Made in Britain

FIXED-UFM Ultrasonic Flowmeter - Modbus RTU Slave Plug-in Module

Operating Instructions

Version 3.0

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Contents

1.0 Introduction

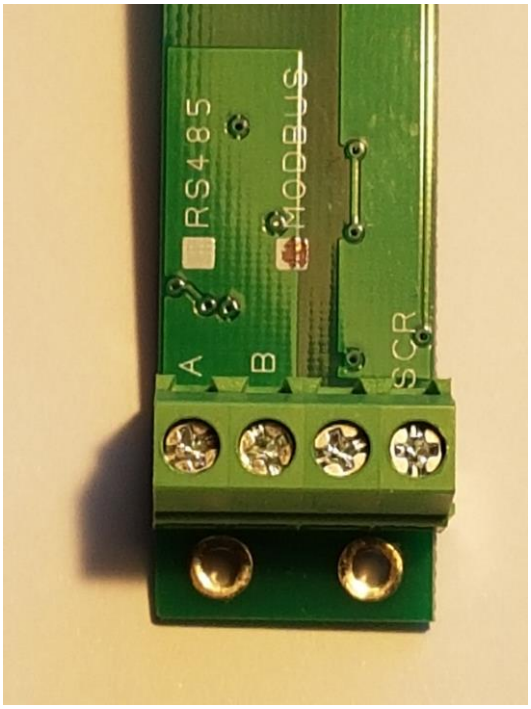
Modbus Slave functionality is implemented in the Sonic Driver ™ range of Fixed clamp-on ultrasonic flowmeters (UFM) by means of an optional plug-in board.

Modbus settings are fully configurable on the UFM using its User Interface (UI).

1.1 Mode

The Modbus RTU protocol is implemented over RS485 hardware.

Physical connection to the 2-wire bus is via the screw terminals on the end of the plug-in board. The terminals are labelled 'A' and 'B', see Figure(1).



Figure(1) Plug-in board screw terminals

Note that some equipment manufacturers label their terminals in other ways, e.g. ‘+’ and ‘-‘ so the exact order that the wires are connected may be reversed.

There is also a screw terminal for connection of cable screen. This may be connected at the Master or the Slave UFM if necessary.

1.2 Baud rate

The RS485 baud rate can be selected using the UI on the UFM;

- 9600 **(Default)**
- 19200

1.3 Parity

The RS485 parity can be selected using the UI on the UFM;

- None **(Default)**
- Even
- Odd

1.4 Stop Bits

The RS485 stop bits can be selected using the UI on the UFM;

- 1 **(Default)**
- 2

1.5 Modbus Address

The Modbus plug-in board Slave address is programmable using the UI on the UFM, from 1 to 247.

The default Slave address is set to **1**.

1.6 Data bits

RS485 serial data is fixed at **8 bit**.

1.7 Register format

In the Modbus plug-in board each Modbus register is a 16-bit word, consisting of two 8-bit bytes.

Register data in Modbus messages are packed as 2 bytes per register. The binary contents are right justified in each byte. For each register the first byte contains the high order bits and the second byte contains the low order bits.

A floating-point number is stored as 32 bits using 4 bytes and therefore occupies 2 Modbus registers.

1.8 Representation of floating-point values

The micro controller on the Modbus plug-in board stores floating point values in IEEE 754 single precision format.

The bus Master accesses a floating-point value from any one of 4 different register tables. Each register table represents a different byte order.

Table start	Byte order	Common Description
0x0000	1,0,3,2	Floating-point Little-Endian with byte swap **(Default)**
0x1000	0,1,2,3	Floating-point Little-Endian Format
0x2000	3,2,1,0	Floating-point Big-Endian Format
0x3000	2,3,0,1	Floating point Big-Endian with byte swap

By reading the first 2 registers of each table the user can determine which format matches their system when a fixed test value of **1234.0** is received.

2.0 Modbus Commands

The Modbus plug-in board implements Modbus commands 03, 04 and 06.

2.1 Read Holding Registers 03

This function code is used to read from 1 to 52 contiguous holding registers from the UFM. Registers are addressed starting at zero. Therefore holding registers numbered 1-32 are addressed as 0-31.

The Modbus Master specifies a start address and register count.

2.2 Read Input Registers 04

This function code is used to read from 1 to 52 contiguous input registers from the flowmeter. Registers are addressed starting at zero. Therefore input registers numbered 1-32 are addressed as 0-31.

The Modbus Master specifies a start address and register count.

2.3 Write Single Register 06

This function code is used to write a single register. This function code is used to reset the Slave UFM internal totals from the Master.

The Master specifies an address and 16-bit data value for write.

The value is an unsigned 16-bit value. Valid values are in the range 1 to 3 inclusive.

Writing a value of 1 to register 60300 will clear the unit's internal flow metering totals.

Writing a value of 2 to register 60300 will clear the unit's internal energy metering totals.

Writing a value of 3 to register 60300 will clear both the unit's internal flow and energy metering totals.

3.0 Broadcast address

The Modbus plug-in board supports broadcast address **0**.

In broadcast address mode the Modbus master can send a command to all slaves.

No response is sent by the slaves.

4.0 Communications Software

There are several communications programs available for download online.

The Modbus plug-in board has been tested using Modbus Poll (for Windows platform) and Modbus Monitor (for Android and Windows platforms).

Appendix 1: Communication Command Structure

Read holding registers		
	Slave ID	(1 byte)
	Function	(1 byte=03H)
	Start Address	(2 bytes)
	No. of Registers R	(2 bytes)
	CRC code	(2 bytes)
Reply		
	Slave ID	(1 byte)
	Function	(1 byte)
N = 2R	Byte Count N	(1 byte)
	Hex Data	(N bytes)
	CRC code	(2 bytes)
Read input registers		
	Slave ID	(1 byte)
	Function	(1 byte=04H)
	Start Address	(2 bytes)
	No. of Registers R	(2 bytes)
	CRC code	(2 bytes)
Reply		
	Slave ID	(1 byte)
	Function	(1 byte)
N = 2R	Byte Count N	(1 byte)
	Hex Data	(N bytes)
	CRC code	(2 bytes)
Write single register	Slave ID	(1 byte)
	Function	(1 byte=06H)
	Start Address	(2 bytes)
	Hex Data	(2 bytes)
	CRC code	(2 bytes)

Appendix 2: UFM Register Map

Modbus Address	Measurement Variable	Bytes	Format
40001	Fixed test pattern 1234.0	4	IEEE
40002			
40003	Flow Velocity (m/s)	4	IEEE
40004			
40005	Flow Rate	4	IEEE
40006			
40007	Flow Positive Total	4	IEEE
40008			
40009	Flow Negative Total	4	IEEE
40010			
40011	Flow Net Total	4	IEEE
40012			
40013	Energy Rate	4	IEEE
40014			
40015	Energy Positive Total	4	IEEE
40016			
40017	Energy Negative Total	4	IEEE
40018			
40019	Energy Net Total	4	IEEE
40020			
40021	Delta Time Difference (ns)	4	IEEE
40022			
40023	Upstream Transit Time (us)	4	IEEE
40024			
40025	Signal Amplitude (dB)	4	IEEE
40026			
40027	Signal Noise (dB)	4	IEEE
40028			
40029	Amplifier gain (dB)	4	IEEE
40030			
40031	SNR (dB)	4	IEEE
40032			

40033	Signal Quality 1 (us)	4	IEEE
40034			
40035	Signal Quality 2 (ADU)	4	IEEE
40036			
40037	Signal Quality 3 (ADU)	4	IEEE
40038			
40039	CU Temperature (degC)	4	IEEE
40040			
40041	Inlet Temperature (degC)	4	IEEE
40042			
40043	Outlet Temperature (degC)	4	IEEE
40044			
40045	Fluid Temperature (degC)	4	IEEE
40046			
40047	ATA/ETA (%)	4	IEEE
40048			
40049	Fluid Density (kg/m3)	4	IEEE
40050			
40051	Fluid Specific Heat Capacity (J/K.degC)	4	IEEE

Modbus Address	Text Strings	Bytes	Format
	Model Code		
40101	Mo	2	WORD
40102	de	2	WORD
40103	l< >	2	WORD
40104	Co	2	WORD
40105	de	2	WORD
40106	< >< >	2	WORD
40107	< >< >	2	WORD
40108	< >< >	2	WORD
40109	< >< >	2	WORD
40110	< >< >	2	WORD
40111	< >< >	2	WORD
40112	< >< >	2	WORD
40113	< >< >	2	WORD
	Serial Number		
40114	88	2	WORD
40115	88	2	WORD
40116	88	2	WORD
40117	88	2	WORD
	Tag		
40118	Ta	2	WORD
40119	g< >	2	WORD
40120	< >< >	2	WORD
40121	< >< >	2	WORD
40122	< >< >	2	WORD
	Ident		
40123	Id	2	WORD
40124	en	2	WORD
40125	t< >	2	WORD
40126	< >< >	2	WORD
40127	< >< >	2	WORD
	Flow rate units		
40128	m/	2	WORD
40129	s< >	2	WORD
40130	< >< >	2	WORD
40131	< >< >	2	WORD
	Flow net total units		
40132	l/	2	WORD
40133	m< >	2	WORD
40134	< >< >	2	WORD
40135	< >< >	2	WORD
	Energy rate units		
40136	GJ	2	WORD
40137	/s	2	WORD
40138	< >< >	2	WORD

40139	< >< >	2	WORD
	Energy net total units		
40140	GJ	2	WORD
40141	< >< >	2	WORD
40142	< >< >	2	WORD
40143	< >< >	2	WORD

Sonic Driver