MODBUS Tables Supplement COI/FEX100/MOD/TBL–EN Rev. A

WaterMaster
Electromagnetic flowmeter

The perfect fit for all water industry applications

Introduction

This user guide defines the tables of coils and registers used for accessing WaterMaster parameters using Modbus.

Refer to the data sheet DS/WM-EN for details of applicable models and order codes. Refer to Modbus supplement OI/FEX100_MOD–EN for all other Modbus related information for this series of flowmeters.

The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

Quality Control

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company and is indicative of our dedication to quality and accuracy.

UKAS Calibration Laboratory No. 0255

Contents

1 MODBUS Protocol

1.1 Definitions, Abbreviations and Acronyms

Big Endian – Data representation format where bytes are ordered from most to least significant byte. The value 65534, for example, is represented as 0xFFFE. Big Endian is the data representation format specified by the Modbus protocol.

Coil – Modbus protocol defined data-type representing a single bit. See also Discrete Input and Output Coil.

CRC – Calculation performed on a message's contents to ensure its integrity.

Discrete Input – A coil that acts as an input to the master. Discrete Input data is read-only because of this.

IEEE format – Most commonly used standard for floating-point computation, established by the Institute of Electrical and Electronics Engineers.

Holding Register – A register that acts as an input to the slave device from the master. Holding Register data can be read and written.

Input Register – A register that acts as an input to the master from the slave device. Input Register data is read-only.

Output Coil – A coil that acts as an output from the master to the slave device. Output coil data can be read and written.

Register – Modbus protocol defined sixteen-bit data-type. See also Holding Register and Input Register.

1.2 Supported Function Codes

The following Function Codes are supported by the WaterMaster.

Function Code	Function Code Description	Applicable WaterMaster Tables
0x02	Read Discrete Inputs	Alarm status Discrete Inputs Alarm history status Discrete Inputs
0x03	Read Holding Registers	Read-write Byte parameters Read-write Byte string parameters Read-write Float parameters Action parameters
0x04	Read Input Registers	Read-only Byte parameters Read-only Short parameters Read-only Integer parameters Read-only Float parameters Read-only Double parameters Alarm history counters Read-only Byte string parameters
0x06	Write Single Register	Read-write Byte parameters Read-write Byte string parameters Action parameters
0x08	Diagnostics	NA
0x10	Write Multiple Registers	Read-write Byte parameters Read-write Byte string parameters Read-write Float parameters Action parameters
0x11	Report Slave ID	NA

1.3 Supported data-types

The Modbus protocol defines input and holding registers, and output coils and discrete inputs as its supported data-types. This section defines the mapping from the Modbus data-types to internal WaterMaster data-types.

Data-type name	Description
Action	Data-type used to trigger instrument activity. Action type parameters have no internal storage requirements. Writing any value to the parameter will trigger the instrument activity.
Alarm history counter	Structured parameter holding details of a device alarm activity. The sub-elements are as follows. Alarm counter (Short, register offset 0) – Indicates the total number of occurrences of the alarm. Alarm time ms (Integer, register offset 1) – The number of ms the current alarm instance has been active for. Alarm time days (Short, register offset 3) – The number of days the current alarm instance has been active for. Total alarm time ms (Integer, register offset 4) – The number of ms all instances of the alarm have been active for. Total alarm time days (Short, register offset 6) – The number of days all instances of the alarm have been active for.
Byte	8-bit data value. Each byte is addressed by a register address, with the upper-byte of the value being ignored. When Byte parameters are read, the upper-byte is always set to 0x20 (space character). A Byte value of 10 would be returned as (Hex) 20,0A.
Byte string	8-bit string data. String elements can be accessed separately or all in a single request. Each string element behaves in the same way as Byte data described above. For example, the response to a request to read a Byte string with value “123” would appear as follows. (Hex) 20,31,20,32,20,33
Discrete input	Discrete input values are transferred in Modbus messages in bytes, meaning up to eight discrete input values can reside in a byte. Bytes are filled from the least-significant-bit to the most. Reading three discrete input values, where the three discrete inputs are in the ‘on’ state, would return the binary value 0b00000111. Unused discrete input values in Modbus message discrete input bytes are always set to 0. The lowest requested discrete input number is placed in the least-significant-bit of the byte data, with lower discrete input addresses being sent first. Reading sixteen discrete inputs, where the first and fifteenth discrete inputs are in the ‘on’ state would return the binary data 0b00000001 0b01000000.

Double	IEEE format double-precision floating-point data. The device option “Word Swap” is used to determine the order the words of the data are interpreted. If set to “Disabled”, the Double format data is sent in standard Modbus big-endian format. For example, the value 5.525 would be returned as (Hex) 40,16,19,99,99,99,99,9A. If “Word Swap” is set to “Enabled”, the order in which the words of the value is reversed, meaning data is sent least-significant-word first. The value 5.525 would be returned in this case as (Hex) 99,9A,99,99,19,99,40,16 in this case.
Float	IEEE format single-precision floating-point data. The device option “Word Swap” is used to determine the order the words are interpreted (refer to Double data-type).
Integer	32-bit data value. The device option “Word Swap” is used to determine the order the words are interpreted (refer to Double data-type).
Short	16-bit data value. Data is interpreted in standard MODBUS big-endian format. For example, the value 256 would be returned as (Hex) 01,00.

1.4 Modbus Function Codes

This section details the function, and request and response formats for all Modbus Function Codes supported by the WaterMaster.

0x02 Read Discrete Inputs

Read Discrete Inputs is used to read the state of discrete input type coil data from the slave device.

The format for a Read Discrete Inputs request is as follows.

Byte number	Description
1	Slave device identifier.
2	Read Discrete Inputs Function Code, 0x02.
3,4	Discrete input address. 16-bit value indicating the address of the first discrete input to be read.
5,6	Number of discrete inputs. 16-bit value indicating the number of discrete inputs to be read.
7,8	Message CRC.

The format of responses to successfully processed Read Discrete Input requests is as follows.

Byte number	Description
1	Slave device identifier.
2	Read Discrete Inputs Function Code, 0x02.
3	Byte count ('n'), number of data bytes in response.
4..(4+n)-1	Discrete input data. Up to 2000 discrete inputs can be read in one request, if available.
(4+n), (4+n)+1	Message CRC.

0x03 Read Holding Registers

Read Holding registers is used to request the value of holding register data. The request format is as follows.

Byte number	Description
1	Slave device identifier.
2	Read Holding Registers Function Code, 0x03.
3,4	Holding register address. 16-bit address indicating the address of the first holding register to read.
5,6	Holding register count. 16-bit value indicating the number of holding registers to read.
7,8	Message CRC.

The format of successfully processed Read Holding Registers requests is as follows.

Byte number	Description
1	Slave device identifier.
2	Read Holding Registers Function Code, 0x03.
3	Holding register count ('n'). 8-bit value indicating the count of holding registers returned in the message.
4..(4+n)-1	Holding register data.
(4+n), (4+n)+1	Message CRC.

0x04 Read Input Registers

Read Input Registers is used to request the value of input registers. The request format is as follows.

Byte number	Description
1	Slave device identifier.
2	Read Input Registers Function Code, 0x04.
3,4	Input register address. 16-bit value indicating the address of the first input register to read.
5,6	Input register count. 16-bit value indicating the number of input registers to read.
7,8	Message CRC.

Responses to successfully processed Read Input Registers requests appear as follows.

Byte number	Description
1	Slave device identifier.
2	Read Input Registers Function Code, 0x04.
3	Byte count ('n'), number of data bytes in response.
4..(4+n)-1	Input register data.
(4+n), (4+n)+1	Message CRC.

0x06 Write Single Register

Write Single Register is used to write a single Holding Register value. The request format is as follows.

Byte number	Description
1	Slave device identifier.
2	Write Single Register Function Code, 0x06.
3,4	16-bit holding register address.
5,6	Holding register value. 16-bit value indicating the value to write.
7,8	Message CRC.

The format of responses to successfully processed Write Single Register requests is as follows.

Byte number	Description
1	Slave device identifier.
2	Write Single Register Function Code, 0x06.
3,4	Holding register address. 16-bit value indicating the address of the holding register that was written.
5,6	Holding register value. 16-bit value indicating the value that was written to the holding register.
7,8	Message CRC.

0x08 Diagnostics

Only the Diagnostics sub-function Return Query Data (0x00, 0x00) is supported. When requests of this type are received by the device, the message is echoed back to the master.

The request and response format is as follows.

Byte number	Description
1	Slave device identifier.
2	Diagnostics Function Code, 0x08.
3,4	Sub-query identifier, 0x00, 0x00.
5..(5+n)-1	Diagnostics query data. (Of length ‘n’).
(5+n) (5+n)+1	Message CRC.

0x10 Write Multiple Registers

Write Multiple Registers is used to write data to the device Holding Registers. The request format is as follows.

Byte number	Description
1	Slave device identifier.
2	Write Multiple Registers Function Code, 0x10.
3,4	Holding register address. 16-bit value indicating the address of the first holding register to write.
5,6	Holding register count. 16-bit value indicating the number of holding registers to write.
7	Byte count ('n'), number of data bytes in the request.
8..(8+n)-1	Holding register message data. The data to write to the holding registers.
(8+n) (8+n)+1	Message CRC.

When successfully processed, the format of responses to Write Multiple Registers requests is as follows.

Byte number	Description
1	Slave device identifier.
2	Write Multiple Registers Function Code, 0x10.
3,4	Holding register address. 16-bit value indicating the address of the first holding register.
5,6	Holding register count. 16-bit value indicating the number of holding registers written.
7,8	Message CRC.

0x11 Report Slave ID

The Report Slave ID command is used to return a unique response specific to a slave device type. The Report Slave ID request format is as follows.

Byte number	Description
1	Slave device identifier.
2	Report Slave ID Function Code, 0x11.
3,4	Message CRC.

The WaterMaster Report Slave Id response is as follows.

Byte number	Description
1	Slave device identifier.
2	Report Slave ID Function Code, 0x11.
3	Count of data bytes.
4	Unique identifier for ABB, 0x1A.
5	Unique identifier for the WaterMaster device type, 0x1F.
6	Software revision, 0x30.
7	Hardware revision, 0x30.
8	Unused, 0x30.
9..11	Reserved for future use, 0x30,0x30,0x30.
12..33	Device type designator. (Hex) 41,42,42,20, 46,45,58,31, 30,30,20,57, 61,74, 65,72,4D,61,73,74,65,72. (ASCII) ‘ABB FEX100 WaterMaster’.
34..35	Message CRC.

Exception codes

In event of an error occurring during processing of a request, an exception response is returned. This is characterised by 0x80 being added to the request Function Code. A single byte exception code then follows detailing the nature of the exception.

The following exception codes are supported.

Exception code	Exception name	Details
0x01	ILLEGAL_FUNCTION	An unrecognised command has been received, or the device is in an incorrect state to handle the request.
0x02	ILLEGAL_DATA_ADDRESS	An invalid register/coil address has been requested.
0x03	ILLEGAL_DATA_VALUE	The request structure is incorrect, or the data in the request is invalid.
0x04	SLAVE_DEVICE_FAILURE	An internal device error occurred whilst processing the request.

The format for exception responses is always as follows.

Byte number	Description
1	Slave device identifier.
2	Function Code with 0x80 added.
3	Exception code.
4,5	Message CRC.

2 Parameter Tables

2.1 Alarm status Discrete Inputs

Modbus Address / Actual Address	Alarm Name / Brief Description	Alarm NAMUR Identifier
10001 / 0	UNUSED Unused alarm bit. 0: Off	-
10002 / 1	STATUS_LOGIC_OP1_SIMULATED Logic simulation selected on OP1. 0: Off 1: On	C168.001
10003 / 2	STATUS_PULSE_OP1_SIMULATED Pulse simulation selected on OP1. 0: Off 1: On	C174.002
10004 / 3	STATUS_LOGIC_OP2_SIMULATED Logic simulation selected on OP2. 0: Off 1: On	C164.003
10005 / 4	STATUS_PULSE_OP2_SIMULATED Pulse simulation selected on OP2. 0: Off 1: On	C172.004
10006 / 5	STATUS_LOGIC_OP3_SIMULATED Logic simulation selected on OP3. 0: Off 1: On	C160.005
10007 / 6	STATUS_LOW_FLOW_VALUE Low flow alarm. 0: Off 1: On	S132.006
10008 / 7	STATUS_HIGH_FLOW_VALUE High flow alarm. 0: Off 1: On	S136.007

10009 / 8	STATUS_103P_REACHED Q >103% Qmax. 0: Off 1: On	S140.008
10010 / 9	STATUS_SIMULATED_FLOW Simulation mode On. 0: Off 1: On	C182.009
10011 / 10	STATUS_CALIBRATOR Tx. simulator/calibrator mode. 0: Off 1: On	C186.010
10012 / 11	STATUS_DISPLAY_OVERRANGE At Qmax, volume display overrun <1600hrs. 0: Off 1: On	M080.011
10013 / 12	STATUS_TOTALIZER_RESET Totalizer reset. 0: Off 1: On	_030.012
10014 / 13	STATUS_POOR_SENSOR_COMMS Intermittent sensor comms. 0: Off 1: On	M090.013
10015 / 14	UNUSED Unused alarm bit. 0: Off	-
10016 / 15	STATUS_TX_MEMORY_FAIL Tx. memory fault detected. 0: Off 1: On	F250.015
10017 / 16	STATUS_NO_SENSOR Sensor memory not detected. 0: Off 1: On	F252.016

10018 / 17	STATUS_MEASUREMENT_OFFLINE Tx. measurement suspended. 0: Off 1: On	F220.017
10019 / 18	STATUS_EMPTY_PIPE Empty pipe. 0: Off 1: On	S150.018
10020 / 19	UNUSED Unused alarm bit. 0: Off	-
10021 / 20	UNUSED Unused alarm bit. 0: Off	-
10022 / 21	STATUS_ELEC_OPEN_CIRCUIT Open circuit electrode. 0: Off 1: On	S147.021
10023 / 22	STATUS_ELEC_SHORT_CIRCUIT Short circuit electrode. 0: Off 1: On	S146.022
10024 / 23	UNUSED Unused alarm bit. 0: Off	-
10025 / 24	STATUS_INSTALLATION_FAULT Installation fault/condition. 0: Off 1: On	F247.024
10026 / 25	STATUS_COIL_OPEN_CIRCUIT Open circuit coil/wiring. 0: Off 1: On	F238.025

10027 / 26	STATUS_COIL_SHORT_CIRCUIT Short circuit coil/wiring. 0: Off 1: On	F236.026
10028 / 27	STATUS_LOOP_RESISTANCE Check cable+coil resistance. 0: Off 1: On	F234.027
10029 / 28	STATUS_TX_HARDWARE Transmitter hardware fault. 0: Off 1: On	F232.028
10030 / 29	STATUS_BAD_FLOW_DATA Bad flow data. 0: Off 1: On	F230.029
10031 / 30	STATUS_ELECTRODE_VOLTAGE Accuracy warning? 0: Off 1: On	S105.030
10032 / 31	STATUS_OIML_SELF_CHECK OIML self-check limits exceeded. 0: Off 1: On	M98.031
10033 / 32	STATUS_MEASUREMENT_STARTING Measurement starting. 0: Off 1: On	S148.032
10034 / 33	UNUSED Unused alarm bit. 0: Off	-
10035 / 34	STATUS_NOT_CALIBRATED Sensor setup not complete. 0: Off 1: On	S110.034

10036 / 35	STATUS_CALIBRATION_MISMATCH Incompatible sensor. 0: Off 1: On	F248.035
10037 / 36	STATUS_ROM_ERROR Tx. code memory fault. 0: Off 1: On	F253.036
10038 / 37	STATUS_RAM_ERROR Tx. data memory fault. 0: Off 1: On	F254.037
10039 / 38	UNUSED Unused alarm bit. 0: Off	-
10040 / 39	STATUS_ALARM_SIMULATION Alarm simulation active. 0: Off 1: On	C190.039
10041 / 40	STATUS_SUMMARY_ALARM Non-volatile summary alarm. 0: Off 1: On	F249.040
10042 / 41	UNUSED Unused alarm bit. 0: Off	-
10043 / 42	UNUSED Unused alarm bit. 0: Off	-
10044 / 43	UNUSED Unused alarm bit. 0: Off	-

10045 / 44	UNUSED Unused alarm bit. 0: Off	-
10046 / 45	UNUSED Unused alarm bit. 0: Off	-
10047 / 46	UNUSED Unused alarm bit. 0: Off	-
10048 / 47	UNUSED Unused alarm bit. 0: Off	-

2.2 Alarm history status Discrete Inputs

Modbus Address / Actual Address	Alarm Name / Brief Description	Alarm NAMUR Identifier
10049 / 48	UNUSED Unused alarm bit. 0: Off	-
10050 / 49	HISTORY_STATUS_LOGIC_OP1_SIMULATED Logic simulation selected on OP1. 0: Off 1: On	C168.001
10051 / 50	HISTORY_STATUS_PULSE_OP1_SIMULATED Pulse simulation selected on OP1. 0: Off 1: On	C174.002
10052 / 51	HISTORY_STATUS_LOGIC_OP2_SIMULATED Logic simulation selected on OP2. 0: Off 1: On	C164.003
10053 / 52	HISTORY_STATUS_PULSE_OP2_SIMULATED Pulse simulation selected on OP2. 0: Off 1: On	C172.004
10054 / 53	HISTORY_STATUS_LOGIC_OP3_SIMULATED Logic simulation selected on OP3. 0: Off 1: On	C160.005
10055 / 54	HISTORY_STATUS_LOW_FLOW_VALUE Low flow alarm. 0: Off 1: On	S132.006
10056 / 55	HISTORY_STATUS_HIGH_FLOW_VALUE High flow alarm. 0: Off 1: On	S136.007

10057 / 56	HISTORY_STATUS_103P_REACHED Q >103% Qmax. 0: Off 1: On	S140.008
10058 / 57	HISTORY_STATUS_SIMULATED_FLOW Simulation mode On. 0: Off 1: On	C182.009
10059 / 58	HISTORY_STATUS_CALIBRATOR Tx. simulator/calibrator mode. 0: Off 1: On	C186.010
10060 / 59	HISTORY_STATUS_DISPLAY_OVERRANGE At Qmax, volume display overrun <1600hrs. 0: Off 1: On	M080.011
10061 / 60	HISTORY_STATUS_TOTALIZER_RESET Totalizer reset. 0: Off 1: On	_030.012
10062 / 61	HISTORY_STATUS_POOR_SENSOR_COMMS Intermittent sensor comms. 0: Off 1: On	M090.013
10063 / 62	UNUSED Unused alarm bit. 0: Off	-
10064 / 63	HISTORY_STATUS_TX_MEMORY_FAIL Tx. memory fault detected. 0: Off 1: On	F250.015
10065 / 64	HISTORY_STATUS_NO_SENSOR Sensor memory not detected. 0: Off 1: On	F252.016

10066 / 65	HISTORY_STATUS_MEASUREMENT_OFFLINE Tx. measurement suspended. 0: Off 1: On	F220.017
10067 / 66	HISTORY_STATUS_EMPTY_PIPE Empty pipe. 0: Off 1: On	S150.018
10068 / 67	UNUSED Unused alarm bit. 0: Off	-
10069 / 68	UNUSED Unused alarm bit. 0: Off	-
10070 / 69	HISTORY_STATUS_ELEC_OPEN_CIRCUIT Open circuit electrode. 0: Off 1: On	S147.021
10071 / 70	HISTORY_STATUS_ELEC_SHORT_CIRCUIT Short circuit electrode. 0: Off 1: On	S146.022
10072 / 71	UNUSED Unused alarm bit. 0: Off	-
10073 / 72	HISTORY_STATUS_INSTALLATION_FAULT Installation fault/condition. 0: Off 1: On	F247.024
10074 / 73	HISTORY_STATUS_COIL_OPEN_CIRCUIT Open circuit coil/wiring. 0: Off 1: On	F238.025

10075 / 74	HISTORY_STATUS_COIL_SHORT_CIRCUIT Short circuit coil/wiring. 0: Off 1: On	F236.026
10076 / 75	HISTORY_STATUS_LOOP_RESISTANCE Check cable+coil resistance. 0: Off 1: On	F234.027
10077 / 76	HISTORY_STATUS_TX_HARDWARE Transmitter hardware fault. 0: Off 1: On	F232.028
10078 / 77	HISTORY_STATUS_BAD_FLOW_DATA Bad flow data. 0: Off 1: On	F230.029
10079 / 78	HISTORY_STATUS_ELECTRODE_VOLTAGE Accuracy warning? 0: Off 1: On	S105.030
10080 / 79	HISTORY_STATUS_OIML_SELF_CHECK OIML self-check limits exceeded. 0: Off 1: On	M98.031
10081 / 80	HISTORY_STATUS_MEASUREMENT_STARTING Measurement starting. 0: Off 1: On	S148.032
10082 / 81	UNUSED Unused alarm bit. 0: Off	-
10083 / 82	HISTORY_STATUS_NOT_CALIBRATED Sensor setup not complete. 0: Off 1: On	S110.034

10084 / 83	HISTORY_STATUS_CALIBRATION_MISMATCH Incompatible sensor. 0: Off 1: On	F248.035
10085 / 84	HISTORY_STATUS_ROM_ERROR Tx. code memory fault. 0: Off 1: On	F253.036
10086 / 85	HISTORY_STATUS_RAM_ERROR Tx. data memory fault. 0: Off 1: On	F254.037
10087 / 86	UNUSED Unused alarm bit. 0: Off	-
10088 / 87	HISTORY_STATUS_ALARM_SIMULATION Alarm simulation active. 0: Off 1: On	C190.039
10089 / 88	HISTORY_STATUS_SUMMARY_ALARM Non-volatile summary alarm. 0: Off 1: On	F249.040
10090 / 89	UNUSED Unused alarm bit. 0: Off	-
10091 / 90	UNUSED Unused alarm bit. 0: Off	-
10092 / 91	UNUSED Unused alarm bit. 0: Off	-

10093 / 92	UNUSED Unused alarm bit. 0: Off	-
10094 / 93	UNUSED Unused alarm bit. 0: Off	-
10095 / 94	UNUSED Unused alarm bit. 0: Off	-
10096 / 95	UNUSED Unused alarm bit. 0: Off	-

2.3 Read-only Byte parameters

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
30001 / 0	READ_ONLY_SWITCH State of the hardware write protect switch. 0: Disabled 1: Enabled	1 / 1	Disabled
30002 / 1	SENSOR_CALIBRATION_TYPE Sensor calibration type performed. 0: Retrofit 1: OIML Class 1 2: OIML Class 2 3: Special 4: OIML Certified Class 1 5: OIML Certified Class 2 6: Probe 7: NMI 8: Select	1 / 1	OIML Class 1
30003 / 2	DRIVE_MODE Drive mode currently in use. 0: User 1: 1 2: 2 3: 3 4: 4 5: 5 6: 6 7: 7 8: 8 9: 3A 10: 4A 11: 5A 12: 5B 13: 6A 14: 6B 15: 7A 16: 7B 17: 7C 18: 7D 19: 8A 20: 8B 21: 8C	1 / 1	5A
30004 / 3	FACTORY_CUTOFF_NUM_AVERAGING_SAMPLES Number of samples used in averaging filter. Min: 0 Max: 9	1 / 1	4

30005 / 4	CALIBRATION_STATUS Sensor calibration status. 0: Not Complete 1: Calibrated	1 / 1	Not Complete
30006 / 5	SENSOR_TYPE Type of sensor in use. 0: Probe 1: Process 2: Hygienic 3: WM Reduced Throat 4: WM Full Bore 5: DE4 6: DE2 7: Process OIML 8: Hygienic OIML 9: No Sensor	1 / 1	DE4

30007 / 6	SENSOR_SIZE Bore size of sensor in use. 0: DN1 1: DN1.5 2: DN2 3: DN3 4: DN4 5: DN6 6: DN8 7: DN10 8: DN15 9: DN20 10: DN25 11: DN32 12: DN40 13: DN50 14: DN65 15: DN80 16: DN100 17: DN125 18: DN150 19: DN200 20: DN250 21: DN300 22: DN350 23: DN400 24: DN450 25: DN500 26: DN600 27: DN700 41: DN750 28: DN760 29: DN800 30: DN900 31: DN1000 32: DN1050 33: DN1100 34: DN1200 42: DN1350 35: DN1400 36: DN1500 37: DN1600 43: DN1650 38: DN1800 44: DN1950 39: DN2000 45: DN2100 46: DN2200 47: DN2400 40: Special	1 / 1	DN20

30008 / 7	SENSOR_FIRST_CAL_LOCATION The initial location where the sensor was calibrated. 0: Stonehouse 1: Göttingen 2: Warminster 3: Moorebank 4: Shanghai 5: Burlington 6: Not Specified	1 / 1	Stonehouse
30009 / 8	SENSOR_LAST_CAL_LOCATION The last location where the sensor was calibrated. 0: Stonehouse 1: Göttingen 2: Warminster 3: Moorebank 4: Shanghai 5: Burlington 6: Not Specified	1 / 1	Stonehouse
30010 / 9	SENSOR_CALIBRATION_MODE Used to distinguish the calibration type of the sensor between ProcessMaster and WaterMaster types. 0: WaterMaster 1: ProcessMaster	1 / 1	WaterMaster
30011 / 10	ELECTRODE_MATERIAL Material type of the sensor electrodes. 0: Stainless Steel 1: Hastelloy C4 2: Hastelloy C276 3: Titanium 4: Tantalum 5: Hastelloy B3 6: Platinum Iridium 7: Duplex Steel 8: Nickel 9: St. Steel 316TI 10: Hastelloy C(DL) 11: Tungsten Carbide 12: Hastelloy C22 13: Super Aust. Steel 14: Other	1 / 1	Stainless Steel

30012 / 11	LINING_MATERIAL Material type of the sensor lining. 0: PTFE 1: Tefzel ETFE 2: PEEK 3: Hard Rubber 4: Linatex 5: Elastomer 6: Elastomer ACS 7: Elastomer NSF61 8: POMC 9: PFA 10: PPS 11: Soft Rubber 12: Polyurethane 13: Polypropylene 14: THICK PTFE 15: Ceramic Carbide 16: FEP 17: Neoprene 18: Other	1 / 1	Polyurethane
30013 / 12	TRANSMITTER_TYPE Used to distinguish between ProcessMaster and WaterMaster transmitter types. 0: WaterMaster 1: ProcessMaster	1 / 1	WaterMaster
30014 / 13	HARDWARE_REVISION Revision number of the device hardware.	1 / 1	0
30015 / 14	MID_STATUS The current MID status of the device. 0: Non-MID 1: Unlocked 2: Locked	1 / 1	Non-MID
30016 / 15	DO1_STATE Output state of Logic Output 1. 0: Open 1: Closed	1 / 1	Open
30017 / 16	DO2_STATE Output state of Logic Output 2. 0: Open 1: Closed	1 / 1	Open

30018 / 17	DO3_STATE Output state of Logic Output 3. 0: Open 1: Closed	1 / 1	Open

2.4 Read-only Short parameters

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
31001 / 1000	TX_PIN Pin used in generation of service level access rights code. Min: 1 Max: 65535	1 / 2	1

2.5 Read-only Integer parameters

Note – Attempting to read a parameter without requesting all parameter sub-registers will return an exception code.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
32001 / 2000	TX_ID Unique factory assigned identification number of the transmitter. Min: 1 Max: 16777215	2 / 4	1
32003 / 2002	SENSOR_ID Unique factory assigned identification number of the sensor. Min: 1 Max: 16777215	2 / 4	1

2.6 Read-only Float parameters

Note – Attempting to read a parameter without requesting all parameter sub-registers will return an exception code.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
33001 / 3000	FACTORY_SENSOR_SPAN Factory set sensor span value. Min: -500 Max: 500 Unit: %	2 / 4	100
33003 / 3002	FACTORY_SENSOR_ZERO Factory set sensor zero value. Min: -50 Max: 50 Unit: mm/s	2 / 4	0
33005 / 3004	TRIM_ST Trim factor. Min: -50 Max: 50 Unit: %	2 / 4	0
33007 / 3006	EXCITATION_CURRENT Coil current value. Min: 10 Max: 200 Unit: mA	2 / 4	180
33009 / 3008	FACTORY_CUTOFF Cutoff velocity set during calibration. Min: 0 Max: 50 Unit: mm/s	2 / 4	0
33011 / 3010	VOLUME_FLOW_RANGE_LOWER Dynamic lower limit for flow values. Min: 0 Max: 1000000 Unit: VOLUME_FLOW_UNITS	2 / 4	0.5

33013 / 3012	VOLUME_FLOW_RANGE_UPPER Dynamic upper limit for flow values. Min: 0 Max: 1000000 Unit: VOLUME_FLOW_UNITS	2 / 4	5
33015 / 3014	FLOW_VELOCITY_RANGE_LOWER Dynamic lower limit for velocity values. Min: 0.2 Max: 20 Unit: VELOCITY_UNIT	2 / 4	0.2
33017 / 3016	FLOW_VELOCITY_RANGE_UPPER Dynamic upper limit for velocity values. Min: 0.2 Max: 20 Unit: VELOCITY_UNIT	2 / 4	20
33019 / 3018	SPECIAL_SENSOR_BORE Special sensor bore size. Min: 1 Max: 5000 Unit: mm	2 / 4	20
33021 / 3020	DO1_PULSES Output frequency of Digital Output 1. Min: 0 Max: 5250 Unit: Hz	2 / 4	0
33023 / 3022	DO2_PULSES Output frequency of Digital Output 2. Min: 0 Max: 5250 Unit: Hz	2 / 4	0

33025 / 3024	LIMIT_FREQUENCY_RANGE_LOWER Limit frequency range lower value. Min: 0.25 Max: 5250 Unit: Hz	2 / 4	0.25
33027 / 3026	LIMIT_FREQUENCY_RANGE_UPPER Limit frequency range upper value. Min: 0.25 Max: 5250 Unit: Hz	2 / 4	5250
33029 / 3028	ELECTRODE_VOLTAGE_NEGATIVE_LIMIT Lower limit of electrode voltage. Min: -2 Max: 2 Unit: V	2 / 4	-1.5
33031 / 3030	ELECTRODE_VOLTAGE_POSITIVE_LIMIT Upper limit of electrode voltage. Min: -2 Max: 2 Unit: V	2 / 4	1.8
33033 / 3032	ELECTRODE_VOLTAGE_DIFFERENTIAL_LIMIT Upper limit of differential electrode voltage. Min: -2 Max: 2 Unit: V	2 / 4	0.5
33035 / 3034	COIL_CURRENT_ALARM_BAND Percentage shift in coil current allowed before alarm. Min: 0.1 Max: 10 Unit: %	2 / 4	1

33037 / 3036	COIL_SHORT_CIRCUIT_RESISTANCE_LIMIT Lower limit of coil resistance range. Min: 2 Max: 550 Unit: Ω	2 / 4	5
33039 / 3038	COIL_OPEN_CIRCUIT_RESISTANCE_LIMIT Upper limit of coil resistance range. Min: 2 Max: 550 Unit: Ω	2 / 4	500
33041 / 3040	SIMULATION_VOLUME_FLOW_RANGE_LOWER Lower limit for simulated volume flowrate values. Min: -1000000 Max: 1000000 Unit: VOLUME_FLOW_UNITS	2 / 4	0
33043 / 3042	SIMULATION_VOLUME_FLOW_RANGE_UPPER Upper limit for simulated volume flowrate values. Min: -1000000 Max: 1000000 Unit: VOLUME_FLOW_UNITS	2 / 4	0
33045 / 3044	SIMULATION_FLOW_VELOCITY_RANGE_LOWER Lower limit for simulated velocity values. Min: -40 Max: 40 Unit: VELOCITY_UNIT	2 / 4	0
33047 / 3046	SIMULATION_FLOW_VELOCITY_RANGE_UPPER Upper limit for simulated velocity values. Min: -40 Max: 40 Unit: VELOCITY_UNIT	2 / 4	0

33049 / 3048	LOOP_RESISTANCE_RANGE_LOWER Lower limit of loop resistance range. Min: 7.5 Max: 150 Unit: Ω	2 / 4	15
33051 / 3050	LOOP_RESISTANCE_RANGE_UPPER Upper limit of loop resistance range. Min: 7.5 Max: 150 Unit: Ω	2 / 4	65
33053 / 3052	TRANSMITTER_AVERAGE_GAIN_SHIFT_RANGE_LOWER Lower limit of transmitter average gain shift range. Min: -25 Max: 25 Unit: %	2 / 4	-0.4
33055 / 3054	TRANSMITTER_AVERAGE_GAIN_SHIFT_RANGE_UPPER Upper limit of transmitter average gain shift range. Min: -25 Max: 25 Unit: %	2 / 4	0.4
33057 / 3056	VOLUME_FLOW Volume flow value expressed in user units. Min: SIMULATION_VOLUME_FLOW_RANGE_LOWER Max: SIMULATION_VOLUME_FLOW_RANGE_UPPER Unit: VOLUME_FLOW_UNITS	2 / 4	0
33059 / 3058	FLOW_RATIO Volume flow value expressed as a percentage of Qmax. Min: -200 Max: 200 Unit: %	2 / 4	0

33061 / 3060	FLOW_VELOCITY Flow velocity value expressed in user units. Min: SIMULATION_FLOW_VELOCITY_RANGE_LOWER Max: SIMULATION_FLOW_VELOCITY_RANGE_UPPER Unit: VELOCITY_UNIT	2 / 4	0
33063 / 3062	VOLUME_FORWARD Volume forward totalizer value expressed in user units. Unit: VOLUME_AND_PULSE_UNIT	2 / 4	0
33065 / 3064	VOLUME_REVERSE Volume reverse totalizer value expressed in user units. Unit: VOLUME_AND_PULSE_UNIT	2 / 4	0
33067 / 3066	VOLUME_NET Volume net totalizer value expressed in user units. Unit: VOLUME_AND_PULSE_UNIT	2 / 4	0
33069 / 3068	ELECTRODE_1_RESISTANCE Resistance of electrode 1. Min: ELECTRODE_RESISTANCE_ALARM_MIN Max: ELECTRODE_RESISTANCE_ALARM_MAX_EP Unit: kΩ	2 / 4	0
33071 / 3070	ELECTRODE_2_RESISTANCE Resistance of electrode 2. Min: ELECTRODE_RESISTANCE_ALARM_MIN Max: ELECTRODE_RESISTANCE_ALARM_MAX_EP Unit: kΩ	2 / 4	0
33073 / 3072	BACK_OFF_VOLTAGE Transmitter internal backoff voltage. Min: -3 Max: 3 Unit: V	2 / 4	0
33075 / 3074	COIL_AND_CABLE_RESISTANCE Resistance of sensor coils and cable. Min: LOOP_RESISTANCE_RANGE_LOWER Max: LOOP_RESISTANCE_RANGE_UPPER Unit: Ω	2 / 4	0

33077 / 3076	COIL_INDUCTANCE Inductance of the sensor coil. Unit: mH	2 / 4	0
33079 / 3078	SENSOR_INDUCTANCE_SHIFT Percentage shift in coil inductance. Min: -100 Max: 100 Unit: %	2 / 4	0
33081 / 3080	TRANSMITTER_AVERAGE_GAIN_SHIFT Percentage shift in transmitter span calibration. Min: TRANSMITTER_AVERAGE_GAIN_SHIFT_RANGE_LOWER Max: TRANSMITTER_AVERAGE_GAIN_SHIFT_RANGE_UPPER Unit: %	2 / 4	0
33083 / 3082	Q_MAX_DN Absolute value of the upper range value (volume flow) of the sensor. Min: VOLUME_FLOW_RANGE_LOWER Max: VOLUME_FLOW_RANGE_UPPER Unit: VOLUME_FLOW_UNITS	2 / 4	2.5

2.7 Read-only Double parameters

Note – Attempting to read a parameter without requesting all parameter sub-registers will return an exception code.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
34001 / 4000	VOLUME_FORWARD_DOUBLE_FORMAT Volume forward totalizer value expressed in user units in double-precision floating-point format. Unit: VOLUME_AND_PULSE_UNIT	4 / 8	0
34005 / 4004	VOLUME_REVERSE_DOUBLE_FORMAT Volume reverse totalizer value expressed in user units in double-precision floating-point format. Unit: VOLUME_AND_PULSE_UNIT	4 / 8	0
34009 / 4008	VOLUME_NET_DOUBLE_FORMAT Volume net totalizer value expressed in user units in double-precision floating-point format. Unit: VOLUME_AND_PULSE_UNIT	4 / 8	0

2.8 Alarm history counters

Note – Attempting to read a parameter element without requesting all element sub-registers will return an exception code.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
35001 / 5000	ALARM_DETAILS_LOGIC_OP1_SIMULATED 'Logic simulation selected on OP1' alarm history counters.	7 / 14	0,0,0,0,0
35008 / 5007	ALARM_DETAILS_PULSE_OP1_SIMULATED 'Pulse simulation selected on OP1' alarm history counters.	7 / 14	0,0,0,0,0
35015 / 5014	ALARM_DETAILS_LOGIC_OP2_SIMULATED 'Logic simulation selected on OP2' alarm history counters.	7 / 14	0,0,0,0,0
35022 / 5021	ALARM_DETAILS_PULSE_OP2_SIMULATED 'Pulse simulation selected on OP2' alarm history counters.	7 / 14	0,0,0,0,0
35029 / 5028	ALARM_DETAILS_LOGIC_OP3_SIMULATED 'Logic simulation selected on OP3' alarm history counters.	7 / 14	0,0,0,0,0
35036 / 5035	ALARM_DETAILS_LOW_FLOW_VALUE 'Low flow alarm' alarm history counters.	7 / 14	0,0,0,0,0
35043 / 5042	ALARM_DETAILS_HIGH_FLOW_VALUE 'High flow alarm' alarm history counters.	7 / 14	0,0,0,0,0
35050 / 5049	ALARM_DETAILS_103P_REACHED 'Q >103% Qmax' alarm history counters.	7 / 14	0,0,0,0,0
35057 / 5056	ALARM_DETAILS_SIMULATED_FLOW 'Simulation mode On' alarm history counters.	7 / 14	0,0,0,0,0
35064 / 5063	ALARM_DETAILS_CALIBRATOR 'Tx. simulator/calibrator mode' alarm history counters.	7 / 14	0,0,0,0,0
35071 / 5070	ALARM_DETAILS_DISPLAY_OVERRANGE 'At Qmax, volume display overrun <1600hrs' alarm history counters.	7 / 14	0,0,0,0,0
35078 / 5077	ALARM_DETAILS_TOTALIZER_RESET 'Totalizer reset' alarm history counters.	7 / 14	0,0,0,0,0
35085 / 5084	ALARM_DETAILS_POOR_SENSOR_COMMS 'Intermittent sensor comms' alarm history counters.	7 / 14	0,0,0,0,0
35092 / 5091	ALARM_DETAILS_TX_MEMORY_FAIL 'Tx. memory fault detected' alarm history counters.	7 / 14	0,0,0,0,0

35099 / 5098	ALARM_DETAILS_NO_SENSOR 'Sensor memory not detected' alarm history counters.	7 / 14	0,0,0,0,0
35106 / 5105	ALARM_DETAILS_EMPTY_PIPE 'Empty pipe' alarm history counters.	7 / 14	0,0,0,0,0
35113 / 5112	ALARM_DETAILS_MEASUREMENT_OFFLINE 'Tx. measurement suspended' alarm history counters.	7 / 14	0,0,0,0,0
35120 / 5119	ALARM_DETAILS_SUMMARY_ALARM 'Non-volatile summary alarm' alarm history counters.	7 / 14	0,0,0,0,0
35127 / 5126	ALARM_DETAILS_ELEC_OPEN_CIRCUIT 'Open circuit electrode' alarm history counters.	7 / 14	0,0,0,0,0
35134 / 5133	ALARM_DETAILS_ELEC_SHORT_CIRCUIT 'Short circuit electrode' alarm history counters.	7 / 14	0,0,0,0,0
35141 / 5140	ALARM_DETAILS_INSTALLATION_FAULT 'Installation fault/condition' alarm history counters.	7 / 14	0,0,0,0,0
35148 / 5147	ALARM_DETAILS_COIL_OPEN_CIRCUIT 'Open circuit coil/wiring' alarm history counters.	7 / 14	0,0,0,0,0
35155 / 5154	ALARM_DETAILS_COIL_SHORT_CIRCUIT 'Short circuit coil/wiring' alarm history counters.	7 / 14	0,0,0,0,0
35162 / 5161	ALARM_DETAILS_LOOP_RESISTANCE 'Check cable+coil resistance' alarm history counters.	7 / 14	0,0,0,0,0
35169 / 5168	ALARM_DETAILS_TX_HARDWARE 'Transmitter hardware fault' alarm history counters.	7 / 14	0,0,0,0,0
35176 / 5175	ALARM_DETAILS_BAD_FLOW_DATA 'Bad flow data' alarm history counters.	7 / 14	0,0,0,0,0
35183 / 5182	ALARM_DETAILS_ELECTRODE_VOLTAGE 'Accuracy warning?' alarm history counters.	7 / 14	0,0,0,0,0
35190 / 5189	ALARM_DETAILS_OIML_SELF_CHECK 'OIML self-check limits exceeded' alarm history counters.	7 / 14	0,0,0,0,0
35197 / 5196	ALARM_DETAILS_MEASUREMENT_STARTING 'Measurement starting' alarm history counters.	7 / 14	0,0,0,0,0
35204 / 5203	ALARM_DETAILS_NOT_CALIBRATED 'Sensor setup not complete' alarm history counters.	7 / 14	0,0,0,0,0
35211 / 5210	ALARM_DETAILS_CALIBRATION_MISMATCH 'Incompatible sensor' alarm history counters.	7 / 14	0,0,0,0,0

35218 / 5217	ALARM_DETAILS_ROM_ERROR 'Tx. code memory fault' alarm history counters.	7 / 14	0,0,0,0,0
35225 / 5224	ALARM_DETAILS_RAM_ERROR 'Tx. data memory fault' alarm history counters.	7 / 14	0,0,0,0,0
35232 / 5231	ALARM_DETAILS_ALARM_SIMULATION 'Alarm simulation active' alarm history counters.	7 / 14	0,0,0,0,0

2.9 Read-only Byte string parameters

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
36001 / 6000	MANUFACTURER_NAME Manufacturer name.	20 / 20	-
36021 / 6020	MANUFACTURER_ADDRESS_1 Manufacturer address line 1.	20 / 20	-
36041 / 6040	MANUFACTURER_ADDRESS_2 Manufacturer address line 2.	20 / 20	-
36061 / 6060	MANUFACTURER_CONTACT Manufacturer contact details.	20 / 20	-
36081 / 6080	SENSOR_SAP_ERP_NUMBER Sensor SAP/ERP number.	20 / 20	-
36101 / 6100	SENSOR_FIRST_CAL_DATE The date of the initial sensor calibration.	20 / 20	-
36121 / 6120	SENSOR_LAST_CAL_DATE The date the sensor was last calibrated.	20 / 20	-
36141 / 6140	SENSOR_CAL_CERT_NO Factory assigned calibration certificate number.	20 / 20	-
36161 / 6160	SENSOR_RUN_HOURS Number of hours the sensor has been in use.	20 / 20	-
36181 / 6180	TRANSMITTER_SAP_ERP_NUMBER Transmitter SAP/ERP number.	20 / 20	-
36201 / 6200	TRANSMITTER_SOFTWARE_VERSION Transmitter firmware version number.	20 / 20	-
36221 / 6220	APPLICATION_CRC CRC of transmitter firmware.	20 / 20	-
36241 / 6240	BOOTLOADER_VERSION_NUMBER Transmitter bootloader firmware version number.	20 / 20	-
36261 / 6260	TRANSMITTER_HARDWARE_VERSION_NUMBER Version string of the transmitter hardware.	20 / 20	-
36281 / 6280	TRANSMITTER_RUN_HOURS Number of hours the transmitter has been in use.	20 / 20	-

36301 / 6300	TRANSMITTER_FIRST_CAL_DATE Initial date of transmitter calibration.	20 / 20	-
36321 / 6320	TRANSMITTER_LAST_CAL_DATE Most recent date of transmitter calibration.	20 / 20	-
36341 / 6340	TX_CAL_CERT_NO Transmitter calibration certificate number.	20 / 20	-
36361 / 6360	TERM_BOARD_SW Remote sensor memory version number.	20 / 20	-

2.10 Read-write Byte parameters

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
40001 / 0	DIAG_ALARM_SIMULATION Selects the device alarm to simulate. 0: None 1: Logic simulation selected on OP1 2: Pulse simulation selected on OP1 3: Logic simulation selected on OP1 4: Pulse simulation selected on OP2 5: Logic simulation selected on OP3 6: Low flow alarm 7: High flow alarm 8: Q > 103% Qmax 9: Simulation mode on 10: Tx. simulator / calibrator mode 11: At Qmax, volume display overrun <1600hrs 12: Totalizer reset 13: Intermittent sensor comms 15: Tx. memory fault detected 16: Sensor memory not detected 17: Tx. measurement suspended 18: Empty pipe 21: Open circuit electrode 22: Short circuit electrode 24: Installation fault/condition 25: Open circuit coil/wiring 26: Short circuit coil/wiring 27: Check cable+coil resistance 28: Transmitter hardware fault 29: Bad flow data 30: Accuracy warning? 31: OIML self-check limits exceeded 32: Measurement starting 34: Sensor setup not complete 35: Incompatible sensor 36: Tx. code memory fault 37: Tx. data memory fault 39: Alarm simulation active 40: Non-volatile summary alarm Note - This parameter is read-only for MID flowmeters.	1 / 1	None
40002 / 1	MASK_MIN_ALARM Mask for the Min. Flow alarm. 0: Disabled 1: Enabled	1 / 1	Enabled

40003 / 2	MASK_MAX_ALARM Mask for the Max. Flow alarm. 0: Disabled 1: Enabled	1 / 1	Enabled
40004 / 3	MASK_OVERRANGE_103 Mask for the Overflow 103% alarm. 0: Disabled 1: Enabled	1 / 1	Enabled
40005 / 4	MASK_MAINTENANCE_REQUIRED Mask for the Maintenance Required group alarms. 0: Disabled 1: Enabled	1 / 1	Disabled
40006 / 5	MASK_CHECK_FUNCTION Mask for the Function Check group alarms. 0: Disabled 1: Enabled	1 / 1	Disabled
40007 / 6	MASK_OFF_SPECIFICATION Mask for the Off Specification group alarms. 0: Disabled 1: Enabled	1 / 1	Disabled
40008 / 7	FLOW_INDICATION Sign correction applied to the flow value. 0: Positive 1: Negative Note - This parameter is read-only for MID flowmeters.	1 / 1	Positive
40009 / 8	METER_MODE Directions of flow over which metering occurs. 0: Forward and reverse 1: Forward only 2: Reverse only Note - This parameter is read-only for MID flowmeters.	1 / 1	Forward and reverse

40010 / 9	MAINS_FREQUENCY Transmitter mains frequency. 50: 50 60: 60 Unit: Hz Note - Changes to this parameter cause the instrument to reboot.	1 / 1	50
40011 / 10	DO1_DO2_FUNCTION Digital Output 1 & 2 operating mode. 0: Pulse F/Pulse R 1: Pulse F/Logic 2: Pulse FR/Logic 3: Logic / Logic	1 / 1	Pulse FR/Logic
40012 / 11	DO1_LOGIC_SIGNAL_SOURCE Signal source for Logic Output 1. 0: No Function 1: F/R Signal 2: Digital Out Alarm	1 / 1	No Function
40013 / 12	DO1_GENERAL_ALARM_BEHAVIOUR General alarm behaviour for Logic Output 1. 0: Off 1: On	1 / 1	Off
40014 / 13	DO1_MIN_ALARM_BEHAVIOUR Min. Flow alarm behaviour for Logic Output 1. 0: Off 1: On	1 / 1	Off
40015 / 14	DO1_MAX_ALARM_BEHAVIOUR Max. Flow alarm behaviour for Logic Output 1. 0: Off 1: On	1 / 1	Off
40016 / 15	DO1_EMPTY_PIPE_BEHAVIOUR Empty Pipe alarm behaviour for Logic Output 1. 0: Off 1: On	1 / 1	Off

40017 / 16	DO1_LOGIC_ACTION_STATE Action state for Logic Output 1. 0: Normally Open 1: Normally Closed	1 / 1	Normally Open
40018 / 17	DO2_LOGIC_SIGNAL_SOURCE Signal source for Logic Output 2. 0: No Function 1: F/R Signal 2: Digital Out Alarm	1 / 1	No Function
40019 / 18	DO2_GENERAL_ALARM_BEHAVIOUR General alarm behaviour for Logic Output 2. 2: Off 3: On	1 / 1	Off
40020 / 19	DO2_MIN_ALARM_BEHAVIOUR Min. Flow alarm behaviour for Logic Output 2. 2: Off 3: On	1 / 1	Off
40021 / 20	DO2_MAX_ALARM_BEHAVIOUR Max. Flow alarm behaviour for Logic Output 2. 2: Off 3: On	1 / 1	Off
40022 / 21	DO2_EMPTY_PIPE_BEHAVIOUR Empty Pipe alarm behaviour for Logic Output 2. 2: Off 3: On	1 / 1	Off
40023 / 22	DO2_LOGIC_ACTION_STATE Action state for Logic Output 2. 0: Normally Open 1: Normally Closed	1 / 1	Normally Open
40024 / 23	DO3_LOGIC_SIGNAL_SOURCE Signal source for Logic Output 3. 0: No Function 1: F/R Signal 2: Digital Out Alarm	1 / 1	No Function

40025 / 24	DO3_GENERAL_ALARM_BEHAVIOUR General alarm behaviour for Logic Output 3. 4: Off 5: On	1 / 1	Off
40026 / 25	DO3_MIN_ALARM_BEHAVIOUR Min. Flow alarm behaviour for Logic Output 3. 4: Off 5: On	1 / 1	Off
40027 / 26	DO3_MAX_ALARM_BEHAVIOUR Max. Flow alarm behaviour for Logic Output 3. 4: Off 5: On	1 / 1	Off
40028 / 27	DO3_EMPTY_PIPE_BEHAVIOUR Empty Pipe alarm behaviour for Logic Output 3. 4: Off 5: On	1 / 1	Off
40029 / 28	DO3_LOGIC_ACTION_STATE Action state for Logic Output 3. 0: Normally Open 1: Normally Closed	1 / 1	Normally Open
40030 / 29	PULSE_MODE Pulse mode of digital outputs. 0: Pulse / Unit 1: Fullscale Frequency	1 / 1	Pulse / Unit
40031 / 30	LANGUAGE Local display language. 0: English 1: German 2: French 3: Spanish 4: Italian 9: Polish	1 / 1	English
40032 / 31	CONTRAST Local display contrast. Min: 0 Max: 100 Unit: %	1 / 1	50

40033 / 32	MAIN_OPERATOR_VIEW_1_DISPLAY_MODE Local display Operator Page 1 mode. 5: 1 x 6 6: 1 x 6 + Bargraph 7: 1 x 9 8: 1 x 9 + Bargraph 9: 2 x 9 10: 2 x 9 + Bargraph 11: 3 x 9	1 / 1	1 x 6
40034 / 33	MAIN_OPERATOR_VIEW_1_1 Local display Operator Page 1 1st line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40035 / 34	MAIN_OPERATOR_VIEW_1_2 Local display Operator Page 1 2nd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40036 / 35	MAIN_OPERATOR_VIEW_1_3 Local display Operator Page 1 3rd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40037 / 36	MAIN_OPERATOR_VIEW_2_DISPLAY_MODE Local display Operator Page 2 mode. 0: Off 5: 1 x 6 6: 1 x 6 + Bargraph 7: 1 x 9 8: 1 x 9 + Bargraph 9: 2 x 9 10: 2 x 9 + Bargraph 11: 3 x 9	1 / 1	Off

40038 / 37	MAIN_OPERATOR_VIEW_2_1 Local display Operator Page 2 1st line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40039 / 38	MAIN_OPERATOR_VIEW_2_2 Local display Operator Page 2 2nd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40040 / 39	MAIN_OPERATOR_VIEW_2_3 Local display Operator Page 2 3rd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40041 / 40	MAIN_OPERATOR_VIEW_3_DISPLAY_MODE Local display Operator Page 3 mode. 0: Off 5: 1 x 6 6: 1 x 6 + Bargraph 7: 1 x 9 8: 1 x 9 + Bargraph 9: 2 x 9 10: 2 x 9 + Bargraph 11: 3 x 9	1 / 1	Off
40042 / 41	MAIN_OPERATOR_VIEW_3_1 Local display Operator Page 3 1st line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate

40043 / 42	MAIN_OPERATOR_VIEW_3_2 Local display Operator Page 3 2nd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40044 / 43	MAIN_OPERATOR_VIEW_3_3 Local display Operator Page 3 3rd line. 0: Volume Flowrate 1: Q% 3: Velocity 4: Volume Forward 5: Volume Reverse 6: Volume Net	1 / 1	Volume Flowrate
40045 / 44	DECIMAL_PLACES_FLOWRATE Local display volume flowrate decimal point format. 0: x 1: x.x 2: x.xx 3: x.xxx 4: x.xxxx 5: x.xxxxx	1 / 1	x.xx
40046 / 45	DECIMAL_PLACES_VOLUME Local display volume totalizer decimal point format. 0: x 1: x.x 2: x.xx 3: x.xxx 4: x.xxxx 5: x.xxxxx	1 / 1	x
40047 / 46	DATE_FORMAT Local display date format. 0: DD-MM-YYYY 1: MM-DD-YYYY 2: YYYY-MM-DD	1 / 1	YYYY-MM-DD

40048 / 47	SIMULATION_MODE Selects the parameter for simulation. 0: Off 1: Flow Velocity 2: Q 3: Q% 5: Pulse 1 6: Pulse 2 7: Logic 1 8: Logic 2 9: Logic 3 Note - Simulation modes 'Flow Velocity', 'Q' and 'Q%' are unavailable for MID flowmeters.	1 / 1	Off
40049 / 48	SIMULATION_LOGIC_1 State to simulate on Logic Output 1. 0: Off 1: On	1 / 1	Off
40050 / 49	SIMULATION_LOGIC_2 State to simulate on Logic Output 2. 0: Off 1: On	1 / 1	Off
40051 / 50	SIMULATION_LOGIC_3 State to simulate on Logic Output 3. 0: Off 1: On	1 / 1	Off

40052 / 51	VOLUME_FLOW_UNITS Volume flow units in use. 12: m^3/s 13: m^3/min 14: m^3/h 15: m^3/d 0: ml/s 1: ml/min 4: l/s 5: l/min 6: l/h 30: hl/h 35: Ml/d 8: ft^3/s 9: ft^3/min 10: ft^3/h 11: ft^3/d 16: ugal/s 17: ugal/min 18: ugal/h 19: ugal/d 61: kugal/min 39: Mugal/d 20: igal/s 21: igal/min 22: igal/h 23: igal/d 24: bls/s 25: bls/min 26: bls/h 27: bls/d	1 / 1	m^3/h
40053 / 52	VELOCITY_UNIT Velocity units in use. 3: cm/s 4: cm/min 6: m/s 7: m/min 9: in/s 10: in/min 12: ft/s 13: ft/min	1 / 1	m/s

40054 / 53	VOLUME_AND_PULSE_UNIT Units for totalizer and digital outputs. 0: m^3 7: ft^3 5: ml 3: l 10: hl 28: Ml 16: igal 17: ugal 31: kugal 30: Mugal Note - This parameter is read-only for MID flowmeters.	1 / 1	m^3
40055 / 54	MODBUS_ADDRESS The device Modbus address. Min:1 Max:247	1 / 1	1
40056 / 55	MODBUS_BAUD_RATE The baud rate used to communicate over Modbus. 0: 2400bps 1: 4800bps 2: 9600bps 3: 19200bps 4: 38400bps 5: 56000bps 6: 57600bps 7: 115200bps	1 / 1	19200bps
40057 / 56	MODBUS_PARITY The parity setting for Modbus communications. 0: None 1: Odd 2: Even	1 / 1	None
40058 / 57	MODBUS_STOP_BIT The number of stop-bits used for Modbus communications. 0: 1 1: 2	1 / 1	1
40059 / 58	MODBUS_WORD_ORDER Determines the word ordering for Float, Double and Integer parameters. 0: Normal 1: Reversed	1 / 1	Normal

2.11 Read-write Byte string parameters

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
41001 / 1000	SENSOR_LOCATION_TAG User defined sensor location tag.	20 / 20	' ?'
41021 / 1020	SENSOR_TAG User defined sensor tag.	20 / 20	' ?'
41041 / 1040	TX_TAG Customer assigned textual description of the transmitter.	20 / 20	' ?'

2.12 Read-write Float parameters

Note – Attempting to read or write a parameter without all parameter sub-registers will return an exception code.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
43001 / 3000	FLOWRATE_LIMIT_MIN_ALARM Flowrate for min. flow alarm. Min: 0 Max: 130 Unit: %	2 / 4	0
43003 / 3002	FLOWRATE_LIMIT_MAX_ALARM Flowrate for max. flow alarm. Min: 0 Max: 130 Unit: %	2 / 4	110
43005 / 3004	LOW_FLOW_CUTOFF User set flow cutoff value. Min: 0 Max: 10 Unit: % Note - This parameter is read-only for MID flowmeters.	2 / 4	0.5
43007 / 3006	USER_ZERO User zero velocity value. Min: -50 Max: 50 Unit: mm/s Note - This parameter is read-only for MID flowmeters.	2 / 4	0
43009 / 3008	Q_MAX Maximum flowrate for the sensor in use. Min: VOLUME_FLOW_RANGE_LOWER Max: VOLUME_FLOW_RANGE_UPPER Unit: VOLUME_FLOW_UNITS	2 / 4	2.5

43011 / 3010	DAMPING System damping value. Min: 0.02 Max: 60 Unit: s	2 / 4	1
43013 / 3012	LOW_FLOW_CUTOFF_HYSTERESIS Hysteresis for flow cutoff in percent. Min: 0 Max: 50 Unit: % Note - This parameter is read-only for MID flowmeters.	2 / 4	20
43015 / 3014	PROBE_PIPE_BORE Bore of pipe where probe type sensor is installed. Min: 1 Max: 5000 Unit: mm	2 / 4	250
43017 / 3016	PROBE_INSERTION_FACTOR Insertion factor for probe type sensors. Min: 0 Max: 3	2 / 4	1
43019 / 3018	PROBE_PROFILE_FACTOR Profile factor probe type sensors. Min: 0 Max: 3	2 / 4	1
43021 / 3020	Q_MAX_DN_SPECIAL QMax DN value for special sensors. Min: 0 Max: 100000 Unit: VOLUME_FLOW_UNITS	2 / 4	2.5

43023 / 3022	USER_SPAN User span value. Min: -250 Max: 250 Unit: % Note - This parameter is read-only for MID flowmeters.	2 / 4	100
43025 / 3024	PULSE_WIDTH Digital Output pulse width. Min: 0.09 Max: 2000 Unit: ms	2 / 4	5
43027 / 3026	LIMIT_FREQUENCY Digital Output limit frequency. Min: LIMIT_FREQUENCY_RANGE_LOWER Max: LIMIT_FREQUENCY_RANGE_UPPER Unit: Hz	2 / 4	100
43029 / 3028	FULL_SCALE_FREQUENCY Digital Output fullscale frequency. Min: 0.25 Max: 10000000 Unit: Hz	2 / 4	5000
43031 / 3030	PULSES_PER_UNIT Digital Output pulse factor. Min: 0.00001 Max: 10000000	2 / 4	50
43033 / 3032	SIMULATION_FLOW_VELOCITY Flow velocity simulation value. Min: SIMULATION_FLOW_VELOCITY_RANGE_LOWER Max: SIMULATION_FLOW_VELOCITY_RANGE_UPPER Unit: VELOCITY_UNIT Note - This parameter is read-only for MID flowmeters.	2 / 4	0

43035 / 3034	SIMULATION_VOLUME_FLOW Volume flow simulation value. Min: SIMULATION_VOLUME_FLOW_RANGE_LOWER Max: SIMULATION_VOLUME_FLOW_RANGE_UPPER Unit: VOLUME_FLOW_UNITS Note - This parameter is read-only for MID flowmeters.	2 / 4	0
43037 / 3036	SIMULATION_FLOW_RATIO Percentage volume flow simulation value. Min: -200 Max: 200 Unit: % Note - This parameter is read-only for MID flowmeters.	2 / 4	0
43039 / 3038	SIMULATION_PULSE Frequency to simulate on Digital Outputs 1 and 2. Min: 0 Max: LIMIT_FREQUENCY Unit: Hz	2 / 4	0
43041 / 3040	ELECTRODE_RESISTANCE_ALARM_MAX_EP Upper limit of electrode resistance. Min: 0 Max: 1000 Unit: Ω Note - This parameter is read-only for MID flowmeters.	2 / 4	200
43043 / 3042	ELECTRODE_RESISTANCE_ALARM_MIN Lower limit of electrode resistance. Min: 0 Max: 1000 Unit: Ω Note - This parameter is read-only for MID flowmeters.	2 / 4	0.1

2.13 Action parameters

Note – Action parameters must be written to trigger the instrument action.

Modbus Address / Actual Address	Parameter Name / Brief Description	Register Size / Byte Size	Default
44001 / 4000	RESET_VOLUME_FORWARD Resets the volume forward totalizer. Note - This parameter is read-only for MID flowmeters.	1 / -	-
44002 / 4001	RESET_VOLUME_REVERSE Resets the volume reverse totalizer. Note - This parameter is read-only for MID flowmeters.	1 / -	-
44003 / 4002	RESET_VOLUME_NET Resets the volume net totalizer. Note - This parameter is read-only for MID flowmeters.	1 / -	-
44004 / 4003	RESET_ALL_VOLUME Resets all volume totalizers. Note - This parameter is read-only for MID flowmeters.	1 / -	-
44005 / 4004	CLEAR_ALARM_HISTORY Clears the alarm history in the device.	1 / -	-

Notes

Products and customer support

Automation Systems
For the following industries:
— Chemical & Pharmaceutical
— Food & Beverage
— Manufacturing
— Metals and Minerals
— Oil, Gas & Petrochemical
— Pulp and Paper

Drives and Motors
— AC and 6 Drives, AC and DC Machines, AC Motors to 1kV
— Drive Systems
— Force Measurement
— Servo Drives

Controllers & Recorders
— Single and Multi-loop Controllers
— Circular Chart and Strip Chart Recorders
— Paperless Recorders
— Process Indicators

Flexible Automation
— Industrial Robots and Robot Systems

Flow Measurement
— Electromagnetic Flowmeters
— Mass Flowmeters
— Turbine Flowmeters
— Wedge Flow Elements

Marine Systems & Turbochargers
— Electrical Systems
— Marine Equipment
— Offshore Retrofit and Refurbishment

Process Analytics
— Process Gas Analysis
— Systems Integration

Transmitters
— Pressure
— Temperature
— Level
— Interface Modules

Valves, Actuators and Positioners
— Control Valves
— Actuators
— Positioners

Water, Gas & Industrial Analytics Instrumentation
— pH, Conductivity and Dissolved Oxygen Transmitters and Sensors
— Ammonia, Nitrate, Phosphate, Silica, Sodium, Chloride, Fluoride, Dissolved Oxygen and Hydrazine Analyzers
— Zirconia Oxygen Analyzers, Katharometers, Hydrogen Purity and Purge-gas Monitors, Thermal Conductivity

Customer support
We provide a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

UK
ABB Limited
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671

USA
ABB Inc.
Tel: +1 215 674 6000
Fax: +1 215 674 7183

Client Warranty
Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.
Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:
— A listing evidencing process operation and alarm logs at time of failure.
— Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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