Data Link Description
D184B093U34

Field^IT
Coriolis Mass Flowmeter
FCM2000
PROFIBUS-PA 3.0

Industrial^IT enabled

Valid for Software Levels from A10
D699G001U02 A.10

HART FIELD COMMUNICATIONS PROTOCOL

PROFIBUS PROCESS FIELD BUS

Fieldbus Foundation

ABB

Coriolis Mass Flowmeter
PROFIBUS-PA 3.0

Data Link Description

D184B093U34

06.2006

Manufacturer:

ABB Automation Products GmbH
Dransfelder Straße 2
D-37079 Göttingen
Germany
Tel.: +49 551 905-534
Fax: +49 551 905-555
CCC-support.deapr@de.abb.com

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1. Hardware

The PA-Bus interface connections have the following specifications:

U = 9 – 32 V
I = 14 mA (in normal operation)
I_{max} = 26 mA (during a fault, FDE)

The instrument supports the Physical Layer per IEC61158-2.

2. Configuration

2.1 Ident Number

Every Profibus-Instrument has been assigned a unique identification number by PNO. For the FCM2000-converter it is 0849. The associated Device Database File is ABB_0849.GSD. Though use of the Ident Number it is possible to utilize the complete functionality of the instrument: six AI-Blocks and two Totalizer-Blocks.

PNO has defined Profiles with their own Ident Numbers. The FCM2000 supports Profile 0x9742 (one AI and one Totalizer-Block) and Profile 0x9700 (only one AI-Block). The advantages of these Profiles is a user independent interchangeability, for instruments which support these general Profiles. The disadvantage is a reduced functionality. This is because not all the special features of an instrument will fit into a general Profile.

The Physical Block contains the parameter IDENT_NUMBER_SELECTOR (Index 24). It is used to define which Ident Number is in effect:

0:	0x9742	Profile specific	3*AI + TOT	PA139742.GSD
1:	0x0849	Manufacturer specific ABB FCM2000	6*AI + 2*TOT	ABB_0849.GSD
128:	0x9700	Profile specific	1*AI	PA139700.GSD

The manufacturer specific GSD-File ABB_0849.GSD is included in the instrument shipment. The Profile-GSD-Files are available o the internet: www.profibus.com → Profibus → In Action / Products → Product Guide → GSD Library.

2.2 Configuration String

During configuration a Configuration String is sent to the PA-Slave. This defines the Data for the cyclic data exchange. The available Configuration Strings are defined in the GSD-File

Excerpt from GSD-File: PA139742.GSD

```
Module 1 = "EMPTY_MODULE"          0x00
Module 2 = "AI"                    0x94
Module 3 = "TOTAL"                 0x41,0x84,0x85
Module 4 = "SETTOT_TOTAL"          0xC1,0x80,0x84,0x85
Module 5 = "SETTOT_MODETOT_TOTAL"  0xC1,0x81,0x84,0x85

Slot(1) = "AI Flow"         2 1,2
Slot(2) = "AI Density"      2 1,2
Slot(3) = "AI Temperature"  2 1,2
Slot(4) = "Totalizer"       3 1,3,4,5
```

Excerpt from GSD-File: ABB_0849.GSD

```
Module 1 = "EMPTY_MODULE"                       0x00
Module 2 = "AI"                                 0x94
Module 3 = "TOTAL"                              0x41,0x84,0x85
Module 4 = "SETTOT_TOTAL"                       0xC1,0x80,0x84,0x85
Module 5 = "SETTOT_MODETOT_TOTAL"               0xC1,0x81,0x84,0x85

Slot(1) = "AI Massflow"                         2 1,2
Slot(2) = "AI Density"                          2 1,2
Slot(3) = "AI Temperature"                      2 1,2
Slot(4) = "Totalizer 1"                         3 1,3,4,5
Slot(5) = "Totalizer 2"                         3 1,3,4,5
Slot(6) = "AI Volumeflow"                       2 1,2
Slot(7) = "AI Internal Mass Totalizer >F"        2 1,2
Slot(8) = "AI Internal Mass Totalizer <R"        2 1,2
```

2.2.1 Module

Every Module has a Configuration String. This indicates in coded form, how many Bytes are transmitted from the Master to the Slave or in the reverse direction from the Slave to the Master. 0x94 means 5 Bytes Slave→Master, 0 Bytes Master→Slave. What data is transmitted is defined in the Profile of the Function Blocks. The Modules above contain:

1. "EMPTY_MODULE"
   This module transmits no data.

2. "AI"
   Cyclically the OUT-Parameter of the AI-Block is transmitted from the Slave to the Master. This is 5 Bytes: Value=Float=4 Bytes + Status=1 Byte

3. "TOTAL"
   Cyclically the TOTAL-Parameter of the Totalizer-Block is transmitted from the Slave to the Master. This is 5 Bytes: Value=Float=4 Bytes + Status=1 Byte

4. "SETTOT_TOTAL"
   Cyclically the TOTAL-Parameter of the Totalizer-Block is transmitted from the Slave to the Master (5 Bytes) and the SET_TOT-Parameter of the Totalizer-Block (1 Byte) is transmitted from the Master to the Slave.

5. "SETTOT_MODETOT_TOTAL"
   Cyclically the TOTAL-Parameter of the Totalizer-Block is transmitted from the Slave to the Master (5 Bytes) and the SET_TOT-Parameter and the MODE_TOT-Parameter of the Totalizer-Block (together 2 Bytes) transmitted from the Master to the Slave.

2.2.2 Slots

The FCM2000, with Ident Number 0849 has 8 Slots. The Slot-Definition indicates which Module is permitted in the corresponding Slot. These are:

- For the AI-Blocks: Module 1 or 2.
- For the Totalizer-Blocks: Module 1, 3, 4 or 5.

2.2.3 Examples

The Configuration String **0x94,0x94,0x94,0x41,0x84,0x85,0x41,0x84,0x85,0x94,0x94,0x94** transmits the OUT-Values from all AI-Blocks and the TOTAL-Values from both Totalizer-Blocks cyclically from the Slave to the Master. Together this is 40 Data Bytes:

	Slot 1 AI1	**Slot 2 AI2**	**Slot 3 AI3**	**Slot 4 Totalizer 1**	**Slot 5 Totalizer 2**	**Slot 6 AI4**	**Slot 7 AI5**	**Slot 8 AI6**	
Config-String	**0x94**	**0x94**	**0x94**	**0x41,0x84, 0x85**	**0x41,0x84, 0x85**	**0x94**	**0x94**	**0x94**	
Selected Module	2 : AI (Out)	2 : AI (Out)	2 : AI (Out)	3 : TOTAL	3 : TOTAL	2 : AI (Out)	2 : AI (Out)	2 : AI (Out)	
Data Master→Slave	0	0	0	0	0	0	0	0	Sum: 0 Bytes
Data Slave→Master	5	5	5	5	5	5	5	5	Sum: 40 Bytes

The Configuration String **0x94,0,00,0x00,0xC1,0x81,0x84,0x85** transmits the OUT-Values from the first AI-Block and the TOTAL-Value from the first Totalizer-Block cyclically from the Slave to the Master. This is a total of 10 Data Bytes. SET_TOT and MODE_TOT from the first Totalizer-Block is transmitted cyclically from the Master to the Slave. This is 2 Bytes.

	Slot 1 AI1	**Slot 2 AI2**	**Slot 3 AI3**	**Slot 4 Totalizer 1**	**Slot 5 Totalizer 2**	**Slot 6 AI4**	**Slot 7 AI5**	**Slot 8 AI6**	
Config-String	**0x94**	**0x00**	**0x00**	**0xC1,0x81 0x84,0x85**					
Selected Module	2 : AI (Out)	1 : empty	1 : empty	5 : SETTOT_ MODETOT_ TOTAL					
Data Master→Slave	0	0	0	2					Sum: 2 Bytes
Data Slave→Master	5	0	0	5					Sum: 10 Bytes

Information:

- These examples apply to Ident Number 0x0849. For the other Ident Numbers another Slot-Quantity may be defined and therefore the Configuration String will be different.

- An „Empty Module“(0x00) added at the end can be ignored. An „Empty Module“ located at the front or in the middle must be included.

2.2.4 Additional Config-Strings

According to the PA-Profile for the AI-Block there is a “short“ Configuration String 0x94 (Identifier Byte) and a „long“ Configuration String (Extended Identifier Format):

0x42, 0x84, 0x08, 0x05

These will also be accepted in place of 0x94.

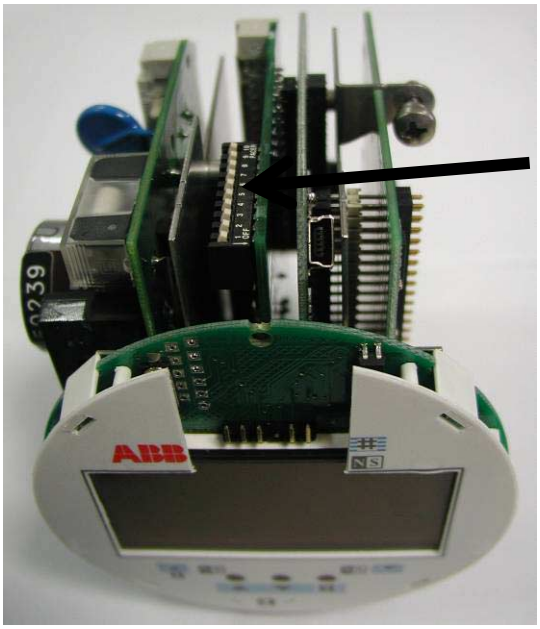
2.3 Address-Setting

There are three ways to set the PA-Address:
- Hardware-Switch
- Bus
- Menu „Slave Address“ (in submenu „Data Link“) in the converter

The hardware switch has the highest priority. An address defined by a switch is fixed and cannot be changed. If the Switch-Address-Setting is not active (switch 8 off). The address can be changed over the Bus, however, only (as specified by PA), when cyclic communication is active. The Address can be changed at any time over the menu.

2.3.1 Hardware-Switch for Address-Setting

A ten position switch is located in the converter. It is not visible from the outside. The switches can be actuated when the housing cover is removed. The switch settings are displayed on the instrument in the submenu Data Link. They can also be read over the PA-Bus in the Transducerblock (rel. Index 127).
Attention: When opening the cover observe the Safety Regulations, see Operation Manual.

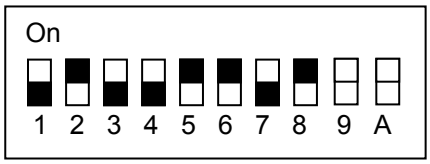


Switch 8 defines if the Address can be set from the switch:
On: The Address is set using Switches 1-7. It cannot be changed over the Bus.
Off: The Address is set over the Bus or the Menu, Switches 1-7 have no meaning.

Switch 1-7: Hardware-Address settings, binary coded. Valid Addresses 0-125.

Switches 9 and A have no meaning for the Address-Setting.

Example: Address 50 set using the Switch: 50dec = 32hex = 110010 binary → Switches 2,5,6 and 8 on



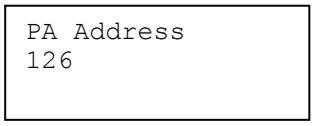
The Address-Switch settings are only read during a restart of the instrument, not during normal operation!
A restart can be initiated by turning on the supply power or by a Software-Reset (Factory_Reset in Physical Block).

The Factory default settings of the Switch are: 0000000000

When the Switch-Addressing is turned off (restart with Switch 8 „on“, followed by a restart with Switch 8 „off“), then, in accord with the PA-Specification, the Address is set to the Default-Value 126 and NO_ ADDRESS_CHANGE is reset to FALSE.

2.3.2 Menu for PA-Address

The Menu PA-Address Is in the submenu Data Link. Here the actual Address is displayed and can be changed:



An Address-Entry is not possible when Switch 8 (see 2.3.1) is closed and the Address is defined by the DIP-Switch settings.

2.3.3 Set address over the Bus

In accord with the PA-Specifications it is only possible to set the Addresses 0 to 125 over the Bus. The Address cannot be reset to its Default-Value 126. An Address-Change is not possible during active cyclic communication, when the Address is defined from the Switch settings or when NO_ADDRESS_ CHANGE is set to TRUE.

2.3.4 Reset Address to the Default-Value 126

The following methods can be used to reset the Address to 126:

- By writing „Reset Bus Address“ (= 2712 decimal = 0A98 Hex) in Factory_Reset (Physical Block rel. Index 19).
- In the Menu „ Data Link“ the PA-Address 126 can be entered.
- A restart with Switch 8 „on“ (=Address from Switch), followed by a restart with Switch 8 „off“.

2.3.5 NO_ADDRESS_CHANGE

The Address is set over the Bus using the Set_Slave_Address-Telegram. It contains the Boolean Variable NO_ADDRESS_CHANGE. When this is set to TRUE, then further Address-Changes using Set_Slave_Address are no longer possible.

Information: This feature is only supported by a few Master-Programs.

Changing the Address over the Bus is only possible by writing 2712 decimal (= 0A98 Hex) in the Factory-Reset (Physical Block rel. Index 19). Then the Address is reset to the Default-Value 126 and NO_ADDRESS_CHANGE to FALSE. Thereafter, any allowable Address-Setting can be made.

It is also possible when NO_ADDRESS_CHANGE = TRUE to change the Address in the Menu „PA-Address“. At the same time, NO_ADDRESS_CHANGE is set to FALSE.

3. Block Overview

The FCM2000 Converter contains, dependent on the Ident Number, the following Blocks:

	0x0849 FCM2000 PA3.0	0x9742 PA Profile 3*AI, 1*Totalizer	0x9700 PA Profile 1*AI
Physical Block	Slot 0	Slot 0	Slot 0
Analog Input Block 1	Slot 1	Slot 1	Slot 1
Analog Input Block 2	Slot 2	Slot 2	-
Analog Input Block 3	Slot 3	Slot 3	-
Totalizer Block 1	Slot 4	Slot 4	-
Totalizer Block 2	Slot 5	-	-
Analog Input Block 4	Slot 6	-	-
Analog Input Block 5	Slot 7	-	-
Analog Input Block 6	Slot 8	-	-
Transducer Block	Slot 9	Slot 9	Slot 9

The Physical-Block and the AI- and Totalizer-Blocks correspond to Profibus PA Profile 3.0.

The Transducer Block includes, up to Index 53, a “Coriolis Transducer Block”. The parameters correspond to the Profile for the Mass Flowmeter. From Index 54 the manufacturer specific parameters and the Transducer-Block are added.

3.1 Block-Table-Legends

In the following tables the attributes are listed:

Rel.Index / Abs. Index:
Relative Index of the parameter within the Blocks and absolute Index. In accord with the PA-Profile all Blocks begin with the absolute Index 16.
BLOCK_OBJECT is, e.g., in every Block is set to Index 0 and therefore to Slot-Index 16.

Data-Type: Data type of the Parameter. A number of Parameters are Structures (DS-xx). The Structures are described in Chapter 3.5.4.

Size: Size of the Parameters in Bytes

Storage Type:
- Cst = Constant Parameter. The parameter never changes.
- S = Static Parameters are stored permanently (nonvolatile). When writing a static parameter the Static Revision Counter ST_REV for the corresponding Block (Index 1 in every Block) is incremented by one.
- N = Nonvolatile parameters are stored permanently. When writing a nonvolatile parameter ST_REV is not changed.
- D = Dynamic parameters are lost when the instrument is turned off.

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

Parameter Usage
- C = Contained: The parameter is only used internally in the Block and cannot be communicated with cyclically.
- I = Input: The parameter is an Input-Parameter for the cyclic communication.
- O = Output: The parameter is an Output-Parameter for the cyclic communication.

Data Transport
- a = The parameter can only be accessed acyclically.
- cyc = The parameter can be accessed cyclically and acyclically.

Default Value: Basic settings for the parameter.
Using the parameter FACTORY_RESET (Index 19 in the Physical Block), selection „Restart with defaults“, the Resource-Block, Function Blocks and a portion of the Transducer-Block-Parameters can be reset to their basic values.

3.2 Slot 0 – Physical Block

The Physical Block contains general specifications about the Fieldbus-Instrument, e.g., the manufacturer, instrument type, versions numbers, etc.

3.2.1 Physical Block Parameters, Sorted by Index

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
0 / 16	BLOCK_OBJECT	DS-32	20	Cst	r	C/a	-	This Structure contains general specifications about the Block, such as the Block Type, the Profile Number, etc.
1 / 17	ST_REV	Unsigned16	2	N	r	C/a	0	Revision counter for static variables. When a static variable changes, this revision counter is incremented by one.
2 / 18	TAG_DESC	OctetString	32	S	r,w	C/a	' '	A Text-Description for this Block. It must be unique within one Fieldbus.
3 / 19	STRATEGY	Unsigned16	2	S	r,w	C/a	0	This parameter can be used to build Groups of Blocks, in which every Block in a Group is assigned the same identification number.
4 / 20	ALERT_KEY	Unsigned8	1	S	r,w	C/a	0	This parameter is used as an Identifying-Number for a System-Section.
5 / 21	TARGET_MODE	Unsigned8	1	S	r,w	C/a	Auto	The desired operating mode for the Block. 0x08 : Auto 0x10 : Man 0x80 : Out Of Service
6 / 22	MODE_BLK	DS-37	3	D	r	C/a	Actual : Permitted: Auto Normal : Auto	This parameter contains the actual, allowed and operating mode of the Block. 0x08 : Auto 0x10 : Man 0x80 : Out Of Service
7 / 23	ALARM_SUM	DS-42	8	D	r	C/a	0,0,0,0	This parameter contains a summary of the Block-Alarms.
8 / 24	SOFTWARE_REVISION	VisibleString	16	Cst	r	C/a	D699G001U02 A.10	Software-Revision of the instrument.
9 / 25	HARDWARE_REVISION	VisibleString	16	Cst	r	C/a	REVISION 0	Hardware-Revision of the instrument.
10 / 26	DEVICE_MAN_ID	Unsigned16	2	Cst	r	C/a	26 (=ABB)	Identification code of the manufacturer of the of the instrument.
11 / 27	DEVICE_ID	VisibleString	16	Cst	r	C/a	FCM2000 PA3.0	Manufacturer-Designation for the instrument.
12 / 28	DEVICE_SER_NUM	VisibleString	16	Cst	r	C/a	-	Series Number of the instrument as a String. Information: The number corresponds to the instrument number, see Transducer-Block rel. Index 90.
13 / 29	DIAGNOSIS	Octetstring	4	D	r	C/a	-	Diagnosis-Information about the instrument, coded bitwise, see 4.2.
14 / 30	DIAGNOSIS_EXTENSION	Octetstring	6	D	r	C/a	-	Additional manufacturer Diagnosis-Information about the instrument, coded bitwise, see 4.3.
15 / 31	DIAGNOSIS_MASK	Octetstring	4	Cst	r	C/a	0x30,0x00,0x00,0x80	Mask with the supported DIAGNOSIS-Bits: 0 : Bit is not used 1 : Bit is used.
16 / 32	DIAGNOSIS_MASK_EXTENSION	Octetstring	6	Cst	r	C/a	0xFF,0x0F,0xFE, 0x01,0xFE,0xFF	Mask with the supported DIAGNOSIS_EXTENSION-Bits: 0 : Bit is not used 1 : Bit is used.
17 / 33	DEVICE_CERTIFICATION	VisibleString	32	Cst	r	C/a	-	Certifications, etc.

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
18 / 34	WRITE_LOCKING	Unsigned16	2	N	r,w	C/a	2457	Software-Write-Protection 0 : no acyclic writing allowed, except to WRITE_LOCKING 1 to 2456 : reserved through PNO 2457 : all writable parameters can be written 2458 to 32767 : reserved through PNO
19 / 35	FACTORY_RESET	Unsigned16	2	S	r,w	C/a	-	Reset-Command: 1 : Reset to Default-Values. The Address is not changed. 2506 : Warm restart 2712 : Rest only the Bus Address
20 / 36	DESCRIPTOR	OctetString	32	S	r,w	C/a	-	A user entered description for the application.
21 / 37	DEVICE_MESSAGE	OctetString	32	S	r,w	C/a	-	A user enterable message.
22 / 38	DEVICE_INSTAL_DATE	OctetString	16	S	r,w	C/a	-	Date of the installation of the instrument.
23 / 39	-							Empty Index, LOCAL_OP_ENA not present.
24 / 40	IDENT_NUMBER_SELECTOR	Unsigned8	1	S	r,w	C/a	1	Every Profibus-Instrument has an Ident-Number assigned by PNO. In addition there are Profile-Ident-Numbers. Selected here are: 0 : Profile-Specific Ident-Number 0x9742 1 : Manufacturer-Specific Ident-Number 0x0849 for FCM2000 128 : Profile-Specific Ident-Number 0x9700 Information: see Chapter 2.1, Ident Number.
25 / 41	-							Empty Index, HW_WRITE_PROTECTION not present.
26 to 32 (42 to 48)	Reserved by PNO							

3.2.2 Physical Block Parameters, Sorted by Name

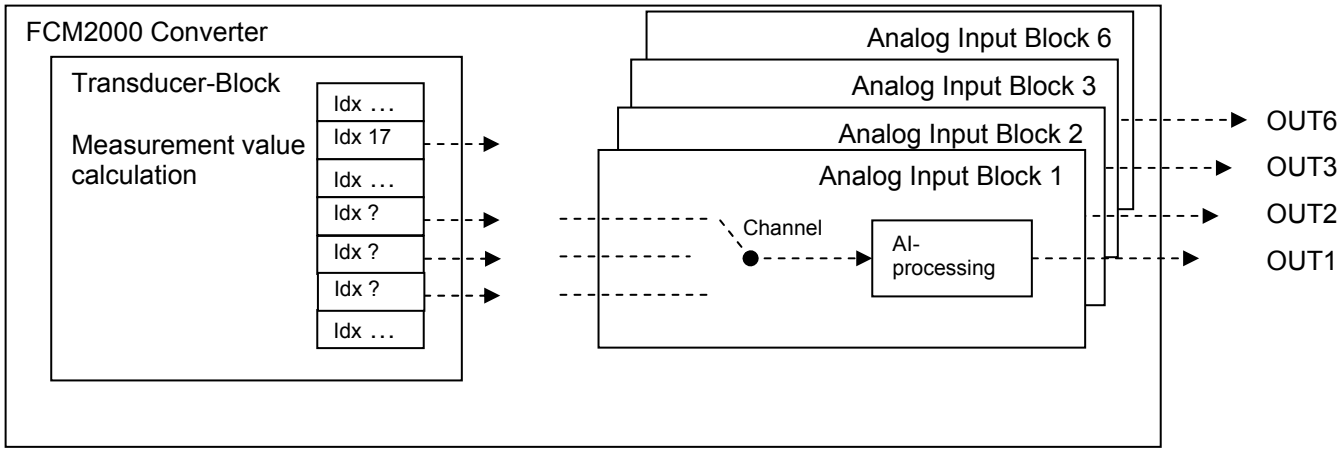
Parameter Name	Rel.Index / Slot Index
ALARM_SUM	7 / 23
ALERT_KEY	4 / 20
BLOCK_OBJECT	0 / 16
DESCRIPTOR	20 / 36
DEVICE_CERTIFICATION	17 / 33
DEVICE_ID	11 / 17
DEVICE_INSTAL_DATE	22 / 38
DEVICE_MAN_ID	10 / 26
DEVICE_MESSAGE	21 / 37
DEVICE_SER_NUM	12 / 28
DIAGNOSIS	13 /29
DIAGNOSIS_EXTENSION	14 / 30
DIAGNOSIS_MASK	15 / 31
DIAGNOSIS_MASK_EXTENSION	16 / 32
FACTORY_RESET	19 / 35
HARDWARE_REVISION	9 / 25
IDENT_NUMBER_SELECTOR	24 / 40
LOCAL_OP_ENA	23 / 39
MODE_BLK	6 / 22
SOFTWARE_REVISION	8 / 24
ST_REV	1 / 17
STRATEGY	3 / 19
TAG_DESC	2 / 18
TARGET_MODE	5 / 21
WRITE_LOCKING	18 / 34

3.3 Slot 1, 2, 3, 6, 7 and 8 – Analog Input Block

The measurement value calculations are carried out in the Transducer-Block. The Transducer-Block readies the measurement values internally. The cyclic output of the measurement values occurs over the Analog Input Block (AI-Block). The converter has one AI-Block.

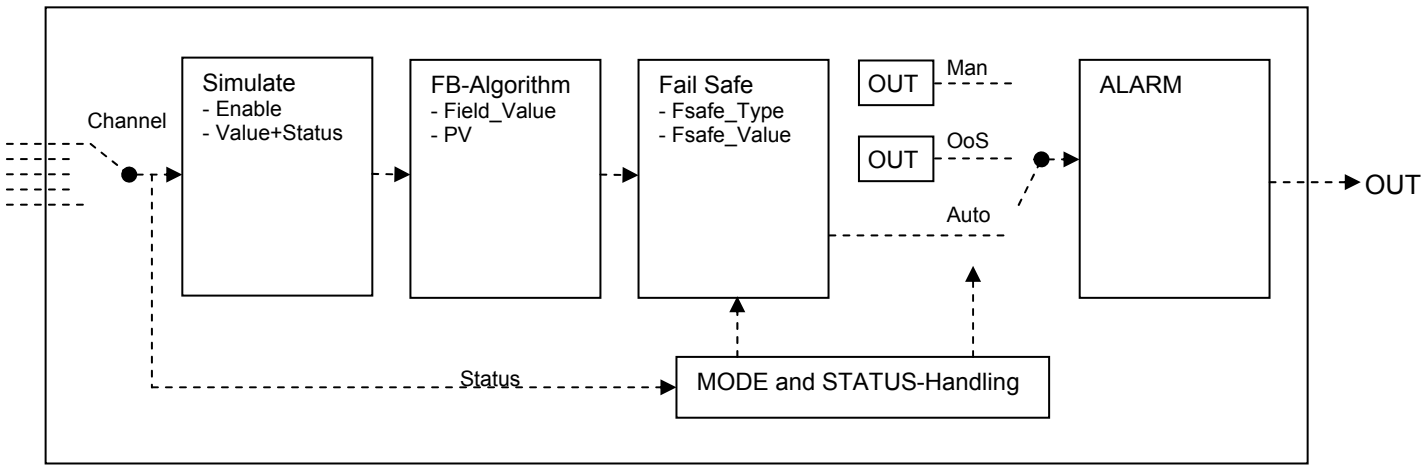
The selection, which parameter is to outputted from the AI-Block, is made over the Channel-Parameter (Index 14 in AI). The possible Channels for the AI-Block are (specified in decimal, see also 3.5.1):

Channel 256+17 = 273: VOLUME_FLOW
Channel 256+21 = 277: MASS_FLOW
Channel 256+25 = 281: DENSITY
Channel 256+29 = 285: TEMPERATURE
Channel 256+81 = 337: Transducer-Block internal mass totalizer >F
Channel 256+83 = 339: Transducer-Block internal mass totalizer <R
Channel 256+85 = 341: Transducer-Block internal volume totalizer >F
Channel 256+87 = 343: Transducer-Block internal volume totalizer <R



An AI-Block completes various tasks including rescaling, alarm processing, simulation, etc. This is described in the following.

3.3.1 Analog Input Block Diagram



Channel: The selection is made in the Channel-Parameter (Index 14) which measurement value is to be transmitted from the Transducer-Block. See also 3.5.1

Simulate: The Simulate-Parameter is a Structure (see 3.6.7). The simulation can be turned on over the Sub-Parameter “Simulate Enable”. The Sub-Parameter “Simulate-Value” then outputs the Simulation-Value, which is processed instead of the Channel-Value.

FB-Algorithm: The input value (usually the Channel-Value) is scaled to percent using the PV_SCALE-Structure. This percent value is named FIELD_VALUE and is only available internally in the Block. It is not accessible over the communication:

FIELD_VAL = 100 * (Channel-Value – PV_SCALE.EU0%) /
(PV_SCALE.EU100% - PV_SCALE.EU0%)

This percent value is scaled to the PV-Value using the OUT_SCALE-Structure:

PV = (FIELD_VAL / 100) * (OUT_SCALE.EU100% - OUT_SCALE.EU0%)
+ OUT_SCALE.EU0%

A damping time in seconds can be prescribed with the parameter PV_FTIME (Index 16). The filtered measurement value is named OUT.

OUT = Filter (PV)

Fail-Safe: FSAFE_TYPE (Index 17) determines the behavior during an error condition. When FSAFE_TYPE=0, the value FSAVE_VALUE (Index 18) is outputted during an error condition. When =1, the last “useable” value is outputted. When =2, the values during the error condition are outputted.

Mode: For Mode=Auto the value calculated up until now is outputted.

For Mode=Man the OUT-Parameter is outputted. The OUT-Parameter can be written acyclically in the Man-Mode.

For Mode=Out of Service the OUT-Parameter is outputted.

Alarm: There are four Alarm-Levels (Index 21,23,25,27)
- High-High-Limit
- High-Limit
- Low-Limit
- Low-Low-Limit

For each of these levels there is an Alarm-Message (Index 30-33) which is released when the value is over or under the corresponding alarm level.
- High-High-Alarm
- High-Alarm
- Low-Alarm
- Low-Low-Alarm

Using ALARM_HYS (Index 19) a hysteresis can be set for the Alarm-Levels.

3.3.2 Analog Input Block Parameter, Sorted by Index

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
0 / 16	BLOCK_OBJECT	DS-32	20	Cst	r	C/a	-	This Structure contains general information about the Block, including Block Type, Profile Number, etc.
1 / 17	ST_REV	Unsigned16	2	N	r	C/a	0	Revision counter for static variables. When a static variable changes, this revision counter is incremented by one.
2 / 18	TAG_DESC	OctetString	32	S	r,w	C/a	' '	A Text-Description for this Block. It must be unique within one Fieldbus.
3 / 19	STRATEGY	Unsigned16	2	S	r,w	C/a	0	This parameter can be used to build Groups of Blocks, in which every Block in a Group is assigned the same identification number.
4 / 20	ALERT_KEY	Unsigned8	1	S	r,w	C/a	0	This parameter is used as an Identifying-Number for a System-Section
5 / 21	TARGET_MODE	Unsigned8	1	S	r,w	C/a	Auto	The desired operating mode for the Block. 0x08: Auto 0x10: Man 0x80: Out Of Service
6 / 22	MODE_BLK	DS-37	3	D	r	C/a	Actual : Permitted: Oos,Man,Auto Normal : Auto	This parameter contains the actual, allowed and normal operating modes for the Block.
7 / 23	ALARM_SUM	DS-42	8	D	r	C/a	0,0,0,0	This parameter contains a summary of the Block-Alarms.
8 / 24	BATCH	DS-67	10	S	r,w	C/a	0,0,0,0	
9 / 25	-							
10 / 26	OUT	DS-33	5	D	r, w (1)	O/cyc	-	In the operating mode AUTO this Structure contains the actual measurement value and its status, corresponding to the Block-Configuration. (1) In the operating mode Manual the value and the status can be set by the user.
11 / 27	PV_SCALE	Array of Float (EU at 100%, EU at 0%)	8	S	r,w	C/a	Measurement range for the selected Channel (After Factory Reset 100, 0)	Input-Scaling. Using the 100% and 0% values the Channel-Value is scaled to percent. Values are automatically adjusted when the measurement range or units in the Channel are changed
12 / 28	OUT_SCALE	DS-36	11	S	r,w	C/a	Measurement range limits for the selected Channel, selected Units, Decimal places : Mass flow : 3 Volume flow : 3 Density : 3 Temperature : 1 Internal mass totalizer Forward: 6 Reverse : 6 Internal volume totalizer	Output-Scaling. Using the 100% and 0% values the percent values are scaled to engineering units. In addition, the Unit-Index and the number of decimal places are outputted. Values are automatically adjusted when the measurement range or units in the Channel are changed

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
							forward: 6 Reverse: 6 (After Factory Reset 100, 0), units decimal places AI1 Mass Flow: Unit : 1322 Decimal places : 3 AI2 Density: Unit : 1103 Decimal places : 3 AI3 Temperature: Unit : 1000 Decimal places : 1 AI4 Volume Flow: Unit : 1349 AI5 Internal Mass totalizer Forward : Unit : 1088 Decimal places : 5 AI6 Internal Mass totalizer Forward : Unit : 1088 Decimal places : 5)	
13 / 29	LIN_TYPE	Unsigned8	1	S	r,w	C/a	0	Type of linearization: 0 = no linearization
14 / 30	CHANNEL	Unsigned16	2	S	r,w (2)	C/a	AI1: 277 = Mass flow AI2: 281 = Density AI3: 285 = Temperature AI4: 273 = Volume flow AI5: 337 = Internal Mass totalizer Forward AI6: 339 = Internal Mass totalizer Reverse	Reference to the Transducer-Block and the relative Index of the Transducer-Block-Parameters, which are processed here in AI. Possible Channels : 277 = Mass flow 273 = Volume flow 281 = Density 285 = Temperature 337 = Internal Mass totalizer Forward 339 = Internal Mass totalizer Reverse 341 = Internal volume totalizer Forward 343 = Internal volume totalizer Reverse

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
								(2) Information: The Channel can only be set in the Modes “Man” or “Out of Service”. When writing the Channel an appropriate scaling is automatically selected in PV_SCALE and OUT_SCALE and a unit entered for the Channel.
16 / 32	PV_FTIME	Float	4	S	r,w	C/a	0	Filter time. Within the specified time the filter output moves from 0 to 63% for a step change at the input.
17 /33	FSAFE_TYPE	Unsigned8	1	S	r,w	C/a	1	Defines the behavior for erroneous values: 0: FSAVE_VALUE is used for OUT, Status is Uncertain_Substitute Value 1: the last value of OUT is held, Status is Uncertain_LastUsableValue 2: the erroneous value is outputted as OUT, Status is Bad
18 / 34	FSAFE_VALUE	Float	4	S	r,w	C/a	0	This value is outputted as OUT, when the Channel delivers erroneous values and FSAVE_TYP is set to 0.
19 / 35	ALARM_HYS	Float	4	S	r,w	C/a	0.5% of range	Hysteresis for the Alarm-Detection.
21 / 37	HI_HI_LIM	Float	4	S	r,w	C/a	max value	Upper Alarm-Level.
23 / 39	HI_LIM	Float	4	S	r,w	C/a	max value	Upper level for Warnings.
25 / 41	LO_LIM	Float	4	S	r,w	C/a	min value	Lower level for Warnings.
27 / 43	LO_LO_LIM	Float	4	S	r,w	C/a	min value	Lower Alarm-Level.
30 / 46	HI_HI_ALM	DS-39	16	D	r	C/a	0	Status of the Alarm at the upper level.
31 / 47	HI_ALM	DS-39	16	D	r	C/a	0	Status of the Warning at the upper level.
32 / 48	LO_ALM	DS-39	16	D	r	C/a	0	Status of the Warning at the lower level.
33 / 49	LO_LO_ALM	DS-39	16	D	r	C/a	0	Status of des Alarm at the lower level.
34 / 50	SIMULATE	DS-50	6	S	r,w	C/a	disable	For test purposes a Simulation can be activated here and a simulated value prescribed.
35 / 51	OUT_UNIT_TEXT	OctetString	16	S	r,w	C/a	‘ ’	For the case, that the Units of the Out-Parameter are not included in the units list, a unit can be entered here.
36 to 44 (52 to 60)	reserved by PNO							

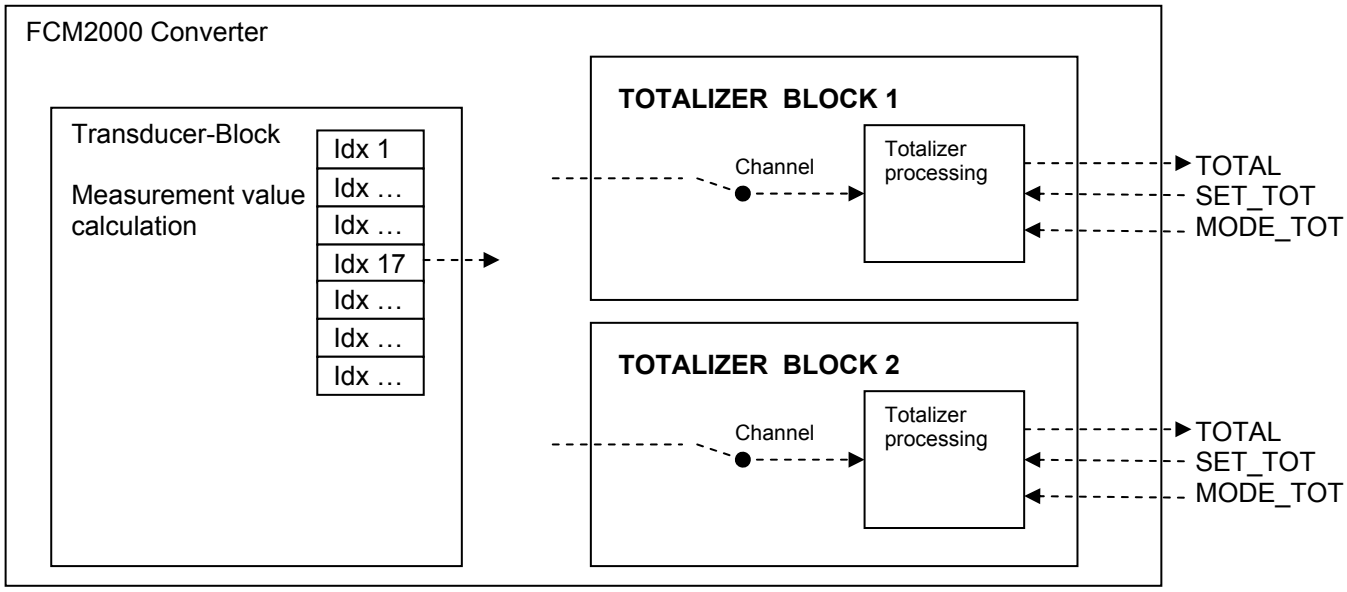
3.3.3 Analog Input Block Parameters, Sorted by Name

Parameter Name	Rel.Index / Slot Index
ALARM_HYS	19 / 35
ALARM_SUM	7 / 23
ALERT_KEY	4 / 20
BATCH	8 / 24
BLOCK_OBJECT	0 / 16
CHANNEL	14 / 30
FSAFE_TYPE	17 /33
FSAFE_VALUE	18 / 34
HI_ALM	31 / 47
HI_HI_ALM	30 / 46
HI_HI_LIM	21 / 37
HI_LIM	23 / 39
LIN_TYPE	13 / 29
LO_ALM	32 / 48
LO_LIM	25 / 41
LO_LO_ALM	33 / 49
LO_LO_LIM	27 / 43
MODE_BLK	6 / 22
OUT	10 / 26
OUT_SCALE	12 / 28
OUT_UNIT_TEXT	35 / 51
PV_FTIME	16 / 32
PV_SCALE	11 / 27
SIMULATE	34 / 50
ST_REV	1 / 17
STRATEGY	3 / 19
TAG_DESC	2 / 18
TARGET_MODE	5 / 21

3.4 Slots 4 and 5 – Totalizer Block

In the Totalizer-Block the flowrate values are integrated. In order to determine the quantity of fluid which has flowed (“Totalizer Value”). The measurement value is received by the Totalizer-Block from the Transducer-Block. The only selections for the Channel are

Channel 256+17 = 273: VOLUME_FLOW
Channel 256+21 = 277: MASS_FLOW



The Totalizer-Block-Parameters
- TOTAL
- SET_TOT
- MODE_TOT

can be communicated cyclically. This is set with the Config-String, see Chapter 2.2.

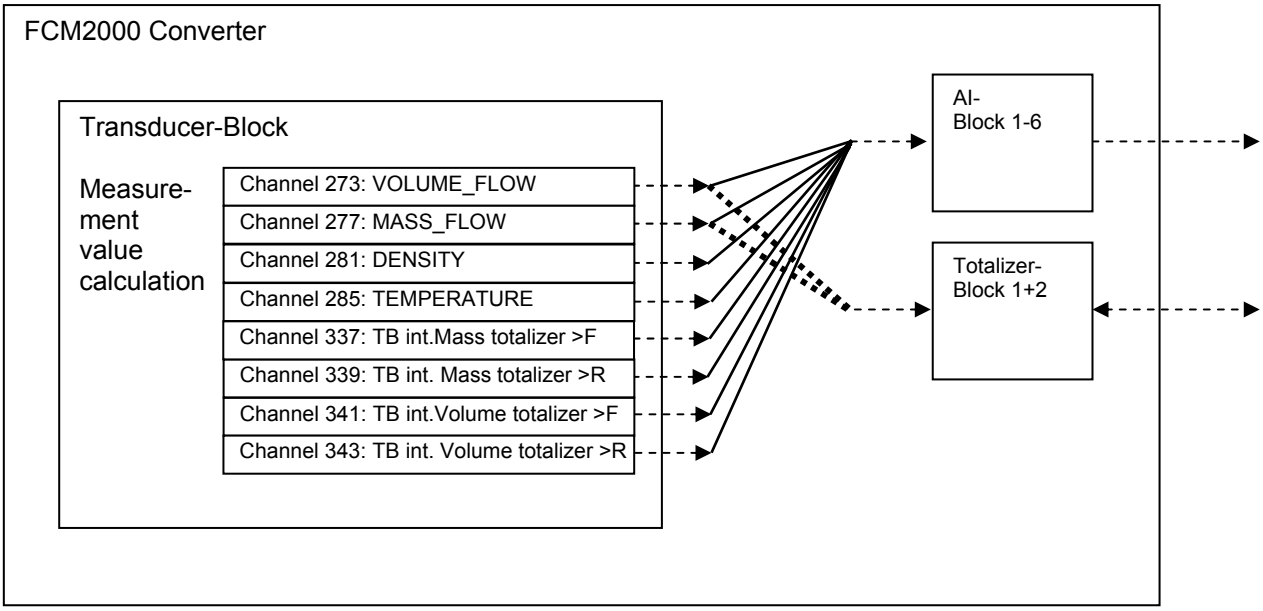
3.4.1 Totalizer Blocks and Internal Converter Totalizers

The FCM2000 converter is available as a standard instrument without PA-Communication and therefore without totalizer blocks. The converter contains always includes its own internal totalizer, which have nothing to do with the Totalizer-Blocks. This internal totalizer is also contained in a PA-Instrument and its values can be read on the LCD-Display on the converter in the submenu Totalizer.

The internal totalizer can also be selected as a Channel for the AI-Block and read cyclically over AI.

For the Totalizer Blocks of the Channel only the Mass- and Volume-Flowrate (Indices 17 and 21 = Channel 273 and 277) can be used, not the internal totalizer, density or temperature! The totalizer integrates the flowrate to a totalized value. It would not make sense to integrate the internal totalizer again or to integrate the temperature or density.

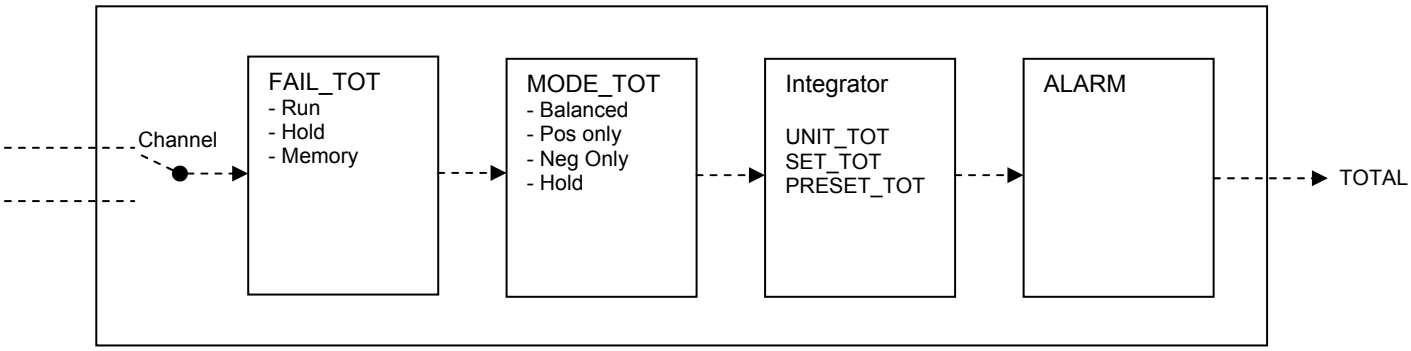
The internal totalizer and the Totalizer-Blocks are independent and can be set differently (units, Mode, ...) and reset at different times. Therefore the totalizer values may differ.



Since the Totalizer Block integrates the flowrate, the Totalizer-Unit corresponds to the flowrate unit without time. Example: Flowrate m3/h $\rightarrow$ Totalizer m3.

The Totalizer-Unit UNIT_TOT (Index 11) is automatically set by the FCM2000 to the appropriate unit, when the flowrate units are changed.

3.4.2 Totalizer Block Diagram



Channel: The Channel-Parameter (Index 12) is used to select the measurement value from the Transducer-Block, which is to be processed. See also 3.5.1

FAIL_TOT (Index 15) determines the behavior for Channel-Values with Status “BAD”. In this case one can let the totalizer continue integrate (Run) and ignore the erroneous values, or one can let the totalizer continue to integrate using the last good value (Memory).

MODE_TOT (Index 14) defines, whether both flow directions are to be integrated or only the positive or only the negative flowrate values. The totalizer can be stopped using Hold.

Integrator: The flowrate values are continuously integrated to the TOTAL-Value (Index 10) and the totalizer value calculated.

UNIT_TOT (Index 11) indicates the Unit This is not checked and UNIT_TOT is not incorporated in the calculations.

SET_TOT (Index 13) is used to reset or preset the TOTAL-Values:
0: Totalize means the totalizer operates and integrates “normally”.
1: Reset resets the totalizer to 0.
2: Preset sets the totalizer to PRESET_TOT (Index 16).
As long as SET_TOT is 1 or 2, the Reset- or Preset-Status is maintained. The „normal“ totalization resumes only after SET_TOT is reset to 0.

Alarm: There are four Alarm-Levels (Index 18-21)
- High-High-Limit
- High-Limit
- Low-Limit
- Low-Low-Limit

For each of these levels there is an Alarm-Message (Index 22-25) which is released when the value is over or under the corresponding alarm level.
- High-High-Alarm
- High-Alarm
- Low-Alarm
- Low-Low-Alarm

Using ALARM_HYS (Index 17) a hysteresis can be set for the Alarm-Levels.

3.4.3 Totalizer Block Parameter, Sorted by Index

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
0 / 16	BLOCK_OBJECT	DS-32	20	C	r	C/a	-	This Structure contains general information about the Block, including Block Type, Profile Number, etc.
1 / 17	ST_REV	Unsigned16	2	N	r	C/a	0	Revision counter for static variables. When a static variable changes, this revision counter is incremented by one.
2 / 18	TAG_DESC	OctetString	32	S	r,w	C/a	' '	A Text-Description for this Block. It must be unique within one Fieldbus.
3 / 19	STRATEGY	Unsigned16	2	S	r,w	C/a	0	This parameter can be used to build Groups of Blocks, in which every Block in a Group is assigned the same identification number.
4 / 20	ALERT_KEY	Unsigned8	1	S	r,w	C/a	0	This parameter is used as an Identifying-Number for a System-Section.
5 / 21	TARGET_MODE	Unsigned8	1	S	r,w	C/a	Auto	The desired operating mode for the Block. 0x08: Auto 0x10: Man 0x80: Out Of Service
6 / 22	MODE_BLK	DS-37	3	D	r	C/a	Actual : Permitted: Oos,Man,Auto Normal : Auto	This parameter contains the actual, allowed and normal operating modes for the Block.
7 / 23	ALARM_SUM	DS-42	8	D	r	C/a	0,0,0,0	This parameter contains a summary of the Block-Alarms.
8 / 24	BATCH	DS-67	10	S	r,w	C/a	0,0,0,0	
9 / 25	-							
10 / 26	TOTAL	DS-33	5	N	r	O/cyc	0	TOTAL is the totalizer value. It is the integrated value of the Channel-Values.
11 / 27	UNIT_TOT	Unsigned16	2	S	r,w	C/a	1088 = kg	Units for TOTAL
12 / 28	CHANNEL	Unsigned16	2	S	r,w (1)	C/a	Tot1 : 277 : Mass flow Tot2 : 273 : Volume flow	Reference to the Transducer-Block and the relative Index of the Transducer-Block-Parameters, which are processed in this Block. Possible Channels : 277 = Mass flow 273 = Volume flow (1)) Information: The Channel can only be set in the Modes “Man” or “Out of Service”.
13 / 29	SET_TOT	Unsigned8	1	N	r,w	I/cyc	0	This is used to reset TOTAL or preset a value. This function is Level-Controlled as long as a 1 is contained therein so that the RESET-Status is active. 0: Normal integration 1: RESET: The TOTAL-Value is reset to 0. 2: PRESET: The TOTAL-Value is set to the value of PRESET_TOTAL.
14 / 30	MODE_TOT	Unsigned8	1	N	r,w	I/cyc	0	This parameter determines the behavior of the integrators: 0: BALANCED: both positive and negative flows are integrated. 1: POS_ONLY: Only positive flows are integrated. 2: NEG_ONLY: Only negative flows are integrated. 3: HOLD: The integration is stopped, the value is held.

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Parameter Usage / Data Transport	Default Value	Description
15 / 31	FAIL_TOT	Unsigned8	1	S	r,w	C/a	0	Defines the behavior for erroneous Channel-Values: 0: RUN: The integration continues in spite of the erroneous vales. The Status is ignored. 1: HOLD: The integration is stopped when erroneous values exist. 2: MEMORY: The integration is continued with the last good Channel-Value.
16 / 32	PRESET_TOT	Float	4	S	r,w	C/a	0.0	Preset value for the function PRESET. This value is copied to the TOTAL-Value using the SET_TOT-Function.
17 / 33	ALARM_HYS	Float	4	S	r,w	C/a	0.0	Hysteresis for the Alarm-Detection.
18 / 34	HI_HI_LIM	Float	4	S	r,w	C/a	max value	Upper level for Alarms.
19 / 35	HI_LIM	Float	4	S	r,w	C/a	max value	Upper level for Warnings.
20 / 36	LO_LIM	Float	4	S	r,w	C/a	min value	Lower level for Warnings.
21 / 37	LO_LO_LIM	Float	4	S	r,w	C/a	min value	Lower level for Alarms.
22 / 38	HI_HI_ALM	DS-39	16	D	r	C/a	0	Status of the Alarm at the upper level.
23 / 39	HI_ALM	DS-39	16	D	r	C/a	0	Status of the Warning at the upper level.
24 / 40	LO_ALM	DS-39	16	D	r	C/a	0	Status of the Warning at the lower level.
25 / 41	LO_LO_ALM	DS-39	16	D	r	C/a	0	Status of the Alarm at the lower level.
26 to 35 (42 to 51)	reserved by PNO							

3.4.4 Totalizer Block Parameter, Sorted by Name

Parameter Name	Rel.Index / Slot Index
ALARM_HYS	17 / 33
ALARM_SUM	7 / 23
ALERT_KEY	4 / 20
BATCH	8 / 24
BLOCK_OBJECT	0 / 16
CHANNEL	12 / 28
FAIL_TOT	15 / 31
HI_ALM	23 / 39
HI_HI_ALM	22 / 38
HI_HI_LIM	18 / 34
HI_LIM	19 / 35
LO_ALM	24 / 40
LO_LIM	20 / 36
LO_LO_ALM	25 / 41
LO_LO_LIM	21 / 37
MODE_BLK	6 / 22
MODE_TOT	14 / 30
PRESET_TOT	16 / 32
SET_TOT	13 / 29
ST_REV	1 / 17
STRATEGY	3 / 19
TAG_DESC	2 / 18
TARGET_MODE	5 / 21
TOTAL	10 / 26
UNIT_TOT	11 / 27

3.5 Slot 9 – Transducer Block

The Transducer-Block contains all the instrument specific parameters and functions required to measure and calculate the flowrate. The measured and calculated values are available as Transducer-Block-Output-Values and can be called as Channels from the AI-Block or the Totalizer-Block.
The cyclic reading of the selected measurement values is only possible from the AI- or Totalizer-Blocks. It is also possible to read the values acyclically from the Transducer-Block using the particular Index.

3.5.1 Channels and Units

The Transducer-Block (TB) in the FCM2000 readies the measurement values in the so called “Channels”. Every Function-Block (FB) has a Channel-Parameter (Index 14 for AI, Index 12 for Totalizer). It is used to select which is to be transferred from the TB to the FB. The following numbers are decimals:

Channel 256+17 = 273: VOLUME_FLOW
Unit: see TB-Parameter VOLUME_FLOW_UNITS (Rel.Index 18)

Channel 256+21 = 277: MASS_FLOW
Unit: see TB-Parameter MASS_FLOW_UNITS (Rel.Index 22)

Channel 256+25 = 281: DENSITY
Unit: see TB-Parameter DENSITY_UNITS (Rel.Index 26)

Channel 256+29 = 285: TEMPERATURE
Unit: see TB-Parameter TEMPERATURE_UNITS (Rel.Index 30)

Channel 256+81 = 337: Transducer-Block internal Mass-Totalizer >F
Channel 256+83 = 339: Transducer-Block internal Mass-Totalizer <R
Unit: see TB-Parameter “Unit Mass-Totalizer” (Rel.Index 60)

Channel 256+85 = 341: Transducer-Block internal Volume-Totalizer >F
Channel 256+87 = 343: Transducer-Block internal Volume-Totalizer <R
Unit: see TB-Parameter “Unit Volume-Totalizer” (Rel.Index 61)

Information: These are not the values from the Totalizer-Blocks! The FCM2000 has internal totalizers, whose values are displayed on the local LCD-Display in the submenu „Totalizer“. These „internal“ totalizers can be read on rel.Index 78, 80, 82 and 84. See 3.4.1.

The Channel-Parameter type is Unsigned16. The high Byte is the Index of the Transducer-Block (in principle an instrument can have multiple Transducer-Blocks), the low Byte is the relative Index of the parameter in the Transducer-Block. The FCM2000 has only a single Transducer-Block. It has the Index 1. Therefore the high Byte is always 1, which corresponds to +256 in the rel.Index.

3.5.2 Transducer Block Parameter, Sorted by Index

The Transducer Block up to Index 52 is a “Coriolis Mass Flow Block”. The parameter corresponds to the Coriolis-Flowrate-Profile. The Manufacturer-Specific parameters are in the Transducer-Block starting at Index 53. The order of the parameters in the manufacturer specific section corresponds to the order or the parameters in the Menu shown in the LCD-Display.

For a number of parameters two Default-Values are listed. The first parameter is a function of the installed converter and for the FCM2000 is the usual Default-Value. The PA-Profile however requires for certain parameters an alternate Default-Value. These values (second Default-Value in the Tables) are set after a Factory-Reset (see Physical Block Index 19).

A number of parameters are listed twice, e.g. rel. Index 9 and 68 (LOW_FLOW_CUTOFF and low flow cutoff value). They are included in the PA-Profile section and in the manufacturer specific section of the Transducer-Block. It is immaterial which one is read or written.

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
0 / 16	BLOCK_OBJECT	DS-32	20	Cst	r	-	This Structure contains general information about the Block, including Block Type, Profile Number, etc.
1 / 17	ST_REV	Unsigned16	2	N	r	0	Revision counter for static variables. When a static variable changes, this revision counter is incremented by one.
2 / 18	TAG_DESC	OctetString	32	S	r,w	‘ ’	A Text-Description for this Block. It must be unique within one Fieldbus.
3 / 19	STRATEGY	Unsigned16	2	S	R,w	0	This parameter can be used to build Groups of Blocks, in which every Block in a Group is assigned the same identification number.
4 / 20	ALERT_KEY	Unsigned8	1	S	R,w	0	This parameter is used as an Identifying-Number for a System-Section.
5 / 21	TARGET_MODE	Unsigned8	1	S	R,w	Auto	The desired operating mode for the Block. 0x08: Auto
6 / 22	MODE_BLK	DS-37	3	D	r	Actual : Auto Permitted: Auto Normal : Auto	This parameter contains the actual, allowed and normal operating modes for the Block. 0x08: Auto
7 / 23	ALARM_SUM	DS-42	8	D	r	0,0,0,0	This parameter contains a summary of the Block-Alarms.
8 / 24	CALIBR_FACTOR	float	4	S	R,w	0	Not used.
9 / 25	LOW_FLOW_CUTOFF	float	4	S	R,w	1.0 (After Factory Reset 0)	This is the FCM2000-Low-Flow- Cutoff. This parameter is identical to rel.Index 69, low flow cutoff.
10 / 26	MEASUREMENT_MODE	unsigned8	1	S	R,w	1 (After Factory Reset 0)	Type of flowrate measurement: 0: unidirectional 1: bi-directional This parameter corresponds to the FCM2000-Parameter “Flow Direction” (rel.Index 55).
11 / 27	FLOW_DIRECTION	unsigned8	1	S	R,w	0	Assignment of a positive or negative sign to the measurement value 0 = positive

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
						(After Factory Reset 0)	1 = negative
12 / 28	ZERO_POINT	float	4	S	R,w	Sensor-specific	This is the FCM2000-System-Zero with the Unit „ZERO_POINT_UNIT“. The parameter corresponds to rel.Index 72, System zero (Unit : Percent).
13 /29	ZERO_POINT_ADJUST	unsigned8	1	N	R,w	0	Adjust the ZERO_POINT: 0 = cancel 1 = execute
14 / 30	ZERO_POINT_UNIT	unsigned16	2	S	R,w	1342 (After Factory Reset 1062)	The System-Zero-Unit for the FCM2000 is %. The PA-Profile requires as a minimum the Unit mm/s. Therefore both units are included here. The conversion factors are: 100% = 10 m/s → 1% = 100 mm/s. 1062 = mm/s 1342 = %
15 / 31	NOMINAL_SIZE	float	4	S	R,w	-	Size of the flowmeter primary in mm or in inches. This parameter corresponds to Index 63, however here (rel.Index 15) the meter size is specified as a float-number and in rel.Index 63 as enumerated. The PA-Profile requires that the parameter be written. Since it makes no sense to make a change to this value, when writing, only the value already set will be accepted.
							Enumerated-Value for Index 62 / inch 4: Trio 1.5S — 0.0588 in (1/17 in) 5: Trio 3T — 0.1 in (1/10 in) 6: Trio 6B — 0.25 in (1/4 in) 7: Trio 10C — 0.375 in (3/8 in) 8: Trio 15D — 0.5 in (1/2 in) 9: Trio 20E — 0.75 in (3/4 in) 10: Trio 25F — 1 in 11: Trio 40G — 1.5 in (1-1/2 in) 12: Trio 50H — 2 in 13: Trio 65I — 2.5 in (2-1/2 in) 14: Trio 80J — 3 in 15: Trio 100K — 4 in 16: Trio 150L — 6 in
16 / 32	NOMINAL_SIZE_UNITS	unsigned16	2	S	R,w	1013 (After Factory Reset 1013)	Unit for NOMINAL_SIZE: 1013 : mm 1019 : inch
17 / 33	VOLUME_FLOW	DS-33	5	D	r	-	Measured Volume-Flowrate. Unit is listed in rel.Index 18.
18 / 34	VOLUME_FLOW_UNITS	unsigned16	2	S	R,w	1352 (After Factory Reset 1349)	Units for VOLUME_FLOW, VOLUME_FLOW_LO_LIMIT and VOLUME_FLOW_HI_LIMIT. This parameter is identical to rel. Index 58, Unit Qv. See Units Table.
19 / 35	-						VOLUME_FLOW_LO_LIMIT is not included in Coriolis Transducer-Block-Profile
20 / 36	-						VOLUME_FLOW_HI_LIMIT is not included in Transducer-Block-Profile
21 / 37	MASS_FLOW	DS-33	5	D	r		Measured Mass-Flowrate. Unit is in rel.Index 22.

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
22 / 38	MASS_FLOW_UNITS	unsigned16	2	S	R,w	1323 (After Factory Reset 1322)	Units for MASS_FLOW, MASS_FLOW_LO_LIMIT and MASS_FLOW_HI_LIMIT. This parameter is identical to rel. Index 57, Unit Qm. See Units Table.
23 / 39	MASS_FLOW_LO_LIMIT	float	4	S	R,w		Lower end of the flow range of the sensor, this parameter is always 0.
24 / 40	MASS_FLOW_HI_LIMIT	float	4	S	R,w		Upper end of the flow range of the sensor. This parameter is identical to rel. Index 64 QmMax Meter Pipe. The PA Profile requires that this parameter be writable. However, only the value which already exists can be written
25 / 41	DENSITY	DS-33	5	D	r		Measured density. Unit is listed in rel.Index 26.
26 / 42	DENSITY_UNITS	unsigned16	2	S	R,w	1104 (After Factory Reset 1103)	Units for DENSITY, DENSITY_LO_LIMIT and DENSITY_HI_LIMIT. This parameter is identical to rel. Index 59, Unit Density. See Units Table.
27 / 43	DENSITY_LO_LIMIT	float	4	S	R,w	0.5 g/ml	The measurement range limit can be read and written. However the value of the measurement range limit cannot be changed.
28 / 44	DENSITY_HI_LIMIT	float	4	S	R,w	3.5 g/ml	The measurement range limit can be read and written. However the value of the measurement range limit cannot be changed.
29 / 45	TEMPERATURE	DS-33	5	D	r		Measured Temperature. Unit is listed in rel.Index 30.
30 / 46	TEMPERATURE_UNITS	unsigned16	2	S	R,w	1001 (After Factory Reset 1000)	Units for TEMPERATURE, TEMPERATURE_LO_LIMIT and TEMPERATURE_HI_LIMIT. This parameter is identical to rel. Index 62, Unit Temperature. See Units Table.
31 / 47	TEMPERATURE_LO_LIMIT	float	4	S	R,w	223.15K	The measurement range limit can be read and written. However the value of the measurement range limit cannot be changed.
32 / 48	TEMPERATURE_HI_LIMIT	Float	4	S	R,w	453.15K	The measurement range limit can be read and written. However the value of the measurement range limit cannot be changed.
33 / 49	-	DS-33	5	D	r		VORTEX_FREQ is not contained in Coriolis Transducer-Block-Profile
34 /50	-	Unsigned16	2	S	R,w		VORTEX_FREQ_UNITS is not contained in Coriolis Transducer-Block-Profile
35 / 51	-	Float	4	S	R,w		VORTEX_FREQ_LO_LIMIT is not contained in Coriolis Transducer-Block-Profile
36 / 52	-	Float	4	S	R,w		VORTEX_FREQ_HI_LIMIT is not contained in Coriolis Transducer-Block-Profile
37 / 53	-	DS-33	5	D	r		SOUND_VELOCITY is not contained in Coriolis Transducer-Block-Profile
38 / 54	-	Unsigned16	2	S	R,w		SOUND_VELOCITY_UNITS is not contained in Coriolis Transducer-Block-Profile
39 / 55	-	float	4	S	R,w		SOUND_VELOCITY_LO_LIMIT is not contained in Coriolis Transducer-Block-Profile
40 / 56	-	float	4	S	R,w		SOUND_VELOCITY_HI_LIMIT is not contained in Coriolis Transducer-Block-Profile
41 / 57	-	DS-33	5	D	r		SAMPLING_FREQ is not contained in Coriolis Transducer-Block-Profile
42 / 58	-	Unsigned16	2	S	R,w		SAMPLING_FREQ_UNITS is not contained in Coriolis Transducer-Block-Profile
43 to 52 (59 to 68)	Reserved						

The Parameters up to 52 correspond to the PA3.0 Profile for Coriolis Mass Flowmeters. From Index 53 and up they are the instrument specific Parameters for the FCM2000:

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
53 / 69	ProgProtCode	Unsigned 16	2	S	r,w	0	Lower limit: 0 Upper limit: 9999 Units : no
54 / 70	Language	Unsigned 8	1	S	r,w	0	0 : German 1 : English
55 / 71	Flow Direction	Unsigned 8	1	S	r,w	0	0 : Forward 1 : Forward/Reverse
56 / 72	Direction Indication	Unsigned 8	1	S	r,w	0	0 : Normal 1 : Inverse
57 / 73	Unit Qm	Unsigned 16	2	S	r,w	1323 (After Factory Reset 1322)	1318: g/s 1319: g/min 1320: g/h 1322: kg/s 1323: kg/min 1324: kg/h 1325: kg/d 1327: t/min 1328: t/h 1329: t/d 1330: lb/s 1331: lb/min 1332: lb/h 1333: lb/d
58 / 74	Einheit Qv	Unsigned 16	2	S	r,w	1352 (nach Factory Reset 1349)	1351: l/s 1352: l/min 1353: l/h 1347: m3/s 1348: m3/min 1349: m3/h 1350: m3/d 1356: ft3/s 1357: ft3/min 1358: ft3/h 1359: ft3/d 1362: usgps 1363: usgpm 1364: usgph 1366: usmgd 1367: igps 1368: igpm 1369: igph 1370: igpd

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
							1371: bbl/s 1372: bbl/m 1373: bbl/h 1374: bbl/d
59 / 75	Unit Density	Unsigned 16	2	S	r,w	1104	1104: g/ml 1105: g/l 1100: g/cm3 1103: kg/l 1097: kg/m3 1107: lb/ft3 1108: lb/ugl
60 / 76	Unit Mass Totalizer	Unsigned 16	2	S	r,w	1088	1089: g 1088: kg 1092: t 1094: lb
61 / 77	Unit Volume Totalizer	Unsigned 16	2	S	r,w	1038	1038: l 1034: m3 1043: ft3 1048: ugl 1049: igl 1051: bbl
62 / 78	Unit Temperature	Unsigned 16	2	S	r,w	1001	1001: C 1000: K 1002: F
63 / 79	Meter Pipe	Unsigned 8	1	S	r	-	4: Trio 1.5S 5: Trio 3T 6: Trio 6B 7: Trio 10C 8: Trio 15D 9: Trio 20E 10: Trio 25F 11: Trio 40G 12: Trio 50H 13: Trio 65I 14: Trio 80J 15: Trio 100K 16: Trio 150L
64 / 80	QmMax Meter Pipe	Float	4	S	r	-	Lower limit: Upper limit: Unit : Unit Qm
65 / 81	Order Number	String	16	S	r	-	
66 / 82	Eex-Protection	Unsigned 8	1	S	r	-	0: off 1: on
67 / 83	QmMax	Float	4	S	r,w	-	Lower limit: 0.01 * QmMax Meter Pipe Upper limit: 1.00 * QmMax Meter Pipe Unit : Unit Qm

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
68 / 84	Damping	Float	4	S	r,w	-	Lower limit: 1,0 Upper limit: 100 Unit : sek
69 / 85	Low Flow Cutoff	Float	4	S	r,w	-	Lower limit: 0 Upper limit: 10 Unit : %
70 / 86	D Correction	Float	4	S	r,w	-	Lower limit: -50 Upper limit: 50 Unit : g/l
71 / 87	Qm Correction	Float	4	S	r,w	-	Lower limit: -5 Upper limit: 5 Unit : %
72 / 88	System Zero	Float	4	S	r,w	-	Lower limit: -10 Upper limit: 10 Unit : %
73 / 89	Start automatic adjustment System Zero	unsigned8	1	D	r,w	0	Read: 0 = no adjustment active 1 = adjustment running Write: 1 = start fast adjustment (duration appr. 3s) 2 = start slow adjustment (duration appr. 20s) The Adjust-Start is rise time triggered. „1“ or „2“ – Write starts the appropriate adjustment procedure.
74 / 90	Min- and Max-Alarm Qm	Array of Float: Min-Alarm Qm Max-Alarm Qm	8	S	r,w	-	Entry range Min-Alarm Qm: 0% to Max Alarm Qm Entry range Max-Alarm Qm: MinAlarm Qm to 105% Unit : %
75 / 91	Min- and Max-Alarm Density	Array of Float: Min-Alarm D. Max-Alarm D.	8	S	r,w	-	Entry range Min-Alarm Density: 0.5 kg/l to Max Alarm Density Entry range Max-Alarm Density: Min-Alarm Density to 3.5 kg/l Unit : Density-Unit
76 / 92	Min- and Max-Alarm Temperature	Array of Float: Min-Alarm T. Max-Alarm T.	8	S	r,w	-	Entry range Min-Alarm Temperature: -50 C to Max Alarm Temperature Entry range Max-Alarm Temperature: Min-Alarm Temperature to 180 C Unit : Temperature-Unit
77 / 93	Display 1st Line	Unsigned 8	1	S	r,w	-	14: Drive current 15: Sensor ampl. A, B 18: DSP Flow 106: TB Density Status 107 TB Temperature Value 108 TB Temperature Status
78 / 94	Display 2nd Line	Unsigned 8	1	S	r,w		
79 / 95	Display 1st Line multiplex	Unsigned 8	1	S	r,w		

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
80 / 96	Display 2nd Line multiplex	Unsigned 8	1	S	r,w	-	21: Temp. Housing 22: Qm Phase + Time 0 : Q [Bargraph] 1 : Qm 2 : Qv 3 : Q [%] 11: Temperature 10: Density 12: TAG Number 4 : Totalizer Mass 5 : Totalizer Mass >F 6 : Totalizer Mass <R 7 : Totalizer Volume 8 : Totalizer Volume >F 9 : Totalizer Volume <R 19: Pipe Frequency 13: Blank Line 20: Off (only possible for Multiplex) 100: PA Adr+State 101: TB MassFlow Value 102: TB MassFlow Status 103: TB VolFlow Value 104: TB VolFlow Status 105: TB Density Value	109: TB TotMass >F Value 110: TB TotMass >F Status 111: TB TotMass <R Value 112: TB TotMass <R Status 113: TB TotVol >F Value 114: TB TotVol >F Status 115: TB TotVol <R Value 116: TB TotVol <R Status 117: FB AI1 Out 118: FB AI1 Status 119: FB AI2 Out 120: FB AI2 Status 121 FB AI3 Out 122 FB AI3 Status 123 FB AI4 Out 124 FB AI4 Status 125 FB AI5 Out 126 FB AI5 Status 127 FB AI6 Out 128 FB AI6 Status 129 FB TOT1 Total 130 FB TOT1 Status 131 FB TOT2 Total 132 FB TOT2 Status
81 / 97	Mass-Totalizer >V	DS-33	5	S	r,w		Lower limit: 0 Upper limit: 9999999.9 Unit : Unit Mass-Totalizer Info: The Totalizer value can be written	
82 / 98	Mass-Totalizer Overflow >V	Unsigned 16	2	S	r			
83 / 99	Mass-Totalizer <R	DS-33	5	S	r,w		Lower limit: 0 Upper limit: 9999999.9 Unit : Unit Mass-Totalizer Info: The Totalizer value can be written.	
84 / 100	Mass-Totalizer Overflow <R	Unsigned 16	2	S	r			
85 / 101	Volume-Totalizer >V	DS-33	5	S	r,w		Lower limit: 0 Upper limit: 9999999.9 Unit : Unit Mass-Totalizer Info: The Totalizer value can be written.	
86 / 102	Volume-Totalizer Overflow >V	Unsigned 16	2	S	r			
87 / 103	Volume-Totalizer <R	DS-33	5	S	r,w		Lower limit: 0 Upper limit: 9999999.9 Unit : Unit Mass-Totalizer Info: The Totalizer value can be written.	
88 / 104	Volume-Totalizer Overflow <R	Unsigned 16	2	S	r			
89 / 105	Totalizer Clear	Unsigned8	1	D	r,w		Write:	

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
							1= Reset all Totalizers & overflows The reset is rise time triggered. Writing 1 initiates the reset, not a continuous value 1. The reset is rise time triggered. Writing 1 initiates the reset, not a continuous value 1.
90 / 106	Instrument Number	Unsigned 32	4	S	r		
91 / 107	-						
92 / 108	Simulation Mode	Unsigned8	1	D	r,w	0	0 : Off 1 : On
93 / 109	Simulation Qm	Unsigned8	1	D	r,w	0	0 : Measure 1 : Enter 2 : Step
94 / 110	Simulation Value Qm	Float	4	D	r,w	0	Lower limit: -115 Upper limit: 115 Unit : %
95 / 111	Simulation Density	Unsigned8	1	D	r,w	0	0 : Measure 1 : Enter 2 : Step
96 / 112	Simulation Value Density	Float	4	D	r,w	0	Lower limit: 0.3 kg/l Upper limit: 3.7 kg/l Unit : Unit Density
97 / 113	-						
98 / 114	-						
99 / 115	Simulation Pipe temperature	Unsigned8	1	D	r,w	0	0 : Measure 1 : Enter 2 : Step
100 / 116	Simulation Value Pipe Temperature	Float	4	D	r,w	0	Lower limit: -60 Upper limit: 190 Unit : Unit Temperature
101 / 117	Simulation Housing Temperature	Unsigned8	1	D	r,w	0	0 : Measure 1 : Enter 2 : Step
102 / 118	Simulation Value Housing Temperature	Float	4	D	r,w	0	Lower limit: -60 Upper limit: 190 Unit : Unit Temperature
103 / 119	-						
104 / 120	-						
105 / 121	-						
106 / 122	-						
107 / 123	-						
108 / 124	Function Test Memory • Checksum Bootloader • Checksum CM Program	Unsigned 8	1	D	r/w	0	0 Memory test not executed 7 Test converter program start / running 8 Test converter program ok 9 Test converter program error 10 Test Bootloader-Program start / running 11 Test Bootloader-Program ok 12 Test Bootloader-Program error

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
109 / 125	Error Register Actual	OctetString	4	D	r		This Error Register shows the actual errors set. When an error automatically disappears (e.g. Error 3: Flow Range Exceeded and the flowrate returns to normal) the corresponding Bit in this Register also disappears. Bit-assignment in Register see **Fehler! Verweisquelle konnte nicht gefunden werden.**	
110 / 126	Warning Register Actual	OctetString	2	D	r		Same as „Error Register Actual “. Bit-assignment in Register see 3.5.4.2	
111 / 127	Error Register History	OctetString	4	S	r,w		The actual error is also displayed in this Register. When the error automatically disappears, the corresponding Bit remains set in the Register. This Register thereby shows the „History“ of the errors detected, i.e. also errors, which for any reason were detected in the past. Bit-assignment in Register see Bit-assignment in Register see **Fehler! Verweisquelle konnte nicht gefunden werden.** Write 0,0,0,0 to clear the Register.	
112 / 128	Warning Register History	OctetString	2	S	r,w		Same as „Error Register History“. Bit-assignment in Register see 3.5.4.2 Write 0,0,0,0 to clear the Register..	
113 / 129	Mains Interrupt	Unsigned 16	2	S	r			
114 / 130	Version	Visible String	16	Cst	r	"D699G001U01 A.10"		
115 / 131	Instrument Flow Calibration	Struct	12	N	r			
		Float	4				Zero	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Span Forward	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Span Reverse	Lower limit: -1000 Upper limit: 1000 Unit : -
116 / 132	Instrument Temp.Pipe	Struct	32	N	r			
		Float	4				Pt100 Adjust Temp.Pipe Min	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Pt1000 Adjust Temp.Pipe Max	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Pt1000 Temp.Pipe Span	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Pt100 Temp.Pipe Zero	Lower limit: -1000 Upper limit: 1000 Unit
		Float	4				Pt100 Adjust Temp.Pipe Min	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit -

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
		Float	4				Pt1000 Adjust Temp.Pipe Max	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Pt1000 Temp.Pipe Span	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Pt1000 Temp.Pipe Zero	Lower limit: -1000 Upper limit: 1000 Unit : -
117 / 133	Instrument-Temp.Housing	Struct	17	N	r			
		Unsigned8	1				Temp.Housing EEx	0 : Rev.0 1 : Rev.1
		Float	4				Adjust Temp.Housing Min	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Adjust Temp.Housing Max	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Temp.Housing Span	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Temp.Housing Zero	Lower limit: -1000 Upper limit: 1000 Unit : -
118 / 134	Instrument Hardware Front-End-Board	Unsigned8	1	N	r		0 : Revision 0 2 : Revision 2 3 : Revision 4 4 : Revision 5 255 : Revision not recognized (board not installed)	
119 / 135	-							
120 / 136	Primary Calibration Driver	Struct	18	N	r			
		Unsigned8	1				Driver	0: off 1: on
		Unsigned8	1				Current limit	0 : Imax=100mA EEx 2 : Imax=160mA EEx 1 : Imax=350mA
		Float	4				Amplitude [rms]	Lower limit: 0 Upper limit: 300 Unit : mV
		Float	4				Driver Kp	Lower limit: 0 Upper limit: 1000 Unit : -: -

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
		Float	4				Driver Ki	Lower limit: 0 Upper limit: 1000 Unit : -
		Float	4				Primary Gain	Lower limit: 0 Upper limit: 1000 Unit : -
121 / 137	Primary-Calibration Temperature Pipe	Struct	17	N	r			
		Unsigned8	1				Temp.Pipe Calib.	0 : Rev. 0 1 : Rev. 1
		Float	4				Adjust Temp.Pipe Min	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Adjust Temp.Pipe Max	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Temp.Pipe Span	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4					Lower limit: -1000 Upper limit: 1000 Unit : -
122 / 138	Primary Calibration Temperature Housing	Struct	19	N	r			
		Unsigned8	1				Temp. Housing	0 : disable 1 : enable
		Unsigned8	1				Temp.Housing EEx	0 : Rev. 0 1 : Rev. 1
		Float	4				Adjust Temp. Housing Min	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Adjust Temp. Housing Max	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Temp. Housing Span	Lower limit: -1000 Upper limit: 1000 Unit : -: -
		Float	4				Temp. Housing Zero	Lower limit: -1000 Upper limit: 1000 Unit : -: -
		Unsigned8	1				Temp. Housing Calib.	0 : Rev. 0 1 : Rev. 1
123 / 139	Primary Calibration Density	Struct	19	N	r			
		Float	4				F1 (20^0C empty)	Lower limit: -1000 Upper limit: 1000 Unit : Hz

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
		Float	4				D1 (empty)	Lower limit: -1 Upper limit: 5 Unit : kg/l
		Float	4				F2 (20^{0}C filled)	Lower limit: 0 Upper limit: 1000 Unit : Hz
		Float	4				D2 (filled)	Lower limit: 0 Upper limit: 5 Unit : kg/l
		Float	4				KtFreq	Lower limit: -1000 Upper limit: 1000 Unit : 1 / 1000K
		Float	4				KtDensity	Lower limit: -10 Upper limit: 10 Unit : 1 / 1000K
124 / 140	Primary Calibration Flow	Struct	33	N	r			
		Float	4				Zero	Lower limit: -1000 Upper limit: 1000 Unit : %
		Float	4				Span Forward	Lower limit: -1000 Upper limit: 1000 Unit : %
		Float	4				Zero Offset Forward	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Span Reverse	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Zero Offset Reverse	Lower limit: -1000 Upper limit: 1000 Unit : -
		Float	4				Kt Qm	Lower limit: -1000 Upper limit: 1000 Unit : 1 / 1000K
		Float	4				Tm Calib. Span	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Float	4				Tm Calib. Zero	Lower limit: -50 C Upper limit: 180 C Unit : Temperature Unit
		Unsigned 8	1				Flow Calculation	0 : Rev. 0 1 : Rev. 1
125 / 141	-							
126 / 142	Service-Connector	Struct	9	N	r			

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
		Unsigned8	1				Service-Connector	6 : off 7 : automatic 5 : 2400 baud 4 : 4800 baud 3 : 9600 baud 2 : 19200 baud 1 : 38400 baud 0 : 57600 baud
		Unsigned32	4				Select Ouput values	Internal Bit-Feld
		Float	4				Output Cycle	Lower limit: 0.1 Upper limit: 3600 Unit : sec
127 / 143	DIP-Switch	Unsigned 16	2	S	r		The actual DIP-Switch settings are displayed (Switch 1-10 on Bit 0 to 9).	
128 / 144	Error Warning Simulation On	Unsigned 8	1	D	r,w	0	0 : Off 1 : On see 3.5.4	
129 / 145	Error Simulation Value	OctetString	4	D	r,w	00,00,00,00	Setting non-existent Error-Bits is not possible. See also 3.5.4	
130 / 146	Warning Simulation Value	OctetString	2	D	r,w	00,08	Setting non-existent Error-Bits is not possible. See also 3.5.4	
131 / 147	TB Diagnosis_Mask_Extension	Octetstring	6	S	r,w	FF,0F,FE,01,00,08	see 4.3	
132 / 148	TB Diagnosis_Mask_Extension Default	Octetstring	6	Cst	r	FF,0F,FE,01,00,08	see 4.3	
133 / 149	Diagnosis Classification	Octetstring	6	S	r,w	FF,0F,FE,01,00,00	see 4.4 This parameter is not processed in the converter. It indicates which Bit in the Diagnosis_Extension is considered an Error and which a Warning: 0 = Warning 1 = Error	
134 / 150	Diagnosis Classification Default	Octetstring	6	Cst	r	FF,0F,FE,01,00,00	see 4.4	
135 / 151	Diagnosis Priority	Array of 48* Unsigned16					Indicates the priority of an Error or Warning. The values are not processed by the converter (see 4.4).	

Bit	Description	Priority
1	Error „Driver Current”	936
2	Error „Driver “	944
3	Error „Sensor Amplitude“	952
4	Error „Sensor”	960
5	Error „AD-Converter “	968
6	Error „DSP Communication“	976
7	Error „External FRAM“	984
8	Error „Internal FRAM“	992
9	ErrorBit is not assigned	0
10	ErrorBit is not assigned	0
11	ErrorBit is not assigned	0
12	ErrorBit is not assigned	0
13	Error „Flowrate > 105%“	896

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description		
						14	Error „T Pipe Measurement“	912	
						15	Error „Density <0,5 Kg/l“	920	
						16	Error „Density Measurement“	928	
						17	Error „Sensor C“	800	
						18	Error „Sensor B“	808	
						19	Error „Sensor A“	816	
						20	Error „Totalizer Vol. <R“	824	
						21	Error „Totalizer Vol. >V“	832	
						22	Error „Totalizer Mass <R“	840	
						23	Error „Totalizer Mass >V“	848	
						24	Errorbit is not assigned	0	
						25	Errorbit is not assigned	0	
						26	Errorbit is not assigned	0	
						27	Errorbit is not assigned	0	
						28	Errorbit is not assigned	0	
						29	Errorbit is not assigned	0	
						30	Errorbit is not assigned	0	
						31	Errorbit is not assigned	0	
						32	Error „THousing Measurement“	904	
						33	Warning „Reverse Q“	236	
						34	Warning „MIN Alarm Temp.“	244	
						35	Warning „MAX Alarm Temp.“	252	
						36	Warning „MIN Alarm Density“	260	
						37	Warning „MAX Alarm Density“	268	
						38	Warning „MIN Alarm Qm“	276	
						39	Warning „MAX Alarm Qm“	284	
						40	Warning „Totalizer reset“	0	
						41	Warning „Overflow <R Vol.“	180	
						42	Warning „Overflow >V Vol.“	188	
						43	Warning „Overflow <R Mass“	196	
						44	Warning „Overflow >V Mass“	204	
						45	Warning „** Simulation **“	172	
						46	Warning „Update ext.Dat.“	212	
						47	Warning „Update int.Dat.“	220	
						48	Warning „Ext.Dat.loaded“	228	
136 / 152	Diagnose Priorität Default	Array of 48* Unsigned16	96	Cst	r	Bit	Description	Priority	The Default-Values for the Diagnosis Priority
						1	Error „Driver Current“	936	
						2	Error „Driver“	944	
						3	Error „Sensor Amplitude“	952	
						4	Error „Sensor“	960	
						5	Error „AD-Converter“	968	
						6	Error „DSP Communikation“	976	

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description	
						7	Error „External FRAM“	984
						8	Error „Internal FRAM“	992
						9	Errorbit is not assigned	0
						10	Errorbit is not assigned	0
						11	Errorbit is not assigned	0
						12	Errorbit is not assigned	0
						13	Error „Flowrate > 105%“	896
						14	Error „T Pipe measurement“	912
						15	Error „Density <0,5 Kg/l“	920
						16	Error „Density measurement“	928
						17	Error „Sensor C“	800
						18	Error „Sensor B“	808
						19	Error „Sensor A“	816
						20	Error „Totalizer Vol. <R“	824
						21	Error „Totalizer Vol. >V“	832
						22	Error „Totalizer Mass <R“	840
						23	Error „Totalizer Mass >V“	848
						24	Errorbit is not assigned	0
						25	Errorbit is not assigned	0
						26	Errorbit is not assigned	0
						27	Errorbit is not assigned	0
						28	Errorbit is not assigned	0
						29	Errorbit is not assigned	0
						30	Errorbit is not assigned	0
						31	Errorbit is not assigned	0
						32	Error „T Housing mesurement“	904
						33	Warning „Reverse Q“	236
						34	Warning „MIN Alarm Temp.“	244
						35	Warning „MAX Alarm Temp.“	252
						36	Warning „MIN Alarm Density“	260
						37	Warning „MAX Alarm Density“	268
						38	Warning „MIN Alarm Qm“	276
						39	Warning „MAX Alarm Qm“	284
						40	Warning „Totalizer reset“	0
						41	Warning „Overflow <R Vol.“	180
						42	Warning „Overflow >V Vol.“	188
						43	Warning „Overflow <R Masse“	196
						44	Warning „Overflow >V Masse“	204
						45	Warning „** Simulation **“	172
						46	Warning „Update ext.Dat.“	212
						47	Warning „Update int.Dat.“	220
						48	Warning „Ext.Dat.geladen“	228

Rel.Idx / Slot Idx	Variable Name	Data Type	Size	Store	Access	Default Value	Description
137 / 153	Reset Diagnosis Parameters to Default	Unsigned8	1	s	r,w	0	Write: 1= TB Diagnosis_Mask_Extension, Diagnosis Classification and Diagnosis Priority are set to their Default-Values. The reset is rise time triggered. Write 1 initiates the procedure, not a continuous value 1.
138 / 154	Housing Temperature	DS-33	5	D	r		Measured temperature. Unit is rel.Index 61.

3.5.3 Transducer Block Parameters, Sorted by Name

Parameter Name	Rel.Index / Slot Index
ALARM_SUM	7 / 23
ALERT_KEY	4 / 20
Display 1st Line	77 / 93
Display 1st Line multiplex	79 / 95
Display 1st Line multiplex	80 / 96
Display 2nd Line	78 / 94
Order Number	65 / 81
BLOCK_OBJECT	0 / 16
CALIBR_FACTOR	8 / 24
D Correction	70 / 86
Damping	68 / 84
DENSITY	25 / 41
DENSITY_HI_LIMIT	28 / 44
DENSITY_LO_LIMIT	27 / 43
DENSITY_UNITS	26 / 42
Diagnosis Classification	133 / 149
Diagnosis Classification Default	134 / 150
Diagnosis Priority	135 / 151
DIP-Switch	127 / 143
Eex-Protection	66 / 82
Unit Density	59 / 75
Unit Mass-Totalizer	60 / 76
Unit Qm	57 / 73
Unit Qv	58 / 74
Unit Temperature	62 / 78
Unit Volume-Totalizer	61 / 77
Error Simulation Value	129 / 145
Error Warning Simulation On	128 / 144
Error Register Actual	109 / 125
Error Register History	111 / 127
Flow direction	55 / 71
FLOW_DIRECTION	11 / 27
Function Test Memory	108 / 124
Instrument Number	90 / 106
Instrument Flow Calibration	115 / 131
Instrument Hardware Front-End-Board	118 / 134
Instrument Temp.Pipe	116 / 132
Instrument-Temp.Housing	117 / 133
LOW_FLOW_CUTOFF	9 / 25
MASS_FLOW	21 / 37
MASS_FLOW_HI_LIMIT	24 / 40
MASS_FLOW_LO_LIMIT	23 / 39
MASS_FLOW_UNITS	22 / 38
Mass-Totalizer <R	83 / 99
Mass-Totalizer >F	81 / 97
Mass-Totalizer Overflow <R	84 / 100
Mass-Totalizer Overflow >F	82 / 98
MEASUREMENT_MODE	10 / 26
Meter Pipe	63 / 79
Min- and Max-Alarm Density	75 / 91
Min- and Max-Alarm Qm	74 / 90
Min- and Max-Alarm Temperature	76 / 92
MODE_BLK	6 / 22
Mains Interrupt	113 / 129
NOMINAL_SIZE	15 / 31
NOMINAL_SIZE_UNITS	16 / 32
Primary Calibration Density	123 / 139
Primary Calibration Driver	120 / 136
Primary Calibration Flow	124 / 140

Parameter Name	Rel.Index / Slot Index
Primary Calibration Temperature Housing	122 / 138
Primary-Calibration Temperature Pipe	121 / 137
ProgProtCode	53 / 69
Qm Correction	71 / 87
QmMax	67 / 83
QmMax Meter Pipe	64 / 80
Direction Indication	56 / 72
Low Flow Cutoff	69 / 85
Service-Connector	126 / 142
Simulation Value Density	96 / 112
Simulation Value Housing Temperature	102 / 118
Simulation Value Qm	94 / 110
Simulation Value Pipe Temperature	100 / 116
Simulation Density	95 / 111
Simulation Housing Temperature	101 / 117
Simulation Mode	92 / 108
Simulation Qm	93 / 109
Simulation Pipe Temperature	99 / 115
Language	54 / 70
ST_REV	1 / 17
Start Automatic Adjust System Zero	73 / 89
STRATEGY	3 / 19
System Zero	72 / 88
TAG_DESC	2 / 18
TARGET_MODE	5 / 21
TB Diagnosis_Mask_Extension	131 / 147
TB Diagnosis_Mask_Extension	132 / 148
TEMPERATURE	29 / 45
TEMPERATURE_HI_LIMIT	32 / 48
TEMPERATURE_LO_LIMIT	31 / 47
TEMPERATURE_UNITS	30 / 46
Version	114 / 130
VOLUME_FLOW	17 / 33
VOLUME_FLOW_UNITS	18 / 34
Volume-Totalizer <R	87 / 103
Volume-Totalizer >F	85 / 101
Volume-Totalizer Overflow <R	88 / 104
Volume-Totalizer Overflow >F	86 / 102
Warning Simulation Value	130 / 146
Warning Register Actual	110 / 126
Warning Register History	112 / 128
Totalizer Clear	89 / 105
ZERO_POINT	12 / 28
ZERO_POINT_ADJUST	13 / 29
ZERO_POINT_UNIT	14 / 30
ALARM_SUM	7 / 23
ALERT_KEY	4 / 20
Display 1st Line	77 / 93
Display 1st Line multiplex	79 / 95
Display 1st Line multiplex	80 / 96
Display 2nd Line	78 / 94
Order Number	65 / 81
BLOCK_OBJECT	0 / 16
CALIBR_FACTOR	8 / 24
D correction	70 / 86
Damping	68 / 84
DENSITY	25 / 41
DENSITY_HI_LIMIT	28 / 44
DENSITY_LO_LIMIT	27 / 43

Parameter Name	Rel.Index / Slot Index
DENSITY_UNITS	26 / 42
Diagnosis Classification	133 / 149
Diagnosis Classification Default	134 / 150
Diagnosis Priority	135 / 151
DIP-Switch	127 / 143
Eex-Protection	66 / 82
Unit Density	59 / 75
Unit Mass-Totalizer	60 / 76
Unit Qm	57 / 73
Unit Qv	58 / 74
Unit Temperature	62 / 78
Unit Volume-Totalizer	61 / 77
Error Simulation Value	129 / 145
Error Warning Simulation On	128 / 144
Error Register Actual	109 / 125
Error Register History	111 / 127
Flow Direction	55 / 71
FLOW_DIRECTION	11 / 27
Function Test Memory	108 / 124
Instrument Number	90 / 106
Instrument Flow Calibration	115 / 131
Instrument Hardware Front-End-Board	118 / 134
Instrument Temp.Pipe	116 / 132
Instrument-Temp.Housing	117 / 133
LOW_FLOW_CUTOFF	9 / 25
MASS_FLOW	21 / 37
MASS_FLOW_HI_LIMIT	24 / 40
MASS_FLOW_LO_LIMIT	23 / 39
MASS_FLOW_UNITS	22 / 38
Mass-Totalizer <R	83 / 99
Mass-Totalizer >F	81 / 97
Mass-Totalizer Overflow <R	84 / 100
Mass-Totalizer Overflow >F	82 / 98
MEASUREMENT_MODE	10 / 26
Meter Pipe	63 / 79
Min- and Max-Alarm Density	75 / 91
Min- and Max-Alarm Qm	74 / 90
Min- and Max-Alarm Temperature	76 / 92
MODE_BLK	6 / 22
Mains Interrupt	113 / 129
NOMINAL_SIZE	15 / 31
NOMINAL_SIZE_UNITS	16 / 32
Primary Calibration Density	123 / 139
Primary Calibration Driver	120 / 136
Primary Calibration Flow	124 / 140
Primary Calibration Temperature Housing	122 / 138
Primary-Calibration Temperature Pipe	121 / 137
ProgProtCode	53 / 69
Qm Correction	71 / 87
QmMax	67 / 83
QmMax Meter Pipe	64 / 80
Direction Indication	56 / 72
Low Flow Cutoff	69 / 85
Service-Connector	126 / 142
Simulation Value Density	96 / 112
Simulation Value Housing Temperature	102 / 118
Simulation Value Qm	94 / 110
Simulation Value Pipe Temperature	100 / 116
Simulation Density	95 / 111
Simulation Housing Temperature	101 / 117
Simulation Mode	92 / 108
Simulation Qm	93 / 109
Simulation Pipe Temperature	99 / 115

Parameter Name	Rel.Index / Slot Index
Language	54 / 70
ST_REV	1 / 17
Start Automatic Adjust System Zero	73 / 89
STRATEGY	3 / 19
System Zero	72 / 88
TAG_DESC	2 / 18
TARGET_MODE	5 / 21
TB Diagnosis_Mask_Extension	131 / 147
TB Diagnosis_Mask_Extension	132 / 148
TEMPERATURE	29 / 45
TEMPERATURE_HI_LIMIT	32 / 48
TEMPERATURE_LO_LIMIT	31 / 47
TEMPERATURE_UNITS	30 / 46
Version	114 / 130
VOLUME_FLOW	17 / 33
VOLUME_FLOW_UNITS	18 / 34
Volume-Totalizer <R	87 / 103
Volume-Totalizer >F	85 / 101
Volume-Totalizer Overflow <R	88 / 104
Volume-Totalizer Overflow >F	86 / 102
Warning Simulation Value	130 / 146
Warning Register Actual	110 / 126
Warning Register History	112 / 128
Totalizer Clear	89 / 105
ZERO_POINT	12 / 28
ZERO_POINT_ADJUST	13 / 29
ZERO_POINT_UNIT	14 / 30

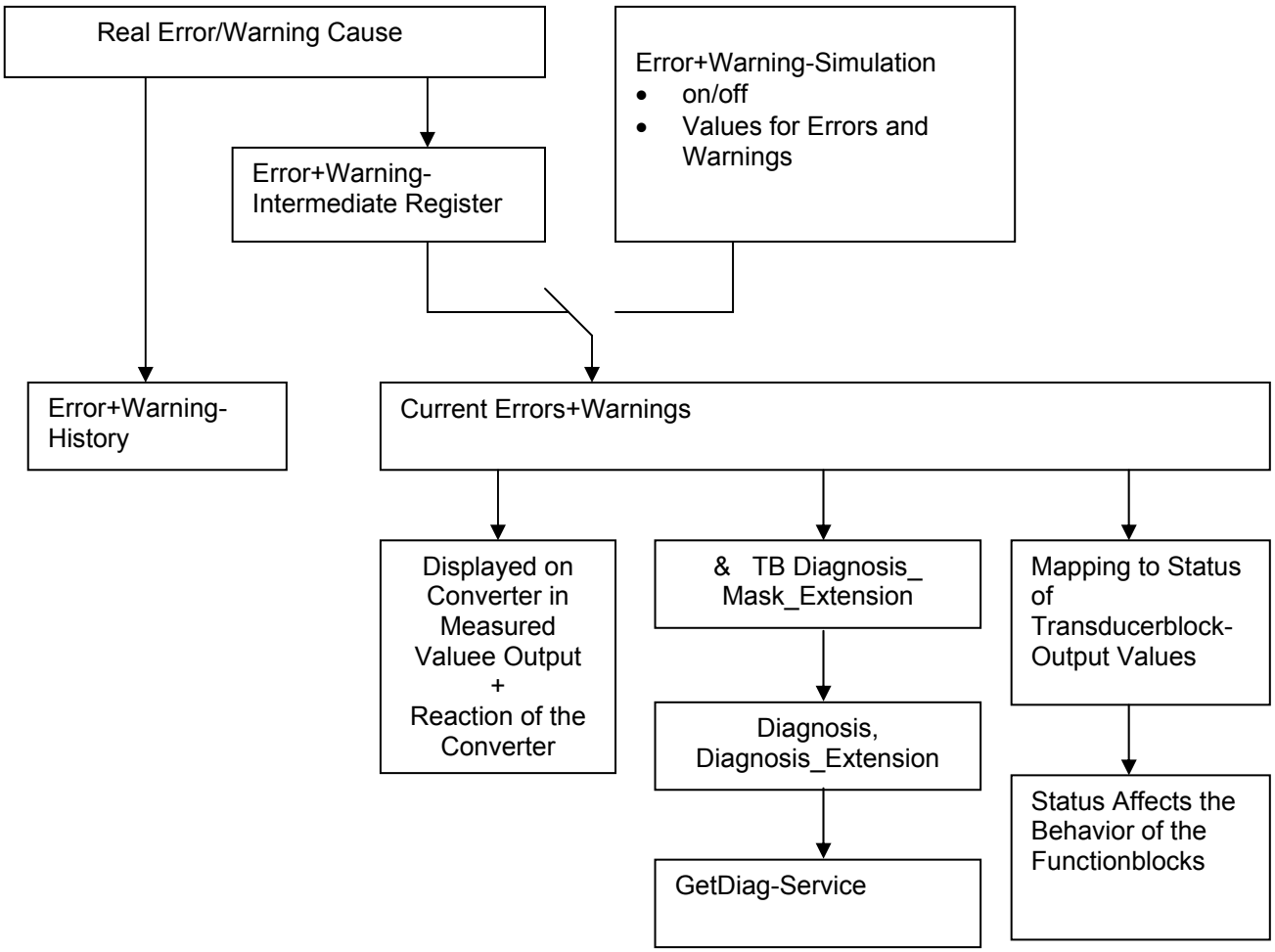
3.5.4 Error- and Warning Processing

The converter has two Error Registers: One Register shows the actual Errors (Transducer Block rel Index 109), and an additional one which shows the all the Errors set in the past (rel. Index 111). The same applies for Warnings: One Register shows the actual Warnings (rel. Index 110), and an additional one which shows the all the Warnings set in the past (rel. Index 112). The Registers for historical records can be cleared.

The past (History) is only for information. The actual Errors and Warnings are important for the present status of the converter:

- They are displayed on the converter and define its behavior.
- They are masked over „TB Diagnosis_Mask_Extension“, and shown in the Parameter „Diagnosis_Extension“ in the Physical Block (see 4.3). This Parameter is reported by PA-GetDiag-Service to the PA-Master (see 4.1.2).
- They define the Status of the Transducerblock-Output values (see 3.5.1). This Status is transferred to the Function-Blocks and defines their behavior (see 4.5).

It is possible for test purposes to simulate the actual Errors and Warnings. To do this, the Error- and Warning-Simulation must be turned on. In this case the simulated values are used in place of the actual values. The Simulation can be run using keypad (see 5.3) or over the Fieldbus (Transducer-Block rel. Index 128 - 130).



3.5.4.1 Error Register

The actual Error Register is in the Transducer-Block at rel. Index 109.
The Error-History (Errors which were set in the past or are currently set), are at Index 111.

Octet 1	Bit 7	Error 2b	Driver Current
	Bit 6	Error 2a	Driver
	Bit 5	Error 0	Sensor Amplitude
	Bit 4	Error 11d	Sensor
	Bit 3	Error 1	AD-Converter
	Bit 2	Error 10	DSP Communication
	Bit 1	Error 5b	External FRAM
	Bit 0	Error 5a	Internal FRAM
Octet 2	Bit 7	-	- (For HART instruments: Iout 2 too large, for PA unassigned)
	Bit 6	-	- (For HART instruments: Iout 1 too small, for PA unassigned)
	Bit 5	-	- (For HART instruments: Iout 1 too large, for PA unassigned)
	Bit 4	-	- (For HART instruments: Ext. Zero Return, for PA unassigned)
	Bit 3	Error 3	Flowrate > 105%
	Bit 2	Error 7a	Pipe Temperature Measurement
	Bit 1	Error 9b	Density <0.5 kg/l
	Bit 0	Error 9a	Density Measurement
Octet 3	Bit 7	Error 11c	Sensor C
	Bit 6	Error 11b	Sensor B
	Bit 5	Error 11a	Sensor A
	Bit 4	Error 6d	Totalizer Volume <R
	Bit 3	Error 6c	Totalizer Volume >F
	Bit 2	Error 6b	Totalizer Mass <R
	Bit 1	Error 6a	Totalizer Mass >F
	Bit 0	-	- (For HART instruments: Iout 2 too small, for PA unassigned)
Octet 4	Bit 7		
	Bit 6	-	
	Bit 5	-	
	Bit 4	-	
	Bit 3	-	
	Bit 2	-	
	Bit 1	-	
	Bit 0	Error 7b	Housing Temperature Measurement

Example: 00 08 00 00 = Error3, Flowrate > 105%

3.5.4.2 Warning Register

The actual Warning Register is in the Transducer-Block at rel. Index 110.
The Warning-History (Warnings which were set in the past or are currently set), are at Index 112.

Octet 1	Bit 7	Warning 10	Reverse Q
	Bit 6	Warning 5c	Min Alarm Temperature
	Bit 5	Warning 6c	Max Alarm Temperature
	Bit 4	Warning 5b	Min Alarm Density
	Bit 3	Warning 6b	Max Alarm Density
	Bit 2	Warning 5a	Min Alarm Qm
	Bit 1	Warning 6a	Max Alarm Qm
	Bit 0	-	- (For HART instruments: Totalizer reset, for PA unassigned)
Octet 2	Bit 7	Warning 9d	Overflow <R Volume
	Bit 6	Warning 9c	Overflow >F Volume
	Bit 5	Warning 9b	Overflow <R Mass
	Bit 4	Warning 9a	Overflow >F Mass
	Bit 3	Warning 1	Simulation
	Bit 2	Warning 8b	Update external Data
	Bit 1	Warning 8a	Update internal Data
	Bit 0	Warning 7	External Data loaded

Example: 80 00 = Warning 10, Reverse Q

3.6 Data Structures

3.6.1 DS-32 – Block Structure

E	Element Name	Data Type	Size in Bytes
1	Reserved	Unsigned8	1
2	Block Object	Unsigned8	1
3	Parent Class	Unsigned8	1
4	Class	Unsigned8	1
5	DD Reference	Unsigned32	4
6	DD Revision	Unsigned16	2
7	Profiles	OctetString	2
8	Profiles Revision	Unsigned16	2
9	Execution Time	Unsigned8	1
10	Number of Parameters	Unsigned16	2
11	Address of VIEW_1	Unsigned16	2
12	Number of Views	Unsigned8	1

3.6.2 DS-33 – Value & Status – Floating Point Structure

E	Element Name	Data Type	Size in Bytes
1	Value	Float	4
2	Status	Unsigned8	1

3.6.3 DS-36 – Scaling Structure

E	Element Name	Data Type	Size in Bytes
1	EU at 100%	Float	4
2	EU at 0%	Float	4
3	Units Index	Unsigned16	2
4	Decimal Point	Integer8	1

3.6.4 DS-37 – Mode Structure

E	Element Name	Data Type	Size in Bytes
1	Actual	Unsigned8	1
2	Permitted	Unsigned8	1
3	Normal	Unsigned8	1

3.6.5 DS-39 – Alarm Float Structure

E	Element Name	Data Type	Size in Bytes
1	Unacknowledged	Unsigned8	1
2	Alarm State	Unsigned8	1
3	Time Stamp	Time Value	8
4	Subcode	Unsigned16	2
5	Value	Float	4

3.6.6 DS-42 – Alarm Summary Structure

E	Element Name	Data Type	Size in Bytes
1	Current	Octet String	2
2	Unacknowledged	Octet String	2
3	Unreported	Octet String	2
4	Disabled	Octet String	2

3.6.7 DS-50 – Simulate – Floating Point Structure

E	Element Name	Data Type	Size in Bytes
1	Simulate Status	Unsigned8	1
2	Simulate Value	Float	4
3	Simulate Enabled	Unsigned8	1

3.6.8 DS-67 – Batch Structure

E	Element Name	Data Type	Size in Bytes
1	BATCH_ID	Unsigned32	4
2	RUP	Unsigned16	2
3	OPERATION	Unsigned16	2
4	PHASE	Unsigned16	2

4. Diagnosis

The Status of the converter can be accessed over the Parameters DIAGNOSIS and DIAGNOSIS_EXTENSION. The Parameters are at relative Index 13 and 14 in the Physical Block and can acyclically read from there. They can also be read over the Service DDLM_SLAVE_DIAG.

The Service DDLM_SLAVE_DIAG delivers for general PA-Profiles 9742 and 9700 only DIAGNOSIS, because this Parameter is defined in the PA-Profile, DIAGNOSIS_EXTENSION however is manufacturer specific.

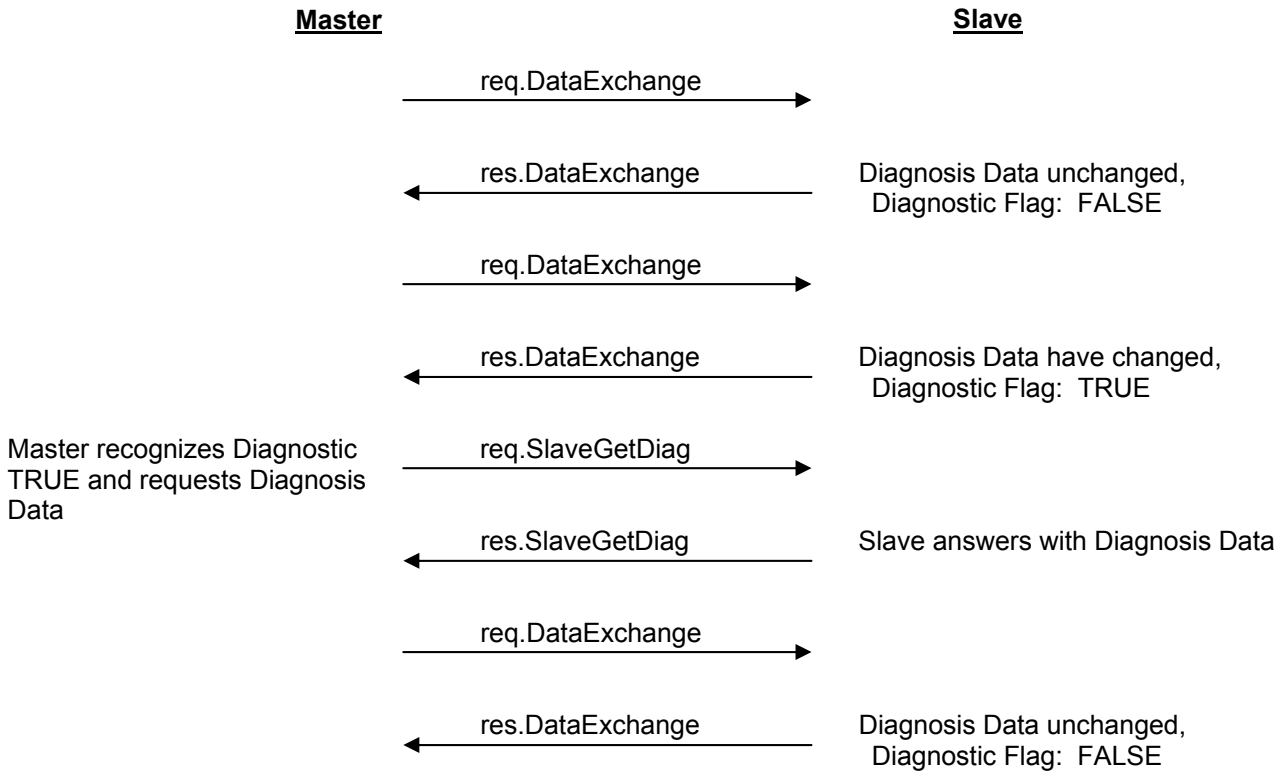
In the FCM2000-Specific Profile 0849 the Service DDLM_SLAVE_DIAG was expanded and also transmits the Parameter DIAGNOSIS_EXTENSION in Bytes 15 to 20 the Parameter DIAGNOSIS_EXTENSION.

4.1 DDLM_SLAVE_DIAG

4.1.1 Sequence

The Master regularly requests Data from the Slave, when running cyclic Communication, using „Request Data Exchange“. It responds with „Response Data Exchange“. In the answer from the Slave is a Bit (Diagnostic Flag), which indicates, if new Diagnosis Information is present in the Slave.

When something changes in the Slave in Diagnosis or Diagnosis Extension (one or more Bits are set/cleared), the Diagnostic Flag is set to True one time by the Slave in „Response Data Exchange“. When the Master requests Diagnosis Data with „Request Get Diag“ from the Slave, it answers with „Response Get Diag“. The Get Diag Service only finds the Diagnosis Data when a change has taken place.



4.1.2 Get Diag Telegrams

Byte Nr.	DPV1 Name	Bit Nr.	Value	"Long" Telegram 9742 or 9700	"Long" Telegram 0849	„Short" Telegram 0849
Byte 1	Station Status 1	Bit 7	Diag Master Lock	0	0	0
		Bit 6	Diag Frame Fault	0	0	0
		Bit 5	Diag Invalid Slave Response	0	0	0
		Bit 4	Diag not supported	0	0	0
		Bit 3	Diag Ext Diag	**1**	**1**	**0**
		Bit 2	Diag Config Fault	0	0	0
		Bit 1	Diag Station Not Ready	0	0	0
		Bit 0	Diag Station Non Existent	0	0	0
Byte 2	Station Status 2	Bit 7	Diag deactivated	0	0	0
		Bit 6	reserved	0	0	0
		Bit 5	Diag Sync Mode	0	0	0
		Bit 4	Diag Freeze Mode	0	0	0
		Bit 3	Diag Watchdog on	x	x	x
		Bit 2	set to 1 by DP slave	1	1	1
		Bit 1	Diag static Diagnostics	0	0	0
		Bit 0	Diag parameterization request	0	0	0
Byte 3	Station Status 3	Bit 7	Ext. Diag Overflow	0	0	0
		Bit 6	reserved	0	0	0
		Bit 5	reserved	0	0	0
		Bit 4	reserved	0	0	0
		Bit 3	reserved	0	0	0
		Bit 2	reserved	0	0	0
		Bit 1	reserved	0	0	0
		Bit 0	reserved	0	0	0
Byte 4	Master Address			0x00	0x00	0x00
Byte 5 – 6	Ident Number			0x97,0x42 or 0x97,0x00	0x08,0x49	0x08,0x49
Byte 7	Header	Bit 7-6	fixed to 0	0x08	0x0E	
		Bit 5 – 0	Block size			
Byte 8	Status_Type	Bit 7	Status	0xFE	0xFE	
		Bit 6 – 0	Not used			
Byte 9	Slot Nr. of PB			0x00	0x00	
Byte 10	Specifier	Bit 2-7	reserved	0x01	0x01	
		Bit 0+1	1 = Status appears 2 = Status disappears			
Byte 11–14			DIAGNOSIS (Example- Data from next page)	0x20 0x00 0x00 0x00	0x00 0x00 0x00 0x80	
Byte 15–20			DIAGNOSIS_EXTENSION (Example- Data from next page)		0x80 0x00 0x00 0x00 0x00 0x00	

The converter answers when there are no Errors or Warnings present with a „Short“ Telegram (only Bytes 1-6). Otherwise it answers the converter with a „Long “ Telegram (14 Bytes for 9742 and 9700, 20 Bytes for 0849).

This Example shows a Telegram for 0849 with Errors /Warnings (Error 3, Flowrate > 105%):

0x08,0x0c,0x00,0x00,0x08,0x49,	0x0e,0xfe,0x00,0x01,	0x00,0x00,0x00,0x80,	0x00,0x08,0x00,0x00,0x00,0x00
Byte 1-6	Bytes 7-10	Bytes 11-14 Diagnosis	Bytes 15-20 Diagnosis_Extension

Bit 3 in Octet 2 the Diagnosis Extension (=Byte 16) shows Error 3.
Bit 7 in Octet 4 from Diagnosis (Byte 14), indicates that the Diagnosis Extension exists.
Bit 3 in Byte 1 indicates that there are Diagnosis Data present.

This Example shows a „Short“ Telegram, which is sent when the last Error/last Warning disappears:

0x00,0x0c,0x00,0x00,0x08,0x49
Byte 1-6

Bit 3 in Byte 1 is 0, because no further Diagnosis Data are present.

4.2 DIAGNOSIS

The Parameter DIAGNOSIS is in Physical Block at rel. Index 13. The meaning of all the Bits in DIAGNOSIS have already been defined in the PA3.0-Profile or the Bits are reserved. The FCM2000 converter itself builds its own Error Messages on a number of the DIAGNOSIS Bits:

	Bit in Octet	Unit_Diag _Bit (GSD)	
Octet 1	Bit 0	24	-
	Bit 1	25	-
	Bit 2	26	-
	Bit 3	27	-
	Bit 4	28	Memory error: • Error 5a: Internal FRAM • Error 5b: External FRAM • Error 6a: Totalizer Mass >F • Error 6b: Totalizer Mass <R • Error 6c: Totalizer Volume >F • Error 6d: Totalizer Volume <R
	Bit 5	29	Failure in measurement: • Error 0: Sensor Amplitude • Error 1: AD-Converter • Error 2a: Driver • Error 2b: Driver Current • Error 7a: Pipe Temperature measurement • Error 7b: Housing Temperature measurement • Error 9a: Density measurement • Error 10: DSP Communication • Error 11a: Sensor A • Error 11b: Sensor B • Error 11c: Sensor C • Error 11d: Sensor
	Bit 6	30	-
	Bit 7	31	-
Octet 2	Bit 0	32	-
	Bit 1	33	-
	Bit 2	34	-
	Bit 3	35	-
	Bit 4	36	-
	Bit 5	37	-
	Bit 6	38	-
	Bit 7	39	-
Octet 3	Bit 0	40	-
	Bit 1	41	-
	Bit 2	42	-
	Bit 3	43	-
	Bit 4	44	-
	Bit 5	45	-
	Bit 6	46	-
	Bit 7	47	-
Octet 4	Bit 0	48	-
	Bit 1	49	-
	Bit 2	50	-
	Bit 3	51	-
	Bit 4	52	-
	Bit 5	53	-
	Bit 6	54	-
	Bit 7	55	More diagnosis information is available • This Bit is set in Profile 0849 for Long Telegrams, because additional information in DIAGNOSIS_EXTENSION follow • For Profiles 9742 and 9700 this is Bit 0, because DIAGNOSIS_EXTENSION does not follow.

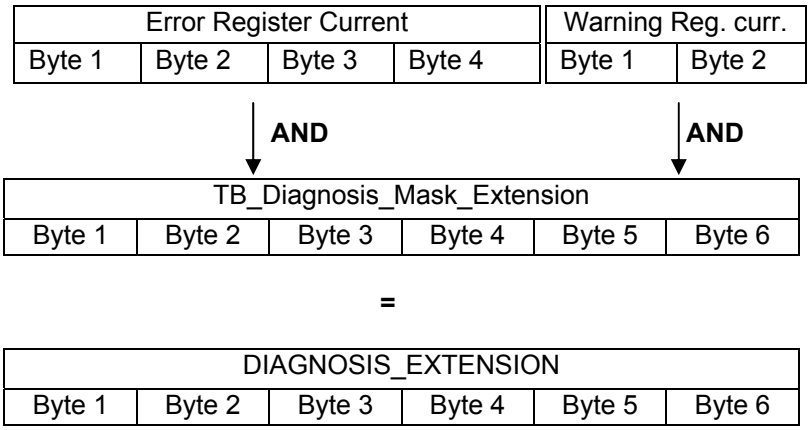
Information: The TB_DiagExtMask. Also applies here. The Bits from the Error- and Warning Register are thereby masked. Then the set Bits proceed as described above to DIAGNOSIS.

4.3 DIAGNOSIS_EXTENSION

The Parameter DIAGNOSIS_EXTENSION (rel. Index 14 in Physical Block) contains the manufacturer specific Diagnosis-Information. DIAGNOSIS_MASK_EXTENSION (rel. Index 16 in PB) describes which Bits are used (0= not supported, 1 = supported). This Mask according to the PA-Specification is a Constant and is read-only.

The converter has an Error Register and a Warning Register with actual messages (Transducerblock rel. Index 109 and 110). Bytes 1-4 of the Error Register are mapped to Bytes 1-4 in the DIAGNOSIS_EXTENSION, the Bytes 1-2 of the Warning Register in Bytes 5-6 in the DIAGNOSIS_EXTENSION.

In order to provide the user an opportunity to decide which Bits are to used or are not to be used, an additional mask was created in the Transducerblock: TB_DiagExtMask (rel. Index 131). This Mask determines which Bits from the Error- or Warning Registers are to be copied in the Parameter DIAGNOSIS_ EXTENSION (0 = Bit is not copied, 1 = Bit Is copied). This Mask can also be set using the keypad (see 5.2.5).



Default-Value TB_DiagExtMask: 0xFF,0x0F,0xFE,0x01,0x00,0x08

Bit 3 in Byte 6 in the TB_DiagExtMask cannot be cleared, it is always 1. Thereby the Warning „Error- and Warning-Simulation active“ cannot be masked. This assures that this Warning will be communicated.

Information: For the Profiles 9742 and 9700 DIAGNOSIS_EXTENSION is not transmitted in GetDiag-Telegram. Therefore the Master cannot recognize from GetDiag-Telegram, if an „Error- and Warning-Simulation“ is active. This the Master can recognize e.g. through an acyclic read of DIAGNOSIS_EXTENSION from the Physical Block.

	Bit in Octet	Unit_Diag_Bit (GSD)		
Octet 1	Bit 0	56	Error 5a	Internal FRAM
	Bit 1	57	Error 5b	External FRAM
	Bit 2	58	Error 10	DSP Communication
	Bit 3	59	Error 1	AD-Converter
	Bit 4	60	Error 11d	Sensor
	Bit 5	61	Error 0	Sensor Amplitude
	Bit 6	62	Error 2a	Driver
	Bit 7	63	Error 2b	Driver Current
Octet 2	Bit 0	64	Error 9a	Density measurement
	Bit 1	65	Error 9b	Density <0.5 kg/l
	Bit 2	66	Error 7a	Pipe Temperature measurement
	Bit 3	67	Error 3	Flowrate > 105%
	Bit 4	68	-	- (For HART instruments: Ext. Zero Return, for PA unassigned)
	Bit 5	69	-	- (For HART instruments: Iout 1 too large, for PA unassigned)
	Bit 6	70	-	- (For HART instruments: Iout 1 too small, for PA unassigned)
	Bit 7	71	-	- (For HART instruments: Iout 2 too large, for PA unassigned)
Octet 3	Bit 0	72	-	- (For HART instruments: Iout 2 too small, for PA unassigned)
	Bit 1	73	Error 6a	Totalizer Mass >F
	Bit 2	74	Error 6b	Totalizer Mass <R
	Bit 3	75	Error 6c	Totalizer Volume >F
	Bit 4	76	Error 6d	Totalizer Volume <R
	Bit 5	77	Error 11a	Sensor A
	Bit 6	78	Error 11b	Sensor B
	Bit 7	79	Error 11c	Sensor C
Octet 4	Bit 0	80	Error 7b	Housing Temperature measurement
	Bit 1	81	-	
	Bit 2	82	-	
	Bit 3	83	-	
	Bit 4	84	-	
	Bit 5	85	-	
	Bit 6	86	-	
	Bit 7	87		
Octet 5	Bit 0	88	-	- (For HART instruments: Totalizer reset, for PA unassigned)
	Bit 1	89	Warning 6a	Max Alarm Qm
	Bit 2	90	Warning 5a	Min Alarm Qm
	Bit 3	91	Warning 6b	Max Alarm Density
	Bit 4	92	Warning 5b	Min Alarm Density
	Bit 5	93	Warning 6c	Max Alarm Temperature
	Bit 6	94	Warning 5c	Min Alarm Temperature
	Bit 7	95	Warning 10	Reverse Q
Octet 6	Bit 0	96	Warning 7	External Data Loaded
	Bit 1	97	Warning 8a	Update internal Data
	Bit 2	98	Warning 8b	Update external Data
	Bit 3	99	Warning 1	Simulation
	Bit 4	100	Warning 9a	Overflow >F Mass
	Bit 5	101	Warning 9b	Overflow <R Mass
	Bit 6	102	Warning 9c	Overflow >F Volume
	Bit 7	103	Warning 9d	Overflow <R Volume

4.4 Priorities and Classifications

The Error- and Warning-Processing is always becoming more important, keyword “Asset Monitoring”. For Diagnosis-Purposes there are the following Parameters:

	Bit 1					Bit 48
DIAGNOSIS_EXTENSION						
DIAGNOSIS_MASK_EXTENS.						
TB_Diagnosis_Mask_Extens.						
Simulation						
Priority						
Classification: Alarm/Warning						

The Parameter DIAGNOSIS_EXTENSION is in the Physical Block at rel. Index 14.

The Parameter DIAGNOSIS_ MASK_EXTENSION is in the Physical Block at rel. Index 16. This Parameter is read only. It indicates which Bits are supported and which cannot be used, in order to mask Bits.

Therefore the Parameter TB_Diagnosis_Mask_Extension was included in the Transducer Block. In this way, the Bits, which are not wanted can be masked out.

A Priority exists for every Diagnosis-Bit. This is always an unsigned16-number.

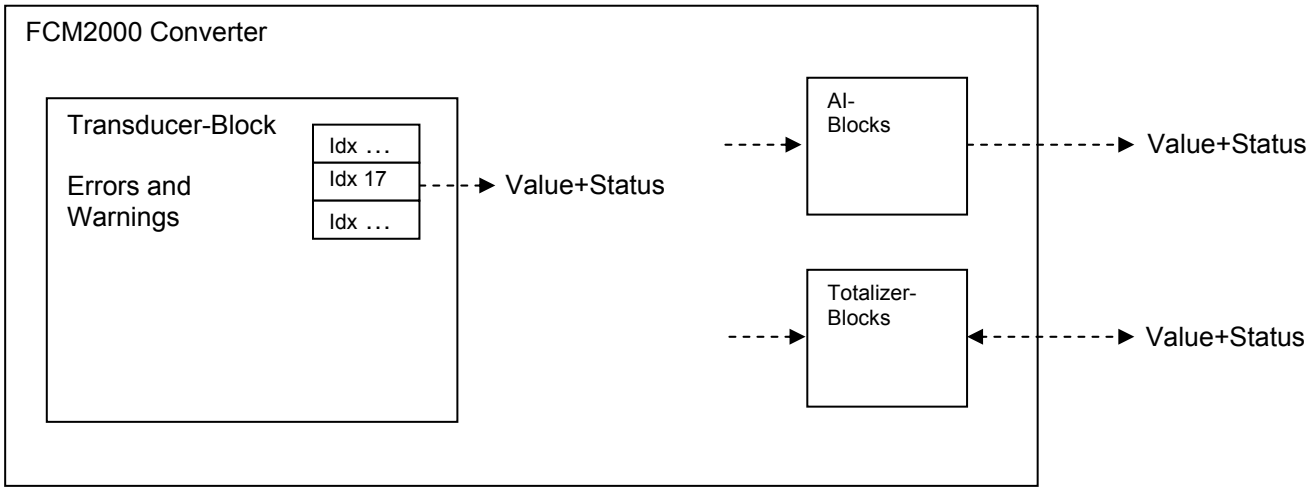
The Classification is a Bit for every Diagnosis-Bit. In this way it can be defined if a Diagnosis-Bit is to considered as an Alarm or a Warning.

The Priority and also the Classification are not processed internally in the converter. They can be written and read. The interpretation and processing of these Bits occurs only in a higher level Master-Software.

Default values exist for TB_Diagnosis_Mask_Extension, Priority and Classification. It is possible to reset these values to their Default-Values.

4.5 Mapping of Errors and Warnings to the Transducerblock-Status

The Transducerblock readies the measurement values for the Functionblocks. This uses the Data Structure DS-33: Value and Status. This Status arrives at the Functionblock (AI or Totalizer-Blocks), which then, based on their settings and PA-Specifications, react and calculate their Value and Status and cyclically communicate them to the outside:



4.5.1 Mapping-Table

The following FCM2000-Error Message and Warnings are formed as the Status of the Transducerblock-Output Values.

	Bit in Octet	Unit_Diag_Bit (GSD)	Error-/ Warning-Number	Error- / Warning-Description	Mapping to Status of VOLUME_FLOW (Index 17)	Mapping to Status of MASS_FLOW (Index 21)	Mapping to Status of DENSITY (Index 25)
Octet 1	Bit 0	56	Error 5a	Internal FRAM	BAD, device failure	BAD, device failure	BAD, device failure
	Bit 1	57	Error 5b	External FRAM	BAD, device failure	BAD, device failure	BAD, device failure
	Bit 2	58	Error 10	DSP Communication	BAD, device failure	BAD, device failure	BAD, device failure
	Bit 3	59	Error 1	AD-Converter	BAD, device failure	BAD, device failure	BAD, device failure
	Bit 4	60	Error 11d	Sensor	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
	Bit 5	61	Error 0	Sensor Amplitude	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
	Bit 6	62	Error 2a	Driver	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
	Bit 7	63	Error 2b	Driver current	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
Octet 2	Bit 0	64	Error 9a	Density measurement	BAD, sensor failure		BAD, sensor failure
	Bit 1	65	Error 9b	Density <0.5 kg/l	BAD, sensor failure		UNCERTAIN, engineering unit range violation
	Bit 2	66	Error 7a	Pipe Temp. measurement			
	Bit 3	67	Error 3	Flowrate > 105%	UNCERTAIN, engineering unit range violation	UNCERTAIN, engineering unit range violation	
	Bit 4	68	-				
	Bit 5	69	-				
	Bit 6	70	-				
	Bit 7	71	-				
Octet 3	Bit 0	72	-				
	Bit 1	73	Error 6a	Totalizer Mass >F			
	Bit 2	74	Error 6b	Totalizer Mass <R			
	Bit 3	75	Error 6c	Totalizer Volume >F			
	Bit 4	76	Error 6d	Totalizer Volume <R			
	Bit 5	77	Error 11a	Sensor A	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
	Bit 6	78	Error 11b	Sensor B	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
	Bit 7	79	Error 11c	Sensor C	BAD, sensor failure	BAD, sensor failure	BAD, sensor failure
Octet 4	Bit 0	80	Error 7b	Housing Temp. measurement			
	Bit 1	81	-				
	Bit 2	82	-				
	Bit 3	83	-				
	Bit 4	84	-				
	Bit 5	85	-				
	Bit 6	86	-				
	Bit 7	87	-				
Octet 5	Bit 0	88	Warning 2	Totalizer reset			

	Bit 1	89	Warning 6a	Max Alarm Qm			
	Bit 2	90	Warning 5a	Min Alarm Qm			
	Bit 3	91	Warning 6b	Max Alarm Density			
	Bit 4	92	Warning 5b	Min Alarm Density			
	Bit 5	93	Warning 6c	Max Alarm Temperature			
	Bit 6	94	Warning 5c	Min Alarm Temperature			
	Bit 7	95	Warning 10	Reverse Q			
Octet 6	Bit 0	96	Warning 7	External Data loaded			
	Bit 1	97	Warning 8a	Update internal Data			
	Bit 2	98	Warning 8b	Update external Data			
	Bit 3	99	Warning 1	Simulation	UNCERTAIN, simulated value	UNCERTAIN, simulated value	UNCERTAIN, simulated value
	Bit 4	100	Warning 9a	Overflow >F Mass			
	Bit 5	101	Warning 9b	Overflow <R Mass			
	Bit 6	102	Warning 9c	Overflow >F Volume			
	Bit 7	103	Warning 9d	Overflow <R Volume			

Table Part 2:

	Bit in Octet	**Unit_Diag_Bit (GSD)**			**Mapping to Status of TEMPERATURE (Index 28)**	**Mapping to Status of Internal Totalizers (Index 78, 80, 82, 84)**	
Octet 1	Bit 0	56	Error 5a	Internal FRAM	BAD, device failure		
	Bit 1	57	Error 5b	External FRAM	BAD, device failure		
	Bit 2	58	Error 10	DSP Communication	BAD, device failure		
	Bit 3	59	Error 1	AD-Converter	BAD, device failure		
	Bit 4	60	Error 11d	Sensor			
	Bit 5	61	Error 0	Sensor Amplitude			
	Bit 6	62	Error 2a	Driver			
	Bit 7	63	Error 2b	Driver Current			
Octet 2	Bit 0	64	Error 9a	Density measurement			
	Bit 1	65	Error 9b	Density <0.5 kg/l			
	Bit 2	66	Error 7a	Pipe Temp. measurement	BAD, sensor failure		
	Bit 3	67	Error 3	Flowrate > 105%			
	Bit 4	68	-				
	Bit 5	69	-				
	Bit 6	70	-				
	Bit 7	71	-				
Octet 3	Bit 0	72	-				
	Bit 1	73	Error 6a	Totalizer Mass >F		BAD, device failure	
	Bit 2	74	Error 6b	Totalizer Mass <R		BAD, device failure	
	Bit 3	75	Error 6c	Totalizer Volume >F		BAD, device failure	
	Bit 4	76	Error 6d	Totalizer Volume <R		BAD, device failure	
	Bit 5	77	Error 11a	Sensor A			

	Bit 6	78	Error 11b	Sensor B			
	Bit 7	79	Error 11c	Sensor C			
Octet 4	Bit 0	80	Error 7b	Housing Temp. measurement	BAD, sensor failure		
	Bit 1	81	-				
	Bit 2	82	-				
	Bit 3	83	-				
	Bit 4	84	-				
	Bit 5	85	-				
	Bit 6	86	-				
	Bit 7	87	-				
Octet 5	Bit 0	88	Warning 2	Totalizer reset			
	Bit 1	89	Warning 6a	Max Alarm Qm			
	Bit 2	90	Warning 5a	Min Alarm Qm			
	Bit 3	91	Warning 6b	Max Alarm Density			
	Bit 4	92	Warning 5b	Min Alarm Density			
	Bit 5	93	Warning 6c	Max Alarm Temperature			
	Bit 6	94	Warning 5c	Min Alarm Temperature			
	Bit 7	95	Warning 10	Reverse Q			
Octet 6	Bit 0	96	Warning 7	External Data loaded			
	Bit 1	97	Warning 8a	Update internal Data			
	Bit 2	98	Warning 8b	Update external Data			
	Bit 3	99	Warning 1	Simulation	UNCERTAIN, simulated value		
	Bit 4	100	Warning 9a	Overflow >F Mass			
	Bit 5	101	Warning 9b	Overflow <R Mass			
	Bit 6	102	Warning 9c	Overflow >F Volume			
	Bit 7	103	Warning 9d	Overflow <R Volume			

4.6 Status-Byte

During cyclic Communication the measurement value is usually transmitted as Data-Structure 33 (see 3.6.2). This Structure consists of the Value as a float-number and a Status-Byte. The Status-Byte consists of three areas:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Quality		Quality Substatus				Limits	

Quality
- 0: bad
- 1: uncertain
- 2: good (Not Cascade)
- 3: good (Cascade)

Substatus for BAD
- 0: non-specific
- 1: configuration error
- 2: not connected
- 3: device failure
- 4: sensor failure
- 5: no communication (last usable value)
- 6: no communication (no usable value)
- 7: out of service

Substatus for UNCERTAIN
- 0: non-specific
- 1: last usable value
- 2: substitute-set
- 3: initial value
- 4: sensor conversion not accurate
- 5: engineering unit range violation (unit not in the valid set)
- 6: sub-normal
- 7: configuration error
- 8: simulated value
- 9: sensor calibration

Substatus for GOOD (Non-Cascade)
- 0: ok
- 1: Update Event
- 2: active advisory alarm (priority < 8)
- 3: active critical alarm (priority > 8)
- 4: unacknowledged update event
- 5: unacknowledged advisory alarm
- 6: unacknowledged critical alarm
- 7: -
- 8: initiate fail safe
- 9: maintenance required

Substatus for GOOD (Cascade)
- 0: ok
- 1: initialization acknowledged
- 2: initialization request
- 3: not invited
- 4: reserved
- 5: do not select
- 6: local override

Limits:
- 0: ok
- 1: low limited
- 2: high limited
- 3: constant

5. Operation at the Converter

5.1 Indications on Display

The converter has a two line LC-Display. The measurement values to be displayed are selected in submenu „Display“ (see Transducerblock rel.Index 76 to 79). Therefore the following selections are available:

PA Adr+State

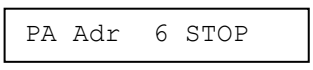
TB MassFlow Value
TB MassFlow Status
TB VolFlow Value
TB VolFlow Status
TB Density Value
TB Density Status
TB Temperature Value
TB Temperature Status
TB TotMass >F Value
TB TotMass >F Status
TB TotMass <R Value
TB TotMass <R Status
TB TotVol >F Value
TB TotVol >F Status
TB TotVol <R Value
TB TotVol <R Status

FB AI1 Out
FB AI1 Status
FB AI2 Out
FB AI2 Status
FB AI3 Out
FB AI3 Status
FB AI4 Out
FB AI4 Status

FB TOT1 Total
FB TOT1 Status
FB TOT2 Total
FB TOT2 Status

5.1.1 Adr+State

The Bus-Address and the Status are displayed during cyclic Communication (STOP, CLEAR or OPERATE):



5.1.2 TB ... Value

The actual value of the output from the Transducerblock is displayed, which it sends over the „Channels“ to the Functionblocks.

5.1.2.1 TB MassFlow Value

The value of MASS_FLOW (Transducerblock rel. Index 21) is displayed.

```
TB MasF  123.45
```

5.1.2.2 TB MassFlow Value

The value of VOLUME_FLOW (Transducerblock rel. Index 17) is displayed.

```
TB VolF  123.45
```

5.1.2.3 TB Density Value

The value of DENSITY (Transducerblock rel. Index 25) is displayed.

```
TB Dens  123.45
```

5.1.2.4 TB Temperature Value

The value of TEMPERATURE (Transducerblock rel. Index 29) is displayed.

```
TB Temp  123.45
```

5.1.2.5 TB TotMass >F Value

The value of Transducer-Block internal Mass-Totalizer >F (Transducerblock rel. Index 78) is displayed.

```
TB Tm>V  123.45
```

5.1.2.6 TB TotMass <R Value

The value of Transducer-Block internal Mass-Totalizer <R (Transducerblock rel. Index 80) is displayed.

```
TB Tm<R  123.45
```

5.1.2.7 TB TotVolume >F Value

The value of Transducer-Block internal Volume-Totalizer >F (Transducerblock rel. Index 82) is displayed.

```
TB Tv>F  123.45
```

5.1.2.8 TB TotVolume <R Value

The value of Transducer-Block internal Volume-Totalizer <R (Transducerblock rel. Index 84) is displayed.

```
TB Tv<R  123.45
```

5.1.3 TB ... Status

The actual output value of the Transducerblock is displayed, which it sends over the „Channels“ to the Functionblocks.

5.1.3.1 TB MassFlow Status

The Status of MASS_FLOW (Transducerblock rel. Index 21) is displayed.

```
TB MasF  GOOD
```

5.1.3.2 TB MassFlow Status

The Status of VOLUME_FLOW (Transducerblock rel. Index 17) is displayed.

```
TB VolF  GOOD
```

5.1.3.3 TB Density Status

The Status of DENSITY (Transducerblock rel. Index 25) is displayed.

```
TB Dens  GOOD
```

5.1.3.4 TB Temperature Status

The Status of TEMPERATURE (Transducerblock rel. Index 29) is displayed.

```
TB Temp  GOOD
```

5.1.3.5 TB TotMass >F Status

The Status of the Transducer-Block internal Mass-Totalizer >F (Transducerblock rel. Index 78) is displayed.

```
TB Tm>V  GOOD
```

5.1.3.6 TB TotMass <R Status

The Status of the Transducer-Block internal Mass-Totalizer <R (Transducerblock rel. Index 80) is displayed.

```
TB Tm<R  GOOD
```

5.1.3.7 TB TotVolume >F Status

The Status of the Transducer-Block internal Volume-Totalizer >F (Transducerblock rel. Index 82) is displayed.

```
TB Tv>V  GOOD
```

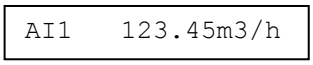
5.1.3.8 TB TotVolume <R Status

The Status of the Transducer-Block internal Volume-Totalizers <R (Transducerblock rel. Index 84) is displayed.

```
TB Tv<R  GOOD
```

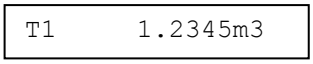
5.1.4 FB AI 1 ... 4 Out

The Out-Value of the particular AI-Block is displayed. The decimal places are derived from Decimal-Point in the OUT_SCALE-Structure. The displayed Unit is UNIT_INDEX from the OUT_SCALE-Structure.



5.1.5 FB TOT 1 and 2 Total

Here the Total-Value of the particular Totalizer-Block is displayed. The displayed Unit is UNIT_TOTAL.



5.1.6 FB AI Status and FB TOT Status

Here the Actual-Mode of the particular Block and the of the Output-Variables (Out.Status or Total.Status) are displayed:

After the Status, when required, the Substatus is displayed as a number. Example: BAD 4 indicates Status is BAD, Substatus is 4 = sensor failure (Substatus-Coding see Chapter 4.6).

5.2 Submenu Data Link

5.2.1 PA Address

Here the actual PA-Address is displayed and can be changed. Addresses from 0 to 126 can be entered.
See also 2.3

```
PA Address
126
```

When Switch 8 (see 2.3.1) is closed and the Address is defined by the DIP-Switch settings, this is displayed. No entry is possible from the keypad.

```
PA Address
10 set by switch
```

An Address-Change using the Communication is not possible during cyclic communication.

5.2.2 IdentNr Selector

Here the Ident-Number-Selector setting is displayed and can be changed.

```
IdentNr Selector
FCM2000 0849
```

Selections:
- Profiles 9742
- FCM2000 0849
- Profiles 9700

5.2.3 AI Channel

Here the set Channel of the AI-Block Is displayed and can be changed. When setting the Channel the PV_SCALE and OUT_SCALE Structure are set base on the Channel setting.

```
AI1 Channel
TB MassFlow
```

Selections:
- TB Mass Flow
- TB Volume Flow
- TB Density
- TB Temperature
- TB TotMass >F
- TB TotMass <R
- TB ToVol >F
- TB TotVol <R

5.2.4 TOT Channel.

Similar to the AI-Channel. The only selections available are:

- TB Mass Flow
- TB Volume Flow

```
TOT1 Channel
TB Mass Flow
```

When setting the Channel the Volume- or Mass-Unit of the Channels is copies from UNIT_TOT (Example kg/h → kg).

5.2.5 TB Diagnosis_Mask_Extension

Here the Mask to mask the Diagnosis_Extension is displayed and can be set (see Transducerblock rel. Index 131 and Chapter 4.3). Without pressing the Enter-Key the entire Diagnosis_Extension hexadecimal is displayed.

```
TB DiagExtMask
0xFF0FFE010008
```

After pressing the Enter-Key each Bit can be individually turned on or off. This is displayed in the first line:

```
Byte 0 Bit 0 OFF
Empty pipe
```

The second line shows the meaning of the particular Bit in clear text.
Operation: Use the Data and Step keys to select the Bit, use ENTER to turn the Bit on/off, use CE (or 20 sec no key stroke) to exit the Menu.

Information: Byte 5 Bit 3 „** Simulation **“ can not be turned off.

5.2.6 Revision Communication Software

Here the Version the Communications-Software is displayed.

```
CommSoftwareRev:
   2.11.0.12
```

5.2.7 Dip Switch

Here the setting of the hardware address switch and, if valid, the PA address is displayed.

```
Dip Switch
```

After Enter the present setting of the switch appears.

```
123456789A  Adr.
--x-x--xxx  20
```

5.3 Submenu Status

In the submenu Status the following menus in the PA-Software for Error and Warning-Simulation were expanded:

5.3.1 Simulation

This menu is only visible when the Service Code has been entered. Here the Error- and Warning-Simulation can be turned on and off.

```
Simulation
Off
```

Information: After 5 minutes the Simulation is automatically turned off.

5.3.2 Error Simulation

This menu is only visible when the Error- and Warning-Simulation is turned on. Here the four Byte Simulation value for the Error Register can be entered.

```
Error Simulation
```

It is possible to turn every Bit in the four Bytes on and off individually. This is displayed in the first line: the second line shows the meaning of the particular Bit in clear text.

```
Byte 0 Bit 0 OFF
Internal Fram
```

Operation: Use the Data and Step keys to select the Bit, use ENTER to turn the Bit on/off, use CE (or 20 sec no key stroke) to exit the Menu. Pressing a key in this menu resets the automatic deactivation time for the Simulation back to 5 minutes.

5.3.3 Warning Simulation

This menu is only visible when the Error- and Warning-Simulation is turned on.

Here the two Byte Simulation value for the Warning Register can be entered. The operation is similar to the „Error Simulation“ operation.

6. Start-up

6.1 Information for AI-Block

When writing the AI-Channel the PV_SCALE and OUT_SCALE (in- and output-scaling of the AI-Block) are set to their appropriate values:

Channel 256+17 = 273: VOLUME_FLOW
Scaling: - (QmMax / DensityMin) to + (QmMax / DensityMin)
DensityMin = 0.5kg/l
Unit: TB-Parameter VOLUME_FLOW_UNITS (Rel.Index 18)

Channel 256+21 = 277: MASS_FLOW
Scaling: -QmMax to +QmMax
Unit: TB-Parameter MASS_FLOW_UNITS (Rel.Index 22)

Channel 256+25 = 281: DENSITY
Scaling: 0.5 to 3.5 kg/l (or corresponding value in other units)
Unit: TB-Parameter DENSITY_UNITS (Rel.Index 26)

Channel 256+29 = 285: TEMPERATURE
Scaling: -50 to 180 C (or corresponding value in other units)
Unit: TB-Parameter TEMPERATURE_UNITS (Rel.Index 30)

Channel 256+81 = 337 Transducer-Block internal Mass-Totalizer >F
Channel 256+83 = 339 Transducer-Block internal Mass-Totalizer <R
Scaling: 0 to 10000000
Unit: TB-Parameter “Unit Mass-Totalizer” (Rel.Index 60)

Channel 256+85 = 341 Transducer-Block internal Volume-Totalizer >F
Channel 256+87 = 343 Transducer-Block internal Volume-Totalizer <R
Scaling: 0 to 10000000
Unit: TB-Parameter “Unit Volume-Totalizer” (Rel.Index 61)

When QmMax is written over the PA-Bus or a Parameter is changed which indirectly affects QmMax (Meter Size, Unit, …) and Channel 273 is set, the Scaling in the AI-Block is automatically adjusted to suit.

6.2 Information for Totalizer Block

The Units in the Totalizer-Block are derived from „Unit Qm“ (TB rel. Index 57) or „Unit Qv“ (TB rel. Index 58), not from „Unit Mass-Totalizer“ (rel. Index 60) or from „Unit Volume-Totalizer“ (rel. Index 61).

Example: Unit Qm = kg/h, Unit Totalizer = t
→ The Transducer-Block-internal Mass-Totalizer (rel. Index 81 and 83) counts in t.
→ The Totalizer-Block integrates the flowrate in kg/h. Therefore the Totalizer-Block-Unit is kg.

In the Totalizer the Channel-Value is periodically totaled:

Total.Value = Total.Value + Channel.Value

The time basis for the Channel-Unit (/s, /m, /h, /d) is considered. Therefore the Totalizer-Block can operate with all possible Channel-Units (see Transducer Block rel. Index 57 and 58).

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ABB Automation Products GmbH
Vertrieb Instrumentation
Borsigstr. 2, 63755 Alzenau, DEUTSCHLAND
Der kostenlose und direkte Zugang zu Ihrem Vertriebszentrum:
Tel: +49 800 1114411, Fax: +49 800 1114422
CCC-support.deapr@de.abb.com