

Special Documentation Proline Promass 300/500 Modbus RS485, Modbus TCP and Modbus TCP over Ethernet-APL

System integration



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1 About this document

1.1 Document function

This manual is special documentation; it does not replace the Operating Instructions and device parameters pertaining to the device. It serves as a reference manual and a complementary source of information for the integration of field devices with a Modbus interface into process control systems and controllers.

This supplementary documentation should only be used in conjunction with a measuring instrument with a Modbus RS485, Modbus TCP or Modbus TCP over Ethernet APL interface.

1.2 Target group

This document is aimed at individuals who are incorporating the device into a Modbus network. It is a requirement that the reader has basic knowledge of Modbus technology.

More detailed information on Modbus technology can be found at www.modbus.org

1.3 Abbreviations

ADU	Application Data Unit
APL	Advanced Physical Layer
ASCII	American Standard Code for Information Interchange
CRC	Cyclic redundancy check
DHCP	Dynamic Host Configuration Protocol
ENP	Electronic nameplate
HTTP	Hypertext Transfer Protocol
ICMP	Internet Control Message Protocol
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet protocol
LSB	Least Significant Byte
MAC	Media access control
MBAP	Modbus application protocol header
MSB	Most Significant Byte
n/a	Not available
NaN	Not a Number (IEEE-754, 7Fh A0h 00h 00h)
ro	Read only
rw	Read and write
RS485	Recommended Standard 485
RTU	Remote terminal unit
TCP	Transmission control protocol

1.4 Symbols

1.4.1 Safety symbols

DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

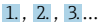
CAUTION

This symbol alerts you to a potentially dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE

This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.4.2 Symbols for certain types of information

Symbol	Meaning
	Permitted Procedures, processes or actions that are permitted.
	Forbidden Procedures, processes or actions that are forbidden.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
	Series of steps
	Result of a step

1.4.3 Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
	Series of steps

1.5 Documentation

 For an overview of the scope of the associated Technical Documentation, refer to the following:

- *Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations app*: Enter serial number from nameplate or scan matrix code on nameplate.

 This Special Documentation and other documentation is available:
In the Download Area of the Endress+Hauser Internet site: www.endress.com → Downloads

This documentation is an integral part of the following Operating Instructions and device parameters:

Measuring instrument	Documentation code			
	Modbus RS485		Modbus TCP over Ethernet-APL	
Cubemass C 300	BA01494D	GP01059D	BA02402D	GP01235D
Promass A 300	BA01842D		BA02401D	
Promass E 300	BA01495D		BA02403D	
Promass F 300	BA01496D		BA02404D	
Promass H 300	BA01497D		BA02405D	
Promass I 300	BA01498D		BA02406D	
Promass O 300	BA01499D		BA02407D	
Promass P 300	BA01500D		BA02408D	
Promass Q 300	BA01501D		BA02409D	
Promass S 300	BA01502D		BA02410D	
Promass X 300	BA01503D		BA02411D	
Cubemass 500	BA01538D	GP01062D	BA02413D	GP01236D
Promass A 500	BA01884D		BA02412D	
Promass E 500	BA01539D		BA02414D	
Promass F 500	BA01540D		BA02415D	
Promass H 500	BA01541D		BA02416D	
Promass I 500	BA01542D		BA02417D	
Promass O 500	BA01543D		BA02418D	
Promass P 500	BA01544D		BA02419D	
Promass Q 500	BA01545D		BA02420D	
Promass S 500	BA01546D		BA02421D	
Promass U 500	BA02342D		BA02422D	
Promass X 500	BA01547D		BA02423D	

1.6 Registered trademarks

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Modbus protocol

Modbus is an open, standardized communication protocol that is used in the areas of manufacturing automation, process automation and building automation.

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

The specifications for the Modbus protocol are freely available on the Modbus organization website: <https://modbus.org/>

2.1 Operating principle

Modbus communication uses a simple request-response mechanism.

Client/Master	Request → ← Response	Server/Slave
---------------	-------------------------	--------------

A distinction is made between three cases:

- If the device receives a valid telegram with a valid request and can respond to this, then it responds with a response telegram with the function code of the request.
- If the device receives an invalid telegram (e.g. CRC error), it does not respond. The application must carry out troubleshooting after a defined time (time-out) has elapsed.
- If the device receives a valid telegram with an invalid request, then it responds with a Modbus exception. The application must carry out troubleshooting.

2.2 Modbus exception codes

If the Modbus slave detects an error in the request telegram from the master, it sends an error message to the master as a response, consisting of the slave address, function code, error code (exception code) and checksum. To indicate that this 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	Description
01	ILLEGAL_FUNCTION The function code sent by the master is not supported by the measuring instrument (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 large.
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. span limits exceeded or incorrect data format.
04	SLAVE_DEVICE_FAILURE The slave did not respond to the request telegram from the master or an error occurred while processing the request telegram.

2.3 Modes of operation

2.3.1 Modbus RS485

ASCII

The data is transmitted as ASCII characters and can therefore be read by humans.

Start	Address	Function	Data	LRC	End
:	Two characters	Two characters	n characters	Two characters	CR LF

Field	Length	Description	Client	Server
Address	2 bytes	Identifies the target device.	Set by client.	Copied from the request to the response.
CRC	2 bytes	Modbus specification	Set by client.	Set by server.

RTU

The data is transmitted in binary form and is therefore more compact.

Address	Function	Data	CRC16
Two characters ¹⁾	One character	n characters	Two characters

1) 0 = broadcast, 247 = unicast



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

Field	Length	Description	Client	Server
Address	1 byte	Identifies the target device.	Set by client.	Copied from the request to the response.
CRC	2 bytes	Modbus specification	Set by client.	Set by server.

2.3.2 Modbus TCP

The data is transmitted in binary form as for RTU. 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	
Transaction number	Protocol character	Number of bytes still to follow	Address	Function	Data
2 bytes	2 bytes	2 bytes	1 byte	1 byte	n bytes
	= 0x0000	= n+2	= 0		

Field	Length	Description	Client	Server
Transaction number	2 bytes	Identifies the transaction.	Set by client.	Copied from the request to the response.
Protocol character	2 bytes		Set by client.	Copied from the request to the response.
Number of bytes still to follow	2 bytes	Number of following bytes.	Set by client.	Set by server.
Unit identifier	1 byte	Identifies a slave which is connected to a serial bus located downstream.	Set by client.	Copied from the request to the response.



Up to four parallel TCP connections can be simultaneously supported with the device via TCP port 502. Please observe the correct structure of the MBAP header here.

2.4 Interface configuration

2.4.1 Modbus RS485

Settings

Setting	Factory setting	Selection
Bus address	247	1 to 247
Transmission type	RTU	RTU, ASCII
Baud rate > bps	19200	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Parity	Even (one stop bit)	Even (one stop bit), uneven (one stop bit), none (two stop bits)



If a valid address is set on the hardware DIP switch, the bus address cannot be changed in the menu. Setting via the hardware DIP switch is given priority.

Path

Setup → Communication

Setting the bus address via the software

Requirement

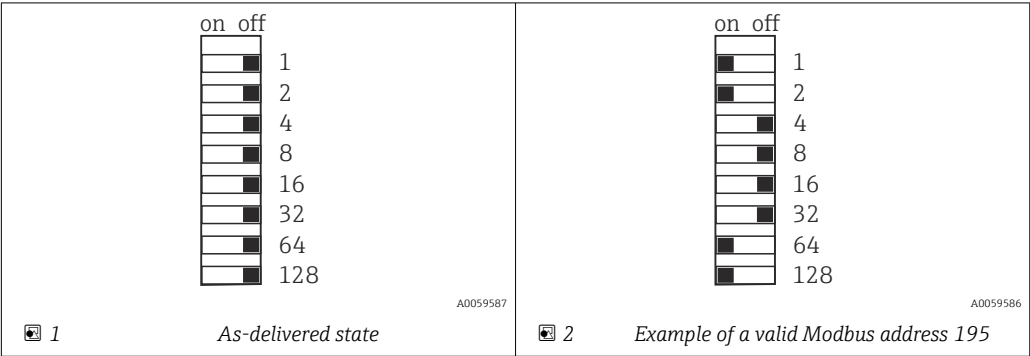
The hardware DIP switch is set to an address outside the valid range of 1 to 247.

Path

Setup → Communication → Bus address

Setting the fieldbus address via the hardware

Valid fieldbus addresses are between 1 and 247. If an invalid address is set, software addressing is automatically enabled via the local setting.



2.4.2 Modbus TCP

The network settings (IP address, subnet mask and gateway) of the device must first be configured before a Modbus TCP connection with the device can be established. The settings depend on the network into which the device is being integrated.

Settings

Port 1: Modbus TCP over Ethernet-APL

Setting	Factory setting	Selection
DHCP	On	Off, On
IP address	0.0.0.0	Valid IPv4 address
Netmask	0.0.0.0	Valid subnet mask
Gateway	0.0.0.0	Valid IPv4 address
MAC address	See menu or labeling on communication module	
TCP port (HTTP)	80	None
TCP port (Modbus TCP)	502	None

Port 2: Modbus TCP over Ethernet

Setting	Factory setting	Selection
DHCP	Off	Off, On
IP address	192.168.1.212	Valid IPv4 address
Netmask	255.255.255.0	Valid subnet mask
Gateway	0.0.0.0	Valid IPv4 address
MAC address	See menu or labeling on communication module	
TCP port (HTTP)	80	None
TCP port (Modbus TCP)	502	None

MAC address

The MAC address can be read out via the menu. The MAC address of the device is used for identification purposes and is permanently assigned at the factory as a one-off.

DHCP (automatic setting)

If a DHCP server is used in the TCP/IP network, then the IP address, gateway and subnet mask are set automatically as soon as the DHCP client function is enabled. The DHCP client function is disabled at port 2 upon delivery of the device and can be enabled in the **APL port** submenu.

Path of port 1: Modbus TCP over Ethernet-APL

Expert → Communication → APL port → DHCP client

Path of port 2: Modbus TCP over Ethernet

Expert → Communication → Service interface → DHCP client

Setting the static IP address

Requirement

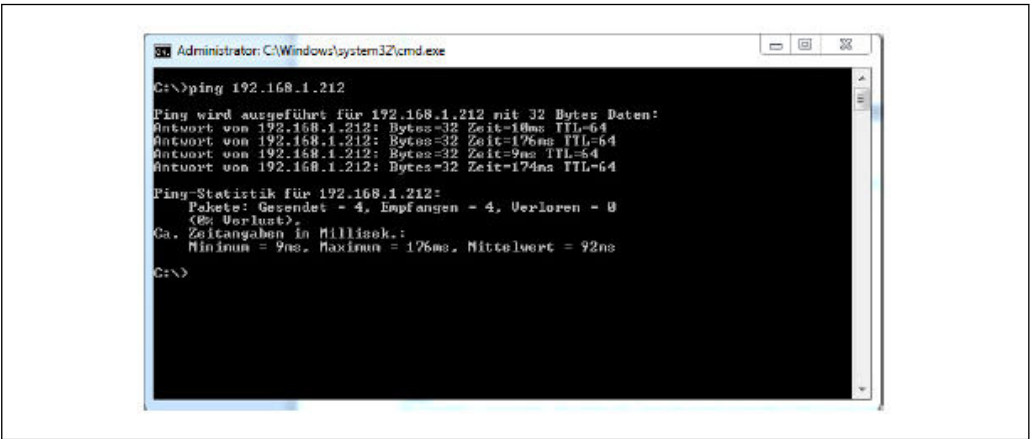
Off option selected in **DHCP client** parameter.

Path

Expert → Communication → APL port → DHCP client

Checking the connection

The Internet Control Message Protocol (ICMP) is implemented in the device. The “ping” command can be used to check whether the device can be reached via the network.



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3 Checking the connection

2.5 Data types

The measuring instrument 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 bytes (9 registers)				
Byte 17	Byte 16	...	Byte 1	Byte 0
Most Significant Byte (MSB)		...		Least Significant Byte (LSB)

2.6 Byte transmission sequence

Byte addressing, i.e. the transmission sequence of the bytes, is not set in the Modbus specification. It is therefore important to agree or adjust the addressing mode between the master and slave or client and server when commissioning. This can be configured in the measuring instrument using the **Byte order** parameter.

The bytes are transmitted depending on the selection in the **Byte order** parameter:

FLOAT				
	Sequence			
Selection	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 setting, S = sign, E = exponent, M = mantissa				

INTEGER		
	Sequence	
Selection	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		

2.7 Modbus data map

2.7.1 Function of the Modbus data map

The measuring instrument offers a special memory area, the Modbus data map (for a maximum of 16 device parameters), to allow users to call up multiple device parameters via Modbus and not only individual device parameters or a group of consecutive device parameters.

Grouping of device parameters is flexible and the Modbus master can read or write to the entire data block simultaneously with a single request telegram.

2.7.2 Structure of the Modbus data map

The Modbus data map consists of two data sets:

- Scan list: Configuration area
The device parameters to be grouped are defined in a list, with their Modbus register addresses being entered in the list.
- Data area
The measuring instrument reads out the register addresses entered in the scan list cyclically and writes the associated device data (values) to the data area.

2.7.3 Scan list configuration

For configuration, the Modbus register addresses of the device parameters to be grouped must be entered in the scan list. Please note the following basic requirements of the scan list:

Max. entries	16 device parameters
Supported device parameters	Only parameters with the following characteristics are supported: ■ Access type: Read or write access ■ Data type: Float or integer

Configuring the scan list via web server, FieldCare or DeviceCare

Carried out using the operating menu of the measuring instrument:
Expert → Communication → Modbus data map → Scan list register 0 to 15

Scan list	
No.	Configuration register
0	Scan list register 0
...	...
15	Scan list register 15

Configuring the scan list via Modbus

Carried out using register addresses 5001 to 5016

Scan list			
No.	Modbus register	Data type	Configuration register
0	5001	Integer	Scan list register 0
...	...	Integer	...
15	5016	Integer	Scan list register 15

2.7.4 Reading out data

The data area of the Modbus data map is accessed to read out the current values of the device parameters defined in the scan list register.

Access to data area	Via register addresses 5051 to 5081
----------------------------	-------------------------------------

Data area						
Device parameter value	Modbus register	I/O data	As-delivered state of registers 5001 to 5016 for Modbus TCP and Modbus TCP over Ethernet-APL	As-delivered state of registers 5001 to 5016 for Modbus RS485	Data type *	Access **
Value of scan list register 0	5051	Mass flow	2007	0	Integer/Real	Read/write
Value of scan list register 1	5053	Volume flow	2009	0	Integer/Real	Read/write
Value of scan list register 2	5055	Corrected volume flow	2011	0	Integer/Real	Read/write
Value of scan list register 3	5057	Density	2013	0	Integer/Real	Read/write
Value of scan list register 4	5059	Reference density	2015	0	Integer/Real	Read/write
Value of scan list register 5	5061	Temperature	2017	0	Integer/Real	Read/write
Value of scan list register 6	5063	Totalizer 1	2610	0	Integer/Real	Read/write
Value of scan list register 7	5065	Totalizer 2	2810	0	Integer/Real	Read/write
Value of scan list register 8	5067	Totalizer 3	3010	0	Integer/Real	Read/write
Value of scan list register 9	5069	Actual diagnostics (no.)	6801	0	Integer/Real	Read/write
Value of scan list register 10	5071	Tot1 Control	2608	0	Integer/Real	Read/write
Value of scan list register 11	5073	Tot2 Control	2808	0	Integer/Real	Read/write
Value of scan list register 12	5075	Tot3 Control	3008	0	Integer/Real	Read/write
Value of scan list register 13	5077	-	0	0	Integer/Real	Read/write
Value of scan list register 14	5079	-	0	0	Integer/Real	Read/write
Value of scan list register 15	5081	-	0	0	Integer/Real	Read/write
* Data type depends on the device parameters entered in the scan list. ** Data access depends on the device parameters entered in the scan list. If the device parameter entered supports read and write access, the parameter can also be accessed via the data area.						

2.8 Register addressing

Register	Data type	Access	Address range ¹⁾	Description
Discrete inputs	Bit	Read only	1XXXX	Is not used by the device.
Coils	Bit	Read/Write	2XXXX	Is not used by the device.
Input register	16-bit word	Read only	3XXXX	This data can only be read by the device.
Holding register	16-bit word	Read/Write	4XXXX	This data can be read by the device and changed by the application.

- 1) The register address is transmitted as a 16-bit word, with the first register being addressed with the value 0. The register addresses are specified in this document in the same way as they are transmitted in the Modbus telegrams.



It is also customary to use a notation in Modbus applications which counts the register addresses starting from a value of 1. In this case, the (register address – 1) is transmitted in the Modbus telegram.

3 Description of functions

3.1 Modbus function codes

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

Code	Name	Description	Application
03	Read holding register	Controller reads one or more Modbus registers of the measuring instrument. A maximum of 125 consecutive registers can be read with one telegram: One register = 2 bytes  The measuring instrument does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read and write access Example: Read mass flow
04	Read input register	Controller reads one or more Modbus registers of the measuring instrument. A maximum of 125 consecutive registers can be read with one telegram: One register = 2 bytes  The measuring instrument does not make a distinction between function codes 03 and 04; these codes therefore yield the same result.	Read device parameters with read access Example: Read totalizer value
06	Write single registers	Controller writes a new value to one Modbus register of the measuring instrument.  Use function code 16 to write multiple registers with just one telegram.	Write only one device parameter Example: Reset totalizer
08	Diagnostics	Controller checks the communication connection to the measuring instrument. The following "Diagnostics codes" are supported: ▪ Sub-function 00 = return query data (loopback test) ▪ Sub-function 02 = return diagnostics register	
16	Write multiple registers	Controller writes a new value to several Modbus registers of the measuring instrument. A maximum of 120 consecutive registers can be written with one telegram.  If the required device parameters are not available as a group, yet must nevertheless be addressed with a single telegram, use Modbus data map →  12	Write multiple device parameters Example: ▪ Mass flow unit ▪ Mass unit
23	Read/Write multiple registers	Controller reads and writes a maximum of 118 Modbus registers of the measuring instrument simultaneously with one telegram. Write access is executed before read access.	Write and read multiple device parameters Example: ▪ Read, e.g. the instantaneous value ▪ Write, e.g. reset totalizer
Modbus TCP only			
43/14	Read device identification	Controller reads device identification	Read multiple device parameters

 Broadcast messages are only allowed with function codes 06, 16 and 23.

3.2 Response time

Response time of the measuring instrument to the request telegram of the Modbus master: Typically 3 to 5 ms

4 **Appendix**

4.1 **Data types**

4.1.1 **Floating point numbers (IEEE-754)**

Byte 3	Byte 2	Byte 1	Byte 0
SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
S = sign, E = power of ten, M = mantissa			

4.1.2 **Integer**

Byte 1	Byte 0
Most Significant Byte (MSB)	Least Significant Byte (LSB)

4.1.3 **Character string**

Byte n	Byte n-1	...	Byte 1	Byte 0
Most Significant Byte (MSB)		...		Least Significant Byte (LSB)

Example

Register	Hex	Character	
40001	0x4C69	L	i
40002	0x7175	q	u
40003	0x696C	i	l
40004	0x696E	i	n
40005	0x6500	e	0

4.1.4 **Other data types**

Other data types with a data length of more than two are treated like character strings.

5 Register information

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Advanced setup / Configuration backup	Operating time	2631	String	14	ro	
Advanced setup / Configuration backup	CurrentDiagnosticNumber	6801	UInt16	2	ro	0...65535
Advanced setup / Totalizer	Totalizer failure behavior	2606, 2806, 3006	Enum16	2	rw	0 : Hold 1 : Continue 2 : Last valid value + continue
Advanced setup / Totalizer	Totalizer operation mode	2605, 2805, 3005	Enum16	2	rw	0 : Net 1 : Forward 2 : Reverse
Advanced setup / Totalizer	Process variable unit	4604, 4605, 4606	Enum16	2	rw	50 : g 51 : kg 52 : t 53 : oz 54 : lb 55 : STon 0 : cm ³ 1 : dm ³ 2 : m ³ 3 : ml 4 : l 5 : hl 6 : Ml 8 : af 9 : ft ³ 111 : Mft ³ 23 : MMft ³ 10 : fl oz (us) 11 : gal (us) 22 : kgal (us) 12 : Mgal (us) 13 : bbl (us;liq.) 14 : bbl (us;beer) 15 : bbl (us;oil) 16 : bbl (us;tank) 17 : gal (imp) 18 : Mgal (imp) 19 : bbl (imp;beer) 20 : bbl (imp;oil) 100 : NI 110 : Nhl 101 : Nm ³ 104 : Sl 102 : Sm ³ 103 : Sft ³ 112 : MSft ³ 109 : MMSft ³ 105 : Sgal (us) 106 : Sbbl (us;liq.) 108 : Sbbl (us;oil) 107 : Sgal (imp) 251 : None

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Advanced setup / Totalizer	Corrected volume unit	2604, 2804, 3004	Enum16	2	rw	0 : NI 110 : Nhl 1 : Nm ³ 4 : Sl 2 : Sm ³ 3 : Sft ³ 112 : MSft ³ 109 : MMSft ³ 5 : Sgal (us) 6 : Sbbbl (us;liq.) 108 : Sbbbl (us;oil) 7 : Sgal (imp)
Advanced setup / Totalizer	Mass unit	2602, 2802, 3002	Enum16	2	rw	0 : g 1 : kg 2 : t 3 : oz 4 : lb 5 : STon
Advanced setup / Totalizer	Volume unit	2603, 2803, 3003	Enum16	2	rw	0 : cm ³ 1 : dm ³ 2 : m ³ 3 : ml 4 : l 5 : hl 6 : Ml Mega 8 : af 9 : ft ³ 111 : Mft ³ 23 : MMft ³ 10 : fl oz (us) 11 : gal (us) 22 : kgal (us) 12 : Mgal (us) 15 : bbl (us;oil) 13 : bbl (us;liq.) 14 : bbl (us;beer) 16 : bbl (us;tank) 17 : gal (imp) 18 : Mgal (imp) 19 : bbl (imp;beer) 20 : bbl (imp;oil)
Application / Medium index	Cutoff inhomogeneous wet gas	34852	Float	4	rw	0...3.0e+38
Application / Medium index	Cutoff inhomogeneous liquid	34850	Float	4	rw	0...3.0e+38
Application / Medium index	Inhomogeneous medium index	34301	Float	4	ro	-3.0e+38...3.0e+38
Application / Medium index	Cutoff suspended bubbles	34858	Float	4	rw	0...3.0e+38
Application / Medium index	Suspended bubbles index	34854	Float	4	ro	-3.0e+38...3.0e+38

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Application / Petroleum	Oil density unit	26433	Enum16	2	rw	23 : °API 4 : kg/m ³ 3 : kg/l 0 : g/cm ³ 97 : g/l 24 : SG60°F 9 : SG15°C 10 : SG20°C 11 : lb/ft ³ 12 : lb/gal (us) 17 : lb/gal (imp) 15 : lb/bbl (us;oil) 19 : lb/bbl (imp;oil) 98 : lb/in ³ 99 : STon/yd ³
Application / Petroleum	Oil density unit	26434	Enum16	2	rw	23 : °API 4 : kg/m ³ 3 : kg/l 0 : g/cm ³ 97 : g/l 24 : SG60°F 9 : SG15°C 10 : SG20°C 11 : lb/ft ³ 12 : lb/gal (us) 17 : lb/gal (imp) 98 : lb/in ³ 99 : STon/yd ³
Application / Petroleum	Water reference density unit	26481	Enum16	2	rw	2 : kg/Nm ³ 1 : kg/Nl 3 : kg/Sm ³ 0 : g/Scm ³ 4 : lb/Sft ³ 6 : RD15°C 7 : RD20°C 8 : RD60°F
Application / Petroleum	S&W correction value	26939	Float	4	ro	0...1.4E+21 (Percent)
Calculated values / Corrected volume flow calculation	External reference density	2509	Float	4	rw	1E-07...3.0e+35 (KiloGramPerNormalLiter / Reference density unit)
Communication / APL port	IP address	55293	String	15	rw	
Communication / APL port	Default gateway	55303	String	15	rw	
Communication / APL port	Subnet mask	55313	String	15	rw	
Communication / APL port	MAC address	55284	String	17	ro	
Communication / Service interface	IP address	4155	String	15	rw	
Communication / Service interface	Default gateway	4171	String	15	rw	
Communication / Service interface	Subnet mask	4163	String	15	rw	
Communication / Service interface	DHCP client	21781	Enum8	1	rw	0 : Off 1 : On
Communication / Service interface	PrimaryNameServer	4181	UInt32	4	rw	0...4294967295
Communication / Service interface	SecondaryNameServer	4183	UInt32	4	rw	0...4294967295
Communication / Service interface	MAC address	4210	String	17	ro	
Communication / Service interface	SecondaryNameServer	4183	UInt32	4	rw	0...4294967295
Communication / Web server	Web server functionality	4220	Enum8	1	rw	0 : Off 2 : HTML Off 1 : On

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Concentration / Concentration profile	A0	28486, 28488, 28490	Float	4	rw	-3.0e+38...3.0e+38
Concentration / Concentration profile	A1	28492, 28494, 28496	Float	4	rw	-3.0e+38...3.0e+38
Concentration / Concentration profile	A2	28498, 28500, 28502	Float	4	rw	-3.0e+38...3.0e+38
Concentration / Concentration profile	A3	28510, 28512, 28514	Float	4	rw	-3.0e+38...3.0e+38
Concentration / Concentration profile	A4	28522, 28524, 28526	Float	4	rw	-3.0e+38...3.0e+38
Concentration / Concentration profile	B1	28504, 28506, 28508	Float	4	rw	-3.0e+38...3.0e+38 (milli)
Concentration / Concentration profile	B2	28516, 28518, 28520	Float	4	rw	-3.0e+38...3.0e+38 (micro)
Concentration / Concentration profile	B3	28528, 28530, 28532	Float	4	rw	-3.0e+38...3.0e+38 (nano)
Concentration / Concentration profile	D1	28565, 28567, 28569	Float	4	rw	-3.0e+38...3.0e+38 (centi)
Concentration / Concentration profile	D2	28571, 28573, 28575	Float	4	rw	-3.0e+38...3.0e+38 (centisquare)
Concentration / Concentration profile	D3	28577, 28579, 28581	Float	4	rw	-3.0e+38...3.0e+38 (milli)
Concentration / Concentration profile	D4	28583, 28585, 28587	Float	4	rw	-3.0e+38...3.0e+38 (centimilli)
Concentration / Concentration profile	Coefficients set name	28462, 28470, 28478	String	16	rw	
Concentration / Concentration settings	Carrier linear expansion coefficient	28541	Float	4	rw	-3.4E+38...3.4E+38 (per_Kelvin)
Concentration / Concentration settings	Carrier type	26943	Enum16	2	rw	82 : Water based 1 : Not water based
Concentration / Concentration settings	Carrier reference density	28537	Float	4	rw	0...3.4e+35 (kiloGramPerNormalLiter / Reference density unit)
Concentration / Concentration settings	Carrier square expansion coefficient	28545	Float	4	rw	-3.4E+38...3.4E+38 (per_squareKelvin)
Concentration / Concentration settings	Water mineral content	28253	Float	4	rw	0...3.4E+38 (milliGram_per_Liter)
Concentration / Concentration settings	Reference temperature expansion	29002	Float	4	rw	-273.15...99999 (Celsius / Temperature unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Concentration / Concentration settings	Liquid type	26492	Enum16	2	rw	0 : Off 5 : Sucrose in water 2 : Glucose in water 1 : Fructose in water 6 : Invert sugar in water 15 : HFCS42 16 : HFCS55 17 : HFCS90 18 : Wort 26 : Whey (Total Solids) 11 : Ethanol in water (OIML) 12 : Methanol in water 4 : Hydrogen peroxide in water 24 : Hydrochloric acid 25 : Sulfuric acid 7 : Nitric acid 8 : Phosphoric acid 10 : Sodium hydroxide 9 : Potassium hydroxide 27 : Ammonia in water 28 : Ammonium hydroxide in water 13 : Ammonium nitrate in water 14 : Iron(III)chloride in water 29 : Sodium chloride in water 19 : %mass / %volume 21 : Coef Set No. 22 : Coef Set No. 23 : Coef Set No.
Concentration / Concentration settings	Create coefficients for liquid type	35076	Enum16	2	ro	0 : Cancel 1 : Coefficient set 1 2 : Coefficient set 2 3 : Coefficient set 3
Concentration / Concentration settings	Target linear expansion coefficient	28543	Float	4	rw	-3.4E+38...3.4E+38 (per_Kelvin)
Concentration / Concentration settings	Target reference density	28539	Float	4	rw	0...3.4e+35 (kiloGramPerNormalLiter / Reference density unit)
Concentration / Concentration settings	Target square expansion coefficient	28547	Float	4	rw	-3.4E+38...3.4E+38 (per_squareKelvin)
Concentration / Concentration unit	Reference temperature	29004	Float	4	rw	-273.15...99999 (Celsius / Temperature unit)
Concentration / Concentration unit	Concentration unit	2439	Enum16	2	rw	0 : WT-% 240 : mol/l 23 : °API 3 : °Balling 4 : °Baum (hv) 5 : °Baum (lt) 6 : °Brix 7 : Plato 10 : ABV 108 : proof/vol 149 : %vol 15 : %Mass 16 : %StdVol 90 : SGU 8 : User conc.
Concentration / Concentration unit	User concentration factor	2554	Float	4	rw	-3.4E+38...3.4E+38
Concentration / Concentration unit	User concentration offset	2490	Float	4	rw	-3.4E+38...3.4E+38
Concentration / Concentration unit	User concentration text	2585	String	10	rw	0

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Concentration / Mineral content determination	Control mineral content determination	28549	Enum16	2	rw	0 : Cancel 1 : Start 2 : Use result
Concentration / Mineral content determination	State mineral content determination	28550	Enum16	2	ro	1 : In progress 0 : Failed 3 : Not done 10 : Done
Concentration / Mineral content determination	Process temperature during determination	28553	Float	4	ro	-273.15...99726.8499 (Celsius / Temperature unit)
Concentration / Mineral content determination	Carrier density during determination	28551	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_cubicMeter / Density unit)
Diagnostics / Device information	Order code	2058	String	20	ro	0
Diagnostics / Device information	Serial number	7003	String	11	ro	0
Diagnostics / Device information	Device tag	2026	String	32	ro	0
Diagnostics / Device information	Manufacturer ID	2078	Uint16	2	ro	0...65535
Heartbeat Technology / Monitoring results	HBSI value reliability	34882	Enum8	1	ro	128 : Good 64 : Uncertain 0 : Bad
Heartbeat Technology / Monitoring results	HBSI	2358	Float	4	ro	-3.0e+38...3.0e+38 (Percent)
Heartbeat Technology / Monitoring results	HBSI deviation	3676, 3678, 3680, 3682, 3684, 3686, 3688, 3690	Float	4	ro	-3.0e+38...3.0e+38 (Percent)
Heartbeat Technology / Monitoring results	MonitoringHBSIDeviationValue	6399	Float	4	ro	-3.0e+38...3.0e+38
Heartbeat Technology / Performing verification	AM/PM	2496	Enum16	2	rw	0 : AM 1 : PM
Heartbeat Technology / Performing verification	Day	2493	Uint8	1	rw	1... (Day)
Heartbeat Technology / Performing verification	Hour	2492	Uint8	1	rw	0
Heartbeat Technology / Performing verification	Minute	2467	Uint8	1	rw	0...59 (Minute)
Heartbeat Technology / Performing verification	Month	2494	Enum16	2	rw	0 : January 1 : February 2 : March 3 : April 4 : May 5 : June 6 : July 7 : August 8 : September 9 : October 10 : November 11 : December
Heartbeat Technology / Performing verification	Year	2495	Uint8	1	rw	9...99
Heartbeat Technology / Performing verification	External device information	20493	String	32	rw	0

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Heartbeat Technology / Performing verification	Measured values	5512	Float	4	rw	0
Heartbeat Technology / Performing verification	Start verification	2270	Enum16	2	ro	0 : Cancel 1 : Start 10 : Output 1 low value 11 : Output 1 high value 12 : Output 2 low value 13 : Output 2 high value 14 : Output 3 low value 15 : Output 3 high value 16 : Output 4 low value 17 : Output 4 high value 21 : Frequency output 1 20 : Pulse output 1 23 : Frequency output 2 22 : Pulse output 2 24 : Pulse output 3 25 : Frequency output 3 2 : Clear data
Heartbeat Technology / Performing verification	Output values	5516	Float	4	ro	0
Heartbeat Technology / Performing verification	Verification mode	2366	Enum16	2	rw	0 : Standard verification 1 : Extended verification
Heartbeat Technology / Performing verification	Verification result	2355	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 254 : Not plugged 0 : Failed
Heartbeat Technology / Performing verification	Status	2079	Enum16	2	ro	1 : Done 8 : Busy 0 : Failed 3 : Not done
Heartbeat Technology / Verification results	Verification ID	2315	Uint16	2	ro	0...65535
Heartbeat Technology / Verification results	HBSI	2129	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 254 : Not plugged 0 : Failed
Heartbeat Technology / Verification results	I/O module	2386	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 254 : Not plugged 0 : Failed
Heartbeat Technology / Verification results	Sensor electronic module (ISEM)	2385	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 254 : Not plugged 0 : Failed
Heartbeat Technology / Verification results	Sensor	2384	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 254 : Not plugged 0 : Failed
Main menu / Diagnostics	Actual diagnostics	2732	Uint32	4	ro	0...4294967295

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Main menu / Operation	Web server language	4219	Enum16	2	rw	0 : English 1 : Deutsch 2 : Français 3 : Español 4 : Italiano 5 : Nederlands 12 : Portuguesa 13 : Polski 14 : русский язык (Russian) 8 : Svenska 18 : Türkçe 16 : 中文 (Chinese) 11 : 日本語 (Japanese) 20 : 한국어 (Korean) 21 : العربية (Arabic) 10 : Bahasa Indonesia 17 : ภาษาไทย (Thai) 19 : tiếng Việt (Vietnamese) 15 : čeština (Czech)
Measured values / Measured variables	Pressure	2089	Float	4	ro	-3.0e+33...3.0e+33 (Bar / Pressure unit)
Measured values / Measured variables	Temp. compensated kinematic viscosity	2095	Float	4	ro	-1.4e+27...1.4e+27 (centiStokes / Kinematic viscosity unit)
Measured values / Measured variables	Target mass flow	2797	Float	4	ro	-5.04e+24...5.04e+24 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	Carrier mass flow	2799	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	Concentration	2598	Float	4	ro	-1.4E+21...1.4E+21 (degBrix / Concentration unit)
Measured values / Measured variables	Target corrected volume flow	25790	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Carrier corrected volume flow	26447	Float	4	ro	-3.0e+38...3.0e+38 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Target volume flow	26449	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	Carrier volume flow	26451	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	Mass flow	3874	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	Volume flow	3876	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	Density	2013	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_cubicMeter / Density unit)
Measured values / Measured variables	Corrected volume flow	2011	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Reference density	2015	Float	4	ro	-1.4E+21...1.4E+21 (kiloGramPerNormalLiter / Reference density unit)
Measured values / Measured variables	Temperature	3977	Float	4	ro	-1.4E+21...1.4E+21 (Celsius / Temperature unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Measured values / Measured variables	Dynamic viscosity	2019	Float	4	ro	-1.4e+24...1.4e+24 (centiPoise / Dynamic viscosity unit)
Measured values / Measured variables	Kinematic viscosity	2083	Float	4	ro	-1.4e+27...1.4e+27 (centiStokes / Kinematic viscosity unit)
Measured values / Measured variables	Temp. compensated dynamic viscosity	2093	Float	4	ro	-1.4e+24...1.4e+24 (centiPoise / Dynamic viscosity unit)
Measured values / Measured variables	Time period signal frequency (TPS)	48180	Float	4	ro	0...10000 (Hertz)
Measured values / Measured variables	Oil CPL	26537	Float	4	ro	0...3.4E+38
Measured values / Measured variables	CTL alternative	26529	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Oil CTL	26531	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Water CTL	26523	Float	4	ro	0...3.4E+38
Measured values / Measured variables	CTPL alternative	26527	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Oil CTPL	26535	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Oil density	26515	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_cubicMeter / Oil density unit)
Measured values / Measured variables	Water density	26519	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_cubicMeter / Water density unit)
Measured values / Measured variables	GSV flow	26311	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	GSV flow alternative	26319	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Oil mass flow	26545	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	Water mass flow	26553	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	NSV flow	26483	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	CPL	26571	Float	4	ro	0...3.4E+38
Measured values / Measured variables	NSV flow alternative	26490	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	CTL	26569	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Oil reference density	26941	Float	4	ro	-1.4E+21...1.4E+21 (kiloGramPerNormalLiter / Reference density unit)
Measured values / Measured variables	Water reference density	28251	Float	4	ro	-1.4E+21...1.4E+21 (kiloGramPerNormCubicMeter / Water reference density unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Measured values / Measured variables	S&W volume flow	26495	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	CTPL	26869	Float	4	ro	0...3.4E+38
Measured values / Measured variables	Oil corrected volume flow	26543	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Water corrected volume flow	26551	Float	4	ro	-1.4E+21...1.4E+21 (NormalLiter_per_Hour / Corrected volume flow unit)
Measured values / Measured variables	Oil volume flow	26539	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	Water volume flow	26547	Float	4	ro	-1.4E+21...1.4E+21 (LiterPerHour / Volume flow unit)
Measured values / Measured variables	Water cut	26521	Float	4	ro	0...100 (Percent)
Measured values / Measured variables	Mass flow	2007	Float	4	ro	-3.0e+38...3.0e+38 (kiloGram_per_Hour / Mass flow unit)
Measured values / Measured variables	Temperature	2017	Float	4	ro	-3.0e+38...3.0e+38 (Celsius / Temperature unit)
Measured values / Measured variables	Volume flow	2009	Float	4	ro	-3.0e+38...3.0e+38 (LiterPerHour / Volume flow unit)
Measured values / Process variables	Time period signal (TPS)	48176	Float	4	ro	0...1.4e+27 (microSecond)
Measured values / Totalizers	Totalizer overflow	2612, 2812, 3012	Float	4	ro	-32000.0...32000.0
Min/max values / Oscillation frequency	Minimum value	2459	Float	4	ro	-3.4E+38...3.4E+38 (Hertz)
Operation / Custody transfer	Firmware version	7277	String	8	ro	0
Operation / Totalizer handling	Reset all totalizers	2609	Enum16	2	rw	0 : Cancel 1 : Reset + totalize
Operation / Totalizer handling	Totalizer control	2608, 2808, 3008	Enum16	2	rw	0 : Totalize 3 : Reset + hold 2 : Preset + hold 1 : Reset + totalize 4 : Preset + totalize 5 : Hold
Operation / Totalizer handling	Preset value	2590, 2592, 2594	Float	4	ro	-3.4E+38...3.4E+38 (kiloGram / Process variable unit)
Operation / Weighted averages	Weighted density average	26555	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_cubicMeter / Density unit)
Operation / Weighted averages	Totalizer value	2610, 2810, 3010	Float	4	ro	-3.4E+38...3.4E+38 (kiloGram / Process variable unit)
Operation / Weighted averages	Weighted temperature average	26559	Float	4	ro	-1.4E+21...1.4E+21 (Celsius / Temperature unit)
Sensor / Calibration	Zero point	7527	Float	4	rw	-3.4E+38...3.4E+38
Sensor / External compensation	External temperature	2507	Float	4	rw	-273.15...99999 (Celsius / Temperature unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Sensor / Supervision	Limit value measuring tube damping	4333	Float	4	rw	0...3.0e+38 (Ampere_per_Meter)
Sensor / Testpoints	Oscillation amplitude	2449, 2451	Float	4	ro	-3.0e+38...3.0e+38 (Percent)
Sensor / Testpoints	Signal asymmetry 0	2443	Float	4	ro	-3.0e+38...3.0e+38 (Percent)
Sensor / Testpoints	Carrier pipe temperature	9513	Float	4	ro	-3.0e+38...3.0e+38 (Celsius / Temperature unit)
Sensor / Testpoints	Oscillation damping	9505, 9507	Float	4	ro	0...3.0e+38
Sensor / Testpoints	Sensor electronics temperature (ISEM)	2457	Float	4	ro	-3.0e+38...3.0e+38 (Celsius / Temperature unit)
Sensor / Testpoints	Exciter current	9509, 9511	Float	4	ro	-3.0e+38...3.0e+38 (mA)
Sensor / Testpoints	Oscillation frequency	9501, 9503	Float	4	ro	-3.0e+38...3.0e+38 (Hertz)
Sensor / Testpoints	Raw value mass flow	10232	Float	4	ro	-3.0e+38...3.0e+38 (kiloGram_per_Hour / Mass flow unit)
Sensor / Testpoints	Oscillation damping fluctuation	2502, 2504	Float	4	ro	-3.0e+38...3.0e+38
Sensor / Testpoints	Frequency fluctuation	2498, 2500	Float	4	ro	-3.0e+38...3.0e+38
Sensor adjustment / Density adjustment	Density adjustment state	10236	Enum16	2	ro	5 : Done 1 : Density1AdjReady 4 : Density2AdjReady 0 : Density1AdjBusy 3 : Density2AdjBusy 2 : Alarm
Sensor adjustment / Zero verification	Status	10237	Enum16	2	ro	8 : Busy 2 : Failed 5 : Done
Sensor adjustment / Zero verification	Progress	6797	UInt8	1	ro	0...100 (Percent)
Sensor adjustment / Zero verification	Zero adjustment control	5121	Enum16	2	rw	0 : Cancel 1 : Start 2 : Start adjustment
Setup / System units	Corrected volume unit	2106	Enum16	2	rw	100 : NI 110 : Nhl 101 : Nm ³ 104 : Sl 102 : Sm ³ 103 : Sft ³ 112 : MSft ³ 109 : MMSft ³ 105 : Sgal (us) 106 : Sbbl (us;liq.) 108 : Sbbl (us;oil) 107 : Sgal (imp)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Corrected volume flow unit	2105	Enum16	2	rw	0 : NI/s 1 : NI/min 2 : NI/h 3 : NI/d 36 : Nhl/s 37 : Nhl/min 38 : Nhl/h 39 : Nhl/d 4 : Nm ³ /s 5 : Nm ³ /min 6 : Nm ³ /h 7 : Nm ³ /d 40 : SI/s 41 : SI/min 42 : SI/h 43 : SI/d 8 : Sm ³ /s 9 : Sm ³ /min 10 : Sm ³ /h 11 : Sm ³ /d 12 : Sft ³ /s 13 : Sft ³ /min 14 : Sft ³ /h 15 : Sft ³ /d 44 : MSft ³ /s 45 : MSft ³ /min 46 : MSft ³ /h 47 : MSft ³ /d 28 : MMSft ³ /s 29 : MMSft ³ /min 30 : MMSft ³ /h 31 : MMSft ³ /d 16 : Sgal/s (us) 17 : Sgal/min (us) 18 : Sgal/h (us) 19 : Sgal/d (us) 20 : Sbbl/s (us;liq.) 21 : Sbbl/min (us;liq.) 22 : Sbbl/h (us;liq.) 23 : Sbbl/d (us;liq.) 24 : Sgal/s (imp) 25 : Sgal/min (imp) 26 : Sgal/h (imp) 27 : Sgal/d (imp) 32 : Sbbl/s (us;oil) 33 : Sbbl/min (us;oil) 34 : Sbbl/h (us;oil) 35 : Sbbl/d (us;oil)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Density unit	2107	Enum16	2	rw	0 : g/cm ³ 21 : g/m ³ 22 : g/ml 97 : g/l 3 : kg/l 2 : kg/dm ³ 4 : kg/m ³ 24 : SG60°F 8 : SG4°C 9 : SG15°C 10 : SG20°C 11 : lb/ft ³ 12 : lb/gal (us) 13 : lb/bbl (us;liq.) 14 : lb/bbl (us;beer) 15 : lb/bbl (us;oil) 16 : lb/bbl (us;tank) 17 : lb/gal (imp) 18 : lb/bbl (imp;beer) 19 : lb/bbl (imp;oil) 98 : lb/in ³ 99 : STon/yd ³ 23 : °API
Setup / System units	Mass unit	2102	Enum16	2	rw	50 : g 51 : kg 52 : t 53 : oz 54 : lb 55 : STon
Setup / System units	Mass flow unit	2101	Enum16	2	rw	0 : g/s 1 : g/min 2 : g/h 3 : g/d 4 : kg/s 5 : kg/min 6 : kg/h 7 : kg/d 8 : t/s 9 : t/min 10 : t/h 11 : t/d 12 : oz/s 13 : oz/min 14 : oz/h 15 : oz/d 16 : lb/s 17 : lb/min 18 : lb/h 19 : lb/d 20 : STon/s 21 : STon/min 22 : STon/h 23 : STon/d
Setup / System units	Pressure unit	2130	Enum16	2	rw	6 : MPa a 9 : MPa g 5 : kPa a 8 : kPa g 4 : Pa a 7 : Pa g 0 : bar 2 : bar g 1 : psi a 3 : psi g

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Reference density unit	2108	Enum16	2	rw	2 : kg/Nm ³ 1 : kg/Nl 0 : g/Scm ³ 3 : kg/Sm ³ 4 : lb/Sft ³ 5 : °APIbase 6 : RD15°C 7 : RD20°C 8 : RD60°F
Setup / System units	Temperature unit	2109	Enum16	2	rw	0 : °C 2 : °F 1 : K 3 : °R
Setup / System units	Volume unit	2104	Enum16	2	rw	3 : ml 4 : l 5 : hl 6 : Ml 0 : cm ³ 1 : dm ³ 2 : m ³ 8 : af 9 : ft ³ 111 : Mft ³ 23 : MMft ³ 10 : fl oz (us) 11 : gal (us) 22 : kgal (us) 12 : Mgal (us) 15 : bbl (us;oil) 13 : bbl (us;liq.) 14 : bbl (us;beer) 16 : bbl (us;tank) 17 : gal (imp) 18 : Mgal (imp) 19 : bbl (imp;beer) 20 : bbl (imp;oil)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Volume flow unit	2103	Enum16	2	rw	0 : cm ³ /s 1 : cm ³ /min 2 : cm ³ /h 3 : cm ³ /d 4 : dm ³ /s 5 : dm ³ /min 6 : dm ³ /h 7 : dm ³ /d 8 : m ³ /s 9 : m ³ /min 10 : m ³ /h 11 : m ³ /d 12 : ml/s 13 : ml/min 14 : ml/h 15 : ml/d 16 : l/s 17 : l/min 18 : l/h 19 : l/d 20 : hl/s 21 : hl/min 22 : hl/h 23 : hl/d 24 : Ml/s 25 : Ml/min 26 : Ml/h 27 : Ml/d 32 : af/s 33 : af/min 34 : af/h 35 : af/d 36 : ft ³ /s 37 : ft ³ /min 38 : ft ³ /h 39 : ft ³ /d 97 : Mft ³ /s 98 : Mft ³ /min 99 : Mft ³ /h 100 : Mft ³ /d 92 : MMft ³ /s 93 : MMft ³ /min 94 : MMft ³ /h 96 : MMft ³ /d 40 : fl oz/s (us) 41 : fl oz/min (us) 42 : fl oz/h (us) 43 : fl oz/d (us) 44 : gal/s (us) 45 : gal/min (us) 46 : gal/h (us) 47 : gal/d (us) 48 : Mgal/s (us) 49 : Mgal/min (us) 50 : Mgal/h (us) 51 : Mgal/d (us) 52 : bbl/s (us;liq.) 53 : bbl/min (us;liq.) 54 : bbl/h (us;liq.) 55 : bbl/d (us;liq.) 56 : bbl/s (us;beer) 57 : bbl/min (us;beer) 58 : bbl/h (us;beer) 59 : bbl/d (us;beer) 60 : bbl/s (us;oil) 61 : bbl/min (us;oil) 62 : bbl/h (us;oil) 63 : bbl/d (us;oil)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
						64 : bbl/s (us;tank) 65 : bbl/min (us;tank) 66 : bbl/h (us;tank) 67 : bbl/d (us;tank) 68 : gal/s (imp) 69 : gal/min (imp) 70 : gal/h (imp) 71 : gal/d (imp) 72 : Mgal/s (imp) 73 : Mgal/min (imp) 74 : Mgal/h (imp) 75 : Mgal/d (imp) 76 : bbl/s (imp;beer) 77 : bbl/min (imp;beer) 78 : bbl/h (imp;beer) 79 : bbl/d (imp;beer) 80 : bbl/s (imp;oil) 81 : bbl/min (imp;oil) 82 : bbl/h (imp;oil) 83 : bbl/d (imp;oil) 88 : kgal/s (us) 89 : kgal/min (us) 90 : kgal/h (us) 91 : kgal/d (us)
Viscosity / Dynamic viscosity	Dynamic viscosity unit	2111	Enum16	2	rw	0 : cP 3 : mPa s 2 : Pa s 1 : P 4 : UserDynVis
Viscosity / Dynamic viscosity	User dynamic viscosity factor	2137	Float	4	rw	-3.4E+38...3.4E+38
Viscosity / Dynamic viscosity	User dynamic viscosity offset	2139	Float	4	rw	-3.4E+38...3.4E+38
Viscosity / Dynamic viscosity	User dynamic viscosity text	3353	String	10	rw	
Viscosity / Kinematic viscosity	Kinematic viscosity unit	2112	Enum16	2	rw	2 : cSt 0 : m ² /s 1 : mm ² /s 3 : St 4 : UserKinVis
Viscosity / Kinematic viscosity	User kinematic viscosity factor	2143	Float	4	rw	-3.4E+38...3.4E+38
Viscosity / Kinematic viscosity	User kinematic viscosity offset	2145	Float	4	rw	-3.4E+38...3.4E+38
Viscosity / Kinematic viscosity	User kinematic viscosity text	3358	String	10	rw	0
Viscosity / Temperature compensation	Calculation model	9401	Enum16	2	rw	1 : Power law 2 : Exponential 0 : Polynomial
Viscosity / Temperature compensation	Reference temperature	9402	Float	4	rw	-273.15...99999 (Celsius / Temperature unit)
Viscosity / Temperature compensation	Compensation coefficient X1	9404	Float	4	rw	-3.0e+38...3.0e+38
Viscosity / Temperature compensation	Compensation coefficient X2	9406	Float	4	rw	-3.0e+38...3.0e+38



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