CoriolisMaster FCB400, FCH400, FCD400
Coriolis mass flowmeter

Modbus protocol
FCB400, FCH400: Valid as of software version 01.06.00
FCD400: Valid as of software version 01.11.00

Measurement made easy

—
FCB400 / FCH400
FCD400

Additional Information

Additional documentation on CoriolisMaster FCB400, FCH400, FCD400 is available for download free of charge at www.abb.com/flow. Alternatively simply scan this code:

Table of contents

1   Introduction

The following interface description is a supplement to the operating instruction of the CoriolisMaster FCx4xx.
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 CoriolisMaster series FCx4xx.

2   Specification

Modbus® communication

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 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

… Modbus® communication

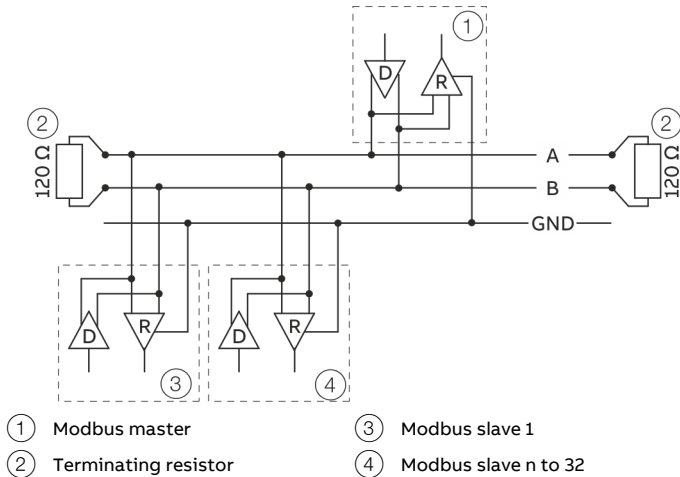|			
①	Modbus master	③	Modbus slave 1
②	Terminating resistor	④	Modbus slave n to 32

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 47.
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.
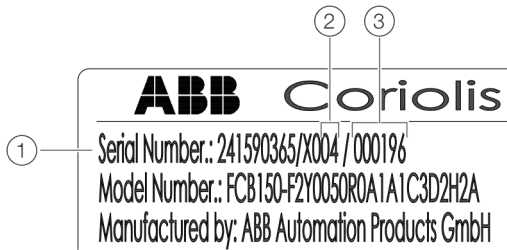
3   Parameterization

Parameterization via the Modbus interface

Note **Parameter descriptions** on page 21 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
65521 TUSIGN32 [2]	manufacturerDeviceID The manufacturer code (ABB = 0x1A) and the device code (FCB1xx = 0xA0) must be written to the register 65522.
65523 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 (65524) of the register.
65525 TUSIGN32 [2]	slaveID The new Modbus Slave ID must be written in the high byte (65526) 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.
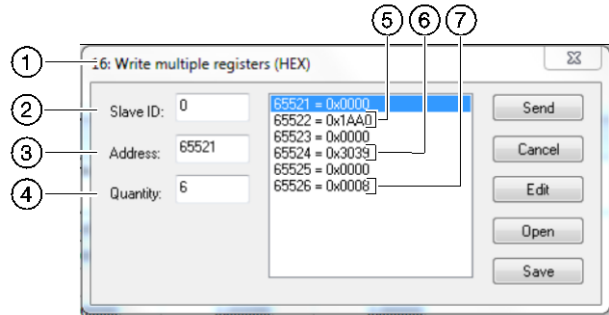
① Functional code 16	⑤ Manufacturer and device codes
② Broadcast address '0'	⑥ Sensor ID
③ Register start address	⑦ New Modbus Slave ID
④ Number of registers	

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".

Register tables (overview)

Table ID [hex]	Table name	Table type	Data type	Start index	End index
Input coils					
0xD	Input Coils Table	Coil	TUSIGN8	2000	3000
Register					
0x0	8-bit register	Single	TUSIGN8	1	99
0x1	Action register	Single	ACTION	100	148
0x2	Float register	Single	TFLOAT	149	360
0x3	16-bit register	Single	TUSIGN16	361	407
0x4	Float register	Single	TFLOAT	408	450
0x5	32-bit register	Single	TUSIGN32	451	569
0x6	8-bit register	Single	TUSIGN8	570	600
0x7	16-bit config scan register 1	Single	TUSIGN16	655	686
0x8	Scan register	Single	16 Bit Register, Data Type depends on Configuration register	687	718
0x9	16-bit config scan register 2	Single	TUSIGN16	751	782
0xA	Scan register 2	Single	16 Bit Register, Data Type depends on Configuration register	783	814
0xB	Float register	Single	TFLOAT	963	1002
0xC	Stringregister	String	TUSIGN8	1003	1499
0xE	String register	String	TCHAR	1500	1999
0xF	Double register	Single	TDOUBLE	847	962
0x10	Slave ID register	Single	TUSIGN32	65521	65526
0x11	Float register	Single	TFLOAT	601	654
0x12	8-bit register	Single	TUSIGN8	3001	3500
0x13	Float register	Single	TFLOAT	3501	4000

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 58.

Supported Modbus function codes

Overview
The function codes listed below are supported by CoriolisMaster FCB400, FCH400, FCD400.

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 CoriolisMaster FCB400, FCH400, FCD400 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	Anzahl (n) der Datenbytes im Antwort-Telegramm
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 code for CoriolisMaster devices, 0xA0
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) 46,43,78,34,78,78,20,43,6F,72,69,6F,6C,69,73,4D,61,73,74,65,72,20 (ASCII) 'FCx 4xx CoriolisMaster'
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 'ACTION' data type 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 47.
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 47. 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.

Note

The 'Code' column indicates the value to which the corresponding parameter must be set, e.g. using the communications 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	Customer unit (user-defined)

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	Customer unit (user-defined)

Table 3: Density units

Selection	Code	Description
g/cm^3	1	Grams per cubic centimeter
kg/m^3	4	Grams per cubic meter
g/ml	7	Grams per milliliter
g/l	10	Grams per liter
kg/l	11	Kilograms per liter
lb/ft^3	13	Pounds (avdp) per cubic foot
lb/ugal	14	Pounds (avdp) per gallon
SG	17	Specific gravity
xx/yy	254	Customer unit (user-defined)

Table 4: Temperature units

Selection	Code	Description
K	1	Kelvin
°C	2	Celsius
°F	3	Fahrenheit
xx/yy	254	Customer unit (user-defined)

Table 5: Concentration units

Selection	Code	Description
%	57	Concentration in %
Brix	101	Brix concentration
Variable Matrix	240	The concentration is calculated with the variables matrix
Baume	241	Baume concentration
API	104	Crude oil density in API degrees

Table 6: Units for the mass totalizer

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

Table 7: 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	Customer unit (user-defined)

Table 8: Pressure units

Selection	Code	Description
Pa	1	Pascals
kPa	4	Kilopascals
Bar	8	Bar
mBar	9	Millibar
psi	65	Pounds per square inch

Table 9: Pulses per flow unit

Selection	Code	Description
1/kg	2	Per kilogram
1/g	3	Per gram
1/m³	4	Per cubic meter
1/t	5	Per metric ton
1/ft³	7	Per cubic foot
1/lb	8	Per pound
1/ml	11	Per milliliter
1/l	13	Per liter
1/hl	14	Per hectoliter
1/Ml	16	Per megaliter
1/ugal	20	Per gallon (US)
1/igal	21	Per gallon (Imperial)
1/bbl	22	Per barrel (petroleum, USA)
1/Mugal	27	Per megagallon (US)
1/bls	31	Barrels (beer, USA)
1/xx	238	Per user-defined volume flow unit
1/yy	239	Per user-defined mass flow unit

… 3 Parameterization

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 / Code [hex] PROFIBUS DP" column indicates the value to which the corresponding parameter must be set, e.g. using the communications interface.

Process variable		Modbus address	Code	Code [hex] PROFIBUS DP	Description	HMI	CO	DO [f]	DO [pulse]
Mass Flow [unit]	Qm	247	1	0x00	Mass flow in the selected mass flow unit	X	—	—	X
Mass Flow [%]	Qm	267	2	0x01	Mass flow in percent	X	X	X	—
Volume Flow [unit]	Qv	253	3	0x02	Volume flow in the selected volume unit	X	—	—	X
Volume Flow [%]	Qv	273	4	0x03	Volume flow in percent	X	X	X	—
Temperature [unit]	Tm	251	5	0x04	Temperature in the selected volume unit	X	—	—	—
Temperature [%]	Tm	271	6	0x05	Temperature in percent	X	X	X	—
Density [unit]	p	249	7	0x06	Density in the selected density unit	X	—	—	—
Density [%]	p	269	8	0x07	Density in percent	X	X	X	—
Net Mass Flow[unit]*	nQm	973	9	0x08	Net mass flow in the selected volume unit	X	—	—	X
Net Mass Flow [%]*	nQm	977	10	0x09	Net mass flow in percent	X	X	X	—
Net Vol. Flow [unit]*	nQv	979	11	0x0A	Net volume flow in the selected volume unit	X	—	—	X
Net Volume Flow [%]*	nQv	983	12	0x0B	Net volume flow in percent	X	X	X	—
Vol.Flow@Tref [unit]*	Q@T	967	13	0x0C	Volume flow at a reference temperature.	X	—	—	X
Vol.Flow@Tref [%]*	Q@T	971	14	0x0D		X	X	X	—
Density@Tref [unit]*	p@T	963	15	0x0E	Density at a reference temperature.	X	—	—	—
Density @ Tref [%]*	p@T	965	16	0x0F		X	X	X	—
Concentr.unit [%]*	β u	987	17	0x10	Concentration in the selected unit in percent	X	X	X	—
Concentr.unit [unit]*	β u	985	18	0x11	Concentration in the selected unit	X	—	—	—
Concentr.% [%]*	β %	989	19	0x12	Concentration in the selected unit	X	X	X	—

*　Process variable is only available if the DensiMass function is activated.

X　Parameter available

—　Parameter not available

Process variable		Modbus address	Code	Code [hex] PROFIBUS DP	Description	HMI	CO	DO [f]	DO [pulse]
Totalizer Qm Fwd	∑m+	851 (double) 259 (float)	20	0x13	Mass flow counter reading in the forward flow direction	X	—	—	—
Totalizer Qm Rev	∑m-	855 (double) 261 (float)	21	0x14	Mass flow counter reading in the reverse flow direction	X	—	—	—
Totalizer Qm Diff	∑m	859 (double) 255 (float)	22	0x15	Mass flow counter reading for forward flow / reverse flow difference	X	—	—	—
Totalizer Qv Fwd	∑v+	863 (double) 263 (float)	23	0x16	Volume flow counter reading in forward flow direction	X	—	—	—
Totalizer Qv Rev	∑v-	867 (double) 265 (float)	24	0x17	Volume flow counter reading in reverse flow direction	X	—	—	—
Totalizer Qv Diff	∑v	871 (double) 257 (float)	25	0x18	Volume flow counter reading for forward flow / reverse flow difference	X	—	—	—
Total. Net Qm Fwd*	∑M+	887 (double) 995 (float)	26	0x19	Net mass flow counter reading in forward flow direction	X	—	—	—
Total. Net Qm Rev*	∑M-	891 (double) 997 (float)	27	0x1A	Net mass flow counter reading in reverse flow direction.	X	—	—	—
Total. Net Qm Diff*	∑M	895 (double) 975 (float)	28	0x1B	Net mass flow counter reading for forward flow / reverse flow difference.	X	—	—	—
Total. Net Qv Fwd*	∑V+	899 (double) 999 (float)	29	0x1C	Net volume flow counter reading in forward flow direction.	X	—	—	—
Total. Net Qv Rev*	∑V-	903 (double) 1001 (float)	30	0x1D	Net volume flow counter reading in reverse flow direction.	X	—	—	—
Total. Net Qv Diff*	∑M	907 (double) 981 (float)	31	0x1E	Net volume flow counter reading for forward flow / reverse flow difference.	X	—	—	—
Total.Qv@Tref Fwd*	∑T+	875 (double) 991 (float)	32	0x1F	Volume flow counter reading in forward flow direction at a reference temperature.	X	—	—	—
Total.Qv@Tref Rev*	∑T-	879 (double) 993 (float)	33	0x20	Volume flow counter reading in reverse flow direction at a reference temperature.	X	—	—	—
Total.Qv@Tref Diff*	∑T	883 (double) 969 (float)	34	0x21	Volume flow counter reading for forward flow / reverse flow difference at a reference temperature.	X	—	—	—
Totalizer Qm Sum	∑m+-S	911 (double) 441 (float)	41	0x28	Absolute value from mass flow counter reading in the forward flow and reverse flow direction. The counter cannot be stopped or reset.	X	—	—	—
Totalizer Qv Sum	∑v+-S	915 (double) 443 (float)	42	0x29	Absolute value from volume flow counter reading in the forward flow and reverse flow direction. The counter cannot be stopped or reset.	X	—	—	—
Total. Net Qm Sum	∑M+-S	919 (double) 445 (float)	43	0x2A	Absolute value from net mass flow counter reading in forward flow and reverse flow direction. The counter cannot be stopped or reset.	X	—	—	—

*   Process variable is only available if the DensiMass function is activated.

**   Process variable is only available if the FillMass function is activated.

X   Parameter available

—   Parameter not available

... 3 Parameterization

... Available process variables

Process variable		Modbus address	Code	Code [hex] PROFIBUS DP	Description	HMI	CO	DO [f]	DO [pulse]
Total. Net Qv Sum	∑V+-S	923 (double) 447 (float)	44	0x2B	Absolute value from net volume flow counter reading in forward flow and reverse flow direction. The counter cannot be stopped or reset.	X	—	—	—
Total. Qv @ Tref Sum	∑T+-S	927 (double) 449 (float)	45	0x2C	Absolute value from volume flow counter reading in forward flow and reverse flow direction at a reference temperature. The counter cannot be stopped or reset.	X	—	—	—
Current Batch Total.**	CBT	847 (double)	35	0x22	Current fill quantity.	X	—	—	—
Batch Counts**	CBC	465	36	0x23	Number of fill operations.	X	—	—	—
Tube Frequency	PF	275	37	0x24	Meter tube frequency in Hz.	X	—	—	—
Driver Output	DOC	291	38	0x25	Driver current in mA.	X	—	—	—
Sensor Signal Sa	SSA	283	39	0x26	Sensor amplitude of sensor A in mV	X	—	—	—
Sensor Signal Sb	SSB	285	40	0x27	Sensor amplitude of sensor B in mV	X	—	—	—
Specific Gravity	SG	431	46	0x2D	Specific weight for liquids.	X	—	—	—
°API Gravity	API	433	47	0x2E	Crude oil density in API degrees	X	—	—	—
Variable 1	Va1	619 (float)	48	—	External fieldbus variable 1	X	—	—	—
Variable 2	Va2	621 (float)	49	—	External fieldbus variable 2	X	—	—	—
Electr. (FEB) Temp	Ttx	281 (float)	50	—	Temperature of the frontend board.	X	—	—	—
Sensor Housing Temp	Tsx	3500 (float)	51	—	Temperature in the sensor housing.	X	—	—	—

*   Process variable is only available if the DensiMass function is activated.

**   Process variable is only available if the FillMass function is activated.

X   Parameter available

—   Parameter not available

Application of the Health Indication Registers (Condensed Status Registers))

The CoriolisMaster FCB400, FCH400, FCD400 has three 'Health indication registers' (Condensed Status Registers). The 'Health indication register 365, 366 and 367 consist of 2 bytes, each containing 8 bits. Each bit represents an error.

The registers are structured as follows:

365		366		367	
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
01234567	01234567	01234567	01234567	01234567	01234567

■= true (1)   □= false (0)

Figure 4:   Health indication register (example)

The bit position is assigned to the errors in accordance with the 'Byte / Bit pos.' column in the table in the chapter **Error messages** on page 58.

The following assignment applies to the example in Figure 4:

Byte / Bit	Fault message
Byte 0 / Bit 3	Flow rate set to 0
Byte 0 / Bit 5	All counters stopped
Byte 4 / Bit 3	Density too low

Using the scan register

The CoriolisMaster FCB400, FCH400, FCD400 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

... Available process variables

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

Config scan register 1, register range 655 ... 686		
Config scan register 2, register range 751 ... 782		
Configuration register	**Parameter address**	**Parameter descriptions**
655 / 751	247	Mass flow in the selected mass flow unit (data type float, register length 2)
656 / 752	249	Volume flow in the selected volume unit (data type float, register length 2)
657 / 753	259	Mass flow counter reading in forward flow direction (data type float, register length 2)
658 / 754	263	Volume flow counter reading in forward flow direction (data type float, register length 2)
659 / 755	365	Diagnosis State 0 (Data type Usign 16, register length 1)
660 / 756	366	Diagnosis State 1 (Data type Usign 16, register length 1)
661 / 757	367	Diagnosis State 2 (Data type Usign 16, register length 1)
662 / 758	368	Mass flow unit Qm (data type Usign 8, register length 1)
... / ...	FFF	Non-configured register spaces must be filled with FFF.
686 / 782	FFF	

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

Scan register 1, register range 687 ... 718	
Scan register 2, register range 783 ... 814	
Configuration register	**Register content**
687 / 783	Mass flow (data type float, register length 2)
688 / 784	
689 / 785	Volume flow (data type float, register length 2)
690 / 786	
691 / 787	Mass flow counter reading in forward flow direction (data type float, register length 2)
692 / 788	
693 / 789	Volume flow counter reading in forward flow direction (data type float, register length 2)
694 / 790	
695 / 791	Diagnosis state 0 (data type Usign 16, register length 1)
696 / 792	Diagnosis state 1 (data type Usign 16, register length 1)
697 / 793	Diagnosis state 2 (data type Usign 16, register length 1)
698 / 794	Mass flow unit Qm (data type Usign 8, register length 1)
... / ...	Non-configured register spaces remain unpopulated.
718 / 846	

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			
1	Sensor Type	**TUSIGN8 [1]** 0: Simulator 1: FCB 2: FCH 4: FCD	Sensor type.
2	Meter Size	**TUSIGN8 [1]** 13: DN08 – ¼ in. 14: DN10 – ⅜ in. 1: DN15 - ½ in. 2: DN25 - 1 in. 3: DN50 - 2 in. 4: DN15 - ½ in. 5: DN25 - 1 in. 6: DN50 - 2 in. 7: DN80 - 3 in. 8: DN100 - 4 in. 9: DN150 - 6 in.	Nominal diameter of sensor.
3	Feature Series	**TUSIGN8 [1]** 2: Series 430 4: Series 450	Sensor model. DensiMass and FillMass functions are only available in models FCB450 / FCH450 / FCD450.
165	Qm Max DN	**TFLOAT [2]**	Maximum mass flow for the selected nominal diameter. The value is set automatically via the selected nominal diameter.
407	Span Forward	**TFLOAT [2]**	Calibration value (span) in forward flow direction of the sensor.
415	Span Reverse	**TFLOAT [2]**	Correction value for 'Span Forward' (span) in reverse flow direction of the sensor. Is needed for increased accuracy.
417	Zero Sensor	**TFLOAT [2]**	Calibration value (zero point) of the sensor for the selected nominal diameter.
159	Freq.@ Empty Pipe	**TFLOAT [2]**	Meter tube frequency and density during calibration with empty meter tube. The calibration is usually performed with air as a measuring medium.
153	Density @ Empty Pipe	**TFLOAT [2]**	
161	Freq.@ Full Pipe	**TFLOAT [2]**	Meter tube frequency and density during calibration with full meter tube. The calibration is usually performed using water as a measuring medium.
155	Density @ Full Pipe	**TFLOAT [2]**	
3553	Calibration Pressure	**TFLOAT [2]**	Measuring medium pressure in the selected pressure unit during calibration.
3555	Calibration Temp.	**TFLOAT [2]**	Measuring medium temperature in °C during calibration.
451	Sensor ID	**TUSIGN32 [2]**	ID number of the sensor.
1003	Sensor Serial No.	**TCHAR [20]**	Serial number of the sensor.
455	Sensor Run Hours	**TUSIGN32 [2]**	Operating hours of the sensor.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Sensor / ...Calibration			
571	First Cal. Date	**TUSIGN8 [3]**	Date of first calibration of sensor (calibration of new device).
574	Last Cal. Date	**TUSIGN8 [3]**	Date of last calibration of sensor.
1029	Cal. Cert. No.	**TCHAR [20]**	Identification (number) of the relevant calibration certificate.
1049	First Cal. Location	**TCHAR [20]**	Place of first calibration of the sensor.
1069	Last Cal. Location	**TCHAR [20]**	Place of last calibration of sensor.
... / ...Transmitter			
4	Transmitter Type	**TUSIGN8 [1]** 3: FCx4xx – Remote mount design 7: FCx4xx – Integral mount design 10: Error	Display of the transmitter type.
453	Transmitter ID	**TUSIGN32 [2]**	ID number of transmitter.
1089	Transm.Serial No.	**TCHAR [20]**	Order number of the transmitter.
457	Transm. Run Hours	**TUSIGN32 [2]**	Operating hours of the transmitter (frontend board).
364	Tx Restart Counter	**TUSIGN16 [1]**	Number of device restarts (switching the power supply off and on).
467	Time since Restart	**TUSIGN32 [2]**	Device operating hours since the last restart.
3144	Option Card Slot 1 / 2		Type of plug-in card present in slot OC1 / OC2.
3145			If the plug-in card is incorrectly detected or incompatible, a corresponding message will be issued.
6	DensiMass On/Off	**TUSIGN8 [1]** 0: Off 1: On	DensiMass function present? 0: Off: No DensiMass function present. 1: On: DensiMass function present.
7	FillMass On/Off	**TUSIGN8 [1]** 0: Off 1: On	FillMass function present? 0: Off: No FillMass function present. 1: On: FillMass function present.
92	VeriMass On/Off	**TUSIGN8 [1]** 0: Off 1: On	VeriMass function present? 0: Off: No VeriMass function present. 1: On: VeriMass function present.
3157	CoriolisContr.On/Off	**TUSIGN8 [1]** 0: Off 1: On	CoriolisControl function present? Off: No CoriolisControl function present. On: CoriolisControl function present.
1195	Manufacturer	**TUSIGN8 [20]**	Name of manufacturer.
1215	Street	**TUSIGN8 [20]**	Manufacturer's address (street)
1235	City	**TUSIGN8 [20]**	Manufacturer's address (city)
1255	Phone	**TUSIGN8 [20]**	Manufacturer's address (phone number)

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Transmitter Version			
3069	FW Device Ver.	**TUSIGN8 [3]**	Version and item number of device software package.
1355	FW Device Part Nr.	**TCHAR [20]**	
3132	FW Motherboard Ver.	**TUSIGN8 [3]**	Version and checksum (CRC) of motherboard (MB) software in transmitter.
372	FW Motherboard CRC	**TUSIGN16 [1]**	
8, 9, 10	FW Frontend Ver.	**CONST_U8 [3]**	Version and checksum (CRC) of frontend board (FEB) software in sensor.
363	FW Frontend CRC	**TUSIGN16 [1]**	
3135	HW Motherboard Ver.	**TUSIGN8 [3]**	Hardware version of motherboard (MB) in transmitter.
1109	HW Frontend Ver.	**TUSIGN8 [20]**	Hardware version of frontend board (FEB) in sensor.
3136	Bootloader MB Ver.	**TUSIGN8 [3]**	Version of motherboard (MB) bootloader in transmitter.
11, 12, 13	Bootloader FEB Ver.	**CONST_U8 [3]**	Version of frontend board (FEB) bootloader in sensor.
3139	Curr. Out FW Ver.	**TUSIGN8 [3]**	Current output module software version and checksum (CRC).
373	Curr. Out FW CRC	**TUSIGN16 [1]**	
... / ...Transmitter / ...Calibration			
577	First Cal. Date	**TUSIGN8 [3]**	Date of first calibration of transmitter (calibration of new device).
580	Last Cal. Date	**TUSIGN8 [3]**	Date of last calibration of transmitter.
1135	Cal. Cert. No.	**TCHAR [20]**	Identification (no.) of the relevant calibration certificate.
1155	First Cal. Location	**TCHAR [20]**	Place of first calibration of transmitter.
1175	Last Cal. Location	**TCHAR [20]**	Place of last calibration of transmitter.

... 3 Parameterization

... Parameter descriptions

Parameter range - config. Device

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Access Control			
5	Read Only Switch	**TUSIGN8 [1]** 0: Off 1: On	Indicator of the position of the write protection switch. This parameter is read only.
... / ...Sensor			
15	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.
165	Qm Max DN	**TFLOAT [2]**	Maximum mass flow for the selected nominal diameter. The value is set automatically via the selected nominal diameter. This parameter is read only.
167	Qm Max	**TFLOAT [2]** 2.0 to 0.01 QmMaxDN	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.
169	Qm Max 2	**TFLOAT [2]** 2.0 to 0.01 QmMaxDN	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.
18	Qm Range Mode	**TUSIGN8 [1]** 0: QmMax 1: QmMax2	Manual switchover between the measuring ranges Qm Max and Qm Max 2.
171	Qv Max DN	**TFLOAT [2]**	Maximum volume flow. The value indicates the calculated maximum volume flow depending on the parameters 'Qm Max DN' and 'Density Min'. This parameter is read only.
173	Qv Max	**TFLOAT [2]** 0.01 to 2.0 Qv MaxDN	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.
175	Qv Max 2	**TFLOAT [2]** 0.01 to 2.0 Qv MaxDN	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.
19	Qv Range Mode	**TUSIGN8 [1]** 0: QvMax 1: QvMax2	Manual switchover between the measuring ranges Qv Max and Qv Max 2.
177	Density Max	**TFLOAT [2]** (Density Min + 0.01) to 3.5 g/cm³	Sets the maximum / minimum density to be measured. This value is used to calculate the percentage density value. These parameters are only available if the density output 'Density [unit]' was selected when configuring the power and digital outputs.
179	Density Min	**TFLOAT [2]** 0.00 g/cm³ to (Density Max − 0.01)	

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Sensor			
181	Temperature Max	**TFLOAT [2]** (Temperature Min + 10 °C) to 205 °C	Sets the maximum / minimum temperature to be measured. This value is used to calculate the percentage temperature value. These parameters are only available if the temperature output 'Temperature [unit]' was selected when configuring the power and digital outputs.
183	Temperature Min	**TFLOAT [2]** −50°C to (Temperature Max −10 °C)	
203	Net Qm Max	**TFLOAT [2]** 0.01 to 2.0 Qv MaxDN	Setting of the minimum and maximum net mass flow. The values are also used to calculate the corresponding percentage value. The parameters are only available when the DensiMass function is activated.
205	Net Qv Max	**TFLOAT [2]** 0.01 to 2.0 Qv MaxDN	
207	Concentration Max	**TFLOAT [2]**	Sets the minimum and maximum concentration of the measuring medium. The values are also used to calculate the corresponding percentage value. The value depends on the selected matrix. The parameters are only available when the DensiMass function is activated.
209	Concentration Min	**TFLOAT [2]**	
185	Density Max at Tref	**TFLOAT [2]** (Density at Tref Min + 0.01 g/cm³) to 3.5 g/cm³	Sets the minimum and maximum density of the measuring medium at the reference temperature T_{ref}. The values are also used to calculate the corresponding percentage value. The parameters are only available when the DensiMass function is activated.
187	Density at Tref Min	**TFLOAT [2]** 0.00 g/cm³ to (Density Max at Tref − 0.01 g/cm³)	
191	Qv at Tref Max	**TFLOAT [2]** 0.01 to 2.0 Qv MaxDN	Sets the maximum volume flow of the measuring medium at the reference temperature T_{ref}. The values are also used to calculate the corresponding percentage value. The parameter is only available when the DensiMass function is activated.
1315	Sensor Location Tag	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the measuring point tagging for the sensor.
1335	Sensor Tag	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the TAG number for the measuring sensor.
... / ...Sensor / ...Operating Mode			
17	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. It is important to note that the accuracy also depends on whether the device has been calibrated in the forward flow direction only or in the forward flow and reverse flow directions.
16	Flow Indication	**TUSIGN8 [1]** 0: Normal 1: Inverted	Inverts the flow direction displayed. It is important to note that the accuracy also depends on whether the device has been calibrated in the forward flow direction only or in the forward flow and reverse flow directions.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter			
189	Damping Qm	**TFLOAT [2]** 0.04 to 300 s (1 Tau)	Setting of the damping for the mass flow volume (the value relates to 1 T (Tau)). The value relates to a stepwise change of the mass flow rate. The setting of 0.04 s deactivates the damping.
193	Damping Density	**TFLOAT [2]** 0.04 to 300 s (1 Tau)	Setting of the damping for the density (the value relates to 1 T (Tau)). The value relates to a stepwise change of the density. The setting of 0.04 s deactivates the damping.
14	Density Mode	**TUSIGN8 [1]** 0: Fixed density value 1: Measured density	Select whether the measured density or a fixed default density is used. Use the fixed default density for example if the density measurement is not needed or for gaseous measuring media.
157	Density Fixed Value	**TFLOAT [2]** 0.01 to 3.5 g/cm³	Enter the fixed default density of the measuring medium. The value is also used to calculate the volume flow. When entering a reference density, this parameter is used to calculate the reference volume. This is particularly common for gas measurements. The parameter is available only if the parameter 'Density Mode' has been set to '0: Fixed density value.'
1275	TX Location TAG	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the measuring point tagging for the transmitter.
1295	TX TAG	**TUSIGN8 [20]** Alphanumeric, maximum 20 characters	Enter the TAG number for the transmitter.
95	Plant Data Sync.	**TUSIGN8 [1]** 1 - FEB > MB 2 - MB > FEB	The transmitter saves its configuration in the 'SensorMemory'. The data is stored redundantly on the motherboard (MB) of the transmitter and on the frontend board (FEB) of the sensor. This means the configuration can be restored quickly if any components are replaced. • FEB > MB: Loading the configuration from the frontend board (FEB) of the sensor. • MB > FEB: Loads the configuration from the motherboard (MB) in the transmitter.
122	Device Restart	**ACTION [1]**	Restarts the device. Compensates for a short interruption of the power supply.
91	Restore Settings	**ACTION [1]**	All user-accessible parameters will be reset to the factory default settings.
3557	Delayed Dev. Restart	**TFLOAT [2]** 0 to 30 s	Restart the device after the entered time has elapsed.

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Units			
47	Unit Massflow Qm	**TUSIGN8 [1]** Refer to .	Selection of the unit for the mass flow (for example for the parameters QmMax / QmMaxDN and for the corresponding process value).
53	Unit Mass Totalizer	**TUSIGN8 [1]** Refer to .	Selection of the unit for the mass counters and the pulse outputs.
50	Unit Volumeflow Qv	**TUSIGN8 [1]** Refer to .	Selection of the unit for the volume flow (for example for the parameters QvMax / QvMaxDN and for the corresponding process value).
54	Unit Vol. Totalizer	**TUSIGN8 [1]** Refer to .	Selection of the unit for the volume totalizers and the pulse outputs.
48	Unit Density	**TUSIGN8 [1]** Refer to .	Selection of the unit for density (for example for the associated parameters and the corresponding process values).
49	Unit Temperature	**TUSIGN8 [1]** Refer to .	Selection of the unit for the temperature (for example for the associated parameters and the corresponding process values).
52	Concentration	**TUSIGN8 [1]** Refer to .	Selection of the unit for the concentration (for example for the associated parameters and the corresponding process value).
1548	Variable 1 Name	**TCHAR [8]**	Selection of the unit for external process variables.
1556	Variable 2 Name	Alphanumeric, maximum 7 characters	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.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Transmitter / ...Custom Units			
1500	Mass flow Qm Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or the abbreviation for the user-defined unit Qm.
239	Mass flow Qm Factor	**TFLOAT [2]** 0.0001 to 100000 kg/s	Sets the factor in kg/seconds for the user-defined unit Qm.
1532	Mass Tot. Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or abbreviation of the unit for the user-defined mass counter.
423	Mass Tot. Factor	**TFLOAT [2]** 0.0001 to 100000 kg	Sets the factor of the unit for the user-defined mass counter.
1508	Volumeflow Qv Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or abbreviation for the user-defined unit Qv.
245	Volumeflow Qv Factor	**TFLOAT [2]** 0.0001 to 100000 l/s	Sets the factor in liters/seconds for the user-defined unit Qv.
1540	Volume Tot. Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or abbreviation of the unit for the user-defined volume totalizer.
425	Volume Tot. Factor	**TFLOAT [2]** 0.0001 to 100000 l	Sets the factor of the unit for the user-defined mass counter.
1516	Density Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or abbreviation for the user-defined density unit.
241	Density Factor	**TFLOAT [2]** 0.0001 to 100000 g/ml	Sets the factor in g/ml for the user-defined density unit.
1524	Temperature Name	**TCHAR [8]** Alphanumeric, maximum 7 characters	Sets the name or abbreviation for the user-defined temperature unit.
243	Temperature Factor	**TFLOAT [2]** 0.0001 to 100000 °C	Sets the factor for the user-defined temperature unit in °C.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Transmitter / …Cut Off			
195	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 %
197	Low Flow Hysteresis	TFLOAT [2] 0.0 to 50%	Sets the hysteresis for the low flow cut-off as defined in the parameter 'Low Flow Cut Off'. Factory setting: 20 %
149	Density Cut Off	TFLOAT [2] 0.0005 to 0.5 g/cm³	Sets the low flow for density. Factory setting: 0.2 g/cm³
… / …Transmitter / …Feature Settings			
6	DensiMass On/Off	TUSIGN8 [1] 0: Off 1: On	DensiMass function active? 0: Off: DensiMass function deactivated. 1: On: DensiMass function activated. This parameter is read only.
361	DensiMass Code*	TUSIGN16 [1] 0x0000 to 0xFFFF	Sets the device-specific code for activating the DensiMass function. After entering the code, restart the device (for example using the parameter 'Device reset', see page 26, or by briefly switching off the power supply).
7	FillMass On/Off	TUSIGN8 [1] 0: Off 1: On	FillMass function active? 0: Off: FillMass function deactivated. 1: On: FillMass function activated. This parameter is read only.
362	FillMass Code*	TUSIGN16 [1] 0x0000 to 0xFFFF	Sets the device-specific code for activating the FillMass function. After entering the code, restart the device (for example using the parameter 'Device reset', see page 26, or by briefly switching off the power supply).
92	VeriMass On/Off	TUSIGN8 [1] 0: Off 1: On	VeriMass function active? 0: Off: VeriMass function deactivated. 1: On: VeriMass function activated. This parameter is read only.
368	VeriMass Code*	TUSIGN16 [1] 0x0000 to 0xFFFF	Sets the device-specific code for activating the FillMass function. After entering the code, restart the device (for example using the parameter 'Device reset', see page 26, or by briefly switching off the power supply).
375	CoriolisContr.On/Off	**TUSIGN8 [1]** 0: Off 1: On	CoriolisControl function active?* 0: Off: CoriolisControl function deactivated. 1: On: CoriolisControl function activated. This parameter is read only.
3157	CoriolisControl Code*	**TUSIGN16 [1]** 0x0000 to 0xFFFF	Set the device-specific code for activating the CoriolisControl function. After entering the code, restart the device (e.g. using the parameter "Device Restart", see page 26, or by briefly switching off the power supply).

*   To use this function subsequently, contact the ABB service team or sales organization.

… 3 Parameterization

… Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …System Zero			
227	Manual	**TFLOAT [2]** -10 to 10 % from $Q_{max}DN$	Sets the value for zero point adjustment in % of $Q_{max}DN$
100, 76, 77, 229, 231, 233, 235	Auto Adjust	**ACTION [1] (100)** **TUSIGN8 (76, 77)** **TFLOAT [2] (229, 231, 233, 235)**	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 100 (data type ACTION). • The progress counter (100 = adjustment complete) of zero point adjustment can be queried via the address 76 (data type TUSIGN8). • The status of adjustment is transmitted (0 = No error, 15 = Error in adjustment) via the address 77. • The values determined by the device during automatic zero point adjustment can be queried via the addresses 229 (mean value), 231 (standard deviation), 233 (max), 235 (min). The data type in each case is TFLOAT [2].
… / …Concentration			These parameters are only available when the DensiMass function is activated.
74	Medium	**TUSIGN8 [1]** 0: Variable matrix 1: Sodium hydroxide 2: Alcohol in water 3: Wheat starch 4: Maize starch 5: Sugar in water	Selection of the matrix for calculating concentration. See the OI/FCB400/FCH400 resp. OI/FCD400 operating instructions for detailed information.
75	Sub Matrix Selection	**TUSIGN8 [1]** 0: Sub matrix 1 1: Sub matrix 2	Selection of the sub matrix for the DensiMass function.
331	Reference Temp.	**TFLOAT [2]** -100 to 250 °C	Sets the reference temperature for calculating the process values 'Qv @ Tref' and 'Density @ Tref'.
… / …Field Optimization			
151	Density Correction	**TFLOAT [2]** −500 to 500 g/l	Sets the correction factor for field optimization of the density measurement. This factor can be used to perform optimization in the field in order to achieve a degree of accuracy in the density measurement that closely approximates a repeatability of 0.0001 g/ml.
279	Qm Correction	**TFLOAT [2]** −20 to 20%	Sets the correction factor for field optimization of the mass flow measurement. The value is entered as a percentage of the current measured value. This factor can be used to perform optimization in the field in order to achieve a degree of accuracy in the flow measurement that closely approximates or even exceeds a repeatability of at least 0.1 % of the measured value.

Modbus register address	Parameter name	Data type / value range	Description
583	Measuring Mode	**TUSIGN8 [1]** 0: Automatic 1: Gases 2: Liquids	Selection of the measurement mode (liquid / gas). The measurement method for liquids and gases can be optimized by selecting the measurement mode. • Automatic: Automatic detection of the measurement mode. Selection with changing measuring media. • Gases: Selection with pure gas measurement. • Liquids: Selection with pure liquid measurement.
327 329	Conc. Zero Matrix 1 Conc. Zero Matrix 2	**TFLOAT [2]** -1000 to 1000	Setting indicating the correction factor for concentration measurement. This factor can be used to perform optimization in the field in order to achieve a degree of accuracy in the concentration measurement that closely approximates or even exceeds the repeatability. This value acts as a correction value for the current concentration measured value. The correction factor is entered in the unit that is currently set for concentration. The correction value is based on the concentration matrix currently selected. In the case of one fixed matrix, only one correction value is available. In case of variable matrices, both correction values are available. The parameter is only available when the DensiMass function is activated.
... / ...Field Optimization / ...Hold Last Good Val.			
335	Hold Time	**TFLOAT [2]** 0.0 to 600.0 sec	Entry of the time for the function 'Keep last valid measured value'. The function is deactivated by the setting of '0'.
337	Threshold Release	**TFLOAT [2]** Threshold Hold to 100mV	Sets the switching threshold for the function 'Keep last valid measured value'. The current measured value is displayed if the sensor voltage is above the set value.
339	Threshold Hold	**TFLOAT [2]** 2.0mV to Threshold Release	Sets the switching threshold for the function 'Keep last valid measured value'. The last valid measured value for the duration of the set hold time is displayed if the sensor voltage is below the set value.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type / value range	Description
... / Field Optimization / Pressure Correction			
51	Pressure Unit	**TUSIGN 8 [1]** Refer to .	Selection of the unit for the pressure (for example for the associated parameters and the corresponding process values). Factory setting: bar
333	Pressure Level	**TFLOAT [2]** 0.0 to 1000.0 [pressure unit].	Input of the process pressure of the medium in the meter tube. ABB uses a special compensation algorithm that takes various influencing effects into account. This allows the pressure influence on the vibrations of the meter tube to be compensated. The compensation factors for mass and density measurement are continuously recalculated and updated.
3549	Flow Compens. factor	**TFLOAT [2]**	Output of the current flow compensation factor used in the device to calculate the mass flow.
3551	Density Comp. factor	**TFLOAT [2]**	Output of the current density compensation factor used in the device to calculate the mass flow.
3162	P.Comp.Status (PECI)	**TUSIGN 8 [1]** 1: CT (On) 2: TD (Off) 3: OS (Off) 4: N/A (Off)	Selection of the pressure compensation mode. According to the API, the following states can be set. • 1: CT – compensation in the Coriolis flowmeter based on the actual pressure entered in the parameter "Pressure Level" • 2: TD – compensation in the Coriolis flowmeter switched off – compensation is performed externally (Tertiary Device) • 3: OS – Compensation in the Coriolis flowmeter switched off – compensation is not performed on site (Off Site) • 4: NA – Compensation in the Coriolis flowmeter switched off – compensation is not considered necessary as the device operates at the pressure at which it was tested (proved).
3163	Unit	**TUSIGN 8 [1]** 101: %/Pa 104: %/kPa 108: %/Bar 109: %/mbar 165: %/psi	Output of the current unit of the flow and density compensation factor. Subject to the pressure unit set.

Modbus register address	Parameter name	Data type / value range	Description
... / ...Field Optimization / ...CoriolisControl			
3158	ECC Mode	**TUSIGN 8 [1]** 0: Off 1: On	Activate the "Extended Coriolis Control Mode" for applications with fast density changes, e.g. in the case of gas bubbles in the measuring medium and filling applications
3159	ECC Level	**TUSIGN 8 [1]** 0: Low 1: Medium 2: High	Selection of interval for frequency estimation.
3160	Flow Noise Reduction	**TUSIGN 8 [1]** 0: Off 1: Filter 1 (0.5 s) 2: Filter 2 (1.0 s) 3: Filter 3 (2.0 s) 4: Filter 4 (4.0 s) 5: Filter 5 (8.0 s)	Selection of the dead time for the noise filter for mass measurement.
3161	Density Noise Reduc.	**TUSIGN 8 [1]** 0: Off 1: Filter 1 (0.5 s) 2: Filter 2 (1.0 s) 3: Filter 3 (2.0 s) 4: Filter 4 (4.0 s) 5: Filter 5 (8.0 s)	Selection of the dead time for the noise filter for density measurement.

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Parameter Range – Display

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / Display			
3100	Language	**TUSIGN8 [1]** 0: English 1: German	Selection of menu language.
3101	Contrast	**TUSIGN8 [1]** 0 to 100	Contrast setting for the LCD display.
3122	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.
3123	Mass Flow Format	**TUSIGN8 [1]** 0: X	Selection of number of decimal places used to display the corresponding process variables.
3124	Mass Format	1: X.X	The selection of decimal places only has an effect on the process variable
3125	Volume Flow Format	2: X.XX	display in the LCD indicator; the internal counter reading is however not
3126	Volume Format	3: X.XXX 4: X.XXXX 5: X.XXXXX	affected by this.
3127	Temperature Format	**TUSIGN8 [1]**	
3128	Density Format	0: X 1: X.X 2: X.XX	
3129	Concentration Format	**TUSIGN8 [1]** 0: X 1: X.X 2: X.XX 3: X.XXX 4: X.XXXX 5: X.XXXXX	
3130	Date / Time Format	**TUSIGN8 [1]** 0: DD-MM-YYYY 1: MM-DD-YYYY 2: YYYY-MM-DD	Set the display format for the date and time.

Modbus register address	Parameter name	Data type [register length] / value range	Description
3147	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.
3148	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.
3131	Display Test	**TUSIGN8 [1]**	Start the test of the LCD display. The display test lasts approx. 10 seconds. Various patterns are shown on the LCD display to check the display.
… / Display / …Operator Pages / …Operator Page 1 to 4			
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.			
3102 (page 1) 3107 (page 2) 3112 (page 3) 3117 (page 4)	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.
3103 (page 1) 3108 (page 2) 3113 (page 3) 3118 (page 4)	1st Line	**TUSIGN8 [1]**	Selection of process variable displayed in the respective row. See table **Available process variables** on page 16.
3104 (page 1) 3109 (page 2) 3114 (page 3) 3119 (page 4)	2nd Line		
3105 (page 1) 3110 (page 2) 3115 (page 3) 3120 (page 4)	3rd Line		
3106 (page 1) 3111 (page 2) 3116 (page 3) 3121 (page 4)	Bargraph	**TUSIGN8 [1]** 0: Volume flow in % 1: Mass flow in %	Selection of process variable displayed as a bar graph.

... 3 Parameterization

... Parameter descriptions

Parameter range - Input / Output

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Curr.Out 31 / 32 / Uco			
3149	Loop Current Mode	**TUSIGN8 [1]** 0: Multi-drop fixed value 1: Normal signal. 2: Power mode	Selection of the operating mode for current output 31/32/Uco. • Multi-drop fixed value: The current output 31/32/Uco supports the HART multi-drop mode, the current output is fixed to 3.6 mA and no longer follows the selected process variable. The process variables can be transferred via the HART protocol. • Normal signal.: The current output 31/32/Uco transfers the selected process variable. In addition, the process variables can be transferred via the HART protocol. • Power mode: The current output 31/32/Uco is set permanently to 22.6 mA and no longer follows the selected process variable. HART communication is deactivated. The current output 31/32/Uco works as a power supply unit for the operation of the digital output 41 / 42 as an active output.
3072	Output Value	**TUSIGN8 [1]**	Selection of process variable issued at the corresponding current output. See table **Available process variables** on page 16.
3073	Loop Current Mode	**TUSIGN8 [1]** 0: 4-20mA FWD 1: 4-12-20 mA 2: 4-20mA FWD/REV 3: 4-20mA REV	Selection of the flow direction for the current output.
3074	Iout for 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.
607	Low Alarm	**TFLOAT [2]** 3.5 to 3.6 mA	Sets the current for Low Alarm.
609	High Alarm	**TFLOAT [2]** 21 to 22.6 mA	Sets the current for High Alarm.
3075	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.
3076	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 'Loop Current Mode' 4-20mA FWD/REV has been selected.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig.Out 41/42			
20	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.
21	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.

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... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...**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. The pulse output can be configured classically via the pulse value (parameter "Pulses per Unit"), or alternatively the pulse frequency at 100% flow (parameter "Frequency @ Qmax") can be specified.
22	Output Value Pulse	**TUSIGN8 [1]**	Selection of the process value issued via the pulse output. See **Available process variables** on page 16
321	Pulses per Unit	**TFLOAT** 0.001 to 100,000 pulses	Setting and output of pulse value per mass flow unit and pulse width for the pulse output.
323	Pulse Width	**TFLOAT** 0.05 to 2000 ms	**Note** 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. The parameter "Frequency @ Qmax" is also adjusted.
3531	Frequency @ Qmax	**TFLOAT[2]**	Setting and output of the pulse frequency in pulses/s at 100% flow (mass or volume flow) for the current device configuration. **Note** The value can be changed within the defined limits. The parameter "Pulses per Unit" is also adjusted.
3533	Max Range	**TFLOAT[2]** xx to xx	Output of limits for the parameter "Frequency @ Qmax". The parameter "Frequency @ Qmax" can be set within these limits. The limits are calculated dynamically.
3535	Min Range	**TFLOAT[2]** xx to xx	
3154	Active Mode	**TUSIGN8 [1]** 0: Active high (closed) 1: Active low (open)	Selection of switching properties for the pulse output.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …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.
			The frequency output can be configured classically via the frequency for 100% flow (parameter "Upper Frequency"), or alternatively the pulse value per unit at 100% flow (parameter "Pulses per Unit") can be specified.
23	Output Value Freq.	**TUSIGN8 [1]**	Selection of the process value issued via the frequency output.
			Refer to **Available process variables** on page 16.
325	Upper Frequency	**TFLOAT** 0.25 to 10500 Hz	Setting and output of frequency for the upper range value. The entered value corresponds to 100 % flow.
3537	Pulses per Unit	**TFLOAT[2]**	Setting and output of pulses per flow unit.
			The value (in 1/unit) is calculated dynamically from the parameter "Upper Frequency", the mass or volume flow and Q_{max}.
			Note
			• The value can be changed within the defined limits. The parameter "Upper Frequency" is also adjusted automatically when doing this.
			• The parameter is only available for the following process variables: Mass Flow [%], Volume Flow [%], Net Mass Flow [%], Net Vol. Flow [%], Vol. Flow @ Tref [%]
3156	Unit	**TUSIGN8 [1]** Refer to **Table 9: Pulses per flow unit** on page 15.	Output of the unit for the parameter "Pulses per Unit".
			The unit is dependent on the selected flow unit and the selected process variable for the frequency output.
			Example:
			Process variable "Output Value Freq." = Volume Flow [%]
			Unit "Unit" = "1 / Ml (1 pulse per megaliter)"
			The output at the frequency output is then 1 pulse per megaliter.
3533	Max Range	**TFLOAT[2]** xx to xx	Output of limits for the parameter Pulses per Unit.
3535	Min Range	**TFLOAT[2]** xx to xx	The parameter "Pulses per Unit" can be set within these limits. The limits are calculated dynamically.

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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.
24	Logic Output Action	**TUSIGN8 [1]** 0: Off 1: F/R signal 2: Alarm signal 3: Two measuring ranges 4: End contact fill function 5: Concentration matrix selection	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). • Concentration matrix selection: the binary output signals the selected concentration matrix (only with the DensiMass function activated and if the variable matrix has been selected).
25	Active Mode	**TUSIGN8 [1]** 0: Active high (closed) 1: Active low (open)	Select switching properties for the binary output.
26	Actual Value	**TUSIGN8 [1]** 0: Output low 1: Output high	Display of the current output status. The parameter is read only.
... / ...Dig.Out 41/42 / ...Alarm Config			
27	General Alarm	TUSIGN8 [1]	Selection of error messages signaled via the binary output 41 / 42.
28	Qm Massflow Max	0: Off	Only if the parameter 'Logic Output Action' has been set to 2 - Alarm signal.
29	Qm Massflow Min	1: On	
3079	Density Max		
3078	Density Min		
30	Density Low Check		
31	Sensor Signal Min		
32	Driver Output Max		

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig.Out 51/52			

55	Mode	**TUSIGN8 [1]**
		
		0: Off
		1: Binary
		2: Frequency
		4: Follow DO1
		5: 90° phase rotation
		6: 180° phase rotation
		7: DO 41 / 42 sequence (frequency)
		8: 180° phase rotation (frequency)
			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 parameter "Logic Output Action").
			• 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.
			• Sequence DO1: digital output 51 / 52 follows digital output 41 / 42. Digital output 51 / 52 then also works as a pulse output, the settings under "… / …Dig.Out 41/42 / …Setup Logic Output" are adopted. The output of pulses at digital output 51 / 52 is dependent on the setting of the register "Outp. Flow Direction" for digital output 41 / 42:
			  – When "Forward & Reverse" is selected, digital output 51 / 52 follows digital output 41 / 42.
			  – When "Forward" is selected, pulses for forward flow are output on digital output 41 / 42, while pulses for reverse flow are output on digital output 51 / 52.
			  – When "Reverse" is selected, pulses for reverse flow are output on digital output 41 / 42, while pulses for forward flow are output on digital output 51 / 52.
			• 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.
			• Sequence DO 41 / 42 (frequency): the digital output 51 / 52 follows the digital output 41 / 42. Digital output 51 / 52 then also works as a frequency output, the settings under "… / Dig.Out 41 / 42 / …Setup Freq Output" are accepted. The output of the frequency at digital output 51 / 52 is dependent on the setting of the register "Outp. Flow Direction" for digital output 41 / 42:
			  – When "Forward" is selected, a frequency for forward flow is output at digital output 41 / 42 and a frequency for reverse flow is output at digital output 51 / 52
			  – When "Reverse" is selected, a frequency for reverse flow is output at digital output 41 / 42 and a frequency for forward flow is output at digital output 51 / 52
			• 180° phase rotation (frequency): 180° phase rotation of output of the same frequency as for digital output 41 / 42.
			
			Note
			If digital output 41 / 42 has been configured as pulse or frequency output, digital output 51 / 52 can be configured separately as binary or frequency output. However, digital output 51 / 52 cannot be configured as a second independent pulse output.

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... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Dig.Out 51/52			
56	Outp. Flow Direction	**TUSIGN8 [1]** 0: Forward flow / reverse flow. 1: Forward flow 2: Reverse flow	Selection of flow direction in which the frequency output 51 / 52 outputs the selected process value. The parameter is only available if digital output 51/52 has been configured as a frequency output. • When "0" is selected, a frequency is output in the forward flow and reverse flow directions. • When "1" is selected, a frequency is output in the forward flow direction. • When "2" is selected, a frequency is output in the reverse flow direction.
... / ...Dig.Out 51/52 ...Setup Freq Output			The following parameters are only available if the digital output 51 / 52 has been configured as a frequency output.
23	Output Value Freq.	**TUSIGN8 [1]**	See the description of digital output 41 / 42 **... / ...Dig.Out 41/42 ...Setup Freq Output** on page 39.
325	Upper Frequency	**TFLOAT** 0.25 to 10500 Hz	
3537	Pulses per Unit	**TFLOAT[2]**	
3156	Unit	**TUSIGN8 [1]** Refer to **Table 9: Pulses per flow unit** on page 15.	
3533	Max Range	**TFLOAT[2]** xx to xx	
3535	Min Range	**TFLOAT[2]** xx to xx	
... / ...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.
57	Logic Output Action	**TUSIGN8 [1]**	See description of digital output 41 / 42.
58	Active Mode	**TUSIGN8 [1]**	
59	Actual Value	**TUSIGN8 [1]**	
... / ...Dig.Out 51/52 / ...Alarm Config			Selection of error messages signaled via the binary output 51 / 52.
60	General Alarm	**TUSIGN8 [1]** 0: Off 1: On	Only if the parameter 'Logic Output Action' has been set to 2 - Alarm signal.
61	Qm Massflow Max		
62	Qm Massflow Min		
3081	Density Max		
3080	Density Min		
63	Density Low Check		
64	Sensor Signal Min		
65	Driver Output Max		

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig.Out V3/V4			
3084	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.
3085	Logic Output Action	**TUSIGN8 [1]**	See description of digital output 41 / 42.
3086	Active Mode	**TUSIGN8 [1]**	
… / …Dig.Out V3/V4 / …Alarm Config			
3088	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.
3089	Qm Massflow Max		
3090	Qm Massflow Min		
3083	Density Max		
3082	Density Min		
3091	Density Too Low		
3092	Sensor Signal Min		
3093	Driver Output Max		

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… Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Dig.In V3/V4			
3084	Function	**TUSIGN8 [1]** 0: Off 1: Reset all Totalizer 2: Stop all Totalizer 3: Auto. Zero Adjust 4: Set Flowrate to zero 5: Batchflow On / Off 6: Dual Range Mass 7: Dual Range Volume 8: Submatrix 1 or 2 9: Pulse Value Qm/Qv	Select a function for the digital input.
3095	Active Mode	**TUSIGN8 [1]** 0: Active high (closed) 1: Active low (open)	Select switching properties for the digital input.
3096	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 'Batchflow On / Off' 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
2048 to 2095	Diagnostic History	**TUSIGN8 [1]**	Display of the alarm history. See also chapter **Error messages** on page 58. The addresses indicated here are read only.
120	Clear Alarm History	**ACTION [1]**	The writing of any value deletes the alarm history saved in the device.
… / …Group Masking			
66	Maintenance Required	**TUSIGN8 [1]**	Alarm messages are divided into groups. If masking is activated for a group (On), no alarm occurs. For more detailed information, see chapter **Diagnosis / error messages** on page 58.
67	Function Check	0: Masking deactivated	
68	Out Of Specification	1: Masking activated	
… / …Alarm Limits			
211	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.
213	Qm Massflow Max	**TFLOAT [2]** 0 to 130%	
215	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.
217	Qv Volumeflow Max	**TFLOAT [2]** 0 to 130%	
199	Density Min	**TFLOAT [2]** 0.0 to 3.5 g/cm³	Sets the minimum / maximum limit value for density measurement. If the process value 'Density [unit]' exceeds or falls below the limit value, an alarm is triggered.
201	Density Max	**TFLOAT [2]** 0.0 to 3.5 g/cm³	
219	Temperature Min	**TFLOAT [2]** -100 to 250 °C	Sets the minimum / maximum limit value for sensor temperature. If the process value 'Temperature [unit]' exceeds or falls below the limit value, an alarm is triggered.
221	Temperature Max	**TFLOAT [2]** -100 to 250 °C	
287*	Concentrat. [%] Min	**TFLOAT [2]** -5% to 105.0%	Sets the minimum / maximum limit value for concentration measurement. If the process value 'Conc. Unit [%]' or 'Conc. unit [%]' or 'Conc. [%]' exceeds or falls below the limit value, an alarm is triggered.
289*	Concentrat. [%] Max	**TFLOAT [2]** -5% to 105.0%	
293*	Concentrat. [u] Min	**TFLOAT [2]** 0 to 200 msec	
295*	Concentrat. [u] Max	**TFLOAT [2]** 0 to 200 msec	

*   These parameters are only available when the DensiMass function is activated.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
223	Driver Output Max	**TFLOAT [2]** 0 to 100 mA	Sets the maximum limit value for driver current. If the driver current exceeds the limit value for the time set under the parameter 'Driver current time', an alarm is triggered.
427	Driver Output Time	**TFLOAT [2]** 5 to 864000 sec	Sets the delay time for the alarm 'Sensor current too high.'
225	Sensor Signal Min	**TFLOAT [2]** 0 to 100 mV	Sets the minimum limit value for the sensor amplitude. If the sensor amplitude exceeds the limit value for the time set under the parameter 'Sensor Amp. Time,' the 'Sensor amplitude outside of spec.' alarm is triggered. Operating amplitude for liquids: 30 mV Operating amplitude for gases: 60 mV
429	Sensor Signal Time	**TFLOAT [2]** 5 to 600 sec	Sets the delay time for the alarm 'Sensor amplitude outside of spec.'
237	Density Low Check	**TFLOAT [2]** 0.00 to 3.5 g/cm³	Sets the alarm limit for the density alarm. If the density falls below the set value, the process variables Qm and Qv are set to '0' and alarm 'Density set to 1g/cm³' is issued.

Parameter range – Communication

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Modbus			
33	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.
34	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.
35	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.
36	Parity	**TUSIGN8 [1]** 0: None 1: Even 2: Odd	Selection of the parity for the Modbus communication. Factory setting: Odd (odd)
37	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
38	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

... 3 Parameterization

... Parameter descriptions

Parameter range – Diagnosis

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Diagnosis Control			
459	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' is set. The setting '0' deactivates the maintenance interval. Factory setting: 0 h
463	Maint. Remain. Time	**TUSIGN32 [2]**	Time remaining in the maintenance interval until the error message 'Maintenance interval is reached' is set. The parameter is read only.
101	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'.
... / ...Diagnosis Values			
291	Driver Output	**TFLOAT [2]**	Output of the current driver current in mA. The parameter is read only.
283	Sensor Signal Sa	**TFLOAT [2]**	Output of current amplitude (sensor voltage) for sensor A in mV. The parameter is read only.
285	Sensor Signal Sb	**TFLOAT [2]**	Output of the current amplitude (sensor voltage) for sensor B in mV. The parameter is read only.
275	Tube Frequency	**TFLOAT [2]**	Output of the current meter tube frequency in Hz. The parameter is read only.
277	Pipe Temperature	**TFLOAT [2]**	Output of current meter tube temperature in °C. The parameter is read only.
281	Sensor Housing Temp	**TFLOAT [2]**	Output of current housing temperature in °C. The parameter is read only.
3501	Electr. (FEB) Temp	**TFLOAT [2]**	Issue of the current frontend board temperature in °C. The parameter is read only.
374	Readback curr. 31/32	**TFLOAT [2]**	Display of the current from current output 31 / 32. Only if the parameter 'Readback curr. 31/32' has been set to 'On.'

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Drag Indicators			
124	Reset Indicators	**ACTION [1]**	Reset all drag indicators.
			The drag indicator is reset by writing any value to this address.
... / ...Drag Indicators / ...Process Indicators			
3503	Mass Flow Min	**TFLOAT [2]**	Display of the minimum / maximum mass flow measured value since the last
3505	Mass Flow Max	**TFLOAT [2]**	reset of the drag indicators.
3507	Density Min	**TFLOAT [2]**	Display of the minimum / maximum density measured value since the last
3509	Density Max	**TFLOAT [2]**	reset of the drag indicators.
... / ...Drag Indicators / ...Sensor Indicators			
3511	Driver Output Max	**TFLOAT [2]**	Display of the maximum transmitter driver current since the last reset of the drag indicators.
3513	Sensor Amp. Sa Min	**TFLOAT [2]**	Display of the minimum transmitter sensor amplitude since the last reset of
3515	Sensor Amp. Sb Min	**TFLOAT [2]**	the drag indicators.
... / ...Drag Indicators / ...Temperature Indic.			
3517	Medium Min	**TFLOAT [2]**	Display of the minimum / maximum measuring medium temperature since the
3519	Medium Max	**TFLOAT [2]**	last reset of the drag indicators.
3521	Sensor Housing Min	**TFLOAT [2]**	Display of the minimum / maximum sensor housing temperature since the last
3523	Sensor Housing Max	**TFLOAT [2]**	reset of the drag indicators.
3525	Electr. (FEB) Min	**TFLOAT [2]**	Display of the minimum / maximum frontend board temperature since the last
3527	Electr. (FEB) Max	**TFLOAT [2]**	reset of the drag indicators.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...Simulation Mode			
70	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: Density [unit] 6: Density [%] 7: Temperature [unit] 8: Temperature [%] 9: Current output 31/32/Uco 12: Digital output 41/42 13: Digital output 51/52 14: Digital output V3/V4 15: Digital input V3/V4	Manual stimulation of measured values / outputs. The simulated output values correspond to the set measured value (Modbus addresses 71, 72, 341-359). Only one measured value / output can be selected for simulation. After power-up / restart of the device, the simulation is switched off.
341	Mass Flow [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'.
343	Mass Flow [%]	**TFLOAT [2]** -200 to 200%	
345	Volume Flow [unit]	**TFLOAT [2]** 0 to 2 x QvMax DN	
347	Volume Flow [%]	**TFLOAT [2]** -200 to 200%	
349	Density [unit]	**TFLOAT [2]** 0.0 to 3.5 g/cm³	
351	Density [%]	**TFLOAT [2]** -200 to 200%	
353	Temperature [unit]	**TFLOAT [2]** -100 to 250 °C	
355	Temperature [%]	**TFLOAT [2]** -200 to 200%	
613	Curr.Out 31/32/Uco	**TFLOAT [2]** 3.5 to 22.6 mA	
71	DO 41/42 State	**TUSIGN8 [1]** 0: Off 1: On	
72	Dig.Out 51/52 State	**TUSIGN8 [1]** 0: Off 1: On	

Modbus register address	Parameter name	Data type [register length] / value range	Description
3098	Dig.Out V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
3099	Dig.In V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
357	Dig.Out 41/42 Freq. Dig.Out 41/42 Pulse	**TFLOAT [2]** 0 to 10500 Hz 0 to 10000 pulses	The respective simulated output value is dependent on the operating mode (pulse / frequency) of the digital output 41 / 42.
359	Dig.Out 51/52 Freq. Dig.Out 51/52 Pulse	**TFLOAT [2]** 0 to 10500 Hz 0 to 10000 pulses	The respective simulated output value is dependent on the operating mode (pulse / frequency) of the digital output 51 / 52.
... / ...Output Readings			
611	Curr.Out 31/32/Uco	**TFLOAT [2]** 3.5 to 22.6 mA	Output of the current output values. The available values are dependent on the configuration of the digital outputs.
419	Dig.Out 41/42 Freq.	TFLOAT [2] 0 to 10500 Hz	The parameters are read only.
26	DO 41/42 State	TUSIGN8 [1] 0: Off 1: On	
421	Dig.Out 51/52 Freq.	**TFLOAT [2]** 0 to 10500 Hz	
59	Dig.Out 51/52 State	TUSIGN8 [1] 0: Off 1: On	
3087	Dig.Out V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
3097	Dig.In V3/V4 State	**TUSIGN8 [1]** 0: Off 1: On	
... / ...Meter Erosion Mon.			These parameters are only available when the VeriMass function is activated.
93	Control Type	**TUSIGN8 [1]** 0: Manual 1: Automatic	Selection of the operating mode for the erosion monitor. • Manual: Manual input of limit values for the erosion monitor. • Automatic: The transmitter calculates the limit values for the erosion monitor automatically. Factory setting: manual.
223	Driver Output Max	**TFLOAT [2]**	Sets the maximum limit value for driver current. If the driver current exceeds the limit value for the time set under the parameter 'Driver Output Time', alarm 'Sensor driver current to high.' is triggered. This parameter is only available if the value 'Manual' has been selected for the parameter 'Control Type'.
427	Driver Output Time	**TFLOAT [2]**	Sets the delay time for alarm 'Sensor driver current to high.'. This parameter is only available if the value 'Manual' has been selected for the parameter 'Control Type'.

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
94	Status Adjust	**TUSIGN8 [1]** 0: Outstanding 1: Requested 2: Self adjust active 3: Completed	Output of the status for automatic adjustment of the erosion monitor. • Outstanding: The limit value is not set, the erosion monitoring is not active. • Requested: Automatic adjustment of the erosion monitor is activated but has not yet been performed. • Self adjust active: Automatic adjustment of the erosion monitor is active. • Complete: Automatic adjustment of the erosion monitor is complete; erosion monitoring is active. This parameter is only available if the value 'Automatic' has been selected for the parameter 'Control Type'. The parameter is read only.
601	Self Adjust Time	**TFLOAT [2]**	Sets the runtime for automatic adjustment of the erosion monitor. The setting depends on the application and should cover several days or, if necessary, weeks.
123	Start Adjust	**ACTION [1]**	Manual start of automatic calibration of the erosion monitor. Automatic calibration is started by writing any value to this address.
469	New Value left Time	**TUSIGN32 [2]**	Output of the time remaining for the current automatic calibration of the erosion monitor. The parameter is read only.
223	Meter Erosion Level	**TFLOAT [2]**	Output of the erosion monitor's automatically calculated erosion value. The parameter is read only.
603	Adjusted Limit	**TFLOAT [2]**	Output of the erosion monitor's automatically calculated limit value. The limit value is calculated from the erosion value from the automatic adjustment process and a tolerance value. The parameter is read only.
605	Actual Value	**TFLOAT [2]**	Output of the current erosion value for comparison with the learned limit. The parameter is read only.
... / ...Diag.CurrOut 31/32			
96	Readback curr. 31/32	**TUSIGN8 [1]** 0: Off 1: On	Activate the monitoring function for current output 31 / 32. The transmitter measures the actual current and compares the measured value to the set point for the current output. If the measured value deviates from the set point by more than ±2 %, the current output on the alarm current of 3.3 mA is set and the 'CO 31/32 readbackcurrent deviates' error message is generated. Factory setting off.
125	Reset Alarm	**ACTION [1]**	Manual reset of the 'CO 31/32 readbackcurrent deviates' error message. The error message is reset by writing any value to this address.

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Diag.CurrOut 31/32 / …Alarm Reset Option			
97	Auto. Reset 10 min	**TUSIGN8 [1]** 0: Off 1: On	Automatic reset of the 'CO 31/32 readbackcurrent deviates' error message. • Off: The error is permanently saved and must be reset manually. After the reset, the current output 31 / 32 is retested. • On: The error is automatically reset after 10 minutes. After the reset, the current output 31 / 32 is retested. Factory setting: on.
98	Auto Reset open Loop	**TUSIGN8 [1]** 0: Off 1: On	Behavior in the case of an open current output 31 / 32 (interruption of the current loop). • Off: If the current loop is interrupted, the 'CO 31/32 readbackcurrent deviates' error message is generated. The reset of the error then depends on the setting of the 'Auto. Reset 10 min' parameter. • On: If the current loop is closed again, the error will automatically reset. Factory setting: on.

… 3 Parameterization

… Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range
… / …Alarm Simulation		

Manual simulation of alarms / error messages.

The simulated alarm is selected by setting the parameter to the corresponding error number of the desired error.

See also chapter **Error messages** on page 58.

69	Alarm Simulation	TUSIGN8 [1]

0: Off, no alarm simulation	24: CO V1 / V2 not calib
1: Mass flow reached	25: CO V3/V4 not calibrated
2: Volume flow reached	26: Span. Monitoring MB,
3: Simulation alarm	27: DSP error
4: Flow rate at zero	28: Density error
5: Maintenance, cycle time	29: Temp. limit exceeded
6: Counter stopped	30: Temp. sensor error
7: Counter reset	31: Sensor ampl. Error
8: Counter overflow	32: Sens. Driver current
9: Device not calibrated	33: Density too low
10: Memory error FEB	34: Flow density reached
11: Memory data error	35: Flow temp. reached
12: FEB not recognized	36: Density at One
13: FEB comm. Error	37: Conc. scal. min/max
14: FEB not compatible	38: Conc. unscal. min/max
15: Memory error MB	39: Span.monitoring FEB
16: DO 41 / 42 mAx. pulse	40: Fieldbus card faulty
17: CO 31 / 32 saturated	41: Outp. 31 / 32 Readback
18: CO Vx/Vy saturated	42: Sensor ampl. outside spec.
19: CO 31 / 32 comm. error	
20: Option 1 comm. error	
21: Option 2 comm. error	
22: CO 31 / 32 security	
23: CO 31 / 32 not calib	

Parameter range – Counter

Modbus register address	Parameter name	Data type [register length] / value range	Description
… / …Operation			
115	Start all Totalizer	**ACTION [1]**	Start all counters of the device.
116	Stop all Totalizer	**ACTION [1]**	Stop all counters of the device.
… / …Reset Totalizer			
114	All Totalizer	**ACTION [1]**	Reset the device counter
112	All Mass Totalizer		
113	All Volume Totalizer		
106	Massflow Fwd		
107	Massflow Rev		
102	Volumeflow Fwd		
103	Volumeflow Rev		
108	Net Massflow Fwd	**ACTION [1]**	These parameters are only available when the DensiMass function is activated.
109	Net Massflow Rev		
110	Net Volumeflow Fwd		
111	Net Volumeflow Rev		
104	Volumeflow Fwd@Tref		
105	Volumeflow Rev@Tref		
… / …Preset Totalizer			
305	Massflow Fwd	**TFLOAT [2]**	Default setting of the device counter.
307	Massflow Rev		
297	Volumeflow Fwd		
299	Volumeflow Rev		
309	Net Massflow Fwd	**TFLOAT [2]**	These parameters are only available when the DensiMass function is activated.
311	Net Massflow Rev		
313	Net Volumeflow Fwd		
315	Net Volumeflow Rev		
301	Volumeflow Fwd@Tref		
303	Volumeflow Rev@Tref		

... 3 Parameterization

... Parameter descriptions

Modbus register address	Parameter name	Data type [register length] / value range	Description
... / ...FillMass			**These parameters are only available when the FillMass function is activated.**
73	Batch Process Value	TUSIGN8 [1] 0: Off 64: Forward flow volumes 65: Forward flow standard volumes 66: Forward flow mass 67: Forward flow net volumes 68: Forward flow net 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.
317	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. NOTICE Before setting the fill quantity, the corresponding process value must be selected with the parameter 'Batch Process Value'.
119	Reset Cur.Batch Tot.	ACTION [1]	Resets the parameter 'Current Batch Total.' to zero and prepares the next fill operation.
117	Start Batching	ACTION [1]	Starts the fill operation by writing any value to the corresponding Modbus address.
847	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.
118	Stop Batching	ACTION [1]	Stops the fill operation by writing any value to the corresponding Modbus address.
465	Batch Counts	TUSIGN32 [2]	Output of the number of fill operations since the last reset. This parameter is read only.
121	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
… / …FillMass / …Lag Correction			These parameters are only available when the FillMass function is activated.
90	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.'
319	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.
435	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.
437	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.
439	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 instructions OI/FCB400/FCH400 resp. OI/FCD400 for a detailed error description and information about troubleshooting.

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
2011	2059	1 / 3	F098.011	No Frontend Board detected
2029	2077	3 / 5	F096.039	DSP Failure on Frontend Board.
2021	2069	2 / 5	F094.021	Safety Alarm Curr.Out 31/32
2033	2081	4 / 1	F093.033	Sensor amplitudeout of range.
2041	2089	5 / 1	F092.041	FEB voltages outside range.
2025	2073	3 / 1	F091.025	MB voltages outside range.
2032	2080	4 / 0	F090.032	Sensor temperature measure error
2012	2060	1 / 4	F088.012	FEB communication error. EMC disturbance.
2018	2066	2 / 2	F086.018	Curr.Out 31/32 com error.
2010	2058	1 / 2	F084.010	NV data defect. Data storage irreparable.
2013	2061	1 / 5	F082.013	Incompatible Frontend Board.
2030	2078	3 / 6	F080.030	Density failure
2003	2051	0 / 3	C078.004	Flowrate to zero
2005	2053	0 / 5	C076.005	All totalizer stopp.
2006	2054	0 / 6	C074.006	Totalizer reset. Reset of one or more Totalizer
2002	2050	0 / 2	C072.002	Simulation is on. Simulating process/output value.
2026	2074	3 / 2	C070.026	An alarm is simulated.

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
2028	2076	3 / 4	S065.028	CO 31/32 readbackcurrent deviates
2034	2082	4 / 2	S060.034	Sensor driver current to high.
2035	2083	4 / 3	S059.035	Density too low.Empty pipe, gas
2038	2086	4 / 6	S058.038	Density to 1g/cm³
2031	2079	3 / 7	S057.031	Sensor temperature out max range
2042	2090	5 / 2	S054.042	Sensor amplitude out of ranges
2016	2064	2 / 0	S052.016	Curr.Out 31/32 is saturated.
2017	2065	2 / 1	S051.017	Curr.Out V1/V2, V3/V4 saturated
2019	2067	2 / 3	S049.019	Option Card 1 com error.
2020	2068	2 / 4	S048.020	Option Card 2 com error.
2015	2063	1 / 7	S047.015	Pulse output is cut off.
2000	2048	0 / 0	S046.000	Mass flowrate exceeds limits.
2001	2049	0 / 1	S044.001	Volume flowrate exceeds limits.
2036	2084	4 / 4	S043.036	Density exceeds min/max limits.
2037	2085	4 / 5	S042.037	Medium temperat exceeds limits.
2039	2087	4 / 7	S041.039	Concentration inunit exceeds
2040	2088	5 / 0	S040.040	Concentration in percent exceeds
2009	2057	1 / 1	M038.009	Sensor memory defective.

… 4 Diagnosis / error messages

… Error messages

Modbus address		Byte / BitPos.	Error code	Fault message
Active	History			
2014	2062	1 / 6	M037.014	NV chips defect on Motherboard.
2022	2070	2 / 6	M032.022	Curr.Out 31/32 not calibrated.
2023	2071	2 / 7	M031.023	Curr.Out V1/V2 not calibrated.
2024	2072	3 / 0	M030.024	Curr.Out V3/V4 not calibrated.
2007	2055	0 / 7	M028.007	Display value is <1600h at Qmax.
2004	2052	0 / 4	M026.004	Maintenance interval is reached
2008	2056	1 / 0	M024.008	Device not calibrated.
2027	2075	3 / 3	M020.027	Communicat. card not responding

Notes

Notes

Notes

ABB

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www.abb.com/contacts

For more product information, visit:
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