

AquaMaster 3 Electromagnetic flowmeter

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potable applications



Introduction

AquaMaster 3™ is a range of high performance electromagnetic flowmeters for the measurement of electrically-conductive fluids and is normally supplied as factory-configured, calibrated systems.

This MODBUS tables supplement contains MODBUS Protocol implementation information and MODBUS Protocol Register Allocation tables and is applicable to product firmware version WAJC2103 v01.00.00 or above.

Detailed specifications and recommendations for using and implementing MODBUS communications are contained in the following external publications:

- MODBUS Over Serial Line – Specification and Implementation Guide V1.02. Dec 20, 2006. <http://www.modbus.org/>.
- MODBUS Application Protocol Specification V1.1b. Dec 28, 2006. <http://www.modbus.org/>.

This supplement should be used in conjunction with the following publications:

- Programming Guide (COI/FET2XX-EN)
- User Guide (OI/FET2XX-EN)

The Company

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

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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

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1 MODBUS Protocol

AquaMaster 3 RS485 MODBUS option implements the MODBUS over Serial Line protocol described in the following MODBUS publications:

- MODBUS Over Serial Line – Specification and Implementation Guide V1.02. Dec 20, 2006.
- MODBUS Application Protocol Specification V1.1b. Dec 28, 2006.

Section 1.1 provides specific AquaMaster 3 MODBUS implementation details and section 1.2 provides an overview of the AquaMaster 3 MODBUS Register mapping.

1.1 Implementation Information

The following information should be considered when implementing a MODBUS master to communicate with AquaMaster 3:

Transmission mode:	Remote Terminal Unit (RTU) slave.
Response time-out:	1s
Turnaround delay:	800ms

Interface power-up considerations.

The AquaMaster 3 MODBUS interface has been designed for low power consumption so that it can be used with battery or renewable energy supplies (as well as with mains power).

When the AquaMaster 3 MODBUS interface is inactive (no characters received for 10s) it is switched into a low power state. In this low power state it is not possible for AquaMaster 3 to receive the first characters sent to it although the interface will be 'woken up' within 1s by communications activity. Therefore, after any period of inactivity longer than 10s it is necessary for a MODBUS master to perform 1 retry to communicate with AquaMaster 3s.

1.2 AquaMaster 3 MODBUS Register Mapping

The AquaMaster 3 MODBUS interface provides access to AquaMaster 3 parameters described in the AquaMaster 3 Programming Guide (part no. COI/AQUAMASTER3-EN).

In general, AquaMaster 3 parameters with security access levels 0 to 7 can be read via MODBUS and, where defined, parameters with security access levels 0 to 4 can be written via MODBUS.

Writeable parameters identified as MID parameters (see Appendix A) become Read Only via MODBUS if the AquaMaster 3 flow meter has been configured for use as an MID instrument – refer to the AquaMaster 3 Programming Guide (COI/AQUAMASTER3-EN) for details. Attempting to write to MID parameters in an MID instrument results in MODBUS exception code 04, Slave Device Failure.

Table 2.1 shows the mapping of AquaMaster 3 MODBUS Registers to MODBUS Function Codes and AquaMaster 3 data types, section 1.3 provides details of usage for each Register Address Range and Appendix A provides the Register allocation tables.

Register Address Range	Applicable Function Codes	AquaMaster Data Type	Description
0001 .. 0500	01 Read Coils 05 Write Single Coil 15 Write Multiple Coils	RW 1-Bit	Read/write access to single bit types.
0501 .. 1000	02 Read Discrete Inputs	RO 1-Bit	Read only access to single bit types.
1001 .. 2000	04 Read Input Registers	RO 8/16-Bit	Read only access to 8- and 16-bit types.
2001 .. 4000	04 Read Input Registers	RO String	Read only access to string types.
4001 .. 5000	04 Read Input Registers	RO 32-Bit	Read only access to 32-bit types.
5001 .. 7000	04 Read Input Registers	RO Float	Read only access to float types.
8001 .. 10000	03 Read Holding Registers 06 Write Single Register 16 Write Multiple Registers	RW 8/16-Bit	Read/write access to 8- and 16-bit types.
10001 .. 12000	03 Read Holding Registers 16 Write Multiple Registers	RW String	Read/write access to string types.
12001 .. 13000	03 Read Holding Registers 16 Write Multiple Registers	RW 32-Bit	Read/write access to 32-bit types.
13001 .. 14000	03 Read Holding Registers 16 Write Multiple Registers	RW Float	Read/write access to float types.

Table 2.1 AquaMaster 3 MODBUS Register Mapping

1.3 Register Usage

This section provides further information and worked examples of MODBUS protocol messages, application data units (ADUs) and their responses for each of the Register ranges corresponding to AquaMaster 3 data types.

Note: MODBUS data model register addressing starts from XXXX1 but within the MODBUS protocol data unit (PDU) addressing starts from XXXX0.

Register addresses shown in the Register allocation tables (Appendix A) are MODBUS data model register addresses.

1.3.1 RW 1-Bit

Read/Write access to single bit types.

Read Coils 1 to 14

Read all RW 1-Bit items

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	81
Function	01	Function	01	Exception Code	Exception Code
Starting Address Hi	00	Byte count	02		
Starting Address Lo	00	Outputs status 00008-00001*	61		
Quantity of Inputs Hi	00	Outputs status 00014-00009*	05		
Quantity of Inputs Lo	0E	CRC	50		
CRC	BD	CRC	6F		
CRC	CE				

*Coils 1,6,7,9,11 = 1

*Coils 2,3,4,5,8,10,12,13,14 = 0

Write Single Coil 3

var54: Display Net Total = ON

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	85
Function	05	Function	05	Exception Code	Exception Code
Output address Hi	00	Output Address Hi	00		
Output Address Lo	02	Output Address Lo	02		
Output Value	FF	Output Value	FF		
Output Value	00	Output Value	00		
CRC	2D	CRC	2D		
CRC	FA	CRC	FA		

1.3.2 RO 1-Bit

Read-only access to single bit types.

Read Discrete Inputs 501 to 503

Read all RO 1-bits

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	82
Function	02	Function	02	Exception Code	Exception Code
Starting Address Hi	01	Byte Count	01		
Starting Address Lo	f4	Outputs Status*	06		
Quantity of Inputs Hi	00	CRC	21		
Quantity of Inputs Lo	03	CRC	8a		
CRC	78				
CRC	05				

*Outputs status = 06

Output status

Bit	Register	Value	Variable	Meaning
0	501	0	007	Flow sensor is not reverse wired
1	502	1	008	Flow sensor is a Probe
2	503	1	416	MID (read only switch) is Active
3 to 7	—	—	—	Not Used

1.3.3 RO 8/16-Bit

Read-only access to 8- and 16-bit types.

8-Bit quantities use the Lo byte of Register Value. The Hi byte is 'don't care' and shows value 0 in Response Messages.

Read Input Register 1002

var12 – Flow sensor settling time (battery power) (16-bit)

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	84
Function	04	Function	04	Exception Code	Exception Code
Starting Address Hi	03	Byte Count	02		
Starting Address Lo	e9	Register Value Hi*	01		
Quantity of Inputs Hi	00	Register Value Lo*	d1		
Quantity of Inputs Lo	01	CRC	78		
CRC	e0	CRC	fc		
CRC	7a				

*Register Value = 01d1h = 465

Read Input Register 1011

var106 – Calibration type (8-bit enum)

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	84
Function	04	Function	04	Exception Code	Exception Code
Starting Address Hi	03	Byte count	02		
Starting Address Lo	f2	Register Value Hi*	00		
Quantity of Inputs Hi	00	Register Value Lo*	01		
Quantity of Inputs Lo	01	CRC	78		
CRC	90	CRC	f0		
CRC	7d				

*Register Value = XX01h = Class1

1.3.4 RO String

Read only access to string types.

Each AquaMaster 3 String type requires 18 MODBUS Registers (36 bytes). Consequently, RO String Register addresses are assigned at intervals of 18 and the Request Message must provide Quantity of Inputs in multiples of 18.

Read Input Registers 2271 to 2288

var215 – Original Manufacturer

Request Message	(Hex)	Response Message	(Hex)	=char	Error Message	(Hex)
Address	01	Address	01		Function	84
Function	04	Function	04		Exception Code	Exception Code
Starting Address Hi	08	Byte count	24			
Starting Address Lo	de	byte0	41	A		
Quantity of Inputs Hi	00	byte1	42	B		
Quantity of Inputs Lo	12	byte2	42	B		
CRC	12	byte3	20	space		
CRC	5d	byte4	4c	L		
		byte5	69	i		
		byte6	6d	m		
		byte7	69	i		
		byte8	74	t		
		byte9	65	e		
		byte10	64	d		
		byte11	00	null		
		byte12	00			
		byte13	00			
		byte14	00			
		byte15	00			
		byte16	00			
		byte17	00			
		byte18	00			

Request Message	(Hex)	Response Message	(Hex)	=char	Error Message	(Hex)
		byte19	00			
		byte20	00			
		byte21	00			
		byte22	00			
		byte23	00			
		byte24	00			
		byte25	00			
		byte26	00			
		byte27	00			
		byte28	00			
		byte29	00			
		byte30	00			
		byte31	00			
		byte32	00			
		byte33	00			
		byte34	00			
		byte35	00			
		CRC	2c			
		CRC	ce			

1.3.5 RO 32-Bit

Read-only access to 32-bit types.

Each AquaMaster 3 32-Bit type requires 2 MODBUS Registers (4 bytes). Consequently, RO 32-Bit Register addresses are assigned at intervals of 2 and the Request Message must provide Quantity of Inputs in multiples of 2.

32-Bit quantities are arranged in big-endian order.

Read Input Registers 4013 to 4014

var207 – Transmitter Unique ID

Request Message	(Hex)	Response Message	(Hex)		Error Message	(Hex)
Address	01	Address	01		Function	84
Function	04	Function	04		Exception Code	Exception Code
Starting Address Hi	0f	Byte Count	04			
Starting Address Lo	ac	H Register Value Hi	00	=27		
Quantity of Inputs Hi	00	H Register Value Lo	00			
Quantity of Inputs Lo	02	L Register Value Hi	00			
CRC	b2	L Register Value Lo	1b			
CRC	fe	CRC	bb			
		CRC	8f			

1.3.6 RO Float

Read-only access to float types.

Each AquaMaster 3 float type requires 2 MODBUS Registers (4 bytes). Consequently, RO float Register addresses are assigned at intervals of 2 and the Request Message must provide Quantity of Inputs in multiples of 2.

Float values use IEEE-754 format arranged in big-endian order.

Read Input Registers 5033 to 5034

var237 – Calibrated bore

Request Message	(Hex)
Address	01
Function	04
Starting Address Hi	13
Starting Address Lo	a8
Quantity of Inputs Hi	00
Quantity of Inputs Lo	02
CRC	f4
CRC	af

Response Message	(Hex)	
Address	01	
Function	04	
Byte count	04	
H Register Value Hi	41	=10.0
H Register Value Lo	20	
L Register Value Hi	00	
L Register Value Lo	00	
CRC	ee	
CRC	72	

Error Message	(Hex)
Function	84
Exception Code	Exception Code

1.3.7 RW 8/16-Bit

Read/write access to 8- and 16-bit types.

8-Bit quantities use the Lo byte of Register Value. The Hi byte is 'don't care' and can be set to value 0 in Request Messages and shows value 0 in Response Messages.

Read Holding Register 8009

var69 – Pulse maximum frequency

Request Message	(Hex)
Address	01
Function	03
Starting Address Hi	1f
Starting Address Lo	48
Quantity of Inputs Hi	00
Quantity of Inputs Lo	01
CRC	03
CRC	c8

Response Message	(Hex)	
Address	01	
Function	03	
Byte count	02	
Register Value Hi	00	=50
Register Value Lo	32	
CRC	39	
CRC	91	

Error Message	(Hex)
Function	83
Exception Code	Exception Code

Write Single Register 8019

var125 – Trip point for high flow = 14

Request Message	(Hex)	
Address	01	
Function	06	
Starting Address Hi	1f	
Starting Address Lo	52	
Register Value Hi	00	=14
Register Value Lo	0e	
CRC	ae	
CRC	0b	

Response Message	(Hex)	
Address	01	
Function	06	
Starting Address Hi	1f	
Starting Address Lo	52	
Register Value Hi	00	=14
Register Value Lo	0e	
CRC	ae	
CRC	0b	

Error Message	(Hex)
Function	86
Exception Code	Exception Code

Write Multiple Registers 8019

var125 – Trip point for high flow = 15

Request Message	(Hex)	
Address	01	
Function	10	
Starting Address Hi	1f	
Starting Address Lo	52	
Quantity of Registers Hi	00	
Quantity of Registers Lo	01	
Byte Count	02	
Register Value Hi	00	=15
Register Value Lo	0f	
CRC	05	
CRC	27	

Response Message	(Hex)
Address	01
Function	10
Starting Address Hi	1f
Starting Address Lo	52
Quantity of Registers Hi	00
Quantity of Registers Lo	01
CRC	a7
CRC	cc

Error Message	(Hex)
Function	90
Exception Code	Exception Code

1.3.8 RW String

Read/Write access to string types.

Each AquaMaster 3 String type requires 18 MODBUS Registers (36 bytes). Consequently, RW String Register addresses are assigned at intervals of 18 and the Request Message must provide Quantity of Registers in multiples of 18.

Read Holding Registers 10217 to 10234

var163 – Owner string

Request Message	(Hex)
Address	01
Function	03
Starting Address Hi	27
Starting Address Lo	e8
Quantity of Registers Hi	00
Quantity of Registers Lo	12
CRC	4f
CRC	47

Response Message	(Hex)	=char
Address	01	
Function	03	
Byte count	24	
byte0	41	A
byte1	42	B
byte2	42	B
byte3	20	space
byte4	53	S
byte5	74	t
byte6	6f	o
byte7	6e	n
byte8	65	e
byte9	68	h
byte10	6f	o
byte11	75	u
byte12	73	s
byte13	65	e
byte14	00	null
byte15	00	
byte16	00	
byte17	00	
byte18	00	
byte19	00	
byte20	00	
byte21	00	
byte22	00	
byte23	00	
byte24	00	
byte25	00	
byte26	00	
byte27	00	
byte28	00	
byte29	00	
byte30	00	
byte31	00	
byte32	00	
byte33	00	
byte34	00	
byte35	00	
CRC	a9	
CRC	b8	

Error Message	(Hex)
Function	83
Exception Code	Exception Code

Write Multiple Registers 10199 to 10216

var162 – Location string = "Flow D&D Office UK"

Request Message	(Hex)	=char
Address	01	
Function	10	
Starting Address Hi	27	
Starting Address Lo	d6	
Quantity of Registers Hi	00	
Quantity of Registers Lo	12	
Byte count	24	
byte0	46	F
byte1	6c	l
byte2	6f	o
byte3	77	w
byte4	20	space
byte5	44	D
byte6	26	&
byte7	44	D
byte8	20	space
byte9	4f	O
byte10	66	f
byte11	66	f
byte12	69	i
byte13	63	c
byte14	65	e
byte15	20	space
byte16	55	U
byte17	4b	K
byte18	00	null
byte19	00	
byte20	00	
byte21	00	
byte22	00	
byte23	00	
byte24	00	
byte25	00	
byte26	00	
byte27	00	
byte28	00	
byte29	00	
byte30	00	
byte31	00	
byte32	00	
byte33	00	
byte34	00	
byte35	00	
CRC	9a	
CRC	e9	

Response Message	(Hex)
Address	01
Function	10
Starting Address Hi	27
Starting Address Lo	d6
Quantity of Registers Hi	00
Quantity of Registers Lo	12
CRC	ab
CRC	48

Error Message	(Hex)
Function	90
Exception Code	Exception Code

1.3.9 RW 32-Bit

Read/Write access to 32-bit types.

Each AquaMaster 3 RW 32-Bit type requires 2 MODBUS Registers (4 bytes). Consequently, RW 32-Bit Register addresses are assigned at intervals of 2 and the Request Message must provide Quantity of Registers in multiples of 2.

32-Bit quantities are arranged in big-endian order.

Read Holding Registers 12003 to 12004

var224 – Totaliser Forward

Request Message	(Hex)	Response Message	(Hex)		Error Message	(Hex)
Address	01	Address	01		Function	83
Function	03	Function	03		Exception Code	Exception Code
Starting Address Hi	2e	Byte count	04			
Starting Address Lo	e2	Register Value H Hi	00	=4041968		
Quantity of Inputs Hi	00	Register Value H Lo	3d			
Quantity of Inputs Lo	02	Register Value L Hi	ac			
CRC	6d	Register Value L Lo	f0			
CRC	15	CRC	39			
		CRC	91			

1.3.10 RW Float

Read/Write access to float types.

Float values use IEEE-754 format arranged in big-endian order.

Each AquaMaster 3 RW Float type requires 2 MODBUS Registers (4 bytes). Consequently, RW Float Register addresses are assigned at intervals of 2 and Fn03 (Read Holding Register) Request Messages must provide Quantity of Registers in multiples of 2.

Read Holding Registers 13005 to 13006

var30 – Insertion probe – profile factor

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	83
Function	03	Function	03	Exception Code	Exception Code
Starting Address Hi	32	Byte count	04		
Starting Address Lo	cc	Register Value H Hi	3f		
Quantity of Inputs Hi	00	Register Value H Lo	66		
Quantity of Inputs Lo	02	Register Value L Hi	66		
CRC	0a	Register Value L Lo	67		
CRC	8c	CRC	7c		
		CRC	72		

Each AquaMaster 3 RW Float type requires 2 MODBUS Registers (4 bytes). Consequently, RW Float Register addresses are assigned at intervals of 2 and Fn16 (Write Multiple Register) Request Messages must provide Quantity of Registers in multiples of 2 and Byte Count in multiples of 4.

Write Multiple Registers 13009 to 13010

var32 – Probe pipe bore = 10.0000

Request Message	(Hex)	Response Message	(Hex)	Error Message	(Hex)
Address	01	Address	01	Function	90
Function	10	Function	10	Exception Code	Exception Code
Starting Address Hi	32	Starting Address Hi	32		
Starting Address Lo	d0	Starting Address Lo	d0		
Quantity of Registers Hi	00	Quantity of Registers Hi	00		
Quantity of Registers Lo	02	Quantity of Registers Lo	02		
Byte count	04	CRC	4e		
Register Value H Hi	41	CRC	89		
Register Value H Lo	20				
Register Value L Hi	00				
Register Value L Lo	00				
CRC	a6				
CRC	64				

Appendix A – MODBUS Register Allocation Tables

Note: MODBUS data model register addressing starts from XXXX1 but within the MODBUS protocol data unit (PDU) addressing starts from XXXX0.

Register addresses shown in these Register allocation tables are MODBUS data model register addresses.

RW 1-Bit

Coil Address	AquaMaster 3 Parameter	Name	Range	Note
1	052	DisplayForwardTotal	0=Off, 1=On	Show Forward Total on AquaMaster 3 LCD display
2	053	DisplayReverseTotal	0=Off, 1=On	—
3	054	DisplayNetTotal	0=Off, 1=On	—
4	055	DisplayTariffA	0=Off, 1=On	—
5	056	DisplayTariffB	0=Off, 1=On	—
6	059	DisplayFlowRate	0=Off, 1=On	—
7	060	DisplayFlowVelocity	0=Off, 1=On	—
8	061	DisplayPressure	0=Off, 1=On	—
9	062	DisplayDateAndTime	0=Off, 1=On	Show Date & Time on AquaMaster 3 LCD display
10	066	PressureDisplayType	0=Absolute, 1=Gauge	—
11	321	DisableDiagnostics	0=No, 1=Yes	—
12	343	ABB Reserved	—	—
13	356	ABB Reserved	—	—
14	375	ABB Reserved	—	—

RO 1 – Bit

Address	AquaMaster 3 Parameter	Name	Range	Note
501	007	FlowSensorReverseWired	0=No, 1=Yes	—
502	008	FlowSensorIsAProbe	0=Full Bore, 1=Probe	Flow sensor type
503	416	ReadOnlySwitchState	0=Off, 1=On	MID switch

RO 8/16 – Bit

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	Note
1001	011	FlowSensorZero	2	x0.01 mms	Sensor zero correction (mains power)
1002	012	FlowSensorSettlingTimeConstant	2	x0.1 ms	Sensor settling time (battery power)
1003	021	FlowSensorLining	1	0 to 23	See Table A.1 Materials
1004	022	FlowSensorElectrodes	1	0 to 23	See Table A.1 Materials
1005	023	FlowSensorFlanges	1	0 to 23	See Table A.1 Materials
1006	024	FlowSensorBody	1	0 to 23	See Table A.1 Materials
1007	029	FlowSensorSettlingTimeHigh	2	x0.1 ms	Sensor settling time (mains power)
1008	034	ABB Reserved	2	—	—
1009	035	ABB Reserved	2	—	—
1010	036	ABB Reserved	1	—	—
1011	106	CalibrationType	1	0 to 4	See Table A.2 Calibration Types
1012	148	ABB Reserved	1	—	—
1013	151	SupplierCode	2	—	Logger supplier
1014	155	ABB Reserved	1	—	—
1015	156	ABB Reserved	1	—	—
1016	195	FlowSensorZeroLowCurrent	2	x 0.01 mms	Sensor zero correction (battery power)
1017	208	ABB Reserved	2	—	—
1018	291	ABB Reserved	1	—	—
1019	319	TxrPowerType	1	0 to 2	0 = Battery, 1 = Mains, 2 = Renewable
1020	324	ABB Reserved	1	—	—
1021	340	ExtPowerStatus	1	0 to 7	See Table A.3 External Power Status
1022	348	ABB Reserved	2	—	—
1023	349	IntPowerStatus	1	0 to 2	0 = OK, 1 = Low, 2 = Fail
1024	368	ABB Reserved	1	—	—
1025	371	ABB Reserved	1	—	—
1026	384	ABB Reserved	1	—	—
1027	387	ABB Reserved	1	—	—
1028	393	ABB Reserved	1	—	—
1029	396	ABB Reserved	1	—	—
1030	414	LoggerEnabled	1	0 = No, 1 = Yes	—

RO String

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Note
2001	000	ApplicationVersionString	34	—
2019	017	FlowSensorContractNo	25	—
2037	018	FlowSensor1stFactory	11	Sensor first factory calibration date (see Table A.4 Date Format)
2055	019	FlowSensorLastFactory	11	Sensor last factory calibration date (see Table A.4 Date Format)
2073	020	FlowSensorCertNo	25	—
2091	101	AmodemVersion	25	—
2109	199	TransmitterType	25	'AquaMaster 3'
2127	200	Manufacturer	25	—
2145	201	Address1	25	—
2163	202	Address2	25	—
2181	203	Address3	25	—
2199	204	Address4	25	—
2217	210	CalibrationDate	11	Transmitter calibration date (see Table A.4 Date Format)
2235	211	CertificateNo	25	—
2253	214	LoggerVersion	25	—
2271	215	OriginalManufacturer1	33	—
2289	216	OriginalManufacturer2	33	—
2307	280	FlowSensorString	25	—
2325	281	PressureSensorString	25	—
2343	282	TransmitterString	25	—
2361	285	ABB Reserved	25	—
2379	286	ABB Reserved	25	—
2397	365	ABB Reserved	25	—
2415	381	ABB Reserved	12	—
2433	383	ABB Reserved	12	—
2451	392	ABB Reserved	12	—
2469	408	BootProgId	34	—
2487	409	UamProgId	34	—
2505	415	ApplicationCRC	12	CRC value for MID

RO 32 – Bit

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	Note
4001	001	FlowSensorId	4	—	Sensor ID number
4003	002	FlowSensorSoftwareRev	4	—	—
4005	003	FlowSensorHardwareRev	4	—	—
4007	172	PressureSoftwareRev	4	—	—
4009	173	PressureHardwareRev	4	—	—
4011	205	HardwareRevisionLevel	4	—	—
4013	207	TransmitterUniqueID	4	—	Transmitter ID number
4015	245	ColdRuntimeTimer	4	s	Time since last cold start
4017	299	WarmRuntimeTimer	4	s	Time since last warm start
4019	331	ABB Reserved	4	—	—
4021	332	ABB Reserved	4	—	—
4023	333	ABB Reserved	4	—	—
4025	372	ABB Reserved	4	—	—

RO Float

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	Note
5001	004	ABB Reserved	4	—	—
5003	006	ABB Reserved	4	—	—
5005	009	ABB Reserved	4	—	—
5007	010	FlowSensorCalFactor	4	—	Factory sensor span factor
5009	013	HeadSpanLow	4	—	Factory span adjustment
5011	016	EmptyPipeZero	4	—	Factory empty pipe zero correction
5013	146	ABB Reserved	4	—	—
5015	147	ABB Reserved	4	—	—
5017	217	FlowRate	4	User flow units	—
5019	218	FlowPercent	4	%	—
5021	219	ABB Reserved	4	—	—
5023	220	ABB Reserved	4	—	—
5025	222	Pressure	4	User units	—
5027	223	PressurePercent	4	%	—
5029	234	LeftElectrode	4	kOhm	—
5031	235	RightElectrode	4	kOhm	—
5033	237	CalibratedBore	4	mm	—
5035	238	ISpan	4	—	Factory coil current span factor
5037	239	IZero	4	—	Factory coil current zero correction
5039	243	CoilCurrent	4	A	—
5041	258	PulseOutput	4	Hz	—
5043	294	SignalCalHighCurrent	4	—	Factory transmitter span (mains)
5045	295	ZeroOffsetHighCurrent	4	—	Factory transmitter zero (mains)
5047	296	SignalCalLowCurrent	4	—	Factory transmitter span (battery)
5049	297	ZeroOffsetLowCurrent	4	—	Factory transmitter zero (battery)
5051	298	CalibratedVelocity	4	ms	—
5053	310	ABB Reserved	4	—	—
5055	311	ABB Reserved	4	—	—
5057	312	VoltageReference	4	V	—
5059	313	PressureGain	4	—	Factory transmitter pressure span
5061	314	PressureOffset	4	—	Factory transmitter pressure zero
5063	328	SigAVolts	4	V	Electrode A voltage
5065	329	SigBVolts	4	V	Electrode B voltage
5067	341	ABB Reserved	4	—	—
5069	376	PowerVExt	4	V	External power supply voltage
5071	377	PowerV3V8	4	V	Internal 3V8 voltage
5073	378	PowerV3V2	4	V	Internal 3V2 voltage

RW 8/16 – Bit

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	MID ?	Note
8001	026	UserFlowSensorZero	2	0.01 mms ¹	y	User's flow sensor zero correction
8002	037	TotaliserUnits	1	0 to 6	y	See Note 1
8003	040	TariffMode	1	0 to 7	y	See Note 1
8004	041	TariffUnits	1	1 to 6	y	See Note 1
8005	044	TariffWeeklyCycleStartDay	1	0 to 7	y	See Note 1
8006	045	TariffWeeklyCycleEndDay	1	0 to 7	y	See Note 1
8007	048	ABB Reserved	1	—	y	—
8008	067	PulseOutputUnits	1	0 to 6	—	See Note 1
8009	069	PulseMaximumFrequency	2	0 to 50 Hz	—	—
8010	070	FunctionOfOutput1	1	0 to 3	—	See Note 1
8011	071	FunctionOfOutput2	1	0 to 4	—	See Note 1
8012	072	FunctionOfOutput3	1	0 to 3	—	See Note 1
8013	102	FlowmeterMode	1	0 to 3	y	0 = Normal, 1 = Backwards, 2 = Fwd Only, 3 = Rev Only
8014	109	VelocityUnits	1	0 to 8	—	See Table A.5 Velocity Units
8015	112	FlowUnits	1	0 to 19	—	See Note 1
8016	117	FlowCutOffLow	1	0 to 255 mms ¹	y	Factory flow cut off (battery mode)
8017	118	UserFlowCutOff	1	0 to 255 %	y	User's flow cut off setting
8018	119	PressureUnits	1	0 to 7	—	See Note 1
8019	125	TripPointForHFlow	2	-200 to +200 %	—	—
8020	126	TripPointForLFlow	2	-200 to +200 %	—	—
8021	131	HysteresisForFlowTrip	1	0 to 10 %	—	—
8022	140	EmptyPipeTripLevel	2	0 to 999.9 kOhm	—	—
8023	141	ABB Reserved	1	—	—	—
8024	142	ABB Reserved	1	—	—	—
8025	143	ABB Reserved	1	—	—	—
8026	144	ABB Reserved	1	—	—	—
8027	145	ABB Reserved	1	—	—	—
8028	150	ABB Reserved	2	—	y	—
8029	158	PowerControlMode	1	0 to 60 s	—	Measurement rate (battery mode)
8030	159	DateFormat	1	0 to 2	—	See Table A.4 Date Format
8031	160	DisplayTimeout	1	0 to 255 mins	—	0=1min
8032	161	Language	1	0 to 6	—	0 = ??, 1 = UK, 2 = F, 3 = NL, 4 = DE, 5 = I, 6 = E
8033	164	PressureLoggerFormat	1	0 to 1	—	0 = Off, 1 = mBar Abs
8034	165	FlowLoggerFormat	1	0 to 1	—	0 = Off, 1 = mms ¹
8035	166	MainLoggerInterval	2	1 to 65535 mins	—	—
8036	167	ABB Reserved	1	—	—	—
8037	168	ABB Reserved	2	—	—	—
8038	170	ABB Reserved	1	—	—	—
8039	176	PressureType	1	0 to 1	—	Transducer type 0 = Gauge, 1 = Absolute
8040	177	ABB Reserved	1	—	—	—

¹ Refer to AquaMaster 3 Programming Guide COI/FET2XX—EN for settings.

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	MID ?	Note
8041	190	PressureBody	1	0 to 23	—	See Table A.1 — Materials
8042	191	PressureWettedParts	1	0 to 23	—	See Table A.1 — Materials
8043	192	PressureSeals	1	0 to 23	—	See Table A.1 — Materials
8044	213	ABB Reserved	1	—	y	—
8045	233	TestMode	1	0 to 1	y	0 = Off, 1 = On (velocity = 1ms ⁻¹)
8046	242	ClockAdjust	2	—500 to +500	—	Secs/31days
8047	244	ABB Reserved	2	—	—	—
8048	255	PressureHeightOffset	2	±32000 mm	—	—
8049	289	ABB Reserved	1	—	—	—
8050	315	SoftwareReset	1	0 to 1	y	1 = Reset
8051	316	ABB Reserved	1	—	—	—
8052	317	FlowCutOffHigh	1	0 to 255 mms	y	Factory flow cut off (mains mode)
8053	320	ExtPowerOkThresholdV	2	5 to 15 V	—	—
8054	326	ABB Reserved	1	—	—	—
8055	327	ABB Reserved	1	—	y	—
8056	334	SoftwareResetCount	2	—	—	—
8057	335	WatchdogResetCount	2	—	—	—
8058	336	SensorCalTxVersion	1	—	y	—
8059	339	ABB Reserved	2	—	—	—
8060	342	LastTxSoftwareVer	1	—	y	—
8061	344	ElectrodeVoltsTripBatt	1	0 to 199 Vx100	y	—
8062	347	ABB Reserved	1	—	—	—
8063	352	ABB Reserved	2	—	—	—
8064	353	ABB Reserved	1	—	—	—
8065	354	ABB Reserved	1	—	—	—
8066	358	ABB Reserved	1	—	—	—
8067	361	ABB Reserved	1	—	—	—
8068	367	ABB Reserved	1	—	—	—
8069	379	ExtPowerLowThresholdV	2	5 to 15 V	—	—
8070	380	IntPowerLowThresholdV	1	31 to 37 Vx10	—	—
8071	385	ABB Reserved	1	—	—	—
8072	386	ABB Reserved	1	—	—	—
8073	388	ABB Reserved	1	—	—	—
8074	389	ABB Reserved	1	—	—	—
8075	394	ABB Reserved	1	—	—	—
8076	395	ABB Reserved	1	—	—	—
8077	399	ABB Reserved	1	—	—	—
8078	400	ABB Reserved	1	—	—	—
8079	401	ABB Reserved	1	—	—	—
8080	402	ABB Reserved	1	—	—	—
8081	405	TotaliserLoggingTime	1	0 to 23 h	—	See Note 1
8082	406	ABB Reserved	1	—	—	—
8083	410	WindClockSecs	2	+/- 32400 s	—	Adjust clock

¹ Refer to AquaMaster 3 Programming Guide COI/FET2XX—EN for settings.

RW String

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	MID ?	Note
10001	027	UserFlowSensorCalDate	11	—	y	See Table A.4 Date Format
10019	028	UserFlowSensorCert	25	—	y	—
10037	033	UserSensorTagNumber	33	—	—	—
10055	039	CustomTotaliserUnitsString	11	—	y	—
10073	042	TariffDailyCycleStartTime	9	hh:mm:ss	y	—
10091	043	TariffDailyCycleEndTime	9	hh:mm:ss	y	—
10109	046	TariffYearlyCycleStartDate	11	—	y	See Table A.4 Date Format
10127	047	TariffYearlyCycleEndDate	11	—	y	See Table A.4 Date Format
10145	111	CustomVelocityUnitsString	11	—	—	—
10163	114	CustomFlowUnitsString	11	—	—	—
10181	121	CustomPressureUnitsString	11	—	—	—
10199	162	LocationString	25	—	—	—
10217	163	OwnerString	25	—	—	—
10235	174	PressureManufacturer	25	—	—	—
10253	175	PressureInfoString	25	—	—	—
10271	186	Pressure1stFactory	11	—	—	See Table A.4 Date Format
10289	187	PressureLastFactory	11	—	—	See Table A.4 Date Format
10307	188	PressureCertNo	25	—	—	—
10325	189	PressureContractNo	25	—	—	—
10343	196	PressureUserCalDate	11	—	—	See Table A.4 Date Format
10361	197	PressureUserCalCert	25	—	—	—
10379	198	PressureUserTag	25	—	—	—
10397	206	MessageString	25	—	—	—
10415	209	TransmitterContractNo	11	—	y	—
10433	212	TransmitterTag	25	—	—	—
10451	246	AlarmsString	25	—	—	Start up NV check result
10469	253	Time	9	hh:mm:ss	—	—
10487	254	Date	11	—	—	See Table A.4 Date Format
10505	300	ABB Reserved	25	—	—	—
10523	301	ABB Reserved	25	—	—	—
10541	302	ABB Reserved	25	—	—	—
10559	303	ABB Reserved	25	—	—	—
10577	304	ABB Reserved	25	—	—	—
10595	305	ABB Reserved	25	—	—	—
10613	306	ABB Reserved	25	—	—	—
10631	307	ABB Reserved	25	—	—	—
10649	308	ABB Reserved	25	—	—	—
10667	309	ABB Reserved	25	—	—	—
10685	325	ABB Reserved	11	—	—	—
10703	337	DiagnosticString	33	—	—	—
10721	351	ABB Reserved	6	—	—	—
10739	355	ABB Reserved	25	—	—	—
10757	362	ABB Reserved	25	—	—	—
10775	363	ABB Reserved	33	—	—	—
10793	382	ABB Reserved	25	—	—	—
10811	391	ABB Reserved	25	—	—	—
10829	411	ABB Reserved	33	—	—	—

RW 32 – Bit

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	MID ?	Note
12001	171	PressureId	4	0 to 999,999,999	—	—
12003	224	TotaliserFwd	4	Totaliser units	y	Write value of 0 permitted unless MID active
12005	225	TotaliserRev	4	Totaliser units	y	Write value of 0 permitted unless MID active
12007	226	TotaliserNet	4	Totaliser units	y	Write value of 0 permitted unless MID active
12009	227	TotaliserTariffA	4	Tariff units	y	Write value of 0 permitted unless MID active
12011	228	TotaliserTariffB	4	Tariff units	y	Write value of 0 permitted unless MID active
12013	290	SystemErrorFlags	4	—	—	See Note 1

¹ Refer to AquaMaster 3 Programming Guide COI/FET2XX – EN for settings.

RW Float

Address	AquaMaster 3 Parameter	Name	Size (bytes)	Range/Units	MID ?	Note
13001	005	EmptyPipeCal	4	—	y	—
13003	025	UserFlowSensorCal	4	—	y	User-defined flow sensor span
13005	030	ProfileFactor	4	—	—	Insertion probe profile factor
13007	031	InsertionFactor	4	—	—	Insertion probe insertion factor
13009	032	ProbePipeBore	4	mm	—	Insertion probe pipe bore
13011	038	CustomTotaliserUnits	4	per m	y	—
13013	068	PulsesPerPulseOutputUnit	4	—	—	—
13015	110	CustomVelocityUnits	4	per ms	—	—
13017	113	CustomFlowUnits	4	per ms	—	—
13019	115	FlowUpperRange	4	Flow units	y	—
13021	116	FlowLowerRange	4	Flow units	y	—
13023	120	CustomPressureUnits	4	per mmHg	—	—
13025	122	PressureUpperRange	4	Pressure units	—	—
13027	123	PressureLowerRange	4	Pressure units	—	—
13029	178	PressureFactoryFSDBar	4	Bar	—	—
13031	179	PressureFactoryFSDVolts	4	V	—	—
13033	180	PressureFactoryZeroVolts	4	V	—	—
13035	193	UserPressureSpan	4	—	—	User span adjustment (dimensionless)
13037	194	UserPressureZero	4	mBar	—	User zero adjustment
13039	231	ExternalPowerUsageDays	4	days	—	—
13041	232	InternalPowerUsageDays	4	days	—	—
13043	256	FlowResponseTime	4	s	y	—
13045	257	PressureResponseTime	4	s	—	—
13047	345	ABB Reserved	4	—	y	—
13049	346	ABB Reserved	4	—	y	—

Tables of Settings

0	Special
1	N/A
2	PFA
3	PTFE
4	FEP
5	ABR
6	Rubber (WRC)
7	Polyurethane
8	HT Rubber
9	Polypropylene
10	PES
11	P E
12	PPS
13	Viton
14	St St
15	C St
16	Brass
17	Gold
18	Titanium
19	Hast B
20	Hast C
21	Plat
22	Tant
23	?

Table A.1 Materials

0	N/A
1	Class1
2	Class2
3	MID Class1
4	MID Class2

Table A.2 Calibration Types

0	Battery Power OK
1	Battery Power LOW
2	Battery Power FAIL
3	Mains Power ON
4	Mains Power OFF
5	Renewable Power OK
6	Renewable Power LOW
7	Renewable Power OFF

Table A.3 External Power Status

Modbus register: 8030 AquaMaster 3 parameter: 159	
0	DDMMYY
1	YYMMDD
2	MMDDYY

Table A.4 Date Format

0	Special
1	m/s
2	m/m
3	cm/s
4	cm/m
5	ft/s
6	ft/m
7	in/s
8	in/m

Table A.5 Velocity Units

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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