

**ECHO Process
Instrumentation, Inc.**



**Modbus RS485 Module
Operating Instructions**

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ECHO Process Instrumentation, Inc.
PO Box 800
Shalimar, FL 32579

PH: 850-609-1300
FX: 850-651-4777
EM: info@echopi.com
www.echopi.com

Introduction

Modbus slave functionality has been implemented for the ECHO range of flowmeters with the development of a Modbus RTU RS485 plug in module.

The flowmeter acts as a slave on the Modbus with an address programmable between 1 and 247.

Mode

The Modbus RTU protocol is implemented by simply fitting the plug in module in the flowmeter.

Connection to the 2 wire bus is via the screw terminals corresponding to the slot in which the module is fitted.

Terminal 3 is A and terminal 4 is B.

Note, this is not to be confused with the RS485 straight through connections which form a separate serial communication channel.

Baud rate

The baud rate can be selected using the flowmeter HMI.

9600
19200 (Default)

If the Flowmeter slave is configured from the HMI for any other available serial baud rate then the Modbus link defaults to 19200.

Parity

The parity can be selected using the flowmeter HMI.

None
Odd
Even (Default)

If parity is None then the bus master must be configured for 2 Stop bits.

If parity is Odd or Even then the bus master must be configured for 1 Stop bit.

Modbus Address

A slave address is required for the flowmeter. This address is programmable from 1 to 247. Every device on a Modbus must have a different address in order for the bus to work correctly.

Data bits

Data is 8bit. The number of data bits cannot be modified.

Commands

The ECHO Modbus RTU module has implemented Modbus commands 04 and 06, see table 1.

04 Read Input Registers

This function code is used to read from 1 to 125 contiguous input registers from the flowmeter. Registers are addressed starting at zero. Therefore input registers numbered 1-16 are addressed as 0-15.

The user specifies a start address and register count, for example,

Start address 122, count 54

This command returns;

Model Code
Serial Number
Tag number
Identifier

The register data in the response message are packed as 2 bytes per register, with the binary contents right justified in each byte. For each register the first byte contains the high order bits and the second contains the low order bits.

Text is 16bit Unicode.

See table 2 for a complete list of registers and the data available for reading.

06 Write Single Register

The user specifies an address and 16 bit data value for write, for example,

Register 60001, data 0

This command zeroes the channel 1 positive totalizer.

See table 2 for a complete list of registers available for writing to.

Representation of floating point values

Internally ECHO flowmeters store floating point values in IEEE 754 single precision format.

The user can access each floating point value from 4 different tables. Each table represents a different byte order.

Table	Byte order
0000	1,0,3,2
1000	0,1,2,3
2000	3,2,1,0
3000	2,3,0,1

By reading the first register of each table the user can determine which format suites his system when the fixed test value of 1234.56 is recognized.

Zero flow totalizers

The user can write values to registers 60001 and 60002 to zero the individual flow totalizers on the flowmeter.

Register	Value	Action
60001	0	Zero channel 1 positive totalizer
60001	1	Zero channel 1 negative totalizer
60001	2	Zero channel 1 positive and negative totalizers
60002	0	Zero channel 2 positive totalizer
60002	1	Zero channel 2 negative totalizer
60002	2	Zero channel 2 positive and negative totalizers

Modbus diagnostic functions

The following standard Modbus diagnostic functions are available for use;

- Return bus message count
- Return bus exception error count

Table 1 ECHO Communications Command Structure

Read input registers COMMAND		
	Slave ID	(1 byte)
	Function	(1 byte=04H)
	Start Address	(2 bytes)
	No of Registers	(2 bytes)
	CRCC code	(2 bytes)
Response		
	Slave ID	(1 byte)
	Function	(1 byte)
	Byte Count	(1 byte)
	Hex Data	(??? bytes)
	CRCC code	(2 bytes)
Write single register COMMAND		
	Slave ID	(1 byte)
	Function	(1 byte=06H)
	Start Address	(2 bytes)
	Data	(2 bytes)
	CRCC code	(2 bytes)

Table 2 Register Map

ECHO Modbus Memory Table				
Modbus Address	Hex Modbus Address	Variables	# Bytes	Format
40001	0000	Fixed test value 1234.56	4	IEEE
40002	0001			
40003	0002	Channel1 flow velocity m/s	4	IEEE
40004	0003			
40005	0004	Channel1 flow volumetric m3/s	4	IEEE
40006	0005			
40007	0006	Channel1 Totalizer+ flow volumetric m3	4	IEEE
40008	0007			
40009	0008	Channel1 Totalizer- flow volumetric m3	4	IEEE
40010	0009			
40011	000A	Channel1 flow Mass Kg/min	4	IEEE
40012	000B			
40013	000C	Channel1 Totalizer+ flow Mass Kg	4	IEEE
40014	000D			
40015	000E	Channel1 Totalizer- flow Mass Kg	4	IEEE
40016	000F			
40017	0010	Channel1 HQM Watts	4	IEEE
40018	0011			
40019	0012	Channel1 Totalizer+ HQM Joules	4	IEEE
40020	0013			
40021	0014	Channel1 Totalizer- HQM Joules	4	IEEE
40022	0015			
40023	0016	Channel1 Temperature in C	4	IEEE
40024	0017			
40025	0018	Channel1 Temperature out C	4	IEEE
40026	0019			
40027	001A	Channel1 SOS m/s	4	IEEE
40028	001B			
40029	001C	Channel1 Signal strength dB	4	IEEE
40030	001D			
40031	001E	Channel1 Signal noise dB	4	IEEE
40032	001F			
40033	0020	Channel1 Missed measurements	4	IEEE
40034	0021			
40035	0022	Channel1 flow velocity f/s	4	IEEE
40036	0023			
40037	0024	Channel1 flow velocity in/s	4	IEEE
40038	0025			
40039	0026	Channel1 flow volumetric m3/h	4	IEEE
40040	0027			
40041	0028	Channel1 flow volumetric m3/min	4	IEEE
40042	0029			
40043	002A	Channel1 flow volumetric l/h	4	IEEE
40044	002B			
40045	002C	Channel1 flow volumetric l/min	4	IEEE
40046	002D			

40047	002E	Channel1 flow volumetric l/s	4	IEEE
40048	002F			
40049	0030	Channel1 flow volumetric Usgall/h	4	IEEE
40050	0031			
40051	0032	Channel1 flow volumetric Usgall/min	4	IEEE
40052	0033			
40053	0034	Channel1 flow volumetric Usgall/s	4	IEEE
40054	0035			
40055	0036	Channel1 flow volumetric bbl/d	4	IEEE
40056	0037			
40057	0038	Channel1 flow volumetric bbl/h	4	IEEE
40058	0039			
40059	003A	Channel1 flow volumetric bbl/min	4	IEEE
40060	003B			
40061	003C	Channel1 flow volumetric g/s	4	IEEE
40062	003D			
40063	003E	Channel1 flow volumetric t/h	4	IEEE
40064	003F			
40065	0040	Channel1 flow volumetric kg/h	4	IEEE
40066	0041			
40067	0042	Channel1 flow volumetric m3	4	IEEE
40068	0043			
40069	0044	Channel1 flow volumetric l	4	IEEE
40070	0045			
40071	0046	Channel1 flow volumetric Usgall	4	IEEE
40072	0047			
40073	0048	Channel1 flow volumetric bbl	4	IEEE
40074	0049			
40075	004A	Channel1 flow volumetric g	4	IEEE
40076	004B			
40077	004C	Channel1 flow volumetric t	4	IEEE
40078	004D			
40079	004E	Channel1 flow volumetric kg	4	IEEE
40080	004F			
40081	0050	Channel1 HQM kW	4	IEEE
40082	0051			
40083	0052	Channel1 HQM MW	4	IEEE
40084	0053			
40085	0054	Channel1 HQM J	4	IEEE
40086	0055			
40087	0056	Channel1 HQM kJ	4	IEEE
40088	0057			
40089	0058	Channel1 HQM MJ	4	IEEE
40090	0059			
40091	005A	SPARE		
40092	005B	SPARE		
40093	005C	SPARE		
40094	005D	SPARE		
40095	005E	SPARE		
40096	005F	SPARE		
40097	0060	SPARE		
40098	0061	SPARE		

40099	0062	SPARE		
40100	0063	SPARE		
40101	0064	SPARE		
40102	0065	SPARE		
40103	0066	SPARE		
40104	0067	SPARE		
40105	0068	SPARE		
40106	0069	SPARE		
40107	006A	SPARE		
40108	006B	SPARE		
40109	006C	SPARE		
40110	006D	SPARE		
40111	006E	SPARE		
40112	006F	SPARE		
40113	0070	SPARE		
40114	0071	SPARE		
40115	0072	SPARE		
40116	0073	SPARE		
40117	0074	SPARE		
40118	0075	SPARE		
40119	0076	SPARE		
40120	0077	SPARE		
40121	0078	SPARE		
40122	0079	SPARE		
40123	007A	SPARE		
40124	007B	SPARE		
40125	007C	SPARE		
40126	007D	SPARE		
40127	007E	SPARE		
40128	007F	SPARE		
40129	0080	SPARE		
40130	0081	SPARE		
40131	0082	SPARE		
40132	0083	SPARE		
40133	0084	SPARE		
40134	0085	SPARE		
40135	0086	SPARE		
40136	0087	SPARE		
40137	0088	SPARE		
40138	0089	SPARE		
40139	008A	SPARE		
40140	008B	SPARE		
40141	008C	SPARE		
40142	008D	SPARE		
40143	008E	SPARE		
40144	008F	SPARE		
40145	0090	SPARE		
40146	0091	SPARE		
40147	0092	SPARE		
40148	0093	SPARE		
40149	0094	SPARE		
40150	0095	SPARE		
40151	0096	SPARE		
40152	0097	SPARE		
40153	0098	SPARE		
40154	0099	SPARE		
40155	009A	SPARE		
40156	009B	SPARE		
40157	009C	SPARE		
40158	009D	SPARE		
40159	009E	SPARE		

40160	009F	SPARE		
40161	00A0	SPARE		
40162	00A1	SPARE		
40163	00A2	SPARE		
40164	00A3	SPARE		
40165	00A4	SPARE		
40166	00A5	SPARE		
40167	00A6	SPARE		
40168	00A7	SPARE		
40169	00A8	SPARE		
40170	00A9	SPARE		
40171	00AA	SPARE		
40172	00AB	SPARE		
40173	00AC	SPARE		
40174	00AD	SPARE		
40175	00AE	SPARE		
40176	00AF	SPARE		
40177	00B0	SPARE		
40178	00B1	SPARE		
40179	00B2	SPARE		
40180	00B3	SPARE		
40181	00B4	SPARE		
40182	00B5	SPARE		
40183	00B6	SPARE		
40184	00B7	SPARE		
40185	00B8	SPARE		
40186	00B9	SPARE		
40187	00BA	SPARE		
40188	00BB	SPARE		
40189	00BC	SPARE		
40190	00BD	SPARE		
40191	00BE	SPARE		
40192	00BF	SPARE		
40193	00C0	SPARE		
40194	00C1	SPARE		
40195	00C2	SPARE		
40196	00C3	SPARE		
40197	00C4	SPARE		
40198	00C5	SPARE		
40199	00C6	SPARE		
40200	00C7	SPARE		
40201	00C8	SPARE		
40202	00C9	SPARE		
40203	00CA	IDENTIFICATION STRING	2	UNICODE
40204	00CB	IDENTIFICATION STRING	2	UNICODE
40205	00CC	IDENTIFICATION STRING	2	UNICODE
40206	00CD	IDENTIFICATION STRING	2	UNICODE
40207	00CE	IDENTIFICATION STRING	2	UNICODE
40208	00CF	IDENTIFICATION STRING	2	UNICODE
40209	00D0	IDENTIFICATION STRING	2	UNICODE
40210	00D1	IDENTIFICATION STRING	2	UNICODE
40211	00D2	IDENTIFICATION STRING	2	UNICODE
40212	00D3	IDENTIFICATION STRING	2	UNICODE
40213	00D4	IDENTIFICATION STRING	2	UNICODE
40214	00D5	IDENTIFICATION STRING	2	UNICODE
40215	00D6	IDENTIFICATION STRING	2	UNICODE
40216	00D7	IDENTIFICATION STRING	2	UNICODE

40217	00D8	IDENTIFICATION STRING	2	UNICODE
40218	00D9	IDENTIFICATION STRING	2	UNICODE
40219	00DA	IDENTIFICATION STRING	2	UNICODE
40220	00DB	IDENTIFICATION STRING	2	UNICODE
40221	00DC	IDENTIFICATION STRING	2	UNICODE
40222	00DD	IDENTIFICATION STRING	2	UNICODE
40223	00DE	IDENTIFICATION STRING	2	UNICODE
40224	00DF	IDENTIFICATION STRING	2	UNICODE
40225	00E0	IDENTIFICATION STRING	2	UNICODE
40226	00E1	IDENTIFICATION STRING	2	UNICODE
40227	00E2	IDENTIFICATION STRING	2	UNICODE
40228	00E3	IDENTIFICATION STRING	2	UNICODE
40229	00E4	IDENTIFICATION STRING	2	UNICODE
40230	00E5	IDENTIFICATION STRING	2	UNICODE
40231	00E6	IDENTIFICATION STRING	2	UNICODE
40232	00E7	IDENTIFICATION STRING	2	UNICODE
40233	00E8	IDENTIFICATION STRING	2	UNICODE
40234	00E9	IDENTIFICATION STRING	2	UNICODE
40235	00EA	IDENTIFICATION STRING	2	UNICODE
40236	00EB	IDENTIFICATION STRING	2	UNICODE
40237	00EC	IDENTIFICATION STRING	2	UNICODE
40238	00ED	IDENTIFICATION STRING	2	UNICODE
40239	00EE	IDENTIFICATION STRING	2	UNICODE
40240	00EF	IDENTIFICATION STRING	2	UNICODE
40241	00F0	IDENTIFICATION STRING	2	UNICODE
40242	00F1	IDENTIFICATION STRING	2	UNICODE
40243	00F2	IDENTIFICATION STRING	2	UNICODE
40244	00F3	IDENTIFICATION STRING	2	UNICODE
40245	00F4	IDENTIFICATION STRING	2	UNICODE
40246	00F5	IDENTIFICATION STRING	2	UNICODE
40247	00F6	IDENTIFICATION STRING	2	UNICODE
40248	00F7	IDENTIFICATION STRING	2	UNICODE
40249	00F8	IDENTIFICATION STRING	2	UNICODE
40250	00F9	IDENTIFICATION STRING	2	UNICODE
40251	00FA	IDENTIFICATION STRING	2	UNICODE
40252	00FB	IDENTIFICATION STRING	2	UNICODE
40253	00FC	IDENTIFICATION STRING	2	UNICODE
40254	00FD	IDENTIFICATION STRING	2	UNICODE
40255	00FE	IDENTIFICATION STRING	2	UNICODE
40256	00FF	IDENTIFICATION STRING	2	UNICODE
40257	0100			
TO		Channel 2 same as channel 1		
40511	01FF			
60001	0000	Channel 1 Totalizer reset	2	16 BIT INT
60002	0001	Channel 2 Totalizer reset	2	16 BIT INT
60003	0002	SPARE	2	16 BIT INT
60004	0003	SPARE	2	16 BIT INT
60005	0004	SPARE	2	16 BIT INT
60006	0005	SPARE	2	16 BIT INT

60007	0006	SPARE	2	16 BIT INT
60008	0007	SPARE	2	16 BIT INT
60009	0008	SPARE	2	16 BIT INT
60010	0009	SPARE	2	16 BIT INT

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