Modbus Protocol

eyc-tech TP05

Temperature Transmitter

Introduction

This document describes the protocol detail of Modbus for TP05 Temperature Transmitter.

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)

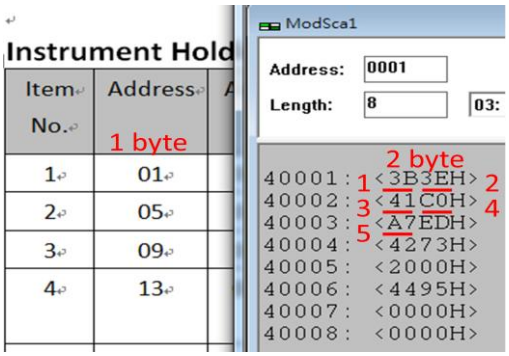
- Support RTU mode
- Broadcast support (Address 0)
- Bit addressable items (i.e. Coils and Discrete inputs) will not be implemented
- Measurement Values are represented in IEEE 754 single-precision 32-bit floating point type http://en.wikipedia.org/wiki/IEEE_754
- Modbus protocol structure:
  - 1st byte: 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	01	0001H	Temperature	HOLDING REGISTER	Floating Pt.	°C[1]
2	09	0001H	Temperature (Before Interpolation)	HOLDING REGISTER	Floating Pt.	°C
3	564	0234H	Temperature	HOLDING REGISTER	Integer	°Cx10[1]

[1][2] Unit could be configured by TP05 UI utility

- 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 Holding Registers for output configuration registers

Analog Output Group

Item No.	Address	Address HEX	Register	Description	Possible Value
1	145	0091H	Reserved	-	-
2	147	0093H	Analog Upper	Analog Output Upper x10	0~200 (mA) (Scale 1/10)
3	149	0095H	Analog Lower	Analog Output Lower x10	0~200 (mA) (Scale 1/10)
4	151	0097H	Reserved	-	-
5	153	0099H	Digital Upper	Digital Span Upper	1000 ~ -1000, signed integer 16bits
6	155	009BH	Digital Lower	Digital Span Lower	1000 ~ -1000, signed integer 16bits
7	157	009DH	Response Rate	Response Rate, Low Pass Filter Process T90 time	0~100 (seconds) (0:Fast, 100:Low)
8	159	009FH	Alarm Mode	Unsigned integer Bit0: Output Acts Alarm Mode Bit1: Scale Selection	Bit0: 0 if Alarm Mode Disable, 1: if Alarm Mode Enable Bit1: 0 if Low Alarm, 1 if High Alarm
9	161	00A1H	Set Point	Alarm Set Point, scale x10	10000 ~ -10000, signed integer 16bits, scale x10
10	163	00A3H	Hysteresis	Hysteresis Interval, scale x10	0 ~ -10000, signed integer 16bits, scale x10
11	165	00A5H	Activate Level	Alarm On Output x10	0~200 (mA) (Scale 1/10)
12	167	00A7H	Inactivate Level	Alarm Off Output x10	0~200 (mA) (Scale 1/10)

Measurement Group

Item No.	Address	Address HEX	Register	Description	Possible Value
1	529	0211H	Temperature Offset	Singed integer and scale x100	-32768 ~ 32767, in the other word -327.68 ~ 327.67 (°C or °F)
2	531	0213H	Temperature Unit	Unsigned integer	0 if degree Celsius, otherwise degree Fahrenheit
3	533	0215H	Response Rate	Response Rate, Low Pass Filter Process T90 time	0~100 (seconds) (0:Fast, 100:Low)

Instrument Holding Registers for interpolation engineering

Item No.	Address	Address HEX	Parameter	Data Type	Unit
1	347	015BH	Unit Temperature of Point1	Floating Pt.	℃
2	351	015FH	Unit Temperature of Point2	Floating Pt.	℃
3	355	0163H	Unit Temperature of Point3	Floating Pt.	℃
4	359	0167H	Unit Temperature of Point4	Floating Pt.	℃
5	363	016BH	Unit Temperature of Point5	Floating Pt.	℃
6	367	016FH	Unit Temperature of Point6	Floating Pt.	℃
7	371	0173H	Unit Temperature of Point7	Floating Pt.	℃
8	375	0177H	Unit Temperature of Point8	Floating Pt.	℃
9	379	017BH	Unit Temperature of Point9	Floating Pt.	℃
10	383	017FH	Unit Temperature of Point10	Floating Pt.	℃
11	387	0183H	Standard Temperature of Point1	Floating Pt.	℃
12	391	0187H	Standard Temperature of Point2	Floating Pt.	℃
13	395	018BH	Standard Temperature of Point3	Floating Pt.	℃
14	399	018FH	Standard Temperature of Point4	Floating Pt.	℃
15	403	0193H	Standard Temperature of Point5	Floating Pt.	℃
16	407	0197H	Standard Temperature of Point6	Floating Pt.	℃
17	411	019BH	Standard Temperature of Point7	Floating Pt.	℃
18	415	019FH	Standard Temperature of Point8	Floating Pt.	℃
19	419	01A3H	Standard Temperature of Point9	Floating Pt.	℃
20	423	01A7H	Standard Temperature of Point10	Floating Pt.	℃

Instrument Holding Registers for software engineering

Item No.	Address	Address HEX	Parameter	Data Type	Value
1	65-80	0041H-0050H	Model Name	ASCII	
2	81-96	0051H-0060H	Serial Number	ASCII	
3	97-112	0061H-0070H	Firmware version	ASCII	
4	129	0081H	Slave Address	unsigned Integer	1-247
5	131	0083H	Baud rate	unsigned Integer	0: 9600 1: 19200 2: 38400 3: 57600 4: 115200
6	133	0085H	Data type	unsigned Integer	0: N81 1: N82 2: E81 3: E82 4: O81 5: O82

ASCII format, Item No. 1-3

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 Temperature with IEEE 754 format

Request the host (PC or PLC) to polling the data of TP05			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Starting Address Hi	0x00	Byte	1
Starting Address Lo	0x00	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x02	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Temperature IEEE 754 are 0x0000 ~ 0x0003

TP05 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	0xA3	Byte	1
IEEE 754 Data Lo Word, Lo Byte	0xD7	Byte	1
IEEE 754 Data Hi Word, Hi Byte	0x41	Byte	1
IEEE 754 Data Hi Word, Lo Byte	0xBE	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the floating point number 23.83 is represented in byte of hexadecimal as <41><BE><A3><D7>

Read Temperature with Integer format

Request the host (PC or PLC) to polling the data of TP05			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Starting Address Hi	0x02	Byte	1
Starting Address Lo	0x33	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x01	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Temperature (Integer) are 0x0233 ~ 0x0234

TP05 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Address of Transmit	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Byte Count	0x02	Byte	1
Integer Data , Hi Byte	0x00	Byte	1
Integer Data, Lo Byte	0xEE	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

* the integer number 238 is represented in byte of hexadecimal as <00><EE> and the temperature reading is 23.8

Read Serial No.

Request the host (PC or PLC) to polling the data of TP05			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Starting Address Hi	0x00	Byte	1
Starting Address Lo	0x50	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x08	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Serial No. are 0x50 ~ 0x5F

TP05 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	0x10	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 TP05			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Starting Address Hi	0x00	Byte	1
Starting Address Lo	0x60	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x08	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Firmware Version are 0x60 ~ 0x6F

TP05 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Read Holding registers	0x03	Byte	1
Byte Count	0x10	Byte	1
1st Word, Lo byte	0x2E	Byte	1
1st Word, Hi byte	0x31	Byte	1
2nd Word, Lo byte	0x2E	Byte	1
2nd Word, Hi byte	0x31	Byte	1
3rd Word, Lo byte	0x2E	Byte	1
3rd Word, Hi byte	0x32	Byte	1
4th Word, Lo byte	0x00	Byte	1
4th Word, Hi byte	0x30	Byte	1
5th Word, Lo byte	0x00	Byte	1
5th Word, Hi byte	0x00	Byte	1
6th Word, Lo byte	0x00	Byte	1
6th Word, Hi byte	0x00	Byte	1
7th Word, Lo byte	0x00	Byte	1
7th Word, Hi byte	0x00	Byte	1
8th Word, Lo byte	0x00	Byte	1
8th Word, Hi byte	0x00	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*example of Firmware Version is “1.1.2.0”

Set Temperature Offset

Request the host (PC or PLC) send command to TP05			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Write Holding registers	0x10	Byte	1
Starting Address Hi	0x02	Byte	1
Starting Address Lo	0x10	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x01	Byte	1
No. of registers byte count	0x02	Byte	1
Registers Value – High Byte of Command	0x00	Byte	1
Registers Value – Low Byte of Command	0x7B	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*The temperature reading will plus offset amount. E.g. $T_{DISP} = T_{RAW} + T_{offset}$

*Example of offset 1.23 and hexadecimal number 0x007B(decimal 123)

TP05 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Slave Address	1~247	Byte	1
Write Holding registers	0x10	Byte	1
Starting Address Hi	0x02	Byte	1
Starting Address Lo	0x10	Byte	1
No. of registers Hi	0x00	Byte	1
No. of registers Lo	0x01	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 2026_03_16 Initial

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