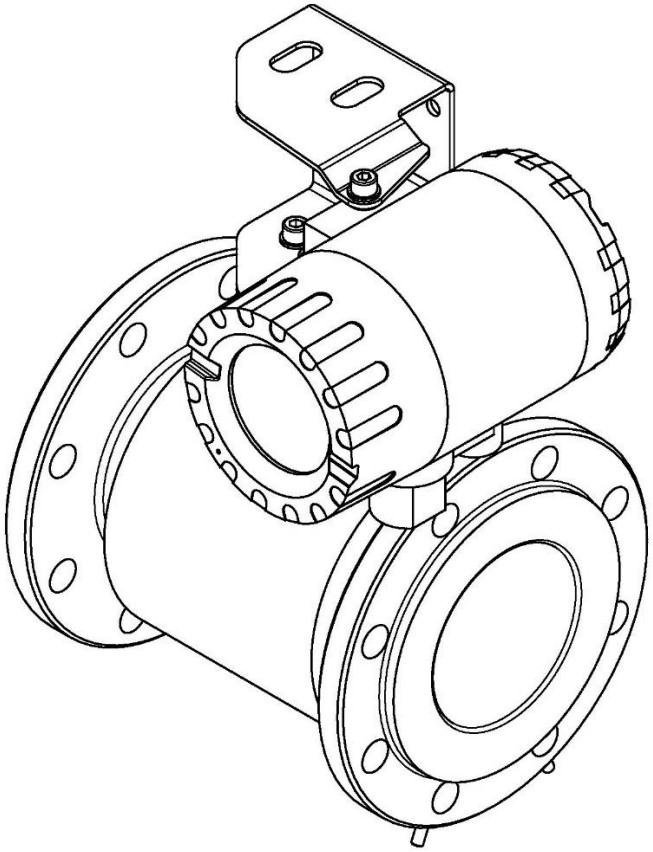
MODBUS MANUAL

ELECTROMAGNETIC FLOWMETER

PEM-1000



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Used markings:

Symbol	Description
	Warning signifying that it is necessary to follow the information in the documentation precisely in order to ensure device safety and complete functionality.
	Information particularly useful during device installation and operation.
	Information concerning dealing with used equipment.

BASIC REQUIREMENTS AND SAFETY OF OPERATION

- The manufacturer is not responsible for damage caused by improper installation of the device, not maintaining the device in good technical condition and operating the device contrary to its intended use.
- Installation should be carried out by qualified personnel authorized to install electrical devices and control and measuring equipment. The installer is responsible for carrying out the installation in accordance with this manual as well as safety and electromagnetic compatibility standards and regulations applicable to a given type of installation.
- In case of an installation with control and measuring equipment, in the event of a leak, medium under pressure causes a risk to the personnel. During device installation, operation and inspection all safety and precautionary requirements must be taken into account.
- If the device malfunctions, it should be disconnected and handed over to the manufacturer or to a body authorized by the manufacturer for repairs.

In order to minimize probability of failure and resultant danger to personnel, avoid installing the device under particularly unfavourable conditions when the following dangers are present:

- Danger of mechanical impacts, excessive shocks and vibrations.
- Excessive temperature variations.
- Vapour condensation, dust, icing.

Changes in product manufacture may precede an update to the user's paper documentation. Up-to-date operating manuals can be found on manufacturer's website at www.aplisens.pl

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1. MODBUS COMMUNICATION

1.1. Data of the MODBUS interface in the device

Physical layer	RS485 half-duplex
Terminating resistor	Built-in, 130Ω, activated by switch on rear wall of electronics unit, item "2".
Specification of RS485 transceiver	Interface galvanically isolated from ground of the flow meter. Allowable voltage between the common wire and lines A, B:-7/+ 12V. "Fail-safe" receiver. Reduction of rate of rise ("slew-rate") during sending. Transceiver does not interfere with the operation of the bus without power to the flowmeter.
Transmission mode	MODBUS RTU, compatible with MODBUS over serial line specification and implementation guide V1.02
Time relationships for transmission	Compatible with the requirements of MODBUS over serial line specification and implementation guide V1.02
MODBUS electrical connection	Three screw terminals in terminal chamber at the back of the device. Interface with galvanic isolation, connection of the common wire is required. *Terminal 9 - line A RS485 (non-reversing);* *Terminal 10 - line B RS485 (reversing);* *Terminal 11 - common wire RS485.*
Range of digital transmission	1200 mm (shielded twisted pair)
Address space	1...247 device addresses
Maximum number of devices on the bus	256
Transmission rate	4800, 9600, 19200, 38400, 57600, 115200 bps
Transmission parity check	no parity, odd, even
Number of bits of sign of transmission frame	11 bits (8N2, 8E1, 8O1). Number of stop bits connected with parity check. For *no parity* there are 2 stop bits, 1 bit for the other cases.
Response time for the query	max. 20ms, typical 10ms, measured from the end of query frame to start of response frame. It does not depend on transmission rate.
Setting of transmission parameters	From the keyboard, from configuration menu or using the MODBUS interface by making entries into the corresponding registers.

1.2. Detailed information

Physical layer

MODBUS interface of the flowmeter is intended for connecting to two-wire RS485 bus. Because the interface is galvanically isolated it is also required to connect a common wire RS485. Method of its connection depends on system configuration and expected differences in potentials between the devices.

Connection diagram is presented on the below figure:

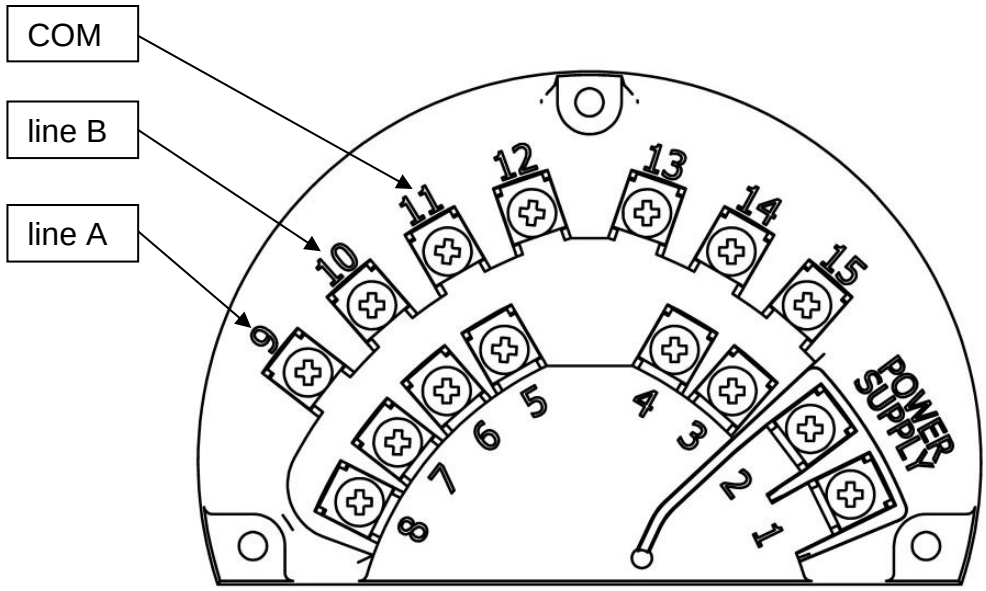


Figure 1.

The most popular terminology of terminals markings acc. to RS485 is given; that is line A is non-reversing line of the interface while the line B is reversing line. This standard is used by the world's largest manufacturers of the RS485 transceivers. It is important to bear in mind that there is also contrary method of marking of these lines compatible with the TIA/EIA standard.

The flowmeter is equipped with galvanically isolated MODBUS interface.

Non-isolated RS485 interface allows difference of ground potentials for the individual interfaces not exceeding -7 to +12V, while each difference of potentials of the grounds causes flow of equalizing currents. Exceeding of the potentials difference may even cause damage of the interface. In case of an isolated interface the common wire is connected only to ground of the Master device (usually using cable screen) and is not connected with the other grounds therefore the potential difference is small and equalizing currents does not flow. Ground (enclosure) potential of the Slave device may considerably differ from the ground potential of the Master device without negative consequences.

Typical connection diagram of two-wire RS485 bus is indicated on the below figure:

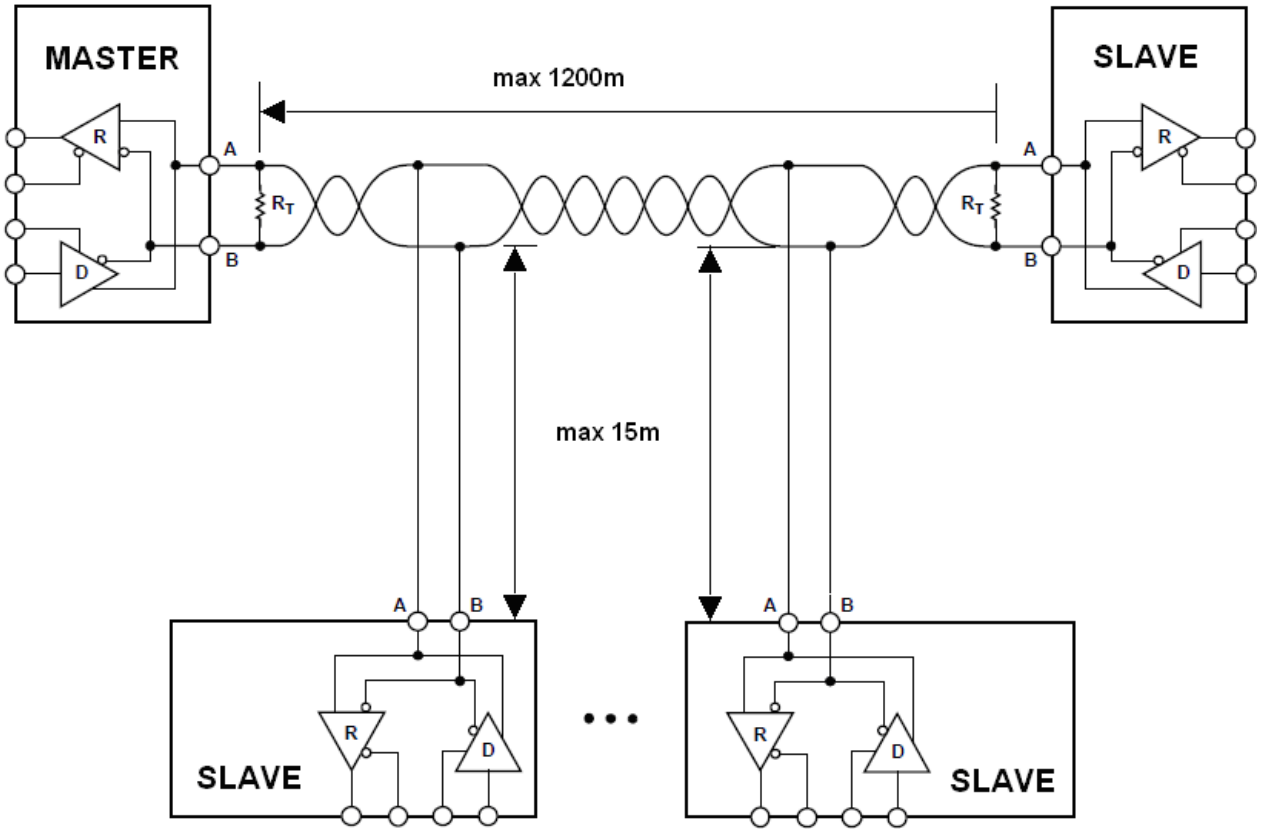


Figure 2. Connection diagram of two-wire RS485 bus

To ensure correct operation of many devices on one serial communication bus you should connect to it in series appropriate leads from the devices. Each device connected to the bus should have unique address assigned.

It is possible to configure network with max. length 1200 metres and maximum 247 Modbus devices. The bus should be led from the Master device, through successive devices (connected directly or through cable junction boxes) up to the last Slave device. Each stub of the conductor from the bus may be max. 15 meters long, while as far as it is possible you should avoid such long stubs. Do not led cables in "star" configuration. Use cables suitable for the RS485 bus that is screened twisted pair with suitable characteristic impedance compatible with EIA-485. Bus should be terminated with a terminating resistor R_T at least from the side of the last Slave device or from both ends as presented on the figure. Flowmeter is equipped with a terminating resistor activated by a configuration switch located on the back wall of the electronics unit.

If the bus consists of at least one device without fail-safe type interface that is it does not interpret differential voltages A-B smaller than ±200mV as an inactive condition then it is required to connect a set of pull-up resistors to the line A, B, which are forcing voltages on lines when no transmitter is active. Flowmeter interface is equipped with such resistors, which may be activated using configuration switch located on the rear wall of the electronics unit.

Marking and operation of the switches is presented on the following figure:

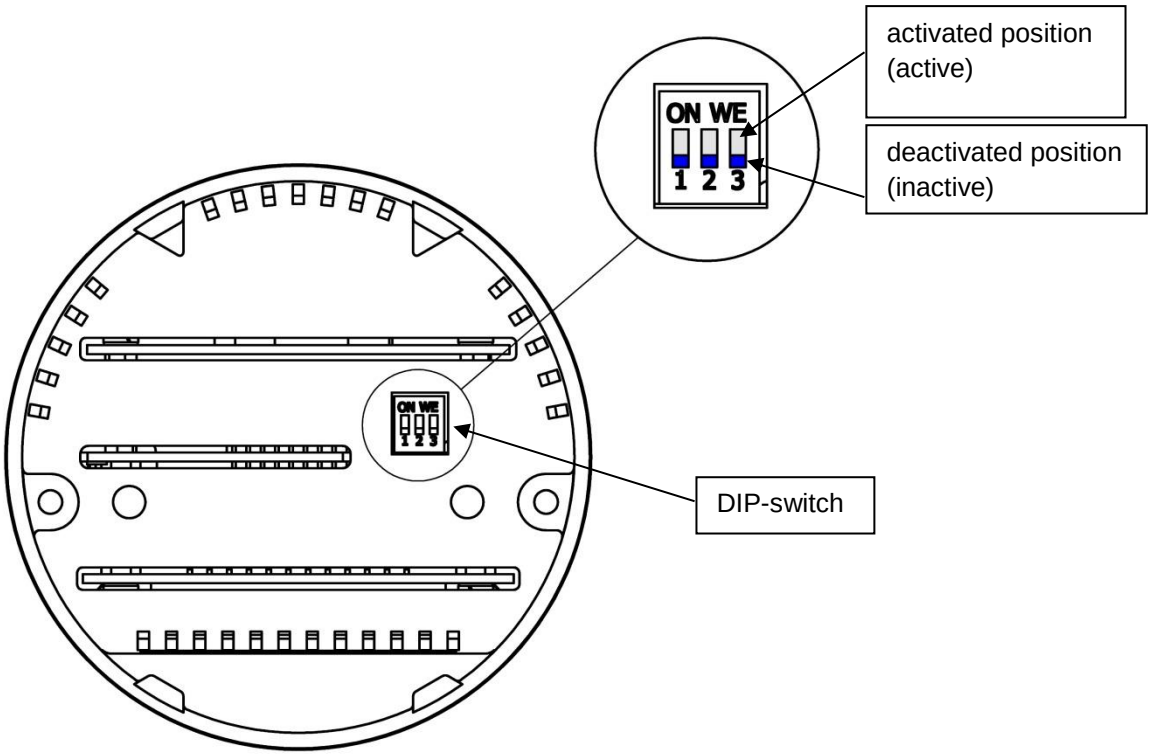


Figure 3.

Pos. 1, 3: "fail-safe" resistors, pos. 2: terminating resistors. Switch for the given position is enabled (switched on) when its slider is set in upper position.

Enable items 1 and 3 in case when the "fail-safe" resistors are activated. Flowmeter receiver does not require to enable the "fail-safe" resistors.
Bus terminator may be located also in the junction box and therefore it is not necessary to manipulate configuration switch.

All positions of the switch are disabled in new devices.

1.3. Checking and setting the parameters of the transmission

Use MODBUS menu for this purpose which is located in: Configuration → Modbus.
In this way you can change the following parameters:

- Enable or disable MODBUS module.
- Switch on or switch off saving using the MODBUS interface.
- Own address of the device.
- Transmission rate.
- Configuration of stop bit parity.
- The format of transferred data.

Access to the menu requires logging in using the appropriate (administrator) code.

Change of transmission parameters is possible in any time also during the transmission and it takes place immediately after confirmation of the changes in the menu. It is important to bear in mind that change of configuration during the transmission will stop it (frame coming from the Master device will be ignored).

All data sent through the MODBUS interface can have one of the four formats (“order”) available (configured) in the menu.

Bytes “order” for the data send by the MODBUS interface (Little Endian coding in RAM) explained based on the example:

Given number:	0x22334455
Assumed description of its component bytes:	0xDDCCBBAA
	[0] [1] [2] [3] (index)
This number is permanently located in RAM:	55 44 33 22

It can be located in the MODBUS frame as follows:

1) the simplest method - MRBO_AABBCCDD 55 44 33 22
2) Big Endian method for MODBUS - MRBO_DDCCBBAA 22 33 44 55 (NATURAL)
3) method changing the words MODBUS - MRBO_BBAADDCC 44 55 22 33 (REVERSED)
4) the least intuitive method - MBRO_CCDDAABB 33 22 55 44

Modbus interface operates in the unicast mode what means than it responds to correct MODBUS frames, with compatible address, send by the Master device.

1.3.1. The Interface supports the following MODBUS functions (frame types)

Function code	Name	Description
0x03	Read holding registers	Registers reading. Basic function used to read the measurement results and current parameters of the equipment. Implemented four address spaces are described in the following part of the manual.
0x10	Write Multiple Registers	Write registers. The function used for setting of device operation parameters both for these saved in the non-volatile memory and these set temporarily (to the moment of device restart).
0x01	Read Coils	Read of “coils” that is bit variables (ON or OFF state): - intended for switching on the device operation parameters, both for this non-volatile and volatile - indicating device system flags - intended for calling device functions. Implemented as one address field allowing free group readout.
0x05	Write Single Coil	Save of the single “coil” that is setting of bit output to ON or OFF. ON state is set by 0xFF00 value, OFF state by 0x0000 value.
0x08 **sub-functions** **0x00 00,** **0x00 01,** **0x00 0A** **÷** **0x00 12**	Diagnostics	Selected set of diagnostic functions allowing checking transmission correctness through the "echo" frame and deleting and reading diagnostic meters compatible with the MODBUS standard.
0x2B **sub-function** **0x0E**	Encapsulated Interface Transport / Read Device Identification	Reading of text information identifying the equipment.

1.3.2. MODBUS exceptions

If MODBUS frame with compatible address and correct CRC control area but with incorrect data will be send to the device then the exception will be returned. For frames saving data to the device, that is frame types 0x05 and 0x10, the exception will be returned also if all data contained in the frame are correct and the option to execute write is not unlocked in the device menu.

Supported MODBUS exceptions are presented in the table:

Error code	Name	Description
1	Illegal function	This exception is returned when function code is not supported by the device.
2	Illegal data address	This exception is returned in case of query for non-implemented address or address, which is not a beginning of the logically coherent register (in case of data longer than 16-bit). Reading of long registers in batches is forbidden due to lack of guarantees of the accuracy of the data.
3	Illegal data value	This exception is returned in case of query for incorrect number of registers that is the end of read area is outside the implemented area or the end of read area divides the logically coherent register (longer than 16-bit). Reading of long registers in batches is forbidden due to lack of guarantees of the accuracy of the data.
4	Slave device failure	This exception is returned when the device is damaged.
6	Server device busy	This exception is returned when all data in the write frame are correct but the option to execute writing is locked in the device menu.

Currently all data made available by the MODBUS interfaces are read-only. It is only possible to erase diagnostic meters.

Frame **0x03** allows reading and frame **0x10** allows writing registers of the device. The unicast mode is only permitted.

1.3.3. Address fields

Address fields, as in the table (MODBUS addresses are given) are available:

Address range: MODBUS*	Name	Description
106-106	Quick identification of the device - "reversed" order	This register is presented due to a backward compatibility with a previous version of the device. Size of area is one (1) 32-bit word.
200-200	Data allowing the identification of the order of data transfer set in the device	A fixed 32-bit data which reading allows identify the order of transmitted bytes that is set in the device. Hexadecimal value of this data - 0x11223344. Field size - one 32-bit word.
2000-2010	Measurement data in basic version corresponding to PEM-1000	This field contains basic measurement data, in the form of 32-bit words and it is compatible with the previous version of the PEM-1000 device. Field size - six 32-bit words.
4000-4030	Extended measurement data	This field contains extended measurement data, in the form of 32-bit words, which, when read in the devices with an older version of the bus, were arranged in the “reversed” order that is younger 16-bit word first and then the older 16-bit word. Field maintained to ensure backward compatibility of the devices. All data contained in 4000-4030 and 5000-5030 fields are identical. Field size - sixteen 32-bit words.
5000-5030	Extended measurement data	This field contains extended measurement data, in the form of 32-bit words, which, when read in the devices with an older version of the bus, were arranged in the “big-endian” order that is older 16-bit word first and then the younger 16-bit word. All data contained in 4000-4030 and 5000-5030 fields are identical. Field size - sixteen 32-bit words.
5032-5036	Input and outputs states of the device	This field contains binary input test status, binary outputs status and also current loop output value in the form of 32-bit words. Field size- three 32-bit words.
5100-5126	General basic parameters of the device	This field contains basic parameters of device operation settings in the form of the 32-bit words. Field size - fourteen 32-bit words.
5200-5218	General advanced parameters of the device	This field contains advanced parameters of device operation settings in the form of the 32-bit words. Field size - ten 32-bit words.
5300-5344	Device output parameters	This field contains the operating parameters of device outputs, in the form of the 32-bit words. Field size - twenty three 32-bit words.
5360-5362	Device input parameters	This field contains the operating parameters of device inputs, in the form of the 32-bit words. Field size - two 32-bit words.
5400-5414	Device filters parameters	This field contains the operating parameters of the filters used in the device, in the form of the 32-bit words. Field size - eight 32-bit words.
5450-5456	Device MODBUS parameters	This field contains MODBUS operation parameters in the form of the 32-bit words. Field size - four 32-bit word.
5500-5506	Device archive parameters	This field contains archive operation parameters in the form of the 32-bit words. Field size - four 32-bit word.
5550-5560	Device time settings	This field contains time settings in the device, in the form of the 32-bit words. Field size - six 32-bit words.

5600-5626	Device calibration parameters	This field contains device calibration parameters, in the form of the 32-bit words. Field size - fourteen 32-bit words.
5650-5668	Device dosing parameters	This field contains device dosing function, in the form of the 32-bit words. Field size - ten 32-bit words.
5700-5720	Device diagnostics parameters	This field contains device diagnostics variables, in the form of the 32-bit words. Field size - eleven 32-bit words.
5800-5800	Device status variables	This field contains device status variable, in the form of the 32-bit word. Field size - one 32-bit word.
5850-5862	Device version variables	This field contains device version and software variables and device serial number, in the form of the 32-bit words. Field size - seven 32-bit words.
7000-7030	Device screen view	This field contains characters displayed on the device screen, in the form of the 32-bit words. Field size - sixteen 32-bit words.
8000-8032	Variables of events archive for the device	This field contains variables of events archive for the device, in the form of the 32-bit words. Field size - seventeen 32-bit words.
9000-9032	Variables of device measurements archive	This field contains variables of readout of device measurement archive, in the form of the 32-bit words. Field size - seventeen 32-bit words.

Frame **0x01** allows reading and frame **0x05** allows writing “coils” (bit variables) in the device. The unicast mode is only permitted.

One **continuous address field** is available; as in the table (MODBUS addresses are given):

Coding	Description	Example
1000-1061	Device bit variables	This field contains bit variables, both saved and volatile as well as read-only bits and executable commands. Field size - 62 bits.

Please remember that MODBUS registers addresses are bigger by 1 than the addresses sent in frames.

Detailed explanation of **data coding** in the MODBUS registers are given in the below table:

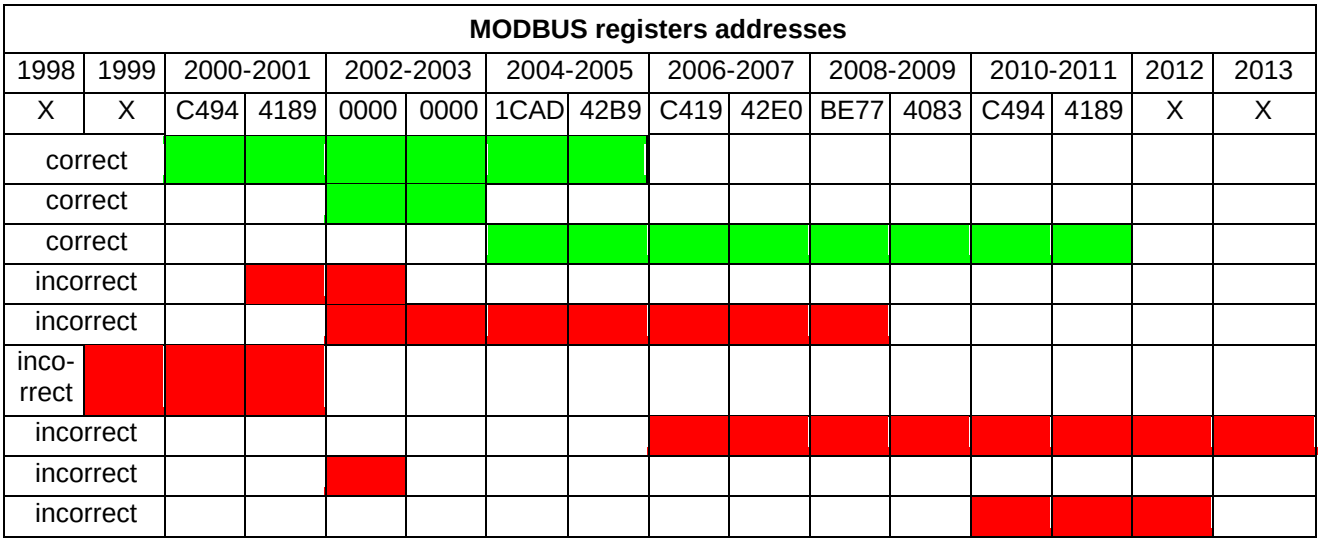
Coding	Description	Example
int	32-bit integer, “big endian” coded. Entry in two MODBUS registers that is on 4 bytes.	Content (hexadecimal) of successive 16-bit registers: *08 F0, D1 80.* It corresponds to 0x08F0D180 that is 150.000.000 in decimal.
float	32-bit floating-point number, conforming IEEE754, saved in the “big-endian” order. Entry in two MODBUS registers that is on 4 bytes.	Content (hexadecimal) of successive 16-bit registers: *42 E0, C4 19.* It corresponds to 0x42E0C419 that is 112,383 in floating-point format.
short	16-bit integer, “big endian” coded. Entry in two MODBUS registers that is on 4 bytes.	Content (hexadecimal) of successive 16-bit registers: *00 00, 3A 98.* It corresponds to 0x3A98 that is 15.000 in decimal.
uchar	8-bit integer, “big endian” coded. Entry in two MODBUS registers that is on 4 bytes.	Content (hexadecimal) of successive 16-bit registers: *00 00, 00 96.* It corresponds to 0x96 that is 150 in decimal.
char table	Table of four 8-bit integers, “big endian” coded. Entry in two MODBUS registers that is on 4 bytes.	Content (hexadecimal) of successive 16-bit registers: *31 32, 33 34.* It corresponds to 0x31323334 that is “1234” in ASCII format.

Because 32-bit areas contains numbers constituting whole, it is not permissible to read/write this numbers in batches (single MODBUS registers) and in case of attempt for such reading **of at least one register** the MODBUS exception will be returned. This is because the 32-bit number consisting of two 16-bit readings may be incorrect if value of such number is changed between the reading/writing.

For example

32-bit register contains increasing number. First value - 0x0000FFFF. Next value - 0x00010000 (bigger by 1). If the number is read in the order "older 16b word - younger 16b word" and the change occurs exactly between the readings then number 0x0000 (first reading) 0x0000 (second reading) will be obtained what will give incorrect number 0x00000000 that is 0.

Below you will find examples of correct and incorrect servicing of registers, illustrated in the 2000-2010 field. Colour fields indicate read/written registers:



1.3.4. Description of the registers implemented in the flowmeter

Explanation of operations executed in the MODBUS registers is given in the below table:

Operation	Description	Example
RD_ONLY	Read-only register. Reading using MODBUS function 0x03.	Reading frame for bytes order register (register 200): *0x05 0x03 0x00 0xC7 0x00 0x02*.
RD/WR	Register intended for both read and write function. Data is stored in the non-volatile memory of the device. Reading using MODBUS function 0x03, while saving using 0x10 function.	Reading and writing frame for user-specified PIN (register 5100, pin 0000). Read: *0x05 0x03 0x13 0xEB 0x00 0x02*. Write: *0x05 0x10 0x13 0xEB 0x00 0x02 0x04 0x00 0x00 0x00 0x00*.
NO_MEM	Register intended for both read and write function (unstable). Data is stored in the volatile memory of the device. Reading using MODBUS function 0x03, while saving using 0x10 function.	Diagnostic reading and writing frame for current loop (register 5700, current 10.0 mA). Read: *0x05 0x03 0x16 0x43 0x00 0x02*. Write: *0x05 0x10 0x16 0x43 0x00 0x02 0x04 0x41 0x20 0x00 0x00*.

1.3.4.1. The contents of registers in 106-106 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
106	0x0069	Short identification	Contains decimal value 2000 indicating the version of the MODBUS interface.	-	short	RD_ONLY

1.3.4.2. The content of registers in 200-200 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
200	0x00C7	Bytes order register	Contains fixed hexadecimal value 0x11223344. After reading it allows identifying the order of data bytes transmission set in the device.	-	int	RD_ONLY

1.3.4.3. The contents of the registers for 2000-2010 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
2000	0x07CF	Current flow Q	Current flow, in litres per second. Filtration can be configured independently for this variable.	l/s	float	RD_ONLY
2002	0x07D1	Empty pipe error	The error is indicated on bit 0 of the number as the value of 1. The other bits are always 0.	-	int	RD_ONLY
2004	0x07D3	Total totalizer S	Counter for the volume of flowing liquid. The counter increases for positive flow and decreases for negative flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
2006	0x07D5	Positive totalizer S+	Counter for the volume of flowing liquid in accordance with the direction of the sensor. The counter increases for positive flow and does not change for negative flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
2008	0x07D7	Negative totalizer S-	Counter for the volume of flowing liquid opposite to the direction of the sensor. The counter increases for negative flow and does not change for positive flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
2010	0x07D9	Current flow Q2 - a copy of the register 2000	Current flow, in litres per second.	l/s	float	RD_ONLY

1.3.4.4. The contents of registers in 4000-4030 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
4000	0x0F9F	Current flow Q	Current flow expressed in cubic metres per hour (basic unit). Filtration can be independently configured for this variable	m^3/h	float	RD_ONLY
4002	0x0FA1	Status / informational flags of the device	Bit meaning: *bit 7* - measurement board error, *bit 6* - sensor error, *bit 5* - sensor coil error, *bit 4* - memory error, *bit 3* - empty pipe error, *bit 2* - unfilled pipe error (for sensors with detection of unfilled pipe) The other bits: 0	-	int	RD_ONLY
4004	0x0FA3	Total totalizer S	Counter for the volume of flowing liquid. The counter increases for positive flow and decreases for negative flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
4006	0x0FA5	Positive totalizer S+	Counter for the volume of flowing liquid in accordance with the direction of the sensor. The counter increases for positive flow and does not change for negative flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
4008	0x0FA7	Negative totalizer S-	Counter for the volume of flowing liquid opposite to the direction of the sensor. The counter increases for negative flow and does not change for positive flow. Counter stored in the non-volatile memory.	m^3	float	RD_ONLY
4010	0x0FA9	User-specified total totalizer US	Counter for the volume of flowing liquid. The counter increases for positive flow and decreases for negative flow. Counter stored in the non-volatile memory. Counter erasable by the user.	m^3	float	RD_ONLY
4012	0x0FAB	User-specified positive totalizer US+	Counter for the volume of flowing liquid in accordance with the direction of the sensor. The counter increases for positive flow and does not change for negative flow. Counter stored in the non-volatile memory. Counter erasable by the user.	m^3	float	RD_ONLY

4014	0x0FAD	User's negative totalizer US-	Counter for the volume of flowing liquid opposite to the direction of the sensor. The counter increases for negative flow and does not change for positive flow. Counter stored in the non-volatile memory. Counter erasable by the user.	m^3	float	RD_ONLY
4016	0x0FAF	Flow velocity V	Linear flow velocity expressed in metres per second (basic unit), allowing a quick assessment of the flow, independently of the pipe diameter.	m/s	float	RD_ONLY
4018	0x0FB1	Pipe diameter	The pipe diameter set in the device menu. This parameter makes flow Q dependent on the linear velocity of liquid flow. Values of diameters (in mm or in) are defined as a selection list: *DN2.5[mm]=0, DN4[mm]=1, DN6[mm]=2, DN10[mm]=3, DN15[mm]=4, DN20[mm]=5, DN25[mm]=6, DN32[mm]=7, DN40[mm]=8, DN50[mm]=9, DN65[mm]=10, DN80[mm]=11, DN100[mm]=12, DN125[mm]=13, DN150[mm]=14, DN200[mm]=15, DN250[mm]=16, DN300[mm]=17, DN350[mm]=18, DN400[mm]=19, DN450[mm]=20, DN500[mm]=21, DN600[mm]=22, DN700[mm]=23, DN800[mm]=24, DN900[mm]=25, DN1000[mm]=26.* DN 1/8[in] = 27, DN 1/4[in] = 28, DN 3/8[in] = 29, DN 1/2[in] = 30, DN 3/4[in] = 31, DN 1[in] = 32, DN 1-1/4[in] = 33, DN 1-1/2[in] = 34, DN 2[in] = 35, DN 2-1/2[in] = 36, DN 3[in] = 37, DN 4[in] = 38, DN 5[in] = 39, DN 6[in] = 40, DN 8[in] = 41, DN 10[in] = 42, DN 12[in] = 43, DN 14[in] = 44, DN 16[in] = 45, DN 18[in] = 46, DN 20[in] = 47, DN 24[in] = 48, DN 26[in] = 49, DN 28[in] = 50, DN 32[in] = 51, DN 40[in] = 52.	-	int	RD_ONLY
4020	0x0FB3	Type of filter for flow Q	Type of filter used for the value of flow Q represented by the MODBUS (not applicable to values sent by a current loop or to the screen). Filter type: *averaging filter = 0, "dumping" filter = 1.*	-	int	RD_ONLY

4022	0x0FB5	Filtration time constant	Filtration time constant for the filter described above (set in the device). The value in seconds from 0 to 60. Value 0 means no filtration (switched off filter).	s	int	RD_ONLY
4024	0x0FB7	Cut-off of low flow	Value 1 means that the function for cutting off low flow is active, value 0 means that it is switched off.	-	int	RD_ONLY
4026	0x0FB9	Cut-off value for low flow	The cut-off value for low flow expressed in cubic metres per hour (basic unit). If the absolute value of current flow is lower than this value, the flow value is substituted with 0.	m^3/h	float	RD_ONLY
4028	0x0FBB	Device operation time counter	Device operation time - in units 0.5 s.	½s	int	RD_ONLY
4030	0x0FBD	User-specified device operation time counter	Device operation time - in units 0.5 s, option to delete by the user.	½s	int	RD_ONLY

1.3.4.5. The contents of registers in 5000-5030 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5000	0x1387	register 4000 copy	Detailed descriptions in the table for registers 4000-4030	m^3/h	float	RD_ONLY
5002	0x1389	register 4002 copy		-	int	RD_ONLY
5004	0x138B	register 4004 copy		m^3	float	RD_ONLY
5006	0x138D	register 4006 copy		m^3	float	RD_ONLY
5008	0x138 F	register 4008 copy		m^3	float	RD_ONLY
5010	0x1391	register 4010 copy		m^3	float	RD_ONLY
5012	0x1393	register 4012 copy		m^3	float	RD_ONLY
5014	0x1395	register 4014 copy		m^3	float	RD_ONLY
5016	0x1397	register 4016 copy		m/s	float	RD_ONLY
5018	0x1399	register 4018 copy		-	int	RD_ONLY
5020	0x139B	register 4020 copy		-	int	RD_ONLY
5022	0x139D	register 4022 copy		s	int	RD_ONLY
5024	0x139 F	register 4024 copy		-	int	RD_ONLY
5026	0x13A1	register 4026 copy		m^3/h	float	RD_ONLY
5028	0x13A3	register 4028 copy		½s	int	RD_ONLY
5030	0x13A5	register 4030 copy		½s	int	RD_ONLY

1.3.4.6. The content of registers in 5032-5036 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5032	0x13A7	Binary input status.	Binary input status assigned as a flag into bit 0	-	uchar	RD_ONLY
5034	0x13A9	Binary outputs status.	Binary input status assigned as a flags into bit : bit 0 – binary output 1 bit 1 – binary output 2.	-	uchar	RD_ONLY
5036	0x13AB	Value of the current exposed on the current loop.	Value of the current exposed on the current loop (without taking into account current loop calibration) expressed in milliamperes.	mA	float	RD_ONLY

1.3.4.7. The content of registers in 5100-5126 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5100	0x13EB	User specified PIN	Four-digit access PIN for the menu specified by the user. Each pin digit is saved in one byte. The allowable byte value is limited in the range from 0 to 9.	-	Char table	RD/WR
5102	0x13ED	Value of threshold for low flow	Value for low flow detection expressed in cubic metres per hour (basic unit). If the absolute value of current flow is lower than this value, it is signalled for activated detection function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR
5104	0x13EF	Empty pipe detection value	Resistance threshold value specifying the detection of an empty pipe (detection over the set threshold). The value of the parameter, which may be set is limited in the range between 0 – 999999999.	ohm	int	RD/WR
5106	0x13F1	Cut-off value for low flow	The cut-off threshold value for low flow expressed in cubic metres per hour (basic unit). If the absolute value of current flow is lower than this value, the flow value is substituted with 0. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR

5108	0x13F3	Totalizers unit	Type of unit of the totalizers displayed on the LCD. Values of unit type are defined as a selection list: *m^3 = 0,* *dm^3 = 1,* *cm^3 = 2,* *Ml = 3 (megalitres),* *hl = 4 (hectolitres),* *l = 5,* *ml = 6 (millilitres),* *in^3 = 7 (cubic inch),* *ft^3 = 8 (cubic foot),* *af = 9 (height of 1 feet for 1-acre area),* *ozf = 10 (volume ounce),* *galUS = 11 (US Gallon),* *MgalUS = 12 (US mega-gallon),* *bblUS = 13 (US barrel),* *galUK = 14 (Imperial gallon),* *MgalUK = 15 (Imperial mega-gallon),* *bblUK = 16 (Imperial barrel),* *User = 17 (unit defined by the user).*	-	uchar	RD/WR
5110	0x13F5	Flow unit	Type of flow unit displayed on the LCD. Values of unit type are defined as a selection list: *m^3/h = 0 (cubic metres per hour),* *m^3/s = 1 (cubic metres per second),* *m^3/min = 2 (cubic metres per minute),* *m^3/day = 3 (cubic metres per day),* *dm^3/h = 4,* *dm^3/s = 5,* *dm^3/min = 6,* *dm^3/day = 7,* *cm^3/h = 8,* *cm^3/s = 9,* *cm^3/min = 10,* *cm^3/day = 11,* *Ml/h = 12,* *Ml/s = 13,* *Ml/min = 14,* *Ml/day = 15,* *hl/h = 16,* *hl/s = 17,* *hl/min = 18,* *hl/day = 19,* *l/h = 20,* *l/s = 21,* *l/min = 22,* *l/day = 23,* *ml/h = 24,* *ml/s = 25,* *ml/min = 26,* *ml/day = 27,*	-	uchar	RD/WR

			in^3/h = 28, *in^3/s = 29,* *in^3/min = 30,* *in^3/day = 31,* *ft^3/h = 32,* *ft^3/s = 33,* *ft^3/min = 34,* *ft^3/day = 35,* *af/h = 36,* *af/s = 37,* *af/min = 38,* *af/day = 39,* *ozf/h = 40,* *ozf/s = 41,* *ozf/min = 42,* *ozf/day = 43,* *galUS/h = 44,* *galUS/s = 45,* *galUS/min = 46,* *galUS/day = 47,* *MgalUS/h = 48,* *MgalUS/s = 49,* *MgalUS/min = 50,* *MgalUS/day = 51,* *bblUS/h = 52,* *bblUS/s = 53,* *bblUS/min = 54,* *bblUS/day = 55,* *galUK/h = 56,* *galUK/s = 57,* *galUK/min = 58,* *galUK/day = 59,* *MgalUK/h = 60,* *MgalUK/s = 61,* *MgalUK/min = 62,* *MgalUK/day = 63,* *bblUK/h = 64,* *bblUK/s = 65,* *bblUK/min = 66,* *bblUK/day = 67,* *User/h = 68,* *User/s = 69,* *User/min = 70,* *User/day = 71.*			
5112	0x13F7	Flow velocity unit	Type of linear flow velocity displayed on the LCD. Values of unit type are defined as a selection list: *m/s = 0 (metres per second),* *m/min = 1 (metres per minute),* *m/h = 2 (metres per hour),* *m/day = 3 (metres per day),* *cm/s = 4,* *cm/min = 5,* *cm/h = 6,* *cm/day = 7.*	-	uchar	RD/WR

5114	0x13F9	Description of user unit	Three-character textual description of the user-defined unit displayed on the LCD screen. ASCII characters from the range 0x20 (character ' ') - 0x7E (character '~') are permitted.	-	Char table	RD/WR
5116	0x13FB	User unit coefficient	The coefficient for recalculation of the user-specified unit - multiplication factor specifying how many cubic metres correspond to the unit specified by the user. The value of the parameter, which may be set, is limited in the range between 0.00001 – 9999999.	m^3	float	RD/WR
5118	0x13FD	Totalizers display type	Totalizers display type on the LCD. Display type is defined as a selection list: *FLOATING = 0 (float type e.g. +12.345),* *SCIENTIFIC = 1 ("scientific" type e.g. +1.2345E+01).*	-	uchar	RD/WR
5120	0x13FF	Flow Q display type	Flow display type on the LCD. Display type is defined as a selection list: *FLOATING = 0 (float type e.g. +12.345),* *SCIENTIFIC = 1 ("scientific" type e.g. +1.2345E+01).*	-	uchar	RD/WR
5122	0x1401	Flow velocity V display type	The Linear velocity of flow display type on the LCD. Display type is defined as a selection list: *FLOATING = 0 (float type e.g. +12.345),* *SCIENTIFIC = 1 ("scientific" type e.g. +1.2345E+01).*	-	uchar	RD/WR
5124	0x1403	Main screen	Type of the screen displayed as the main screen. Screen selection is defined as a list: *MAIN = 0* (screen containing flow, the main totalizer and status of the device), *COUN = 1* (screen containing directional totalizers and linear velocity of flow and operation time of the device), *USER = 2* (user screen containing totalizers and operation time).	-	uchar	RD/WR

5126	0x1405	Screen change time	Time of an automatic change of the main screens (how many seconds for the switch of the screen). The function is deactivated for the time set to value 0. The value of time, which may be set is limited in the range between 0 – 120.	sec.	uchar	RD/WR

1.3.4.8. The content of registers in 5200-5218 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5200	0x144 F	Administrator PIN	Four-digit access PIN for the menu specified by the administrator. Each pin digit is saved in one byte. The allowable byte value is limited in the range from 0 to 9.	-	Char table	RD/WR
5202	0x1451	Pipe diameter	Diameter of the pipe expressed in millimetres. This parameter makes flow Q dependent on the linear velocity of liquid flow. Values of diameters (in mm of in) are defined as a selection list: *DN2,5[mm]=0, DN4[mm]=1, DN6[mm]=2, DN10[mm]=3, DN15[mm]=4, DN20[mm]=5, DN25[mm]=6, DN32[mm]=7, DN40[mm]=8, DN50[mm]=9, DN65[mm]=10, DN80[mm]=11, DN100[mm]=12, DN125[mm]=13, DN150[mm]=14, DN200[mm]=15, DN250[mm]=16, DN300[mm]=17, DN350[mm]=18, DN400[mm]=19, DN450[mm]=20, DN500[mm]=21, DN600[mm]=22, DN700[mm]=23, DN800[mm]=24, DN900[mm]=25, DN1000[mm]=26.* DN 1/8[in] = 27, DN 1/4[in] = 28, DN 3/8[in] = 29, DN 1/2[in] = 30, DN 3/4[in] = 31, DN 1[in] = 32, DN 1-1/4[in] = 33, DN 1-1/2[in] = 34, DN 2[in] = 35, DN 2-1/2[in] = 36, DN 3[in] = 37, DN 4[in] = 38, DN 5[in] = 39, DN 6[in] = 40, DN 8[in] = 41, DN 10[in] = 42, DN 12[in] = 43, DN 14[in] = 44, DN 16[in] = 45, DN 18[in] = 46, DN 20[in] = 47, DN 24[in] = 48, DN 26[in] = 49, DN 28[in] = 50, DN 32[in] = 51, DN 40[in] = 52.	Mm	uchar	RD/WR
5204	0x1453	Sensor type	Type of sensor connected to the flowmeter. Sensor type is defined as a selection list: *2 active electrodes = 0,* *3 active electrodes = 1.*	-	uchar	RD/WR

5206	0x1455	Active alarms	Alarms activity flags in the device. Setting of the corresponding bit to value 1 in a 32-bit word activates a given alarm, while setting the value to 0 deactivates it. Alarm flags assigned to the given bits: *bit 0 – empty pipe detection alarm,* *bit 1 – unfilled pipe detection alarm,* *bit 2 – low liquid flow detection alarm,* *bit 3 – measurement board error alarm (FrontEnd),* *bit 4 – measuring sensor error alarm,* *bit 5 – flowmeter's internal memory error alarm,* *bit 6 – measurement coil failure alarm,* *bit 7 – alarm for flow higher than the value set as a parameter,* *bit 8 – alarm for flow lower than the value set as a parameter,* *bit 9 – alarm for linear velocity of flow higher than the value set as a parameter,* *bit 10 – alarm for linear velocity of flow lower than the value set as a parameter,* *bit 11 – alarm indicating that absolute value of user's positive totalizer exceeds the value set as a parameter* *bit 12 – alarm indicating that absolute value of user's negative totalizer exceeds the value set as a parameter* The other bits have a value equal to 0 and do not have any alarms assigned.	-	int	RD/WR
5208	0x1457	Alarm Q_{max} value	Value of maximum flow as a parameter for alarm from exceeding the set threshold (bit 7 in register 5206) expressed in cubic metres per hour (basic unit). If the absolute value of current flow is higher than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR
5210	0x1459	Alarm Q_{min} value	Value of minimum flow as a parameter for alarm from exceeding the set threshold (bit 8 in register 5206) expressed in cubic metres per hour (basic unit). If the absolute value of current flow is lower than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR

5212	0x145B	Alarm V_{max} value	Value of maximum linear velocity of flow as a parameter for alarm from exceeding the set threshold (bit 9 in register 5206) expressed in metres per second (basic unit). If the absolute value of the velocity of current flow is higher than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m/s	float	RD/WR
5214	0x145D	Alarm V_{min} value	Value of minimum linear velocity of flow as a parameter for alarm from exceeding the set threshold (bit 10 in register 5206) expressed in metres per second (basic unit). If the absolute value of the velocity of current flow is lower than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m/s	float	RD/WR
5216	0x145 F	TP alarm value	Value of threshold for user's positive totalizer as a parameter for alarm from exceeding the set threshold (bit 11 in register 5206) expressed in cubic metres (basic unit). If the value of user-specified positive totalizer is higher than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR
5218	0x1461	TM alarm value	Value of threshold for user-specified negative totalizer as a parameter for alarm from exceeding the set threshold (bit 12 in register 5206) expressed in cubic metres (basic unit). If the value of user's negative totalizer is higher than this value, it is signalled for the activated alarm function. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR

1.3.4.9. The content of registers in 5300-5344 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5300	0x14B3	Current loop 4-20mA operation mode	Current loop 4-20mA output operation mode. Operation modes are defined as a selection list: *NORMAL = 0* (normal operation mode of the current output, currents proportional to the flow), *INVERTED = 1* (negated operation mode of the current output, currents proportional to the flow multiplied by -1), *MODULO = 2* (absolute value mode of operation of the current output, currents proportional to the absolute value of the flow).	-	uchar	RD/WR
5302	0x14B5	Current loop 4-20mA alarm mode	Current loop 4-20mA output operation mode during setting of the alarm (alarm current type). Alarm current types are defined as a selection list: *LOW = 0* (low alarm current - current with value 3.75[mA]), *HIGH = 1* (high alarm current - current with value 21.6[mA]), *CUSTOM = 2* (user-specified alarm current - current with a value defined in the device by the user from the range between 3.6[mA] – 23.0[mA]).	-	uchar	RD/WR
5304	0x14B7	Flow value for current 4mA	Value of flow Q corresponding to the current 4[mA] set by the current loop expressed in cubic metres per hour (basic unit). The absolute value of flow, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR
5306	0x14B9	Flow value for current 20mA	Value of flow Q corresponding to the current 20[mA] set by the current loop expressed in cubic metres per hour (basic unit). The absolute value of flow, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR
5308	0x14BB	Value of user-specified alarm current	Value of alarm current for the CUSTOM mode of the current loop alarm expressed in milliamperes (basic unit). The value of the current, which may be set as a parameter is limited in the range between 3.6[mA] – 23.0[mA].	mA	float	RD/WR

5310	0x14BD	Operation mode of pulse output	The operation mode of pulse output. Operation modes are defined as a selection list: *PULSE = 0* (operation mode as a pulse output - generation of a pulse as a result of flowing of a given volume of the liquid), *PWM = 1* (operation mode as a PWM - generation of a function, which frequency proportional to the value of current flow).	-	uchar	RD/WR
5312	0x14BF	Pulse width	Duration of generated pulse expressed in milliseconds. The value of the time, which may be set is limited in the range between 0 – 10000 [ms].	ms	short	RD/WR
5314	0x14C1	Pulse polarization	The polarization of pulse output (generated pulse). Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	RD/WR
5316	0x14C3	Liquid volume for a pulse	Value of liquid volume corresponding to the generation of a pulse by pulse output expressed in cubic metres (basic unit). The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR
5318	0x14C5	Generating pulses operation mode	The operation mode that generates pulses by output. Operation modes are defined as a selection list: *POSITIVE = 2 (operation mode that generates pulses by output only for forward flow direction),* *NEGATIVE = 3 (operation mode that generates pulses by output only for reverse flow direction),* *MODULO = 4 (operation mode that generates pulses by output in both flow directions).*	-	uchar	RD/WR
5320	0x14C7	Minimum flow value for PWM	Value of minimum flow Q_{min} (expressed in cubic metres per hour-basic unit) corresponding to the PWM output frequency, which is equal to 1Hz. The value of flow, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR

5322	0x14C9	Maximum flow value for PWM	Value of maximum flow Q_{max} (expressed in cubic metres per hour-basic unit) corresponding to the frequency of the PWM output equal to 2000Hz. The value of flow, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h	float	RD/WR
5324	0x14CB	Value of frequency for PWM pulse output	The value of the frequency set by the PWM pulse output.	Hz	float	RD_ONLY
5326	0x14CD	Polarization of pulse output PWM	The polarization of pulse output PWM. Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	RD/WR
5328	0x14CF	Value of duty cycle for PWM pulse output	A fixed value of duty cycle for the PWM pulse output operation mode. PWM output operating with a fixed set duty cycle. The frequency of this signal changes depending on the current flow. The value of the duty cycle is equal to 50[%].	%	uchar	RD_ONLY
5330	0x14D1	Binary output 1 operation mode	Binary status output 1 operation mode. Output changes its state as a result of the occurrence of the functionality assigned to it. Operation modes are defined as a selection list: *Empty pipe = 0* (signalling of detection of an empty pipe), *Low flow = 1* (signalling detection of low level of flow), *Unfil. pipe = 2* (signalling detection of an unfilled pipe), *Errors all = 3* (signalling of errors detection - FrontEnd, sensor, memory), *Coil error = 4* (signalling detection of measurement coil error), *I saturat. = 5* (signalling saturation of the current loop), *Direction = 6* (signalling of liquid flow direction - setpoint of output for positive flow), *Q>value = 7* (signalling of current flow higher than the assumed value), *Q<value = 8* (signalling of current flow lower than the assumed value), *TP>value = 9* (signalling exceeding of the assumed value of flow by user's positive totalizer), *TP>value = 10* (signalling exceeding of the assumed value of flow by user's negative totalizer),	-	uchar	RD/WR

			Dosing = 11 (dosing function, the setpoint of output depending on the dosing process). *Pulse dir. = 12 (signalling of flow direction for either flow directions pulse output operation mode (setpoint of output for positive flow))- that operating mode status output is synchronized with pulse output without delay time*			
5332	0x14D3	Binary output 2 operation mode	Binary status output 2 operation mode. Output changes its state as a result of the occurrence of the functionality assigned to it. Operation modes are defined as a selection list: *Empty pipe = 0* (signalling of detection of an empty pipe), *Low flow = 1* (signalling detection of low level of flow), Unfil. pipe = 2 (signalling detection of an unfilled pipe), *Errors all = 3* (signalling of errors detection - FrontEnd, sensor, memory), *Coil error = 4* (signalling detection of measurement coil error), *I saturat. = 5* (signalling saturation of the current loop), *Direction = 6* (signalling of liquid flow direction - setpoint of output for positive flow), *Q>value = 7* (signalling of current flow higher than the assumed value), *Q<value = 8* (signalling of current flow lower than the assumed value), *TP>value = 9* (signalling exceeding of the assumed value of flow by user's positive totalizer), *TP>value = 10* (signalling exceeding of the assumed value of flow by user's negative totalizer), *Dosing = 11* (dosing function, the setpoint of output depending on the dosing process). *Pulse dir. = 12 (signalling of flow direction for either flow directions pulse output operation mode (setpoint of output for positive flow))- that operating mode status output is synchronized with pulse output without delay time*	-	uchar	RD/WR
5334	0x14D5	Value of parameter of binary output 1	Value of a parameter correct for the selected operation mode of the binary status output 1. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h, m^3	float	RD/WR

5336	0x14D7	Value of parameter of binary output 2	Value of a parameter correct for the selected operation mode of the binary status output 2. The value of the parameter, which may be set, is limited in the range between 0.0000001 – 9999999 and 0.	m^3/h, m^3	float	RD/WR
5338	0x14D9	Delay time for binary output 1	Delay time for activation of the binary status output 1 expressed in the seconds. The delay is turned off for time setting equal to 0 seconds. The value of the time delay, which may be set as a parameter is limited in the range between 0 – 3600 [s].	s	short	RD/WR
5340	0x14DB	Delay time for binary output 2	Delay time for activation of the binary status output 2 expressed in the seconds. The delay is turned off for time setting equal to 0 seconds. The value of the time delay, which may be set as a parameter is limited in the range between 0 – 3600 [s].	s	short	RD/WR
5342	0x14DD	Polarization of binary output 1	The polarization of binary status output 1. Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	RD/WR
5344	0x14DF	Polarization of binary output 2	The polarization of binary status output 2. Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	RD/WR

1.3.4.10. The content of registers in 5360-5362 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5360	0x14EF	Binary input operation mode	Binary input operation mode. Operation modes are defined as a selection list: Reset = 0 (function allowing deleting the values of the user-specified totalizers and counter of user working time using an input), Dosing = 1 (dosing function allowing “reloading” of counters of set values of flow metered in a dosing operation mode using an input).	-	uchar	RD/WR
5362	0x14F1	Delay time for binary input	Delay time for activation of the binary status input expressed in the seconds. The delay is turned off for time set equal to 0 seconds. The value of the time delay, which may be set as a parameter is limited in the range between 0 – 3600 [s].	s	short	RD/WR

1.3.4.11. The content of registers in 5400-5414 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5400	0x1517	The operation mode of LCD filter	The operation mode of the filter used for data (current flow and the linear velocity of flow) displayed on the LCD screen. Operation modes are defined as a selection list: *AVERAGE = 0* (filter being an average value for a period of set time), *DAMPING = 1* (filter taking into account the previous measurement values for a period of set time).	-	uchar	RD/WR
5402	0x1519	The time constant for LCD display filter	The filtering time (time constant) for measurements for data displayed on the LCD screen expressed in seconds. Filtering is turned off for time setting equal to 0 seconds. The value of filtering, which may be set as a parameter is limited in the range between 0 – 60 [s].	s	short	RD/WR
5404	0x151B	The operation mode of the filter of the current loop 4-20mA	The operation mode of the filter used for data (current flow) used by the current loop. Operation modes are defined as a selection list: *AVERAGE = 0* (filter being an average value for a period of set time), *DAMPING = 1* (filter taking into account the previous measurement values for a period of set time).	-	uchar	RD/WR
5406	0x151D	The time constant of the filter of the current loop 4-20mA	Filtering time (time constant) for measurements used by the current loop and expressed in seconds. Filtering is turned off for time setting equal to 0 seconds. The value of filtering, which may be set as a parameter is limited in the range between 0 – 60 [s].	s	short	RD/WR
5408	0x151 F	The operation mode of filter of pulse output PWM	The operation mode of the filter used for data (current flow) used by the pulse output operating in the PWM mode. Operation modes are defined as a selection list: *AVERAGE = 0* (filter being an average value for a period of set time), *DAMPING = 1* (filter taking into account the previous measurement values for a period of set time).	-	uchar	RD/WR
5410	0x1521	The time constant of the filter of pulse output PWM	Filtering time (time constant) for measurements used by the PWM pulse output expressed in seconds. Filtering is turned off for time set equal to 0 seconds. The value of filtering, which may be set as a parameter is limited in the range between 0 – 60 [s].	s	short	RD/WR

5412	0x1523	The operation mode of the MODBUS bus filter	The operation mode of the filter used for data (current flow and the linear velocity of flow) read using MODBUS. Operation modes are defined as a selection list: *AVERAGE = 0* (filter being an average value for a period of set time), *DAMPING = 1* (filter taking into account the previous measurement values for a period of set time).	-	uchar	RD/WR
5414	0x1525	The time constant of the filter of MODBUS bus	Filtering time (time constant) for measurements used for data read using the MODBUS bus expressed in seconds. Filtering is turned off for time setting equal to 0 seconds. The value of filtering, which may be set as a parameter is limited in the range between 0 – 60 [s].	s	short	RD/WR

1.3.4.12. The content of registers in 5450-5456 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5450	0x1549	MODBUS device address	Address of the device on the MODBUS bus. The value of the device address, which may be set as a parameter is limited in the range between 1 – 247.	-	uchar	RD/WR
5452	0x154B	MODBUS transmission speed	Transmission speed on MODBUS expressed in bits per second. Transmission speeds are defined as a selection list: *4800 = 0,* *9600 = 1,* *19200 = 2,* *38400 = 3,* *57600 = 4,* *115200 = 5.*	bit/s	uchar	RD/WR
5454	0x154D	MODBUS transmission parameters	Transmission parameters on the MODBUS bus (parity, stop bits). Transmission parameters are defined as a selection list: *EVEN 1 STOP = 0* (with Even parity and a single stop bit), *ODD 1 STOP = 1* (with Odd parity and one stop bit), *NOPAR 2 STOP = 2* (without parity and with two stop bits).	-	uchar	RD/WR
5456	0x154 F	MODBUS transmission data format	The format of data transferred through MODBUS. It specifies a sequence of transmitted bytes in the 32-bit words. The data format is defined as a selection list (for assumed hexadecimal number 0xDDCCBBAA): *AABBCCDD = 0,* *DDCCBBAA = 1,* *BBAADDCC = 2,* *CCDDAABB = 3.*	-	uchar	RD/WR

1.3.4.13. The content of registers in 5500-5506 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5500	0x157B	Active events in the archive	Events activity flags archived in the device. The setting of the corresponding bit to value 1 in a 32-bit word activates the event (option to record in the memory), while setting the value to 0 deactivates it. Event activity flags assigned to given bits: *bit 0* – device start, *bit 1* – log in to device menu, *bit 2* – device "OK" status (return of the device to the correct state after the occurrence of an "erroneous" event), *bit 3* - error of FrontEnd measurement board, *bit 4* - measuring sensor error, *bit 5* – error of internal memory of the flowmeter, *bit 6* – empty pipe detection, *bit 7* – unfilled pipe detection, *bit 8* – deleting user specified totalizers, the counter of user time and device errors, *bit 9* – recovery of default settings in the device, *bit 10* – recovery of factory settings in the device, *bit 11* – writing of a new calibration coefficient for the flowmeter, *bit 12* – measurement coil error, *bit 13* – detection of low liquid flow. The other bits have a value equal to 0 and do not have any of the events assigned.	-	int	RD/WR
5502	0x157D	The time interval for measurements archive	Time period expressed in minutes specifying the interval of saving of an average flow value into the device memory. The value of the time period, which can be set as a parameter, is limited in the range between 10 minutes - 24 hours with a 10-minute step.	min	int	RD/WR
5504	0x157 F	A number of writes of event archive	The counter of writes in the events archive memory. The 32-bit counter, where its sixteen younger bits (two younger bytes) indicate the number of events currently saved in the memory (maximum possible number of writes in the memory - 8128), while its sixteen older bits (two older bytes) are a counter of full writes of the memory (in case when the continuous write function is activated).	-	int	RD_ONLY

5506	0x1581	A number of writes of measurem ent archive	The counter of writes in the measurements archive memory. The 32-bit counter, where its sixteen younger bits (two younger bytes) indicate the number of measurements currently saved in the memory (maximum possible number of writes in the memory - 8128), while its sixteen older bits (two older bytes) are a counter of full writes of the memory (in case when the continuous write function is activated).	-	int	RD_ONLY

1.3.4.14. The content of registers in 5550-5560 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5550	0x15AD	Time - hour	RTC time hour of the device. The hour, which may be set as a parameter is limited in the range between 0 – 23.	h	uchar	RD/WR
5552	0x15AF	Time - minute	RTC time minute of the device. The minute, which may be set as a parameter is limited in the range between 0 – 59.	min	uchar	RD/WR
5554	0x15B1	Time - second	RTC time second of the device. The second, which may be set as a parameter is limited in the range between 0 – 59.	sec.	uchar	RD/WR
5556	0x15B3	Time - year	RTC time year of the device. The year, which may be set as a parameter is limited in the range between 10 – 99.	-	uchar	RD/WR
5558	0x15B5	Time - month	RTC time month of the device. The month, which may be set as a parameter is limited in the range between 1 – 12.	-	uchar	RD/WR
5560	0x15B7	Time - day	RTC time day of the device. The day, which may be set as a parameter is limited in the range between 1 – 31.	-	uchar	RD/WR

1.3.4.15. The content of registers in 5600-5626 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5600	0x15DF	Calibration status	Device electronics calibration status. Value 1 indicates that the calibration of flowmeter electronics has been executed, while value 0 informs about lack of calibration.	-	uchar	RD_ONLY
5602	0x15E1	Zero calibration time	Duration of the zeroing procedure (data collection) of the flowmeter sensor expressed in minutes. The time value of zeroing, which may be set as a parameter, is limited in the range between 1 – 60 [min].	min	uchar	RD/WR

5604	0x15E3	Electronics calibration coefficient - temporary	The calibration coefficient of the electronics of the device is calculated temporarily during the calibration procedure based on the collected data.	-	float	RD_ONLY
5606	0x15E5	Electronics calibration coefficient	Electronics calibration coefficient saved in the device memory and used during operation of the flowmeter.	-	float	RD_ONLY
5608	0x15E7	Current loop calibration coefficient – temporary	Parameter allowing the control of current loop 4-20mA during the loop calibration procedure or calibration of loop measurement. „Unsigned short int" type 16-bit value (two bytes) in the range between 0 - 65535.	-	short	NO_MEM
5610	0x15E9	Current loop calibration coefficient – 4[mA]	Calibration coefficient for the current loop for current 4mA. "Unsigned short int" type 16-bit value for which the current loop is set to current equal to 4mA.	-	short	RD_ONLY
5612	0x15EB	Current loop calibration coefficient – 20[mA]	Calibration coefficient for current loop for current 20mA. "Unsigned short int" type 16-bit value for which the current loop is set to current equal to 20mA.	-	short	RD_ONLY
5614	0x15ED	Current measurement calibration coefficient - 4[mA]	Calibration coefficient of the internal current measurement for 4 mA. The value of current in mA, for which the measurement of current indicates 4mA.	mA	float	RD_ONLY
5616	0x15EF	Current measurement calibration coefficient - 20[mA]	Calibration coefficient of the internal current measurement for 20 mA. The value of current in mA, for which the measurement indicates 20mA.	mA	float	RD_ONLY
5618	0x15F1	Coefficient A of sensor calibration	Coefficient A of measuring sensor calibration. Coefficient A for the calibration line obtained on the calibration stand for the flowmeters. The absolute value of the coefficient, which may be set as a parameter is limited in the range between 0.0000001 – 9999999.	-	float	RD/WR
5620	0x15F3	Coefficient B of sensor calibration - temporary	The calibration coefficient B of the measuring sensor is calculated temporarily during the zeroing flowmeter procedure based on the collected data.	m/s	float	RD_ONLY

5622	0x15F5	Coefficient B of sensor calibration	Coefficient B of measuring sensor calibration expressed in metres per second. Coefficient B for calibration line obtained during flowmeter zeroing procedure. The absolute value of the coefficient, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m/s	float	RD/WR
5624	0x15F7	Coefficient V of sensor calibration	Coefficient V of measuring sensor calibration expressed in metres per second. Coefficient V specifies the point of the calibration line, where the characteristics can be “deflected”. The absolute value of the coefficient, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m/s	float	RD/WR
5626	0x15F9	Sensor characteristics “deflection” coefficient	The coefficient of percentage “deflection” of the calibration characteristics of the measuring sensor for point V, expressed in %. Coefficient specifies the percentage value of deflection of the measuring sensor calibration characteristics that should be applied in the point specified by the coefficient V. The absolute value of the coefficient, which may be set as a parameter is limited in the range between 0.1 – 10 % and 0.	%	float	RD/WR

1.3.4.16. The content of registers in 5650-5668 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5650	0x1611	Dosing - counter 1	Value of first counter for dosing function. The counter counts the volume flowing in the dosing mode “backwards” (from the set value).	m^3	float	RD_ONLY
5652	0x1613	Dosing - counter 2	Value of second counter for dosing function. The counter counts the volume flowing in the dosing mode “backwards” (from the set value).	m^3	float	RD_ONLY

5654	0x1615	Status flags for dosing	Informational flags containing current dosing status. Bit meaning: *bit 7* – active status output 2, *bit 6* – stopped dosing using channel no. 2 (status output 2), *bit 5* – activated dosing using channel no. 2 (status output 2), *bit 4* – readiness of dosing channel no. 2 ("overloaded" value of dosing counter 2), *bit 3* – active status output 1, *bit 2* – stopped dosing using channel no. 1 (status output 1), *bit 1* – activated dosing using channel no. 1 (status output 1), *bit 0* – readiness of dosing channel no. 1 ("overloaded" value of dosing counter 1),	-	uchar	RD_ONLY
5656	0x1617	Dosing operation mode	Dosing function operation mode. Operation modes are defined as a selection list: *INDEPE = 0* (independent operation mode of both dosing channels - both status outputs used in the dosing), *DEPEND = 1* (related operation mode of both dosing channels - both status outputs used in the dosing are related with each other).	-	uchar	RD/WR
5658	0x1619	Dosing control mode	Dosing function control mode. Control modes are defined as a selection list: *INPUT = 0* (dosing control using a binary input), *BUTTON = 1* (dosing control using a keyboard), *BUTTON = 2* (dosing control using a MODBUS bus),	-	uchar	RD/WR
5660	0x161B	The volume of dosed liquid V1	Value of liquid volume V1 dosed using the first channel. The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR
5662	0x161D	The volume of dosed liquid V2	Value of liquid volume V2 dosed using the second channel. The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR
5664	0x161 F	The volume of dosed liquid V3	Value of liquid volume V3 used in the related dosing mode (volume after which occurs e.g. decrease of dosing speed). The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR

5666	0x1621	The volume of deactivation of dosing DP1	Value of liquid volume DP1 for the advance of deactivation of dosing of the first channel. The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR
5668	0x1623	The volume of deactivation of dosing DP2	Value of liquid volume DP2 for the advance of deactivation of dosing of the second channel. The absolute value of the fluid volume, which may be set as a parameter is limited in the range between 0.0000001 – 9999999 and 0.	m^3	float	RD/WR

1.3.4.17. The content of registers in 5700-5720 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5700	0x1643	Diagnostic current of current loop	Parameter allowing a test control of current loop 4-20mA. The set value in mA is permitted in full performance range of the current loop.	mA	float	NO_MEM
5702	0x1645	The diagnostic operation mode of pulse output	Parameter allowing switching of the operation mode of the pulse output for testing purposes. Operation modes are defined as a selection list: *PULSE = 0* (operation mode as a pulse output - generation of a pulse with a specified length every 0.5 seconds), *PWM = 1* (operation mode as a PWM output - generation of a function with a specified frequency).	-	uchar	NO_MEM
5704	0x1647	Diagnostic pulse width	Duration of generated test pulse expressed in milliseconds. The value of time, which may be set is limited in the range between 0 – 10000 [ms].	ms	short	NO_MEM
5706	0x1649	Diagnostic pulse polarization	The polarization of pulse output (pulse generated for testing purposes). Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	NO_MEM
5708	0x164B	Diagnostic frequency of the PWM output	Fixed value of test frequency for PWM pulse output operation mode with a specified duty cycle expressed in Hz. The value of the frequency, which may be set is limited in the range between 1.0 – 2000.0 [Hz].	Hz	float	NO_MEM
5710	0x164D	Diagnostic duty cycle of the PWM output	Value of duty cycle of test signal for PWM pulse output operation mode with specified frequency expressed in %. The value of the duty cycle is equal to 50[%].	%	uchar	RD_ONLY

5712	0x164 F	Diagnostic polarization of the PWM output	The polarization of test PWM output. Polarization type is defined as a selection list: *NEGATIVE = 0* (negative polarization), *POSITIVE = 1* (positive polarization).	-	uchar	NO_MEM
5714	0x1651	Diagnostic status of status output 1	Test operation mode of binary status output 1. Output status may have only two states (values) 0 or 1.	-	uchar	NO_MEM
5716	0x1653	Diagnostic status of status output 2	Test operation mode of binary status output 2. Output status may have only two states (values) 0 or 1.	-	uchar	NO_MEM
5718	0x1655	Diagnostic status of binary input	Binary input test status. Input state can have only two states (values) 0 or 1.	-	uchar	RD_ONLY
5720	0x1657	Diagnostic value of simulated flow	Simulation value for flow expressed in cubic metres per hour for which operation of the flowmeter is checked. The absolute value of flow, which can be set, should not be lower than 0.0001 [m^3/h].	m^3/h	float	NO_MEM

1.3.4.18. The content of registers in 5800-5800 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5800	0x16A7	Status / informational flags of the device	Informational flags containing current device status. Bit meaning: *bit 7* - error of (FrontEnd) measurement board, *bit 6* - measuring sensor error, *bit 5* - measuring sensor coil error, *bit 4* – error of the internal memory of the flowmeter, *bit 3* - empty pipe detection error, *bit 2* - unfilled pipe error (for sensors with detection of an unfilled pipe) The other bits: value 0.	-	uchar	RD_ONLY

1.3.4.19. The content of registers in 5850-5826 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
5850	0x16D9	Device serial number	Device serial number assigned during the production process. Value of the serial number is limited in the range between 1170000 – 12999999.	-	int	RD_ONLY
5852	0x16DB	Hardware version	Flowmeter hardware version.	-	float	RD_ONLY
5854	0x16DD	Software version	Flowmeter software version.	-	float	RD_ONLY
5856	0x16DF	Revision	Revision of the flowmeter software version.	-	int	RD_ONLY

5858	0x16E1	FrontEnd hardware version	Hardware version of the measurement board (FrontEnd) of the flowmeter.	-	uchar	RD_ONLY
5860	0x16E3	FrontEnd software version	Software version of the measurement board (FrontEnd) of the flowmeter.	-	int	RD_ONLY
5862	0x16E5	CRC	CRC calculated from the Flash memory area containing the metrological function.	-	int	RD_ONLY

1.3.4.20. The content of registers in 7000-7030 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
7000	0x1B57	Screen - digits 1-4	A variable containing characters 1-4 displayed on the device screen.	-	Char table	RD_ONLY
7002	0x1B59	Screen - digits 5-8	A variable containing characters 5-8 displayed on the device screen.	-	Char table	RD_ONLY
7004	0x1B5B	Screen - digits 9-12	A variable containing characters 9-12 displayed on the device screen.	-	Char table	RD_ONLY
7006	0x1B5D	Screen - digits 13-16	A variable containing characters 13-16 displayed on the device screen.	-	Char table	RD_ONLY
7008	0x1B5F	Screen - digits 17-20	Variable containing characters 17-20 displayed on the device screen.	-	Char table	RD_ONLY
7010	0x1B61	Screen - digits 21-24	A variable containing characters 21-24 displayed on the device screen.	-	Char table	RD_ONLY
7012	0x1B63	Screen - digits 25-28	A variable containing characters 25-28 displayed on the device screen.	-	Char table	RD_ONLY
7014	0x1B65	Screen - digits 29-32	A variable containing characters 29-32 displayed on the device screen.	-	Char table	RD_ONLY
7016	0x1B67	Screen - digits 33-36	A variable containing characters 33-36 displayed on the device screen.	-	Char table	RD_ONLY
7018	0x1B69	Screen - digits 37-40	Variable containing characters 37-40 displayed on the device screen.	-	Char table	RD_ONLY
7020	0x1B6B	Screen - digits 41-44	A variable containing characters 41-44 displayed on the device screen.	-	Char table	RD_ONLY
7022	0x1B6D	Screen - digits 45-48	A variable containing characters 45-48 displayed on the device screen.	-	Char table	RD_ONLY
7024	0x1B6F	Screen - digits 49-52	A variable containing characters 49-52 displayed on the device screen.	-	Char table	RD_ONLY
7026	0x1B71	Screen - digits 53-56	A variable containing characters 53-56 displayed on the device screen.	-	Char table	RD_ONLY
7028	0x1B73	Screen - digits 57-60	Variable containing characters 57-60 displayed on the device screen.	-	Char table	RD_ONLY
7030	0x1B75	Screen - digits 61-64	A variable containing characters 61-64 displayed on the device screen.	-	Char table	RD_ONLY

1.3.4.21. The content of registers in 8000-8032 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
8000	0x1F3F	Archive - address of events readout	Variable containing the base address for readout of eight successive events from the archive. Writing to address register, from which we want to execute register readout, initiates a readout procedure for eight successive events and writing them in the corresponding registers. The address, which can be set, is limited in the range between 1 - 8128 (maximum number of events, which can be saved in the archive) in case of completely written archive or to address value of the last executed entry at the moment (checking of the number of entries in the registers with address 5504).	-	int	NO_MEM
8002	0x1F41	Archive - event 1 part L	Variable containing four younger bytes of the event read from the address written to register 8000.	-	Char table	RD_ONLY
8004	0x1F43	Archive - event 1 part H	Variable containing four older bytes of the event read from the address written to register 8000.	-	Char table	RD_ONLY
8006	0x1F45	Archive - event 2 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 1.	-	Char table	RD_ONLY
8008	0x1F47	Archive - event 2 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 1.	-	Char table	RD_ONLY
8010	0x1F49	Archive - event 3 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 2.	-	Char table	RD_ONLY
8012	0x1F4B	Archive - event 3 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 2.	-	Char table	RD_ONLY
8014	0x1F4D	Archive - event 4 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 3.	-	Char table	RD_ONLY
8016	0x1F4F	Archive - event 4 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 3.	-	Char table	RD_ONLY
8018	0x1F51	Archive - event 5 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 4.	-	Char table	RD_ONLY
8020	0x1F53	Archive - event 5 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 4.	-	Char table	RD_ONLY
8022	0x1F55	Archive - event 6 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 5.	-	Char table	RD_ONLY

8024	0x1F57	Archive - event 6 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 5.	-	Char table	RD_ONLY
8026	0x1F59	Archive - event 7 part L	Variable containing four younger bytes of the event read from the address written to the register 8000 plus 6.	-	Char table	RD_ONLY
8028	0x1F5B	Archive - event 7 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 6.	-	Char table	RD_ONLY
8030	0x1F5D	Archive - event 8 part L	Variable containing four younger bytes of the event read from the address written to register 8000 plus 7.	-	Char table	RD_ONLY
8032	0x1F5F	Archive - event 8 part H	Variable containing four older bytes of the event read from the address written to register 8000 plus 7.	-	Char table	RD_ONLY

1.3.4.22. The content of registers in 9000-9032 field

Register	Address (hex)	Brief description	Extended description	Unit	Format	Operation
9000	0x2327	Archive - measurement readout address	Variable containing the base address for readout of eight successive measurements from the archive. Saving to address register, from which we want to make archive readout, initiates a procedure of readout of eight successive measurements and writing them in the appropriate registers. The address, which can be set, is limited in the range between 1 - 8128 (maximum number of measurements, which can be saved in the archive) in case of completely written archive or to address value of the last executed entry at the moment (checking of the number of entries in the registers with address 5506).	-	int	NO_MEM
9002	0x2329	Archive - measurement 1 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000.	-	Char table	RD_ONLY
9004	0x232B	Archive - measurement 1 part H	Variable containing four older bytes of the measurement read from the address written to register 9000.	-	Char table	RD_ONLY
9006	0x232D	Archive - measurement 2 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 1.	-	Char table	RD_ONLY
9008	0x232 F	Archive - measurement 2 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 1.	-	Char table	RD_ONLY
9010	0x2331	Archive - measurement 3 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 2.	-	Char table	RD_ONLY

9012	0x2333	Archive - measurement 3 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 2.	-	Char table	RD_ONLY
9014	0x2335	Archive - measurement 4 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 3.	-	Char table	RD_ONLY
9016	0x2337	Archive - measurement 4 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 3.	-	Char table	RD_ONLY
9018	0x2339	Archive - measurement 5 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 4.	-	Char table	RD_ONLY
9020	0x233B	Archive - measurement 5 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 4.	-	Char table	RD_ONLY
9022	0x233D	Archive - measurement 6 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 5.	-	Char table	RD_ONLY
9024	0x233 F	Archive - measurement 6 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 5.	-	Char table	RD_ONLY
9026	0x2341	Archive - measurement 7 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 6.	-	Char table	RD_ONLY
9028	0x2343	Archive - measurement 7 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 6.	-	Char table	RD_ONLY
9030	0x2345	Archive - measurement 8 part L	Variable containing four younger bytes of the measurement read from the address written to register 9000 plus 7.	-	Char table	RD_ONLY
9032	0x2347	Archive - measurement 8 part H	Variable containing four older bytes of the measurement read from the address written to register 9000 plus 7.	-	Char table	RD_ONLY

1.3.5. Description of "coils" implemented in the flowmeter

Explanation of operations executed in the MODBUS "coils" is given in the table below:

Operation	Description	Example
RD_ONLY	Read-only coil. Reading using MODBUS function 0x01.	Reading frame of calibration duration bit (coil 1028): *0x05 0x01 0x04 0x03 0x00 0x01*.
RD/WR	Coil intended for both the read and write function. Data is stored in the non-volatile memory of the device. Reading using MODBUS function 0x01, while saving using 0x05 function.	Bit reading and writing frame for detection of low flow (coil 1000, activation of options). Read: *0x05 0x01 0x03 0xE7 0x00 0x01*. Write: *0x05 0x05 0x03 0xE7 0xFF 0x00.*
NO_MEM	Coil intended for both the read and write function (unstable). Data is stored in the volatile memory of the device. Reading using MODBUS function 0x01, while saving using 0x05 function.	Bit reading and writing frame for diagnostic display mode (coil 1053, activation of options). Read: *0x05 0x01 0x04 0x1C 0x00 0x01*. Write: *0x05 0x05 0x04 0x1C 0xFF 0x00*.
TRIGGER	Tripping coil, entering bit 1 causes the appropriate function to be called. The read value is always equal to 0. Reading using MODBUS function 0x01, while saving using 0x05 function.	Bit reading and writing frame for deleting command for user-specified totalizers (coil 1016, activation of options). Read: *0x05 0x01 0x03 0xF7 0x00 0x01*. Write: *0x05 0x05 0x03 0xF7 0xFF 0x00*.

1.3.5.1. The content of "coils" (bit variables) in 1000-1061 field

Coil	Address (hex)	Brief description	Extended description	Operation
1000	0x03E7	Detection of low flow	Switching on & off the function for detection of low flow.	RD/WR
1001	0x03E8	Empty pipe detection	Switching on & off the function for detection of an empty pipe.	RD/WR
1002	0x03E9	Cut-off of low flow	Switching on & off the function for discrimination of zero (cut-off of low flow).	RD/WR
1003	0x03EA	Current loop	Switching on & off the operation of the current loop.	RD/WR
1004	0x03EB	Current loop alarm	Switching on & off the alarm mode using the current loop.	RD/WR
1005	0x03EC	Pulse output	Switching on & off of the pulse output.	RD/WR
1006	0x03ED	Binary output 1	Switching on & off of the binary status output 1.	RD/WR
1007	0x03EE	Binary output 2	Switching on & off of the binary status output 2.	RD/WR
1008	0x03EF	Binary input	Switching on & off the binary input.	RD/WR
1009	0x03F0	MODBUS bus	Switching on & off the MODBUS.	RD/WR
1010	0x03F1	Events archiving	Switching on & off of archiving (option to save in the non-volatile memory) of events occurring during operation of the device.	RD/WR
1011	0x03F2	Measurements archiving	Switching on & off of archiving (option to save in the non-volatile memory) of measurements of average values of flow.	RD/WR
1012	0x03F3	Continuous saving of events	Switching on & off the option for general (continuous) writing to events memory (when the entire events memory is written, that is 8128 items - replacing of the oldest entries with new ones).	RD/WR
1013	0x03F4	Continuous saving of the measurements	Switching on & off the option for general (continuous) writing to measurements memory (when the entire measurement memory is written, that is 8128 items - replacing of the oldest entries with new ones).	RD/WR

1014	0x03F5	Events erasing	Command for deleting events memory. The setting of the bit to 1 result in deleting events saved in the device memory. The bit sets automatically to 0 after execution of the command.	TRIGGER
1015	0x03F6	Measurements erasing	Command for deleting measurements memory. The setting of the bit to 1 result in deleting measurements saved in the device memory. The bit sets automatically to 0 after execution of the command.	TRIGGER
1016	0x03F7	Erasing of user-specified totalizers	Command for deleting of user-specified totalizers. The setting of the bit to 1 result in deleting user-specified totalizers saved in the device memory. The bit sets automatically to 0 after execution of the command.	TRIGGER
1017	0x03F8	Erasing working time of the user	Command for deleting working time of the user. The setting of the bit to 1 result in deleting the user's working time counter saved in the device memory. The bit sets automatically to 0 after execution of the command.	TRIGGER
1018	0x03F9	Errors erasing	Command for deleting status errors from the device. The setting of the bit to 1 results in deleting status errors from the device. The bit sets automatically to 0 after execution of the command.	TRIGGER
1019	0x03FA	Default parameters	Command for the setting of default parameters in the device (basic parameters of a correct operation with calibration saved in the production stage of the device). The setting of the bit to 1 results in writing of settings of the device with default parameters. The bit sets automatically to 0 after execution of the command, while the device restarts.	TRIGGER
1020	0x03FB	Factory parameters	Command for the setting of factory parameters of the device (parameter permanently saved in the device memory, without the possibility of any intervention in their value). The setting of the bit to 1 results in writing of settings of the device with factory parameters. The bit sets automatically to 0 after execution of the command, while the device restarts. The device is not calibrated after setting factory parameters.	TRIGGER
1021	0x03FC	Electronics calibration	Command for starting a procedure for calibration of the electronics. The setting of the bit to 1 results in starting of the calibration process (the procedure should be executed using an artificial measuring sensor). The bit sets automatically to 0 after execution of the command.	TRIGGER
1022	0x03FD	The end of electronics calibration	Command for ending a procedure for calibration of the electronics. The setting of the bit to 1 results in ending of the calibration process (leaving of the calibration menu). The bit sets automatically to 0 after execution of the command.	TRIGGER
1023	0x03FE	Writing of electronics calibration	Command for writing of an obtained coefficient of calibration of electronics. The setting of the bit to 1 results in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command. Status of execution of electronics calibration using the artificial sensor will be set in the device.	TRIGGER

1024	0x03FF	Erasing calibration of the electronics	Command for deleting the electronics calibration coefficient. The setting of the bit to 1 results in deleting the calibration coefficient from the memory. The bit sets automatically to 0 after execution of the command. The calibration coefficient will be set to the value equal to 0.00011 as a result of the procedure. Status of execution of electronics calibration using the artificial sensor will be deleted from the device.	TRIGGER
1025	0x0400	Zero calibration	Command for starting a procedure of calibration of zero of the flow. The setting of the bit to 1 results in starting of the calibration process (the procedure should be executed when the flow is missing that is on “lentic water”). The bit sets automatically to 0 after execution of the command. The procedure can be executed only after previously executed calibration of the electronics.	TRIGGER
1026	0x0401	The end of zero calibration	Command for ending a procedure of calibration of zero of the flow. The setting of the bit to 1 results in ending of the calibration process (leaving of the calibration menu). The bit sets automatically to 0 after execution of the command.	TRIGGER
1027	0x0402	Save of zero calibration	Command for the writing of the obtained coefficient of calibration of zero of the flow. Setting of bit to 1 result in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command. Saving of the coefficient is possible only when its value does not exceed 0.3 [m/s] (threshold protecting against zeroing during flow).	TRIGGER
1028	0x0403	Duration of calibration	Flag indicating the duration of electronics calibration or calibration of zero of the flow. The value of read bit equal to 1 means that the device is busy with the execution of calibration procedure.	RD_ONLY
1029	0x0404	Calibration 4mA	Command for starting of calibration of the current loop for value 4 mA. The setting of the bit to 1 results in starting of the calibration process (the calibration procedure requires the use of external reference measurement of the current). The bit sets automatically to 0 after execution of the command.	TRIGGER
1030	0x0405	Calibration save 4mA	Command for the writing of the obtained coefficient of calibration of the current loop for value 4mA. The setting of the bit to 1 results in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command.	TRIGGER
1031	0x0406	Calibration 20mA	Command for starting of calibration of the current loop for value 20 mA. The setting of the bit to 1 results in starting of the calibration process (the calibration procedure requires the use of external reference measurement of the current). The bit sets automatically to 0 after execution of the command.	TRIGGER

1032	0x0407	Calibration save 20mA	Command for the writing of the obtained coefficient of calibration of the current loop for value 20mA. The setting of the bit to 1 results in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command.	TRIGGER
1033	0x0408	Calibration of internal measurement 4mA	Command for starting of calibration of the internal measurement of the current loop for value 4 mA. The setting of the bit to 1 results in starting of the calibration process (the calibration procedure requires the use of external reference measurement of the current). The bit sets automatically to 0 after execution of the command.	TRIGGER
1034	0x0409	Write of calibration of internal measurement 4mA	Command for the writing of the obtained coefficient of internal measurement of the current loop for value 4mA. The setting of the bit to 1 results in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command.	TRIGGER
1035	0x040A	Calibration of internal measurement 20mA	Command for starting of calibration of the internal measurement of the current loop for value 20 mA. The setting of the bit to 1 results in starting of the calibration process (the calibration procedure requires the use of external reference measurement of the current). The bit sets automatically to 0 after execution of the command.	TRIGGER
1036	0x040B	Write of internal measurement calibration 20mA	Command for the writing of the obtained coefficient of internal measurement of the current loop for value 20mA. The setting of the bit to 1 results in saving to the newly obtained calibration coefficient. The bit sets automatically to 0 after execution of the command.	TRIGGER
1037	0x040C	Dosing function	Switching on & off the dosing function in the flowmeter.	RD/WR
1038	0x040D	Dosing start	Dosing function start command. The setting of the bit to 1 results in the start of dosing of both channels. The bit sets automatically to 0 after execution of the command.	TRIGGER
1039	0x040E	Dosing stop	Dosing function stop command. The setting of the bit to 1 results in the stop of dosing for both channels. The bit sets automatically to 0 after execution of the command.	TRIGGER
1040	0x040 F	Overload of dosing value	Command for overloading of the volume value and setting of readiness condition for the dosing function. The setting of the bit to value 1 results in loading of the set volume values dosed by both channels to dosing counters. The bit sets automatically to 0 after execution of the command.	TRIGGER
1041	0x0410	Backup bit 1	Backup bit 1 which may be used in the future.	RD_ONLY
1042	0x0411	Backup bit 2	Backup bit 2 which may be used in the future.	RD_ONLY
1043	0x0412	Backup bit 3	Backup bit 3 which may be used in the future.	RD_ONLY
1044	0x0413	Backup bit 4	Backup bit 4 which may be used in the future.	RD_ONLY
1045	0x0414	Backup bit 5	Backup bit 5 which may be used in the future.	RD_ONLY
1046	0x0415	Backup bit 6	Backup bit 6 which may be used in the future.	RD_ONLY
1047	0x0416	Backup bit 7	Backup bit 7 which may be used in the future.	RD_ONLY
1048	0x0417	Backup bit 8	Backup bit 8 which may be used in the future.	RD_ONLY
1049	0x0418	Backup bit 9	Backup bit 9 which may be used in the future.	RD_ONLY

1050	0x0419	LCD diagnostics	Start of a test procedure for the LCD display. The setting of the bit to 1 result in the start of LCD display testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1051	0x041A	LCD diagnostics stop	Stop of a test procedure for the LCD display. The setting of the bit to 1 result in the stop of LCD display testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1052	0x041B	Diagnostics of current loop	Start of the test procedure of current loop 4-20mA. The setting of the bit to 1 result in the start of current loop output testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1053	0x041C	Stop of current loop diagnostics	Stop of the test procedure of current loop 4-20mA. The setting of the bit to 1 results in the stop of testing of the output of the current loop. The bit sets automatically to 0 after execution of the command.	TRIGGER
1054	0x041D	Diagnostics of pulse output	Start of a test procedure for pulse output. The setting of the bit to 1 results in the start of pulse output testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1055	0x041E	Stop of pulse output diagnostics	Stop of a test procedure for pulse output. The setting of the bit to 1 results in the stop of pulse output testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1056	0x041 F	Diagnostics of status outputs	Start of a test procedure for binary pulse outputs. The setting of the bit to 1 results in the start of testing of the binary outputs. The bit sets automatically to 0 after execution of the command.	TRIGGER
1057	0x0420	Stop of status outputs diagnostics	Stop of a test procedure for binary pulse outputs. The setting of the bit to 1 results in the stop of binary outputs testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1058	0x0421	Input diagnostics	Start of a test procedure for isolated binary input. The setting of the bit to 1 results in the start of binary input testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1059	0x0422	Input diagnostics stop.	Stop of a test procedure for isolated binary input. The setting of the bit to 1 results in the stop of binary input testing. The bit sets automatically to 0 after execution of the command.	TRIGGER
1060	0x0423	Diagnostics of measurement simulation	Start of a test procedure for simulation of flow measurements. The setting of the bit to 1 results in the start of flow simulation. The bit sets automatically to 0 after execution of the command.	TRIGGER
1061	0x0424	Stop of diagnostics of measurement simulation	Stop of a test procedure for simulation of flow measurements. The setting of the bit to 1 results in the end of flow simulation. The bit sets automatically to 0 after execution of the command, while the device restarts.	TRIGGER

1.3.5.2. Sub-function 0x08 frame

Frame 0x08 allows you to perform diagnostic operations. This frame defines sub-functions described by 16-bit value. Majority of the diagnostic functions is based on the diagnostic meters defined by MODBUS. Only unicast mode is available. Available sub-functions of 0x08 frame with their description are presented in the following table.

Code sub-function (hex)	Meter number	Name of function or meter acc. to MODBUS	Description of function
00 00	-	Return Query Data	In response to this query a frame is sent which is an accurate echo (copy) of query frame, including the data field. The data field can be of any type.
00 01	1-8	Restart Communications Options	This frame restarts serial port (with currently selected parameters in the menu) and zeroing of diagnostic meters. Data field of query frame can consist both 0x0000 and 0xFF00 values because this device does not run Communications Event Log.
00 0A	1-8	Clear Counters and Diagnostic Register	This frames resets diagnostic meters. Data field of query frame: 0x0000.
00 0B	1	Return Bus Message Count	This frame returns value of diagnostic meter Return Bus Message Count. This meter contains number of correct* frames detected on the bus. The data field of the query frame is always 0x0000.
00 0C	2	Return Bus Communication Error Count	This frame returns values of diagnostic meter Return Bus Communication Error Count. This meter contains number of incorrect frames on bus, with incorrect CRC, with parity error, with lost characters or shorter than 3 bytes. The data field of the query frame is always 0x0000.
00 0D	3	Return Slave Exception Error Count	This frame returns value of diagnostic meter Return Slave Exception Error Count. This meter contains number of exceptions in received, correct frames (incorrect code, address, data in frame). The data field of the query frame is always 0x0000.
00 0E	4	Return Slave Message Count	This frame returns value of diagnostic meter Return Slave Message Count. This meter contains number of correct frames directed to this device, including broadcast frames. The data field of the query frame is always 0x0000.

**) correct frame is a frame without parity errors, CRC error and frame length is correct, in other words: this is a frame, which structure (in ADU layer) is correct and therefore the frame can be directed for decoding and execution of the command. It does not mean correctness of data contained in PDU.*

Frame 0x2B allows data tunneling in various formats using MODBUS frames. One sub-function of this frame, 0x0E, is supported that is Read Device Identification. Only unicast mode is available. Response to this frame returns information about the device, organized in compact structure of objects with **byte** organization (what differs from the MODBUS data organization, which is usually 16-bit). Each object contains ID, byte informating about data

field length and data field. Data field contains a string of text characters coded in ASCII standard, not terminated with zero. Returned objects are presented below:

Object ID	Object length (hex.)	Object length (decimal)	Content of object data field
00	0D	13	Aplisens S.A.
01	08	8	PEM-1000
02	0A	10	v0.01.0000 *Current software revision of the device e.g.:* v2.08.0825

1.3.6. Examples of flowmeter servicing procedures using the MODBUS bus

Readout of the events archive from the device with address 5:

- Reading of number of events written in the device from register 5504 – 0x05 0x03 0x15 0x7F 0x00 0x02.
- For example, we obtain in response that 110 events are saved. We assume that we want to read events from 100 to 110.
- We write to register 8000 an event readout address from the archive equal to 100 – 0x05 0x10 0x1F 0x3F 0x00 0x02 0x04 0x00 0x00 0x00 0x64.
- While reading registers from 8002 to 8032, we take 8 successive events read from the device memory: 0x05 0x03 0x1F 0x41 0x00 0x20.
- We write to register 8000 an address of reading of successive events from the archive equal to 108 – 0x05 0x10 0x1F 0x3F 0x00 0x02 0x04 0x00 0x00 0x00 0x6C.
- Reading registers from 8002 to 8012 we take 3 successive lacking events read from the device memory: 0x05 0x03 0x1F 0x41 0x00 0x06. In addition, like the first time it is possible to read all 32 registers, but registers with the addresses 8014 – 8032 will have all bytes equal to 0x00 (because only three events for download are available during this readout and “empty” registers have a value equal to 0x00).

1.3.7. Calibration of the flowmeter electronics

Execution of calibration of the flowmeter electronics (when an artificial measuring head is connected) with the address of 5:

- Checking whether the device is not in the calibration state by readout of a busy bit with address 1028 – 0x05 0x01 0x04 0x03 0x00 0x01.
- If the value of the busy flag has a value of 0 (the device is not in the calibration mode) then the electronics calibration procedure is started by setting bit 1021 – 0x05 0x05 0x03 0xFC 0xFF 0x00.
- Waiting for the completion of data collection by the device. The busy bit has a value of 1 during collection of the data. Readout of the busy bit with address 1028 until it reaches value 0 – 0x05 0x01 0x04 0x03 0x00 0x01.

- Readout of the temporarily calculated coefficient from register 5604 after ending of data collection by the device – 0x05 0x03 0x15 0xE3 0x00 0x02. The applicable coefficient can be read from register 5606 - 0x05 0x03 0x15 0xE5 0x00 0x02.
- After analysis of the obtained value of a new parameter - possibility to end the procedure without writing a new coefficient by setting bit 1022 0x05 0x05 0x03 0xFD 0xFF 0x00 or writing a new coefficient in the non-volatile memory of the device by setting bit 1023 - 0x05 0x05 0x03 0xFE 0xFF 0x00 and then ending the procedure by setting bit 1022.

1.3.8. Decomposition of the data

Decomposition of the data read from the flowmeter archive using the MODBUS bus.

1.3.8.1. Data of events archive

A single event read from the device through the MODBUS takes two (double) addresses, that is 8 data bytes. The variable read from the first address, e.g. 8002 contains younger four bytes of the event, while the variable read from successive address 8004 contains four older bytes of this event. The byte order send through the MODBUS interface during reading from the address has a format (“order”, one of four) set in the device menu.

The data in the device memory is coded in Little Endian format. The structure of eight bytes describing the transferred event is as follows:

```
typedef struct
{
  byte Data1;
  byte Data2;
  byte Data3;
  byte Data4;
  byte Data5;
  byte Type;
  byte Parameter;
  byte CRC;
}EventTypeDef;
```

Therefore, the four younger event bytes are: *Data1, Data2, Data3, Data4* and the four older bytes are: *Data5, Type, Parameter, CRC.*

Assuming that the data transfer method through the MODBUS interface is set as DDCCBBAA type (Big Endian), readout of the first address (e.g. 8002) will be as follows: *Data4, Data3, Data2, Data1* while for the second (address 8004 likewise): *CRC, Parameter, Type, Data5.*

1.3.8.2. The data mean

- *Type* – type of event saved in the archive. The following types of events assuming the following values are defined:
  - 1 = Start – device start;
  - 2 = Login – user log in to the device menu;
  - 3 = Status OK – change of the device status to the correct value;
  - 4 = Error FE – error of measurement board of FrontEnd;
  - 5 = Error Sen – measuring sensor error;

- 6 = Error Mem – device internal memory error;
- 7 = Empty – detection of an empty pipe by the flowmeter;
- 8 = Unfilled – detection of an unfilled pipe by the flowmeter;
- 9 = Reset – reset of user counters;
- 10 = Default – setting of device parameters to the default values;
- 11 = Factory – setting of device parameters to the factory values;
- 12 = Calibrat. – saving of calibration parameters of the device;
- 13 = Coil Err – error of measurement coil of the flowmeter;
- 14 = Low Flow – detection of low liquid flow by the flowmeter.

- *Parameter* – event parameters. The following parameters (applying to given types) of events assuming the following values are defined:
  - 0 = no parameter (applies to all types of events);
  - 1 = User – logged in operator with user authorizations (applies to event type no. 2);
  - 2 = Admin – logged in operator with administrator authorizations (applies to event type no. 2);
  - 3 = Service – logged in operator with service authorizations (applies to event type no. 2);
  - 4 = Off – operator log out (applies to event type no. 2);
  - 5 = Total. – deleting of user totalizers (applies to event type no. 9);
  - 6 = Count. – deleting of user time counter (applies to event type no. 9);
  - 7 = Error. – deleting of device errors (applies to event type no. 9);
  - 8 = Tot.in – deleting of user totalizers using binary input (applies to event type no. 9);
  - 9 = Device – saving of electronics calibration (using a sensor of the artificial head, applies to event type no. 12);
  - 10 = Zero – saving of zero calibration for the sensor (applies to event type no. 12);
  - 11 = Sensor – saving of sensor calibration (coefficients A, B and C, applies to event type no. 12);
  - XX = error code (one byte number saved in the hex format, applies to no. 4 event type);
  - YY = error code (one byte number saved in the hex format, applies to no. 5 event type);
  - ZZ = error code (one byte number saved in the hex format, applies to no. 6 event type) where bit 0 set to value 1 indicates an error of SRAM, while bit 4 set to value 1 indicates an error of EEPROM.
- *Data1* – data containing second of time of the event saved in the archive.
- *Data2* – data containing minute of time of the event saved in the archive.
- *Data3* – data containing an hour of time of the event saved in the archive.
- *Data4* – data containing the number of the day on bits 0 - 4, while three youngest bits of the year of the event time saved in the archive, on bits 5 - 7.

- *Data5* – data containing the number of the month on bits 0 - 3, while four older bits of the year of the event time saved in the archive, on bits 4 - 7.
- *CRC* – one byte checksum of the correctness of event writing in the device memory. CRC is counted as a 256 modulo sum of other bytes of the event (one byte operation 0 - the sum of all other bytes of the event).

An example of readout of the event from the archive:

- 0x3A|0x0F|0x1B|0x14 0x5C|0x04|0x02|0x26 - readout of younger and older part of the event from the device that is 8 bytes (representing sequence: younger part *Data4*|*Data3*|*Data2*|*Data1* and older part *CRC*|*Parameter*|*Type*|*Data5*).
- After the decomposition, we obtain that this is the event: Login / Off (type 2 parameter 4) that is logout of the operator from the device menu, which occurred 26-06-2017 (five bits from 0x3A, four bits from 0x26 and 2000 plus composition from 0x10 and 0x01) at 15:27:20 (0x0F, 0x1B, 0x14).

1.3.8.3. Data of measurement archive

A single result of measurement of average flow read from the device through MODBUS takes two (double) addresses, that is 8 data bytes. The variable read from the first address, e.g. 9002 contains younger four bytes of the item, while the variable read from the successive address 9004 contains four older bytes of this item. The byte order send through the MODBUS interface during reading from the address has a format (“order”, one of four) set in the device menu.

The data in device memory is coded in Little Endian format. The structure of eight bytes describing the transferred archive item is as follows:

```
typedef struct
{
  byte Data1;
  byte Data2;
  byte Data3;
  float AverageFlow;   (4-byte float data)
  byte CRC;
}MeasTypeDef;
```

Therefore, four younger bytes of the archive item are: *Data1, Data2, Data3, AverageFlow (the youngest brother)* and older four bytes are: *AverageFlow (three older bytes), CRC.*

Assuming that the data transfer method through the MODBUS interface is set as DDCCBBAA type (Big Endian), readout of the first address (e.g. 9002) will be as follows: *AverageFlow (the youngest byte), Data3, Data2, Data1* while for the second (address 9004 likewise): *CRC, AverageFlow (three older bytes).*

The data mean:

- *AverageFlow* – average measurement of flow for a period of time set in the menu (four-byte floating point number).
- *Data1* – data containing minute of time of saving of measurement of average flow in the archive.

- *Data2* – data containing hour on bits 0 - 4, and two older bits of the number of the month on bits 5 - 6 for the time of saving of average measurement of flow in the archive.
- *Data3* – data containing a number of the day on bits 0 - 4, while two younger bits of the number of the month of the event time saved in the archive, on bits 5 - 6.
- *CRC* – one byte checksum of the correctness of measurement writing in the device memory. CRC is counted as a 256 modulo sum of other bytes of the measurement (one byte operation 0 - the sum of all other bytes of the measurement).

1.3.8.4. An example of readout of measurement from the archive

- 0xA1|0x38|0x2F|0x0E 0x99|0x42|0x9B|0x74 - readout of younger and older part of the measurement from the device that is 8 bytes (representing sequence: younger part *AverageFlow (the youngest byte)*|*Data3*|*Data2*|*Data1* and older part *CRC*|*AverageFlow (three older bytes)*.
- After the decomposition, we obtain that this is the average measurement of flow of the value equal to 77.7277908 m^3/h (0x42, 0x9B, 0x74, 0xA1), which was written as 24-05 (five bits from 0x38, two bits from 0x38 plus two bits from 0x2F) at 15:14 (five bits from 0x2F, 0x0E).

2. ADDITIONAL INFORMATION

2.1. Additional information

The manufacturer reserves the right to introduce design and process changes in the device not decreasing its performance parameters.

User manual for the flow meter IO.PEM-1000(ENG) can be found on the manufacturer's website www.aplisens.pl

2.2. Revision log

No. of revision	Document edition	Description of review
1	01.A.001 24.10.17	Changes related to software v. 2.7 - Introduction of the full MODBUS
2	01.A.003 05.04.18	Changes related to software v. 2.8