SD01189C/07/EN/07.22
71535395

Endress+Hauser
People for Process Automation

Supplementary documentation

Liquiline CM44x, Liquiline CM44Rx, Liquiline CM44P, Liquiline System CA80xx, Liquistation CSFxx

Data transmission via Modbus®

Valid as of:
Software version 1.11.00

Document: Data transmission via Modbus

First edition Dec 9, 2011
Current edition Dec 19, 2021

Author:

Endress+Hauser
Gesellschaft für Mess- und Regeltechnik mbH+Co. KG
Dieselstr. 24
70839 Gerlingen
Germany

Table of contents

1 Note ... 4
1.1 About this manual ... 4
1.2 Abbreviations ... 4
2 Installation and wiring ... 5
2.1 A-, B-wire ... 5
2.2 Termination ... 5
3 Modbus Protocol ... 6
3.1 Mode of operation ... 6
3.2 Transmission Modes ... 6
3.2.1 ASCII ... 6
3.2.2 RTU ... 7
3.2.3 TCP ... 7
3.3 Modbus exception codes ... 8
3.4 Response times ... 8
3.5 Byte transmission sequence ... 9
3.6 Data types ... 10
3.7 Device variables with status ... 11
3.8 Supported function codes ... 12
3.8.1 FC03 Read Holding Register ... 13
3.8.2 FC04 Read Input Register ... 13
3.8.3 FC08 Diagnostics (only serial) ... 14
3.8.4 FC16 Write Multiple Register ... 15
3.8.5 FC23 Read/Write Multiple Register ... 15
3.9 Register information ... 15
4 Commissioning ... 16
4.1 Modbus network settings ... 16
4.1.1 Modbus RS485 (RTU/ASCII) ... 16
4.1.2 Modbus TCP (RTU) ... 17
4.1.2.1 Ethernet settings ... 17
4.1.2.2 Byte order and Watchdog ... 18
4.2 Configuration of the Modbus output: device variables ... 18
4.2.1 Select analog data sources for device variables AI ... 19
4.2.2 Select digital data sources for device variables DI ... 20
4.2.3 Select analog data sinks for device variables AO ... 21
4.2.3.1 Example: Value of controlled variable of PID controller from Modbus ... 21
4.2.3.2 List of data sinks ... 21
4.2.4 Select digital data sinks for device variables DO ... 21
4.2.4.1 Example: Hold over Modbus ... 21
4.2.4.2 Example: Enable or disable PID controller ... 22
4.2.4.3 List of data sinks ... 22
4.3 Web server ... 23
4.3.1 Function description ... 23
4.3.2 Security ... 23
4.4 Exporting Heartbeat Verification Report ... 25
5 Diagnostics ... 26
5.1 LED displays ... 26
5.2 Status of device variables ... 26
5.3 Status signal ... 26
5.4 Diagnostic messages ... 27
5.4.1 Device related diagnostics ... 27
5.4.2 Sensor related diagnostics ... 28
5.4.2.1 Current diagnostic message ... 28

5.4.2.2 Last active diagnostic message 29
5.5 Communication related diagnostics 29
5.5.1 Bus termination 29
5.5.2 Protocol counters 29
6 Applications 30
6.1 CA80xx: How to start Measurement, Calibration and Cleaning 30
6.1.1 Activate “Fieldbus”-mode using the device menu 30
6.1.2 Activate “Fieldbus”-mode using Modbus 31
6.1.3 State machine 32
6.1.4 How-to execute actions 33
6.1.4.1 How-to execute a Measurement 33
6.1.4.2 How-to run a Calibration 33
6.1.4.3 How-to start a Cleaning 33
6.1.4.4 How-to abort an action 34
6.1.4.5 Error evaluation 34
6.1.5 Modbus Registers 35
6.1.5.1 Analyzer Manual Actions 35
6.1.5.2 Analyzer manual actions state 36
7 Tables 38
7.1 Unit codes 38
7.2 Legacy unit handling (Software version 1.06.06 and older) 42
7.3 Modbus register information 44
7.3.1 Numbering of Modbus-Registers 44
7.3.2 Liquiline CM44x, Liquistation CSFxx and Liquiline CA80xx 44
7.3.2.1 Identification (Input, FC: 04) 44
7.3.2.2 Process (Holding/Input, FC: 03, 16, 23, 04) 45
7.3.2.3 Diagnostics (Input, FC: 04) 48
7.3.2.4 Configuration (Holding, FC: 03, 16, 23) 52
7.3.2.5 Sensor X (Input, FC: 04) 54
7.3.2.6 Sensor X Setup (Holding, FC: 03, 16, 23) 61
7.3.3 Liquistation CSFxx 66
7.3.3.1 Sampler Info (Input, FC: 04) 66
7.3.3.2 Sampler Setup (Holding, FC: 03, 16, 23) 67
7.3.4 Liquiline CA80xx 69
7.3.4.1 Analyzer SP 1 Info (Input, FC: 04) 69
7.3.4.2 Analyzer SP 1 setup (Holding, FC: 03, 16, 23) 70
7.3.4.3 Analyzer SP 2 Info (Input, FC: 04) 72
7.3.4.4 Analyzer SP 2 setup (Holding, FC: 03, 16, 23) 73
7.3.4.5 Analyzer Config (Holding, FC: 03, 16, 23) 75
7.3.4.6 Analyzer Info (Input, FC: 04) 76
7.3.4.7 Analyzer Program (Holding, FC: 03, 16, 23) 82
7.3.4.8 Analyzer Manual actions (Holding, FC: 03, 16, 23) 82
7.3.4.9 Analyzer Photometer Info (Input, FC: 04) 83
7.3.4.10 Analyzer Measurement data (Input, FC: 04) 84
7.3.4.11 Analyzer manual actions state (Input, FC: 04) 84
7.3.5 Heartbeat Monitoring (requires activation code) 84
7.3.5.1 Sensor pH (Input, FC: 04) 85
7.3.5.2 Sensor Conductivity (Input, FC: 04) 86
7.3.5.3 Sensor Disinfection (Input, FC: 04) 86
7.3.5.4 Sensor Oxygen (Input, FC: 04) 87
7.3.5.5 Sensor SAC (Input, FC: 04) 89
7.3.5.6 Sensor CUS (Input, FC: 04) 90
7.3.5.7 Sensor ISE (Input, FC: 04) 91
7.3.5.8 Sensor Nitrate (Input, FC: 04) 93
7.3.5.9 Sensor Fluorescense (Input, FC: 04) 94

1 Note

1.1 About this manual

This supplementary document must only be used in conjunction with a field device Liquiline CM44x Modbus, an analyzer Liquiline System CA80xx Modbus or a sampler Liquistation CSFxx Modbus.

This supplementary document is an integral part of the Operating Instruction and extends it with additional information for use with Modbus.

Additional information is contained in the Operating Instructions of each product.

This document is aimed at individuals who are integrating the device into a Modbus network. It is assumed that the reader has fundamental knowledge of Modbus technology.

Additional information about Modbus technology is available, for example, on the website:

www.modbus.org

1.2 Abbreviations

n.a.	Not applicable
NaN	Not a Number (IEEE-754, 7Fh A0h 00h 00h)
ENP	Electronic name plate
AI	Analog Input
DI	Discrete Input
AO	Analog Output
DO	Discrete Output

2 Installation and wiring

Installation and wiring are described in detail in the operating instructions of each product.

2.1 A-, B-wire

The 485/ETH communication module uses the same connector labeling as for PROFIBUS devices. It must be stated that the usage of A and B is not consistent over all available Modbus devices. The 485/ETH modules use the following definition:

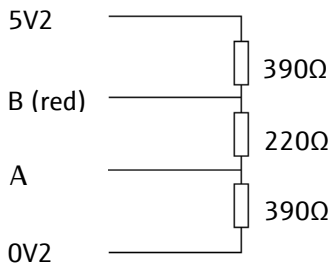
Label on connector	color	signal	meaning
B	Red	RxD/TxD-P	Received/transmitted data - P
A	Green	RxD/TxD-N	Received/transmitted data - N
C	--	DGND	Data reference potential output

In case RS485 communication is not working, please verify that the RS485-signals are connected correctly, otherwise switch the signals. Switching the RS485-signals does not damage the RS485 interface of the device.

2.2 Termination

The communication module provides the possibility of activating a bus termination via a 4-pin DIL slide switch. Here, the downstream Modbus devices are not separated from the Modbus RS485 segment. The communication module must be removed to activate the bus termination. If the communication module is installed and supplied with voltage, the bus termination state is indicated by the T LED (yellow).

The termination is according the definition for PROFIBUS DP, as the RS485 interface can be used for PROFIBUS DP communication.



The procedure of activating and deactivating the bus termination is described in the operating instructions of each product.

3 Modbus Protocol

Modbus is an open, standardized communication protocol that is used in the areas of Manufacturing, Process- and Building automation.

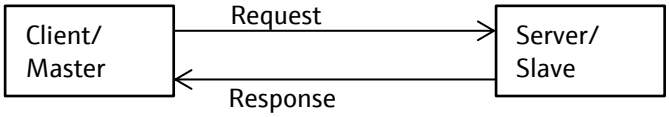
The Modbus protocol is used for data exchange with intelligent field devices via master/slave (client/server) connections. Here, the Modbus protocol can be used with different transmission media and embedded in other communication protocols.

The specifications for the Modbus protocol are freely available on the web site of the Modbus Organization.

http://www.modbus.org/

3.1 Mode of operation

Modbus communication (unicast) uses a simple request-response mechanism.



There are three different scenarios:

If the device (server) receives a valid telegram with a valid request and can reply to it, it replies with a response telegram containing the function code of the request.

If the device (server) receives an invalid telegram (e.g. CRC error), it does not reply. The application (client) must carry out an error diagnosis once a specified time-out has elapsed.

If the device (server) receives a valid telegram with an invalid request, it replies with a Modbus exception. The application (client) must carry out an error diagnosis.

3.2 Transmission Modes

There are three data transmission modes: ASCII, RTU and TCP.

3.2.1 ASCII

This mode is supported for Modbus RS485. The data are transmitted as ASCII characters and are therefore readable by humans.

Start	Address	Function	Data	LRC	End
1 character	2 characters	2 characters	N characters	2 characters	2 characters
= „:“					CRLF

Field	Length	Info	Client	Server
Address	2 Byte	Identifies the target device	Set by the client	Copied from the request into the reply
LRC	2 Byte	see Modbus specification	Set by the client	Set by the server

3.2.2 RTU

This mode is supported for Modbus RS485. The data are transmitted in binary format and are therefore more compact.

Address	Function	Data	CRC16
1 character	1 character	N character	2 characters
0 = Broadcast 247 = Unicast			

A delimiter of at least 3.5 characters must be maintained between two Modbus telegrams.

Field	Length	Info	Client	Server
Address	1 Byte	Identifies target	Set by the client	Copied from the request into the reply
CRC16	2 Byte	see Modbus specification	Set by the client	Set by the server

3.2.3 TCP

This mode is supported for Modbus TCP. As with RTU, the data are transmitted in binary format. Address and checksum used in RTU mode are dispensed with. The Modbus ADU is embedded in the TCP/IP telegram.

Modbus TCP/IP ADU					
MBAP header				Modbus PDU	
Transaction number	Protocol attribute	Number of bytes to follow	Address	Function	Data
2 Byte	2 Bytes	2 Bytes	1 Byte	1 Byte	N Bytes
	= 0x0000	= N + 2	= 0		

Field	Length	Info	Client	Server
Transaction number	2 Byte	Identifies the transaction	Set by the client	Copied from the request into the reply
Protocol attribute	2 Byte		Set by the client	Copied from the request into the reply
Number of bytes to follow	2 Byte	Number of bytes to follow	Set by the client	Set by the server
Address	1 Byte	Identifies a slave that is connected to a serial bus located downstream. Note The devices in the Liquiline product family do not use the unit identifier. This should always be set to 0.	Set by the client	Copied from the request into the reply

Via the TCP port 502, you can use up to 3 parallel TCP connections with the device simultaneously. Please note the correct structure of the MBAP header.

3.3 Modbus exception codes

If the MODBUS slave detects an error in the request telegram from the master, it replies to the master with an error message comprising the slave address, function code, error code (exception code) and checksum. To indicate that it is an error message, the leading bit of the returned function code is set. The cause of the error is transmitted to the master via the error code (exception code).

Exception Code	Info
01	ILLEGAL_FUNCTION The function code sent by the master is not supported by the measuring device (slave).
02	ILLEGAL_DATA_ADDRESS The register addressed by the master is not assigned (i.e. it does not exist), or the length of the data queried is too long.
03	ILLEGAL_DATA_VALUE The master attempts to write to a register which allows only read access. The value that appears in the data field is not permitted: e.g. range limits have been exceeded or the data format is incorrect.
04	SLAVE_DEVICE_FAILURE The slave has not replied to the request telegram from the master, or an error has occurred while processing the request telegram.

A parameter must be read or written completely, otherwise SLAVE_DEVICE_FAILURE is returned.

- The numbering of the Modbus registers in this document starts with 0 as it is transmitted over the wire. In case your PLC is using Modicon addressing you must add 1 to the register addresses.
- Please note that Modbus requests must read or write parameters completely. Trying to read or write only a part of a parameter returns Modbus exception SLAVE_DEVICE_FAILURE.

3.4 Response times

Response time of the measuring device to the request telegram of the Modbus master:
typically, below 100 ms

3.5 Byte transmission sequence

Byte addressing, i.e. the transmission sequence of the bytes, is not specified in the Modbus specification. For this reason, it is important to coordinate or match the addressing method between the master and slave during commissioning. This can be configured in the measuring device using the **Byte order** parameter. The bytes are transmitted depending on the selection in the **Byte order** parameter:

FLOAT				
	Sequence			
Options	1.	2.	3.	4.
1-0-3-2*	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)
0-1-2-3	Byte 0 (MMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)
2-3-0-1	Byte 2 (EMMMMMMM)	Byte 3 (SEEEEEEE)	Byte 0 (MMMMMMMM)	Byte 1 (MMMMMMMM)
3-2-1-0	Byte 3 (SEEEEEEE)	Byte 2 (EMMMMMMM)	Byte 1 (MMMMMMMM)	Byte 0 (MMMMMMMM)
* Factory default, S = Sign, E = Exponent, M = Mantissa				

INTEGER		
	Sequence	
Options	1.	2.
1-0-3-2* 3-2-**1-0**	Byte 1 (MSB)	Byte 0 (LSB)
0-1-2-3 2-3-**0-1**	Byte 0 (LSB)	Byte 1 (MSB)
* = factory setting, MSB = most significant byte, LSB = least significant byte		

STRING Presentation taking the example of a device parameter with a data length of 18 bytes.					
	Sequence				
Options	1.	2.		17.	18.
1-0-3-2* 3-2-**1-0**	Byte 17 (MSB)	Byte 16	...	Byte 1	Byte 0 (LSB)
0-1-2-3 2-3-**0-1**	Byte 16	Byte 17 (MSB)	...	Byte 0 (LSB)	Byte 1
* = factory setting, MSB = most significant byte, LSB = least significant byte					

Any other data type with a size of more than two bytes uses the transmission sequence for STRING.

3.6 Data types

The measuring device supports the following data types:

FLOAT (floating point number IEEE 754) Data length = 4 bytes (2 registers)			
Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
S = sign, E = exponent, M = mantissa			

INTEGER Data length = 2 bytes (1 register)	
Byte 1	Byte 0
Most significant byte (MSB)	Least significant byte (LSB)

STRING Data length = depends on the device parameter, e.g. presentation of a device parameter with a data length = 18 byte (9 registers)				
Byte 17	Byte 16	...	Byte 1	Byte 0
Most significant byte (MSB)		...		Least significant byte (LSB)

DATETIME Data length = 7 bytes (4 registers)									
Byte	Bit								Description
	7	6	5	4	3	2	1	0	
0	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	0 ... 59999 ms
1	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	
2	0	0	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	0 ... 59 min
3	S	0	0	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	Bits 0 to 4: 0 ... 23 h S=0: standard time, S=1: summer time
4	2^{2}	2^{1}	2^{0}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	Bits 6 to 8: 1...7 day of week (1=Monday, 7=Sunday) Bits 1 to 5: 1...31 day of month
5	0	0	0	0	2^{3}	2^{2}	2^{1}	2^{0}	Month (1...12)
6	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}	Year (0...255) / 0 = 1900
7	Padding								

Other data types with a data length of more than 2 bytes are treated like strings.

3.7 Device variables with status

The measuring device does support a fix number of device variables which can be connected to various data sources and sinks:

Device variable	Name	Description	Application / Example
AI1 … AI16	Analog Input	Value that is read from the device	Read measurement values
DI1 … DI8	Digital Input	Value that is read from the device	Read limit switch state
AO1 … AO4	Analog Output	Value that is written to the device	Write PID controlled variable
DO1 … DO8	Digital Output	Value that is written to the device	Start cleaning sequence

A device variable consists of multiple elements:

AI (Analog Input) These device variables are transmitted from measurement device to Modbus master			
Register-Offset	Name	Data type	Description
+ 0-1	Value	Float	Measurement value
+ 2	Status	Unsigned8	Status of value
+ 3	Unit code	Unsigned8	Unit of value

DI (Digital Input) These device variables are transmitted from measurement device to Modbus master				
Register-Offset	Name	Data type	Description	
+ 0-1	Value	Unsigned8	Measurement value	0: False 1: True
+ 2	Status	Unsigned8	Status of value	

AO (Analog Output) These device variables are transmitted from Modbus master to measurement device			
Register-Offset	Name	Data type	Description
+ 0-1	Value	Float	Measurement value
+ 2	Status	Unsigned8	Status of value
+ 3	Unicode	Unsigned8	Unit of value

DO (Digital Output) These device variables are transmitted from Modbus master to measurement device				
Register-Offset	Name	Data type	Description	Semantics
+ 0-1	Value	Unsigned8	Measurement value	0: False 1…255: True
+ 2	Status	Unsigned8	Status of value	

Each device variable is accompanied by a **Status** which provides information on the validity and therefore the usability of this device variable. The status can become the following values:

Status	Quality	Description
0	Good	The value is valid and can be used by the application.
1	Uncertain	The value is of this device variable is not accurate. The application must decide whether it can use the value.
2	Bad	The value of this device variable is not valid.
3	Not assigned	No data source is selected for this device variable.

The status of AO or DO device variables and must be set to 0 (good) to be used by the device. Otherwise the device considers the value of this device variable as invalid.

3.8 Supported function codes

Function codes are used to define which read or write action is carried out via the Modbus protocol. The measuring device supports the following function codes:

Code	Name	Description	Application
03	Read holding register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes	Read device parameters with read and write access. Example: Read measurement value
04	Read input register	Master reads one or more Modbus registers from the device. A maximum of 125 consecutive registers can be read with 1 telegram: 1 register = 2 bytes	Read device parameters with read access. Example: Read Heartbeat Monitoring
08	Diagnostics	Master checks the communication connection to the measuring device. The following codes are supported: ▪ Sub function 00 = Return query data (loopback test) ▪ Sub function 02 = Return diagnostics register	Verify communication and read basic diagnostics information including NE 107 status signal. More diagnostic information is available in input registers.
16	Write multiple registers	Master writes a new value to multiple Modbus registers of the device. A maximum of 120 consecutive registers can be written with 1 telegram. All registers that are addressed using the written registers must be writable, as otherwise the request may be responded to with an ILLEGAL DATA VALUE exception.	Write multiple device parameters. Example: Write set point values
23	Read/write multiple registers	Master reads and writes a maximum of 118 Modbus registers of the measuring device simultaneously with 1 telegram. Write access is executed **before** read access.	Write and read multiple device parameters. Example: Read and write device variables with a single Modbus transaction

Broadcast messages are only permitted with function codes 06, 16 and 23. Function code 08 is only supported for Modbus RS485.

The measuring device does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.

3.8.1 FC03 Read Holding Register

Request

Function code	1 Byte	0x03
Starting address	2 Byte	0x0000 to 0xFFFF
Quantity of Registers	2 Byte	1 to 125 (0x7D)

Response

Function code	1 Byte	0x03
Byte Count	1 Byte	2 * Quantity of Registers
Holding register value	(2 * Quantity of Registers) Byte	2 to 250

Error

Error code	1 Byte	0x83
Exception code	1 Byte	01 or 02 or 03 or 04

3.8.2 FC04 Read Input Register

Request

Function code	1 Byte	0x04
Starting address	2 Byte	0x0000 to 0xFFFF
Quantity of Registers	2 Byte	1 to 125 (0x7D)

Reply

Function code	1 Byte	0x04
Byte Count	1 Byte	2 * Quantity of Registers
Holding register value	(2 * Quantity of Registers) Byte	2 to 250

Error

Error code	1 Byte	0x84
Exception code	1 Byte	01 or 02 or 03 or 04

3.8.3 FC08 Diagnostics (only serial)

Request

Function code	1 Byte	0x06
Starting address	2 Byte	
Quantity of Registers	N x 2 Byte	

Reply

Function code	1 Byte	1 Byte
Byte Count	2 Byte	
Holding register value	N x 2 Byte	

Error

Error code	1 Byte	0x88
Exception code	1 Byte	01 or 03 or 04

Subfunction 0x00: Return Query Data (Loopback)

Example Request

Function code	0x08
Subfunction	0x00
Data (example)	0x01 0x02 0x03 0x04

Response is identical to Request

Function code	0x08
Subfunction	0x00
Data	0x01 0x02 0x03 0x04

Subfunction 0x02: Return diagnostic register

Reads the parameter:

Parameter	Register	Bit	
MB_FC08_DIAGNOSE	500	0	Sensor 1 has a diagnostic message
		1	Sensor 2 has a diagnostic message
		2	Sensor 3 has a diagnostic message
		3	Sensor 4 has a diagnostic message
		4	Sensor 5 has a diagnostic message
		5	Sensor 6 has a diagnostic message
		6	Sensor 7 has a diagnostic message
		7	Sensor 8 has a diagnostic message
		8	General diagnostic message
		9..11	Reserved = 0
		12	Status signal F (failure)
		13	Status signal C (function check)
		14	Status signal M (maintenance request)
		15	Status signal S (out of specification)

The definition of the status signal complies with Namur recommendation NE 107 and is described in section 5.3.

3.8.4 FC16 Write Multiple Register

Request

Function code	1 Byte	0x10
Starting address	2 Byte	0x0000 to 0xFFFF
Quantity of Registers	2 Byte	0x0001 to 0x007B
Byte Count	1 Byte	(2 * Quantity of Registers) Byte
Register Value	(2 * Quantity of Registers) Byte	value

Response

Function code	1 Byte	0x10
Byte Count	2 Byte	0x0000 to 0xFFFF
Quantity of Registers	2 Byte	1 to 123 (0x7B)

Error

Error code	1 Byte	0x90
Exception code	1 Byte	01 or 02 or 03 or 04

3.8.5 FC23 Read/Write Multiple Register

Request

Function code	1 Byte	0x17
Read starting address	2 Byte	0x0000 to 0xFFFF
Quantity to read	2 Byte	0x0001 to 0x007D
Write starting address	2 Byte	0x0000 to 0xFFFF
Quantity to write	2 Byte	0x0001 to 0x0079
Write byte count	1 Byte	2 x (Quantity to write)
Write register value	2 x (Quantity to write)	

Response

Function code	1 Byte	1 Byte
Byte Count	2 Byte	
Data	N x 2 Byte	

Error

Error code	1 Byte	0x97
Exception code	1 Byte	01 or 03 or 04

This function can be used to read or to write the complete process data with one Modbus transaction.

3.9 Register information

For an overview of device parameters with their respective Modbus register information, please refer to the "Modbus register information" section 7.3.

4 Commissioning

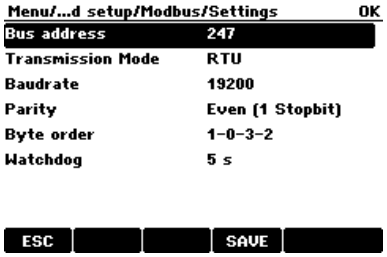
4.1 Modbus network settings

For integration of the device into a Modbus network it is necessary to assign addressing information to the device. The procedure depends on whether you have a device with Modbus RS485 or Modbus TCP interface.

4.1.1 Modbus RS485 (RTU/ASCII)

To ensure that a Modbus RS485 connection can be established with the device, it is first necessary to adjust the device's network settings (Bus address, Transmission Mode, Baud rate and Parity). The settings depend on the network into which the device is being integrated.

Menu: Setup/General settings/Extended setup/Modbus/Settings



Parameter	Default value	Selection
Bus address	247	1 … 247
Transmission Mode	RTU	RTU, ASCII
Baud rate	19200	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	Even (1 Stop bit)	Even (1 Stop bit), Odd (1 Stop bit), None (1 Stop bit), None (2 Stop bit)
Byte order	1-0-3-2	1-0-3-2, 0-1-2-3, 2-3-0-1, 3-2-1-0
Watchdog	5 s	0 … 999, 0 = Watchdog is deactivated. If the device does not receive a valid MODBUS request telegram, a diagnostic code S969 (Modbus Watchdog) and the red BF LED are set. The next valid Modbus request will remove this diagnose.

The setting of the bus address with the Address-Switch of the module has priority over the menu setting. If a valid address is set, the bus address in the menu is read only.

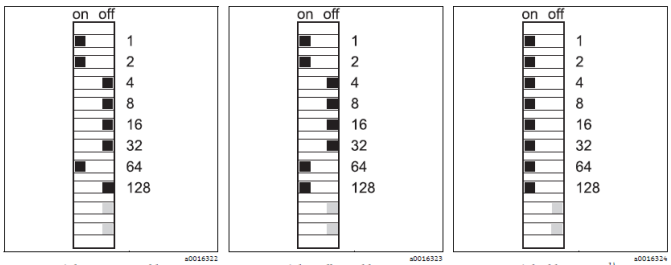


Fig. 70: Valid PROFIBUS address 67 *Fig. 71: Valid Modbus address 195* *Fig. 72: Invalid address 255* [1]

1) Order configuration, software addressing is enabled, software address configured at the factory: PROFIBUS 126, Modbus 247

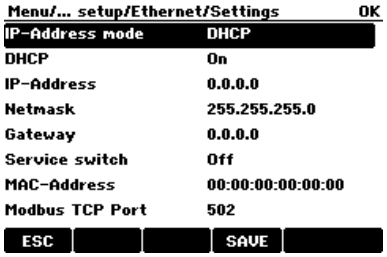
Valid bus addresses are between 1 and 247. If you configure an invalid address, software addressing is automatically enabled via the menu setting.

4.1.2 Modbus TCP (RTU)

4.1.2.1 Ethernet settings

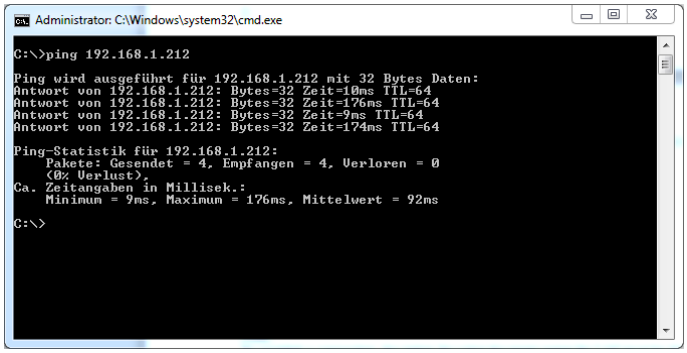
To ensure that a Modbus TCP connection can be established with the device, it is first necessary to adjust the device's network settings (IP address, subnet mask and gateway). The settings depend on the network into which the device is being integrated.

Menu: /Setup/General settings/Extended setup/Ethernet/Settings



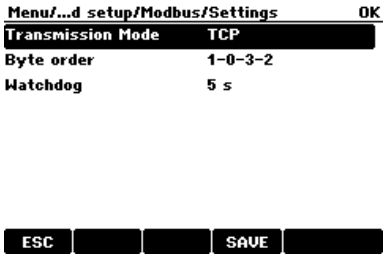
Parameter	Default value	Selection
IP-Address mode	DHCP	DHCP: If a DHCP server is used within the TCP/IP network, the IP address, gateway and subnet mask are set automatically when the DHCP client function is enabled. The DHCP client function is enabled when the measuring device is delivered. The DHCP client function is activated by default but can be disabled in the "Ethernet settings" menu. Software: The network settings can be edited in the menu. Hardware: The low-byte of the IP-Address can be set with the DIP switch located on the front of the 485/ETH module. The other parts of the IP-Address are unchanged. This allows you to set the higher 3 bytes using e.g. software addressing and the low-byte by Hardware.
DHCP	On	Off, On
IP-Address	0.0.0.0	Valid IP address
Netmask	255.255.255.0	Valid Netmask
Gateway	0.0.0.0	IP-Address of Gateway (optional)
Service switch		The service switch is located on the module. While this switch is in position “On”, the following network settings are active: IP-Address = 192.168.1.212 Netmask =255.255.255.0 Gateway = 0.0.0.0 When returning the switch to “Off”, the original network settings are restored.
MAC-Address		The MAC address is imprinted on the communication module or can be read via the menu. The MAC address of the measuring device is used for identification purposes and is uniquely and permanently assigned in the factory.
Modbus TCP Port	502	-

The device implements the ICMP protocol. The "ping" command allows you to check if the measuring device is accessible via the network.



4.1.2.2 Byte order and Watchdog

Menu: /Setup/General settings/Extended setup/Modbus/Settings



Parameter	Factory default	Selection
Transmission Mode	TCP	Modbus TCP uses always RTU (binary mode)
Byte order	1-0-3-2	Byte transmission sequence 1-0-3-2, 1-0-2-3, 2-3-0-1, 3-2-1-0
Watchdog	5 s	0 ... 999, 0 = Watchdog is deactivated If the device does not receive a valid MODBUS request telegram, a diagnostic code S969 (Modbus Watchdog) and the red BF LED are set. The next valid Modbus request will remove this diagnose.

4.2 Configuration of the Modbus output: device variables

A device variable acts as a kind of place holder for measured values or actuating values that can be transmitted via Modbus communication.

The device platform is based on a modular multi-channel, plug & play sensor concept. Therefore, there is no general relationship between the sensor measured value and a device variable. The data sources for the device variables must be selected by the user as required of the application.

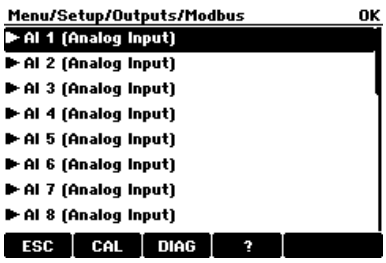
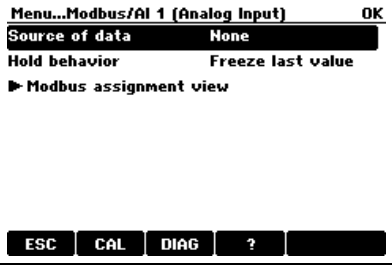
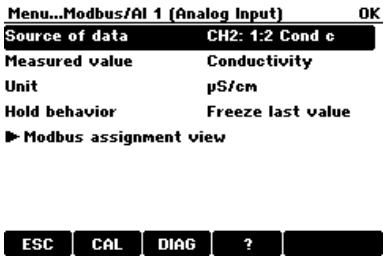
Data sources for device variables are configured in the menu Setup/Outputs like data sources for other outputs like 4...20 mA current outputs. Data sinks for device variables are selected in the menu of the consuming component, e.g. a PID controller or a sampling program.

4.2.1 Select analog data sources for device variables AI

The value mapped to a device variable AI must be configured in the menu:
/Setup/Outputs/Modbus/AI 1 (Analog Input) … AI 16 (Analog Input)

Function	Options	Info
Source of data	Options • None • Any data source Factory setting • None	The data sources presented for selection depend on your device version. You can choose from all the sensors connected to the inputs, controllers as well as mathematic functions and current inputs. For more information and an overview about the available options see main operation manual.
Measured value	Options • None • Depends on data source Factory setting • None	The measured value that you can choose depends on the option selected under "Source of data". For more information and an overview about the available options see main operation manual.
Unit	Options • Any compatible unit	
Unit text	Textual unit	Visible only for user defined units
Hold behavior	Options • Freeze last value • Status only	Behavior in device or sensor hold state • The last value is hold • A hold does not affect the value

Example

Step	Action	Result
1	Enter menu /Setup/Outputs/Modbus	
2	Select an AI device variable, e.g. AI1	
3	Select data source and measurement value Select unit Select hold behavior	

After these steps the value, status and unit code can be read from Modbus holding register 0…3.

4.2.2 Select digital data sources for device variables DI

The value mapped to a device variable DI must be configured in the menu:
Menu: /Setup/Outputs/Modbus/DI 1 (Digital Input) ... DI 8 (Digital Input)

Function	Options	Info
Function	Options • Off • Source value • Diagnostics Factory setting • Off	
If Function = Source value:		
Source of data	Options • None • Limit switches • Alarm relay • Relay • Binary inputs Factory setting • None	The data sources presented for selection depend on your device configuration. For more information see operating manual.
Hold behavior	Options • Freeze • None Factory setting None	For more information see operating manual.
If Function = Diagnostics:		
Operating mode	Options • as assigned • Namur M • Namur S • Namur C • Namur F Factory setting • as assigned	For more information see operating manual.

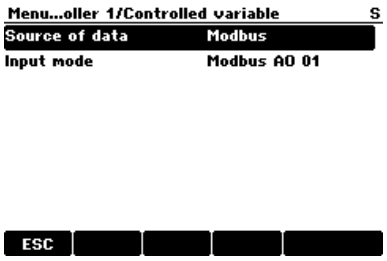
4.2.3 Select analog data sinks for device variables AO

The value mapped to a device variable AO must be configured in the menu of the component using the device variable as input. A device variable AO is used to transmit an analog value to the measuring device instead of using a 4...20 mA current input of the measuring device.

A device variable AO correspond to a current input and has the same connection possibilities.

4.2.3.1 Example: Value of controlled variable of PID controller from Modbus

Menu: /Setup/General Settings/Additional functions/Controller 1/Controlled variable



4.2.3.2 List of data sinks

CM44x	CM44P	CSFxx	CA80xx	Menu
x	x	x	x	Setup/Additional functions/Limit switches/.../Source of data
x	x	x	x	Setup/Additional functions/Controllers/.../Controlled variable/Source of data
x	x	x	x	Setup/General settings/Logbooks/Data logbooks/Source of data
x	x	x	x	Display/User definable screens/.../Source of data
x	x	x	x	Setup/Inputs/Conductivity/Temperature source

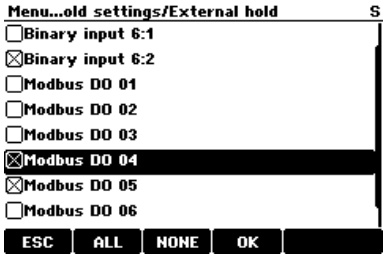
4.2.4 Select digital data sinks for device variables DO

The value mapped to a device variable DO must be configured in the menu of the component using the device variable as input. A device variable DO is used to transmit an analog value to the measuring device instead of using a binary input of the measuring device.

A device variable DO correspond to a binary input and has the same connection possibilities.

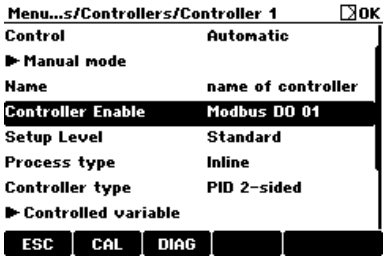
4.2.4.1 Example: Hold over Modbus

Menu: /Setup/General Settings/Hold Settings/External Hold
Multiple DO signals can be selected. If at least one of these signals is set (1), the hold function is active.



4.2.4.2 Example: Enable or disable PID controller

Menu: /Setup/General Settings/Additional functions/Controller 1/



4.2.4.3 List of data sinks

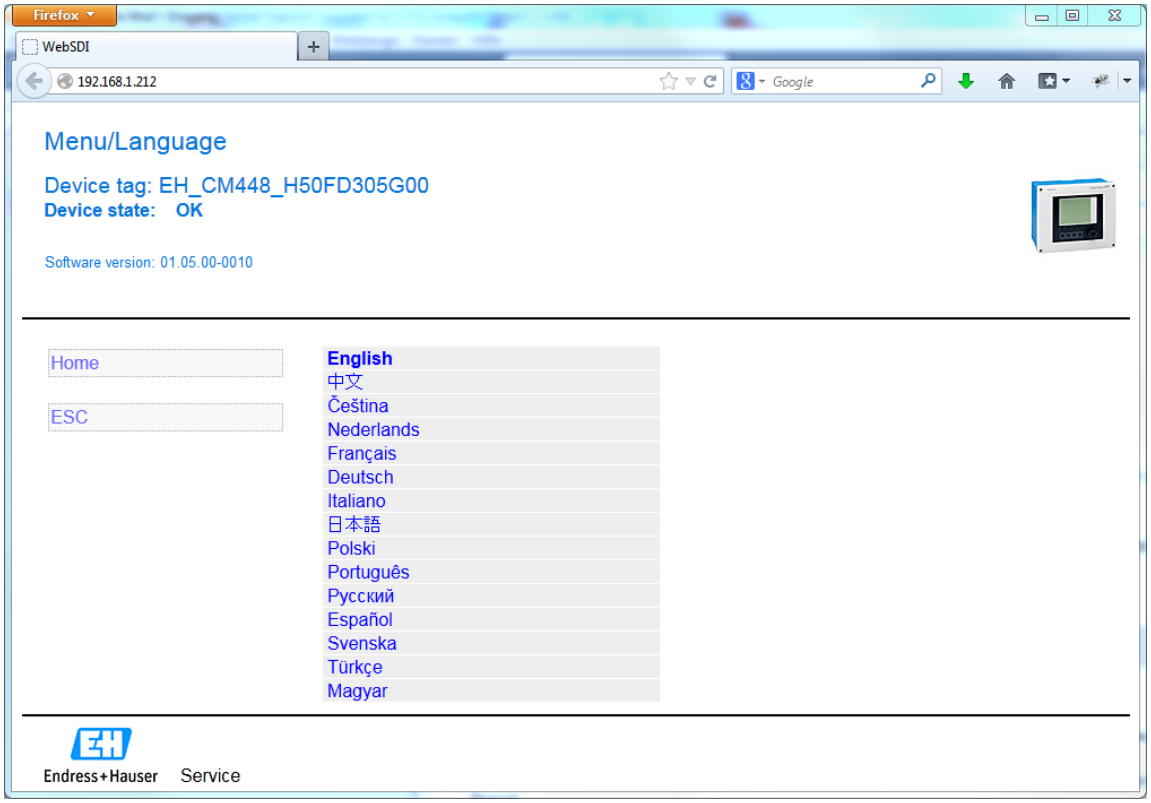
CM44x	CM44P	CSFxx	CA80xx	Menu
x	x	x	x	Setup/Additional functions/Controllers/.../Controller Enable
x	x	x	x	Setup/Additional functions/Cleaning/.../Start signal
x	x	x	x	Setup/General settings/Hold settings/External hold
x	x	x	x	Setup/General settings/Logbooks/Data logbooks/Source of data
x	x	x	x	Setup/Inputs/Sensor/Extended setup/External hold/Source
x	x	x	x	Display/User definable screens/.../Source of data
x	x	x	x	Setup/Additional functions/Diagnostic modules
x	x	x	x	Setup/Inputs/Oxygen/Extended setup/Input pressure
x	x	x	x	Setup/Additional functions/Mathematical functions/MF X/Formula
x	x	x	x	Setup/Additional functions/Measuring range switch/MRS set X
	x			Setup/Inputs/Photometer/Lamp control input
	x			Setup/Inputs/Photometer/Extended Setup/Ext. dataset control
		x		Sample-Program/Programsetup/Advanced/Startcondition
		x		Sample-Program/Programsetup/Advanced/Startsignal
		x		Sample-Program/Programsetup/Advanced/Stopcondition
		x		Sample-Program/Programsetup/Advanced/Stopsignal
		x		Sample-Program/Advanced/Subprogramsetup/Samplemode
		x		Sample-Program/Advanced/Subprogramsetup/Samplesignal
		x		Sample-Program/Advanced/Subprogramsetup/Bottle change
		x		Sample-Program/Advanced/Subprogramsetup/Change signal
		x		Sample-Program/Advanced/Subprogramsetup/Change signal
		x		Sample-Program/Advanced/Subprg.setup/Subprogram-Activation
		x		Sample-Program/Advanced/Subprogramsetup/Activationsignal

4.3 Web server

4.3.1 Function description

You can remotely access local device operation via the integrated Web server.

All the languages of the local operation system are supported.



4.3.2 Security

Please note that communication via the HTTP protocol is not encrypted.

The Web server does support Basic HTTP Authentication.

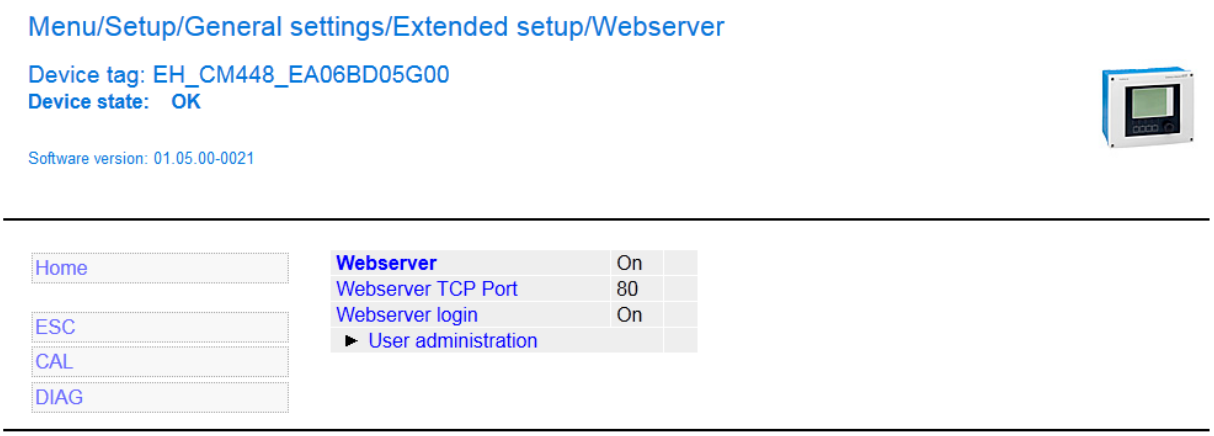
A factory default reset resets the access data to the default login.

You can disable the Web server via the menu:

Setup/General settings/Extended setup/Webserver → Webserver (on/off)

Furthermore, the Web server can also be disabled via Modbus Register 519 (WEBSERVER_ENABLE). This allows you to control access for the Web server via Modbus.

4.3.3 Web server settings



Parameter	Options	Info
Web server	On (default) Off	When the Web server is disabled it is not possible to access the Web server via any interface (Ethernet, CDI or DTM).
Web server TCP port	80	Fixed value
Web server login	On (default) Off	
User administration	Wizard	You can change the user name and/or the user password. You require the access data that are currently valid to change the name/password.

4.3.4 Web server login

The following access data are pre-programmed into the device when the device is delivered:

User name: admin
Password: admin

Please note that communication via the HTTP protocol is not encrypted. The user name and the password are transmitted as non-encrypted information.

4.3.5 Exporting the logbooks

The logbooks can be exported via the Web server and saved to a PC. Open a Web browser and enter one of the following URLs to get to an overview page.

http://<IP address>/logbooks_csv.fhtml	This file format can be read with any text editor or can be imported into Microsoft Excel, for instance. Separator: ";"
http://<IP address>/logbooks_fdm.fhtml	This data format can be imported into the Endress+Hauser Field Data Manager Software: http://www.endress.com/MS20

4.3.5.1 Web server login

Device software version 1.05.00 and higher supports login to the Web server using HTTP Basic Authentication. The user must be logged in to view the logbook overview. The individual logbooks can be downloaded directly without the need to log in beforehand.

4.3.5.2 Direct URLs of the logbooks

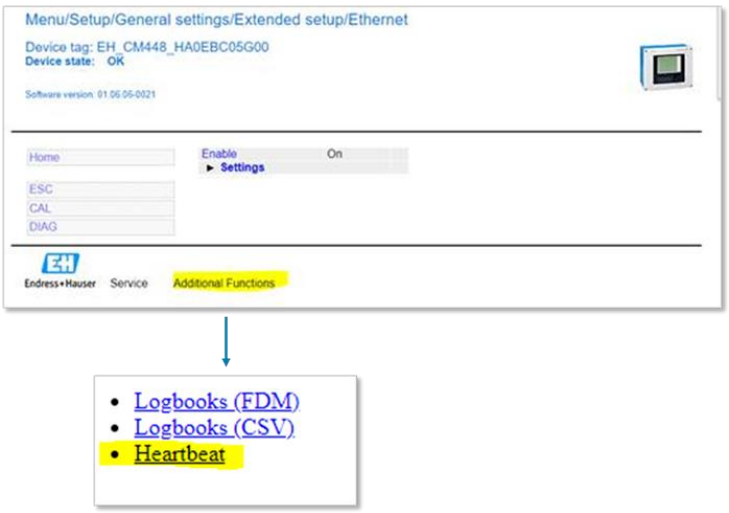
*.csv	*.dat
http://<IP address>/Calibration_logbook.csv	http://<IP address>/Calibration_logbook.dat
http://<IP address>/Diagnostic_logbook.csv	http://<IP address>/Diagnostic_logbook.dat
http://<IP address>/Configuration_logbook.csv	http://<IP address>/Configuration_logbook.dat
http://<IP address>/HW_version_logbook.csv	http://<IP address>/HW_version_logbook.dat
http://<IP address>/Version_logbook.csv	http://<IP address>/Version_logbook.dat
http://<IP address>/Data0_logbook.csv	http://<IP address>/Data0_logbook.dat
http://<IP address>/Data1_logbook.csv	http://<IP address>/Data1_logbook.dat
http://<IP address>/Data2_logbook.csv	http://<IP address>/Data2_logbook.dat
http://<IP address>/Data3_logbook.csv	http://<IP address>/Data3_logbook.dat
http://<IP address>/Data4_logbook.csv	http://<IP address>/Data4_logbook.dat
http://<IP address>/Data5_logbook.csv	http://<IP address>/Data5_logbook.dat
http://<IP address>/Data6_logbook.csv	http://<IP address>/Data6_logbook.dat
http://<IP address>/Data7_logbook.csv	http://<IP address>/Data7_logbook.dat

The *.dat format can be used for data import into the Endress+Hauser Field Data Manager Software.

4.4 Exporting Heartbeat Verification Report

The last Heartbeat Verification Report can be downloaded from:

http://<IP-Adresse>/heartbeat.fhtml



5 Diagnostics

Diagnostic information for the device is provided through various mechanisms:

- LEDs of the 485/ETH module
- Status of device variables
- Modbus registers

5.1 LED displays

LED	Name	Color	Info
RJ45	LNK/ACT	Green	off = Connection inactive on = Connection is enabled Flashing = Data transmission
RJ45	10/100	Yellow	off = Transmission rate 10 MBit/s on = Transmission rate 100 MBit/s
PWR	Power (Voltage supply)	Green	Supply voltage is present, and module is initialized.
BF	Bus Failure	Red	Bus Failure
SF	System Failure	Red	Device error
COM	Communication	Yellow	Modbus telegram is being received or used.
T	Bus Termination	Yellow	off = No termination on = Termination is used

5.2 Status of device variables

The status information of a device variable provides information about its validity and usability. It should be evaluated in the PLC program. Device variables AO/DO transmit from the PLC have to be sending with a status “good” to be used by the device.

For more information about the encoding of the status see section 3.7.

5.3 Status signal

The status signal is in accordance with NAMUR recommendation NE 107.

Signal	Diagnostics category	Description
F	Failure	The measured value of the affected channel is no longer reliable. The cause can be found in the measuring point. Any control unit that may be connected should be switched to manual operation.
C	Function Check	Maintenance work is being carried out on the device. Wait until it is completed.
S	Out of Specification	The measuring point is being operated out of specification. Operation is still possible. However, there is the risk of increased wear and tear, a shorter operating life or reduced accuracy. The cause can be found outside the measuring point.
M	Maintenance required	The measurement functionality is still available. There is no immediate need for action. However, maintenance will prevent the future occurrence of possible faults.

The status signal can be read via the Modbus diagnostic function code #08 or directly as a parameter.

Parameter	Input Register	Bit	
MB_FC08_DIAGNOSE	500	0	Sensor 1 has a diagnostic message
		1	Sensor 2 has a diagnostic message
		2	Sensor 3 has a diagnostic message
		3	Sensor 4 has a diagnostic message
		4	Sensor 5 has a diagnostic message
		5	Sensor 6 has a diagnostic message
		6	Sensor 7 has a diagnostic message
		7	Sensor 8 has a diagnostic message
		8	General diagnostic message
		9..11	Reserved = 0
		12	Status signal F (failure)
		13	Status signal C (function check)
		14	Status signal M (maintenance required)
		15	Status signal S (out of specification)

The FCMS error category can be adapted individually for each diagnostic message.

For device related diagnostic messages:
Menu: Setup/General settings/Extended setup/Diagnostics settings/Diag. behavior

For sensor related diagnostic messages:
Menu: Setup/Inputs/<Sensor>/Extended setup/Diagnostics settings/Diag. behavior

5.4 Diagnostic messages

Via Modbus registers, the device provides detailed information on the current diagnostic message with the highest priority and the last diagnostic message to be displayed. This information is available for the device and for each sensor.

The diagnostic codes and the corrective measures which can be taken based on the error code, are described in the Operating Instructions "Maintenance & diagnostics".

5.4.1 Device related diagnostics

Current, active diagnostic message with the highest priority:

Parameter	Input Register	Data Type	Info
DEVICE_CURRENT_DIAG_MODUL	504	UNSIGNED16	Slot number 0 to 7 of the module.
DEVICE_CURRENT_DIAG_PORT	505	UNSIGNED8	Connection 0 to 3 on the module.
DEVICE_CURRENT_DIAG_NE107_STATUS	506	UNSIGNED8	Bit 0: Failure (F) Bit 1: Function check (C) Bit 2: Maintenance (M) Bit 3: Out of specification (S) Bit 4-7: Reserved = 0
DEVICE_CURRENT_DIAG_CODE	507	UNSIGNED16	Diagnostic code (0 to 999)

Parameter	Input Register	Data Type	Info
DEVICE_CURRENT_DIAG_TIMESTAMP	508	UNSIGNED32	Time stamp (seconds since 1.1.1970)
DEVICE_NUMBER_ADDITIONAL_DIAG	510	UNSIGNED8	Number of low-priority diagnostic messages present at the same time: A complete list of all diagnostic messages can be found on the onsite display or the web server.

Last diagnostic message to be displayed:

Parameter	Input Register	Data Type	Info
DEVICE_PAST_DIAG_MODUL	512	UNSIGNED8	see above
DEVICE_PAST_DIAG_NE107_STATUS	514	UNSIGNED8	
DEVICE_PAST_DIAG_PORT	513	UNSIGNED8	
DEVICE_PAST_DIAG_CODE	515	UNSIGNED16	
DEVICE_PAST_DIAG_TIMESTAMP	516	UNSIGNED32	

5.4.2 Sensor related diagnostics

For each of the 8 sensors, the current diagnostic message and the last diagnostic message to be displayed can be read independently of each other via Modbus.

X = 1 (sensor 1) to 8 (sensor 8)

5.4.2.1 Current diagnostic message

Parameter	Input Register	Data Type	Info
SENSOR_X_CURRENT_DIAG_MODUL	X*1000+92	UNSIGNED16	Slot number 0 to 7 of the module.
SENSOR_X _CURRENT_DIAG_PORT	X*1000+93	UNSIGNED8	Connection 0 to 3 of the module.
SENSOR_X_CURRENT_DIAG_NE107_STATUS	X*1000+94	UNSIGNED8	Status signal as per NE107: Bit 0: Failure (F) Bit 1: Function check (C) Bit 2: Maintenance (M) Bit 3: Out of specification (S) Bit 4-7: Reserved = 0
SENSOR_X _CURRENT_DIAG_CODE	X*1000+95	UNSIGNED16	Diagnostic code (0 to 999)
SENSOR_X _CURRENT_DIAG_TIMESTAMP	X*1000+96	UNSIGNED32	Time stamp (seconds since 1.1.1970)
SENSOR_X _NUMBER_ADDITIONAL_DIAG	X*1000+98	UNSIGNED8	Number of simultaneously occurring lower-priority diagnostic messages. A complete list of all diagnostic messages can be found on the onsite display or the web server.

5.4.2.2 Last active diagnostic message

Parameter	Input Register	Data Type	Info
SENSOR_X_PAST_DIAG_MODUL	X*1000+100	UNSIGNED8	see above
SENSOR_X_PAST_DIAG_PORT	X*1000+101	UNSIGNED8	
SENSOR_X_PAST_DIAG_NE107_STATUS	X*1000+102	UNSIGNED8	
SENSOR_X_PAST_DIAG_CODE	X*1000+103	UNSIGNED16	
SENSOR_X_PAST_DIAG_TIMESTAMP	X*1000+104	UNSIGNED32	

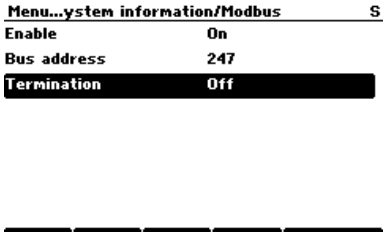
5.5 Communication related diagnostics

5.5.1 Bus termination

Each Modbus segment must be terminated at each end using a bus terminator resistor.

The device has a terminating resistor with on/off switch. The status of this terminating resistor is displayed via the T-LED on the communication module and can also be read via the device menu or Modbus.

Menu: Diagnostics/System information/Modbus

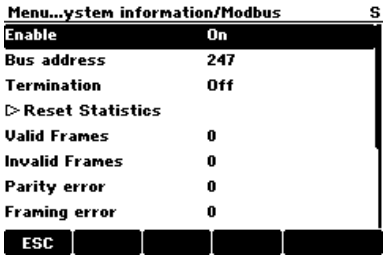


Parameter	Input Register	Data Type	Info
RS485_TERMINATION_STATE	941	UNSIGNED8	0 = RS485 terminating resistor is OFF 1 = RS485 terminating resistor is ON

5.5.2 Protocol counters

The device monitors communication and makes error counters available. The error counters can be read via Modbus. The protocol counters can be accessed with user role Expert at the device:

Menu: Expert/Diagnostics/System information/Modbus



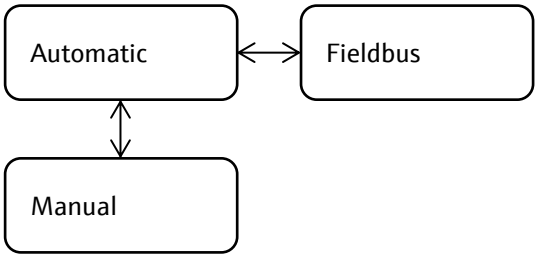
6 Applications

6.1 CA80xx: How to start Measurement, Calibration and Cleaning

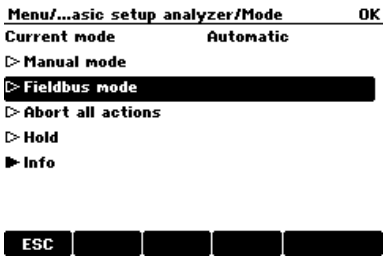
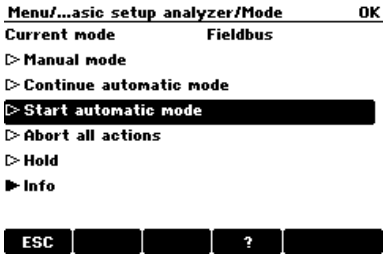
This chapter applies only to the Liquiline CA80xx analyzer.

The actions “Measurement”, “Calibration” and “Cleaning” can be controlled by Modbus while the analyzer is in the operation mode “Fieldbus”.

The operation mode “Fieldbus” can be activated either by Modbus or the device menu.



6.1.1 Activate “Fieldbus”-mode using the device menu

Step	Action	Result
1	Press the soft key “MODE” to enter the menu in which the operation mode can be selected.	
2	Activate the “Fieldbus mode”.	

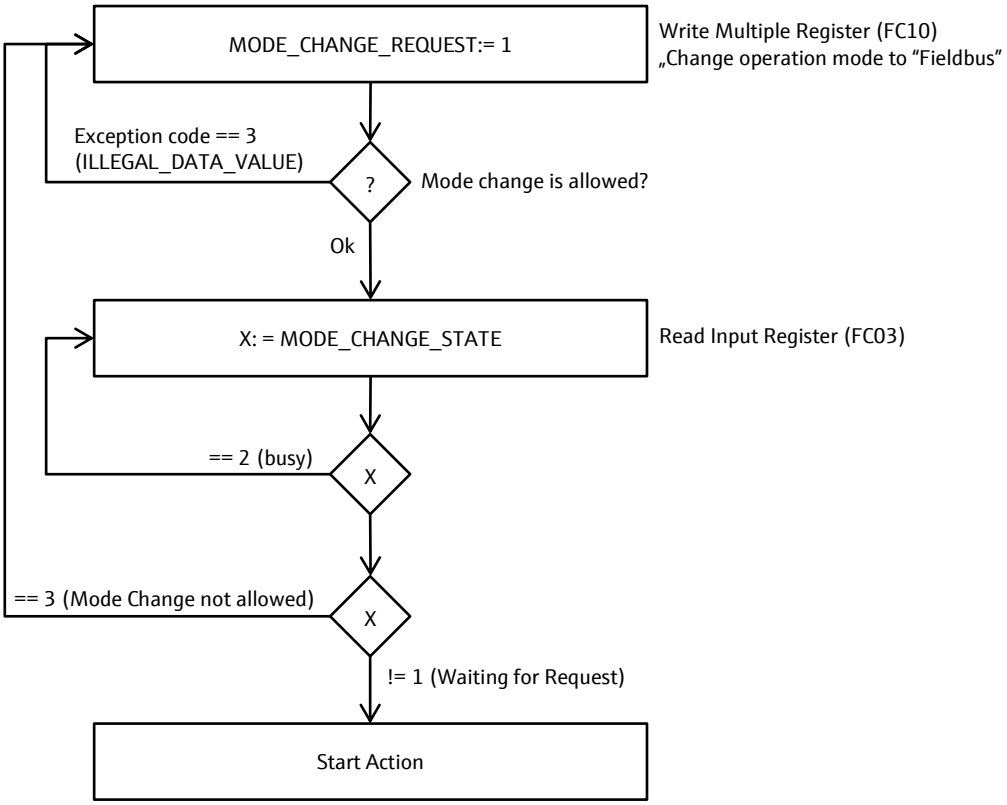
The operation mode can be changed at any time using the device menu. The setting of the device menu has priority over the setting by Modbus. This is a safety measure to prevent the start of actions over Modbus while the analyzer is in operation mode “Manual” during maintenance work.

Important:
A change from “Manual” directly to “Fieldbus” is now allowed by Modbus. Modbus can only change the operation mode from “Automatic” to “Fieldbus”.

6.1.2 Activate “Fieldbus”-mode using Modbus

The following diagram shows an example sequence without error handling. The application program should at least consider the following additional cases:

- The analyzer is not reachable by Modbus communication, e.g. because it is switched off
- A write access to a register fails and an exception code is returned in the Modbus reply
- A read access to a register fails and an exception code is returned in the Modbus reply
- The analyzer is switched temporarily to manual mode during maintenance

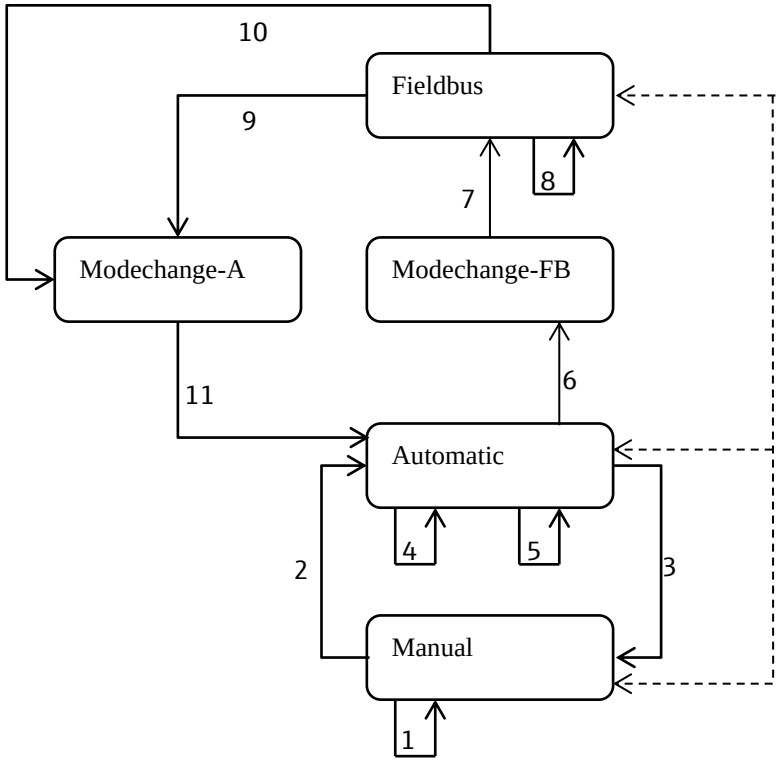


The following examples in Pseudocode show how a program can access the functionality over Modbus.

```
// Example program (Pseudocode)
Write ModeChangeRequest “Fieldbus”
IF Write access returns error
   Abort procedure with error
DO
   Read ModeChangeStatus
WHILE ModeChangeStatus is “Busy”
IF ModeChangeStatus is NOT “WaitingForRequest”
   Abort procedure with error
// now fieldbus mode is active
```

6.1.3 State machine

The following state diagram describes the operation mode and state transitions.



The mode can be changed by the device menu at any time, e.g. during maintenance work the mode is typically changed to "Manual".

Important:
A change of the operation mode does not interrupt a pending action. A new action can only be started after the pending action has finished or is aborted.

#	Current state	Condition → Action	Next state
1	Manual	→ MODE_CHANGE_STATE:=3, ACTION_REQUEST_STATE:=2	Manual
2	Manual	Mode Automatic → MODE_CHANGE_STATE:=1, ACTION_REQUEST_STATE:=2	Automatic
3	Automatic	Mode Manual → MODE_CHANGE_STATE:=3, ACTION_REQUEST_STATE:=2	Manual
4	Automatic	MODE_CHANGE_REQUEST:=0 → MODE_CHANGE_STATUS:=1, ACTION_REQUEST_STATE:=2	Automatic
5	Automatic	MODE_CHANGE_REQUEST:=1 and mode change is not possible → MODE_CHANGE_STATE:=3, ACTION_REQUEST_STATE:=2	Automatic
6	Automatic	MODE_CHANGE_REQUEST:=1 and mode change is accepted → MODE_CHANGE_STATUS:=2, ACTION_REQUEST_STATE:=2	Modechange -FB
7	Modechange-FB	Mode change finished → ACTION_REQUEST_STATE:=1, ACTION_REQUEST_STATE:=0	Fieldbus
8	Feldbus	See "Fieldbus status machine"	Fieldbus
9	Feldbus	MODE_CHANGE_REQUEST:=2 → MODE_CHANGE_STATUS:=2	Modechange -A
10	Feldbus	MODE_CHANGE_REQUEST:=3 → MODE_CHANGE_STATE:=1, ACTION_REQUEST_STATE:=2, Time-controlled programs are restarted with the current time.	Modechange -A
11	Modechange -A	Mode changed finished → MODE_CHANGE_STATE:=1, ACTION_REQUEST_STATE:=2	Automatic

6.1.4 How-to execute actions

6.1.4.1 How-to execute a Measurement

The analyzer must be in the operation mode “Fieldbus” to start an action. The current operation mode can be verified by pressing the soft-key labeled “MODE” at the device menu or by reading the Modbus register MANUAL_CHANGE_STATUS.

```
// execute a measurement
Write AnalyzerRequest “Measurement”
IF Write access returns error
   Abort procedure with error
DO
   Read FunctionExecutionStatus
WHILE FunctionExecutionStatus is “Busy” OR
     FunctionExecutionStatus is “MeasurementInProgress”
IF FunctionExecutionStatus is NOT “MeasurementFinished”
   Abort procedure with error
// now measurement was successfully executed
```

If the user locally switches to manual or automatic the Modbus write requests gets an error response.
An error is also, if a measurement shall be executed and another action is running (e.g. a calibration). As the above pseudo code shows, this will be detected as an error.

6.1.4.2 How-to run a Calibration

The analyzer must be in the operation mode “Fieldbus” to start an action. The current operation mode can be verified by pressing the soft-key labeled “MODE” at the device menu or by reading the Modbus register MANUAL_CHANGE_STATUS.

```
// execute a measurement
Write AnalyzerRequest “Measurement”
IF Write access returns error
   Abort procedure with error
DO
   Read FunctionExecutionStatus
WHILE FunctionExecutionStatus is “Busy” OR
     FunctionExecutionStatus is “MeasurementInProgress”
IF FunctionExecutionStatus is NOT “MeasurementFinished”
   Abort procedure with error
// now measurement was successfully executed
```

If the user locally switches to manual or automatic the Modbus write requests gets an error response.
An error is also, if a measurement shall be executed and another action is running. As the above pseudo code shows, this will be detected as an error.

6.1.4.3 How-to start a Cleaning

The analyzer must be in the operation mode “Fieldbus” to start an action. The current operation mode can be verified by pressing the soft-key labeled “MODE” at the device menu or by reading the Modbus register MANUAL_CHANGE_STATUS.

```
// execute a measurement
Write AnalyzerRequest “Measurement”
IF Write access returns error
```

```
   Abort procedure with error
DO
   Read FunctionExecutionStatus
WHILE FunctionExecutionStatus is “Busy” OR
     FunctionExecutionStatus is “MeasurementInProgress”
IF FunctionExecutionStatus is NOT “MeasurementFinished”
   Abort procedure with error
// now measurement was successfully executed
```

If the user locally switches to manual or automatic the Modbus write requests gets an error response.
An error is also, if a measurement shall be executed and another action is running. As the above pseudo code shows, this will be detected as an error.

6.1.4.4 How-to abort an action

```
// “Abort” can be executed at any time
Write CommonRequest “AbortOfCurrentActivity”
IF Write access returns error
   Abort procedure with error
DO
   Read FunctionExecutionStatus
WHILE FunctionExecutionStatus is “AbortOfCurrentActivityInProgress”
IF FunctionExecutionStatus is NOT “AbortOfCurrentActivityFinished”
   Abort procedure with error
```

6.1.4.5 Error evaluation

The examples in the former chapters show how to detect an error. How to handle an error may dependent from the cause of error.

Two errors can occur:

1. Write access fails and returns fieldbus specific error codes. In most cases the analyzer is in a state where it cannot execute the desired function. This can be checked by reading the parameters “OperationMode” and “FunctionExecutionStatus”.

2. The parameter “FunctionExecutionStatus” has not the expected value. Since the PLC has already read the function execution status, it can rely on this value to check the cause of error, e.g.:
    a. Other function is running or even finished or failed. So, another user accessed the analyzer and started this function.
    b. The desired function failed. In most times a failure is signaled by a diagnosis that can be read via fieldbus specific mechanism, e.g. diagnosis parameters. Remark: The user shall be aware that the diagnosis may not reflect the function error because other diagnosis events might be triggered. All diagnosis events are logged.

Example for a simple error handling is to wait until device is available again:

```
DO
  DO
    Write ModeChangeRequest “Fieldbus”
  WHILE Write access returns error
  DO
    Read ModeChangeStatus
  WHILE ModeChangeStatus is “Busy”
WHILE ModeChangeStatus is NOT “WaitingForRequest”
```

DO
  Write ResetRequest "ResetOfStatus"
WHILE Write access returns error

Of course, such a simple error handling will generate some traffic on Modbus.

This procedure is also recommended on startup of a PLC program. To limit traffic on fieldbus, it is enough to read or write the fieldbus every 15 seconds or even less frequently.

6.1.5 Modbus Registers

Important:
The register addresses in the tables start with 0 as transmitted over the wire. Depending on the system it is necessary to add +1 to the register according the tables to access the parameters correctly.

6.1.5.1 Analyzer Manual Actions

The following parameters are available to switch into fieldbus mode, which enables the remote control over Modbus function, and to start an action and read back its progress.

Register block	Analyzer Manual Actions				
Register type	Holding				
Function code	3 (Read Holding Registers)				
	16 (Write Multiple Registers)				
Register	Parameter	Bytes	Data Type	Access	Description
9400	MODE_CHANGE_REQUEST	1	Unsigned8	R/W	This parameter is used to control the active operation mode and can be written with the following values: 0: None 1: Enter fieldbus mode. The CA80xx changes from automatic mode to fieldbus mode. 2: Continue automatic mode: The CA80xx changes from fieldbus mode to automatic mode continuing with the time schedule as it was calculated when entering automatic mode, the first time. 3: Restart automatic mode: The system changes from fieldbus mode to automatic mode and restarts the time schedule with the current time as starting point.
9401	ABORT_ACTION_REQUEST	1	Unsigned8	R/W	The parameter is used to abort the current activity and can be written with the following values: 0: None 1: Abort current action

9402	MANUAL_ACTION_REQUEST	1	Unsigned8	R/W	This parameter is used to start an action and can be written with the following values: 0: None 1: Start measurement 2: Start calibration 3: Start cleaning

6.1.5.2 Analyzer manual actions state

The parameters in the register block "Analyzer manual actions state" are used to read the status of the status machine.

Register block	Analyzer manual actions state				
Register type	Input				
Function code	4 (Read Input Registers)				
Register	Parameter	Bytes	Data Type	Access	Description
9900	MODE_CHANGE_STATE	1	Unsigned8	R	This parameter reads the status of the mode change. Allowed values: 1: Waiting for Request: The analyzer is waiting for a request. 2: Busy: Writing the parameter "Mode change request" was accepted. Mode change is in progress. 3: Mode Change not allowed: The analyzer is in operation mode that the fieldbus is not allowed to change (like manual mode).
9901	ACTION_REQUEST_STATE	1	Unsigned8	R	0: Ready to start action No procedure is running. This state is entered, if the analyzer enters fieldbus mode, while nothing is running that disturbs the start of any function via fieldbus. 1: Action request accepted The request was accepted, but the requested function is not started yet. 2: Fieldbus not active The analyzer is not in fieldbus mode and cannot accept action requests. 3: Other activity in progress 32: Current action abort in progress 33: Measurement started 34: Calibration started 35: Cleaning started 36: Reference sample inspection in progress

					37: Calibration zero-point in progress 38: Calibration calibration factor in progress 64: Current activity aborted 65: Measurement finished 66: Calibration finished 67: Cleaning finished 68: Reference sampe inspection finished 69: Calibration zero point finished 70: Calibration calibration factor finished 96: Reference sample inspection failed 97: Measurement not successful 98: Calibration not successful 99: Cleaning not successful

7 Tables

7.1 Unit codes

Modbus unit code	Symbol	Name	Standard unit
0		None	
1	1/K	LfTempCompensation	1/K
2	nAs	NanoAmpereSeconds	As
3	µAs	MicroAmpereSeconds	As
4	As	AmpereSeconds	As
5	ppb	ppb	%
6	ppm	ppm	%
7	%	Percent	%
8	%SAT	PercentSaturation	%
9	1/mm	PerMilliMeter	1/m
10	1/cm	PerCentiMeter	1/m
11	1/m	PerMeter	1/m
12	g/kg	GramPerKilogram	g/kg
13	ppmVol	ppmVol	%Vol
14	%Vol	PercentVol	%Vol
15	%/K	PercentPerKelvin	%/K
16	%/µV	PercentPerMicroVolt	%/V
17	%/mV	PercentPerMilliVolt	%/V
18	%/V	PercentPerVolt	%/V
19	µS	MicroSiemens	S
20	mS	MilliSiemens	S
21	S	Siemens	S
22	pA	PicoAmpere	A
23	nA	NanoAmpere	A
24	µA	MicroAmpere	A
25	mA	MilliAmpere	A
26	A	Ampere	A
27	nA/(mg/l)	NanoAmperePerMilligramPerLiter	A/(kg/m³)
28	A/(kg/m³)	AmperePerKilogramPerCubicMeter	A/(kg/m³)
29	A/Pa	AmperePerPascal	A/Pa
30	pA/hPa	PicoAmperePerHektoPascal	A/Pa
31	A/hPa	AmperePerHektoPascal	A/Pa
32	°	Degree	°
33	FNU	Formazine_Nephelometric	FNU
34	NTU	Nephelometric_Turbidity	FNU
35	Hz	Hertz	Hz
36	1/min	OnePerMinute	Hz
37	1/h	OnePerHour	Hz
38	1/d	OnePerDay	Hz
39	KByte	Kilobytes	KByte
40	mm	MilliMeter	m

Modbus unit code	Symbol	Name	Standard unit
41	cm	CentiMeter	m
42	dm	DeciMeter	m
43	m	Meter	m
44	km	KiloMeter	m
45	g/ml	GramPerMilliLiter	kg/m³
46	µg/l	MicroGramPerLiter	kg/m³
47	mg/l	MilliGramPerLiter	kg/m³
48	g/l	GramPerLiter	kg/m³
49	kg/l	KiloGramPerLiter	kg/m³
50	kg/m³	KiloGramPerCubicMeter	kg/m³
51	ppb	ppb_density1	kg/m³
52	ppm	ppm_density1	kg/m³
53	pH	PH	pH
54	mm/s	MilliMeterPerSecond	m/s
55	mm/min	MilliMeterPerMinute	m/s
56	mm/h	MilliMeterPerHour	m/s
57	mm/d	MilliMeterPerDay	m/s
58	Pa	Pascal	Pa
59	hPa	HectoPascal	Pa
60	mbar	MilliBar	Pa
61	Pa/A	PascalPerAmpere	Pa/A
62	PSU	PSU	PSU
63	mΩ	MilliOhm	Ω
64	Ω	Ohm	Ω
65	kΩ	KiloOhm	Ω
66	MΩ	MegaOhm	Ω
67	GΩ	GigaOhm	Ω
68	rH	rH	rH
69	µS/mm	MicroSiemensPerMilliMeter	S/m
70	nS/cm	NanoSiemensPerCentiMeter	S/m
71	µS/cm	MicroSiemensPerCentiMeter	S/m
72	mS/cm	MilliSiemensPerCentiMeter	S/m
73	S/cm	SiemensPerCentiMeter	S/m
74	µS/m	MicroSiemensPerMeter	S/m
75	mS/m	MilliSiemensPerMeter	S/m
76	S/m	SiemensPerMeter	S/m
77	kS/m	KiloSiemensPerMeter	S/m
78	MS/m	MegaSiemensPerMeter	S/m
79	nΩm	NanoOhmMeter	Ωm
80	µΩm	MicroOhmMeter	Ωm
81	mΩm	MilliOhmMeter	Ωm
82	Ωm	OhmMeter	Ωm
83	kΩm	KiloOhmMeter	Ωm
84	MΩm	MegaOhmMeter	Ωm
85	GΩm	GigaOhmMeter	Ωm

Modbus unit code	Symbol	Name	Standard unit
86	Ωcm	OhmCentiMeter	Ωm
87	kΩcm	KiloOhmCentiMeter	Ωm
88	MΩcm	MegaOhmCentiMeter	Ωm
89	℃	Celsius	℃
90	K	Kelvin	℃
91	℃	DeltaCelsius	℃
92	K	DeltaKelvin	℃
93	µs	MicroSeconds	s
94	ms	MilliSeconds	s
95	s	Seconds	s
96	min	Minutes	s
97	h	Hours	s
98	d	Days	s
99	week(s)	Weeks	s
100	month(s)	Month	month(s)
101	l/s	LiterPerSecond	m^3/s
102	m^3/s	CubicMeterPerSecond	m^3/s
103	l/min	LiterPerMinute	m^3/s
104	m^3/min	CubicMeterPerMinute	m^3/s
105	l/h	LiterPerHour	m^3/s
106	m^3/h	CubicMeterPerHour	m^3/s
107	l/d	LiterPerDay	m^3/s
108	m^3/d	CubicMeterPerDay	m^3/s
109	µV	MicroVolt	V
110	mV	MilliVolt	V
111	V	Volt	V
112	mV/%	MilliVoltPerPercent	V/%
113	V/%	VoltPerPercent	V/%
114	mV/pH	MilliVoltPerPH	V/pH
115	V/pH	VoltPerPH	V/pH
116	ml	MilliLiter	m^3
117	l	Liter	m^3
118	m^3	CubicMeter	m^3
119	inch	Inch	m
120	ft	Feet	m
121	yd	Yards	m
122	mi	Miles	m
123	in/s	InchPerSecond	m/s
124	inch/min	InchPerMinute	m/s
125	inch/h	InchPerHour	m/s
126	inch/d	InchPerDay	m/s
127	℉	Fahrenheit	℃
128	℉	DeltaFahrenheit	℃
129	gps	GallonPerSecond	m^3/s
130	cfs	CubicFeetPerSecond	m^3/s

Modbus unit code	Symbol	Name	Standard unit
131	mgs	MegaGallonPerSecond	m^3/s
132	gpm	GallonPerMinute	m^3/s
133	cfm	CubicFeetPerMinute	m^3/s
134	mgm	MegaGallonPerMinute	m^3/s
135	gph	GallonPerHour	m^3/s
136	cfh	CubicFeetPerHour	m^3/s
137	mgh	MegaGallonPerHour	m^3/s
138	gpd	GallonPerDay	m^3/s
139	cfd	CubicFeetPerDay	m^3/s
140	mgd	MegaGallonPerDay	m^3/s
141	gal	Gallons	m^3
142	cf	CubicFeet	m^3
143	mol/m^3	MolPerCubicMeter	mol/m^3
144	mol/l	MolPerLiter	mol/m^3
145	%TS	PerCentTS	kg/m^3
146	bar	Bar	Pa
147	nm	NanoMeter	m
148	m/s	MeterPerSecond	m/s
149	ft/s	FeetPerSecond	m/s
150	MByte	Megabytes	KByte
151	Byte	Bytes	KByte
152	GByte	Gigabytes	KByte
153	pA/(mg/l)	PicoAmperePerMilligramPerLiter	$A/(kg/m^3)$
154	kg/mol	KiloGramPerMol	kg/mol
155	g/mol	GramPerMol	kg/mol
156	FTU	Formazine_Turbidity_Unit	FNU
157	TE/F	Turbidity_Formazine	FNU
158	ASBC	American_Society_of_Brewing_Chemists	FNU
159	EBC	European_Brewing_Convention	FNU
160	å°¦	Dough	kg/m^3
161	mg/l	MilliGramPerLiterPercent	%
162	AU	AbsorbanceUnit	AU
163	%T	PercentTransmission	%T
164	OD	OpticalDensity	AU
165	ml/min	MilliLiterPerMinute	m^3/s
166	eq	Equivalent	eq
167	eq/m^3	EquivalentPerCubicMeter	eq/m^3
168	eq/l	EquivalentPerLiter	eq/m^3
169	eq/gal	EquivalentPerGallon	eq/m^3
170	˚C/s	CelsiusPerSecond	˚C/s
171	˚C/min	CelsiusPerMinute	˚C/s
172	FAU	FormazineAttenuationUnit	FNU
173	Ah	AmpereHours	As
174	m/h	MeterPerHour	m/s
175	1/Pa	PerPascal	1/Pa

Modbus unit code	Symbol	Name	Standard unit
176	1/hPa	PerHectoPascal	1/Pa
177	1/MPa	PerMegaPascal	1/Pa
254		Used defined textual unit	

7.2 Legacy unit handling (Software version 1.06.06 and older)

Measuring devices with software prior to version 1.06.07 supported only fixed units for measurement values.

Deviating units on the device's onsite display are automatically converted to the corresponding Modbus unit and the converted process value is transmitted.

Source of data	Selection	Fixed Unit	Info
Current input	Current	mA	
	Parameter	mA	
Binary input	PFM value	none	
Controller	Bipolar	none	
	Unipolar+	none	
	Unipolar-	none	
pH Glass	Raw value mV	mV	
	Temperature	°C/°F/K	depends on temperature unit setting
	pH	pH	
	Impedance glass	MOhm	
Oxygen (amp.)	Temperature	°C/°F/K	depends on temperature unit setting
	Raw value nA	mA	
	Partial pressure	hPa	
	Liquid concentration	mg/l	
	Saturation	%	
	Gas concentration	%Vol	
Oxygen (opt.)	Temperature	°C/°F/K	depends on temperature unit setting
	Partial pressure	hPa	
	Liquid concentration	mg/l	
	Saturation	%	
	Raw value µs	S	
	Gas concentration	%Vol	
pH ISFET	Raw value mV	mV	
	Temperature	°C/°F/K	depends on temperature unit setting
	pH	pH	
	Leak current	mA	
ORP	ORP mV	mV	
	ORP %	%	
	Temperature	°C	
Conduct.cond.	Temperature	°C/°F/K	depends on temperature unit setting
	Conductivity	mS/m	
	Resistance	Ωm	
	TDS	mg/l	

Source of data	Selection	Fixed Unit	Info
Conduct.cond. 4-pol	Temperature	°C/°F/K	depends on temperature unit setting
	Conductivity	mS/m	
	Resistance	Ωm	
	TDS	mg/l	
Induct.cond.	Temperature	°C/°F/K	depends on temperature unit setting
	Conductivity	mS/cm	
	Concentration	%	
	TDS	mg/l	
TU/TS	Turbidity FNU	FNU	
TU	Turbidity FNU	FNU	
Nitrate	Temperature	°C/°F/K	depends on temperature unit setting
	NO3	mg/l	
	NO3-N	mg/l	
SAC	Temperature	°C/°F/K	depends on temperature unit setting
	SAC	1/m	
	Transm.	%	
	Tr. 10mm	%	
	Absorption	none	
	COD	mg/l	
	TOC	mg/l	
	DOC	mg/l	
	BOD	mg/l	
ISE	Temperature	°C/°F/K	depends on temperature unit setting
	Raw value (1...4)	mV	
	Concentration (2...4)	mg/l	
	pH	pH	
	ORP mV	mV	
Ultrasonic interface	Interface	m	
Chlorine	Temperature	°C/°F/K	depends on temperature unit setting
	Sensor current	mA	
	Concentration	mg/l	
Photometer (CM44P)	Measurement value	User defined	CM44P only
	2nd meas. value	User defined	CM44P only
	Raw meas. current	mA	CM44P only
	Raw ref. current	mA	CM44P only
	Lamp current	mA	CM44P only
	Lamp voltage	mV	CM44P only
	Raw meas. value	User defined	CM44P only
	Raw 2nd meas. value	User defined	CM44P only
	Raw ref. value	User defined	CM44P only
	Reference value	User defined	CM44P only

7.3 Modbus register information

7.3.1 Numbering of Modbus-Registers

The numbering of the Modbus registers starts with 0 as it is transmitted over the wire. In case your PLC is using Modicon addressing you must add 1 to the addresses as provided in the following tables.

7.3.2 Liquiline CM44x, Liquistation CSFxx and Liquiline CA80xx

7.3.2.1 Identification (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9000	BUS_ADDRESS	UNSIGNED8	1	R	None	Modbus connection setting: bus address Factory default: 247
9001	DEVICE_TAG	OCTETSTRING32	32	R	None	Device description / TAG
9017	DEVICE_ID	UNSIGNED8	1	R	None	Device ID Selection: 0: Liquiline CM442 1: Liquiline CM448 2: Liquiport CSP44 3: Liquistation CSF48 4: Liquistation CSF22 5: Liquistation CSF33 6: Liquiline System CA80 7: Liquistation CSF34 8: Liquistation CSF39 9: Liquiline CM44P Factory default: 0

7.3.2.2 Process (Holding/Input, FC: 03, 16, 23, 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
0	MODBUS_AI_1_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
2	MODBUS_AI_1_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
3	MODBUS_AI_1_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
4	MODBUS_AI_2_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
6	MODBUS_AI_2_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
7	MODBUS_AI_2_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
8	MODBUS_AI_3_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
10	MODBUS_AI_3_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
11	MODBUS_AI_3_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
12	MODBUS_AI_4_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
14	MODBUS_AI_4_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
15	MODBUS_AI_4_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
16	MODBUS_AI_5_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
18	MODBUS_AI_5_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
19	MODBUS_AI_5_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
20	MODBUS_AI_6_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
22	MODBUS_AI_6_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
23	MODBUS_AI_6_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
24	MODBUS_AI_7_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
26	MODBUS_AI_7_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
27	MODBUS_AI_7_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
28	MODBUS_AI_8_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
30	MODBUS_AI_8_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
31	MODBUS_AI_8_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
32	MODBUS_AI_9_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
34	MODBUS_AI_9_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
35	MODBUS_AI_9_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
36	MODBUS_AI_10_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
38	MODBUS_AI_10_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
39	MODBUS_AI_10_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
40	MODBUS_AI_11_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
42	MODBUS_AI_11_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
43	MODBUS_AI_11_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
44	MODBUS_AI_12_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
46	MODBUS_AI_12_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
47	MODBUS_AI_12_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
48	MODBUS_AI_13_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
50	MODBUS_AI_13_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
51	MODBUS_AI_13_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
52	MODBUS_AI_14_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
54	MODBUS_AI_14_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
55	MODBUS_AI_14_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
56	MODBUS_AI_15_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
58	MODBUS_AI_15_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
59	MODBUS_AI_15_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
60	MODBUS_AI_16_VALUE	FLOAT	4	R	None	Analog process value from device to control system: value
62	MODBUS_AI_16_STATUS	UNSIGNED8	1	R	None	Analog process value from device to control system: state
63	MODBUS_AI_16_UNIT	UNSIGNED8	1	R	None	Analog process value from device to control system: unit
64	CURRENTOUT_01_PV_VALUE	FLOAT	4	R	None	Current output: process value
66	CURRENTOUT_01_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
67	CURRENTOUT_01_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
68	CURRENTOUT_02_PV_VALUE	FLOAT	4	R	None	Current output: process value
70	CURRENTOUT_02_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
71	CURRENTOUT_02_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
72	CURRENTOUT_03_PV_VALUE	FLOAT	4	R	None	Current output: process value
74	CURRENTOUT_03_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
75	CURRENTOUT_03_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
76	CURRENTOUT_04_PV_VALUE	FLOAT	4	R	None	Current output: process value
78	CURRENTOUT_04_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
79	CURRENTOUT_04_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
80	CURRENTOUT_05_PV_VALUE	FLOAT	4	R	None	Current output: process value
82	CURRENTOUT_05_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
83	CURRENTOUT_05_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
84	CURRENTOUT_06_PV_VALUE	FLOAT	4	R	None	Current output: process value
86	CURRENTOUT_06_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value

87	CURRENTOUT_06_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
88	CURRENTOUT_07_PV_VALUE	FLOAT	4	R	None	Current output: process value
90	CURRENTOUT_07_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
91	CURRENTOUT_07_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
92	CURRENTOUT_08_PV_VALUE	FLOAT	4	R	None	Current output: process value
94	CURRENTOUT_08_PV_STATUS	UNSIGNED8	1	R	None	Current output: state of process value
95	CURRENTOUT_08_PV_UNIT	UNSIGNED8	1	R	None	Current output: unit of process value
96	CURRENTOUT_01_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
98	CURRENTOUT_02_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
100	CURRENTOUT_03_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
102	CURRENTOUT_04_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
104	CURRENTOUT_05_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
106	CURRENTOUT_06_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
108	CURRENTOUT_07_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
110	CURRENTOUT_08_MA_VALUE	FLOAT	4	R	Ampere	Current output: current
112	MODBUS_DI_1_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
113	MODBUS_DI_1_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
114	MODBUS_DI_2_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
115	MODBUS_DI_2_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
116	MODBUS_DI_3_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
117	MODBUS_DI_3_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
118	MODBUS_DI_4_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
119	MODBUS_DI_4_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
120	MODBUS_DI_5_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
121	MODBUS_DI_5_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
122	MODBUS_DI_6_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
123	MODBUS_DI_6_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
124	MODBUS_DI_7_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
125	MODBUS_DI_7_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
126	MODBUS_DI_8_VALUE	UNSIGNED8	1	R	None	Discrete process value from device to control system: value
127	MODBUS_DI_8_STATUS	UNSIGNED8	1	R	None	Discrete process value from device to control system: state
250	MODBUS_DO_01_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
251	MODBUS_DO_01_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
252	MODBUS_DO_02_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
253	MODBUS_DO_02_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
254	MODBUS_DO_03_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
255	MODBUS_DO_03_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
256	MODBUS_DO_04_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
257	MODBUS_DO_04_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
258	MODBUS_DO_05_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
259	MODBUS_DO_05_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
260	MODBUS_DO_06_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
261	MODBUS_DO_06_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
262	MODBUS_DO_07_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
263	MODBUS_DO_07_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
264	MODBUS_DO_08_VALUE	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: value
265	MODBUS_DO_08_STATUS	UNSIGNED8	1	R/W	None	Discrete process value from control system to device: state
266	MODBUS_AO_01_VALUE	FLOAT	4	R/W	None	Analog process value from control system to device: value
268	MODBUS_AO_01_STATUS	UNSIGNED8	1	R/W	None	Analog process value from control system to device: state
269	MODBUS_AO_01_UNIT	UNSIGNED8	1	R/W	None	Analog process value from control system to device: unit
270	MODBUS_AO_02_VALUE	FLOAT	4	R/W	None	Analog process value from control system to device: value
272	MODBUS_AO_02_STATUS	UNSIGNED8	1	R/W	None	Analog process value from control system to device: state
273	MODBUS_AO_02_UNIT	UNSIGNED8	1	R/W	None	Analog process value from control system to device: unit
274	MODBUS_AO_03_VALUE	FLOAT	4	R/W	None	Analog process value from control system to device: value
276	MODBUS_AO_03_STATUS	UNSIGNED8	1	R/W	None	Analog process value from control system to device: state
277	MODBUS_AO_03_UNIT	UNSIGNED8	1	R/W	None	Analog process value from control system to device: unit
278	MODBUS_AO_04_VALUE	FLOAT	4	R/W	None	Analog process value from control system to device: value
280	MODBUS_AO_04_STATUS	UNSIGNED8	1	R/W	None	Analog process value from control system to device: state
281	MODBUS_AO_04_UNIT	UNSIGNED8	1	R/W	None	Analog process value from control system to device: unit

7.3.2.3 Diagnostics (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
500	MB_FC08_DIAGNOSE	UNSIGNED16	2	R	None	Content of Modbus function code FC08 (diagnostic) Factory default: 0
501	DEVICE_HIGHEST_PRIOR_DIAG_CODE	UNSIGNED16	2	R	None	Most important device-diagnosis: diagnosis code Factory default: 0
502	DEVICE_HIGHEST_PRIOR_DIAG_CHANNEL	UNSIGNED8	1	R	None	Most important device-diagnosis: channel ID (0=device) Factory default: 0
503	DEVICE_HIGHEST_PRIOR_DIAG_STATUS	UNSIGNED8	1	R	None	Most important device-diagnosis: status according to NAMUR NE107 Factory default: 0
504	DEVICE_CURRENT_DIAG_MODUL	UNSIGNED8	1	R	None	Most important device-related diagnosis: name of module Selection: 0: Slot 1 1: Slot 1 2: Slot 2 3: Slot 3 4: Slot 4 5: Slot 5 6: Slot 6 7: Slot 7 8: Sampler 9: Software 10: Analyzer Factory default: 0
505	DEVICE_CURRENT_DIAG_PORT	UNSIGNED8	1	R	None	Most important device-related diagnosis: connection ID Factory default: 0
506	DEVICE_CURRENT_DIAG_NE107_STATUS	UNSIGNED8	1	R	None	Most important device-related diagnosis: status according to NAMUR NE107 Factory default: 0
507	DEVICE_CURRENT_DIAG_CODE	UNSIGNED16	2	R	None	Most important device-related diagnosis: diagnosis code Factory default: 0
508	DEVICE_CURRENT_DIAG_TIMESTAMP	UNSIGNED32	4	R	None	Most important device-related diagnosis: time of diagnosis appearance Factory default: 0
510	DEVICE_NUMBER_ADDITIONAL_DIAG	UNSIGNED8	1	R	None	Number of additional device-related diagnosis messages Factory default: 0
511	DEVICE_PAST_DIAG_SOURCETYPE	UNSIGNED8	1	R	None	Past device-diagnosis: component Selection: 0: General 1: Temperature input 2: Binary input 3: Binary output 4: Current input 5: Current output 6: Relay 7: Memosens sensor 8: Controller 9: Cleaning 10: Limit switch 11: Mathematic function 12: Binary input module 13: Binary output module 14: Sample point Factory default: 0

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
512	DEVICE_PAST_DIAG_MODUL	UNSIGNED8	1	R	None	Past device-diagnosis: name of module Selection: 0: Slot 1 1: Slot 1 2: Slot 2 3: Slot 3 4: Slot 4 5: Slot 5 6: Slot 6 7: Slot 7 8: Sampler 9: Software 10: Analyzer Factory default: 0
513	DEVICE_PAST_DIAG_PORT	UNSIGNED8	1	R	None	Past device-diagnosis: port Factory default: 0
514	DEVICE_PAST_DIAG_NE107_STATUS	UNSIGNED8	1	R	None	Past device-diagnosis: status according to NAMUR NE107 Factory default: 0
515	DEVICE_PAST_DIAG_CODE	UNSIGNED16	2	R	None	Past device-diagnosis: diagnosis code Factory default: 0
516	DEVICE_PAST_DIAG_TIMESTAMP	UNSIGNED32	4	R	None	Past device-diagnosis: time of diagnosis appearance Factory default: 0
518	MODBUS_VALID_FRAMES	UNSIGNED32	4	R	None	Modbus statistics: Number of valid packets Factory default: 0
520	MODBUS_INVALID_FRAMES	UNSIGNED32	4	R	None	Modbus statistics: Number of invalid packets Factory default: 0
522	MODBUS_FRAMING_ERRORS	UNSIGNED32	4	R	None	Modbus statistics: Number of framing errors Factory default: 0
524	MODBUS_CRC_ERRORS	UNSIGNED32	4	R	None	Modbus statistics: Number of CRC errors Factory default: 0
526	MODBUS_PARITY_ERRORS	UNSIGNED32	4	R	None	Modbus statistics: Number of parity errors Factory default: 0
528	MODBUS_01_EXCEPTIONS	UNSIGNED32	4	R	None	Modbus statistics: Number of exception code 01 exceptions Factory default: 0
530	MODBUS_02_EXCEPTIONS	UNSIGNED32	4	R	None	Modbus statistics: Number of exception code 02 exceptions Factory default: 0
532	MODBUS_03_EXCEPTIONS	UNSIGNED32	4	R	None	Modbus statistics: Number of exception code 03 exceptions Factory default: 0
534	MODBUS_04_EXCEPTIONS	UNSIGNED32	4	R	None	Modbus statistics: Number of exception code 04 exceptions Factory default: 0
536	ETHERNET_RECEIVED_FRAMES	UNSIGNED32	4	R	None	Ethernet statistics: Number of received packets Factory default: 0
538	ETHERNET_SEND_FRAMES	UNSIGNED32	4	R	None	Ethernet statistics: Number of packets send Factory default: 0
540	ETHERNET_VALID_FRAMES	UNSIGNED32	4	R	None	Ethernet statistics: Number of valid packets Factory default: 0
542	ETHERNET_INVALID_FRAMES	UNSIGNED32	4	R	None	Ethernet statistics: Number of invalid packets Factory default: 0
544	ETHERNET_CRC_ERRORS	UNSIGNED32	4	R	None	Ethernet statistics: Number of CRC errors Factory default: 0

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
546	DEVICE_SW_VERSION	OCTETSTRING16	16	R	None	Software version of the device Factory default: 0
554	DEVICE_BOOTLOADER_VERSION	OCTETSTRING16	16	R	None	Software version of the bootloader Factory default: 0
562	DEVICE_SERIAL	OCTETSTRING32	32	R	None	Serial number of the device Factory default: 0
578	DISPLAY_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the device display Factory default: 0
594	BACKPLANE_SER_NUM	OCTETSTRING32	32	R	None	Serial of sub-rack Factory default: 0
610	POWER_SUPPLY_SER_NUM	OCTETSTRING32	32	R	None	Serial number of integrated power supply Factory default: 0
626	BASE_MODUL_SER_NUM	OCTETSTRING32	32	R	None	Serial of base module Factory default: 0
642	EXTENSION_MODUL_1_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
658	EXTENSION_MODUL_2_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
674	EXTENSION_MODUL_3_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
690	EXTENSION_MODUL_4_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
706	EXTENSION_MODUL_5_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
722	EXTENSION_MODUL_6_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
738	EXTENSION_MODUL_7_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
754	EXTENSION_MODUL_8_SER_NUM	OCTETSTRING32	32	R	None	Serial number of extension module Factory default: 0
770	SENSOR_1_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
786	SENSOR_2_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
802	SENSOR_3_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
818	SENSOR_4_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
834	SENSOR_5_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
850	SENSOR_6_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
866	SENSOR_7_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
882	SENSOR_8_SER_NUM	OCTETSTRING32	32	R	None	Serial number of the sensor Factory default: 0
898	FMSY1_MODUL_SER_NUM	OCTETSTRING32	32	R	None	Serial number of 'FXAB1' module Factory default: 0
941	RS485_TERMINATION_STATE	UNSIGNED8	1	R	None	State of Modbus termination Selection: 0: Off 1: On Factory default: 0
942	ETHERNET_MAC	OCTETSTRING6	6	R	None	MAC address of the device Factory default: 0
945	CLEANINGACTIONSTATE_1	UNSIGNED8	1	R	None	Current state of the cleaning program. Selection: 0: Off 1: Waiting 2: Waiting 3: Pre-rinse 4: Cleaning 5: Postrinsing 6: Failsafe

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						7: Manual mode 8: Waiting for execution Factory default: 0
946	CLEANINGACTIONSTATE_2	UNSIGNED8	1	R	None	Current state of the cleaning program. Selection: 0: Off 1: Waiting 2: Waiting 3: Pre-rinse 4: Cleaning 5: Postrinsing 6: Failsafe 7: Manual mode 8: Waiting for execution Factory default: 0
947	CLEANINGACTIONSTATE_3	UNSIGNED8	1	R	None	Current state of the cleaning program. Selection: 0: Off 1: Waiting 2: Waiting 3: Pre-rinse 4: Cleaning 5: Postrinsing 6: Failsafe 7: Manual mode 8: Waiting for execution Factory default: 0
948	CLEANINGACTIONSTATE_4	UNSIGNED8	1	R	None	Current state of the cleaning program. Selection: 0: Off 1: Waiting 2: Waiting 3: Pre-rinse 4: Cleaning 5: Postrinsing 6: Failsafe 7: Manual mode 8: Waiting for execution Factory default: 0
949	RTC_DATETIME	DATETIME	8	R	None	Current date and time
953	HEARTBEAT_DEVICE_STATUS	FLOAT	4	R	None	Heartbeat status device Factory default: 0.0
955	HEARTBEAT_DEVICE_HEALTH_CONDITION	FLOAT	4	R	Percent	Heartbeat health device Factory default: 0.0
957	MAINTENANCE_TIMER_VALUE	FLOAT	4	R	None	Heartbeat maintenance timer device Factory default: 0.0
959	HEARTBEAT_INDEX_DEVICE	FLOAT	4	R	None	Heartbeat index device Factory default: 0.0
965	KEY_PERF_INDICATOR_DEVICE_AVAILABILITY	FLOAT	4	R	Percent	(Operating time - Time in failure) / Operating time * 100 % Factory default: 100.0
967	KEY_PERF_INDICATOR_DEVICE_OPERATING_TIME	DATETIME	8	R	None	The operating time since reset
971	KEY_PERF_INDICATOR_DEVICE_TIME_IN_FAILURE	DATETIME	8	R	None	Operating time with NAMUR F status signal
975	KEY_PERF_INDICATOR_DEVICE_NUMBER_OF_FAILURES	UNSIGNED16	2	R	None	Number of failure diagnostic messages Factory default: 0
976	KEY_PERF_INDICATOR_DEVICE_MTBF	DATETIME	8	R	None	Mean time between failures
980	KEY_PERF_INDICATOR_DEVICE_MTTR	DATETIME	8	R	None	Mean time to repair

7.3.2.4 Configuration (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
500	TEMPERATURE_UNIT	UNSIGNED8	1	R/W	None	Temperature unit Factory default: 0
501	RS485_BAUDRATE	UNSIGNED8	1	R/W	None	Modbus setting: baud rate Selection: 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 115200 Factory default: 4
502	RS485_ADDRESS_MODE	UNSIGNED8	1	R/W	None	Modbus setting: address mode (1=Hardware, 0=Software) Factory default: false
503	RS485_PARITY	UNSIGNED8	1	R/W	None	Modbus setting: parity Selection: 0: Even (1 Stopbit) 1: Odd (1 Stopbit) 2: None (2 Stopbit) 3: None (1 Stopbit) Factory default: 0
504	RS485_ENABLE	UNSIGNED8	1	R/W	None	Activation of Modbus interface Selection: 0: Off 1: On Factory default: 1
505	MODBUS_MODE	UNSIGNED8	1	R/W	None	Modbus setting: operating mode Selection: 0: RTU 1: ASCII Factory default: 0
506	MODBUS_WATCHDOG	FLOAT	4	R/W	Seconds	Timeout for Modbus communication watchdog Factory default: 5.0
508	MODBUS_COMMAND	UNSIGNED8	1	R/W	None	Command for controlling Modbus statistics Selection: 0: No operation 1: Retransmit error counters 2: Reset error counters Factory default: 0
509	ETHERNET_ENABLE	UNSIGNED8	1	R/W	None	Activation of ethernet interface Selection: 0: Off 1: On Factory default: 1
510	ETHERNET_IP_ADDRESS	UNSIGNED32	4	R/W	None	Ethernet setting: IP address of the device Factory default: 0
512	ETHERNET_NETMASK	UNSIGNED32	4	R/W	None	Ethernet setting: Netmask Factory default: 4294967040
514	ETHERNET_GATEWAY	UNSIGNED32	4	R/W	None	Ethernet setting: IP address of the gateway Factory default: 0

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
516	ETHERNET_AUTONEGOTIATION	UNSIGNED8	1	R/W	None	Ethernet statistics: Link settings Selection: 0: Auto negotiation 1: 10MBps Half duplex 2: 10MBps Full duplex 3: 100MBps Half duplex 4: 100MBps Full duplex Factory default: 0
517	ETHERNET_COMMAND	UNSIGNED8	1	R/W	None	Command for controlling ethernet statistics Selection: 0: No operation 1: Retransmit error counters 2: Reset error counters Factory default: 0
518	DHCP_ENABLE	UNSIGNED8	1	R/W	None	Dynamic setting of device IP address (DHCP) Selection: 0: Off 1: On Factory default: 1
519	WEBSERVER_ENABLE	UNSIGNED8	1	R/W	None	Webserver activation Selection: 0: Off 1: On Factory default: 1
520	DEVICE_RESET	UNSIGNED16	2	R/W	None	Device reset Factory default: 0
521	MODBUS_BYTE_ORDER	UNSIGNED8	1	R/W	None	Setting of byte transmission sequence Selection: 0: 1-0-3-2 1: 0-1-2-3 2: 2-3-0-1 3: 3-2-1-0 Factory default: 0
600	DEVICE_TAG	OCTETSTRING32	32	R/W	None	Device description / TAG Factory default: EH_[*Product*]_[*Serial number*]
700	REGULATOR0_SETPOINT	FLOAT	4	R/W	None	Controller: set value for controller 0 Factory default: 0.0
702	REGULATOR0_P_PART	FLOAT	4	R/W	None	Controller: proportional band (Xp) for controller 0 Factory default: 10.0
704	REGULATOR0_I_PART	FLOAT	4	R/W	Seconds	Controller: reset time (Tn) for controller 0 Factory default: 0.0
706	REGULATOR0_D_PART	FLOAT	4	R/W	Seconds	Controller: rate time (Tv) for controller 0 Factory default: 0.0
708	REGULATOR1_SETPOINT	FLOAT	4	R/W	None	Controller: set value for controller 1 Factory default: 0.0
710	REGULATOR1_P_PART	FLOAT	4	R/W	None	Controller: proportional band (Xp) for controller 1 Factory default: 10.0
712	REGULATOR1_I_PART	FLOAT	4	R/W	Seconds	Controller: reset time (Tn) for controller 1 Factory default: 0.0
714	REGULATOR1_D_PART	FLOAT	4	R/W	Seconds	Controller: rate time (Tv) for controller 1 Factory default: 0.0
716	RTC_DATETIME_SET	DATETIME	8	R/W	None	Real-Time Clock Factory default: 2009-01-01T12:00:00

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
720	CONTROL_PANEL_LOCK	UNSIGNED8	1	R/W	None	no description Factory default: false
721	REGULATOR2_SETPOINT	FLOAT	4	R/W	None	Controller : set value for controller 2 Factory default: 0.0
723	REGULATOR2_P_PART	FLOAT	4	R/W	None	Controller: proportional band (Xp) for controller 2 Factory default: 10.0
725	REGULATOR2_I_PART	FLOAT	4	R/W	Seconds	Controller: reset time (Tn) for controller 2 Factory default: 0.0
727	REGULATOR2_D_PART	FLOAT	4	R/W	Seconds	Controller: rate time (Tv) for controller 2 Factory default: 0.0
729	REGULATOR3_SETPOINT	FLOAT	4	R/W	None	Controller : set value for controller 3 Factory default: 0.0
731	REGULATOR3_P_PART	FLOAT	4	R/W	None	Controller: proportional band (Xp) for controller 3 Factory default: 10.0
733	REGULATOR3_I_PART	FLOAT	4	R/W	Seconds	Controller: reset time (Tn) for controller 3 Factory default: 0.0
735	REGULATOR3_D_PART	FLOAT	4	R/W	Seconds	Controller: rate time (Tv) for controller 3 Factory default: 0.0

7.3.2.5 Sensor X (Input, FC: 04)

The X in the parameter list is a variable that describes the sensor number. See also the other Sensors respectively registers in the table below.

Sensor	Register	X =
Sensor 1	1000-1999	1
Sensor 2	2000-2999	2
Sensor 3	3000-3999	3
Sensor 4	4000-4999	4
Sensor 5	5000-5999	5
Sensor 6	6000-6999	6
Sensor 7	7000-7999	7
Sensor 8	8000-8999	8

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
X000	SENSOR_ENABLE_CH0	UNSIGNED8	1	R	None	Activation of sensor channel Selection: 0: On 1: Off Factory default: 0
X001	ACTIVE_SENSOR_TYPE_CH0	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None 1: Oxygen (amp.) 2: Oxygen (opt.) 3: pH Glass 4: pH Glass 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						13: Ultrasonic interface 14: Disinfection (CCS142D) 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt.) 21: TU 22: Inline photometer 23: TU/AU 24: Disinfection 25: Spectrometer 27: ORP Factory default: 0
X002	CONNECTED_SENSOR_TYPE_CH0	UNSIGNED8	1	R	None	Connected sensor type Selection: 0: None 1: Oxygen (amp.) 2: Oxygen (opt.) 3: pH Glass 4: pH Glass 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Disinfection (CCS142D) 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt.) 21: TU 22: Inline photometer 23: TU/AU 24: Disinfection 25: Spectrometer 27: ORP Factory default: 0
X003	SENSOR_TAG_CH0	OCTETSTRING32	32	R	None	Sensor description/TAG Factory default: 0
X019	SENSOR_SERIAL_CH0	OCTETSTRING16	16	R	None	Serial number of the sensor Factory default: 0
X027	SENSOR_HW_VERSION_CH0	OCTETSTRING16	16	R	None	Hardware version of connected sensor Factory default: 0
X035	SENSOR_SW_VERSION_CH0	OCTETSTRING16	16	R	None	Software version of connected sensor Factory default: 0
X043	SENSOR_MANUFACTURER_CH0	OCTETSTRING32	32	R	None	Manufacturer of the sensor Factory default: 0
X059	SENSOR_ORDERCODE_CH0	OCTETSTRING32	32	R	None	Order code of the sensor Factory default: 0
X075	SENSOR_MANUFACTURING_DATE_CH0	DATETIME	8	R	None	Manufacturing date of the sensor
X079	SENSOR_INITIAL_OPERATION_DATE_CH0	DATETIME	8	R	None	Initial-operation date of sensor
X083	SENSOR_EXTREME_SPECIFIC_MIN_CH0	FLOAT	4	R	None	Min. measured value Factory default: 0.0
X085	SENSOR_EXTREME_TEMP_MIN_CH0	FLOAT	4	R	Celsius	Min. measured temperature value Factory default: 0.0
X087	SENSOR_EXTREME_SPECIFIC_MAX_CH0	FLOAT	4	R	None	Max. measured value Factory default: 0.0
X089	SENSOR_EXTREME_TEMP_MAX_CH0	FLOAT	4	R	Celsius	Max. measured temperature value Factory default: 0.0

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
X091	SENSOR_CURRENT_DIAG_SOURCETYPE_CH0	UNSIGNED8	1	R	None	Current sensor-diagnosis: component Selection: 0: General 1: Temperature Input 2: Binary Input 3: Binary Output 4: Current Input 5: Current Output 6: Relay 7: Memosens Sensor 8: PID Controller 9: Cleaning 10: Limit switch 11: Binary formula result 12: Binary Input Module 13: Binary Output Module 14: Sample point Factory default: 0
X092	SENSOR_CURRENT_DIAG_MODUL_CH0	UNSIGNED8	1	R	None	Current sensor-diagnosis: name of module Selection: 0: Slot 1 1: Slot 1 2: Slot 2 3: Slot 3 4: Slot 4 5: Slot 5 6: Slot 6 7: Slot 7 8: Sampler 9: Software 10: Analyzer Factory default: 0
X093	SENSOR_CURRENT_DIAG_PORT_CH0	UNSIGNED8	1	R	None	Current sensor-diagnosis: port Factory default: 0
X094	SENSOR_CURRENT_DIAG_NE107_STATUS_CH0	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107 Factory default: 0
X095	SENSOR_CURRENT_DIAG_CODE_CH0	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code Factory default: 0
X096	SENSOR_CURRENT_DIAG_TIMESTAMP_CH0	UNSIGNED32	4	R	None	Current sensor-diagnosis: time of diagnosis appearance Factory default: 0
X098	SENSOR_NUMBER_ADDITIONAL_DIAG_CH0	UNSIGNED8	1	R	None	Number of additional active sensor diagnosis Factory default: 0
X099	SENSOR_PAST_DIAG_SOURCETYPE_CH0	UNSIGNED8	1	R	None	Past sensor-diagnosis : component Selection: 0: General 1: Temperature Input 2: Binary Input 3: Binary Output 4: Current Input 5: Current Output 6: Relay 7: Memosens Sensor 8: PID Controller 9: Cleaning 10: Limit switch 11: Binary formula result

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						12: Binary Input Module 13: Binary Output Module 14: Sample preparation Factory default: 0
X100	SENSOR_PAST_DIAG_MODUL_CH0	UNSIGNED8	1	R	None	Past sensor-diagnosis : name of module Selection: 0: Slot 1 1: Slot 1 2: Slot 2 3: Slot 3 4: Slot 4 5: Slot 5 6: Slot 6 7: Slot 7 8: Sampler 9: Software 10: Analyzer Factory default: 0
X101	SENSOR_PAST_DIAG_PORT_CH0	UNSIGNED8	1	R	None	Past sensor-diagnosis: port Factory default: 0
X102	SENSOR_PAST_DIAG_NE107_STATUS_CH0	UNSIGNED8	1	R	None	Past sensor-diagnosis: status according to NAMUR NE107 Factory default: 0
X103	SENSOR_PAST_DIAG_CODE_CH0	UNSIGNED16	2	R	None	Past sensor-diagnosis: diagnosis code Factory default: 0
X104	SENSOR_PAST_DIAG_TIMESTAMP_CH0	UNSIGNED32	4	R	None	Past sensor-diagnosis: time of diagnosis appearance Factory default: 0
X106	OP_TIME_TOTAL_CH0	FLOAT	4	R	Seconds	Operating hours of connected sensor Factory default: 0.0
X108	OP_TIME_ABOVE_SPEC_TEMP_CH0	FLOAT	4	R	Seconds	Operating hours above maximal operating temperature Factory default: 0.0
X110	OP_TIME_BELOW_SPEC_TEMP_CH0	FLOAT	4	R	Seconds	Operating hours below minimal operating temperature Factory default: 0.0
X112	OP_TIME_LAMP_LIFE_CH0	FLOAT	4	R	None	Operating hours of lamp, unit seconds [s] Factory default: 0.0
X114	OP_TIME_STERILISATIONS_CH0	UNSIGNED16	2	R	None	Number of sterilization cycles Factory default: 0
X115	OP_TIME_CIP_CYCLES_CH0	UNSIGNED16	2	R	None	Number of clean in place cycles Factory default: 0
X116	OP_TIME_CAP_CALIBRATIONS_CH0	UNSIGNED16	2	R	None	Number of sensor-cap calibrations Factory default: 0
X117	OP_TIME_CAP_CALIB_TIMER_CH0	FLOAT	4	R	Seconds	Calibration timer of sensor cap Factory default: 0.0
X119	OP_TIME_CAP_STERILISATIONS_CH0	UNSIGNED16	2	R	None	Number of sensor-cap sterilizations Factory default: 0
X120	OP_TIME_CAP_FILTER_CHANGED_CH0	FLOAT	4	R	Seconds	Number of filter changes Factory default: 0.0
X122	CAL_COUNT_0_CH0	UNSIGNED16	2	R	None	Number of calibrations Factory default: 0
X123	CAL_COUNT_1_CH0	UNSIGNED16	2	R	None	Number of calibrations, 2nd parameter of multiparameter sensor Factory default: 0
X124	CAL_COUNT_2_CH0	UNSIGNED16	2	R	None	Number of calibrations, 3rd parameter of multiparameter

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						sensor Factory default: 0
X125	CAL_COUNT_3_CH0	UNSIGNED16	2	R	None	Number of calibrations, 4th parameter of multiparameter sensor Factory default: 0
X126	CAL_DATETIME_0_CH0	DATETIME	8	R	None	Time stamp of last calibration
X130	CAL_DATETIME_1_CH0	DATETIME	8	R	None	Time stamp of last calibration, 2nd parameter of multiparameter sensor
X134	CAL_DATETIME_2_CH0	DATETIME	8	R	None	Time stamp of last calibration, 3rd parameter of multiparameter sensor
X138	CAL_DATETIME_3_CH0	DATETIME	8	R	None	Time stamp of last calibration, 4th parameter of multiparameter sensor
X142	CAL_METHOD_0_CH0	UNSIGNED8	1	R	None	Calibration method of last calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X143	CAL_METHOD_1_CH0	UNSIGNED8	1	R	None	Calibration method of last calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X144	CAL_METHOD_2_CH0	UNSIGNED8	1	R	None	Calibration method of last calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X145	CAL_METHOD_3_CH0	UNSIGNED8	1	R	None	Calibration method of last calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X146	CAL_COUNT_ZERO_CH0	UNSIGNED16	2	R	None	Number of zero-point calibrations Factory default: 0
X147	CAL_DATETIME_ZERO_CH0	DATETIME	8	R	None	Time stamp of last zero-point calibration
X151	CAL_METHOD_ZERO_CH0	UNSIGNED8	1	R	None	Calibration method of last zero point calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 2-point 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X152	CAL_COUNT_TEMP_CH0	UNSIGNED16	2	R	None	Number of temperature calibrations Factory default: 0
X153	CAL_DATETIME_TEMP_CH0	DATETIME	8	R	None	Time stamp of last temperature calibration

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
X157	CAL_METHOD_TEMP_CH0	UNSIGNED8	1	R	None	Calibration method of last temperature calibration Selection: 0: None 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 6: Grab sample 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. Reference 26: Int. Reference 27: in water 28: in air Factory default: 0
X158	HEARTBEAT_SENSOR_STATUS_CH0	FLOAT	4	R	Percent	Heartbeat status sensor
X160	HEARTBEAT_SENSOR_HEALTH_CONDITION_CH0	FLOAT	4	R	Percent	Heartbeat health sensor
X162	MAINTENANCE_TIMER_VALUE_CH0	FLOAT	4	R	Percent	Heartbeat maintenance timer sensor
X164	HEARTBEAT_INDEX_SENSOR_CH0	FLOAT	4	R	Percent	Heartbeat index sensor
x166	KEY_PERF_INDICATOR_SENSOR_AVAILABILITY_CH1	FLOAT	4	R	Percent	(Operating time - Time in failure) / Operating time * 100 % Factory default: 100.0
x168	KEY_PERF_INDICATOR_SENSOR_OPERATING_TIME_CH1	DATETIME	8	R	None	The total operating time since commissioning
x172	KEY_PERF_INDICATOR_SENSOR_TIME_IN_FAILURE_CH1	DATETIME	8	R	None	Operating time with NAMUR F status signal
x176	KEY_PERF_INDICATOR_SENSOR_NUMBER_OF_FAILURES_CH1	UNSIGNED16	2	R	None	Number of failure diagnostic messages Factory default: 0
x177	KEY_PERF_INDICATOR_SENSOR_MTBF_CH1	DATETIME	8	R	None	Mean time between failures
x181	KEY_PERF_INDICATOR_SENSOR_MTTR_CH1	DATETIME	8	R	None	Mean time to repair
x185	KEY_PERF_INDICATOR_SENSOR_TIME_IN_CALIBRATION_CH1	DATETIME	8	R	None	Operating time with calibration status
x189	KEY_PERF_INDICATOR_SENSOR_NUMBER_OF_CALIBRATIONS_CH1	UNSIGNED16	2	R	None	Number of calibrations and/or adjust-ments Factory default: 0
x190	KEY_PERF_INDICATOR_SENSOR_MTBC_CH1	DATETIME	8	R	None	Mean time between calibrations

7.3.2.6 Sensor X Setup (Holding, FC: 03, 16, 23)

The X in the parameter list is a variable that describes the sensor number. See also the other Sensors respectively registers in the table below.

Sensor	Register	X =
Sensor 1	1000-1999	1
Sensor 2	2000-2999	2
Sensor 3	3000-3999	3
Sensor 4	4000-4999	4
Sensor 5	5000-5999	5
Sensor 6	6000-6999	6
Sensor 7	7000-7999	7
Sensor 8	8000-8999	8

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
X000	SENSOR_SAC_SWITCHDATASET_CHX	UNSIGNED8	1	R/W	None	Dataset switch for SAK 0: Factory calib. 1: Dataset1 2: Dataset2 3: Dataset3 4: Dataset4 5: Dataset5 6: Dataset6 7: undefined Factory default: 0
X001	SENSOR_NITRATE_SWITCHDATASET_CHX	UNSIGNED8	1	R/W	None	Dataset switch for nitrate Selection: 0: Factory calib. 1: Dataset1 2: Dataset2 3: Dataset3 4: Dataset4 5: Dataset5 6: Dataset6 7: undefined Factory default: 0
X002	SENSOR_TURBIDITY_SWITCHDATASET_CHX	UNSIGNED8	1	R/W	None	Dataset switch for turbidity Selection: 0: Formazine 1: Kaolin 2: SiO2 3: TiO2 4: Excess sludge 5: Digested sludge 6: Activated sludge 7: Dataset1 8: Dataset2 9: Dataset3 10: Dataset4 11: Dataset5 13: Thin sludge 14: PSL 15: Diatomite 16: Dataset6 17: Absorbance 18: ThinSludge 19: EBC 20: Milk 21: Apha 22: EBCColor 23: OEM Dataset 1 24: OEM Dataset 2 25: OEM Dataset 3 26: OEM Dataset 4 27: OEM Dataset 5 28: OEM Dataset 6 29: Product loss 30: Sludge 31: Auto sludge 32: Dataset7 33: Dataset8 34: Sludge, general Factory default: 0

X003	SENSOR_INLINEPHOTOMETER_SWITCHDATASET_MC_CHX	UNSIGNED8	1	R/W	None	Dataset switch for Inline Photometer Selection: 0: Dataset 1 1: Dataset 2 2: Dataset 3 3: Dataset 4 4: Dataset Factory default: 0
X004	SENSOR_INLINEPHOTOMETER_SWITCHDATASET_RC_CHX	UNSIGNED8	1	R/W	None	Dataset switch for Inline Photometer Selection: 0: Dataset 1 1: Dataset 2 2: Dataset 3 3: Dataset 4 4: Dataset 5 Factory default: 0

7.3.3 Liquistation CSFxx

7.3.3.1 Sampler Info (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
1500	RUNNING_PROGRAM_NAME	OCTETSTRING16	16	R	None	Program name Factory default: 0
1508	PROGRAM_BOTTLE_POSITION	UNSIGNED8	1	R	None	Current bottle position Factory default: 0
1509	PROGRAM_SAMPLING_MODE	UNSIGNED8	1	R	None	Mode of sampling Selection: 0: Time paced CTCV 1: Flow paced VTCV 2: Time/flow paced CTVV 3: Single sample 4: Sampling table 5: External signal 6: Manual 7: %0V Factory default: 0
1510	DATETIME_NEXT_SAMPLING	DATETIME	8	R	None	Date and time of next sampling Factory default: 2000-01-01T00:00:00
1514	FLOW_NEXT_SAMPLING	FLOAT	4	R	None	Dosing volume of last sample taking Factory default: 0.0
1516	PROGRAM_NAME	OCTETSTRING16	16	R	None	Name of current active program Factory default: [Program]
1524	PROGRAM_STATE	UNSIGNED8	1	R	None	Program state Selection: 0: Inactive 1: Active 2: Pause 3: Waiting for pause Factory default: 0
1525	BOTTLE_CONFIGURATION	UNSIGNED8	1	R	None	Bottle assignment Selection: 0: 1x - PE Direct distribution 1: 2x - PE Direct distribution 2: 4x - PE Direct distribution 3: 4x - Glass Direct distribution 4: 12x - PE Direct distribution 5: 12x - PE/Glass Plate distribution 6: 24x - PE Direct distribution 7: 24x - PE/Glass Plate distribution 8: 6x+1x - PE/Glass Plate distribution 9: 6x+2x - PE+PE Plate distribution 10: 6x+2x - PE+Glass Plate distribution 11: 12x+1x - PE/Glass Plate distribution 12: 12x+2x - PE+PE Plate distribution 13: 12x+2x - PE+Glass Plate distribution 14: 12x+6x - PE Direct distribution 15: 12x+6x - PE/Glass Plate distribution 16: 4x - Glass Schott GLS80 Direct distribution Factory default: 0
1526	BOTTLE_VOLUME_LEFT	FLOAT	4	R	CubicMeter	Bottle volume Factory default: 0.03
1528	BOTTLE_VOLUME_RIGHT	FLOAT	4	R	CubicMeter	Bottle volume of the right bottle box Factory default: 0
1530	CURRENT_BOTTLE_FILL_LEVEL	FLOAT	4	R	CubicMeter	Liquid level of selected bottle Factory default: 0.0
1532	SAMPLING_TECHNIQUE	UNSIGNED8	1	R	None	Sampling mode

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						Selection: 0: Peristaltic 1: Vacuum 2: Inline Factory default: 0
1533	SAMPLING_VOLUME_VACUUM	FLOAT	4	R	CubicMeter	Dosing volume of vacuum- or inline-sampler Factory default: 0.0002
1535	LAST_SAMPLING_START_TIME	DATETIME	8	R	None	Start time of last sampling Factory default: 1970-01-01T00:00:00
1539	CAL_COUNT_DISTLEVER	UNSIGNED32	4	R	None	Number of distribution lever calibrations Factory default: 0
1541	CAL_DATETIME_DISTLEVER	DATETIME	8	R	None	Time stamp of last distribution lever calibration Factory default: 1970-01-01T00:00:00
1545	CAL_COUNT_PERISTVOLUME	UNSIGNED32	4	R	None	Number of peristaltic sampling volume calibrations Factory default: 0
1547	CAL_DATETIME_PERISTVOLUME	DATETIME	8	R	None	Time stamp of last peristaltic sampling volume calibration Factory default: 1970-01-01T00:00:00
1551	CAL_METHOD_PERISTVOLUME	UNSIGNED8	1	R	None	Calibration method of last peristaltic sampling volume calibration Selection: 0: None 1: 1-point calibration 2: 2-point calibration Factory default: 0
1552	CAL_COUNT_TEMP2	UNSIGNED32	4	R	None	Number of calibrations of temperature sensor 2 Factory default: 0
1554	CAL_DATETIME_TEMP2	DATETIME	8	R	None	Time stamp of last calibration of temperature sensor 2 Factory default: 1970-01-01T00:00:00
1558	CAL_COUNT_TEMP3	UNSIGNED32	4	R	None	Number of calibrations of temperature sensor 3 Factory default: 0
1560	CAL_DATETIME_TEMP3	DATETIME	8	R	None	Time stamp of last calibration of temperature sensor 3 Factory default: 1970-01-01T00:00:00

7.3.3.2 Sampler Setup (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
1500	SAMPLING_STATE	UNSIGNED8	1	R/W	None	Sampling progress Selection: 0: Waiting 1: Reference run 2: Dist. arm positioned 3: Purge process 4: Suction process 5: Medium detected 6: Dose process 7: sampling Ok 8: sampling nOk 9: Sampling delay 10: Sampling 11: Pre rinsing 12: Post rinsing 13: Launch bottle 14: Sample bottling 15: Emptying bottle 16: Rinsing bottle

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						17: Draining bottle Factory default: 0
1501	MAN_SAMPLING_VOLUME_PERIST	FLOAT	4	R/W	CubicMeter	Sample volume of manual sampling with peristaltic pump Factory default: 0.0001
1503	MAN_SAMPLING_BOTTLE_POS	UNSIGNED8	1	R/W	None	Manual sampling bottle position Selection: 0: Front 1: Bottle 1 2: Bottle 2 3: Bottle 3 4: Bottle 4 5: Bottle 5 6: Bottle 6 7: Bottle 7 8: Bottle 8 9: Bottle 9 10: Bottle 10 11: Bottle 11 12: Bottle 12 13: Bottle 13 14: Bottle 14 15: Bottle 15 16: Bottle 16 17: Bottle 17 18: Bottle 18 19: Bottle 19 20: Bottle 20 21: Bottle 21 22: Bottle 22 23: Bottle 23 24: Bottle 24 25: Back Factory default: 0
1504	MAN_SAMPLING_COMMAND	UNSIGNED8	1	R/W	None	Manual sampling command Selection: 0: None 1: Start 2: Stop Factory default: 0
1505	MAN_SAMPLING_PARK_POS	UNSIGNED8	1	R/W	None	Distribution arm park position Selection: 0: None 1: Back Factory default: 1

7.3.4 Liquiline CA80xx

7.3.4.1 Analyzer SP 1 Info (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8500	ORDERCODE_SP1	OCTETSTRING32	32	R	None	Order code of sample preparation Factory default: 0
8516	ORDERCODE_EXT_SP1	OCTETSTRING32	32	R	None	Extended order code of sample preparation Factory default: 0
8532	SERIAL_SP1	OCTETSTRING16	16	R	None	Serial number of sample preparation Factory default: 0
8540	HW_VERSION_SP1	OCTETSTRING16	16	R	None	Hardware version of sample preparation Factory default: 0
8548	SW_VERSION_SP1	OCTETSTRING16	16	R	None	Software version of sample preparation Factory default: 0
8556	TYPE_SP1	OCTETSTRING16	16	R	None	Type of sample preparation Factory default: 0
8564	CONTROL_MODE_SP1	UNSIGNED8	1	R	None	Operating mode Selection: 0: Local control 1: Remote control Factory default: 1
8565	STATE_SP1	UNSIGNED8	1	R	None	Current state of sample preparation Selection: 0: Inactive 1: Sampling 2: Cleaning 3: Flush with air 4: Flush with cleaner 5: Flush filter 6: Flush with air 7: Flush with cleaner 8: Flush with air 9: Flush with cleaner 10: Cleaning up 11: Cleaning up 12: Cleaning up 13: Cleaning up 14: Flush with air 15: Flush with cleaner 16: Flush with air 17: Flush with cleaner 18: Flush filter 19: Sampling 20: Pump backward 21: Cleaning up Factory default: 0
8566	OP_TIME_FILTER_SP1	UNSIGNED32	4	R	None	Operating hours of sample preparation filter Factory default: 1970-01-01T00:00:00
8568	OP_TIME_HOSE_SP1	UNSIGNED32	4	R	None	Operating hours of sample preparation hose Factory default: 1970-01-01T00:00:00
8570	OP_TIME_MEMBRANEPUMP_SP1	UNSIGNED32	4	R	None	Operating hours of sample preparation membrane pump Factory default: 1970-01-01T00:00:00
8572	AMBIENT_TEMPERATURE_SP1	FLOAT	4	R	Celsius	Ambient temperature
8574	HOUSING_TEMPERATURE_SP1	FLOAT	4	R	Celsius	Cabinet temperature
8576	OPERATING_MODE_SP1	UNSIGNED8	1	R	None	Operating mode Selection: 0: Independent 1: Controlled Factory default: 1

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8577	SAMPLE_PREPARATION_TYPE_SP1	UNSIGNED8	1	R	None	Type of sample preparation Selection: 0: 3rd party 1: Inlet 2: Aeration/Outlet 3: Unknown Factory default: 0
8578	PRESSURIZED_AIR_AVAILABLE_SP1	UNSIGNED8	1	R	None	Pressurized air available Selection: 0: Available 1: Not available Factory default: 0
8579	PPSCLEANING_VALVE_INSTALLED_SP1	UNSIGNED8	1	R	None	Cleaning valve Selection: 0: Not available 1: Available Factory default: 0
8580	HOUSING_HEATING_AVAILABLE_SP1	UNSIGNED8	1	R	None	Cabinet heating Selection: 0: Available 1: Not available Factory default: 1
8581	FILTERTUBE_HEATING_AVAILABLE_SP1	UNSIGNED8	1	R	None	Hose heating filter Selection: 0: Available 1: Not available Factory default: 1
8582	ANALYZERTUBE_HEATING_AVAILABLE_SP1	UNSIGNED8	1	R	None	Hose heating analyzer Selection: 0: Available 1: Not available Factory default: 1
8583	AMBIENT_TEMPERATURE_SENSOR_AVAILABLE_SP1	UNSIGNED8	1	R	None	Ambient temperature sensor Selection: 0: Available 1: Not available Factory default: 1

7.3.4.2 Analyzer SP 1 setup (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8500	CLEANING_TRIGGER_SP1	UNSIGNED8	1	R/W	None	Start condition of first sample preparation cleaning Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 0
8501	CLEANING_STARTDATE_SP1	DATETIME	8	R/W	None	Date of first sample preparation cleaning Factory default: 1970-01-01T00:00:00

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8505	CLEANING_STARTTIME_SP1	DATETIME	8	R/W	None	Time of first sample preparation cleaning Factory default: 1970-01-01T00:00:00
8509	CLEANING_INTERVAL_SP1	UNSIGNED32	4	R/W	None	Interval for sample preparation cleaning Factory default: 1970-01-02T00:00:00
8511	CLEANING_DURATION_SP1	UNSIGNED32	4	R/W	None	Duration of sample preparation cleaning Factory default: 1970-01-01T00:01:00
8513	TRANSPORT_TIME_MAX_SP1	UNSIGNED32	4	R/W	None	Max. transport time of sample preparation Factory default: 1970-01-01T00:15:00
8515	HEATING_TUBE_SETPOINT_SP1	FLOAT	4	R/W	Celsius	Switch on temperature for sample preparation hose heating Factory default: 5.0
8517	HEATING_HOUSING_SETPOINT_SP1	FLOAT	4	R/W	Celsius	Switch on temperature for outlet sample preparation cabinet heating Factory default: 5.0
8519	HEATING_HOUSING_SETPOINT_INLET_SP1	FLOAT	4	R/W	Celsius	Switch on temperature for inlet sample preparation cabinet heating Factory default: 10.0
8521	FILTERCHANGE_WARNLEVEL_SP1	UNSIGNED32	4	R/W	None	Warn level for sample preparation filter change Factory default: 1970-03-02T00:00:00
8523	HOSECHANGE_WARNLEVEL_SP1	UNSIGNED32	4	R/W	None	Warn level for sample preparation hose change Factory default: 1970-03-02T00:00:00
8525	MEASUREMENT_ITERATIONS_SP1	UNSIGNED8	1	R/W	None	Number of consecutive measurements for one channel Factory default: 1
8526	FILTER_CHANGE_ACTIVATION_SP1	UNSIGNED8	1	R/W	None	Limit change filter Selection: 0: Off 1: On Factory default: 0
8527	HOSE_CHANGE_ACTIVATION_SP1	UNSIGNED8	1	R/W	None	Limit change hose Selection: 0: Off 1: On Factory default: 1
8528	TIMEOUT_SAMPLING_SP1	UNSIGNED32	4	R/W	None	Timeout no sample Factory default: 1970-01-01T00:05:00
8530	TIMEOUT_SAMPLING_PPS_SP1	UNSIGNED32	4	R/W	None	Timeout no sample (pressurized pipe) Factory default: 1970-01-01T00:01:00
8532	FILTER_AIRCLEANING_DURATION_SP1	FLOAT	4	R/W	Seconds	Filter air cleaning duration Factory default: 30.0
8534	FILTER_AIRCLEANING_INTERVAL_SP1	UNSIGNED32	4	R/W	None	Filter air cleaning interval Factory default: 1970-01-01T02:00:00
8536	FILTER_AIRCLEANING_MODE_SP1	UNSIGNED8	1	R/W	None	Filter air cleaning mode Selection: 0: On 1: Off Factory default: 0
8537	CLEANING_DETERGENT_RESIDENCE_TIME_SP1	UNSIGNED32	4	R/W	None	Cleaner residence time Factory default: 1970-01-01T00:01:00
8539	CLEANING_DISCARD_TIME_SP1	UNSIGNED32	4	R/W	None	Cleaning discard time Factory default: 1970-01-01T00:01:30
8541	CLEANING_DURATION_PPS_SP1	FLOAT	4	R/W	Seconds	Pressurized pipe cleaning duration Factory default: 10.0
8543	CLEANING_DISCARD_TIME_PPS_SP1	FLOAT	4	R/W	Seconds	Pressurized pipe cleaning discard time Factory default: 180.0
8545	CLEANING_TRIGGER_PPS_SP1	UNSIGNED8	1	R/W	None	Start condition of first pressurized pipe cleaning

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						Selection: 0: On 1: Date/time 2: Off Factory default: 0
8546	CLEANING_INTERVAL_PPS_SP1	UNSIGNED32	4	R/W	None	Interval for pressurized pipe cleaning Factory default: 1970-01-01T00:30:00

7.3.4.3 Analyzer SP 2 Info (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8700	ORDERCODE_SP2	OCTETSTRING32	32	R	None	Order code of sample preparation Factory default: 0
8716	ORDERCODE_EXT_SP2	OCTETSTRING32	32	R	None	Extended order code of sample preparation Factory default: 0
8732	SERIAL_SP2	OCTETSTRING16	16	R	None	Serial number of sample preparation Factory default: 0
8740	HW_VERSION_SP2	OCTETSTRING16	16	R	None	Hardware version of sample preparation Factory default: 0
8748	SW_VERSION_SP2	OCTETSTRING16	16	R	None	Software version of sample preparation Factory default: 0
8756	TYPE_SP2	OCTETSTRING16	16	R	None	Type of sample preparation Factory default: 0
8764	CONTROL_MODE_SP2	UNSIGNED8	1	R	None	Operating mode Selection: 0: Local control 1: Remote control Factory default: 1
8765	STATE_SP2	UNSIGNED8	1	R	None	Current state of sample preparation Selection: 0: Inactive 1: Sampling 2: Cleaning 3: Flush with air 4: Flush with cleaner 5: Flush filter 6: Flush with air 7: Flush with cleaner 8: Flush with air 9: Flush with cleaner 10: Cleaning up 11: Cleaning up 12: Cleaning up 13: Cleaning up 14: Flush with air 15: Flush with cleaner 16: Flush with air 17: Flush with cleaner 18: Flush filter 19: Sampling 20: Pump backward 21: Cleaning up Factory default: 0
8766	OP_TIME_FILTER_SP2	UNSIGNED32	4	R	None	Operating hours of sample preparation filter Factory default: 1970-01-01T00:00:00
8768	OP_TIME_HOSE_SP2	UNSIGNED32	4	R	None	Operating hours of sample preparation hose Factory default: 1970-01-01T00:00:00
8770	OP_TIME_MEMBRANEPUMP_SP2	UNSIGNED32	4	R	None	Operating hours of sample preparation membrane pump Factory default: 1970-01-01T00:00:00
8772	AMBIENT_TEMPERATURE_SP2	FLOAT	4	R	Celsius	Ambient temperature

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8774	HOUSING_TEMPERATURE_SP2	FLOAT	4	R	Celsius	Cabinet temperature
8776	OPERATING_MODE_SP2	UNSIGNED8	1	R	None	Operating mode Selection: 0: Independent 1: Controlled Factory default: 1
8777	SAMPLE_PREPARATION_TYPE_SP2	UNSIGNED8	1	R	None	Type of sample preparation Selection: 0: 3rd party 1: Inlet 2: Aeration/Outlet 3: Unknown Factory default: 0
8778	PRESSURIZED_AIR_AVAILABLE_SP 2	UNSIGNED8	1	R	None	Pressurized air available Selection: 0: Available 1: Not available Factory default: 0
8779	PPSCLEANING_VALVE_INSTALLED_ SP2	UNSIGNED8	1	R	None	Cleaning valve Selection: 0: Not available 1: Available Factory default: 0
8780	HOUSING_HEATING_AVAILABLE_S P2	UNSIGNED8	1	R	None	Cabinet heating Selection: 0: Available 1: Not available Factory default: 1
8781	FILTERTUBE_HEATING_AVAILABLE _SP2	UNSIGNED8	1	R	None	Hose heating filter Selection: 0: Available 1: Not available Factory default: 1
8782	ANALYZERTUBE_HEATING_AVAILA BLE_SP2	UNSIGNED8	1	R	None	Hose heating analyzer Selection: 0: Available 1: Not available Factory default: 1
8783	AMBIENT_TEMPERATURE_SENSOR _AVAILABLE_SP2	UNSIGNED8	1	R	None	Ambient temperature sensor Selection: 0: Available 1: Not available Factory default: 1

7.3.4.4 Analyzer SP 2 setup (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
8700	CLEANING_TRIGGER_SP2	UNSIGNED8	1	R/W	None	Start condition of first sample preparation cleaning Selection:

						0: Immediate 1: Date/time 2: Disabled Factory default: 0
8701	CLEANING_STARTDATE_SP2	DATETIME	8	R/W	None	Date of first sample preparation cleaning Factory default: 1970-01-01T00:00:00
8705	CLEANING_STARTTIME_SP2	DATETIME	8	R/W	None	Time of first sample preparation cleaning Factory default: 1970-01-01T00:00:00
8709	CLEANING_INTERVAL_SP2	UNSIGNED32	4	R/W	None	Interval for sample preparation cleaning Factory default: 1970-01-02T00:00:00
8711	CLEANING_DURATION_SP2	UNSIGNED32	4	R/W	None	Duration of sample preparation cleaning Factory default: 1970-01-01T00:01:00
8713	TRANSPORT_TIME_MAX_SP2	UNSIGNED32	4	R/W	None	Max. transport time of sample preparation Factory default: 1970-01-01T00:15:00
8715	HEATING_TUBE_SETPOINT_SP2	FLOAT	4	R/W	Celsius	Switch on temperature for sample preparation hose heating Factory default: 5.0
8717	HEATING_HOUSING_SETPOINT_SP2	FLOAT	4	R/W	Celsius	Switch on temperature for outlet sample preparation cabinet heating Factory default: 5.0
8719	HEATING_HOUSING_SETPOINT_INLET_SP2	FLOAT	4	R/W	Celsius	Switch on temperature for inlet sample preparation cabinet heating Factory default: 10.0
8721	FILTERCHANGE_WARNLEVEL_SP2	UNSIGNED32	4	R/W	None	Warn level for sample preparation filter change Factory default: 1970-03-02T00:00:00
8723	HOSECHANGE_WARNLEVEL_SP2	UNSIGNED32	4	R/W	None	Warn level for sample preparation hose change Factory default: 1970-03-02T00:00:00
8725	MEASUREMENT_ITERATIONS_SP2	UNSIGNED8	1	R/W	None	Number of consecutive measurements for one channel Factory default: 1
8726	FILTER_CHANGE_ACTIVATION_SP2	UNSIGNED8	1	R/W	None	Limit change filter Selection: 0: Off 1: On Factory default: 0
8727	HOSE_CHANGE_ACTIVATION_SP2	UNSIGNED8	1	R/W	None	Limit change hose Selection: 0: Off 1: On Factory default: 1
8728	TIMEOUT_SAMPLING_SP2	UNSIGNED32	4	R/W	None	Timeout no sample Factory default: 1970-01-01T00:05:00
8730	TIMEOUT_SAMPLING_PPS_SP2	UNSIGNED32	4	R/W	None	Timeout no sample (pressurized pipe) Factory default: 1970-01-01T00:01:00
8732	FILTER_AIRCLEANING_DURATION_SP2	FLOAT	4	R/W	Seconds	Filter air cleaning duration Factory default: 30.0
8734	FILTER_AIRCLEANING_INTERVAL_SP2	UNSIGNED32	4	R/W	None	Filter air cleaning interval Factory default: 1970-01-01T02:00:00
8736	FILTER_AIRCLEANING_MODE_SP2	UNSIGNED8	1	R/W	None	Filter air cleaning mode Selection: 0: On 1: Off Factory default: 0
8737	CLEANING_DETERGENT_RESIDENCE_TIME_SP2	UNSIGNED32	4	R/W	None	Cleaner residence time Factory default: 1970-01-01T00:01:00
8739	CLEANING_DISCARD_TIME_SP2	UNSIGNED32	4	R/W	None	Cleaning discard time Factory default: 1970-01-01T00:01:30
8741	CLEANING_DURATION_PPS_SP2	FLOAT	4	R/W	Seconds	Pressurized pipe cleaning duration Factory default: 10.0
8743	CLEANING_DISCARD_TIME_PPS_SP2	FLOAT	4	R/W	Seconds	Pressurized pipe cleaning discard time Factory default: 180.0

8745	CLEANING_TRIGGER_PPS_SP2	UNSIGNED8	1	R/W	None	Start condition of first pressurized pipe cleaning Selection: 0: On 1: Date/time 2: Off Factory default: 0
8746	CLEANING_INTERVAL_PPS_SP2	UNSIGNED32	4	R/W	None	Interval for pressurized pipe cleaning Factory default: 1970-01-01T00:30:00

7.3.4.5 Analyzer Config (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9000	ORDERCODE_EXT_CURRENT	OCTETSTRING64	64	R/W	None	Current extended order code of the device Factory default: 0
9032	MEAS_VALUE_INDEX	UNSIGNED8	1	R/W	None	Index of selected measurement value in measurement value list Factory default: 0
9033	MEAS_VALUE_UNIT	UNSIGNED8	1	R/W	None	User selectable measurand unit Factory default: 1
9034	POWERFAIL_REACTION	UNSIGNED8	1	R/W	None	Power fail reaction Selection: 0: Last mode 1: Manual mode Factory default: 0
9035	CALIBRATION_RETRIES	UNSIGNED8	1	R/W	None	Number of retries in case of failed calibration Factory default: 2
9036	CALIBRATION_FACTOR	FLOAT	4	R	None	Calibration factor of the photometer Factory default: 1.00
9038	CALIBRATION_FACTOR_DELTA	FLOAT	4	R/W	Percent	Max. allowed deviation of calibration factor for calibration Factory default: 10
9040	CALIBRATION_FACTOR_MIN	FLOAT	4	R/W	None	Min. allowed calibration factor Factory default: 0.5
9042	CALIBRATION_FACTOR_MAX	FLOAT	4	R/W	None	Max. allowed calibration factor Factory default: 2.0
9044	CALIBRATION_CONCENTRATION	FLOAT	4	R/W	KiloGram PerCubic Meter	Concentration of the calibration standard Factory default: 0.0
9046	MEASUREMENT_OFFSET	FLOAT	4	R	KiloGram PerCubic Meter	Concentration offset for concentration value calculation Factory default: 0.0
9048	MEASUREMENT_DILUTION_FACTOR	FLOAT	4	R/W	None	Dilution factor for concentration value calculation Factory default: 1.0
9050	CALIBRATION_ZEROPOINT_DELTA	FLOAT	4	R/W	KiloGram PerCubic Meter	Max. allowed deviation of zero point for calibration Factory default: 0.0
9052	CALIBRATION_ZEROPOINT_MIN	FLOAT	4	R/W	KiloGram PerCubic Meter	Min. allowed calibration zero point Factory default: 0.0
9054	CALIBRATION_ZEROPOINT_MAX	FLOAT	4	R/W	KiloGram PerCubic Meter	Max. allowed calibration zero point Factory default: 0.0
9056	MULTIPLE_CALIBRATIONS_COUNT	UNSIGNED8	1	R/W	None	Calibration: Number determinations Factory default: 1
9057	MULTIPLE_MEASUREMENTS_COUNT	UNSIGNED8	1	R/W	None	Number measurements Factory default: 1
9058	SP_FOR_FIELDBUS_ACTIVITIES	UNSIGNED8	1	R/W	None	Sampling point for fieldbus activities Selection: 0: Sequence of measurements

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						1: SP1 2: SP2 3: SP3 4: SP4 5: SP5 6: SP6 Factory default: 0
9059	REF_INSPECT_CONCENTRATION	FLOAT	4	R/W	KiloGram PerCubic Meter	Concentration of standard solution for reference sample inspection, if present Factory default: 0

7.3.4.6 Analyzer Info (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9100	ANALYZER_ORDERCODE	OCTETSTRING64	64	R	None	Order code of the device Factory default: 0
9132	ANALYZER_ORDERCODE_EXT	OCTETSTRING64	64	R	None	Extended order code of the device Factory default: 0
9164	ANALYZER_ORDERCODE_EXT_CURRENT	OCTETSTRING64	64	R	None	Current extended order code of the device Factory default: 0
9196	ANALYZER_HW_VERSION	OCTETSTRING16	16	R	None	Hardware version of the device Factory default: 0
9204	ANALYZER_SW_VERSION	OCTETSTRING16	16	R	None	Software version of the device Factory default: 0
9212	ANALYZER_MODE	UNSIGNED8	1	R	None	Operation mode Selection: 0: Manual 1: Automatic 2: Fieldbus Factory default: 0
9213	ANALYZER_ACTIVITY	UNSIGNED8	1	R	None	Current activity Selection: 0: None 1: Measurement %0V 2: Calibration 3: Cleaning 4: --- 5: --- 6: Emptying SC 7: --- 8: --- 9: Empty hoses 10: Initializing 11: Cleaning up 12: Cleaning sample preparation 13: Dispenser replacem. 14: Dispenser replacem. 15: Testing liquidmanager actuator 16: Bottle insertion 17: Bottle removal 18: Open valves 19: Close valves 20: Rinse reagents 21: Rinse with water 22: Commissioning 23: Empty reactor 24: Empty dosing unit 25: Empty dilution module 26: Rinse analyzer 27: Reactor heating test 28: Reactor pressure test 29: Custom 30: Rinsing

						31: Rinsing 32: Rinsing 33: Rinsing 34: Preparing 35: Service function 1 36: Service function 2 37: Service function 3 38: Service function 4 39: Service function 5 40: Dispenser test 41: Dispenser test 42: Grab sample meas. Factory default: 0
9214	ANALYZER_ACTIVITY_TIME	UNSIGNED32	4	R	None	Remaining time of current activity
9216	ANALYZER_OP_TIME_FILTERMAT	FLOAT	4	R	Seconds	Operating time of filter mat Factory default: 0.0
9218	ANALYZER_OP_TIME_PELTIER	FLOAT	4	R	Seconds	Operating time of peltier element Factory default: 0.0
9220	ANALYZER_SAMPLE_COLLECTOR_TYPE	UNSIGNED8	1	R	None	Type of sample preparation Selection: 0: None 1: Conductive 2: Capacitive 3: Flow rate Factory default: 0
9221	ANALYZER_ACTIVE_SAMPLINGPOINT	UNSIGNED8	1	R	None	Active channel Selection: 0: SP1 1: SP2 2: SP3 3: SP4 4: SP5 5: SP6 6: None Factory default: 0
9222	ANALYZER_SP_INSTALLATION_TYPE	UNSIGNED8	1	R	None	SP Installation Type Selection: 0: Others 1: Pressurized pipe sampling Factory default: 0
9223	ANALYZER_MEAS_PARAM_ACTIVETEXT	OCTETSTRING32	32	R	None	Measuring parameter Factory default: 0
9239	CAL_COUNT	UNSIGNED32	4	R	None	Number of calibrations Factory default: 0
9241	CAL_DATETIME	DATETIME	8	R	None	Time stamp of last calibration Factory default: 1970-01-01T00:00:00
9245	CAL_METHOD	UNSIGNED8	1	R	None	Calibration method of last calibration Selection: 0: None 1: Zero point 2: Cal. factor 3: 2-point calibration 4: Application calibration 5: Numeric input zero point 6: Numeric input cal. factor 7: Numeric input appl. cal. Factory default: 0
9246	RAW_VALUE_OTS	FLOAT	4	R	None	Raw value
9248	RAW_VALUE_STATE_OTS	UNSIGNED8	1	R	None	Raw value state

9249	ZEROPOINT_CAL	FLOAT	4	R	KiloGramPerCubicMeter	Zero point Factory default: 0.0
9251	ZEROPOINT_CAL_DATE	UNSIGNED32	4	R	None	Date of last zero-point calibration
9253	CALIBRATION_FACTOR	FLOAT	4	R	None	Calibration factor of the photometer Factory default: 1.00
9255	CALIBRATION_FACTOR_DATE	UNSIGNED32	4	R	None	Date of last calibration factor determination
9257	APPLICATION_CAL_ACTIVE	UNSIGNED8	1	R	None	Application calibration active Factory default: 0
9258	INTERNAL_DILUTION	UNSIGNED8	1	R	None	Internal dilution factor Factory default: 1
9259	EXTERNAL_SAMPLE_DILUTION	FLOAT	4	R	None	External dilution factor Factory default: 1.0
9261	CONCENTRATION_OFFSET	FLOAT	4	R	KiloGramPerCubicMeter	Offset Factory default: 0.0
9263	SP1_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP1: Measured value
9265	SP1_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP1: Measured value state
9266	SP1_MEAS_DATE	UNSIGNED32	4	R	None	SP1: Date of last measured value Factory default: 1970-01-01T00:00:00
9268	SP1_MEAS_TIME	UNSIGNED32	4	R	None	SP1: Time of last measured value Factory default: 1970-01-01T00:00:00
9270	SP2_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP2: Measured value
9272	SP2_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP2: Measured value state
9273	SP2_MEAS_DATE	UNSIGNED32	4	R	None	SP2: Date of last measured value Factory default: 1970-01-01T00:00:00
9275	SP2_MEAS_TIME	UNSIGNED32	4	R	None	SP2: Time of last measured value Factory default: 1970-01-01T00:00:00
9277	INFO_MEASRANGE_ACTIVETEXT	OCTETSTRING32	32	R	None	Measuring range Factory default: 0
9293	DIGESTION_TIME	UNSIGNED32	4	R	None	Digestion time
9295	DIGESTION_TEMPERATURE	FLOAT	4	R	Celsius	Digestion temperature Factory default: 0.0
9297	TURBID_SAMPLE_MODE	UNSIGNED8	1	R	None	Turbid sample mode Selection: 0: Off 1: On 2: Automatic Factory default: 1
9298	CALIBRATION_CONCENTRATION	FLOAT	4	R	KiloGramPerCubicMeter	Concentration of the calibration standard Factory default: 0.0
9300	PROGRAM_CAL_TRIGGER	UNSIGNED8	1	R	None	Start condition for calibration Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 2

9301	PROGRAM_CAL_INTERVAL	UNSIGNED32	4	R	None	Interval for calibration Factory default: 1970-01-03T00:00:00
9303	PROGRAM_CLEAN_TRIGGER	UNSIGNED8	1	R	None	Start condition for cleaning Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 2
9304	PROGRAM_CLEAN_INTERVAL	UNSIGNED32	4	R	None	Interval for cleaning Factory default: 1970-01-03T00:00:00
9306	MULTIPLE_CALIBRATIONS_COUNT	UNSIGNED8	1	R	None	Calibration: Number determinations Factory default: 1
9307	MULTIPLE_MEASUREMENTS_COUNT	UNSIGNED8	1	R	None	Number measurements Factory default: 1
9308	BLANK_VALUE	FLOAT	4	R	None	Blank value Factory default: 0.0
9310	SAMPLE_VALUE	FLOAT	4	R	None	Sample value Factory default: 0.0
9312	SLOPE	FLOAT	4	R	KiloGramPerCubicMeter	Slope Factory default: 0.001
9314	SP1_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9316	SP2_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9318	SP3_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP3: Measured value
9320	SP3_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP3: Measured value state
9321	SP3_MEAS_DATE	UNSIGNED32	4	R	None	SP3: Date of last measured value Factory default: 1970-01-01T00:00:00
9323	SP3_MEAS_TIME	UNSIGNED32	4	R	None	SP3: Time of last measured value Factory default: 1970-01-01T00:00:00
9325	SP3_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9327	SP4_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP4: Measured value
9329	SP4_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP4: Measured value state
9330	SP4_MEAS_DATE	UNSIGNED32	4	R	None	SP4: Date of last measured value Factory default: 1970-01-01T00:00:00
9332	SP4_MEAS_TIME	UNSIGNED32	4	R	None	SP4: Time of last measured value Factory default: 1970-01-01T00:00:00
9334	SP4_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9336	SP5_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP5: Measured value
9338	SP5_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP5: Measured value state
9339	SP5_MEAS_DATE	UNSIGNED32	4	R	None	SP5: Date of last measured value Factory default: 1970-01-01T00:00:00
9341	SP5_MEAS_TIME	UNSIGNED32	4	R	None	SP5: Time of last measured value Factory default: 1970-01-01T00:00:00

9343	SP5_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9345	SP6_MEAS_VALUE	FLOAT	4	R	KiloGramPerCubicMeter	SP6: Measured value
9347	SP6_MEAS_STATE	UNSIGNED8	1	R	KiloGramPerCubicMeter	SP6: Measured value state
9348	SP6_MEAS_DATE	UNSIGNED32	4	R	None	SP6: Date of last measured value Factory default: 1970-01-01T00:00:00
9350	SP6_MEAS_TIME	UNSIGNED32	4	R	None	SP6: Time of last measured value Factory default: 1970-01-01T00:00:00
9352	SP6_TIME_OF_SAMPLE	UNSIGNED32	4	R	None	no description Factory default: 1970-01-01T00:00:00
9354	ZEROPOINT_CAL_TIME_UTC0	UNSIGNED32	4	R	None	Date of last zero-point calibration
9356	CALIBRATION_FACTOR_TIME_UTC0	UNSIGNED32	4	R	None	Date of last calibration factor determination
9358	SP1_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9360	SP1_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9362	SP2_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP2: Time of last measured value
9364	SP2_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9366	SP3_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP3: Time of last measured value
9368	SP3_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9370	SP4_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP4: Time of last measured value
9372	SP4_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9374	SP5_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP5: Time of last measured value
9376	SP5_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9378	SP6_MEAS_TIME_UTC0	UNSIGNED32	4	R	None	SP6: Time of last measured value
9380	SP6_TIME_OF_SAMPLE_UTC0	UNSIGNED32	4	R	None	SP1: Time of last measured value
9382	LAST_INSPECT_STATUS	UNSIGNED8	1	R	None	Result status of reference sample inspection: 0 = Fail, 1 = Pass, 2=NoResult, 3 = Disabled Selection: 0: Failed 1: Passed 2: No previous result 3: Disabled Factory default: 2
9383	LAST_INSPECT_NOMINAL_VALUE	Float	4	R	None	Nominal concentration of standard solution Factory default: 0.0
9385	LAST_INSPECT_MEAS_VALUE	Float	4	R	None	Actual measured concentration
9387	LAST_INSPECT_TIME	UNSIGNED32	4	R	None	Local time of last reference sample inspection Factory default: 1970-01-01T00:00:00
9389	LAST_INSPECT_TIME_UTC0	UNSIGNED32	4	R	None	UTC time of last reference sample inspection Factory default: 1970-01-01T00:00:00
9391	SP1_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP1 according to HJ 212, table 8. ASCII encoded character values, in order of increasing severity: 78 (“N”): Analyzer works normally 77 (“M”): Analyzer is in manual mode for maintenance 84 (“T”): Sample exceeds upper measurement limit 67 (“C”): Analyzer calibration is running 83 (“S”): Simulated output value (e.g. “HOLD” mode) 68 (“D”): Analyzer fault, manual maintenance required

						Factory default: 78
9392	SP2_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP2 according to HJ 212, table 8. Factory default: 78
9393	SP3_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP2 according to HJ 212, table 8. Factory default: 78
9394	SP4_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP2 according to HJ 212, table 8. Factory default: 78
9395	SP5_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP2 according to HJ 212, table 8. Factory default: 78
9396	SP6_DATA_FLAG	UNSIGNED8	1	R	None	Data flag for SP2 according to HJ 212, table 8. Factory default: 78
9397	TURBID_CORRECTION_FACTOR	Float	4	R	None	Turbidity compensation Factory default: 0.0

7.3.4.7 Analyzer Program (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9200	PROGRAM_MEAS_TRIGGER	UNSIGNED8	1	R/W	None	Start condition for measurement Selection: 0: Immediate 1: Date/time 2: Continuous Factory default: 0
9201	PROGRAM_MEAS_START_DATE	DATETIME	8	R/W	None	Start of first measurement: date Factory default: 1970-01-01T00:00:00
9205	PROGRAM_MEAS_START_TIME	DATETIME	8	R/W	None	Start of first measurement: time Factory default: 1970-01-01T00:00:00
9209	PROGRAM_MEAS_INTERVAL	UNSIGNED32	4	R/W	None	Interval for measurement Factory default: 1970-01-01T00:30:00
9211	PROGRAM_CAL_TRIGGER	UNSIGNED8	1	R/W	None	Start condition for calibration Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 2
9212	PROGRAM_CAL_START_DATE	DATETIME	8	R/W	None	Start of first calibration: date Factory default: 1970-01-01T00:00:00
9216	PROGRAM_CAL_START_TIME	DATETIME	8	R/W	None	Start of first calibration: time Factory default: 1970-01-01T00:00:00
9220	PROGRAM_CAL_INTERVAL	UNSIGNED32	4	R/W	None	Interval for calibration Factory default: 1970-01-03T00:00:00
9222	PROGRAM_CLEAN_TRIGGER	UNSIGNED8	1	R/W	None	Start condition for cleaning Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 2
9223	PROGRAM_CLEAN_START_DATE	DATETIME	8	R/W	None	Start of first cleaning: date Factory default: 1970-01-01T00:00:00
9227	PROGRAM_CLEAN_START_TIME	DATETIME	8	R/W	None	Start of first cleaning: time Factory default: 1970-01-01T00:00:00
9231	PROGRAM_CLEAN_INTERVAL	UNSIGNED32	4	R/W	None	Interval for cleaning Factory default: 1970-01-03T00:00:00
9233	PROGRAM_INSPECT_TRIGGER	UNSIGNED8	1	R/W	None	Start condition for automatic reference sample inspection: 0 = Immediate, 1 = Date/time, 2 = Disabled Selection: 0: Immediate 1: Date/time 2: Disabled Factory default: 2
9234	PROGRAM_INSPECT_START_DATE	DATETIME	8	R/W	None	Start of first reference inspection (Date) Factory default: 1970-01-01T00:00:00
9238	PROGRAM_INSPECT_START_TIME	DATETIME	8	R/W	None	Start of first reference inspection (Time) Factory default: 1970-01-01T00:00:00
9242	PROGRAM_INSPECT_INTERVAL	UNSIGNED32	4	R/W	None	Interval for reference inspection Factory default: 1970-01-01T00:00:00

7.3.4.8 Analyzer Manual actions (Holding, FC: 03, 16, 23)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9400	MODE_CHANGE_REQUEST	UNSIGNED8	1	R/W	None	Mode change request

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
						Selection: 0: None 1: Enter fieldbus mode 2: Continue automatic mode 3: Restart automatic mode Factory default: 0
9401	ABORT_ACTION_REQUEST	UNSIGNED8	1	R/W	None	Abort current activity Selection: 0: None 1: Abort current action Factory default: 0
9402	MANUAL_ACTION_REQUEST	UNSIGNED8	1	R/W	None	Manual activity request Selection: 0: None 1: Start measurement 2: Start calibration 3: Start cleaning Factory default: 0

7.3.4.9 Analyzer Photometer Info (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9600	PHOTOMETER_HW_VERSION	OCTETSTRING16	16	R	None	Hardware version of photometer Factory default: 0
9608	PHOTOMETER_SW_VERSION	OCTETSTRING16	16	R	None	Software version of photometer Factory default: 0
9616	PHOTOMETER_OP_TIME	FLOAT	4	R	Seconds	Operating hours of photometer Factory default: 0.0
9618	PHOTOMETER_TEMPERATURE	FLOAT	4	R	Celsius	Temperature of photometer cuvette Factory default: 25
9620	PHOTOMETER_RAW_MEAS_VALUE	FLOAT	4	R	None	Raw value of photometer

7.3.4.10 Analyzer Measurement data (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9700	DATA_MEAS_LISTSIZE	UNSIGNED8	1	R	None	Amount of available/selectable measurands Factory default: 0
9701	DATA_MEAS_LIST1	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9709	DATA_MEAS_LIST2	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9717	DATA_MEAS_LIST3	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9725	DATA_MEAS_LIST4	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9733	DATA_MEAS_LIST5	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9741	DATA_MEAS_LIST6	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9749	DATA_MEAS_LIST7	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9757	DATA_MEAS_LIST8	OCTETSTRING16	16	R	None	Descriptor of available/selectable measurand Factory default: 0
9765	DATA_MEASRANGE_ACTIVETEXT	OCTETSTRING32	32	R	None	Measuring range Factory default: 0
9781	DATA_AUTOMEASRANGECHANGE	UNSIGNED8	1	R	None	Automatic range switch Selection: 0: Manual 1: Automatic Factory default: 0

7.3.4.11 Analyzer manual actions state (Input, FC: 04)

Register	Parameter	Data Type	Bytes	R/W	Unit	Description
9900	MODE_CHANGE_STATE	UNSIGNED8	1	R	None	State of mode change request interface (0=ready) Factory default: 0
9901	ACTION_REQUEST_STATE	UNSIGNED8	1	R	None	Manual action request state. 0 = ready. Factory default: 0

7.3.5 Heartbeat Monitoring (requires activation code)

Without activation code these registers read back with the value 0.

The Heartbeat Monitoring registers are mapped to deliver additional status information about the sensor in addition to the parameters available in the standard registers. For each sensor channel and sensor type a register block is defined, which can be read with one Modbus request.

Each register block has a length of 200 registers. The following table contains that start register of each block depending on sensor channel and sensor type.

Channel	Sensor Type							
	pH	Conductivity	Disinfection	Oxygen	SAK	CUS	ISE	Nitrate
Sensor 1	10000	11600	13200	14800	16400	18000	19600	21200
Sensor 2	10200	11800	13400	15000	16600	18200	19800	21400
Sensor 3	10400	12000	13600	15200	16800	18400	20000	21600
Sensor 4	10600	12200	13800	15400	17000	18600	20200	21800
Sensor 5	10800	12400	14000	15600	17200	18800	20400	22000
Sensor 6	11000	12600	14200	15800	17400	19000	20600	22200
Sensor 7	11200	12800	14400	16000	17600	19200	20800	22400
Sensor 8	11400	13000	14600	16200	17800	19400	21000	22600

The subsequent chapters contain the offset to add to the start register to read a specific parameter for a given sensor type.

The parameter
- Heartbeat_sensor_status
- Heartbeat_sensor_health
- Maintenance_timer (hours until next recommended maintenance)

for each sensor can be mapped individually to any AI device variable. Via Modbus they can be read out at the registers of the AI device variables.

7.3.5.1 Sensor pH (Input, FC: 04)

Offset	Data Type	Bytes	R/W	Unit	Description
0	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
4	DATETIME	8	R	None	Manufacturing date of the sensor
8	DATETIME	8	R	None	Initial-operation date of sensor
12	DATETIME	8	R	None	Date of the last successful calibration of the sensor
16	FLOAT	4	R	None	Slope
18	FLOAT	4	R	None	Difference of slope between current and last calibration
20	FLOAT	4	R	None	Zero point
22	FLOAT	4	R	None	Difference of zero point between current and last calibration
24	FLOAT	4	R	Ohm	Glass impedance
26	FLOAT	4	R	Ohm	Reference impedance
28	FLOAT	4	R	DeltaCelsius	Temperature offset
30	FLOAT	4	R	Ampere	Leakage current
32	FLOAT	4	R	None	Min. measured value
34	FLOAT	4	R	Celsius	Min. measured temperature value
36	FLOAT	4	R	None	Max. measured value
38	FLOAT	4	R	Celsius	Max. measured temperature value
40	FLOAT	4	R	Seconds	Operating hours of connected sensor
42	FLOAT	4	R	Seconds	Operating time >80°C
44	FLOAT	4	R	Seconds	Operating time >100°C
46	FLOAT	4	R	Seconds	Operating time <-300mV (pH)
48	FLOAT	4	R	Seconds	Operating time >300mV (pH)
50	UNSIGNED16	2	R	None	Number of sterilization cycles
51	UNSIGNED16	2	R	None	Number of clean in place cycles
52	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
53	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
54	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
55	FLOAT	4	R	None	Temperature slope (2-point temp. calibration)
57	FLOAT	4	R	None	The pH value of buffer 1
59	FLOAT	4	R	None	The pH value of buffer 2

Offset	Data Type	Bytes	R/W	Unit	Description
61	FLOAT	4	R	None	The pH value of buffer 3

7.3.5.2 Sensor Conductivity (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
4	DATETIME	8	R	None	Manufacturing date of the sensor
8	DATETIME	8	R	None	Initial-operation date of sensor
12	DATETIME	8	R	None	Date of the last successful slope calibration of the sensor
16	FLOAT	4	R	None	Cell constant
18	FLOAT	4	R	None	Difference of cell constant between current and last calibration
20	FLOAT	4	R	DeltaCelsius	Temperature offset
22	FLOAT	4	R	None	Min. measured value
24	FLOAT	4	R	Celsius	Min. measured temperature value
26	FLOAT	4	R	None	Max. measured value
28	FLOAT	4	R	Celsius	Max. measured temperature value
30	FLOAT	4	R	Seconds	Operating hours of connected sensor
32	FLOAT	4	R	Seconds	Raw value
34	FLOAT	4	R	Seconds	Operating time >80°C
36	FLOAT	4	R	Seconds	Operating time >100°C (Cond 4pol)
38	FLOAT	4	R	Seconds	Operating time >120°C (cond.)
40	FLOAT	4	R	Seconds	Operating time >125°C (ind.)
42	FLOAT	4	R	Seconds	Operating time >140°C (Cond 2pol)
44	FLOAT	4	R	Seconds	Operating time >150°C (Cond i, Cond 4pol)
46	FLOAT	4	R	Seconds	Operating time <100nS (cond.)
48	UNSIGNED16	2	R	None	Number of sterilization cycles
49	UNSIGNED16	2	R	None	Number of clean in place cycles
50	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
51	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
52	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer

7.3.5.3 Sensor Disinfection (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
4	DATETIME	8	R	None	Manufacturing date of the sensor
8	DATETIME	8	R	None	Initial-operation date of sensor
12	DATETIME	8	R	None	Date of the last successful slope calibration of the sensor
16	DATETIME	8	R	None	Date of the last successful zero-point calibration of the sensor
20	FLOAT	4	R	None	Slope
22	FLOAT	4	R	None	Difference of slope between current and last calibration
24	FLOAT	4	R	None	Zero point

Register	Data Type	Bytes	R/W	Unit	Description
26	FLOAT	4	R	None	Difference of zero point between current and last calibration
28	FLOAT	4	R	DeltaCelsius	Temperature offset
30	FLOAT	4	R	AmpereSeconds	Charge (electrical)
32	FLOAT	4	R	None	Min. measured value
34	FLOAT	4	R	Celsius	Min. measured temperature value
36	FLOAT	4	R	None	Max. measured value
38	FLOAT	4	R	Celsius	Max. measured temperature value
40	FLOAT	4	R	Seconds	Operating hours of connected sensor
42	FLOAT	4	R	Seconds	Operating time >15°C
44	FLOAT	4	R	Seconds	Operating time >30°C
46	FLOAT	4	R	Seconds	Operating time <-20 nA
48	FLOAT	4	R	Seconds	Operating time <-100 nA
50	UNSIGNED16	2	R	None	Number of sensor-cap calibrations
51	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
52	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
53	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
54	UNSIGNED16	2	R	None	Number of calibrations
55	UNSIGNED16	2	R	None	Number of sterilizations
56	UNSIGNED16	2	R	None	Number of clean in place cycles
57	UNSIGNED16	2	R	None	Number of autoclavings
58	UNSIGNED8	1	R	None	Number of sterilization cycles for cap
59	UNSIGNED16	2	R	None	Number of clean in place cycles for cap
60	UNSIGNED16	2	R	None	Number of autoclavings for cap
61	FLOAT	4	R	AmpereSeconds	Electrolyte capacity
63	FLOAT	4	R	Seconds	Operating hours above a temperature of T3
65	FLOAT	4	R	Seconds	Cap operating hours of connected sensor
67	FLOAT	4	R	Seconds	Cap operating hours above a temperature of T1
69	FLOAT	4	R	Seconds	Cap operating hours above a temperature of T2
71	FLOAT	4	R	Seconds	Cap operating hours above a temperature of T3
73	FLOAT	4	R	Seconds	Cap operating hours raw value above T4
75	FLOAT	4	R	Seconds	Cap operating hours raw value above T5
77	UNSIGNED8	1	R	None	Sensor element
78	UNSIGNED8	1	R	None	Temperature threshold T1 for operating hours counter
79	UNSIGNED8	1	R	None	Temperature threshold T2 for operating hours counter
80	UNSIGNED8	1	R	None	Temperature threshold T3 for operating hours counter
81	FLOAT	4	R	Ampere	Current threshold T4 for operating hours counter
83	FLOAT	4	R	Ampere	Current threshold T5 for operating hours counter

7.3.5.4 Sensor Oxygen (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance

Register	Data Type	Bytes	R/W	Unit	Description
4	DATETIME	8	R	None	Manufacturing date of the sensor
8	DATETIME	8	R	None	Initial-operation date of sensor
12	DATETIME	8	R	None	Date of the last successful calibration of the sensor
16	DATETIME	8	R	None	Date of the last successful zero-point calibration of the sensor
20	FLOAT	4	R	None	Slope
22	FLOAT	4	R	None	Difference of slope between current and last calibration
24	FLOAT	4	R	None	Zero point
26	FLOAT	4	R	None	Difference of slope between current and last calibration
28	FLOAT	4	R	DeltaCelsius	Temperature offset
30	FLOAT	4	R	AmpereSeconds	Charge (electrical)
32	FLOAT	4	R	Celsius	Min. measured temperature value
34	FLOAT	4	R	Celsius	Max. measured temperature value
36	FLOAT	4	R	Seconds	Operating hours of connected sensor
38	FLOAT	4	R	Seconds	Operating time <5°C (COS61D, COS81D)
40	FLOAT	4	R	Seconds	Operating time >25°C (COS61D), >40°C (COS21D), >5°C(COS51D), >T1 (COS81D)
42	FLOAT	4	R	Seconds	Operating time >40°C (COS21D), >80°C (COS51D), >30°C (COS51D), >T2 (COS81D)
44	FLOAT	4	R	Seconds	Operating time >40°C (COS21D), >80°C (COS51D), >30°C (COS51D), >T2 (COS81D)
46	FLOAT	4	R	Seconds	Operating time >T3 (COS81D), >15nA (COS21D), > 30nA (COS51D)
48	FLOAT	4	R	Seconds	Operating time >T3 (COS81D), >15nA (COS21D), > 30nA (COS51D)
50	FLOAT	4	R	Seconds	Operating time >50nA (COS21D), > 160nA (COS51D), <5°C (COS21D), <="">
52	FLOAT	4	R	Seconds	Operating time >50nA (COS21D), > 160nA (COS51D), <5°C (COS21D), <="">
54	FLOAT	4	R	Seconds	Operating time <25µs (COS61D)
56	FLOAT	4	R	Seconds	Operating time >40µs (COS61D)
58	UNSIGNED16	2	R	None	Number of sterilization cycles
59	UNSIGNED16	2	R	None	Number of clean in place cycles
60	UNSIGNED16	2	R	None	Number of calibrations
61	UNSIGNED16	2	R	None	Number of sensor-cap calibrations
62	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
63	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
64	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
65	FLOAT	4	R	None	Normalized Ksv of point-at-oxygen calibration
67	FLOAT	4	R	None	Normalized Ksv of zero-point calibration
69	FLOAT	4	R	None	Normalized τ0 of point-at-oxygen calibration
71	FLOAT	4	R	None	Normalized τ0 of zero-point calibration
73	FLOAT	4	R	None	Calibration quality index of point-at-oxygen calibration
75	FLOAT	4	R	None	Calibration quality index of zero-point calibration
77	FLOAT	4	R	None	EIP_DO_CAL_SLOPE_ABS

Register	Data Type	Bytes	R/W	Unit	Description
79	FLOAT	4	R	None	EIP_DO_CAL_DELTA_SLOPE_ABS
81	FLOAT	4	R	None	Fermenter scaling factor
83	UNSIGNED8	1	R	None	Temperature threshold T1 for operating hours counter
84	UNSIGNED8	1	R	None	Temperature threshold T2 for operating hours counter
85	UNSIGNED8	1	R	None	Temperature threshold T3 for operating hours counter
86	UNSIGNED8	1	R	None	Temperature threshold T4 for operating hours counter
87	FLOAT	4	R	Seconds	Cap Operating hours of connected sensor
89	FLOAT	4	R	Seconds	Cap Operating hours above a temperature of T1
91	FLOAT	4	R	Seconds	Cap Operating hours above a temperature of T2
93	FLOAT	4	R	Seconds	Cap Operating hours above a temperature of T3
95	FLOAT	4	R	Seconds	Cap Operating hours below a temperature of T4
97	UNSIGNED16	2	R	None	Number of autoclavings
98	UNSIGNED16	2	R	None	Number of clean in place cycles for cap
99	UNSIGNED16	2	R	None	Number of autoclavings for cap
100	UNSIGNED8	1	R	None	Number of sterilisation cycles for cap
101	UNSIGNED8	1	R	None	Fermenter scaling active
102	DATETIME	8	R	None	Date and time of the last successful fermenter scaling
106	UNSIGNED16	2	R	None	Number of point-at-oxygen calibrations
107	UNSIGNED16	2	R	None	Number of zero-point calibrations
108	UNSIGNED8	1	R	None	Mode point-at-oxygen calibration
109	UNSIGNED8	1	R	None	Mode zero-point calibration

7.3.5.5 Sensor SAC (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	FLOAT	4	R	None	Calibration offset
2	FLOAT	4	R	PerMeter	ExtendedSAC
4	FLOAT	4	R	Celsius	Min. measured temperature value
6	FLOAT	4	R	Celsius	Max. measured temperature value
8	FLOAT	4	R	Seconds	Operating hours of connected sensor
10	FLOAT	4	R	Seconds	Operating time of filter
12	UNSIGNED32	4	R	None	Flash lamp counter
14	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
18	DATETIME	8	R	None	Manufacturing date of the sensor
22	DATETIME	8	R	None	Initial-operation date of sensor
26	DATETIME	8	R	None	Date of the last successful calibration of the sensor
30	UNSIGNED8	1	R	None	Dataset switch for SAK Selection: 0: Factory calib. (default) 1: Dataset1 2: Dataset2 3: Dataset3 4: Dataset4 5: Dataset5 6: Dataset6 7: undefined
31	UNSIGNED8	1	R	None	Calibration method Selection: 0: None (default) 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 7: Zero point 8: Slope air 9: Slope H2O 10: Slope variable 11: Zero point reference 12: Slope reference 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp

Register	Data Type	Bytes	R/W	Unit	Description
					17: Standard addition 18: Numeric input slope 19: Numeric input zero point 20: Numeric input 2-point 21: Factory calib. 22: Slope test gas 23: Value acquisition
32	UNSIGNED16	2	R	None	Number of calibrations
33	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
34	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
35	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
36	FLOAT	4	R	None	Raw value
38	FLOAT	4	R	None	Calibration factor

7.3.5.6 Sensor CUS (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	FLOAT	4	R	None	Calibration offset
2	FLOAT	4	R	Celsius	Min. measured temperature value
4	FLOAT	4	R	Celsius	Max. measured temperature value
6	FLOAT	4	R	Seconds	Operating hours of connected sensor
8	FLOAT	4	R	Seconds	Operating hours of connected sensor
10	FLOAT	4	R	Seconds	Operating hours of connected sensor
12	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
16	DATETIME	8	R	None	Manufacturing date of the sensor
20	DATETIME	8	R	None	Initial-operation date of sensor
24	DATETIME	8	R	None	Date of the last successful calibration of the sensor
28	UNSIGNED8	1	R	None	Dataset switch for turbidity Selection: 0: Formazine (default) 1: Kaolin 2: SiO2 3: TiO2 4: Excess sludge 5: Digested sludge 6: Activated sludge 7: Dataset1 8: Dataset2 9: Dataset3 10: Dataset4 11: Dataset5 13: Thin sludge 14: PSL

Register	Data Type	Bytes	R/W	Unit	Description
					15: Diatomite 16: Dataset6
29	UNSIGNED16	2	R	None	Number of calibrations
30	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
31	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
32	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
33	FLOAT	4	R	None	Calibration factor

7.3.5.7 Sensor ISE (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	FLOAT	4	R	None	Min. measured value
2	FLOAT	4	R	Celsius	Min. measured temperature value
4	FLOAT	4	R	None	Max. measured value
6	FLOAT	4	R	Celsius	Max. measured temperature value
8	FLOAT	4	R	None	Slope reference slot
10	FLOAT	4	R	None	Difference of slope between current and last calibration reference slot
12	FLOAT	4	R	None	Zero-point reference slot
14	FLOAT	4	R	None	Delta zero-point reference slot
16	FLOAT	4	R	None	Slope slot 1
18	FLOAT	4	R	None	Difference of slope between current and last calibration slot 1
20	FLOAT	4	R	None	Zero-point slot 1
22	FLOAT	4	R	None	Delta zero-point slot 1
24	FLOAT	4	R	None	Slope slot 2
26	FLOAT	4	R	None	Difference of slope between current and last calibration slot 2
28	FLOAT	4	R	None	Zero-point slot 2
30	FLOAT	4	R	None	Delta zero-point slot 2
32	FLOAT	4	R	None	Slope slot 3
34	FLOAT	4	R	None	Difference of slope between current and last calibration slot 3
36	FLOAT	4	R	None	Zero-point slot 3
38	FLOAT	4	R	None	Delta zero-point slot 3
40	FLOAT	4	R	Seconds	Operating hours of connected sensor
42	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
46	DATETIME	8	R	None	Manufacturing date of the sensor
50	DATETIME	8	R	None	Initial-operation date of sensor
54	DATETIME	8	R	None	Date of the last successful calibration of the sensor reference slot
58	DATETIME	8	R	None	Date of the last successful calibration of the sensor slot 1
62	DATETIME	8	R	None	Date of the last successful calibration of the sensor slot 2
66	DATETIME	8	R	None	Date of the last successful calibration of the sensor slot 3
70	UNSIGNED8	1	R	None	Electrode type reference slot (measured parameter) Selection:

Register	Data Type	Bytes	R/W	Unit	Description
					0: disabled (default) 5: pH
71	UNSIGNED16	2	R	None	Number of calibrations reference slot
72	UNSIGNED8	1	R	None	Electrode type slot 1 (measured parameter) Selection: 0: disabled (default) 1: Nitrate 2: Ammonium 3: Potassium 4: Chloride 5: pH 6: ORP 7: user defined name
73	UNSIGNED16	2	R	None	Number of calibrations slot 1
74	UNSIGNED8	1	R	None	Electrode type slot 2 (measured parameter) Selection: 0: disabled (default) 1: Nitrate 2: Ammonium 3: Potassium 4: Chloride 5: pH 6: ORP 7: user defined name
75	UNSIGNED16	2	R	None	Number of calibrations slot 2
76	UNSIGNED8	1	R	None	Electrode type slot 3 (measured parameter) Selection: 0: disabled (default) 1: Nitrate 2: Ammonium 3: Potassium 4: Chloride 5: pH 6: ORP 7: user defined name
77	UNSIGNED16	2	R	None	Number of calibrations slot 3
78	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
79	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
80	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer

7.3.5.8 Sensor Nitrate (Input, FC: 04)

Register	Data Type	Bytes	R/W	Unit	Description
0	FLOAT	4	R	None	Calibration offset
2	FLOAT	4	R	Celsius	Min. measured temperature value
4	FLOAT	4	R	Celsius	Max. measured temperature value
6	FLOAT	4	R	Seconds	Operating hours of connected sensor
8	FLOAT	4	R	Seconds	Operating time of filter
10	UNSIGNED32	4	R	None	Flash lamp counter
12	DATETIME	8	R	None	Current sensor-diagnosis: time of diagnosis appearance
16	DATETIME	8	R	None	Manufacturing date of the sensor
20	DATETIME	8	R	None	Initial-operation date of sensor
24	DATETIME	8	R	None	Date of the last successful calibration of the sensor
28	UNSIGNED8	1	R	None	Dataset switch for nitrate Selection: 0: Factory calib. (default) 1: Dataset1 2: Dataset2 3: Dataset3 4: Dataset4 5: Dataset5 6: Dataset6 7: undefined
29	UNSIGNED8	1	R	None	Calibration method Selection: 0: None (default) 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint Calibration 5: Table 7: Zero point 8: Slope air 9: Slope H2O 10: Slope variable 11: Zero point reference 12: Slope reference 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input slope 19: Numeric input zero point 20: Numeric input 2-point 21: Factory calib. 22: Slope test gas 23: Value acquisition
30	UNSIGNED16	2	R	None	Number of calibrations
31	UNSIGNED16	2	R	None	Current sensor-diagnosis: diagnosis code
32	UNSIGNED8	1	R	None	Current sensor-diagnosis: status according to NAMUR NE107
33	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: None (default) 1: Oxygen (amp.) 2: Oxygen (opt. fixed cable) 3: pH Glass 4: pH/ORP 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate

Register	Data Type	Bytes	R/W	Unit	Description
					11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt. Memosens coupling) 21: TU 22: Inline photometer
34	FLOAT	4	R	None	Raw value
36	FLOAT	4	R	None	Calibration factor

7.3.5.9 Sensor Fluorescense (Input, FC: 04)

Supported with software version 1.12.00 or newer.

Register	Data Type	Bytes	R/W	Unit	Description
0	DATETIME	8	R	None	Current sensor-diagnosis : time of diagnosis apperance Factory default: 0
4	DATETIME	8	R	None	Manufacturing date of the sensor
8	DATETIME	8	R	None	Initial-operation date of sensor
12	DATETIME	8	R	None	Date of the last successful calibration of the sensor
16	FLOAT	4	R	None	Calibration offset Factory default: 0.0
18	FLOAT	4	R	Celsius	Min. measured temperature value Factory default: 0.0
20	FLOAT	4	R	Celsius	Max. measured temperature value Factory default: 3.0
22	FLOAT	4	R	Seconds	Operating hours of connected sensor Factory default: 0.0
24	FLOAT	4	R	Seconds	Operating hours above maximal operating temperature Factory default: 0.0
26	FLOAT	4	R	Seconds	Operating hours below minimal operating temperature Factory default: 0.0
28	UNSIGNED16	2	R	None	Number of calibrations (does not apply to COS81D, COS81E) Factory default: 0
29	UNSIGNED16	2	R	None	Current sensor-diagnosis : diagnosis code Factory default: 0
30	UNSIGNED8	1	R	None	Current sensor-diagnosis : status according to NAMUR NE107 Factory default: 0
31	UNSIGNED8	1	R	None	Selected sensor type. The selected type has to match with the connected sensor type. Selection: 0: --- 1: Oxygen (amp.) 2: Oxygen (opt.) 3: pH Glass 5: pH ISFET 6: Cond c 7: Cond i 8: ORP 9: TU/TS 10: Nitrate 11: ISE 12: SAC 13: Ultrasonic interface 14: Chlorine (CCS142D) 18: pH/ORP 19: Cond c 4-pol 20: Oxygen (opt.) 21: TU 22: Inline photometer 23: TU/AU 24: Disinfection 25: Spectrometer

					28: Fluorescence Factory default: 0
32	FLOAT	4	R	None	Calibration factor Factory default: 0.0
34	FLOAT	4	R	None	Lightsource degradation in % Factory default: 0.0
36	FLOAT	4	R	None	Adjustment deviation in % Factory default: 0.0
38	DATETIME	8	R	None	Last Cal/Adj Date + Alarm Limit
42	UNSIGNED8	1	R	None	no description Factory default: false
43	UNSIGNED8	1	R	None	Calibration method Selection: 0: --- 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint calibration 5: Table 6: Sample calibration 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. reference 26: Int. reference 27: in water 28: in air 29: Solid state reference Factory default: 0
44	OCTETSTRING32	32	R	None	Serial of the Transmitter Factory default: 0
60	FLOAT	4	R	Celsius	Sensor air Temperature Factory default: 0.0
62	FLOAT	4	R	Celsius	Sensor solid Temperature Factory default: 0.0
64	FLOAT	4	R	None	Air measurement Factory default: 0.0
66	FLOAT	4	R	None	Air measurement acceptance threshold (constant value) Factory default: 0.0
68	OCTETSTRING32	32	R	None	Serial number of the solid state standard Factory default: 0
84	FLOAT	4	R	None	Nominal value of the solid state standard Factory default: 0.0
86	FLOAT	4	R	None	Solid state standard measurement raw value Factory default: 0.0
88	FLOAT	4	R	None	Solid state standard measurement Factory default: 0.0
90	FLOAT	4	R	None	Min. acceptance thresholds for the solid state standard measurement Factory default: 0.0

92	FLOAT	4	R	None	Max. acceptance thresholds for the solid state standard measurement Factory default: 0.0
94	UNSIGNED8	1	R	None	no description Selection: 0: Factory 1: Done 2: Unchanged 3: Failed Factory default: 0
95	UNSIGNED8	1	R	None	no description Selection: 0: Not OK 1: OK 2: n/a Factory default: 0
96	UNSIGNED8	1	R	None	no description Factory default: false
97	DATETIME	8	R	None	Date of the last successful calibration of the sensor
101	UNSIGNED8	1	R	None	Calibration method Selection: 0: --- 1: Numeric input 2: 1-point calibration 3: 2-point calibration 4: Multipoint calibration 5: Table 6: Sample calibration 7: Zero point 8: Air 100%% rh 9: H2O air-saturated 10: Air variable 11: Zero point sample 12: Slope sample 13: Offset 14: Slope 15: with temp. comp 16: without temp. comp 17: Standard addition 18: Numeric input 19: Numeric input zero point 20: Numeric input 21: Factory calib. 22: Test gas calibration 23: Value acquisition 24: 3-point calibration 25: Ext. reference 26: Int. reference 27: in water 28: in air 29: Solid state reference Factory default: 0
102	OCTETSTRING32	32	R	None	Serial of the Transmitter Factory default: 0
118	FLOAT	4	R	Celsius	Sensor air Temperature Factory default: 0.0
120	FLOAT	4	R	Celsius	Sensor solid Temperature Factory default: 0.0
122	FLOAT	4	R	None	Air measurement Factory default: 0.0
124	FLOAT	4	R	None	Air measurement acceptance threshold (constant value) Factory default: 0.0
126	OCTETSTRING32	32	R	None	Serial number of the solid state standard Factory default: 0

142	FLOAT	4	R	None	Nominal value of the solid state standard Factory default: 0.0
144	FLOAT	4	R	None	Solid state standard measurement raw value Factory default: 0.0
146	FLOAT	4	R	None	Solid state standard measurement Factory default: 0.0
148	FLOAT	4	R	None	Min. acceptance thresholds for the solid state standard measurement Factory default: 0.0
150	FLOAT	4	R	None	Max. acceptance thresholds for the solid state standard measurement Factory default: 0.0

www.addresses.endress.com

Endress+Hauser

People for Process Automation