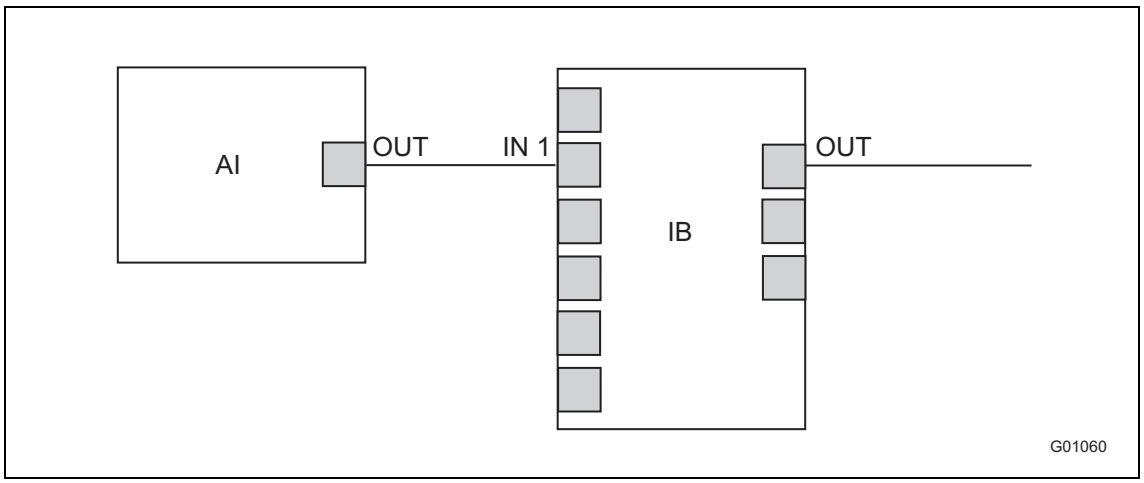


Fig. 9:

### 4.6.2 Block diagram

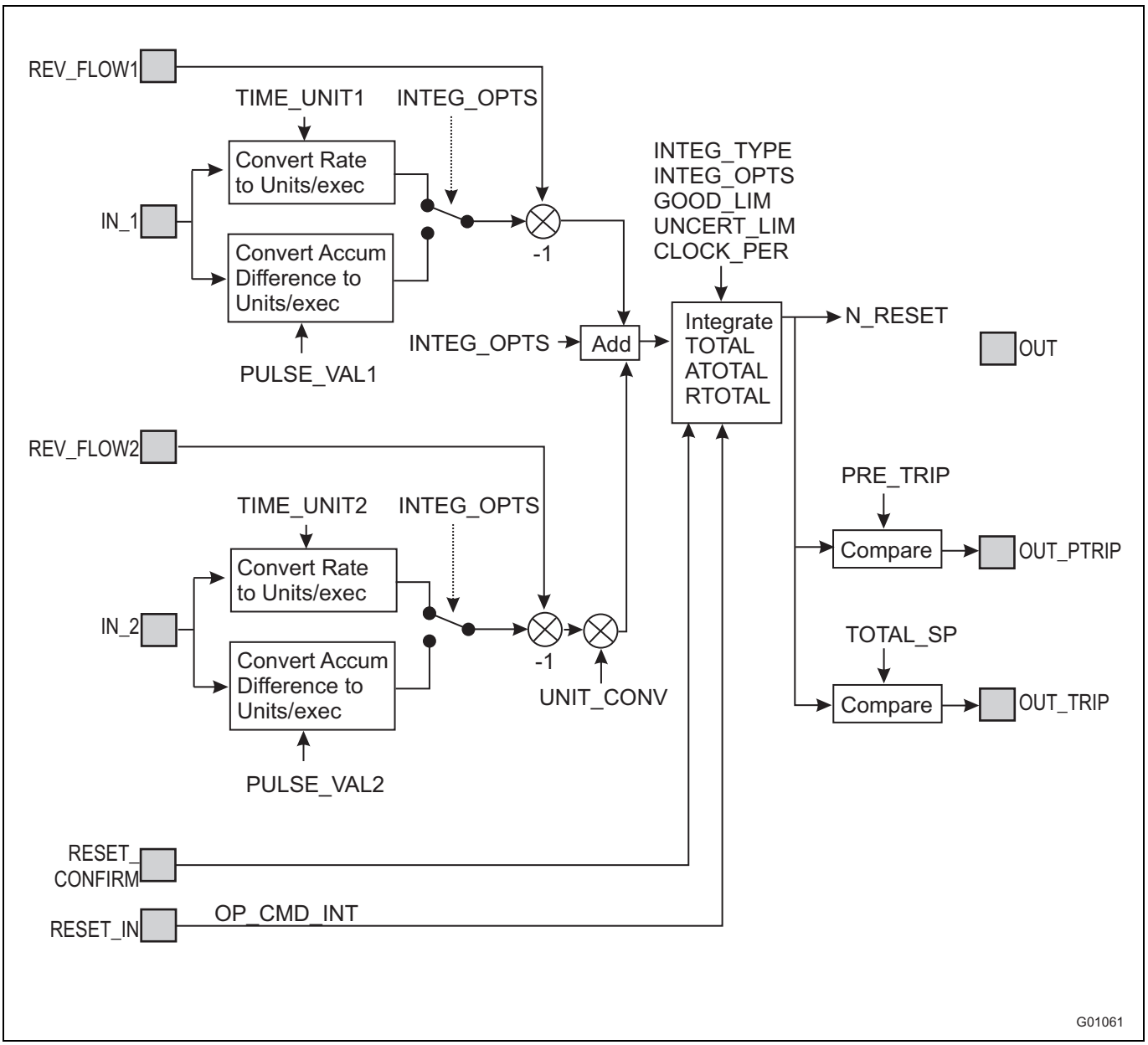


Fig. 10: Structure of the Integrator Block

The function block has two inputs for flow values: IN_1 and IN_2. You can either apply "Rate" values (e.g., from an Analog Input Function Block) or "Accum" values (from a Pulse Input Block) to the input.

For "Rate" flow values the time base (/s, /m, /h, /d) must be scaled accordingly in order to obtain an internal "/s" time base. The parameters TIME_UNIT1 and TIME_UNIT2 are used for this. The input IN_2 can have another volume or mass flow unit than IN_1. In order that both inputs use the same unit, the path of IN_2 includes UNIT_CONV for converting the unit. The flow in "unit/s" multiplied by the Block Execution Time gives the delta value in the unit, which is then added to the totalizer value.

**Example**

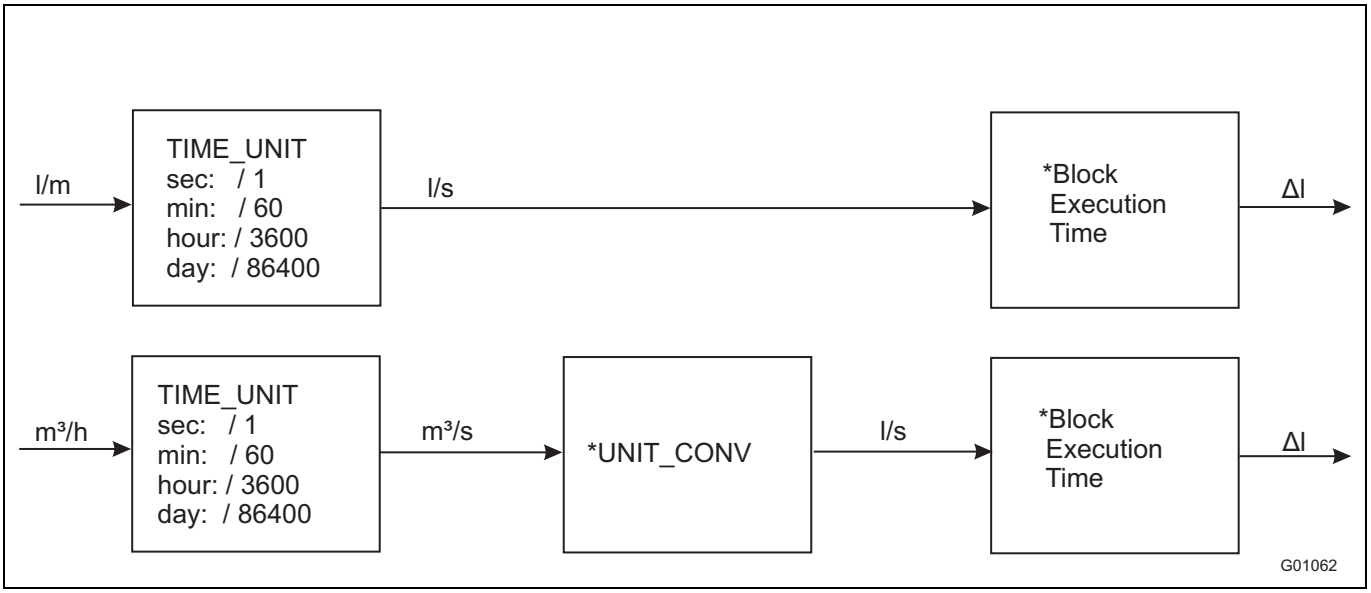


Fig. 11:

The "Accum" values are calculated according to the following scheme:

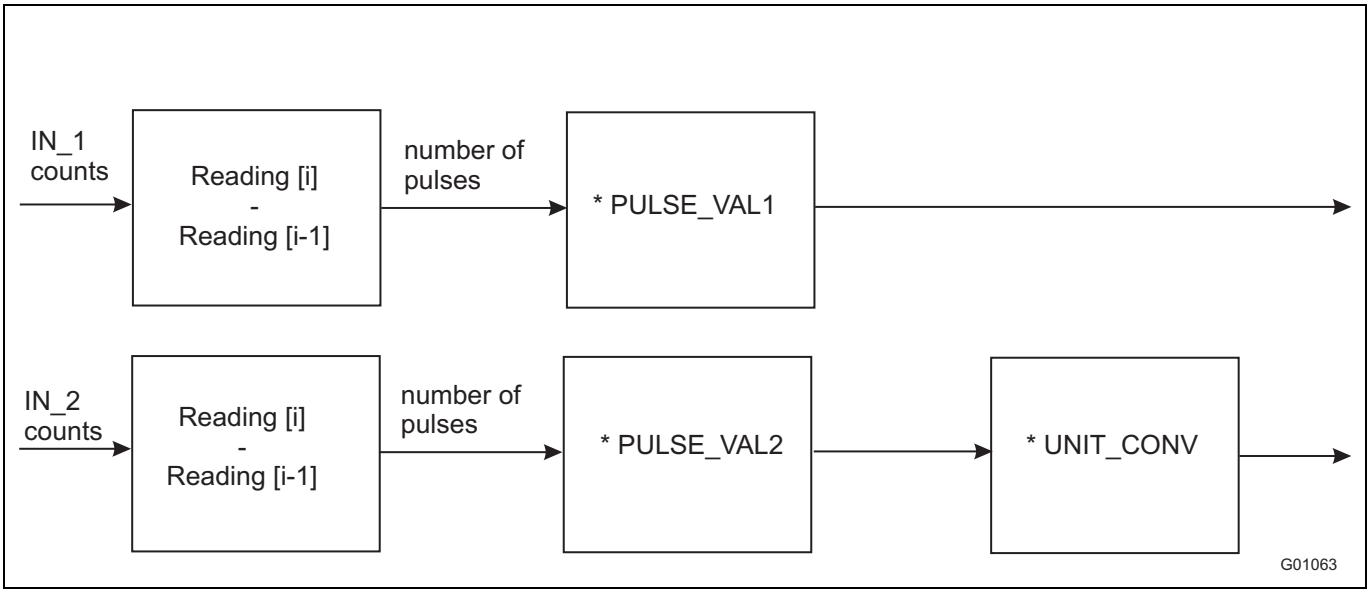


Fig. 12:

First, the difference between the "counts" of the current value and the previous value is calculated. The results are re-scaled to one unit using PULSE_VAL1 and PULSE_VAL2. As the units may be different on the two paths, the unit on the second path is re-scaled to the unit of the first path using UNIT_CONV.

With REV_FLOW1 and REV_FLOW2 (reverse flow) you can change the sign (+ / -).

The delta totalizer values of the first and second path are added up. The total is added up using TOTAL, ATOTAL and RTOTAL according to the following rule:

**TOTAL**

Every value is added to TOTAL with sign, independently of the status.

**ATOTAL**

Every value is added to ATOTAL as an absolute value, independently of the status.

**RTOTAL**

Only values with BAD or UNCERTAIN status (independent of the INTEG_OPTS settings) are added to RTOTAL as absolute values.

**Important (Notice)**

TOTAL and ATOTAL are internal variables in the Integrator Block. They are not included in the list of block parameters. TOTAL is output to the OUT parameter (Index 8).

N_RESET totalizes the number of resets. The values are added up to 999999. Then there is an overflow to 0.

The Integrator Block provides functions for fill operation. In TOTAL_SP the required fill quantity is entered The totalizer can count upwards or downward.

- When counting upwards, the OUT_TRIP output is set if TOTAL is equal to or greater than TOTAL _SP.
- When counting downwards, TOTAL_SP is the starting point. When TOTAL reaches zero, the OUT_TRIP output is set.

PRE_TRIP is a forward total for fill operation.

- When counting upwards and TOTAL is equal to or greater than (TOTAL_SP – PRE_TRIP), the OUT_PTRIP output is set.
- When counting downwards and TOTAL is equal to or smaller than PRE_TRIP, the OUT_PTRIP output is set.

### 4.6.3 Totalizer blocks and internal totalizers of the transmitter

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

The internal totalizers (forward / reverse flow) are available on the AI blocks 2 and 3 and can also be read out cyclically. AI Block 1 can transfer the flow value to the Integrator Block.

The internal totalizers and the Integrator Block are independent of each other, can be set differently (regarding units, mode, etc.) and can also be reset at different times. As a result, the totalizer values may differ.

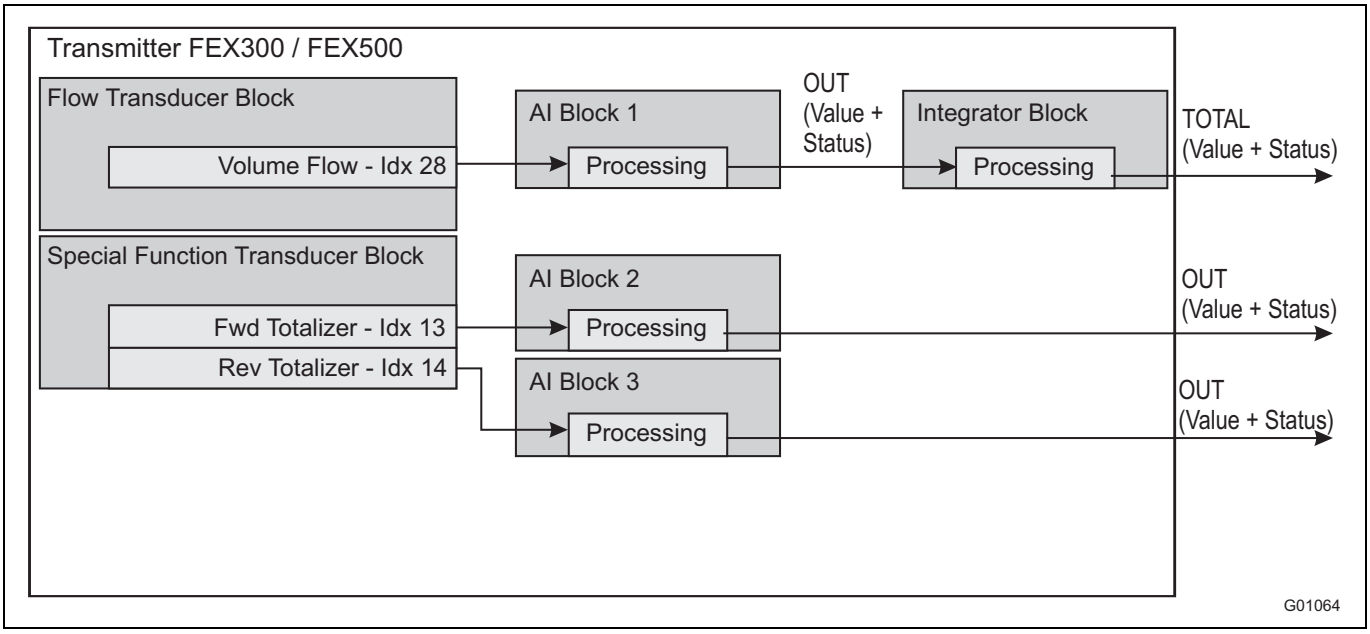


Fig. 13:

### 4.7 Discrete Input Function Block

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

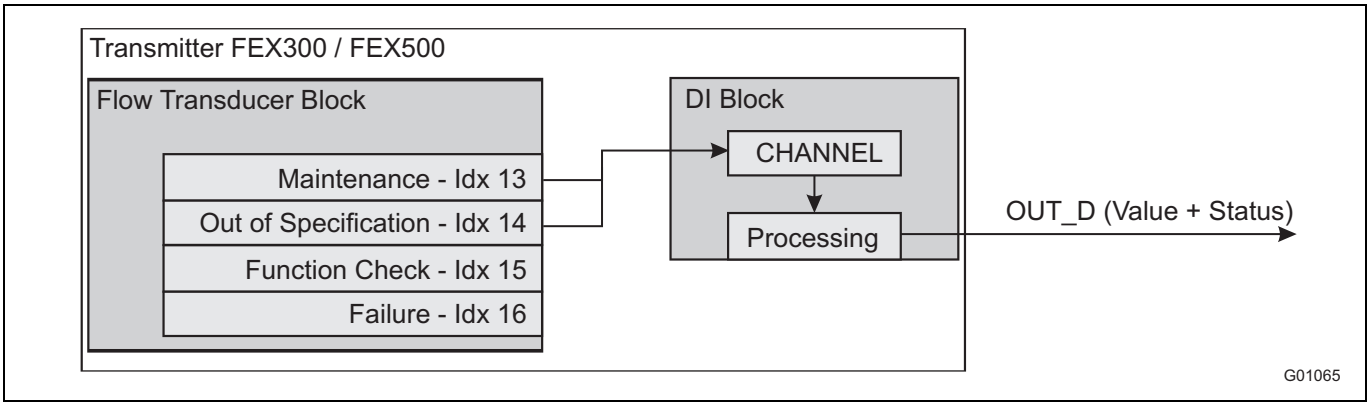


Fig. 14:

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 when any channel is selected, whereas a "Maintenance Alarm" reaches the control system only when a "Maintenance Channel" is selected.

For a detailed description of the existing alarm messages of the transmitter refer to the "Alarm handling" chapter.

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

In the manufacturer-specific profile the transmitter supports a Discrete Output Function Block. It is used for cyclic transfer of binary switching operations from the control system to the transmitter. These start and stop specific transmitter actions like adjustment and others.

The Transducer Block verifies whether the status of the value is "good" or higher. Should the DI switch status be "bad" or "uncertain", the Transducer Block will discard the measured value. The following choice of channels is available for the DO Block.

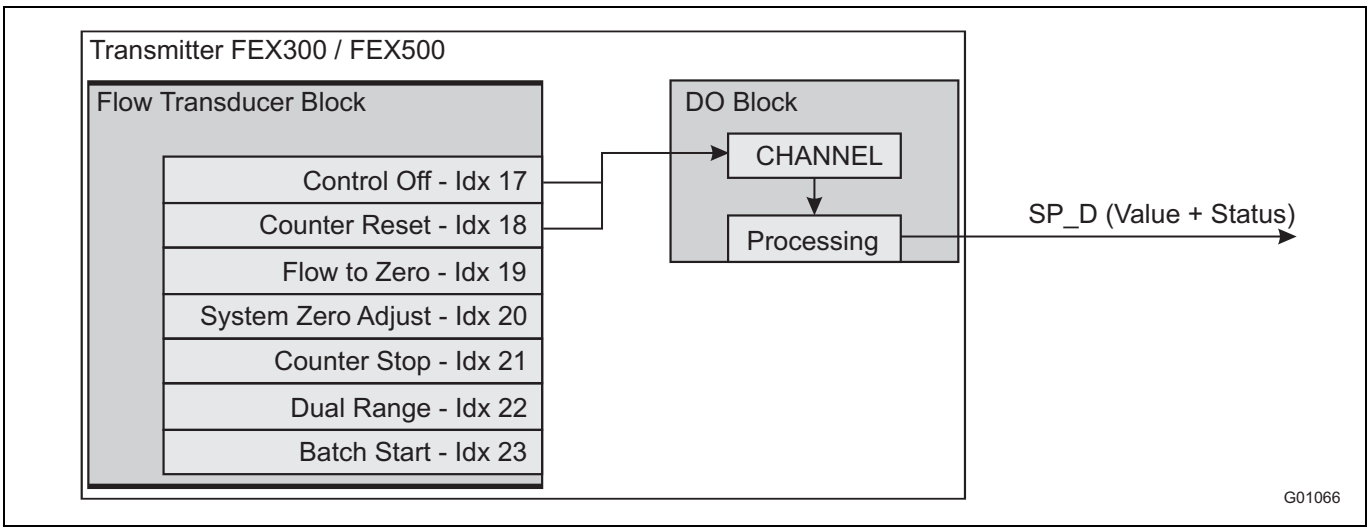


Fig. 15:

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

„0“: Stops the device functionalities
„1“: Starts the 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. The Integrator Block is not reset to zero. |
| DO_PV_FLOW_TO_ZERO | The flow signal is set to zero. |
| DO_PV_SYSTEM_ZERO_ADJUST | Start of system zero. |
| DO_PV_COUNTER_STOP | Stops the integration of the internal totalizers. The Integrator Block is not stopped. |
| DO_PV_DUAL_RANGE | This function is only available for the FEX500 transmitter. Change-over between two measuring ranges (Qmax and Qmax2) |
| DO_PV_BATCH_START | This function is only available for the FEX500 transmitter. Starts a fill operation. |

## 4.9 Transducer Block Standard Parameter

### 4.9.1 Parameter overview

All Transducer Blocks have the same standard parameters at the start of each block.

| Relative index | Parameter name | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|
| 1 | ST_REV | Unsigned 16 | S | 2 | r |
| 2 | TAG_DESC | Octet String | S | 32 | r,w |
| 3 | STRATEGY | Unsigned 16 | S | 2 | r,w |
| 4 | ALERT_KEY | Unsigned 8 | S | 1 | r,w |
| 5 | MODE_BLK | DS-69 | N,D,S,S | 4 | r,w |
| 6 | BLOCK_ERR | Bit String | D | 2 | r |
| 7 | UPDATE_EVT | DS-73 | D | 14 | r,w |
| 8 | BLOCK_ALM | DS-72 | D | 13 | r,w |
| 9 | TRANSDUCER_DIRECTORY | Array of Unsigned 16 | C | 1 | r |
| 10 | TRANSDUCER_TYPE | Unsigned 16 | C | 2 | r |
| 11 | XD_ERROR | Unsigned 8 | D | 1 | r |
| 12 | COLLECTION_DIRECTORY | Array of Unsigned 32 | C | 4 | r |

### 4.9.2 Parameter description

| Parameter name | Description |
|---|---|
| ST_REV | Revision counter for static variables. Each time when a static variable changes, the revision counter is incremented by one. |
| TAG_DESC | A user-defined text description of the application of this block. |
| 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. It can be used in a control system, e.g. for sorting alarms. |
| MODE_BLK | The current, wanted, allowed and normal operating modes of the block. |
| BLOCK_ERR | This parameter indicates errors related to the hardware or configuration of the block. |
| UPDATE_EVT | This event is generated on each change of static data. |
| BLOCK_ALM | The block alarm signals errors and problems in the Transducer Block. |
| TRANSDUCER_DIRECTORY | This directory specifies the number of transducers in the Transducer Block and their start index. |
| TRANSDUCER_TYPE | Specifies the type of the Transducer Block. |
| XD_ERROR | Indicates errors in the Transducer Block. |
| COLLECTION_DIRECTORY | A directory which contains the number, start index and DD Item ID‘s of the available data collections for each transducer in the Transducer Block. |

## 4.10 Flow Transducer Block

### 4.10.1 Contents

The Flow Transducer Block is manufacturer-specific and 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.

### 4.10.2 Parameter overview

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 0 … 12 | Standard block parameter | | | | | |
| 13 | DI_PV_DIAG_MAINTENANCE | Record | DS-66 | D | 2 | r |
| 14 | DI_PV_DIAG_OUT_SPEC | Record | DS-66 | D | 2 | r |
| 15 | DI_PV_DIAG_FUNC_CHECK | Record | DS-66 | D | 2 | r |
| 16 | DI_PV_DIAG_FAILURE | Record | DS-66 | D | 2 | r |
| 17 | DO_PV_CONTROL_OFF | Record | DS-66 | D | 2 | r |
| 18 | DO_PV_COUNTER_RESET | Record | DS-66 | D | 2 | r |
| 19 | DO_PV_FLOW_TO_ZERO | Record | DS-66 | D | 2 | r |
| 20 | DO_PV_SYSTEM_ZERO_ADJUST | Record | DS-66 | D | 2 | r |
| 21 | DO_PV_COUNTER_STOP | Record | DS-66 | D | 2 | r |
| 22 | DO_PV_DUAL_RANGE | Record | DS-66 | D | 2 | r |
| 23 | DO_PV_BATCH_START | Record | DS-66 | D | 2 | r |
| 24 | LOW_FLOW_CUTOFF | Simple | Float | S | 4 | r,w |
| 25 | FLOW_DIRECTION | Simple | Unsigned8 | S | 1 | r,w |
| 26 | ZERO_POINT | Simple | Float | S | 4 | r,w |
| 27 | ZERO_POINT_ADJUST | Simple | Unsigned8 | S | 1 | r,w |
| 28 | VOLUME_FLOW | Record | DS-65 | D | 5 | r |
| 29 | VOLUME_FLOW_UNITS | Simple | Unsigned16 | S | 2 | r,w |
| 30 | FLOW_RATIO | Simple | Float | D | 4 | r |
| 31 | FLOW_VELOCITY | Simple | Float | D | 4 | r |
| 32 | FLOW_VELOCITY_UNITS | Simple | Unsigned16 | S | 2 | r,w |
| 33 | VOLUME_FLOW_USER_UNIT_FACTOR | Simple | Float | S | 4 | r,w |
| 34 | VOLUME_FLOW_USER_UNIT_TYPE | Simple | Unsigned8 | S | 1 | r,w |
| 35 | VOLUME_FLOW_USER_UNIT_STRING | Simple | VisibleString | S | 8 | r,w |
| 36 | SENSOR_LOCATION_TAG | Simple | VisibleString | S | 20 | r,w |
| 37 | SENSOR_TAG | Simple | VisibleString | S | 20 | r,w |
| 38 | TX_LOCATION_TAG | Simple | VisibleString | S | 20 | r,w |
| 39 | TX_TAG | Simple | VisibleString | S | 20 | r,w |
| 40 | Q_MAX | Simple | Float | S | 4 | r,w |
| 41 | Q_MAX2 | Simple | Float | S | 4 | r,w |
| 42 | DUAL_RANGE_SELECTION | Simple | Unsigned8 | S | 1 | r,w |
| 43 | DAMPING | Simple | Float | S | 4 | r,w |
| 44 | DENSITY | Simple | Float | S | 4 | r,w |
| 45 | LOW_FLOW_CUTOFF_HYSTERESIS | Simple | Float | S | 4 | r,w |
| 46 | METER_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 47 | NOISE_REDUCTION | Simple | Unsigned8 | S | 1 | r,w |
| 48 | READ_ONLY_SWITCH | Simple | Unsigned8 | S | 1 | r,w |
| 49 | UZA_ADJ_PROGRESS | Simple | Unsigned8 | D | 1 | r |
| 50 | UZA_ADJ_FAIL_INFO | Simple | Unsigned8 | D | 1 | r |

### 4.10.3 Parameter description

| Parameter name | Description |
|---|---|
| LOW_FLOW_CUTOFF | This is the low flow cutoff value of FEX300 / FEX500. If the flowrate is below the low flow cut-off setting, the flow is not measured.<br>Limits: 0 … 10 % of the set Qmax<br>Factory setting: 1 % |
| MEASUREMENT_MODE | Setting of the measurement direction for the sensor:<br>0: Forward (device measures and totalizes only in forward direction)<br>1: Forward / Reverse (device measures and totalizes in both directions)<br>2: Reverse (device measures and totalizes only in reverse direction)<br>Factory setting: 1 - Forward / Reverse |
| FLOW_DIRECTION | Assignment of a positive or negative sign to the measured value:<br>0: positive<br>1: negative<br>Factory setting: 0: positive |
| ZERO_POINT | This is system zero.<br>Limits: -50.0 mm/s … +50.0 mm/s<br>Factory setting: 0 mm/s |
| ZERO_POINT_ADJUST | System zero adjustment. The valve must be closed. The fluid may not be in motion. The sensor must be filled completely with fluid.<br>0: cancel<br>1: start (starts the adjustment)<br>2: execute (read-only; adjustment in progress)<br>3: ready (read-only; adjustment completed successfully)<br>4: failed (read-only; adjustment failed) |
| ZERO_POINT_UNIT | The unit of system zero is mm/s (unit code: 1062). |
| NOMINAL_SIZE | Nominal size of the sensor in mm or inch. |
| NOMINAL_SIZE_UNITS | Unit for NOMINAL_SIZE:<br>1013: mm<br>1019: inch<br>Factory setting: 1013: mm |
| VOLUME_FLOW | Measured volume flow in set unit. |

<table>
<tr><th>Parameter name</th><th>Description</th></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:
<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>
Factory setting: m³/h</td></tr>
<tr><td>VOLUME_FLOW_LO_LIMIT</td><td>Start of the sensor's flow measurement range. This parameter is always 0.</td></tr>
<tr><td>VOLUME_FLOW_HI_LIMIT</td><td>End of the sensor's flow measurement range.<br>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.<br>See the "Discrete Input Function Block" section.</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="8">Channel selection for the DI Function Block.<br>See section: "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 (Nur bei FEX500)</td></tr>
<tr><td>DO_PV_BATCH_START<br>(Nur bei 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>
</table>

<table>
<tr><th>Parameter name</th><th>Description</th></tr>
<tr><td>FLOW_VELOCITY_UNITS</td><td>Unit of FLOW_VELOCITY. The transmitter supports the following units:
<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>
Factory setting: m/s</td></tr>
<tr><td>VOLUME_FLOW_USER_UNIT_FACTOR</td><td>Factor for the user-specific flow unit. The input is in l/s.<br>Limits: 0,0001 … 100000,0<br>Factory setting: 1</td></tr>
<tr><td>VOLUME_FLOW_USER_UNIT_TYPE</td><td>The type of the user-specific flow unit.<br>6: Volume flow<br>4: Mass flow<br>Factory setting: 6 - 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 number of the flowmeter sensor (shown in the upper left of 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 meter location for the transmitter.</td></tr>
<tr><td>TX_TAG</td><td>Enter the TAG number of the transmitter.</td></tr>
<tr><td>Q_MAX</td><td>Select the flow range for forward and reverse flow.<br>Min. 0 … 0.2 m/s (0 … 0.02 x Qmax DN).<br>Max. 0 … 20 m/s (0 … 2 x Qmax DN)<br>Factory setting: 1 x Qmax DN</td></tr>
<tr><td>Q_MAX2</td><td>Only FEX500:<br>Same configuration as Qmax.</td></tr>
<tr><td>DUAL_RANGE_SELECTION</td><td>Only FEX500:<br>Change-over between Qmax and Qmax2. Can also be done cyclically via the DO Function Block.</td></tr>
<tr><td>DAMPING</td><td>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.<br>Limits: 0.02 … 60 s<br>Factory setting: 30 sec.</td></tr>
</table>

| Parameter name | Description |
|---|---|
| DENSITY | This is the density of the fluid. The parameter is used only if a mass unit has been selected for VOLUME_FLOW. It is also possible to write this parameter cyclically via the AO Function Block.<br>See section: "Analog Output Function Block - Slot 6"<br>Limits: 0.01 ... 5.0 g/cm$^3$<br>Factory setting: 1 g/cm$^3$ |
| LOW_FLOW_CUTOFF_HYSTERESIS | This is the hysteresis for low flow cut-off (LOW_FLOW_CUTOFF).<br>Limits: 0 … 50 %<br>Factory setting: 20 % |
| METER_MODE | Setting of the measurement direction for the sensor:<br>0: Forward / Reverse (device measures and totalizes in both directions)<br>1: Forward (device measures and totalizes only in forward direction)<br>2: Reverse (device measures and totalizes only in reverse direction)<br>Factory setting: 0: Forward / Reverse |
| NOISE_REDUCTION | Activates noise reduction in case of unstable flow signal. Activating noise reduction increases the response time.<br>0: Off<br>1: Mean filter<br>2: Notch filter<br>3: Lowpass V=Auto<br>4: Lowpass V=1<br>Factory setting: Off |
| READ_ONLY_SWITCH | Display 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. |

## 4.11 DeviceInfo Transducer Block

### 4.11.1 Contents

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.

### 4.11.2 Parameter overview

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 0 … 12 | Standard block parameter | | | | | |
| 13 | SENSOR_TYPE | Simple | Unsigned8 | N | 1 | r |
| 14 | SENSOR_SIZE | Simple | Unsigned8 | N | 1 | r |
| 15 | SENSOR_MODEL | Simple | VisibleString | N | 20 | r |
| 16 | SPECIAL_SENSOR_SIZE | Simple | Float | N | 4 | r |
| 17 | Q_MAX_DN | Simple | Float | N | 4 | r |
| 18 | SENSOR_SPAN | Simple | Float | N | 4 | r |
| 19 | SENSOR_ZERO | Simple | Float | N | 4 | r |
| 20 | SENSOR_SPAN_TRIM | Simple | Float | N | 4 | r |
| 21 | MAINS_FREQUENCY | Simple | Unsigned8 | N | 1 | r |
| 22 | EXCITATION_FREQUENCY | Simple | Unsigned8 | N | 1 | r |
| 23 | COIL_CURRENT | Simple | Unsigned8 | N | 1 | r |
| 24 | PRE_AMPLIFIER | Simple | Unsigned8 | N | 1 | r |
| 25 | SENSOR_ID | Simple | VisibleString | N | 8 | r |
| 26 | SENSOR_SAP_ERP_NO | Simple | VisibleString | N | 20 | r |
| 27 | TERM_BOARD_SW | Simple | VisibleString | N | 20 | r |
| 28 | SENSOR_RUN_HOURS | Simple | VisibleString | N | 20 | r |
| 29 | ELECTRODE_MATERIAL | Simple | Unsigned8 | N | 1 | r |
| 30 | LINING_MATERIAL | Simple | Unsigned8 | N | 1 | r |
| 31 | SENSOR_FIRST_CAL_DATE | Simple | VisibleString | N | 20 | r |
| 32 | SENSOR_LAST_CAL_DATE | Simple | VisibleString | N | 20 | r |
| 33 | SENSOR_CAL_CERT_NO | Simple | VisibleString | N | 20 | r |
| 34 | SENSOR_FIRST_CAL_LOCATION | Simple | Unsigned8 | N | 1 | r |
| 35 | SENSOR_LAST_CAL_LOCATION | Simple | Unsigned8 | N | 1 | r |
| 36 | SENSOR_CAL_MODUS | Simple | Unsigned8 | N | 1 | r |
| 37 | SENSOR_CAL_STATUS | Simple | Unsigned8 | N | 1 | r |
| 38 | DEVICE_SW_VERSION | Simple | Unsigned8 | N | 1 | r |
| 39 | SCAN_MASTER_OPTION | Simple | Unsigned8 | N | 1 | r |
| 40 | TX_TYPE | Simple | Unsigned8 | N | 1 | r |
| 41 | TX_SPAN | Simple | Float | N | 4 | r |
| 42 | TX_ZERO | Simple | Float | N | 4 | r |
| 43 | SIMULATOR | Simple | Unsigned8 | N | 1 | r |
| 44 | TX_ID | Simple | VisibleString | N | 8 | r |
| 45 | TX_SAP_ERP_NO | Simple | VisibleString | N | 20 | r |

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 46 | FIRMWARE_VERSION | Simple | VisibleString | N | 20 | r |
| 47 | SOM_FIRMWARE_VERSION | Simple | VisibleString | N | 8 | r |
| 48 | BOOTLOADER_VERSION | Simple | VisibleString | N | 20 | r |
| 49 | TX_RUN_HOURS | Simple | VisibleString | N | 20 | r |
| 50 | TX_FIRST_CAL_DATE | Simple | VisibleString | N | 20 | r |
| 51 | TX_LAST_CAL_DATE | Simple | VisibleString | N | 20 | r |
| 52 | TX_CAL_CERT_NO | Simple | VisibleString | N | 20 | r |
| 53 | TX_FIRST_CAL_LOCATION | Simple | Unsigned8 | N | 1 | r |
| 54 | TX_LAST_CAL_LOCATION | Simple | Unsigned8 | N | 1 | r |
| 55 | MAKER | Simple | VisibleString | N | 20 | r |
| 56 | STREET | Simple | VisibleString | N | 20 | r |
| 57 | CITY | Simple | VisibleString | N | 20 | r |
| 58 | PHONE | Simple | VisibleString | N | 20 | r |
| 59 | RATE_ADC | Simple | Unsigned8 | N | 1 | r |
| 60 | NOISE_RESET_ON | Simple | Unsigned16 | N | 2 | r |
| 61 | NOISE_RESET_MAX | Simple | Unsigned8 | N | 1 | r |
| 62 | DRIVER_DAC | Simple | Unsigned8 | N | 1 | r |
| 63 | LOOP_CONTROL_MODE | Simple | Unsigned8 | N | 1 | r |
| 64 | DIFF_CURRENT_MODE | Simple | Unsigned8 | N | 1 | r |
| 65 | CONTROL_TIMER | Simple | Unsigned16 | N | 2 | r |
| 66 | AMPLIFIER | Simple | Unsigned8 | N | 1 | r |
| 67 | CM_REJECT_VALUE | Simple | Unsigned8 | N | 1 | r |
| 68 | GAIN_1_VALUE | Simple | float | N | 4 | r |
| 69 | GAIN_8_VALUE | Simple | float | N | 4 | r |
| 70 | GAIN_16_VALUE | Simple | float | N | 4 | r |
| 71 | GAIN_32_VALUE | Simple | float | N | 4 | r |

### 4.11.3 Parameter description

<table>
<tr><th>Parameter name</th><th>Description</th></tr>
<tr><td>SENSOR_TYPE</td><td>Display the sensor type (ProcessMaster, HygienicMaster).<br>1: Process 300 series<br>2: Hygienic 300 series<br>5: DE4<br>6: DE2<br>10: Process 500 series<br>11: Hygienic 500 series</td></tr>
<tr><td>SENSOR_SIZE</td><td>Size of sensor.
<table>
<tr><th>Value</th><th>Name</th><th>Value</th><th>Name</th><th>Value</th><th>Name</th><th>Value</th><th>Name</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>The 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 of the mains frequency for the power supply.</td></tr>
<tr><td>EXCITATION_FREQUENCY</td><td>Display the frequency used to operate the magnet coils for the sensor.</td></tr>
<tr><td>COIL_CURRENT</td><td>Display 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 sensor memory 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>
<tr><td>SENSOR_CAL_CERT_NO</td><td>Identification (no.) of the relevant calibration certificate.</td></tr>
<tr><td>SENSOR_FIRST_CAL_LOCATION</td><td>Place of first calibration of the sensor.</td></tr>
<tr><td>SENSOR_LAST_CAL_LOCATION</td><td>Place of last calibration of sensor.</td></tr>
<tr><td>SENSOR_CAL_MODUS</td><td>Calibration mode of the sensor.</td></tr>
<tr><td>SENSOR_CAL_STATUS</td><td>Calibration status of the sensor.</td></tr>
</table>

| Parameter name | Description |
|---|---|
| DEVICE_SW_VERSION | Indicates whether the transmitter is of type FEX300 or FEX500.<br>2: Series 300 FF<br>5: Series 500 FF |
| SCAN_MASTER_OPTION | Indicates whether the transmitter can be operated with ScanMaster.<br>0: ScanMaster support is disabled.<br>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 can be operated on the simulator. |
| TX_ID | ID number of transmitter. |
| TX_SAP_ERP_NO | Order number of transmitter. |
| FIRMWARE_VERSION | Software version of transmitter. |
| SOM_FIRMWARE_VERSION | Software version of communication controller. |
| BOOTLOADER_VERSION | Software version of 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 | |

## 4.12 Special Function Transducer Block

### 4.12.1 Contents

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

### 4.12.2 Parameter overview

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 0 … 12 | Standard Block Parameter | | | | | |
| 13 | FWD_TOTALIZER | Record | DS-65 | D | 5 | r,w |
| 14 | REV_TOTALIZER | Record | DS-65 | D | 5 | r,w |
| 15 | NET_TOTALIZER | Simple | Float | D | 4 | r,w |
| 16 | FWD_TOTALIZER_RESET | Simple | Unsigned8 | D | 1 | w |
| 17 | REV_TOTALIZER_RESET | Simple | Unsigned8 | D | 1 | w |
| 18 | NET_TOTALIZER_RESET | Simple | Unsigned8 | D | 1 | w |
| 19 | ALL_TOTALIZER_RESET | Simple | Unsigned8 | D | 1 | w |
| 20 | TOTALIZER_PULSE_UNITS | Simple | Unsigned16 | S | 2 | r,w |
| 21 | TOTALIZER_PULSE_USER_UNIT_TYPE | Simple | Unsigned8 | S | 1 | r,w |
| 22 | TOTALIZER_PULSE_USER_UNIT_FACTOR | Simple | Float | S | 4 | r,w |
| 23 | TOTALIZER_PULSE_USER_UNIT_STRING | Simple | VisibleString | S | 8 | r,w |
| 24 | TOTALIZER_BATCH_START | Simple | Unsigned8 | D | 1 | w |
| 25 | TOTALIZER_BATCH_STOP | Simple | Unsigned8 | D | 1 | w |
| 26 | TOTALIZER_BATCH_COUNTER_RESET | Simple | Unsigned8 | D | 1 | w |
| 27 | TOTALIZER_BATCH_COUNTER | Simple | Unsigned16 | S | 2 | r |
| 28 | TOTALIZER_BATCH_ACTUAL | Simple | Float | S | 4 | r |
| 29 | TOTALIZER_BATCH_PRESET | Simple | Float | S | 4 | r,w |
| 30 | DIGITAL_OUTPUT_FUNCTION | Simple | Unsigned8 | S | 1 | r,w |
| 31 | LOGIC_SIGNAL_SOURCE | Simple | Unsigned8 | S | 1 | r,w |
| 32 | LOGIC_ACTION | Simple | Unsigned8 | S | 1 | r,w |
| 33 | LOGIC_GENERAL_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 34 | LOGIC_EMPTY_PIPE_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 35 | LOGIC_MIN_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 36 | LOGIC_MAX_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 37 | LOGIC_TFE_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 38 | LOGIC_GAS_BUBBLE_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 39 | LOGIC_ELECTRODE_COATED_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 40 | LOGIC_CONDUCTIVITY_LOW_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 41 | LOGIC_SENSOR_TEMP_ALARM | Simple | Unsigned8 | S | 1 | r,w |
| 42 | PULSE_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 43 | FULLSCALE_FREQUENCY | Simple | Float | S | 4 | r,w |
| 44 | PULSES_PER_UNIT | Simple | Float | S | 4 | r,w |
| 45 | PULSES_PER_UNIT_RANGE_MAX | Simple | Float | N | 4 | r |
| 46 | PULSES_PER_UNIT_RANGE_MIN | Simple | Float | N | 4 | r |
| 47 | PULSE_WIDTH | Simple | Float | S | 4 | r,w |
| 48 | PULSE_WIDTH_RANGE_MAX | Simple | Float | N | 4 | r |
| 49 | PULSE_WIDTH_RANGE_MIN | Simple | Float | N | 4 | r |
| 50 | LIMIT_FREQUENCY | Simple | Float | N | 4 | r |
| 51 | LIMIT_FREQUENCY_RANGE_MAX | Simple | Float | N | 4 | r |
| 52 | LIMIT_FREQUENCY_RANGE_MIN | Simple | Float | N | 4 | r |

### 4.12.3 Parameter description

<table>
<tr><th>Parameter name</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 unit for internal totalizer and fill totalizer.
<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 l.<br>Limits: 0,0001 … 100000,0<br>Factory setting: 1</td></tr>
<tr><td>TOTALIZER_PULSE_USER_UNIT_FACTOR</td><td>The type of the user-specific totalizer unit.<br>0: Volume flow<br>1. Mass flow<br>Factory setting: 0. Volume flow</td></tr>
<tr><td>TOTALIZER_PULSE_USER_UNIT_STRING</td><td>The designation of the user-specific totalizer unit.</td></tr>
<tr><td>TOTALIZER_BATCH_START</td><td>Only FEX500:<br>Starts the fill process.</td></tr>
<tr><td>TOTALIZER_BATCH_STOP</td><td>Only FEX500:<br>Stops the fill process.</td></tr>
<tr><td>TOTALIZER_BATCH_COUNTER_RESET</td><td>Only FEX500:<br>Resets the fill totalizers.</td></tr>
<tr><td>TOTALIZER_BATCH_COUNTER</td><td>Only FEX500:<br>Number of fill processes.</td></tr>
<tr><td>TOTALIZER_BATCH_ACTUAL</td><td>Only FEX500:<br>Quantity already filled.</td></tr>
<tr><td>TOTALIZER_BATCH_PRESET</td><td>Only FEX500:<br>Presetting counter for the fill process.<br>Factory setting: 0 $m^3$</td></tr>
<tr><td>DIGITAL_OUTPUT_FUNCTION</td><td>Selection of functions for digital output DO2.<br>0: Pulse output, forward direction<br>1: Pulse output, reverse direction<br>2: Pulse output, forward and reverse direction<br>3: Digital output. The function of the digital output is determined by the LOGIC_SIGNAL_SOURCE parameter.<br>Factory setting: 0: Pulse output, forward direction</td></tr>
<tr><td>LOGIC_SIGNAL_SOURCE</td><td>Selection of the digital output function:<br>0: No function (DO2 as digital output has no function)<br>1: Forward / Reverse signal (DO2 signals the flow direction)<br>2: Alarm signal (DO2 as alarm output)<br>3: Dual range (only FEX500)<br>4: Batch mode (only FEX500)<br>Factory setting: Forward / Reverse signal</td></tr>
</table>

| Parameter name | Description |
|---|---|
| LOGIC_ACTION | Selection of the switching behavior for the digital output.<br>Factory setting: Normally open |
| LOGIC_GENERAL_ALARM<br>LOGIC_EMPTY_PIPE_ALARM<br>LOGIC_MIN_ALARM<br>LOGIC_MAX_ALARM<br>LOGIC_TFE_ALARM<br>LOGIC_GAS_BUBBLE_ALARM<br>LOGIC_ELECTRODE_COATED_ALARM<br>LOGIC_CONDUCTIVITY_LOW_ALARM<br>LOGIC_SENSOR_TEMP_ALARM | Configuration of alarms that can be signaled via DO2.<br>The prerequisite is that the DIGTAL_OUTPUT_FUNCTION is set to digital output and the LOGIC_SIGNAL_SOURCE is set to alarm signaling.<br>General: All alarms that cannot be added individually.<br>Empty: Pipe: "Empty pipe" detector<br>Min: Flow is lower than the minimum limit value<br>Max: Flow exceeds the maximum limit value<br>TFE: Meter pipe is only partially filled (only if TFE electrode is present)<br>Only FEX500:<br>Gas bubbles: Flow contains gas bubbles.<br>Electrode deposits: Electrode deposits exceed specified limit values.<br>Low conductivity: Conductivity is below the specified limit values.<br>Sensor temperature: The sensor temperature is out of the specified range.<br>0: On<br>1: Off<br>Factory setting: Off |
| PULSE_MODE | Selection of the operating mode for DO2 in pulse mode. There are two operating modes available:<br>0 Pulse mode: In pulse mode, pulses per unit are output. (e.g., 1 pulse per $m^3$).<br>1 Frequency mode: In the frequency mode, a frequency proportional to the flowrate is output. The maximum frequency can be configured according to the flow measurement range.<br>Factory setting: 0: Pulse mode |
| FULLSCALE_FREQUENCY | In frequency mode, the flow range end value corresponding to the frequency is set here.<br>Range: 0.025 … 5250 Hz |
| PULSES_PER_UNIT | Select the number of counting pulses transmitted by the digital output.<br>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.<br>Factory setting: 30 ms<br>Range 0.09 … 2000 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 of the limiting frequency. No selection possible. |
| LIMIT_FREQUENCY_RANGE_MAX | The maximum limiting frequency. |
| LIMIT_FREQUENCY_RANGE_MIN | The minimum limiting frequency. |

## 4.13 Display Transducer Block

### 4.13.1 Contents

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

### 4.13.2 Parameter overview

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 0…12 | Standard Block Parameter | | | | | |
| 13 | LANGUAGE | Simple | Unsigned8 | S | 1 | r,w |
| 14 | PAGE_1_DISPLAY_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 15 | PAGE_1_LINE_1 | Simple | Unsigned8 | S | 1 | r,w |
| 16 | PAGE_1_LINE_2 | Simple | Unsigned8 | S | 1 | r,w |
| 17 | PAGE_1_LINE_3 | Simple | Unsigned8 | S | 1 | r,w |
| 18 | PAGE_1_BARGRAPH | Simple | Unsigned8 | S | 1 | r,w |
| 19 | PAGE_2_DISPLAY_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 20 | PAGE_2_LINE_1 | Simple | Unsigned8 | S | 1 | r,w |
| 21 | PAGE_2_LINE_2 | Simple | Unsigned8 | S | 1 | r,w |
| 22 | PAGE_2_LINE_3 | Simple | Unsigned8 | S | 1 | r,w |
| 23 | PAGE_2_BARGRAPH | Simple | Unsigned8 | S | 1 | r,w |
| 24 | PAGE_3_DISPLAY_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 25 | PAGE_3_LINE_1 | Simple | Unsigned8 | S | 1 | r,w |
| 26 | PAGE_3_LINE_2 | Simple | Unsigned8 | S | 1 | r,w |
| 27 | PAGE_3_LINE_3 | Simple | Unsigned8 | S | 1 | r,w |
| 28 | PAGE_3_BARGRAPH | Simple | Unsigned8 | S | 1 | r,w |
| 29 | PAGE_4_DISPLAY_MODE | Simple | Unsigned8 | S | 1 | r,w |
| 30 | PAGE_4_LINE_1 | Simple | Unsigned8 | S | 1 | r,w |
| 31 | PAGE_4_LINE_2 | Simple | Unsigned8 | S | 1 | r,w |
| 32 | PAGE_4_LINE_3 | Simple | Unsigned8 | S | 1 | r,w |
| 33 | PAGE_4_BARGRAPH | Simple | Unsigned8 | S | 1 | r,w |
| 34 | CONTRAST | Simple | Unsigned8 | S | 1 | r,w |
| 35 | DECIMAL_PLACES_FLOWRATE | Simple | Unsigned8 | S | 1 | r,w |
| 36 | DECIMAL_PLACES_VOLUME | Simple | Unsigned8 | S | 1 | r,w |
| 37 | AUTOSCROLL | Simple | Unsigned8 | S | 1 | r,w |
| 38 | DATE_FORMAT | Simple | Unsigned8 | S | 1 | r,w |

### 4.13.3 Parameter description

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

| Parameter name | Description |
|---|---|
| PAGE_1_LINE_2 | See PAGE_1_LINE_1 |
| PAGE_1_LINE_3 | See PAGE_1_LINE_1 |
| PAGE_1_BARGRAPH | The bargraph configuration for FF is fixed to Q in %. |
| PAGE_2_DISPLAY_MODE | See description of PAGE_1_DISPLAY_MODE |
| PAGE_2_LINE_1 | See PAGE_1_LINE_1 |
| PAGE_2_LINE_2 | See PAGE_1_LINE_1 |
| PAGE_2_LINE_3 | See PAGE_1_LINE_1 |
| PAGE_2_BARGRAPH | The bargraph configuration for FF is fixed to Q in %. |
| PAGE_3_DISPLAY_MODE | See description of PAGE_1_DISPLAY_MODE |
| PAGE_3_LINE_1 | See PAGE_1_LINE_1 |
| PAGE_3_LINE_2 | See PAGE_1_LINE_1 |
| PAGE_3_LINE_3 | See PAGE_1_LINE_1 |
| PAGE_3_BARGRAPH | The bargraph configuration for FF is fixed to Q in %. |
| PAGE_4_DISPLAY_MODE | See description of PAGE_1_DISPLAY_MODE |
| PAGE_4_LINE_1 | See PAGE_1_LINE_1 |
| PAGE_4_LINE_2 | See PAGE_1_LINE_1 |
| PAGE_4_LINE_3 | See PAGE_1_LINE_1 |
| PAGE_4_BARGRAPH | The bargraph configuration for FF is fixed to Q in %. |
| CONTRAST | Adjust the contrast of the LCD display.<br>0 … 100<br>Factory setting: 50 |
| DECIMAL_PLACES_FLOWRATE | Setting of the decimal places for the flow indicator and for the flow totalizer:<br>0: x<br>1: x.x<br>2: x.xx<br>3: x.xxx<br>4: x.xxxx<br>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 appear on the LCD window in ten-second intervals.<br>0: On<br>1: Off<br>Factory setting: On |
| DATE_FORMAT | Setting of the display format for the date and time.<br>0: DD-MM-YYYY<br>1: MM-DDYYYY<br>2: YYYY-MM-DD<br>Factory setting: YYYY-MM-DD |

## 4.14 Diagnostics Transducer Block

### 4.14.1 Contents

The transmitter has functions for process diagnostics. The functions are incorporated in the Diagnostics Transducer Block.

### 4.14.2 Parameter overview

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 0 … 12 | Standard Block Parameter | | | | | |
| 13 | SNR_VALUE | Simple | Float | D | 4 | r |
| 14 | REFERENCE | Simple | Unsigned32 | D | 4 | r |
| 15 | SIGNAL_RATIO | Simple | Unsigned16 | D | 2 | r |
| 16 | SIGNAL_MAX | Simple | Unsigned16 | D | 2 | r |
| 17 | SIGNAL_MIN | Simple | Unsigned16 | D | 2 | r |
| 18 | SIGNAL_ERROR | Simple | Unsigned16 | D | 2 | r |
| 19 | NV_RESETS | Simple | Unsigned16 | D | 2 | r |
| 20 | AMPLIFICATION_INTERNAL | Simple | Unsigned8 | D | 1 | r |
| 21 | EMPTY_PIPE_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 22 | EMPTY_PIPE_THRESHOLD | Simple | Unsigned16 | S | 2 | r,w |
| 23 | EMPTY_PIPE_DETECTOR | Simple | Float | D | 4 | r |
| 24 | EMPTY_PIPE_ADJ_START | Simple | Unsigned8 | D | 1 | w |
| 25 | EMPTY_PIPE_ADJ_PROGRESS | Simple | Unsigned8 | D | 1 | r |
| 26 | EMPTY_PIPE_ADJ_FAIL_INFO | Simple | Unsigned8 | D | 1 | r |
| 27 | EMPTY_PIPE_MAN_ADJ_FULL | Simple | Unsigned8 | D | 1 | r,w |
| 28 | TFE_ELECTRODE_AVAILABLE | Simple | Unsigned8 | N | 1 | r |
| 29 | TFE_DETECTION_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 30 | TFE_THRESHOLD | Simple | Unsigned16 | S | 2 | r,w |
| 31 | TFE_ADJ_START | Simple | Unsigned8 | D | 1 | w |
| 32 | TFE_ADJ_PROGRESS | Simple | Unsigned8 | D | 1 | r |
| 33 | TFE_ADJ_FAIL_INFO | Simple | Unsigned8 | D | 1 | r |
| 34 | TFE_DETECTOR | Simple | Unsigned16 | D | 2 | r |
| 35 | SIL_DIAG_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 36 | SENSOR_MEASURE_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 37 | SENSOR_TEMP_CALIB | Simple | Float | S | 4 | r,w |
| 38 | SENSOR_TEMPERATURE | Simple | DS-65 | D | 5 | r |
| 39 | SENSOR_CABLE_LENGTH | Simple | Float | S | 4 | r,w |
| 40 | SENSOR_TEMP_MAX_ALARM | Simple | Float | S | 4 | r,w |
| 41 | SENSOR_TEMP_MIN_ALARM | Simple | Float | S | 4 | r,w |
| 42 | COIL_CURRENT_VALUE | Simple | Float | D | 4 | r |
| 43 | COIL_RESISTOR | Simple | Float | D | 4 | r |
| 44 | COIL_VOLTAGE | Simple | Float | D | 4 | r |
| 45 | COIL_RESISTOR_MAX_ALARM | Simple | Float | S | 4 | r,w |

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 46 | COIL_RESISTOR_MIN_ALARM | Simple | Float | S | 4 | r,w |
| 47 | GAS_BUBBLE_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 48 | GAS_BUBBLE_VALUE | Record | Float | D | 4 | r |
| 49 | GAS_BUBBLE_THRESHOLD | Simple | Float | S | 4 | r,w |
| 50 | GAS_BUBBLE_ADJ_START | Simple | Unsigned8 | D | 1 | w |
| 51 | GAS_BUBBLE_ADJ_PROGRESS | Simple | Unsigned8 | D | 1 | r |
| 52 | GAS_BUBBLE_ADJ_FAIL_INFO | Simple | Unsigned8 | D | 1 | r |
| 53 | COATING_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 54 | COATING_INFORMATION | Simple | Unsigned8 | D | 1 | r |
| 55 | COATING_VALUE_QE1 | Simple | Float | D | 4 | r |
| 56 | COATING_VALUE_AE1 | Simple | Float | D | 4 | r |
| 57 | COATING_VALUE_QE2 | Simple | Float | D | 4 | r |
| 58 | COATING_VALUE_AE2 | Simple | Float | D | 4 | r |
| 59 | COATING_QE_MAX_ALARM | Simple | Float | S | 4 | r,w |
| 60 | COATING_QE_MIN_ALARM | Simple | Float | S | 4 | r,w |
| 61 | CONDUCTIVITY_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 62 | CONDUCTIVITY_VALUE | Record | DS-65 | D | 5 | r |
| 63 | CONDUCTIVITY_ADJ_VALUE | Simple | Float | S | 4 | r,w |
| 64 | CONDUCTIVITY_MAX_ALARM | Simple | Float | S | 4 | r,w |
| 65 | CONDUCTIVITY_MIN_ALARM | Simple | Float | S | 4 | r,w |
| 66 | ELEC_IMP_E1_GND | Simple | Float | D | 4 | r |
| 67 | ELEC_IMP_E2_GND | Simple | Float | D | 4 | r |
| 68 | ELEC_IMP_MAX_ALARM | Simple | Float | S | 4 | r,w |
| 69 | ELEC_IMP_MIN_ALARM | Simple | Float | S | 4 | r,w |
| 70 | GROUND_CHECK_START | Simple | Unsigned8 | D | 1 | w |
| 71 | GROUND_CHECK_PROGRESS | Simple | Unsigned8 | D | 1 | r |
| 72 | GROUND_CHECK_FREQ1 | Simple | Float | D | 4 | r |
| 73 | GROUND_CHECK_FREQ2 | Simple | Float | D | 4 | r |
| 74 | GROUND_CHECK_FREQ3 | Simple | Float | D | 4 | r |
| 75 | GROUND_CHECK_FREQ4 | Simple | Float | D | 4 | r |
| 76 | GROUND_CHECK_AMP1 | Simple | Float | D | 4 | r |
| 77 | GROUND_CHECK_AMP2 | Simple | Float | D | 4 | r |
| 78 | GROUND_CHECK_AMP3 | Simple | Float | D | 4 | r |
| 79 | GROUND_CHECK_AMP4 | Simple | Float | D | 4 | r |
| 80 | GROUND_CHECK_POW_SPEC | Simple | Float | D | 4 | r |
| 81 | LOGGER_CONDUCTIVITY | Array | Unsigned16 | N | 24 | r |
| 82 | LOGGER_COATING_QE1 | Array | Integer16 | N | 24 | r |
| 83 | LOGGER_COATING_QE2 | Array | Integer16 | N | 24 | r |
| 84 | LOGGER_ON_OFF | Simple | Unsigned8 | S | 1 | r,w |
| 85 | LOGGER_LOG_TIME | Simple | Unsigned16 | S | 2 | r,w |

| Relative index | Parameter name | Object type | Data Type | Store | Bytes | Access |
|---|---|---|---|---|---|---|
| 86 | SIMULATION_MODE | Simple | Unsigned8 | D | 1 | r,w |
| 87 | SIM_FLOW_VELOCITY | Simple | Float | D | 4 | r,w |
| 88 | SIM_VOLUME_FLOW | Simple | Float | D | 4 | r,w |
| 89 | SIM_FLOW_RATIO | Simple | Float | D | 4 | r,w |
| 90 | SIM_PULSE_FREQ | Simple | Float | D | 4 | r,w |
| 91 | SIM_LOGIC_COMMAND | Simple | Unsigned8 | D | 1 | r,w |
| 92 | OUTPUT_FREQ | Simple | Float | D | 4 | r |
| 93 | OUTPUT_LOGIC | Simple | Unsigned8 | D | 1 | r |
| 94 | SIM_FLOW_VELOCITY_RANGE_MAX | Simple | Float | N | 4 | r |
| 95 | SIM_FLOW_VELOCITY_RANGE_MIN | Simple | Float | N | 4 | r |
| 96 | FLOW_VELOCITY_RANGE_MAX | Simple | Float | N | 4 | r |
| 97 | FLOW_VELOCITY_RANGE_MIN | Simple | Float | N | 4 | r |
| 98 | SIM_VOLUME_FLOW_RANGE_MAX | Simple | Float | N | 4 | r |
| 99 | SIM_VOLUME_FLOW_RANGE_MIN | Simple | Float | N | 4 | r |
| 100 | VOLUME_FLOW_RANGE_MAX | Simple | Float | N | 4 | r |
| 101 | VOLUME_FLOW_RANGE_MIN | Simple | Float | N | 4 | r |
| 102 | MAX_FLOWRATE_ALARM | Simple | Float | S | 4 | r,w |
| 103 | MAX_FLOWRATE_ALARM_RANGE_MAX | Simple | Float | N | 4 | r |
| 104 | MAX_FLOWRATE_ALARM_RANGE_MIN | Simple | Float | N | 4 | r |
| 105 | MIN_FLOWRATE_ALARM | Simple | Float | S | 4 | r,w |
| 106 | MIN_FLOWRATE_ALARM_RANGE_MAX | Simple | Float | N | 4 | r |
| 107 | MIN_FLOWRATE_ALARM_RANGE_MIN | Simple | Float | N | 4 | r |

### 4.14.3 Parameter description

| Parameter name | Description |
|---|---|
| SNR_VALUE | Signal-to-noise ratio |
| REFERENCE | The measured reference. |
| SIGNAL_RATIO | The ratio of "Signal max." to "Signal min." 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 Detector" function (only for sizes ≥ DN 10 and without preamplifier).<br>An entirely full measuring tube is essential for an accurate measurement. The "Empty Pipe Detection" function detects the empty pipe.<br>0: Off<br>1: On<br>Factory setting: Off |
| EMPTY_PIPE_THRESHOLD | Setting of the threshold for tripping the empty pipe alarm.<br>Limits: 100 … 60000 Hz<br>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.<br>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 Detector function. |
| TFE_ELECTRODE_AVAILABLE | Information about the presence of the TFE electrode.<br>0: Sensor without TFE electrode.<br>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:<br>0: Off<br>1: On<br>Factory setting: Off |
| TFE_THRESHOLD | Setting of the threshold for tripping the TFE alarm (partially filled pipe).<br>Limits: 1 … 10000<br>Factory setting: 5000 |
| TFE_ADJ_START | Automatic adjustment of the Partially Filled Pipe Detection function.<br>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 name | Description |
|---|---|
| SIL_DIAG_ON_OFF | Only FEX500:<br>Switch-on of the input circuit check.<br>0: Off<br>1: On<br>Factory setting: Off |
| SENSOR_MEASURE_ON_OFF | Switch-on of the sensor check functions, e.g. for the coil voltage, resistance and sensor temperature.<br>0: Off<br>1: On<br>Factory setting: Off |
| SENSOR_TEMP_CALIB | Only FEX500:<br>Calibration value for the coil temperature measurement. |
| SENSOR_TEMPERATURE | Only FEX500:<br>Measured sensor temperature value. |
| SENSOR_CABLE_LENGTH | Only FEX500:<br>Cable length between sensor and transmitter. |
| SENSOR_TEMP_MAX_ALARM | Only FEX500:<br>High limit for the sensor temperature alarm. |
| SENSOR_TEMP_MIN_ALARM | Only FEX500:<br>Low limit for the sensor temperature alarm. |
| COIL_CURRENT_VALUE | Currently measured coil current. |
| COIL_RESISTOR | Only with enabled sensor check function.<br>Currently measured coil resistance. |
| COIL_VOLTAGE | Only with enabled sensor check function.<br>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:<br>Switch-on of the Gas Bubble Detection function.<br>0: Off<br>1: On<br>Factory setting: Off |
| GAS_BUBBLE_VALUE | Only FEX500:<br>Measured gas bubble value. |
| GAS_BUBBLE_THRESHOLD | Only FEX500:<br>Setting of the threshold for tripping the gas bubble alarm.<br>Limits: 0,01 … 100000<br>Factory setting: 200 |
| GAS_BUBBLE_ADJ_START | Only FEX500:<br>Automatic adjustment of the Gas Bubble Detection function.<br>Start the adjustment with 1. |
| GAS_BUBBLE_ADJ_PROGRESS | Only FEX500:<br>Progress information about the adjustment of the Gas Bubble Detection function. |
| GAS_BUBBLE_ADJ_FAIL_INFO | Only FEX500:<br>Status information about the adjustment of the Gas Bubble Detection function. |

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

| Parameter name | 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 four 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:<br>Logger for the fluid conductivity (up to 12 measured values). |
| LOGGER_COATING_QE1 | Only FEX500:<br>Logger for deposit detection on electrode E1<br>(up to 12 measured values). |
| LOGGER_COATING_QE2 | Only FEX500:<br>Logger for deposit detection on electrode E1<br>(up to 12 measured values). |
| LOGGER_ON_OFF | Only FEX500:<br>Switch-on of measured value logger. Up to 12 measured values can be stored.<br>0: Off<br>1: On<br>Factory setting: Off |
| LOGGER_LOG_TIME | Only FEX500:<br>Configuration of the logging time.<br>Limits: 0 … 1460 h<br>Factory setting: 1 h |
| SIMULATION_MODE | Setting of the device simulation.<br>0: Off<br>1: Flow velocity<br>2: Flowrate (Q) in unit<br>3: Flowrate (Q) in %<br>6: Frequency on DO2<br>8: Switch output on DO2 |
| SIM_FLOW_VELOCITY | Simulation value for the flow velocity.<br>Limits:<br>SIM_FLOW_VELOCITY_RANGE_MIN …<br>SIM_FLOW_VELOCITY_RANGE_MAX<br>Factory setting: 0 m/s |
| SIM_VOLUME_FLOW | Simulation value for the flowrate (Q) in unit.<br>Limits:<br>SIM_FLOW_VOLUME_RANGE_MIN …<br>SIM_FLOW_VOLUME_RANGE_MAX<br>Factory setting: 0 $m^3/h$ |

| Parameter name | Description |
|---|---|
| SIM_FLOW_RATIO | Simulation value for the flowrate (Q) in %.<br>Limits: -200 … 200%<br>Factory setting: 0 % |
| SIM_PULSE_FREQ | Simulation value for the frequency on DO2.<br>Limits: 0 … 5250 Hz (The maximum limit depends on the pulse width).<br>Factory setting: 0 Hz |
| SIM_LOGIC_COMMAND | Simulation value for the switch output.<br>0: Off<br>1: On<br>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 | |

### 4.15 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.

| Data structure | Description |
|---|---|
| Type | Block |
| Size | 14 bytes |
| Description | 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

## 5.1 Field Diagnostics Profile

The alarm handling is based on the FF Specification FF-912: "Field Diagnostics Profile", but does not fully comply with it. The following chart shows the flow:

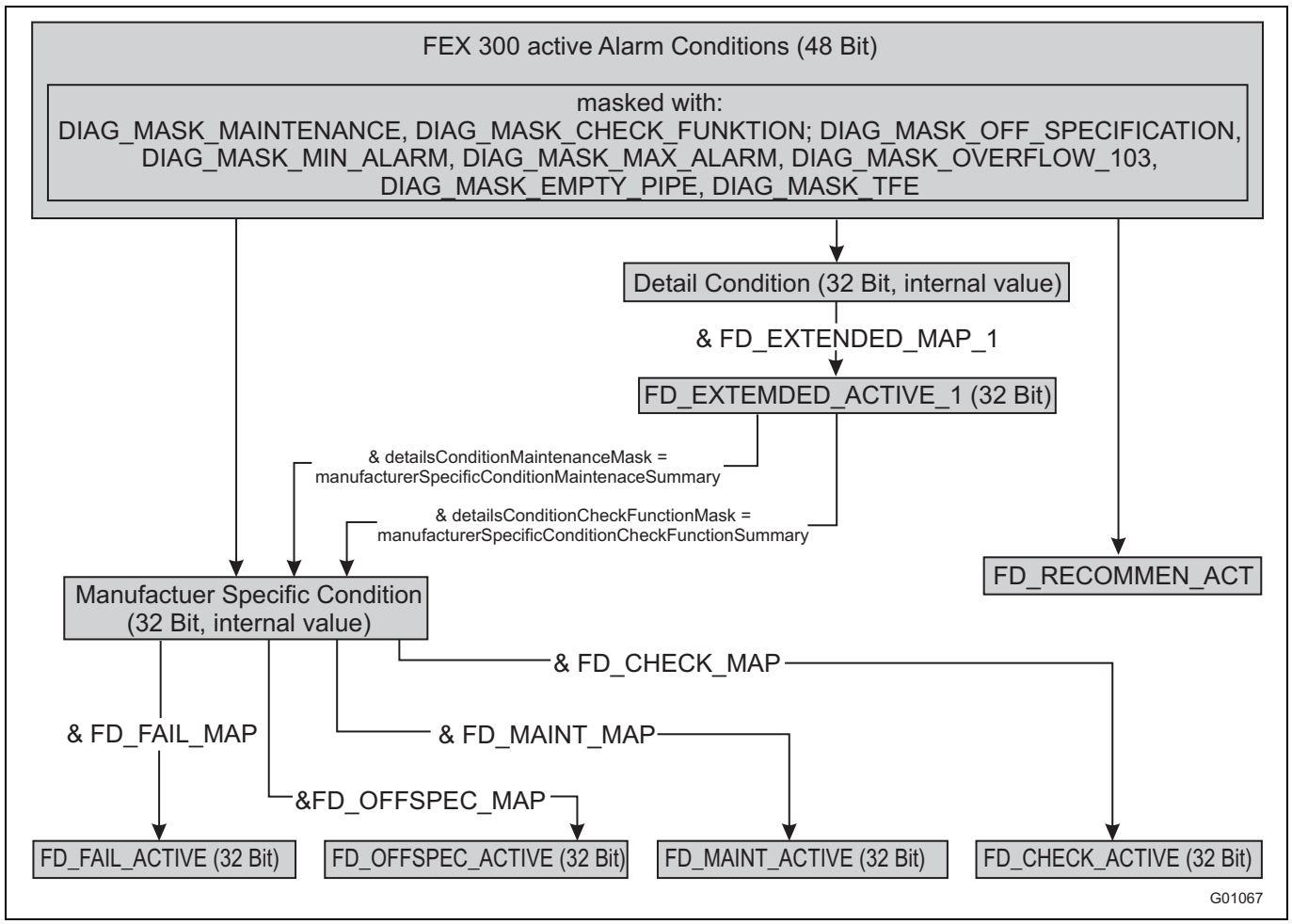


Fig. 16:

In the HART variant, the transmitter has 48 error messages (active alarm conditions). They can be masked already in the HART variant (DIAG_MASK_...) in order to suppress specific error messages.

The "Field Diagnostics Profile" provides a 32-bit register of "Manufacturer Specific Conditions" for the manufacturer-specific error messages. In the event that 32 bits should not be sufficient, the profile provides additional "FD_EXTENDED_ACTIVE_..." registers (of 32 bits, each). Their content can be masked via "FD_EXTENDED_MAP…". The FEX300 / FEX500 has one of these registers, each.

Summaries of the content for FD_EXTENDED_ACTIVE_1 are mapped to one bit in the "Manufacturer Specific Conditions" register, each.

The "Field Diagnostics Profile" has four "FD_..._ACTIVE" registers in accordance with the four error categories of Namur NE-107. Four "FD_..._MAP" masks are used to define which errors from the "Manufacturer Specific Conditions" register are to be copied into which error category.

FD_RECOMMEN_ACT also comes from the "Field Diagnostics Profile". It shows the recommended action to be taken against errors with the currently highest priority.

## 5.2 Alarm Overview

The following tables list the device-specific alarms. Every alarm is assigned to an alarm group (in accordance with Namur) and to a priority. The simulation value specifies which value must be written into the DIAG_ALARM_SIMULATION parameter in order to simulate an alarm.

### 5.2.1 Manufacturer Specific Conditions

| Bit in bit string | Description | NAMUR Class | Priority | Alarm ID | Alarm simulation value |
|---|---|---|---|---|---|
| 0 | Maintenance requirements summary | MAINTENANCE | 80 | 12 | 13 |
| 1 | Funtional test summary | CHECK_FUNCTION | 90 | 14 | 15 |
| 2 | Pulse output limited | OFF_SPECIFICATION | 108 | 44 | 40 |
| 3 | Not calibrated | OFF_SPECIFICATION | 110 | 35 | 35 |
| 4 | Electrode noise signal | OFF_SPECIFICATION | 120 | 23 | 24 |
| 5 | Electrode voltage | OFF_SPECIFICATION | 122 | 26 | 27 |
| 6 | Electrode impedance too high | OFF_SPECIFICATION | 124 | 29 | 30 |
| 7 | Electrode balance | OFF_SPECIFICATION | 128 | 28 | 29 |
| 8 | Low "Flow" alarm | OFF_SPECIFICATION | 132 | 5 | 6 |
| 9 | High "Flow" alarm | OFF_SPECIFICATION | 136 | 6 | 7 |
| 10 | Flow > 103 % | OFF_SPECIFICATION | 140 | 7 | 8 |
| 11 | Housing temperature too high | OFF_SPECIFICATION | 141 | 46 | 46 |
| 12 | Conductivity alarm | OFF_SPECIFICATION | 142 | 41 | 42 |
| 13 | Electrode deposit alarm | OFF_SPECIFICATION | 143 | 42 | 43 |
| 14 | Partially filled pipe (TFE) | OFF_SPECIFICATION | 144 | 33 | 45 |
| 15 | Gas bubble alarm | OFF_SPECIFICATION | 146 | 43 | 44 |
| 16 | Empty pipe | OFF_SPECIFICATION | 148 | 25 | 26 |
| 17 | Coil resistance | OFF_SPECIFICATION | 149 | 21 | 22 |
| 18 | AD converter overloaded | FAILURE | 226 | 19 | 20 |
| 19 | "Coil circuit" error | FAILURE | 228 | 20 | 21 |
| 20 | Reference voltage Uref = 0 | FAILURE | 232 | 22 | 23 |
| 21 | DC too high | FAILURE | 236 | 24 | 25 |
| 22 | "Internal voltage" error | FAILURE | 244 | 31 | 32 |
| 23 | Stack EEPROM | FAILURE | 245 | 47 | 47 |
| 24 | "Digital potentiometer" error | FAILURE | 246 | 32 | 33 |
| 25 | Incompatible calibration mode | FAILURE | 248 | 36 | 36 |
| 26 | | | | | |
| 27 | "FRAM communication" error | FAILURE | 250 | 16 | 17 |
| 28 | SIL | FAILURE | 251 | 40 | 41 |
| 29 | No SensorMemory | FAILURE | 252 | 17 | 18 |
| 30 | ROM error | FAILURE | 253 | 37 | 37 |
| 31 | RAM error | FAILURE | 254 | 38 | 38 |

### 5.2.2 Details conditions

| Bit in bit string | Description | NAMUR Class | Priority | Alarm ID | Alarm simulation value |
|---|---|---|---|---|---|
| 0 | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| 11 | | | | | |
| 12 | | | | | |
| 13 | "Non-volatile memory" general alarm | MAINTENANCE | 99 | 27 | 28 |
| 14 | Display value < 1600 h | MAINTENANCE | 80 | 12 | 13 |
| 15 | "Sensor communication" error | MAINTENANCE | 90 | 14 | 15 |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | | | | |
| 19 | | | | | |
| 20 | | | | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | Simulation of "Logic on DO1" | CHECK_FUNCTION | 168 | 1 | 2 |
| 24 | Simulation of "Pulse on DO1" | CHECK_FUNCTION | 174 | 2 | 3 |
| 25 | External totalizer reset | CHECK_FUNCTION | 175 | 13 | 14 |
| 26 | External totalizer stop | CHECK_FUNCTION | 176 | 11 | 12 |
| 27 | Flow simulation | CHECK_FUNCTION | 182 | 8 | 9 |
| 28 | External output switch-off | CHECK_FUNCTION | 184 | 10 | 11 |
| 29 | Hold last value | CHECK_FUNCTION | 185 | 30 | 31 |
| 30 | Converter on simulator | CHECK_FUNCTION | 186 | 9 | 10 |
| 31 | An alarm is being simulated | CHECK_FUNCTION | 190 | 45 | -- |

If a MAINTENANCE bit is set here, bit 0 is set as a summary in the "Manufacturer Specific Conditions" register.

If a CHECK_FUNCTION bit is set here, bit 1 is set as a summary in the "Manufacturer Specific Conditions" register.

### 5.3 Error mapping to status

The transducer blocks provide the measured values for the function block. They consist of a data structure with value and status. The status reaches the function blocks which react according to their settings and FF specifications and calculate their value and status and cyclically communicate them outside.

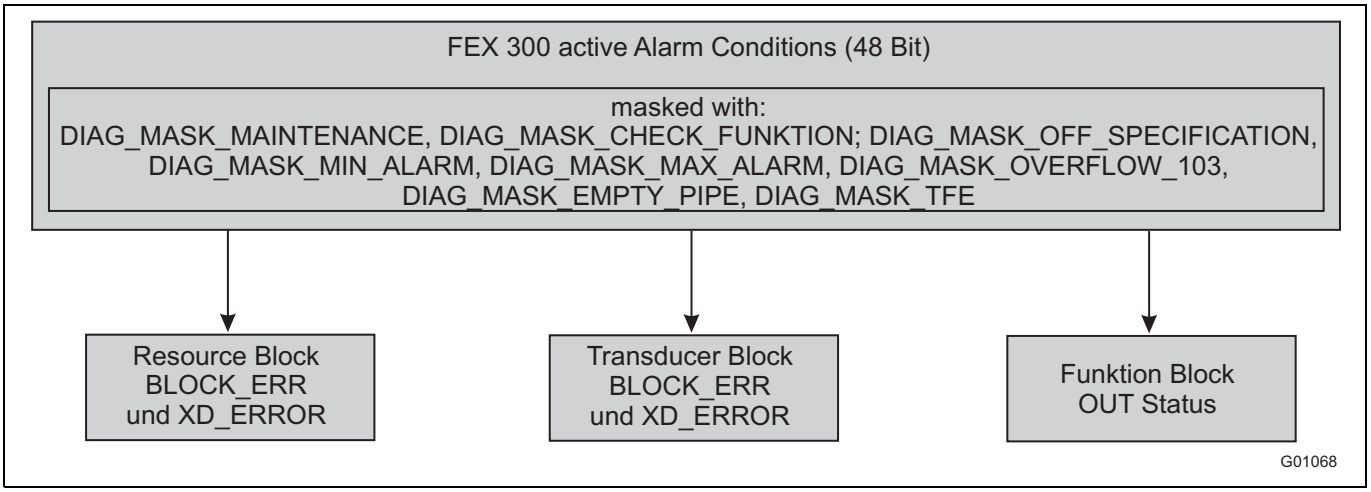


Fig. 17:

### 5.3.1 Mapping table

| Description | Volume flow | Fwd. / rev. totalizer | Conductivity / Temperature |
|---|---|---|---|
| Pulse output limited | Good(nc) | Good(nc) | Good(nc) |
| Not calibrated | Uncertain | Uncertain | Uncertain |
| Electrode noise signal | Uncertain, eu range viol. | Uncertain, eu range viol. | Uncertain, eu range viol. |
| Electrode voltage | Uncertain, eu range viol. | Uncertain, eu range viol. | Uncertain, eu range viol. |
| Electrode impedance too high | Uncertain | Uncertain | Uncertain |
| Electrode balance | Uncertain | Uncertain | Uncertain |
| Low. "flow" alarm | Good(nc), low limit | Good(nc), low limit | Good(nc), low limit |
| High "flow" alarm | Good(nc), high limit | Good(nc), high limit | Good(nc), high limit |
| Flow > 103 % | Good(nc), high limit | Good(nc), high limit | Good(nc), high limit |
| Housing temperature too high | Uncertain | Uncertain | Uncertain |
| Conductivity alarm | Bad, device failure | Bad, device failure | Bad, device failure |
| Electrode deposit alarm | Bad, device failure | Bad, device failure | Bad, device failure |
| Partially filled pipe (TFE) | Uncertain | Uncertain | Uncertain |
| Gas bubble alarm | Bad, device failure | Bad, device failure | Bad, device failure |
| Empty pipe | Uncertain | Uncertain | Uncertain |
| Coil resistance | Uncertain, eu range viol. | Uncertain, eu range viol. | Uncertain, eu range viol. |
| AD converter overloaded | Bad, device failure | Bad, device failure | Bad, device failure |
| "Coil circuit" error | Bad, device failure | Bad, device failure | Bad, device failure |
| Reference voltage Uref = 0 | Bad, device failure | Bad, device failure | Bad, device failure |
| DC too high | Bad, device failure | Bad, device failure | Bad, device failure |
| "Internal voltage" error | Bad, device failure | Bad, device failure | Bad, device failure |
| Stack EEPROM | Bad, device failure | Bad, device failure | Bad, device failure |
| "Digital potentiometer" error | Bad, device failure | Bad, device failure | Bad, device failure |
| Incompatible calibration mode | Bad, device failure | Bad, device failure | Bad, device failure |
| "FRAM communication" error | Bad, device failure | Bad, device failure | Bad, device failure |
| SIL | Bad, device failure | Bad, device failure | Bad, device failure |
| No SensorMemory | Bad, device failure | Bad, device failure | Bad, device failure |
| ROM error | Bad, device failure | Bad, device failure | Bad, device failure |
| RAM error | Bad, device failure | Bad, device failure | Bad, device failure |
| General alarm "Nonvolatile memory" | Good(nc) | Good(nc) | Good(nc) |
| Display value < 1600 h | Good(nc) | Good(nc) | Good(nc) |
| "Sensor communication" error | Good(nc) | Good(nc) | Good(nc) |
| Simulation of "Logic on DO1" | Good(nc) | Good(nc) | Good(nc) |
| Simulation of "Pulse on DO1" | Good(nc) | Good(nc) | Good(nc) |
| External totalizer reset | Good(nc) | Uncertain, init. value | Good(nc) |
| External totalizer stop | Uncertain | Uncertain, last usable val. | Good(nc) |
| Flow simulation | Uncertain | Uncertain | Good(nc) |
| External output switch-off | Uncertain | Uncertain | Uncertain |
| Hold last value | Uncertain, last usable val, | Uncertain, last usable val. | Uncertain, last usable val. |
| Converter on simulator | Uncertain | Uncertain | Good(nc) |
| An alarm is being simulated | Good(nc) | Good(nc) | Good(nc) |

# 6 Configuration on the transmitter

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

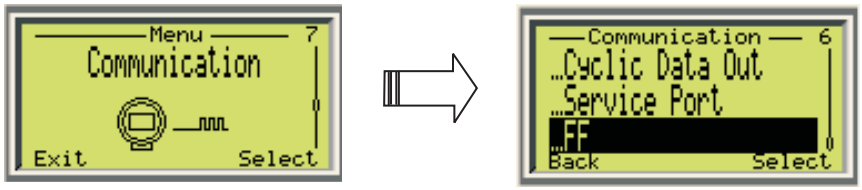


Fig. 18:

Some FF parameters are shown here. These include the FF addresses and some function block input and output values:

| **Communication** | | | |
|---|---|---|---|
| | **FF** | | |
| | | Show FF Addr. | The current FF address is shown here. It can be adjusted via the bus, only. |
| | | AI1-Q Flowrate | Indication of the current output value with status. The block input variable is the volume flow in the set customer-defined unit from the Flow Transducer Block. |
| | | INT1-Q Flowrate | Indication of the current output value of the Integrator Block with status. The integrator totalizes the flow to obtain the total value. |
| | | AI2-Internal Tot Fwd | Indication of the current output value with status. The block input variable is the internal forward totalizer in the set customer-defined unit from the Transducer Block Spec. |
| | | AI3-Internal Tot Rev | Indication of the current output value with status. The block input variable is the internal reverse totalizer in the set customer-defined unit from the Special Function Transducer Block. |
| | | AI4-Diagnostics | Indication of the current output value with status. The block input variable depends on the selected channel. |
| | | AO-Density Adjust | Indication of the current output value with status. The block output variable is applied to the density value in the Flow Transducer Block. As a result, cyclic adjustment of the density value is possible. |
| | | DI-Alarm Info | Indication of the current output value with status. |
| | | DO-Cyclic Control | Indication of the current output value with status. |

# 7 Required FF settings

In order to be able to switch the function blocks to "Auto" mode, the following settings are at least required.

## 7.1 AI Block

- The resource block must be in "AUTO" mode.
- A valid channel must be entered (default setting).
- L_Type must be set to "Direct" or "Indirect" ("Indirect Square Root" is also possible).
- The XD_Scale unit must be the same as the channel unit (default setting: $m^3/h$).

  Example: Channel is Flow, the VOLUME_FLOW_UNITS are set to $m^3/h$. Then the XD_SCALE unit must also be set to $m^3/h$. Units that do not match the channel unit cannot be written. When changing units, you first have to write the unit into the Transducer Block and then write the same unit into the "AI".
- If L_Type is set to "Direct", the XD_Scale and OUT_Scale structure must have exactly the same settings throughout.

## 7.2 AO Block

- The resource block must be in "AUTO" mode.
- A valid channel must be entered (default setting).

## 7.3 PID Block

- The resource block must be in "AUTO" mode.
- "Bypass" must have the correct setting (must not be set to the default value "uninitialized")
- Shed_Opt must have the correct setting (must not be set to the default value "uninitialized")
- "Gain" and "SP" must be set

## 7.4 Integrator Block

- The resource block must be in "AUTO" mode.
- Time_Unit of the used input must be set.
- Integ_Type must be set.

## 7.5 DI Block

- The resource block must be in "AUTO" mode.
- A valid channel must be entered (default setting).

### 7.6 DO Block

- The resource block must be in "AUTO" mode.
- A valid channel must be entered (default setting).

### 7.7 Error when writing a parameter

If it should not be possible to write a parameter, this may have different reasons:

- The hardware write protection has been enabled, see WRITE_LOCK in the Resource Block and the  switch position (chapter 3.1).
- Some function block parameters can be written in specific operating modes, only (e.g., only in OOS or MAN, not in AUTO). Switch the block to this operating mode.
- Some parameters are read only.
- It was attempted to write a value that is out of the permissible range.

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