

Special Documentation

Proline Prowirl 200

Modbus TCP over Ethernet-APL

System integration



Table of contents

1	About this document	4
1.1	Document function	4
1.2	Target group	4
1.3	Abbreviations	4
1.4	Symbols	5
1.5	Documentation	6
1.6	Registered trademarks	6
2	Modbus protocol	7
2.1	Operating principle	7
2.2	Modes of operation	7
2.3	Interface configuration	8
2.4	Data types	9
2.5	Byte transmission sequence	9
2.6	Modbus data map	10
2.7	Register addressing	12
3	Description of functions	13
3.1	Modbus function codes	13
3.2	Response time	13
4	Appendix	14
4.1	Data types	14
5	Register information	15

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 .

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.

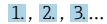
CAUTION

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 TCP over Ethernet-APL	
Prowirl D 200	BA02397D	GP01240D
Prowirl F 200	BA02398D	
Prowirl O 200	BA02399D	
Prowirl R 200	BA02400D	

1.6 Registered trademarks

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

2 Modbus protocol

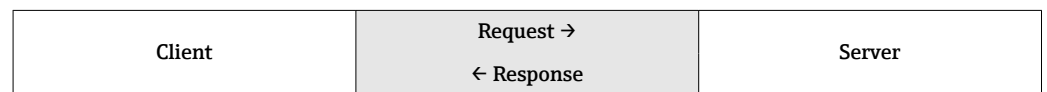
Modbus is an open, standardized communication protocol that is used in the areas of manufacturing automation, process automation and building automation.

The Modbus protocol is used to exchange data with intelligent field devices via 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.



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 Modes of operation

2.2.1 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.

2.3 Interface configuration

2.3.1 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

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

Setting the static IP address

Requirement

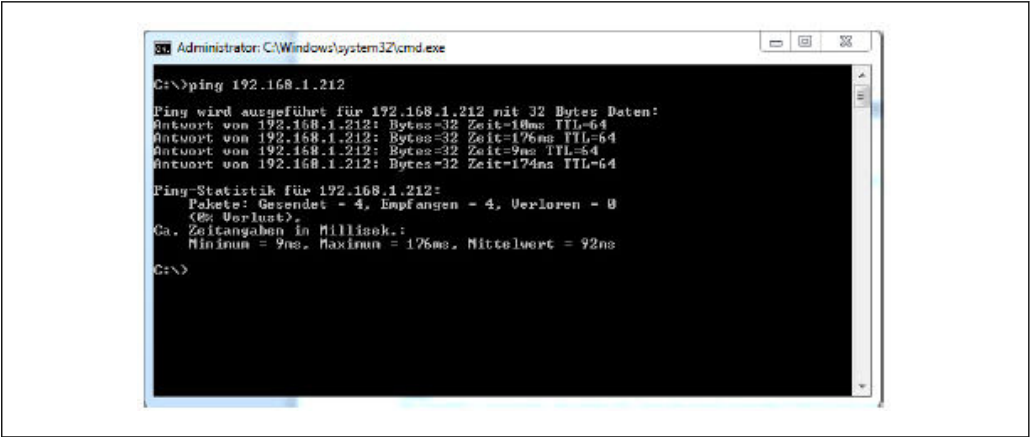
Off option selected in **DHCP client** parameter.

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.



A0058931

1 Checking the connection

2.4 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)

2.5 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 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		

2.6 Modbus data map

2.6.1 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 client can read or write to the entire data block simultaneously with a single request telegram.

2.6.2 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.

2.6.3 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

2.6.4 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 over Ethernet-APL	Data type *	Access **
Value of scan list register 0	5051	Volume flow	35944	Integer/Real	Read/write
Value of scan list register 1	5053	Mass flow	35958	Integer/Real	Read/write
Value of scan list register 2	5055	Corrected volume flow	35946	Integer/Real	Read/write
Value of scan list register 3	5057	Flow velocity	5085	Integer/Real	Read/write
Value of scan list register 4	5059	Temperature	35952	Integer/Real	Read/write
Value of scan list register 5	5061	Totalizer 1	2610	Integer/Real	Read/write
Value of scan list register 6	5063	Totalizer 2	2810	Integer/Real	Read/write
Value of scan list register 7	5065	Totalizer 3	3010	Integer/Real	Read/write
Value of scan list register 8	5067	Actual diagnostics (no.)	6801	Integer/Real	Read/write
Value of scan list register 9	5069	Tot1 Control	2608	Integer/Real	Read/write
Value of scan list register 10	5071	Tot2 Control	2808	Integer/Real	Read/write
Value of scan list register 11	5073	Tot3 Control	3008	Integer/Real	Read/write
Value of scan list register 12	5075	-	0	Integer/Real	Read/write
Value of scan list register 13	5077	-	0	Integer/Real	Read/write
Value of scan list register 14	5079	-	0	Integer/Real	Read/write
Value of scan list register 15	5081	-	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.					

2.7 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 volume 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 →  10	Write multiple device parameters
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 client:
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 / Totalizer	Totalizer failure behavior	2606, 2806, 3006	Enum16	2	rw	0 : Hold 1 : Continue 2 : Last valid value + continue
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)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
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 : Sbbbl (us;liq.) 108 : Sbbbl (us;oil) 107 : Sgal (imp) 128 : kWh 130 : MWh 129 : GWh 163 : kJ 164 : MJ 167 : GJ 171 : kcal 162 : Mcal 170 : Gcal 165 : Btu 172 : MBtu 173 : MMBtu 251 : None
Application / Totalizer	Mass unit	2602, 2802, 3002	Enum16	2	rw	0 : g 1 : kg 2 : t 3 : oz 4 : lb 5 : STon
Application / Totalizer	Preset value	2590, 2592, 2594	Float	4	rw	-3.4E+38...3.4E+38 (cubicMeter / Process variable unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Application / 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 : Sbbl (us;liq.) 108 : Sbbl (us;oil) 7 : Sgal (imp)
Communication / APL port	IP address	4155	String	15	rw	0
Communication / APL port	Subnet mask	4163	String	15	rw	0
Communication / APL port	Default gateway	4171	String	15	rw	0
Communication / APL port	DHCP client	21781	Enum8	1	rw	0 : Off 1 : On
Communication / APL port	MAC address	4210	String	17	ro	0
Communication / APL port	PrimaryNameServer	4181	UInt32	4	rw	0...4294967295
Communication / APL port	SecondaryNameServer	4183	UInt32	4	rw	0...4294967295
Diagnostics / Device information	Serial number	7003	String	11	ro	0
Diagnostics / Device information	Order code	2058	String	20	ro	0
Diagnostics / Device information	Device tag	2026	String	32	ro	0
Diagnostics / Device information	CurrentDiagnosticNumber	6801	UInt16	2	ro	0...65535
Guidance / Commissioning	Manufacturer ID	2078	UInt16	2	ro	0...65535
Guidance / Commissioning	Manufacturer	8001	String	32	ro	0
Heartbeat Technology / Performing verification	Progress	6797	UInt8	1	ro	0...100 (Percent)
Heartbeat Technology / Performing verification	Verification result	2355	Enum16	2	ro	250 : Not supported 2 : Passed 3 : Not done 0 : Failed
Heartbeat Technology / Performing verification	Start verification	2270	Enum16	2	ro	0 : Cancel 1 : Start 2 : Clear data
Heartbeat Technology / Performing verification	Status	2079	Enum16	2	ro	1 : Done 8 : 0% 0 : Failed 3 : Not done
Heartbeat Technology / Verification results	Verification ID	2315	UInt16	2	ro	0...65535
Measured values / Process variables	Mass flow	35958	Float	4	ro	-1.4E+21...1.4E+21 (kiloGram_per_Hour / Mass flow unit)
Measured values / Process variables	Corrected volume flow	35946	Float	4	ro	-1.4E+21...1.4E+21 (NormalcubicMeterPerHour / Corrected volume flow unit)
Measured values / Process variables	Temperature	35952	Float	4	ro	-1.4e+21...1.4e+21 (Celsius / Temperature unit)
Measured values / Process variables	Volume flow	35944	Float	4	ro	-1.4E+21...1.4E+21 (cubicMeterPerHour / Volume flow unit)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Measured values / Process variables	Flow velocity	5085	Float	4	ro	-1.4E+21...1.4E+21 (Meter_per_Second / Velocity unit)
Measured values / Process variables	Calculated saturated steam pressure	47232	Float	4	ro	-1.4e+16...1.4e+16 (Bar / Pressure unit)
Measured values / Process variables	Steam quality	47234	Float	4	ro	-1.4E+21...1.4E+21 (Percent)
Measured values / Process variables	Total mass flow	47254	Float	4	ro	-5.04e+24...5.04e+24 (kiloGram_per_Hour / Mass flow unit)
Measured values / Process variables	Condensate mass flow	48010	Float	4	ro	-5.04e+24...5.04e+24 (kiloGram_per_Hour / Mass flow unit)
Measured values / Process variables	Energy flow	48012	Float	4	ro	-1.4e+18...1.4e+18 (kiloWatt / Energy flow unit)
Measured values / Process variables	Heat flow difference	48014	Float	4	ro	-1.4e+18...1.4e+18 (kiloWatt / Energy flow unit)
Measured values / Process variables	Reynolds number	48016	Float	4	ro	-1.4E+21...1.4E+21
Measured values / Process variables	Vortex frequency	33123	Float	4	ro	0...5000 (Hertz)
Measured values / Process variables	Density	45086	Float	4	ro	0...1.4E+21 (kiloGram_per_cubicMeter / Density unit)
Measured values / Process variables	Pressure	45322	Float	4	ro	0...250 (Bar / Pressure unit)
Measured values / System values	Vortex amplitude	45104	Float	4	ro	0...1
Measured values / System values	Measuring tube pressure	46811	Float	4	ro	0...250 (Bar / Pressure unit)
Measured values / System values	Pressure cell temperature	46833	Float	4	ro	-273.15...24999726.85 (Celsius / Temperature unit)
Measured values / Totalizers	Totalizer overflow	2612, 2812, 3012	Float	4	ro	-32000.0...32000.0
Measured values / Totalizers	Totalizer value	2610, 2810, 3010	Float	4	ro	-3.4E+38...3.4E+38 (cubicMeter / Process variable unit)
Medium properties / Gas composition	Mol% CO2	45244	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% C2H6	45246	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% C3H8	45248	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% i-C4H10	45250	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C4H10	45252	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% i-C5H12	45254	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C6H14	45256	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C7H16	45258	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C8H18	45260	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C9H20	45262	Float	4	rw	0...100 (Percent)

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Medium properties / Gas composition	Mol% H ₂ O	45264	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% H ₂ S	45266	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% H ₂	45268	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% CO	45270	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% O ₂	45272	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% He	45274	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C ₅ H ₁₂	45276	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% n-C ₁₀ H ₂₂	45278	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% C ₂ H ₃ Cl	45280	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% HCl	45282	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% Kr	45284	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% Ne	45286	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% NH ₃	45288	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% other gas	45290	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% SO ₂	45292	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% Xe	45294	Float	4	rw	0...100 (Percent)
Medium properties / Gas composition	Mol% C ₂ H ₄	45296	Float	4	rw	0...100 (Percent)
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
Process parameters / Low flow cutoff	Off value low flow cutoff	5104	Float	4	rw	0...100.0 (Percent)
Process parameters / Low flow cutoff	On value low flow cutoff	5138	Float	4	rw	0
Process parameters / Low flow cutoff	Pressure shock suppression	5140	Float	4	rw	0...100 (Second)
Sensor / Process parameters	Flow override	5503	Enum16	2	rw	0 : Off 1 : On

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Sensor / System units	Specific heat capacity unit	26396	Enum16	2	rw	1 : kJ/(kgK) 2 : MJ/(kgK) 3 : kWh/(kgK) 4 : kcal/(kgK) 5 : Btu/(lb°R)
Sensor / Testpoints	Vortex kurtosis	45106	Float	4	ro	0...10
Setup / Medium selection	Steam quality value	45298	Float	4	rw	0...100 (Percent)
Setup / System units	Density unit	2107	Enum16	2	rw	0 : g/cm ³ 3 : kg/l 2 : kg/dm ³ 4 : kg/m ³ 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)
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

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 : Sl/s 41 : Sl/min 42 : Sl/h 43 : Sl/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 32 : Sbbl/s (us;oil) 33 : Sbbl/min (us;oil) 34 : Sbbl/h (us;oil) 35 : Sbbl/d (us;oil)
Setup / System units	Temperature unit	2109	Enum16	2	rw	0 : °C 2 : °F 1 : K 3 : °R

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)
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)
Setup / System units	Mass unit	2102	Enum16	2	rw	50 : g 51 : kg 52 : t 53 : oz 54 : lb 55 : STon

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Pressure unit	2130	Enum16	2	rw	237 : MPa 12 : kPa 11 : Pa 0 : bar 8 : mbar 13 : torr 14 : atm 6 : psi 10 : kgf/cm ² 9 : gf/cm ² 238 : inH ₂ O (4°C) 1 : inH ₂ O (68°F) 239 : mmH ₂ O (4°C) 4 : mmH ₂ O (68°F) 3 : ftH ₂ O (68°F) 2 : inHg (0°C) 5 : mmHg (0°C)
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 ³ 108 : Sbbl (us;oil)
Setup / System units	Energy flow unit	5786	Enum16	2	rw	127 : kW 0 : MW 144 : GW 1 : kJ/s 2 : kJ/min 3 : kJ/h 4 : kJ/d 5 : MJ/s 141 : MJ/h 6 : MJ/min 7 : MJ/d 24 : GJ/s 25 : GJ/min 26 : GJ/h 27 : GJ/d 11 : kcal/s 12 : kcal/min 13 : kcal/h 14 : kcal/d 8 : Mcal/s 9 : Mcal/min 140 : Mcal/h 10 : Mcal/d 28 : Gcal/s 29 : Gcal/min 30 : Gcal/h 31 : Gcal/d 32 : Btu/s 33 : Btu/min 142 : Btu/h 34 : Btu/day 15 : MBtu/s 16 : MBtu/min 17 : MBtu/h 18 : MBtu/d 19 : MMBtu/s 20 : MMBtu/min 21 : MMBtu/h 22 : MMBtu/d

Parameter group	Parameter label	Register (1-based)	Data Type	Size (Bytes)	Access	Range
Setup / System units	Energy unit	5809	Enum16	2	rw	128 : kWh 130 : MWh 129 : GWh 163 : kJ 164 : MJ 167 : GJ 171 : kcal 162 : Mcal 170 : Gcal 165 : Btu 172 : MBtu 173 : MMBtu
Setup / System units	Calorific value unit	5785	Enum16	2	rw	0 : kJ/Nm ³ 8 : MJ/Nm ³ 1 : kWh/Nm ³ 11 : MWh/Sm ³ 3 : kJ/Sm ³ 10 : MJ/Sm ³ 2 : kWh/Sm ³ 9 : MWh/Nm ³ 4 : Btu/Sm ³ 5 : MBtu/Sm ³ 7 : Btu/Sft ³ 6 : MBtu/Sft ³
Setup / System units	Velocity unit	2600	Enum16	2	rw	21 : m/s 20 : ft/s
Setup / System units	Dynamic viscosity unit	2111	Enum16	2	rw	0 : cP 2 : Pa s 1 : P
Setup / System units	Specific volume unit	35069	Enum16	2	rw	240 : m ³ /kg 0 : ft ³ /lb
Setup / System units	Calorific value unit	26239	Enum16	2	rw	4 : kJ/kg 5 : MJ/kg 2 : kWh/kg 3 : MWh/kg 6 : kJ/lb 7 : MJ/lb 8 : kWh/lb 9 : MWh/lb 10 : Btu/lb 11 : MBtu/lb
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



www.addresses.endress.com
