Modbus Protocol
For FTSXX

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Modbus Protocol of FTSxx

Introduction

This document describes the protocol detail of Modbus for FTSXX

Hardware interface

- The interface on the sensor is RS-485.
- Hardware named D+, D-
- Meet the standards TIA/EIA-232-F and TIA/EIA-485-A

RS-485 Slave Address, Baud rate, Data format

- Slave Address: 1~247
- Baud rate: 9600, 19200, 38400, 57600, 115200
- Parity: None, Even, Odd
- Data length: 8 bit
- Stop bit: 1 or 2 bit
- Default Address = 1, Data format= 9600, N81

About Modbus (ref PI–MBUS–300)

- Support RTU mode
- Broadcast support (Address 0)
- Bit addressable items (i.e. Coils and Discrete inputs) will not be implemented
- Measurement Values are represented in IEEE 754 single-precision 32-bit floating point type http://en.wikipedia.org/wiki/IEEE_754
- Modbus protocol structure:
  - 1st byte: Address (1~247)
  - 2nd byte: Function code (1 byte)
  - 3~Nth bytes: Data bytes
  - N+1th~N+2th byte: CRC (16 bits), LSB first

Modbus Protocol of FTSxx

Instrument Holding Registers for application engineering (ex: ModScan)

Item No.	Address	Address HEX	Parameter	Point Type	Data Type	Unit	Value
1	1025	0401H	Flow Velocity	Holding Register	Floating Pt.	m/s	
2	1029	0405H	Flow Velocity	Holding Register	Floating Pt.	ft/s	
3	1033	0409H	Flow Velocity	Holding Register	Floating Pt.	km/h	
4	1037	040DH	Flow Velocity	Holding Register	Floating Pt.	mph	
5	1041	0411H	Flow Velocity	Holding Register	Floating Pt.	knot	
6	1045	0415H	Temperature	Holding Register	Floating Pt.	℃	
7	1049	0419H	Temperature	Holding Register	Floating Pt.	℉	
8	1057	0421H	Flow Velocity	Holding Register	32-bit Integer	m/s	x10000
9	1061	0425H	Flow Velocity	Holding Register	32-bit Integer	ft/s	x10000
10	1065	0429H	Flow Velocity	Holding Register	32-bit Integer	km/h	x10000
11	1069	042DH	Flow Velocity	Holding Register	32-bit Integer	mph	x10000
12	1073	0431H	Flow Velocity	Holding Register	32-bit Integer	knot	x10000
13	1077	0435H	Temperature	Holding Register	32-bit Integer	℃	x10000
14	1081	0439H	Temperature	Holding Register	32-bit Integer	℉	x10000

Modbus Protocol of FTSxx

Instrument Holding Registers for software engineering

Item No.	Starting Address		Parameter	Data Bytes	Data Type	Unit	Value
	Hi byte	Lo Byte					
Information							
1	00	30-3F	Serial Number	16 bytes	ASCII		
2	00	40-49	Firmware version	10 bytes	ASCII		
RS-485 Slave Address, Baud rate, Data format							
3	00	4C	Slave Address	1 bytes	unsigned Integer		1-247
4	00	4E	Baud rate	1 bytes	unsigned Integer		0: 9600 1: 19200 2: 38400 3: 57600 4: 115200
5	00	50	Data type	1 bytes	unsigned Integer		0: N81 1: N82 2: E81 3: E82 4: O81 5: O82
Physical Quantities							
6	04	00	Flow Velocity	4 bytes	IEEE 754	m/s	
7	04	04	Flow Velocity	4 bytes	IEEE 754	ft/s	
8	04	08	Flow Velocity	4 bytes	IEEE 754	km/h	
9	04	0C	Flow Velocity	4 bytes	IEEE 754	mph	
10	04	10	Flow Velocity	4 bytes	IEEE 754	knot	
11	04	14	Temperature	4 bytes	IEEE 754	℃	
12	04	18	Temperature	4 bytes	IEEE 754	°F	
13	04	20	Flow Velocity	4 bytes	32-bit Integer	m/s	X10000
14	04	24	Flow Velocity	4 bytes	32-bit Integer	ft/s	X10000
15	04	28	Flow Velocity	4 bytes	32-bit Integer	km/h	X10000
16	04	2C	Flow Velocity	4 bytes	32-bit Integer	mph	X10000
17	04	30	Flow Velocity	4 bytes	32-bit Integer	knot	X10000
18	04	34	Temperature	4 bytes	32-bit Integer	℃	X10000
19	04	38	Temperature	4 bytes	32-bit Integer	°F	X10000

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ASCII format, Item No. 1-2

1st Word		2nd Word		3rd Word		4th Word		5th Word		6th Word		7th Word		8th Word	
Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte	Hi byte	Lo byte

"ABCDEF0123456789" is represented as

<41><42><43><44><45><46><30><31><32><33><34><35><36><37><38><39>

IEEE754 format, Item No. 6-14

Data Hi Word, Hi Byte	Data Hi Word, Lo Byte	Data Lo Word, Hi Byte	Data Lo Word, Lo Byte
SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM

Where

S represents the sign bit where 1 is negative and 0 is positive

E is the two's complement exponent with an offset of 127 i.e. an exponent of zero is represented by 127, an exponent of 1 by 128 etc.

M is the 23-bit normal mantissa. The highest bit is always 1 and, therefore, is not stored.

Using the above format the floating point number 23.83 is represented as <41><BE><A3><D7>:

Data Hi Word, Hi Byte	Data Hi Word, Lo Byte	Data Lo Word, Hi Byte	Data Lo Word, Lo Byte
0x41	0xBE	0xA3	0xD7

Modbus Protocol of FTSxx

Communication Examples

Read Flow Velocity [m/s] IEEE 754

Request the host (PC or PLC) to polling the data of FTSXX			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	04	Byte	1
Starting Address Lo	00	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	02	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Flow Velocity IEEE 754 are 0x0400 ~ 0x0403

Response FTSXX response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	04	Byte	1
IEEE 754 Data Lo Word, Hi Byte	0x77	Byte	1
IEEE 754 Data Lo Word, Lo Byte	0xCF	Byte	1
IEEE 754 Data Hi Word, Hi Byte	0x42	Byte	1
IEEE 754 Data Hi Word, Lo Byte	0x13	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the floating point number 36.87 is represented as <42><13><77><CF>:

Modbus Protocol of FTSxx

Read Flow Velocity [m/s] 32-bit Integer

Request the host (PC or PLC) to polling the data of FTSXX			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	04	Byte	1
Starting Address Lo	20	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	02	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Flow Velocity 32-bit Integer are 0x0420 ~ 0x0423

Response FTSXX response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	04	Byte	1
Hi Word, Hi Byte	0x11	Byte	1
Hi Word, Lo Byte	0x22	Byte	1
Lo Word, Hi Byte	0x33	Byte	1
Lo Word, Lo Byte	0x44	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the 32-bit Integer number 287454020 is represented as <11><22><33><44>

Example Flow velocity is 28745.4020 [m/s]

Modbus Protocol of FTSxx

Read Serial No.

Request the host (PC or PLC) to polling the data of FTSXX			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	00	Byte	1
Starting Address Lo	30	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	08	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Serial No. are 0x30 ~ 0x3F

Response FTSXX response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	10	Byte	1
1st Word, Lo byte	0x4E	Byte	1
1st Word, Hi byte	0x53	Byte	1
2nd Word, Lo byte	0x31	Byte	1
2nd Word, Hi byte	0x30	Byte	1
3rd Word, Lo byte	0x33	Byte	1
3rd Word, Hi byte	0x32	Byte	1
4th Word, Lo byte	0x35	Byte	1
4th Word, Hi byte	0x34	Byte	1
5th Word, Lo byte	0x37	Byte	1
5th Word, Hi byte	0x36	Byte	1
6th Word, Lo byte	0x39	Byte	1
6th Word, Hi byte	0x38	Byte	1
7th Word, Lo byte	0x42	Byte	1
7th Word, Hi byte	0x41	Byte	1
8th Word, Lo byte	0x44	Byte	1
8th Word, Hi byte	0x43	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*example of Serial No. is “SN0123456789ABCD”

Modbus Protocol of FTSxx

Read Firmware Version

Request the host (PC or PLC) to polling the data of FTSXX			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	00	Byte	1
Starting Address Lo	40	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	05	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Firmware Version are 0x40 ~ 0x49

Response FTSXX response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	03	Byte	1
Byte Count	0A	Byte	1
1st Word, Lo byte	0x31	Byte	1
1st Word, Hi byte	0x56	Byte	1
2nd Word, Lo byte	0x33	Byte	1
2nd Word, Hi byte	0x32	Byte	1
3rd Word, Lo byte	0x2E	Byte	1
3rd Word, Hi byte	0x34	Byte	1
4th Word, Lo byte	0x36	Byte	1
4th Word, Hi byte	0x35	Byte	1
5th Word, Lo byte	0x38	Byte	1
5th Word, Hi byte	0x37	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*example of Firmware Version is “V1234.5678”

Revise history

- V1 2015_08_07 Initial