



Modbus Protocol eyc-tech FDM06-P

Pitot Tube Thermal Mass Flowmeter



Introduction

This document describes the protocol detail of Modbus for FDM06-P Pitot Tube Thermal Mass Flowmeter.

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

Instrument Holding Registers for measurement engineering (ex: ModScan)

Item No.	Address	Address HEX	Parameter	Point Type	Data Type	Unit
1	1	0001H	OUT1 (Configurable) ^[1]	Holding Register	Floating Pt.	--
2	5	0005H	OUT2 (Configurable) ^[2]	Holding Register	Floating Pt.	--
3	9	0009H	Raw Flow volume	Holding Register	Floating Pt.	m/s
4	13	000DH	CTA Voltage	Holding Register	Floating Pt.	Volt

^{[1][2]} Parameter could be configured by display configuration registers

- The base address is 1 rather than 0 in ModScan application.
- The register shown on the table is 1 byte whereas the ModScan 2 bytes.
- So the corresponding value against address 5 of the "table" would be address 40003 of the ModScan

Instrument Hold

Item No.	Address	Address HEX
1	01	
2	05	
3	09	
4	13	

1 byte

ModSca1

Address: 0001

Length: 8 03:

40001:	<3B3EH>	2
40002:	<41C0H>	4
40003:	<A7EDH>	
40004:	<4273H>	
40005:	<2000H>	
40006:	<4495H>	
40007:	<0000H>	
40008:	<0000H>	

2 byte

Instrument Holding Registers for output configuration registers

Analog Register Group

Item No.	Addresses	Address HEX	Register	Description	Possible Value
1	137	0089H	Analog Type	Type Selection	0: Voltage 1: Current
2	139	008BH	Analog Upper	Analog Output Upper x10	0~100 (Volt) or 0~200 (mA) (Scale 1/10)
3	141	008DH	Analog Lower	Analog Output Lower x10	0~100 (Volt) or 0~200 (mA) (Scale 1/10)
4	143	008FH	Output Quantity	Analog Output Quantity Selection	0: Flow Velocity (m/s) 1: Flow Velocity (ft/s) 2: Flow Rate (L/min) 3: Flow Rate (m ³ /h) 4: Flow Rate (m ³ /m) 5: Reserved 6: Reserved 7: Reserved
5	145	0091H	Digital Upper	Digital Span Upper(integer with decimal), signed integer 32bits	-99999~99999 (decimal position refer to item 8, bit1~3)
6	149	0095H	Digital Lower	Digital Span Lower(integer with decimal), signed integer 32bits	-99999~99999 (decimal position refer to item 8, bit1~3)
7	153	0099H	Response Rate	Response Rate, Additional 3 Seconds of T90 / Step	0~100 (0:Low, 100:Fast)
8	155	009BH	Alarm Mode	Unsigned integer Bit0: Output Acts Alarm Mode Bit1~Bit3: Decimal Position of Digital Span	Bit0: 0 if Alarm Mode Disable, 1: if Alarm Mode Enable Bit1~3: 0~4
9	157	009DH	Alarm Upper	Alarm On Trigger(integer with decimal), signed integer 32bits	-99999~99999 (decimal position refer to item 8, bit1~3)
10	161	00A1H	Alarm Lower	Alarm Off Trigger(integer with decimal), signed integer 32bits	-99999~99999 (decimal position refer to item 8, bit1~3)
11	165	00A5H	Level Upper	Alarm On Output x10	0~100 (Volt) or 0~200 (mA) (Scale 1/10)
12	167	00A7H	Level Lower	Alarm Off Output x10	0~100 (Volt) or 0~200 (mA) (Scale 1/10)

Relay Register Group

Item No.	Address	Address HEX	Register	Description	Possible Value
1	169	00A9H	Alarm Mode	Unsigned integer Bit0: Relay Alarm Mode	Bit0: 0 if Upscale Alarm Mode 1: if Downscale Alarm Mode
2	189	00BDH	Alarm Set Point	Alarm On Trigger(integer with decimal), signed integer 32bits	-99999~99999 or 0~99999999 if Totalizer mode (decimal position refer to item 5, bit1~3)
3	193	00C1H	Alarm Hysteresis	Alarm Off Trigger(integer with decimal), signed integer 32bits	0~99999 or 0~99999999 if Totalizer mode (decimal position refer to item 5, bit1~3)
4	197	00C5H	Delay On	Time (second) of delay on	0~3600
5	199	00C7H	Delay Off	Time (second) of delay off	0~3600

Display Register Group

Item No.	Address	Address HEX	Register	Description	Possible Value
1	1393	0571H	Line 1	Unsigned integer Bit7..0: Quantity Selection Bit8~Bit10: Position of Decimal Places, this setting affects display only	Bit7..0: 0: Flow Velocity (m/s) 1:Flow Velocity (ft/s) 2:Flow Rate (L/min) 3:Flow Rate (m³/h) 4:Flow Rate (m³/m) 5:Reserved 6:Reserved 7:Reserved 8: m³ 9:L 10:mL 11:ft³ 12:in³ 13:gal 14:gal,uk Bit8..10: 3 decimal places max.
2	1395	0573H	Line 2	Unsigned integer Bit7..0: Quantity Selection Bit8~Bit10: Position of Decimal Places, this setting affects display only	Bit7..0: 0: Flow Velocity (m/s) 1:Flow Velocity (ft/s) 2:Flow Rate (L/min) 3:Flow Rate (m³/h) 4:Flow Rate (m³/m) 5:Reserved 6:Reserved

					7:Reserved 8: m ³ 9:L 10:mL 11:ft ³ 12:in ³ 13:gal 14:gal,uk Bit8..10: 3 decimal places max.
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The actual units available will vary depending on the model type. E.g. the unit m³ only available if Totalizer is equipped.

Instrument Holding Registers for application engineering

Item No.	Address	Address HEX	Parameter	Point Type	Data Type	Unit
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 Rate	Holding Register	Floating Pt.	L/min
4	1037	040DH	Flow Rate	Holding Register	Floating Pt.	m ³ /h
5	1041	0411H	Flow Rate	Holding Register	Floating Pt.	m ³ /min
6	1057	0421H	Flow Velocity	Holding Register	32-bit Integer	m/s
7	1061	0425H	Flow Velocity	Holding Register	32-bit Integer	ft/s
8	1065	0429H	Flow Rate	Holding Register	32-bit Integer	L/min
9	1069	042DH	Flow Rate	Holding Register	32-bit Integer	m ³ /h
10	1073	0431H	Flow Rate	Holding Register	32-bit Integer	m ³ /min
11	1153	00481H	Totalizer 1	Holding Register	32-bit Integer	m ³ (default*)
12	1157	00485H	Totalizer 2	Holding Register	32-bit Integer	m ³ (default*)

*The actual volumetric unit is programmable. User may assign the unit through front keypad menu or FDM06-P UI. The FDM06-P UI is free, and it can be downloaded from EYC website.

Remark: The base address is 1 rather than 0 in ModScan application. One register occupies 2 bytes memory address and one floating number splits into 2 registers. Thus, one measure occupies 4 bytes memory address or 2 registers length of count.

Instrument Holding Registers for additional engineering

Item No.	Address	Address HEX	Parameter	Data Bytes	Data Type	Unit	Value
1	1357	054DH	Flow Velocity Offset	4 bytes	IEEE 754	m/s	0
2	1361	0551H	Flow Low Cut-off	4 bytes	IEEE 754	m/s	0
3	1365	0555H	Flow Scaler	4 bytes	IEEE 754	N/A	1
4	1369	0559H	Flow Profile Factor	4 bytes	IEEE 754	N/A	1

Instrument Holding Registers for interpolation engineering

Item No.	Address	Address HEX	Parameter	Data Type	Unit
1	649	0289H	Unit Flow Velocity of Point1	Floating Pt.	m ³ /h
2	653	028DH	Unit Flow Velocity of Point2	Floating Pt.	m ³ /h
3	657	0291H	Unit Flow Velocity of Point3	Floating Pt.	m ³ /h
4	661	0295H	Unit Flow Velocity of Point4	Floating Pt.	m ³ /h
5	665	0299H	Unit Flow Velocity of Point5	Floating Pt.	m ³ /h
6	669	029DH	Unit Flow Velocity of Point6	Floating Pt.	m ³ /h
7	673	02A1H	Unit Flow Velocity of Point7	Floating Pt.	m ³ /h
8	677	02A5H	Unit Flow Velocity of Point8	Floating Pt.	m ³ /h
9	681	02A9H	Unit Flow Velocity of Point9	Floating Pt.	m ³ /h
10	685	02ADH	Unit Flow Velocity of Point10	Floating Pt.	m ³ /h
11	689	02B1H	Standard Flow Velocity of Point1	Floating Pt.	m ³ /h
12	693	02B5H	Standard Flow Velocity of Point2	Floating Pt.	m ³ /h
13	697	02B9H	Standard Flow Velocity of Point3	Floating Pt.	m ³ /h
14	701	02BDH	Standard Flow Velocity of Point4	Floating Pt.	m ³ /h
15	705	02C1H	Standard Flow Velocity of Point5	Floating Pt.	m ³ /h
16	709	02C5H	Standard Flow Velocity of Point6	Floating Pt.	m ³ /h
17	713	02C9H	Standard Flow Velocity of Point7	Floating Pt.	m ³ /h
18	717	02CDH	Standard Flow Velocity of Point8	Floating Pt.	m ³ /h
19	721	02D1H	Standard Flow Velocity of Point9	Floating Pt.	m ³ /h
20	725	02D5H	Standard Flow Velocity of Point10	Floating Pt.	m ³ /h

Instrument Holding Registers for software engineering

Item No.	Address	Address HEX	Parameter	Data Bytes	Data Type	Unit	Value
Information							
1	81-96	0051H-0060H	Serial Number	16 bytes	ASCII		
2	97-112	0061H-0070H	Firmware version	16 bytes	ASCII		
RS-485 Slave Address, Baud rate, Data format							
3	129	0081H	Slave Address	2 bytes	unsigned Integer		1-247
4	131	0083H	Baud rate	2 bytes	unsigned Integer		0: 9600 1: 19200 2: 38400 3: 57600 4: 115200
5	133	0085H	Data type	2 bytes	unsigned Integer		0: N81 1: N82 2: E81 3: E82 4: O81 5: O82

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 in byte of hexadecimal as

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

IEEE754 format

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 in byte of hexadecimal 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

Communication Examples

Read Flow Rate [m³/h] IEEE 754

Request the host (PC or PLC) to polling the data of FDM06			
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	0D	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 0x0404 ~ 0x0405

Response FDM06 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	0xF9	Byte	1
IEEE 754 Data Lo Word, Lo Byte	0x59	Byte	1
IEEE 754 Data Hi Word, Hi Byte	0x42	Byte	1
IEEE 754 Data Hi Word, Lo Byte	0xC7	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the floating point number 99.98701 is represented in byte of hexadecimal as <42><C7><F9><59>

Read Flow Velocity [m/s] IEEE 754

Request the host (PC or PLC) to polling the data of FDM06			
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	01	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 0x041C ~ 0x041F

Response FDM06 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 13.5940533 is represented in byte of hexadecimal as <41> <59>< 81>< 3E>

Read Serial No.

Request the host (PC or PLC) to polling the data of FDM06			
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	50	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 FDM06 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"

Read Firmware Version

Request the host (PC or PLC) to polling the data of FDM06			
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	60	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 FDM06 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	0x2E	Byte	1
2nd Word, Lo byte	0x30	Byte	1
2nd Word, Hi byte	0x2E	Byte	1
3rd Word, Lo byte	0x31	Byte	1
3rd Word, Hi byte	0x00	Byte	1
4th Word, Lo byte	0x00	Byte	1
4th Word, Hi byte	0x00	Byte	1
5th Word, Lo byte	0x00	Byte	1
5th Word, Hi byte	0x00	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*example of Firmware Version is "1.0.1"

Set Flow Rate Offset

Request the host (PC or PLC) send command to FDM06			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Write Holding registers	10	Byte	1
Starting Address Hi	05	Byte	1
Starting Address Lo	4C	Byte	1
No. of registers Hi	00	Byte	1
No. of registers Lo	02	Byte	1
No. of registers byte count	04	Byte	1
Registers Value – High Byte of Command	5C	Byte	1
Registers Value – Low Byte of Command	29	Byte	1
Registers Value – High Byte of Argument	3F	Byte	1
Registers Value – Low Byte of Argument	0F	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Unit in m³/h, the flow rate reading will plus offset amount. E.g. $F_{DISP} = F_{RAW} + F_{offset}$

*Example of offset 0.56 m³/s and floating number 0.56 would be 0x3f0f5c29 in Hexadecimal Representation

Response FDM06 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Write Holding registers	10	Byte	1
Starting Address Hi	05	Byte	1
Starting Address Lo	4C	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

*FDM may reply error code 0x90 and exception code 0x02 if register under read only protection

Revise history

- V1 2025_04_18 Initial

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enhance your capability with **sensor** technology

Air flow | Humidity | Dew point | Differential pressure | Liquid flow

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