Processmaster FEP630, HygienicMaster FEH630
Electromagnetic flowmeter

Modbus protocol
Valid from software version 01.07.00

Measurement made easy

Additional Information

Additional documentation on Processmaster FEP630, HygienicMaster FEH630 is available for download free of charge at www.abb.com/. Alternatively simply scan this code:

Table of contents

1 Introduction

The following interface description is a supplement to the operating instruction of the ProcessMaster FEP630 / HygienicMaster FEH630.
The safety instructions it includes are valid and must be observed.

These instructions offer additional information about the supported Modbus functionalities and provide information about the configuration.

This description applies to the entire ProcessMaster and HygienicMaster series FEx630.

2 Specification

Modbus is an open standard owned and administrated by an independent group of device manufacturers styled the Modbus Organization (www.modbus.org).
Using the Modbus protocol allows devices made by different manufacturers to exchange information via the same communication bus, without the need for any special interface devices to be used.

Modbus protocol	
Terminals	V1 / V2
Configuration	Via the Modbus interface or via the local operating interface in connection with Asset Vision Basic (DAT200) and a corresponding Device Type Manager (DTM)
Transmission	Modbus RTU - RS485 serial connection
Baud rate	2400, 4800, 9600, 19200, 38400, 56000, 57600, 115200 baud
	Factory setting: 9600 baud
Parity	None, even, odd
	Factory setting: odd
Stop bit	One, two
	Factory setting: One
IEEE format	Little endian, big endian
	Factory setting: Little endian
Typical response time	< 100 ms
Response delay time	0 to 200 milliseconds
	Factory setting: 10 milliseconds

... 2 Specification

① Modbus master
② Terminating resistor
③ Modbus slave 1
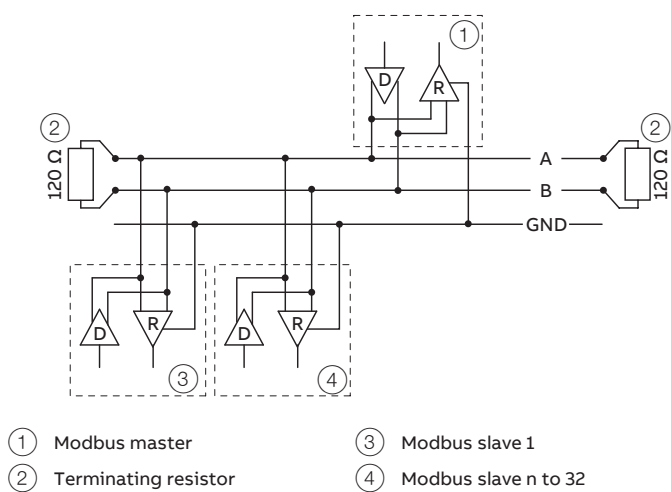④ Modbus slave n to 32

Figure 1:   Communication with the Modbus protocol

Modbus response time

The typical response time of the device is normally less than 100 ms (minimum response time). The response time is calculated from the end of the request telegram from the master to the beginning of the response telegram from the slave. The response time can be increased via the parameter 'Response Delay'.
Refer to **Parameter range – Communication** on page 38.
The length of the response telegram is dependent upon the number of bytes read and the baud rate configured.

Cable specification

The maximum permissible length is dependent on the baud rate, the cable (diameter, capacity and surge impedance), the number of loads in the device chain, and the network configuration (2-core or 4-core).

- At a baud rate of 9600 and with a conductor cross-section of at least 0.14 mm^2 (AWG 26), the maximum length is 1000 m (3280 ft).
- When using a 4-core cable as a 2-wire wiring system, the maximum length must be halved.
- The spur lines must be short, a maximum of 20 m (66 ft).
- When using a distributor with 'n' connections, each branch must have a maximum length of 40 m (131 ft) divided by 'n.'

The maximum cable length depends on the type of cable used. The following standard values apply:
- Up to 6 m (20 ft):
  cable with standard shielding or twisted-pair cable.
- Up to 300 m (984 ft):
  double twisted-pair cable with overall foil shielding and integrated earth cable.
- Up to 1200 m (3937 ft):
  double twisted-pair cable with individual foil shielding and integrated earth cables. Example: Belden 9729 or equivalent cable.

A category 5 cable can be used for Modbus RS485 up to a maximum length of 600 m (1968 ft). For the symmetrical pairs in RS485 systems, a surge impedance of more than 100 Ω is preferred, especially at a baud rate of 19200 and above.
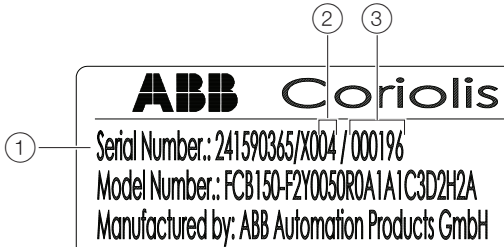
3 Parameterization

Parameterization via the Modbus interface

Note **Parameter descriptions** on page 19 when parameterizing via the Modbus interface.

Factory setting for the Modbus slave ID (address)
The Modbus Slave ID of the device is preset at the factory. The Modbus Slave ID corresponds to the last two digits of the serial number of the device on the name plate.

① Serial number   ③ Sensor ID
② Modbus slave ID

Figure 2:   Modbus-address on the name plate (example)

The Modbus Slave ID (address) of the device must be known for Modbus communication.
Upon delivery, the Modbus Slave ID corresponds to the last two digits of the serial number of the device (see **Parameterization via the Modbus interface** on page 5).
If the Modbus address is not known, the Modbus Slave ID can be reset via a Modbus broadcast message. To do this, the following three Modbus registers must be sent to the bus together with the function code 16 (0x10) 'Write Multiple Registers.'

Address / data type [register length]	Description
65520 TUSIGN32 [2]	manufacturerDeviceID The manufacturer code (ABB = 0x1A) and the device code (FEW53x, FEX63x = A4) must be written to the register 65521.
65522 TUSIGN32 [2]	sensorSerialID The Sensor ID of the device (on the name plate, see **Factory setting for the Modbus slave ID (address)** on page 5). The information must first be written in the high-byte (65523) of the register.
65524 TUSIGN32 [2]	slaveID The new Modbus Slave ID must be written in the high byte (65525) of the register.

The three Modbus registers must now be sent from the Modbus master to the broadcast address '0.' All of the devices connected to the bus receive the message, but only the device addressed via the manufacturer code and the Sensor ID sets the Modbus Slave ID to the new required value.
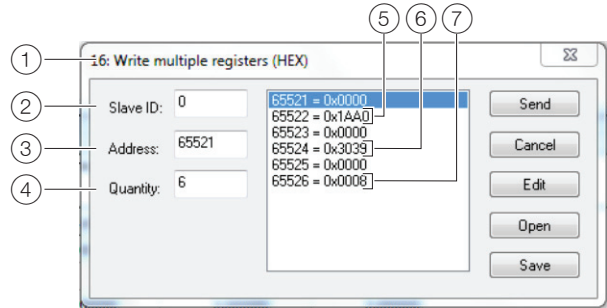
① Functional code 16   ⑤ Manufacturer and device codes
② Broadcast address '0'   ⑥ Sensor ID
③ Register start address   ⑦ New Modbus Slave ID
④ Number of registers

Figure 3:   Write Multiple Registers (example)

... 3 Parameterization

Interface description

NOTICE
All Modbus addresses in this chapter are indicated in the format "PLC Base 1".

Overview of the register tables

Table ID [hex]	Table name	Table type	Data type	Start index	End index
0x0	Unsigned Integer 8bit ReadOnly dynamic U8ROD	Single	TUSIGN8	1	125
0x1	Action 8bit WriteOnly A8WO	Single	Action	9001	9999
0x2	Float 32bit ReadOnly F32RO	Single	TFLOAT	2201	2499
0x3	ReadOnly 16bit unsigned integer U16RO	Single	TUSIGN16	2101	2199
0x4	ReadWrite 32bit float F32RW	Single	TFLOAT	5001	5999
0x5	ReadWrite 32bit unsigned integer U32RW und U32RO	Single	TUSIGN32	3301	3399
0x6	ReadWrite 8bit unsigned integer U8RW	Single	TUSIGN8	4001	4999
0x7	Unsigned Integer 16bit ReadWrite ScanRegister1 U16RW1	Single	TUSIGN16	3101	3150
x08	Variant 16bit ReadOnly ScanRegister1 V16RO1	Single	TUSIGN16	1101	1200
0x9	Unsigned Integer 16bit ReadWrite ScanRegister2 U16RW2	Single	TUSIGN16	3201	3250
0xA	Variant 16bit ReadOnly ScanRegister2 V16RO2	Single	TFLOAT	1201	1300
0xB	Character 8bit ReadOnly C8RO	String	TUSIGN8	2501	2999
0xC	Read Only 1bit bool B1RO1	Coil	TUSIGN16	1	1999
0XD	Character 8bit ReadWrite C8RW	String	TCHAR	3401	4000
0xE	Float 64bit ReadOnly dynamic F64ROD	Single	TUSIGN8	401	524
0xF	Unsigned Integer 32bit WriteOnly U32WO	Single	TCHAR	65521	65526
0x10	Float 32bit ReadOnly dynamic F32ROD	Single	TDOUBLE	201	400
0x11	Unsigned Integer 8bit ReadOnly U8RO	Single	TUSIGN32	2001	2099

The device error messages are transmitted via the Modbus interface by means of the 'Input Coils.'

For more detailed information, see **Diagnosis / error messages** on page 50.

Supported Modbus function codes

Overview
The function codes listed below are supported by Processmaster FEP630, HygienicMaster FEH630.

Function code	Description	Applicable to register tables
0x02	Read Discrete Inputs	Alarm status Discrete Inputs
		Alarm history status Discrete Inputs
0x03	Read Holding Registers	Read-write Byte parameters
		Read-write Byte string parameters
		Read-write Float parameters
		Action parameters
0x04	Read Input Registers	Read-only Byte parameters
		Read-only Short parameters
		Read-only Integer parameters
		Read-only Float parameters
		Read-only Double parameters
		Alarm history counters
		Read-only Byte string parameters
0x06	Write Single Register	Read-write Byte parameters
		Read-write Byte string parameters
		Action parameters
0x08	Diagnostics	NA
0x10	Write Multiple Registers	Read-write Byte parameters
		Read-write Byte string parameters
		Read-write Float parameters
		Action parameters
0x11	Report Slave ID	NA

… 3 Parameterization

… Interface description

Modbus function codes

In this chapter, all Modbus function codes supported by Processmaster FEP630, HygienicMaster FEH630 are described.

0x02   Read Discrete Inputs

The 'Read Discrete Inputs' function code is used to read off register 'Discrete Inputs (Coil)' of the device.
The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Read Discrete Inputs Function Code, 0x02.
3, 4	Discrete input address. 16-bit value indicating the address of the first discrete input to be read.
5, 6	Number of discrete inputs. 16-bit value indicating the number of discrete inputs to be read.
7, 8	Check sum (CRC) of the Modbus telegram

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Read Discrete Inputs Function Code, 0x02.
3	Number (n) of data bytes in the reply telegram
4 to (4+n)-1	Discrete input data. Up to 2000 discrete inputs can be read in one request, if available.
(4+n), (4+n)+1	Check sum (CRC) of the Modbus telegram

0x03   Read Holding Registers

The 'Read Holding registers' function code is used to read off the 'Read Holding Registers' of the device.
The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Read Holding Registers Function Code, 0x03.
3, 4	Holding register address. 16-bit address indicating the address of the first holding register to read.
5, 6	Holding register count. 16-bit value indicating the number of holding registers to read.
7, 8	Check sum (CRC) of the Modbus telegram

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Read Holding Registers Function Code, 0x03.
3	Holding register count ('n'). 8-bit value indicating the count of holding registers returned in the message.
4 to (4+n)-1	Holding register data.
(4+n), (4+n)+1	Check sum (CRC) of the Modbus telegram

0x04   Read Input Registers

The 'Read Input Registers' function code is used to read off the 'Input Register' of the device.
The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Read Input Registers Function Code, 0x04.
3, 4	Input register address. 16-bit value indicating the address of the first input register to read.
5, 6	Input register count. 16-bit value indicating the number of input registers to read.
7, 8	Check sum (CRC) of the Modbus telegram

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Read Input Registers Function Code, 0x04.
3	Number (n) of data bytes in the reply telegram
4 to (4+n)-1	Input register data.
(4+n), (4+n)+1	Check sum (CRC) of the Modbus telegram

0x06   Write Single Register

The 'Write Single Register' function code is used to write a value in one of the 'Holding Register' of the device.
The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Write Single Register Function Code, 0x06.
3, 4	16-bit holding register address.
5, 6	Holding register value. 16-bit value indicating the value to write.
7, 8	Check sum (CRC) of the Modbus telegram

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Write Single Register Function Code, 0x06.
3, 4	Holding register address. 16-bit value indicating the address of the holding register that was written.
5, 6	Holding register value. 16-bit value indicating the value that was written to the holding register.
7, 8	Check sum (CRC) of the Modbus telegram

... 3 Parameterization

... Interface description

0x08   Diagnostics

Only the subfunction 'Return Query Data (0x00, 0x00)' is supported.

If the device receives a query telegram, the telegram is sent back to the Master without changes.

The query and reply telegrams are designed as follows:

Byte	Description
1	Slave device code
2	Diagnostics Function Code, 0x08.
3, 4	Sub-query identifier, 0x00, 0x00.
5 to (5+n)-1	Diagnostics query data. (Of length 'n').
(5+n)	Check sum (CRC) of the Modbus telegram
(5+n)+1	

0x10   Write Multiple Registers

The 'Write Multiple Register' function code is used to write a value in the 'Holding Register' of the device.

The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Write Multiple Registers Function Code, 0x10.
3, 4	Holding register address. 16-bit value indicating the address of the first holding register to write.
5, 6	Holding register count. 16-bit value indicating the number of holding registers to write
7	Byte count ('n'), number of data bytes in the request.
8 to (8+n)-1	Holding register message data. The data to write to the holding registers.
(8+n)	Check sum (CRC) of the Modbus telegram
(8+n)+1	

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Write Multiple Registers Function Code, 0x10.
3, 4	Holding register address. 16-bit value indicating the address of the first holding register.
5, 6	Holding register count. 16-bit value indicating the number of holding registers written.
7, 8	Check sum (CRC) of the Modbus telegram

0x11   Report Slave ID

The 'Report Slave ID' commando is used to uniquely identify the slave device.

The query telegram is designed as follows:

Byte	Description
1	Slave device code
2	Report Slave ID Function Code, 0x11.
3, 4	Check sum (CRC) of the Modbus telegram

The reply telegram to a successfully processed query is designed as follows:

Byte	Description
1	Slave device code
2	Report Slave ID Function Code, 0x11
3	Number of data bytes
4	Manufacturer identification for ABB 0x1A
5	Device detection for ProcessMaster, HygienicMaster and WaterMaster devices, 0xA4
6	Software version, 0x30
7	Hardware version, 0x30
8	Not used, 0x30
9 to 11	Reserved for future use, 0x30,0x30,0x30
12 to 33	Device name (Hex) 46, 45, 57, 35, 33, 78, 20, 46, 45, 78, 36, 33, 78, 20, 20, 20, 20, 20, 20, 20, 20, 20, (ASCII) 'FEW53x, Fex63x'
34 to 35	Check sum (CRC) of the Modbus telegram

... 3   Parameterization

... Interface description

Modbus error handling (exception codes)

If the recipient of the message determines an error, it sends an appropriate error message back to the Master. Here the function code from query telegram 0x80 is added. An appropriate error code is sent as data. The following error codes are supported:

Error code	Name	Description
0x01	ILLEGAL_FUNCTION	Use of an unsupported function code or the device currently cannot process the query.
0x02	ILLEGAL_DATA_ADDRESS	Invalid register address is used or an attempt has been made to write to a write-protected register address.
0x03	ILLEGAL_DATA_VALUE	Use of unauthorized data values, for example an incorrect number of registers.
0x04	SLAVE_DEVICE_FAILURE	The device currently cannot process the query. Repeat the query later.

The reply telegram with error message is designed as follows:

Byte	Description
1	Slave device code
2	Function code + 0x80
3	Error code (exception code)
4.5	Check sum (CRC) of the Modbus telegram

Modbus Data Types

ABB data type	Data type	Register count	Description
ACTION	unsigned char	One register	The data type 'ACTION' is used to trigger device functions. Parameters with the data type 'ACTION' have no internal memory requirements. Writing any value into the parameters triggers the corresponding device function.
TUSIGN8	unsigned char	One register	16-bit register, but only the first 8-bits are used – unsigned char.
TUSIGN16	unsigned short	One register	16-bit unsigned integer
TINT16	signed short	One register	16-bit signed integer
TUSIGN32	unsigned long	Two consecutive registers	32-bit unsigned integer
TINT32	signed long	Two consecutive registers	32-bit signed integer
TCHAR	unsigned char	One register. The total length of the register depends on the object length.	16-bit register, but only the first 8-bits are used - unsigned char. The register content is interpreted as an ASCII-value.
TFLOAT	float	Two consecutive registers	32-bit IEEE floating point. The device parameter 'IEEE Format' determines the order in which the data words of the data types 'float' and 'double' are interpreted. See also **Parameter range – Communication** on page 38.
TDOUBLE	double	Four consecutive registers	64-bit IEEE double-precision floating point. The device parameter 'IEEE Format' determines the order in which the data words of the data types 'float' and 'double' are interpreted. See also **Parameter range – Communication** on page 38. If the parameter is set to '1' (IEEE format deactivated), the data words of the data types 'float' and 'double' are sent in the standard Modbus format 'big endian'. **Example:** The value '5.525' is returned in hex as '40, 16, 19, 99, 99, 99, 99, 9A'. If the parameter is set to '0' (IEEE format activated), the data words of the data types 'float' and 'double' are sent in the format 'little endian' with the lowest value word first. **Example:** The value '5.525' is returned in hex as '99, 9A, 99 ,99, 19, 99, 40, 16'.

... 3 Parameterization

... Interface description

Available units

For certain parameters it is possible to choose among the following units.

The 'code' column indicates which value the corresponding parameter must be set to using the Modbus interface.

Table 1: Units for the volume flow

Selection	Code	Description
m^3/s	13	Cubic meters per second
m^3/min	14	Cubic meters per minute
m^3/h	15	Cubic meters per hour
m^3/d	16	Cubic meters per day
ft^3/s	29	Cubic feet per second
ft^3/min	30	Cubic feet per minute
ft^3/h	31	Cubic feet per hour
ft^3/d	32	Cubic feet per day
ml/s	46	Milliliters per second
ml/min	47	Milliliters per minute
l/s	48	Liters per second
l/min	49	Liters per minute
l/h	50	Liters per hour
l/d	51	Liters per day
hl/h	54	Hectoliters per hour
Ml/d	62	Megaliters per day
ugal/s	71	US gallons per second
ugal/min	72	US gallons per minute
ugal/h	73	US gallons per hour
ugal/d	74	US gallons per day
Mugal/d	82	Mega US gallons per day
igal/s	91	Imperial gallons per second
igal/min	92	Imperial gallons per minute
igal/h	93	Imperial gallons per hour
Igal/d	94	Imperial gallons per day
bbl/s	112	Oil barrels per second
bbl/min	113	Oil barrels per minute
bbl/h	114	Oil barrels per hour
bbl/d	115	Oil barrels per day
bls/s	130	Brew barrels per second
bls/min	131	Brew barrels per minute
bls/h	132	Brew barrels per hour
bls/d	133	Brew barrels per day
xx/yy	254	User-defined unit

Table 2: Units for the mass flow

Selection	Code	Description
g/s	1	Grams per second
g/min	2	Grams per minute
g/h	3	Grams per hour
g/d	4	Grams per day
kg/s	5	Kilograms per second
kg/min	6	Kilograms per minute
kg/h	7	Kilograms per hour
kg/d	8	Kilograms per day
lb/s	9	Pounds (avdp) per second
lb/min	10	Pounds (avdp) per minute
lb/h	11	Pounds (avdp) per hour
lb/d	12	Pounds (avdp) per day
t/min	30	Metric tons per minute
t/h	31	Metric tons per hour
t/d	32	Metric tons per day
xx/yy	254	User-definable unit

Table 3: Units for the volume totalizer

Selection	Code	Description
m^3	4	Cubic meters
ft^3	7	Cubic feet
ml	11	Milliliters
l	13	Liters
hl	14	Hectoliters
ugal	20	US gallons
igal	21	Imperial gallons
bbl	22	Barrels (petroleum, USA)
bls	31	Barrels (beer, USA)
xx/yy	254	User-definable unit

Table 4: Units for the mass totalizer

Selection	Code	Description
kg	2	Kilograms
g	3	Grams
t	5	Tons (metric)
Pounds	8	Pounds (advp)
xx/yy	254	User-definable unit

Table 5: Density units

Selection	Code	Description
g/cm^3	1	Grams per cubic centimeter

Table 6: Temperature units

Selection	Code	Description
°C	1	Celsius

Table 7: Flow velocity units

Selection	Code	Description
m/s	1	Meters per second
mm/s	2	Millimeters per second

Table 8: Pressure units

Selection	Code	Description
Bar	1	Bar

Table 9: Various units

Selection	Code	Description
mm	1	Millimeters
inch	2	Inches (in.)
Hz	3	Frequency Hertz

... 3 Parameterization

... Interface description

Available Process Variables

The process variables available in the software are listed in the table.

Process variables can be assigned to the display (HMI), the current outputs (CO), the frequency outputs (DO [f]), and the pulse outputs (DO [pulse]).

The 'code' column indicates the value to which the corresponding parameter must be set, e.g. using the communications interface.

Process variable	Short form	Modbus address	Code	Description	HMI	CO	DO [f]	DO [pulse]
Volume flow [unit]	Qv	201 (float)	1	Volume flow in the selected volume unit	X	–	–	X
Volume flow [%]	Qv	205 (float)	2	Volume flow in percent	X	X	X	–
Volume totalizer forward flow (direction)	∑v+	413 (double) 213 (float)	3	Volume totalizer counter reading in forward flow (direction)	X	–	–	–
Volume totalizer reverse flow (direction)	∑v-	417 (double) 217 (float)	4	Volume totalizer counter reading in the reverse flow (direction)	X	–	–	–
Volume totalizer difference	∑v	421 (double) 211 (float)	5	Difference totalizer counter reading forward flow (direction) – reverse flow (direction)	X	–	–	–
Flow velocity	v	209 (float)	6	Temperature in percent	X	–	–	–
Current output 31/32/Uco	Io1	227 (float)	7	Density in the selected density unit	X	X	–	–
Mass flow [unit]	Qm	203 (float)	8	Mass flow in the selected mass flow unit	X	–	–	X
Mass flow [%]	Qm	207 (float)	9	Mass flow in percent	X	X	X	–
Mass totalizer forward flow (direction)	∑m+	401 (double) 219 (float)	10	Mass totalizer counter reading in forward flow (direction)	X	–	–	–
Mass totalizer reverse flow (direction)	∑m-	405 (double) 221 (float)	11	Mass totalizer counter reading in reverse flow (direction)	X	–	–	–
Mass totalizer difference	∑m	409 (double) 217 (float)	12	Mass totalizer counter reading forward flow (direction) – reverse flow (direction)	X	–	–	–
External variable 1	Va1	5101 (float)	21	External fieldbus variable	X	–	–	–
Conductivity [µS/cm]	–	237 (float)	–	Measuring medium conductivity in µs/cm.	–	X	X	–

X = parameter available, – = parameter not available

Application of the Health Indication Registers (Condensed Status Registers))
The Processmaster FEP630, HygienicMaster FEH630 has three 'Health indication registers' (Condensed Status Registers). The 'Health indication register 2104, 2105 and 2106 consist of 2 bytes, each containing 8 bits. Each bit represents an error.

2104		2105		2106	
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7

■ = true (1)   □ = false (0)

Figure 4:   Setup of Health indication register (example)

The bit position is assigned to the errors using the 'Byte / Bit pos.' column in the table in **Error messages** on page 50.

The following assignment applies to the example in Figure 4:

Byte / Bit	Fault message
Byte 0 / Bit 3	Flowrate to zero.
	Check digital in terminals.
Byte 0 / Bit 5	All totalizer stopp.
	Check digital in terminals.
Byte 4 / Bit 5	Gas bubble alarm.
	Check conditions of application.

Using the scan register
The Processmaster FEP630, HygienicMaster FEH630 has two 'Scan Register' via which groups of parameters can be requested.
As a result, the parameters do not need to be requested individually and the bus load on the Modbus is reduced.

A scan register consists of a configuration register and the actual scan register.

Configuration register
The Modbus addresses of the parameters are entered in the configuration register. These addresses are to be requested as a group when the scan register is read. The configuration is stored in the transmitter and must only be rewritten in the event of changes. A maximum of 32 Modbus addresses may be stored.

Scan register
When read out, the Scan Register returns the values of the parameters that were entered in the configuration register.
The scan register has a length of 32 holding registers that must be considered when entering addresses in the configuration register.
For example, a maximum of 32 addresses with a register length of [1] can be requested via the scan register.

Note
If the total register length of the addresses entered in the configuration register exceeds the register length of the scan register, the response will be shortened accordingly when read out.

Restrictions
When using the Scan Registers, observe the following points:
- The scan registers are read only. It is not possible to gain write access to the parameters entered in the configuration register.
- Action Registers cannot be addressed via the Scan Registers, as Action Registers require write access
- String Registers cannot be read out via the Scan Registers, as a String would overwrite the available register length of the Scan Register in most cases.

... 3 Parameterization

... Interface description

Design of the scan register (example)
Content of the configuration register (Config scan register)

Config scan register 1, register range 3101 to 3132		
Config scan register 2, register range 3201 to 3232		
Configuration register	**Parameter address**	**Parameter descriptions**
3101 / 3201	203	Mass flow in the selected mass flow unit (data type float, register length 2)
3102 / 3202	201	Volume flow in the selected volume unit (data type float, register length 2)
3103 / 3203	219	Mass flow counter reading in forward flow direction (data type float, register length 2)
3104 / 3204	213	Volume flow counter reading in forward flow direction (data type float, register length 2)
3105 / 3205	2103	Diagnosis State 0 (data type Usign 16, register length 1)
3106 / 3206	2104	Diagnosis State 1 (data type Usign 16, register length 1)
3107 / 3207	2105	Diagnosis State 2 (data type Usign 16, register length 1)
3108 / 3208	4013	Volume flow unit Qv (data type Usign 8, register length 1)
... / ...	FFF	Non-configured register spaces must be filled with FFF.
3132 / 3232	FFF	

Response following the scan register request
In this example, 12 registers are used in the scan register.

Scan register 1, register range 1101 to 1200	
Scan register 2, register range 1201 to 1300	
Configuration register	**Register content**
1101 / 1201	Mass flow (data type float, register length 2)
1102 / 1202	
1103 / 1203	Volume flow (data type float, register length 2)
1104 / 1204	
1105 / 1205	Mass flow counter reading in forward flow direction (data type float, register length 2)
1106 / 1206	
1107 / 1207	Volume flow counter reading in forward flow direction (data type float, register length 2)
1108 / 1208	
1109 / 1209	Diagnosis state 0 (data type Usign 16, register length 1)
1110 / 1210	Diagnosis state 1 (data type Usign 16, register length 1)
1111 / 1211	Diagnosis state 2 (data type Usign 16, register length 1)
1112 / 1212	Volume flow unit Qv (data type Usign 8, register length 1)
... / ...	Non-configured register spaces remain unpopulated.
1200 / 1300	

Parameter descriptions

Parameter range – Device info
The parameterization of the device can be read out via the Modbus addresses listed here.
All Modbus addresses specified here are read only.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Sensor			
2018	QmaxDN Type	**TUSIGN8 [1]** 0: Standard Q_{max}DN 1: OIML Q_{max}DN 2: Test Q_{max}DN 3: Reduced Bore Q_{max}DN	Sensor type. For informational purposes only.
2019	Meter Size	**TUSIGN8 [1]**	Nominal diameter of sensor. 0: DN 1 12: DN 40 24: DN 450 36: DN 1350 1: DN 1.5 13: DN 50 25: DN 500 37: DN 1400 2: DN 2 14: DN 65 26: DN 600 38: DN 1500 3: DN 3 15: DN 80 27: DN 700 39: DN 1600 4: DN 4 16: DN 100 28: DN 750 40: DN 1650 5: DN 6 17: DN 125 29: DN 760 41: DN 1800 6: DN 8 18: DN 150 30: DN 800 42: DN 1950 7: DN 10 19: DN 200 31: DN 900 43: DN 2000 8: DN 15 20: DN 250 32: DN 1000 44: DN 2100 9: DN 20 21: DN 300 33: DN 1050 45: DN 2200 10: DN 25 22: DN 350 34: DN 1100 46: DN 2300 11: DN 32 23: DN 400 35: DN 1200 47: DN 2400
2219	Qm Max DN	**TFLOAT [2]**	The value provides the maximum mass flow at a flow velocity of 10 m/s. The value is automatically set through the selected nominal diameter, multiplied by the set density.
2221	Qv Max DN	**TFLOAT [2]**	The value provides the maximum volume flow at a flow velocity of 10 m/s. The value is set automatically via the selected nominal diameter.
2020	Mains Frequency	**TUSIGN8 [1]** 0: 50 Hz 1: 60 Hz	Supply frequency for the power supply.
2021	Exitation Freq	**TUSIGN8 [1]** 0: 30 & 25 Hz 1: 15 & 12.5 Hz 2: 5 & 6.25 Hz 3: 3.75 & 3.125 Hz	Excitation frequency of the magnetic coils of the flowmeter sensor.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Sensor			
2024	Coil Current Regul.	**TUSIGN8 [1]** 0: Control off 1: Control on	For service information only.
2217	Set Point Curr.	**TFLOAT [2]**	Set point of the coil current.
2025	DC Feedback DAC	**TUSIGN8 [1]**	For service information only.
3301	Sensor ID	**TUSIGN32 [2]**	ID number of the sensor.
2501	Sensor Serial No.	**TCHAR [20]**	Serial number of the sensor.
3303	Sensor Run Hours	**TUSIGN32 [2]**	Operating hours of the sensor.
2023	Tfe On/Off	**TUSIGN8 [1]** 0: Partial filling detection off 1: Partial filling detection on	Shows if the partial filling detection (TFE) has been activated or deactivated.
... / ...Sensor / ...Se Calibration			
2203	Se Zero	**TFLOAT [2]**	Calibration value of the sensor in forward flow (direction)
2201	Se Span	**TFLOAT [2]**	Calibration value of the sensor in reverse flow (direction)
2026	First Cal. Date	**TUSIGN8 [3]**	Date of first calibration of sensor (calibration of new device).
2029	Last Cal. Date	**TUSIGN8 [3]**	Date of last calibration of sensor.
2521	Cal. Cert. No.	**TCHAR [20]**	Identification (number) of the relevant calibration certificate.
2541	First Cal. Location	**TCHAR [20]**	Place of first calibration of the sensor.
2561	Last Cal. Location	**TCHAR [20]**	Place of last calibration of sensor.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter			
2011	Transmitter Type	**TUSIGN8 [1]** 1: FExx32 – remote mount design 5: FExx31 – integral mount design 6: Error	Output (read only) of the transmitter type.
3305	Transmitter ID	**TUSIGN32 [2]**	ID number of transmitter.
2581	Transm.Serial No.	**TCHAR [20]**	Order number of the transmitter.
3307	Transm. Run Hours	**TUSIGN32 [2]**	Operating hours of the transmitter (frontend board).
2110	Tx Restart Counter	**TUSIGN16 [1]**	Number of device restarts (switching the power supply off and on).
3309	Time since Restart	**TUSIGN32 [2]**	Device operating hours since the last restart.
2054	Option Card Slot 1 / 2	**TUSIGN8 [1]** 9: Modbus RTU	Type of plug-in card present in slot OC1 / OC2. If the plug-in card is incorrectly detected or incompatible, a corresponding message will be issued.
2055		**TUSIGN8 [1]** 0: Detection outstanding 1: Current output 2: Digital input 3: Digital output 13: Slot empty 14: Error	
2661	Manufacturer	**TUSIGN8 [20]**	Name of manufacturer.
2681	Street	**TUSIGN8 [20]**	Manufacturer's address (street)
2701	City	**TUSIGN8 [20]**	Manufacturer's address (city)
2721	Phone	**TUSIGN8 [20]**	Manufacturer's address (phone number)

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Transmitter Version			
2001	FW Device Ver.	**TUSIGN8 [3]**	Version and item number of device software package.
2741	FW Device Part Nr.	**TCHAR [20]**	
2004	FW Motherboard Ver.	**TUSIGN8 [3]**	Version and checksum (CRC) of motherboard (MB) software in transmitter.
2102	FW Motherboard CRC	**TUSIGN16 [1]**	
2037	FW Frontend Ver.	**CONST_U8 [3]**	Version and checksum (CRC) of frontend board (FEB) software in sensor.
2101	FW Frontend CRC	**TUSIGN16 [1]**	
2007	HW Motherboard Ver.	**TUSIGN8 [3]**	Hardware version of motherboard (MB) in transmitter.
2040	HW Frontend Ver.	**TUSIGN8 [20]**	Hardware version of frontend board (FEB) in sensor.
2008	Bootloader MB Ver.	**TUSIGN8 [3]**	Version of motherboard (MB) bootloader in transmitter.
2041	Bootloader FEB Ver.	**CONST_U8 [3]**	Version of frontend board (FEB) bootloader in sensor.
2044	Curr. Out FW Ver.	**TUSIGN8 [3]**	Current output module software version and checksum (CRC).
2103	Curr. Out FW CRC	**TUSIGN16 [1]**	
... / ...Transmitter / ...Tx Calibration			
2223	TX Span	**TUSIGN32 [2]**	Calibration value of the transmitter.
2225	TX Zero		
2012	First Cal. Date	**TUSIGN8 [3]**	Date of first calibration of transmitter (calibration of new device).
2015	Last Cal. Date	**TUSIGN8 [3]**	Date of last calibration of transmitter.
2601	Cal. Cert. No.	**TCHAR [20]**	Identification (no.) of the relevant calibration certificate.
2621	First Cal. Location	**TCHAR [20]**	Place of first calibration of transmitter.
2641	Last Cal. Location	**TCHAR [20]**	Place of last calibration of transmitter.

Parameter range - config. Device

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Access Control			
1	Read Only Switch	**TUSIGN8 [1]** 0: Off 1: On	Output (read only) of the position of the write protection switch This parameter is read only.
... / ...Sensor			
4017	Range Mode Config	**TUSIGN8 [1]** 0: Deactivated 1: Qm and Qv 2: Only Qm 3: Only Qv	Activation of the second measuring range for the mass and volume flow. The setting can be performed separately for the mass flow rate (Qm) and volume flow (Qv). Thus you have the possibility to quickly switch between two measuring ranges (e.g. Qm Max and Qm Max2). Switching is performed via the parameters 'Qm Range Mode','Qv Range Mode' or via the correspondingly configured digital input.
2219	Qm Max DN	**TFLOAT [2]**	The value provides the maximum mass flow at a flow velocity of 10 m/s. The value is automatically set through the selected nominal diameter, multiplied by the set density.
5051	Qm Max 1	**TFLOAT [2]**	Setting of the upper measuring range value 1 for the mass flow for forward flow and reverse flow. The value is also used to calculate the corresponding percentage value.
5053	Qm Max 2	**TFLOAT [2]**	Setting of the upper measuring range value 2 for the mass flow for forward flow and reverse flow. The value is also used to calculate the corresponding percentage value.
4018	Qm Range Mode	**TUSIGN8 [1]** 0: QmMax 1: QmMax2	Manual switchover between the measuring ranges Qm Max and Qm Max 2.
2221	Qv Max DN	**TFLOAT [2]**	The value provides the maximum volume flow at a flow velocity of 10 m/s. The value is set automatically via the selected nominal diameter.
5047	Qv Max 1	**TFLOAT [2]**	Setting of the upper measuring range value 1 for the mass flow for forward flow and reverse flow. The value is also used to calculate the corresponding percentage value.
5049	Qv Max 2	**TFLOAT [2]**	Setting of the upper measuring range value 2 for the mass flow for forward flow and reverse flow. The value is also used to calculate the corresponding percentage value.
4019	Qv Range Mode	**TUSIGN8 [1]** 0: QvMax 1: QvMax2	Manual switchover between the measuring ranges Qv Max and Qv Max 2.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Sensor			
3421	Sensor Location Tag	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the measuring point tagging for the sensor.
3401	Sensor Tag	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the TAG number for the measuring sensor.
... / ...Sensor / ...Probe			For 'AquaProbe' sensor type only
2209	Probe Bore	**TFLOAT [2]** 200.0 to 80000.0	Meter tube diameter.
2213	Insertion Factor	**TFLOAT [2]** 0.0 to 3.0	Input factor F_I.
2215	Profil factor	**TFLOAT [2]** 0.0 to 3.0	Profile factor F_P.
... / ...Sensor / ...Operating Mode			
4021	Flow Direction	**TUSIGN8 [1]** 0: Forward flow / reverse flow 1: Only forward flow 2: Only reverse flow	Set the measuring direction for the sensor. As delivered, the device measures and counts in both flow directions.
4022	Flow Indication	**TUSIGN8 [1]** 0: Normal 1: Inverted	Inverts the flow direction displayed.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter			
5055	Damping	**TFLOAT [2]** 0.04 to 60 s (1 Tau)	Select the damping. The value set here (0.04 to 60 s) refers to 1 τ (Tau). The value refers to the response time for a step flowrate change. It affects the instantaneous value in the display and at the current output.
4020	Damping On/Off	**TUSIGN8 [1]** 0: Damping off 1: Damping on	Switches the damping on or off.
5057	Density Fixed Value	**TFLOAT [2]** 0.5 to 3.5 g/cm^3	If the flow count and display are performed using mass flow units, a fixed density value must be included in the calculations. To convert to mass flow, a density value in the range of 0.5 to 3.5 g/cm^3 can be set.
3461	TX Location TAG	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the measuring point tagging for the transmitter.
3441	TX TAG	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the TAG number for the transmitter.
4094	Plant Data Sync.	**TUSIGN8 [1]** 1: Tx -> Sens 2: Sens -> Tx	The transmitter saves its configuration in the 'SensorMemory'. The settings are redundantly saved in two data modules. One of them is the SensorMemory, the other is the transmitter motherboard (backplane). This means the configuration can be restored quickly if any components are replaced. • Tx -> Sens: By selecting 'Tx -> Sens', location-specific settings such as measuring range or damping are replicated from the transmitter motherboard (backplane) to the SensorMemory. • Sens -> Tx: By selecting 'Sens -> Tx', location-specific settings such as measuring range or damping are replicated from the SensorMemory to the transmitter motherboard (backplane).
9002	Device Address	**ACTION [1]**	Restarts the device. Compensates for a short interruption of the power supply.
4095	Restore Factory Def.	**ACTION [1]**	All user-accessible parameters will be reset to the factory default settings.
4170	Noise Reduction	**TUSIGN8 [1]** 0: Off 1: Filter 15 2: Filter 30 3: Filter 60 4: Filter 120 5: Filter 240	Activates the filter technology for noise reduction. Filter: Off, Filter 15, 30, 60, 120, 240 (15: weak filtering, 240: heavy filtering) The filter setting affects the current output (damping). Default setting: Off

... 3 Parameterization

... Parameter descriptions

| Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Units			
4015	Unit Massflow Qm	**TUSIGN8 [1]** Refer to **Table 2: Units for the mass flow** on page 14.	Selection of the unit for the mass flow (for example for the parameters QmMax / QmMaxDN and for the corresponding process value).
4016	Unit Mass Tot.	**TUSIGN8 [1]** Refer to **Table 4: Units for the mass totalizer** on page 14.	Selection of the unit for the mass counters and the pulse outputs.
4013	Unit Volumeflow Qv	**TUSIGN8 [1]** Refer to **Table 1: Units for the volume flow** on page 14.	Selection of the unit for the volume flow (for example for the parameters QvMax / QvMaxDN and for the corresponding process value).
4014	Unit Volume Tot.	**TUSIGN8 [1]** Refer to **Table 3: Units for the volume totalizer** on page 14.	Selection of the unit for the volume totalizers and the pulse outputs.
3481	Cust Qm Unit N.	**TCHAR [8]** Alphanumeric, maximum 7 characters	Enter the name of the user-defined unit for mass flow.
5067	Cust Qm Unit F.	**TFLOAT [2]** 0.0001 to 100000 kg/s	Enter the factor for the user-defined unit for mass flow.
3489	Cust Qm Tot Unit N.	**TCHAR [8]** Alphanumeric, maximum 7 characters	Enter the name of the user-defined totalizer unit for mass flow.
5069	Cust Qm Tot Unit F.	**TFLOAT [2]** 0.0001 to 100000 kg	Enter the factor for the user-defined totalizer unit for mass flow.
3497	Cust Qv Unit N.	**TCHAR [8]** **Alphanumeric, maximum 7 characters**	Enter the name of the user-defined unit for volume flow.
5063	Cust Qv Unit F.	**TFLOAT [2]** 0.0001 to 100000 l/s	Enter the factor for the user-defined unit for volume flow.
3505	Cust Qv Tot Unit N.	**TCHAR [8]** **Alphanumeric, maximum 7 characters**	Enter the name of the user-defined totalizer unit for volume flow.
5065	Cust Qv Tot Unit F.	**TFLOAT [2]** 0.0001 to 100000 l	Enter the factor for the user-defined totalizer unit for volume flow.
3513	Variable 1 Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Selection of the unit for external process variables. The transmitter can show two external process variables in the display. The process variables can be transferred from the fieldbus master to the transmitter via the HART, Modbus or PROFIBUS DP protocol.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Cut Off			
5059	Low Flow Cut Off	**TFLOAT [2]** 0.0 to 10 %	Sets the switching threshold for the low flow cut-off. If the flow rate is below the switching threshold, there is no flow measurement. The setting of 0 % deactivates the low flow cut-off. Factory setting: 0.5 %
5061	Low Flow Hysteresis	**TFLOAT [2]** 0.0 to 50 %	Sets the hysteresis for the low flow cut-off as it is defined in the parameter 'Low Flow Cut Off'. Factory setting: 20 %
... / ...Transmitter / ...Feature Settings			
2032	Backwards Comp.	**TUSIGN8 [1]** 0: Off 1: On	'Backward compatibility' function active? This parameter is read only.
3236	Backwards Comp. Code	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code to activate the 'backward compatibility' function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (for example using the parameter 'Device Reset', see page 25, or by briefly switching off the power supply).
2033	Verifying Capab.	**TUSIGN8 [1]** 0: Off 1: On	'Verification' function active? This parameter is read only.
3237	Verifying Capab.Code	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code to activate the 'verification' function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (for example using the parameter 'Device Reset', see page 25, or by briefly switching off the power supply).
2034	Batchmode	**TUSIGN8 [1]** 0: Off 1: On	'Filler' function active? This parameter is read only.
3238	Batchmode Code	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code to activate the 'filler' function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (for example using the parameter 'Device Reset', see page 25, or by briefly switching off the power supply).

... 3   Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Feature Settings			
2035	Expert Diagn.	**TUSIGN8 [1]** 0: Off 1: On	'Advanced diagnosis' function active? This parameter is read only.
3239	Expert Diagn. Code	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code to activate the 'advanced diagnosis' function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (for example using the parameter 'Device Reset', see page 25, or by briefly switching off the power supply).
2036	SIL Comp.	**TUSIGN8 [1]** 0: Off 1: On	'SIL monitoring' function active? This parameter is read only.
3240	SIL Comp. Code	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code to activate the 'SIL monitoring' function. To use this function subsequently, contact the ABB service team or sales organization. After entering the code, restart the device (for example using the parameter 'Device Reset', see page 25, or by briefly switching off the power supply).
... / ...System Zero			
5095	Manual	**TFLOAT [2]** −50 to +50 mm/s	Set the value for zero point adjustment in mm/s.
9020 24 25	Auto Adjust	**ACTION [1] (9020)** **TUSIGN8 (24)** **TUSIGN8 (25)**	Start of automatic zero point adjustment for the mass and volume flow. Adjustment lasts approx. 60 seconds. • Zero point adjustment is started via the address 9020 (data type ACTION). • The progress counter (100 = adjustment complete) of automatic adjustment can be queried via address 24 (data type TUSIGN8). • The result of automatic adjustment can be queried via address 25 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
... / ......Piston Pump			
4160	Filter On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate filter function for piston pumps.
4161	Filter length	**TUSIGN8 [1]** 3 to 30 sec	Set filter length. Default setting: 10 sec.
5093	Strokes per minute	**TFLOAT [2]**	Output (read only) of the detected stroke rate of the piston pump per minute.

Parameter range – Display

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / Display			
4076	Language	**TUSIGN8 [1]** 0: English 1: German 2: Français 3: Español 4: Italiano 9: Polski 11: Chinese 14: Português	Selection of menu language.
4077	Contrast	**TUSIGN8 [1]** 0 to 100	Contrast setting for the LCD display.
4078	Autoscroll	**TUSIGN8 [1]** 0: Deactivated 1: Activated	If Multiplex mode is enabled, you can also activate the 'Autoscroll' function on the information level of the operator menu. In this function, operator pages are automatically displayed in succession on the process screen, changing every 10 seconds. Manual scrolling through pre-configured operator pages as described above is no longer necessary. When Auto scroll mode is enabled, the icon ↻ is displayed in the lower left corner of the screen. Default setting: disabled.
4079	Flow Format	**TUSIGN8 [1]** 0: X 1: X.X 2: X.XX 3: X.XXX 4: X.XXXX 5: X.XXXXX	Selection of number of decimal places used to display the corresponding process variables. The selection of decimal places only has an effect on the process variable display in the LCD indicator; the internal counter reading is however not affected by this.
4080	Tot Format		
4081	Date Format	**TUSIGN8 [1]** 0: DD-MM-YYYY 1: MM-DD-YYYY 2: YYYY-MM-DD	Set the display format for the date and time.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
4171	Display Tag	**TUSIGN8 [1]** 0: Off 1: Measuring point tagging 2: Bus address 3: HART address	Selection of the displayed data in the 'measuring point tagging' field of the process display.
4172	Display Rotation	**TUSIGN8 [1]** 0: Rotation 0° 1: Rotation 180°	Rotation of the display content by 180°. The function of the operating buttons is adapted accordingly.

... / Display / ...Operator Pages / ...Operator Page 1 to 2

Up to four user-specific operator pages (layouts) can be configured for the process display.

If multiple operator pages have been configured, these can be scrolled through manually on the information level. In the factory setting only Operator Page 1 is enabled.

4082 (page 1) 4087 (page 2)	Display Mode	**TUSIGN8 [1]** 0: Off 1: Graphic view 2: 1x4 3: 1x6 A 4: 1x6 A bar 7: 1x9 8: 1x9 bar 9: 2x9 10: 2x9 bar 11: 3x9	Configure each operator page. The following versions can be selected: Off, graphic view, 1x4, 1x6A, 1x6A bar, 1x9, 1x9 bar, 2x9, 2x9 bar, 3x9. Selecting 'Off' deactivates the corresponding operator page. The 'graphic view' is only available for the operator page 1.
4083 (page 1) 4088 (page 2)	1st Line	**TUSIGN8 [1]**	Selection of process variable displayed in the respective row. See table **Available Process Variables** on page 16.
4084 (page 1) 4089 (page 2)	2nd Line		
4085 (page 1) 4090 (page 2)	3rd Line		
4086 (page 1) 4091 (page 2)	Bargraph	**TUSIGN8 [1]** 1: Volume flow in % 6: Current output 31 / 32 8: Mass flow in %	Selection of process variable displayed as a bar graph.

Parameter range - Input / Output

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / Curr.Out 31/32			
4023	Output Value	**TUSIGN8 [1]** 0: Mass flow 2: Volume flow 4: Conductivity	Selection of process variable issued at the corresponding current output. See also Table **Available Process Variables** on page 16.
4024	Curr.Out Mode	**TUSIGN8 [1]** 0: 4-20mA FWD 1: 4-12-20 mA 2: 4-20mA FWD/REV	Selection of the flow direction for the current output.
4025	Curr.Out at Alarm	**TUSIGN8 [1]** 0: High 1: Low	Selection of status of the current output in error condition. The output 'low' or 'high' current is set in the subsequent parameters.
5017	Low Alarm	**TFLOAT [2]** 3.5 to 3.6 mA	Sets the current for Low Alarm.
5019	High Alarm	**TFLOAT [2]** 21 to 22.6 mA	Sets the current for High Alarm.
4026	Curr.Out > 20.5mA	**TUSIGN8 [1]** 0: Hold last value 1: High alarm 2: Low alarm	Behavior of current output if 20.5 mA is exceeded. • Hold last value: the last measured value is retained and issued. • High alarm: the high alarm current is issued. • Low alarm: the low alarm current is issued.
4027	Curr.Out < 3.8mA	**TUSIGN8 [1]** 0: Hold last value 1: High alarm 2: Low alarm	Behavior of the current output if 3.8 mA is not reached. • Hold last value: the last measured value is retained and issued. • High alarm: the high alarm current is issued. • Low alarm: the low alarm current is issued. Parameter is not available if the parameter 'Curr.Out Mode' 4-20mA FWD/REV has been selected.
4028 4029	Curr. at EPD Alarm Curr. at TFE Alarm	**TUSIGN8 [1]** 0: Off 1: Q = 0% 2: High alarm 3: Low alarm	Behavior of the current output with an empty or partially filled meter tube. • Off: no effect on current output. • Q = 0%: current output is set to 4 mA, 'no flow'. • High alarm: the high alarm current is issued. • Low alarm: the low alarm current is issued.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Dig.Out 41/42			
4030	Mode	**TUSIGN8 [1]** 0: Off 1: Binary 2: Pulse 3: Frequency	Selection of the operating mode for the digital output 41 / 42. • Off: Digital output deactivated. • Binary: Digital output functions as binary output (for function, see the parameter 'Logic Output Action'). • Pulse: Digital output functions as pulse output (for process value, see the parameter 'Output Value Pulse'). In pulse mode, pulses per unit are output (e.g. 1 pulse per m^3). • Frequency: Digital output functions as frequency output (for process value see the parameter 'Output Value Freq...'). In frequency mode, a frequency proportional to the flow rate is given as output. The maximum frequency can be configured in accordance with the upper range value.
4037	Outp. Flow Direction	**TUSIGN8 [1]** 0: Forward flow / reverse flow. 1: Forward flow 2: Reverse flow	Selection of flow direction in which the pulse / frequency output issues the selected process value. The parameter is only available if the digital output has been configured as a pulse or frequency output. • When '0' is selected, pulses are given in the forward flow and reverse flow directions. • When '1' is selected, pulses are given in the forward flow direction. • When '2' is selected, pulses are given in the reverse flow direction.
... / ...Dig.Out 41/42 / ...Setup Pulse Output			The following parameters are only available if the digital output 41 / 42 has been configured as a pulse output.
4034	Output Value Pulse	**TUSIGN8 [1]** 0: Off 1: Mass flow pulse 2: Volume flow pulse	Selection of the process value issued via the pulse output. See also Table **Available Process Variables** on page 16.
5025	Pulses per Unit	**TFLOAT** 0.001 to 100,000 pulses	Setting of pulses per mass flow unit and per pulse width for the pulse output.
5027	Pulse Width	**TFLOAT** 0.05 to 2000 ms	The pulse value and the pulse width are dependent on each other and on the limit frequency of the digital output and are calculated dynamically.
... / ...Dig.Out 41/42 / ...Setup Freq Output			The following parameters are only available if the digital output 41 / 42 has been configured as a frequency output.
4035	Output Value Freq.	**TUSIGN8 [1]** 0: Off 1: Mass flow [%] 2: Volume flow [%] 3: Conductivity [%]	Selection of the process value issued via the frequency output. See also Table **Available Process Variables** on page 16.
5029	Upper Frequency	**TFLOAT** 0.25 to 10500 Hz	Sets the frequency for the upper range value. The entered value corresponds to 100 % flow.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig.Out 41/42 / …Setup Logic Output			The following parameters are only available if the digital output 41 / 42 has been configured as a binary output.
4036	Logic Output Action	**TUSIGN8 [1]** 0: Off 1: F/R signal 2: Alarm signal 3: Two measuring ranges 4: End contact fill function	Selection of binary output function. • F/R signal: the binary output signals the flow direction. • Alarm signal: the binary output functions as an alarm output. The alarm type is selected with the parameters '…Alarm Config'. • Two measuring ranges: The binary output is activated when measuring range 2 (QmMax 2 / QvMax 2) is selected. This selection is only available if the parameter 'Range Mode Config' has been configured to Qm or Qv. • End contact fill function: the binary output is activated when the set fill quantity is reached (only if the FillMass function is activated).
4032	Active Mode	**TUSIGN8 [1]** 0: Active high (closed) 1: Active low (open)	Select switching properties for the binary output.
… / …Dig.Out 41/42 / …Alarm Config			
4040	General Alarm	**TUSIGN8 [1]** 0: Off 1: On	Selection of error messages signaled via the binary output 41 / 42. Only if the parameter 'Logic Output Action' has been set to 2 - Alarm signal.
4041	Qv Volumeflow Max		
4042	Qv Volumeflow Min		
4043	EPD Alarm		
4044	TFE Alarm		
4045	Gas bubble Alarm		
4046	Conductivity		
4047	Sensor Temp. Alarm		
4048	In house Temp		

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
...Dig.Out 51/52			
4031	Mode	**TUSIGN8 [1]** 0: Off 1: Binary 4: Follow DO1 5: 90° phase rotation 6: 180° phase rotation	Selection of the operating mode for the digital output 51 / 52. The operating modes 'Follow DO1', '90°' and '180°' are only available if digital output 41 / 42 has been configured as a pulse output. • Off: Digital output deactivated. • Binary: Digital output functions as binary output (for function, see the parameter 'Logic Output Action'). • Follow DO1: Digital output 51 / 52 operates according to the pulses from digital output 41 / 42. The function depends on the setting for the parameter 'Outp. Flow Direction'. • 90° phase rotation: 90° phase rotation of output of the same pulses as for digital output 41 / 42. • 180° phase rotation: 180° phase rotation of output of the same pulses as for digital output 41 / 42. **Note** Digital output 51 / 52 cannot be configured as a second frequency output.
... / ...Dig.Out 51/52 / ...Setup Logic Output			The following parameters are only available if the digital output 51 / 52 has been configured as a binary output.
4038	Logic Output Action	**TUSIGN8 [1]**	See description of digital output 41 / 42.
4033	Active Mode	**TUSIGN8 [1]**	
... / ...Dig.Out 51/52 / ...Alarm Config			
4049	General Alarm	**TUSIGN8 [1]** 0: Off 1: On	Selection of error messages signaled via the binary output 51 / 52. Only if the parameter 'Logic Output Action' has been set to 2 - Alarm signal.
4050	Qv Volumeflow Max		
4051	Qv Volumeflow Min		
4052	EPD Alarm		
4053	TFE Alarm		
4054	Gas bubble Alarm		
4055	Conductivity		
4056	Sensor Temp. Alarm		
4057	In house Temp		

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig. Out V3/V4			
4058	Mode	**TUSIGN8 [1]** 0: Off 1: Binary	Selection of the operating mode for digital output V3 / V4. The operating modes 'Follow DO1', '90°' and '180°' are only available if digital output 41 / 42 has been configured as a pulse output. • Off: Digital output deactivated. • Binary: Digital output functions as binary output (for function, see the parameter 'Logic Output Action').
… / …Dig. Out V3/V4 / …Setup Logic Output			The following parameters are only available if the digital output V3 / V4 has been configured as a binary output.
4060	Logic Output Action	**TUSIGN8 [1]**	See description of digital output 41 / 42.
4059	Active Mode	**TUSIGN8 [1]**	
… / …Dig. Out V3/V4 / …Alarm Config			
4061	General Alarm	**TUSIGN8 [1]** 0: Off 1: On	Select error messages signaled via the binary output V3 / V4. Only if the parameter 'Logic Output Action' has been set to 2 - Alarm signal.
4062	Qv Volumeflow Max		
4063	Qv Volumeflow Min		
4064	EPD Alarm		
4065	TFE Alarm		
4066	Gas bubble Alarm		
4067	Conductivity		
4068	Sensor Temp. Alarm		
4069	In house Temp		

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Dig.In V3/V4			
4072	Function	**TUSIGN8 [1]** 0: Off 1: Reset all Totalizer 2: Auto. Zero Adjust 3: Set Flowrate to zero 4: Stop all Totalizer 5: Start/Stop Batching 6: Dual Range Mass 7: Dual Range Volume	Select a function for the digital input V3 / V4.
4070	Active Mode	**TUSIGN8 [1]** 0: Active high (closed) 1: Active low (open)	Select switching properties for the digital input.
4071	Delay Time	**TUSIGN8 [1]** 1: 100ms 5: 500ms 10: 1000ms	Selection of delay time for suppressing EMC faults on the digital input. **Note** If the digital input has been configured with the function 'Start/Stop Batching' the pulse for starting the filling process must fit at least for the set delay time!

Parameter range – Process alarm

Modbus register address	Parameter name	Data type [register length] / value range	Description
49 to 96 (COIL Register)	Diagnostic History	**TUSIGN8 [1]**	Output (read only) of the alarm history. See also chapter **Error messages** on page 50. The addresses indicated here are read only.
9001	Clear Alarm History	**ACTION [1]**	The writing of any value deletes the alarm history saved in the device.
… / …Group Masking			
4073	Maintenance Required	**TUSIGN8 [1]**	Alarm messages are divided into groups. If masking is activated for a group (On), no alarm occurs.
4074	Function Check	0: Masking deactivated	
4075	Out Of Specification	1: Masking activated	For more detailed information, see chapter **Error messages** on page 50.
… / …Alarm Limits			
5075	Qm Massflow Min	**TFLOAT [2]** 0 to 130 %	Sets the minimum / maximum limit value for mass measurement. If the process value 'Qm [unit]' exceeds or falls below the limit value, an alarm is triggered.
5077	Qm Massflow Max	**TFLOAT [2]** 0 to 130 %	
5071	Qv Volumeflow Min	**TFLOAT [2]** 0 to 130 %	Sets the minimum / maximum limit value for volume measurement. If the process value 'Qv [unit]' exceeds or falls below the limit value, an alarm is triggered.
5073	Qv Volumeflow Max	**TFLOAT [2]** 0 to 130 %	

... 3 Parameterization

... Parameter descriptions

Parameter range – Communication

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Modbus			
4007	Address	**TUSIGN8 [1]** 1 to 127	Setting of the Modbus device address. For factory settings, see chapter **Parameterization via the Modbus interface** on page 5.
4012	IEEE Format	**TUSIGN8 [1]** 0: IEEE-format activated 1: IEEE-format disabled	Selection of the byte order for the Modbus communication. • If the IEEE format is activated (1), the data words are sent in the 'little-endian' format, with the lowest value word transmitted first. • If the IEEE format is deactivated (0), the data words are sent in the standard Modbus 'big-endian' format. Factory setting: IEEE format activated.
4008	Baud Rate	**TUSIGN8 [1]** 0: 2400 Bd 1: 4800 Bd 2: 9600 Bd 3: 19200 Bd 4: 38400 Bd 5: 56000 Bd 6: 57600 Bd 7: 115200 Bd	Selection of the transmission speed (baud rate) for the Modbus communication. Factory setting: 9600 baud.
4009	Parity	**TUSIGN8 [1]** 0: None 1: Even 2: Odd	Selection of the parity for the Modbus communication. Factory setting: Odd (odd)
4010	Stop Bits	**TUSIGN8 [1]** 0: One stop bit 1: Two stop bits	Selection of the stop bits for the Modbus communication. Factory setting: One stop bit
4011	Response Delay	**TUSIGN8 [1]** 0 to 200 ms	Setting of the pause time in milliseconds after receiving a Modbus command. The device sends a response no earlier than expiration of the set pause time. Factory setting: 10 ms

Parameter range – Diagnosis

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Maintenance control			
3315	Preset Maint. cycle	**TUSIGN32 [2]** 0 to 50000 h	Sets the service interval. After the maintenance interval has expired, the corresponding error message 'Maintenance interval is reached. Perform maintenance.' is set. The setting '0' deactivates the maintenance interval. Factory setting: 0 h
3311	Maint. Remain. Time	**TUSIGN32 [2]**	Time remaining in the maintenance interval until the error message 'Maintenance interval is reached. Perform maintenance.' is set. The parameter is read only.
9003	Start New Cycle	**ACTION [1]**	Resetting of the maintenance interval. By writing any value to this address, the maintenance interval is reset to the value set under 'Preset Maint. cycle'.
3233	Diagnosis Interval	**TINT16 [1]**	Set the time span between the performance of each individual diagnosis. Default setting: 5 sec.
… / …Diagnosis Control / …Diagnosis Tfe			Only for devices with optional 'Partial Filling Detection'.
4162	Tfe On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'Partial Filling Detection' function.
9015, 29, 30	Start Tfe Adjust	**ACTION [1] (9015)** **TUSIGN8 (29)** **TUSIGN8 (30)**	Start the automatic adjustment of the 'Partial Filling Detection' function. • Automatic adjustment is started via address 9015 (data type ACTION). • The progress counter (100 = adjustment complete) of automatic adjustment can be queried via address 29 (data type TUSIGN8). • The result of automatic adjustment can be queried via address 30 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
4163	Manual Tfe Adjust		Manual setting of the Partial Filling Detection function.
3234	Tfe Threshold		Manual fine adjustment of the switching threshold. The switching threshold is set automatically during automatic adjustment. If the current value should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.
2112	Actual Tfe Value		Output (read only) of the value of the partial filling detection. If the value should exceed the switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Diagnosis Control / ...Empty Pipe Detector			
4164	Empty Pipe Detector	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'Empty Tube Detection' function. A completely filled meter tube is essential for an accurate measurement. The 'Empty Tube Detection' function detects an empty meter tube..
9016, 27, 28	Adjust EP	**ACTION [1] (9016)** **TUSIGN8 (27)** **TUSIGN8 (28)**	Start the automatic adjustment of the 'Empty Tube Detection' function. • Automatic adjustment is started via address 9016 (data type ACTION). • The progress counter (100 = adjustment complete) of automatic adjustment can be queried via address 27 (data type TUSIGN8). • The result of automatic adjustment can be queried via address 28 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
4165	Manual Adjust EP F.		Manual adjustment of the 'Empty Tube Detection' function.
3235	Threshold		Set the switching threshold for the empty tube detection. The switching threshold is set automatically during automatic adjustment. The switching threshold can be changed for manual fine adjustment.
2113	Detector EP Value		Frequency display for empty tube detection. If the frequency should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.
... / ...Diagnosis Control / ...Diagnosis Coil			Only for devices with the 'Advanced diagnosis' option.
4166	Coil Diag On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'Coil Diagnosis' function.
253	Coil Resistor	**TFLOAT [2]**	Display the coil resistance.
251	Coil Current	**TFLOAT [2]**	Display the coil current.
247	Coil Inductance	**TFLOAT [2]**	Display the coil inductance.
249	Coil Temperature	**TFLOAT [2]**	Display the coil temperature within the sensor.
5091	Coil Temperature Adj	**TFLOAT [2]**	Measurement of coil temperature must be set in accordance with the conditions on-site. Temperature measured with a separate thermometer can be entered here.
5097	Coil Temp. Min Alarm	**TFLOAT [2]** -40 to 180 °C	Set the minimum / maximum limit value for coil temperature monitoring. If the coil temperature up-scales or down-scales the limit values, an alarm is triggered.
5099	Coil Temp. Max Alarm		

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Diagnosis Control / …Diagnosis Gas Bub.			Only for devices with the 'Advanced diagnosis' option.
4167	Gas Bubble On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'Gas Bubble Detection' function.
235	Gas Bubble Value		Displays current gas bubble value.
9017, 31, 32	Start Adj Gas Bubble	**ACTION [1] (9017)** **TUSIGN8 (31)** **TUSIGN8 (32)**	Start the automatic adjustment of the 'Gas Bubble Detection' function. • Automatic adjustment is started via address 9017 (data type ACTION). • The progress counter (100 = adjustment complete) can be queried via address 31 (data type TUSIGN8). • The result of automatic adjustment can be queried via address 32 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
5089	Gas Bubble Threshold	**TFLOAT [2]**	Set the switching threshold. If the gas bubble value should exceed the defined switching threshold, a message will appear on the display and an alarm will be triggered through the digital output, if appropriately configured.
… / …Diagnosis Control / …Diagnosis Conductiv			Only for devices with the 'Advanced diagnosis' option.
4168	Conductivity On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'Conductivity Monitoring' function.
237	Conductivity[µS/cm]	**TFLOAT [2]**	Output (read only) of the measured conductivity in µS/cm.
5087	Adj. Cond. Value	**TFLOAT [2]**	Conductivity must be set on-site independently of the measuring medium. Measure the conductivity using a conductivity meter on-site and enter the measured value here. Limits: 5 to 20000 µS/cm
5079	Cond. Iout Min Value	**TFLOAT [2]**	The 'Conductivity' process variable is available via the current output (option card). Set the 4 mA and 20 mA value which correspond to the upper and lower range of the conductivity value.
5081	Cond. Iout Max Value		
5085	Cond.Min Alarm Value	**TFLOAT [2]**	Set the alarm for minimum and maximum conductivity. In the case of up-scale or down-scale, an alarm is triggered. Limits: 5 to 20000 µS/cm
5083	Cond.Max Alarm Value	**TFLOAT [2]**	
239	Elec. Imp. E1-GND	**TFLOAT [2]**	Output (read only) of the current impedance between electrode E1 and grounding potential (GND).
241	Elec. Imp. E2-GND	**TFLOAT [2]**	Output (read only) of the current impedance between electrode E2 and grounding potential (GND).

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Diagnosis Control / ...Diagnosis SIL			Only for devices with the 'Advanced diagnosis' option.
4169	SIL On/Off	**TUSIGN8 [1]** 0: Off 1: On	Activate the 'SIL Diagnosis' function.
... / ...Diagnosis Control / ...Noise Check			
9018, 23, 24	Start Noise Check	**ACTION [1] (9018)** **TUSIGN8 (23)** **TUSIGN8 (24)**	Activate the 'Noise Check' function. • Noise Check is started via address 9018 (data type ACTION). • The progress counter (100 = adjustment complete) can be queried via address 31 (data type TUSIGN8). • The result can be queried via address 32 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
22	Noise Check result	**TUSIGN8 [1]** 0: N.C. not performed 1: Noise Check successful 2: Noise Check finished with an error	Output (read only) of the results of Noise Check
265	Power Spectrum	**TFLOAT [2]**	Output (read only) of the current power spectrum.
267	Amplitude 1 Value	**TFLOAT [2]**	Display (read only) the four highest amplitudes in the power spectrum.
269	Amplitude 2 Value	**TFLOAT [2]**	
271	Amplitude 3 Value	**TFLOAT [2]**	
273	Amplitude 4 Value	**TFLOAT [2]**	
275	Frequency 1	**TFLOAT [2]**	Output (read only) of the four strongest amplitudes in the power spectrum with the appropriate frequency.
277	Frequency 2	**TFLOAT [2]**	
279	Frequency 3	**TFLOAT [2]**	
281	Frequency 4	**TFLOAT [2]**	

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Diagnosis Control / ...Fingerprints			Output (read only) of the value of the default fingerprint.
283	Tx Factory CMR	**TFLOAT [2]**	The 'fingerprint database' allows for a comparison of the values at the time
285	Tx Factory 1m/s		of factory calibration with the currently recorded values. Errors in the
287	Tx Factory 10m/s		integrity of the 'Tx Fabrik 1m/s' device can already be detected early on.
289	Se Factory Coil Ind.		Corrective measures can be taken.
291	Se Factory Imp E1		
293	Se Factory Imp E2		
9019, 20, 21	Start Customer FP	**ACTION [1] (9019)** **TUSIGN8 (20)** **TUSIGN8 (21)**	Create a fingerprint and perform verification. • Verification is started via address 9019 (data type ACTION). • The progress counter (100 = adjustment complete) can be queried via address 20 (data type TUSIGN8). • The result can be queried via address 21 (data type TUSIGN8). A value not equal to 0 means that an error has occurred.
19	Result FP verification	**TUSIGN8 [1]**	Output (read only) of the verification result. Based on the result, one of the following messages will be issued.
			0: FP Verificat. passed 9: CMR, Coil failed 1: CMR failed 10: 1m/s, Coil failed 2: 1m/s failed 11: CMR,1m/s,Coil failed 3: CMR, 1m/s failed 12: 10m/s, Coil failed 4: 10m/s failed 13: CMR,10m/s,Coil faile 5: CMR, 10m/s failed 14: 1, 10m/s,Coil failed 6: 1m/s, 10m/s failed 15: All Fingerp. failed 7: All TxFingerp.failed 16: No Verific.performed 8: Coil Fingerp. Failed
295	Tx Customer CMR	**TFLOAT [2]**	Output (read only) of the values of the customer fingerprint.
297	Tx Customer 1m/s		
299	Tx Customer 10m/s		
301	Se Customer Coil Ind		
303	Se Customer Imp. E1		
305	Se Customer Imp. E2		

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Diagnosis Values			
225	Inhouse Temperature	**TFLOAT [2]**	Output (read only) of the temperature within the transmitter housing.
257	Inhouse Temp MaxPeak	**TFLOAT [2]**	
259	Inhouse Temp MinPeak	**TFLOAT [2]**	
251	Driver Current	**TFLOAT [2]**	Output (read only) of the present driver current of the coils in the sensor.
243	DC Voltage E1	**TFLOAT [2]**	Output (read only) of the voltage on electrodes E1 and E2 in the sensor. Only for devices with the 'Advanced diagnosis' option.
245	DC Voltage E2	**TFLOAT [2]**	
261	Signal Region on ADC	**TFLOAT [2]**	Output (read only) of the measurement signal on the AD-converter input.
2111	Coil DAC Preset	**TUSIGN16 [1]**	Output (read only) of the DA-converter set point (driver current).
263	DC Feedback DAC	**TFLOAT [2]**	Output (read only) of the AD-converter feedback.
3327	ADC Errors	**TFLOAT [2]**	Output (read only) of the AD-converter error.
2110	Device Restart Count	**TUSIGN16 [1]**	Output (read only) of the device restart.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ......Simulation Mode			
4001	Simulation Switch	**TUSIGN8 [1]** 0: Off 1: Qm mass flow [unit] 2: Qm mass flow [%] 3: Qv volume flow [unit] 4: Qv volume flow [%] 5: Conductivity [µS/cm] 6: Current output 31/32/Uco 8: Curr.Out V3/V4 9: Digital output 41/42 10: Digital output 51/52 11: Digital output V3/V4 12: Digital input V3/V4	Manual stimulation of measured values / outputs. The simulated output values correspond to the measured value set. Only one measured value / output can be selected for simulation. After power-up / restart of the device, the simulation is switched off.
5001	Qm [unit]	**TFLOAT [2]** 0 to 2 x QmMax DN	Setting of the simulated measured values. The simulated value is selected with the parameter 'Simulation Switch'.
5003	Mass Flow [%]	**TFLOAT [2]** -200 to 200 %	
5005	Qv [unit]	**TFLOAT [2]** 0 to 2 x QvMax DN	
5007	Volume Flow [%]	**TFLOAT [2]** -200 to 200 %	
5009	Conductivity[µS/cm]	**TFLOAT [2]** 0.0 to µS/cm	
5011	Curr.Out 31/32	**TFLOAT [2]** 3.5 to 22.6 mA	
4003	Dig.Out 41/42 State	**TUSIGN8 [1]** 0: Off 1: On	
5013	Dig.Out 41/42 Freq.	**TFLOAT [2]** 0 to 10500 Hz	
5013	Dig.Out 41/42 Pulse	**TFLOAT [2]** 0 to 10500 pulses	

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
4004	Dig.Out 51/52 State	**TUSIGN8 [1]** 0: Off 1: On	
5015	Dig.Out 51/52 Pulse	**TFLOAT [2]** 0 to 10500 pulses	Only if the digital output 51 / 52 has been configured as a pulse output.
4005	Dig.Out V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
4006	Dig.In V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
... / ...Output Readings			
227	Curr.Out 31/32	**TFLOAT [2]** 3.5 to 22.6 mA	Output (read only) of the current output values. The available values are dependent on the configuration of the digital outputs.
229	Dig.Out 41/42 Freq.	**TFLOAT [2]** 0 to 10500 Hz	
14	Dig.Out 41/42 State	**TUSIGN8 [1]** 0: Off 1: On	
15	Dig.Out 51/52 State	**TUSIGN8 [1]** 0: Off 1: On	
16	Dig.Out V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
17	Dig.In V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	

Parameter range – Counter

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Reset Totalizer			
9006	All Totalizer	**ACTION [1]**	Reset the device counter
9007	Massflow Fwd		
9008	Massflow Rev		
9009	Volumeflow Fwd		
9010	Volumeflow Rev		
… / …Preset Totalizer			
5031	Massflow Fwd	**TFLOAT [2]**	Default setting of the device counter.
5033	Massflow Rev		
5035	Volumeflow Fwd		
5037	Volumeflow Rev		

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Batching			These parameters are only available when the filling function is activated.
4092	Batch Process Value	**TUSIGN8 [1]** 0: Off 64: Forward flow volumes 66: Forward flow mass	Selection of the process value used for the fill operation. The process variables 'net forward flow volume' and 'net forward flow mass' are only available when the DensiMass function is activated.
5039	Preset Batch Total.	**TFLOAT [2]** XX to XX	Sets the fill quantity using the selected unit. When the defined fill quantity is reached, the configured binary output is activated. **Note** Before setting the fill quantity, the corresponding process value must be selected with the parameter 'Batch Process Value'.
9011	Reset Cur.Batch Tot.	**ACTION [1]**	Resets the parameter 'Current Batch Total.' to zero and prepares the next fill operation.
9012	Start Batching	**ACTION [1]**	Starts the fill operation by writing any value to the corresponding Modbus address.
433	Current Batch Total.	**TFLOAT [2]** XX to XX	Output of the current fill quantity. Once a fill operation has been started, the quantity already filled is shown here. The counter restarts at zero for each fill operation initiated and then counts up to the set fill quantity. This parameter is read only.
9013	Stop Batching	**ACTION [1]**	Stops the fill operation by writing any value to the corresponding Modbus address.
3317	Batch Counts	**TUSIGN32 [2]**	Output of the number of fill operations since the last reset. This parameter is read only.
9014	Reset Batch Counts	**ACTION [1]**	Resets the counter 'Current Batch Counts' by writing an arbitrary value into the corresponding Modbus address.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Batching / …Lag Correction			These parameters are only available when the FillMass function is activated.
4093	Mode	**TUSIGN8 [1]** 0: Manual 1: Automatic	Selection of overrun correction. Closing the fill valve takes some time and as a consequence more liquid is added, even though the fill quantity is reached and the contact for closing the valve is actuated. • Automatic: The overrun quantity is calculated by the transmitter automatically. — Manual: The overrun quantity must be determined manually and entered in the selected unit via the parameter 'Quantity.'
5041	Quantity	**TFLOAT [2]** -0.0 to 100.0	Manually sets the overrun quantity correction value in the selected unit. Closing the fill valve takes some time and as a consequence more liquid is added, even though the fill quantity is reached and the contact for closing the valve is actuated. Only if the parameter 'Mode' has been set to 2 - Manual.
233	Quantity automatic	**TFLOAT [2]** Read only or set to 0.0.	Output of the overrun quantity automatically calculated by the transmitter. Only if the parameter 'Mode' has been set to 1 - Automatic.
5043	Factor	**TFLOAT [2]** 0.0 to 1.0 Factory setting: 0.25	Sets the weighting of the last filling process during automatic calculation of the overrun quantity. The calculation is based on the following formula: New correction value = last correction value + (Factor x correction value during the last fill operation) • 0.0: No change to correction value. • 1.0: The correction value is immediately adjusted to the overrun quantity calculated during the last fill operation.
5045	Time	**TFLOAT [2]** 0.1 to 10 s Factory setting: 0.1 s	Sets the time for the overrun quantity correction after the fill valve is closed.

4 Diagnosis / error messages

NOTICE

All Modbus addresses in this chapter are indicated in the format "PLC Base 1".

Error messages

Note
Observe the associated operating instruction OI/FEP630/FEH630 for a detailed error description and information about troubleshooting.

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
42	90	5 / 2	F099.042	ADC overrange alarm.
			Electronics	Noise too high. Check applicati. Call service.
11	59	1 / 3	F098.011	No Frontend Board detected.
			Electronics	Wrong connection. Defect Frontend. Check wiring.
29	77	3 / 5	F097.029	Coil regulation error.
			Electronics	Check wiring of sensor coils. Call service
43	91	5 / 3	F096.043	SIL self check alarm.
			Electronics	Call service.
36	84	4 / 4	F095.036	Coil isolation alarm.
			Electronics	Call service.
21	69	2 / 5	F094.021	Safety Alarm Curr. Out 31 / 32
			Electronics	SIL function detects error. Call Service.
32	80	4 / 0	F093.032	Electrode short cuircit.
			Electronics	Check wiring of sensor electrode. Call service.
33	81	4 / 1	F092.033	Electrode open cuircit.
			Electronics	Check wiring of sensor electrode. Call service.
30	78	3 / 6	F091.030	Coil wiring error.
			Electronics	Check wiring of sensor coils. Call service.
35	83	4 / 3	F090.035	ADC RX210 com. error.
			Electronics	Call service.
12	60	1 / 4	F088.012	FEB communication error.
			Electronics	EMC disturbance. Call Service.
18	66	2 / 2	F086.018	Curr.Out 31 / 32 com error.
			Electronics	Defective Board. EMC disturbance. Call Service.
10	58	1 / 2	F084.010	NV data defect.
			Electronics	Data storage irreparable. Call Service.
13	61	1 / 5	F082.013	Incompatible Frontend Board.
			Electronics	Frontend not fit to Motherboard. Call Service.
25	73	3 / 1	F081.025	MB voltages outside range.
			Electronics	Defective Motherboard HW. Call Service.
3	51	0 / 3	C078.003	Flowrate to zero.
			Configuration	Check digital in terminals.
5	53	0 / 5	C076.005	All totalizer stopp.
			Configuration	Check digital in terminals.

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
6	54	0 / 6	C074.006	Totalizer reset.
			Configuration	Reset of one or more Totalizers.
2	50	0 / 2	C072.002	Simulation is on.
			Configuration	Simulated values.
				Switch off Simulation Mode.
26	74	3 / 2	C070.026	An alarm is simulated.
			Configuration	Switch off alarm simulation.
44	92	5 / 4	S065.044	Inhouse temp. alarm.
			Operation	Reduce ambient temperature.
41	89	5 / 1	S064.041	EPD alarm.
			Operation	Secure pipe is completely filled.
40	88	5 / 0	S063.040	TFE alarm.
			Operation	Secure pipe is completely filled.
39	87	4 / 7	S062.039	Sensor temp. limits alarm.
			Operation	Change limits or change fluid temperature.
38	86	4 / 6	S061.038	Conductivity limits alarm.
			Operation	Change limits or Check application.
37	85	4 / 5	S060.037	Gas bubble alarm.
			Operation	Check conditions of application.
16	64	2 / 0	S052.016	Curr.Out 31 / 32 is saturated.
			Operation	CO process value out of range. Adapt Qmax.
17	65	2 / 1	S051.017	Curr.Out V1 / V2, V3 / V4 saturated.
			Operation	CO process value out of range. Adapt Qmax.
19	67	2 / 3	S049.019	Option Card 1 com error.
			Electronics	Defective Card. Check Card 1. Call Service.
20	68	2 / 4	S048.020	Option Card 2 com error.
			Electronics	Defective Card. Check Card 2. Call Service.
15	63	1 / 7	S047.015	Pulse output is cut off.
			Operation	Wrong config. Check pulse out configuration.
0	48	0 / 0	S046.000	Mass flowrate exceeds limits.
			Operation	Check flowrate and alarm limits.
1	49	0 / 1	S044.001	Volume flowrate exceeds limits.
			Operation	Check flowrate and alarm limits.
34	82	4 / 2	S041.034	DC feedback regulation.
			Electronics	Check conditions of application. Call service.
31	79	3 / 7	S040.031	Coil Inductance alarm.
			Electronics	Call service.

... 4 Diagnosis / error messages

... Error messages

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
9	57	1 / 1	M038.009	Sensor memory defective.
			Electronics	Mem. or connect. defective. Replace memory.
14	62	1 / 6	M037.014	NV chips defect on Motherboard.
			Electronics	Defective MB. Replace MB. Call Service.
22	70	2 / 6	M032.022	Curr.Out 31 / 32 not calibrated.
			Configuration	Call Service.
23	71	2 / 7	M031.023	Curr.Out V1 / V2 not calibrated.
			Configuration	Replace Current Option Card. Call Service.
24	72	3 / 0	M030.024	Curr.Out V3 / V4 not calibrated.
			Configuration	Replace Current Option Card. Call Service.
7	55	0 / 7	M028.007	Display value is < 1600 h at Qmax.
			Configuration	Change mass Unit or vol. Unit for Totalizer.
4	52	0 / 4	M026.004	Maintenance interval is reached.
			Operation	Perform maintenance.
8	56	1 / 0	M024.008	Device not calibrated.
			Configuration	Call Service.
27	75	3 / 3	M020.027	DUMMY_ALARM_1_27
			Electronics	

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