Modbus Protocol
For GTH53_GM3X_GS3X

V4.0

Modbus Protocol of GTH53 / GS3X / GM3X

Introduction

This document describes the protocol detail of Modbus for GTH53 / GS3X / GM3X

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 Address, Baud rate, Data format

- 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)

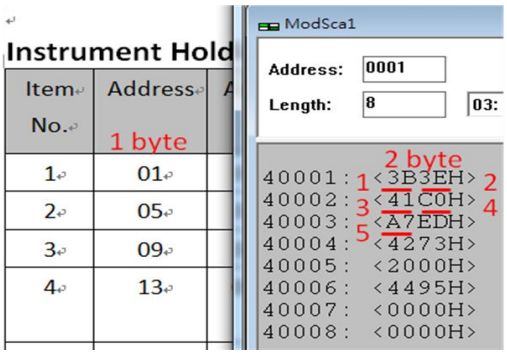
- Support RTU mode
- Broadcast support (Address 0)
- Bit addressable items (i.e. Coils and Discrete inputs) will not be implemented
- Measurement Values are represented in IEEE 754 single-precision 32-bit floating point type http://en.wikipedia.org/wiki/IEEE_754
- Modbus protocol structure:
  - 1st byte: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

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Instrument Holding Registers for application engineering (ex: ModScan)

Item No.	Address	Address HEX	Parameter	Point Type	Data Type	Value
1	01	0001H	Temperature	HOLDING REGISTER	Floating Pt.	℃
2	05	0005H	Relative Humidity	HOLDING REGISTER	Floating Pt.	%
3	09	0009H	Carbon Dioxide (CO2)	HOLDING REGISTER	Floating Pt.	PPM
4	13	000DH	Carbon Monoxide (CO)	HOLDING REGISTER	Floating Pt.	PPM
5	17	0011H	Volatile Organic Compound (VOC)	HOLDING REGISTER	Floating Pt.	PPM
6	21	0015H	Formaldehyde (HCHO)	HOLDING REGISTER	Floating Pt.	PPM

- 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



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Instrument Holding Registers (rev 0.5)

Item No.	Address	Address HEX	Parameter	Data Bytes	Data Type	Value
Information						
1	65-80	0041H-0050H	Model Name	16 bytes	ASCII	
2	81-96	0051H-0060H	Serial Number	16 bytes	ASCII	
3	97-112	0061H-0070H	Firmware version	16 bytes	ASCII	
RS-485 Slave Address, Baud rate, Data format						
4	129	0081H	Slave Address	1 bytes	unsigned Integer	1-247
5	131	0083H	Baud rate	1 bytes	unsigned Integer	0: 9600 1: 19200 2: 38400 3: 57600 4: 115200
6	133	0085H	Data type	1 bytes	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 Measurement Value

Request the host (PC or PLC) to polling the data of GTH53			
Field Name	Value	Type	Byte
Address of Transmit	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	00	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 Temperature are 0x00 ~ 0x03

Response GTH53 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Address of Transmit	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>

Modbus Protocol of GTH53 / GS3X / GM3X

Read Relativity Humidity Measurement Value

Request the host (PC or PLC) to polling the data of GTH53			
Field Name	Value	Type	Byte
Address of Transmit	1~247	Byte	1
Read Holding registers	03	Byte	1
Starting Address Hi	00	Byte	1
Starting Address Lo	04	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 Relativity Humidity are 0x04 ~ 0x07

Response GTH53 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Address of Transmit	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 in byte of hexadecimal as <42><13><77><CF>:

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Read Serial No.

Request the host (PC or PLC) to polling the data of GTH53			
Field Name	Value	Type	Byte
Address of Transmit	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 0x50 ~ 0x5F

Response GTH53 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Address of Transmit	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 GTH53 / GS3X / GM3X

Read Firmware Version

Request the host (PC or PLC) to polling the data of GTH53			
Field Name	Value	Type	Byte
Address of Transmit	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	08	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*Registers of Firmware Version are 0x60 ~ 0x6F

Response GTH53 response data to the host (PC or PLC)			
Field Name	Value	Type	Byte
Address of Transmit	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
6th Word, Lo byte	0x42	Byte	1
6th Word, Hi byte	0x41	Byte	1
7th Word, Lo byte	0x44	Byte	1
7th Word, Hi byte	0x43	Byte	1
8th Word, Lo byte	0x46	Byte	1
8th Word, Hi byte	0x45	Byte	1
CRC Lo	CRC Lo	Byte	1
CRC Hi	CRC Hi	Byte	1

*example of Firmware Version is “V1234.5678ABCDEF”

Modbus Protocol of GTH53 / GS3X / GM3X

Revise history

- V1 2014_12_27 Initial
- V2 2015_05_12 Add RS-485 setting information
- V3 2015_08_06
  - Error correction for Temperature and Humidity “Starting Address”
  - Error correction for slave address from 1 to 247
  - Add registers table for application engineering
- V4 2017_11_06 Integrated communication address for ModScan