RS485 MODBUS Protocol for

PST20 series MEMS Inclinometer

Revision History

Revision	Date	Change Description
A	9/30/2018	Initial Release

4 DATA READING AND COMMUNICATION

4.1 Preparation For Data Reading

1） After installing PST20, please correctly connect the power cable and the signal cable according to the connection definition；

2） Check and confirm the correct connection of power cable and signal cable before power on PST20. The sensor should be preheated for 1 minute after the first power on. Be careful not to restart PST20 continuously and instantaneously；

3） Reading the angle data of PST20 according to output type and communication protocol.

The output types and protocols of PST20 series inclinometers are diversified in order to meet different needs from cust omers. Users need to implement the specific outputs and protocols in the process of reading angle data. Users can also purchase the PSTsoftware which is applicable to communication with all PST series inclinometers to acquire and store angle datas of PST20 series inclinometers.

4.2 ModBus RTU Protocol (RS485 output)

When PST20 with RS485-ModBus RTU protocol communicates the default communication parameters is as below:

Items	Default value
baud rate	9600bps
Data bits	8bits
Start bit	1bit
Stop bit	1bit
Parity check	None
Flow control	None

Among the default parameters of above, user can modify the sensor’s baud rate according to the actual demand. The adjustable range is 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps.

4.2.1 ModBus RTU protocol Communication Frame Format

1) Request to read sensor angle and temperature data (function code 0x04)

Host request command				
Sensor address	Function code	Access register first address	Number of read registers	CRC
1Byte	0x04	0x03E8	2Bytes	2Bytes

Note：

- Sensor address is 1 byte data, default value is 0x01, valid range is 0x01 ~ 0x7F, user can modify.
- When reading sensor angle and temperature data, a maximum of 3 (0x0003) registers can be read. The corresponding data of the three registers are:

X axis angle (corresponding protocol address 0x03E8);

Y axis angle (corresponding protocol address 0x03E9);

Temperature data (corresponding to protocol address 0x03EA).

If one register value is read, the number of read registers is 0x0001 and the X-axis angle is read; if two registers are read, the number of read registers is 0x0002 and the X-axis and Y-axis angles are read; if three registers are read, the number of read registers is 0x0003 and the X-axis angle, Y-axis angle and temperature data are read.

- If the default address of the sensor (0x01) is used when connecting with PST20, the first address of the access register is 0x03E8, and the values of three registers are read, the CRC value is 0x307B.
- Sensor angle and temperature data are read-only attributes.

Sensor response				
Sensor address	Function code	Data bytes	Read register data	CRC
1Byte	0x04	1Byte	2Bytes or 4Bytes or 6Bytes	2Bytes

Note：

- Data bytes is the read register data bytes, 1byte. If the read register data is 2 bytes, the number of data bytes is 0x02, if the read register data is 4 bytes, the number of data bytes is 0x04; if the read register data is 6 bytes, the number of data bytes is 0x06；

- The register data is sensor angle and temperature data. If the request instruction reads one register, the reader data of the sensor response is 2 bytes and the X-axis angle data; if the request instruction reads two registers, the reader data of the sensor response is 4 bytes, the first 2 bytes are X-axis angle data, and the last 2 bytes are Y-axis angle data; if the request instruction reads 3 bytes. For each register, the sensor responds with 6 bytes of read register data, the first 2 bytes are X-axis angle data, the middle 2 bytes are Y-axis angle data, and the last 2 bytes are temperature data. Read register value is 2 bytes unsigned integer data, register value and decimal real value conversion relationship is as below:

Angle conversion:

Angle register value (2bytes signed inter) → convert → Decimal register value

Actual angle value = Decimal register value ÷ 32767.0 × angle range of sensor

Temperature conversion:

Temperature register value (2bytes signed inter) → convert → Decimal register value

Actual temperature value = Decimal register value ÷ 32767.0 × 125.0

Note: In angle data conversion, when the converted decimal register value is greater than 32767, it means that the acquired angle is negative.

The actual angle value at this time = (decimal register value -65536) divide 32767 x sensor angle range.

For example, sensor with range of ±30°, the angle range of sensor above should be 30.

2) Request to read sensor configuration parameters (function code 0x03)

Host request command				
Sensor address	Function code	Access register first address	Number of read registers	CRC
1Byte	0x03	0x03E8	0x0006	2Bytes

- The sensor address is 1 byte data, the default value is 0x01, the effective range is 0x01~0x7F, and the user can modify it.
- When the sensor configuration parameters are read, up to 6 registers (0x0006) can be read, and the corresponding data of 6 registers are:

X-axis zero offset (corresponding protocol address 0x03E8), 2 bytes unsigned integer;
Y-axis zero offset (corresponding protocol address 0x03E9), 2 bytes unsigned integer;
Sensor bandwidth (corresponding to protocol address 0x03EA), 2 bytes unsigned integer;
Filter coefficient (corresponding protocol address 0x03EB), 2 bytes unsigned integer;
Sensor address (corresponding to protocol address 0x03EC), 2 bytes unsigned integer;
Sensor baud rate (corresponding protocol address 0x03ED), 2 bytes unsigned integer.

- When connecting to a sensor, the default address of the sensor is 0x01 , the first address of the access register is 0x03E8, and six registers are read. The CRC value is 0x45B8.
- Sensor configuration parameters are read and write properties.
- The zero offset data read is the same as the angle conversion method.
- The default bandwidth of PST20 sensor is 3Hz, corresponding to the HEX code 0x00. User can set a bandwidth range of 3Hz (HEX code 0x00)、5Hz (HEX code 0x01) and 10Hz (HEX code 0x02).
- The default filtering coefficient of the PST20 tilt sensor is 200 (decimal), corresponding to the HEX value of 0x00C8. User can set a filter coefficient range of 0(HEX value 0x0000) ~65535 (HEX value 0xFFFF).
- The default address of the PST20 tilt sensor is 1, corresponding to the HEX value of 0x0001. User can set the address range to 1 (HEX value 0x0001) ~127 (HEX value 0x007F).
- The default baud rate of the PST20 tilt sensor is 9600bps, corresponding to the HEX code 0x0003. User can set baud rate range as follows:

Baud rate	HEX code
1200bps	0x0000
2400bps	0x0001
4800bps	0x0002
9600bps (default)	0x0003
19200bps	0x0004
38400bps	0x0005
57600bps	0x0006
115200bps	0x0007

3) Request to write to a single configuration register (function code 0x06).

Host request command				
Sensor address	Function code	Access register first address	Write register value	CRC
1Byte	0x06	2Bytes	2Bytes	2Bytes

Note：

- The sensor address is 1 byte data, the default value is 0x01, and the effective range is 0x01~0x7F. User can modify it. After modifying the address, a new modified address is needed for communication.
- When writing sensor configuration parameters, up to 6 (0x0006) registers can be written, and the corresponding data of 6 registers is:
  X axis zero offset (corresponding protocol address 0x03E8), 2 byte unsigned integer;
  Y axis zero offset (corresponding protocol address 0x03E9), 2 byte unsigned integer;
  Sensor bandwidth (corresponding to protocol address 0x03EA), 2 byte unsigned integer;
  Filter coefficient (corresponding protocol address 0x03EB), 2 byte unsigned integer;
  Sensor address (corresponding to protocol address 0x03EC), 2 byte unsigned integer;
  Sensor baud rate (corresponding protocol address 0x03ED), 2 byte unsigned integer.
- When writing zero offset data, the conversion relationship between decimal angle zero offset data and written register value is as follows:

Conversion { Decimal register value = （zero offset value ×32767.0 ÷ angle range of sensor） （Convert to integer）

Conversion { Decimal register value —convert→ hexadecimal register value（2Bytes）

- The default bandwidth of the PST20 is 3Hz, corresponding to the HEX code 0x00. User can set the bandwidth range to 3Hz (HEX code 0x0000), 5Hz (HEX code 0x0001) and 10Hz (HEX code 0x0002).
- The default filtering coefficient of the PST20 tilt sensor is 200 (decimal), corresponding to the HEX value of 0x00C8. User can set a filter coefficient range of 0 (HEX value 0x0000) ~65535 (HEX value 0xFFFF).
- The default address of the PST20 tilt sensor is 1, corresponding to the HEX value of 0x0001. User can set the address range to 1 (HEX value 0x0001) ~127 (HEX value 0x007F).
- The default baud rate of the PST20 is 9600bps, corresponding to the HEX code 0x0003. The user can set baud rate range as follows:

Baud rate	HEX code
1200bps	0x0000
2400bps	0x0001
4800bps	0x0002
9600bps (default)	0x0003
19200bps	0x0004
38400bps	0x0005
57600bps	0x0006
115200bps	0x0007

After modifying the baud rate, PST20 needs to be restarted, and the connection between the host computer and PST20 also needs to be restarted.

Angst+Pfister
Sensors and Power

We are here for you. Addresses and Contacts.

Headquarter Switzerland:

Angst+Pfister Sensors and Power AG
Thurgauerstrasse 66
CH-8050 Zurich
Phone +41 44 877 35 00
sensorsandpower@angst-pfister.com

Office Germany:

Angst+Pfister Sensors and Power Deutschland GmbH
Edisonstraße 16
D-85716 Unterschleißheim
Phone +49 89 374 288 87 00
sensorsandpower.de@angst-pfister.com

Scan here and get an overview of personal contacts!

sensorsandpower.angst-pfister.com