

Flexible Inclinometer Modbus RTU Protocol Manual

Version: V1.0 Date: 2026-01-20 Applicable Device: Flexible Inclinometer (RS485 Version)

1. Overview

This protocol defines the communication standards for the flexible inclinometer under Modbus RTU mode. The device acts as a Modbus Slave, supporting standard function codes **0x03** (Read Holding Registers), **0x06** (Write Single Register), and **0x10** (Write Multiple Registers).

This mode is designed to facilitate the integration of the device with PLCs, SCADA software, or industrial gateways.

2. Physical Interface & Communication Parameters

- **Physical Interface:** RS485 (Half-duplex)
- **Default Baud Rate:** 9600 bps
- **Data Bits:** 8
- **Parity:** None
- **Stop Bits:** 1
- **Default Slave Address:** **0x01** (Modifiable via register)

3. Data Encoding Format

- **Byte Order:** Big-Endian (ABCD). High byte first, low byte second.
- **Floating Point (Float):** Follows the IEEE-754 standard, occupying 2 registers (4 bytes).
Example: The floating-point number 12.05 in hex is **0x4140CCCD**.
Transmission Sequence: Register N (High Word **0x4140**) → Register N+1 (Low Word **0xCCCD**).
- **Long Integer / Long Address:** 4-byte unsigned integer, occupying 2 registers.

4. Register Address Mapping Table

All registers are mapped as Holding Registers, corresponding to function code **0x03**.

4.1 Real-Time Data Area (Read Only)

This area stores the real-time data collected by the sensor. It is recommended that the host computer reads this cyclically.

PLC Address	Start Addr (Hex)	Data Name	Data Type	Length	Unit/ Desc.	Remarks
40001	0x0000	Axis A Data (X)	Float	2 Reg	mm	Corresponds to proprietary protocol Axis A data
40003	0x0002	Axis B Data (Y)	Float	2 Reg	mm	Corresponds to proprietary protocol Axis B data
40005	0x0004	Axis Z Data	Float	2 Reg	mm	Corresponds to proprietary protocol Axis Z data
40007	0x0006	Power Supply Voltage	Float	2 Reg	V	
40009	0x0008	Firmware Version	Float	2 Reg	-	
40011	0x000A	Device Status	Uint16	1 Reg	hex	0x0003=Normal, 0x00FD=Range Exceeded
40012	0x000B	Current Range Type	Uint16	1 Reg	-	Corresponds to proprietary protocol Range Data
40013	0x000C	Temperature	Float	2 Reg	°C	Temperature

4.2 Device Configuration Area (Read/Write)

This area is used to query the device identity or modify communication parameters. After modifying address parameters, a reboot or using the new address for communication is required.

PLC Address	Start Addr (Hex)	Data Name	Data Type	Length	R/ W	Description
40101	0x0064	Device Long Address (High)	Uint16	1 Reg	R/ W	High 16-bits of the 4-byte fixed address
40102	0x0065	Device Long Address (Low)	Uint16	1 Reg	R/ W	Low 16-bits of the 4-byte fixed address
40103	0x0066	Modbus Slave Address	Uint16	1 Reg	R/ W	Range 1~247 (Default 1)
40104	0x0067	Work Mode Control	Uint16	1 Reg	W	Write 1 = Sleep immediately; Write 0 = Wakeup/Normal
40105	0x0068	Baud Rate Setting	Uint16	1 Reg	R/ W	0=9600, 1=115200 (Reserved function)

5. Communication Message Examples

5.1 Read Sensor Real-Time Data

Scenario: Read Axis A, Axis B, Axis Z, and Voltage data (4 floats in total, 8 registers).

Host Sends (Hex):

01 03 00 00 00 08 44 0C

01: Slave Address

03: Function Code

00 00: Start Register Address (Axis A)

00 08: Number of registers to read (8 registers = 16 bytes)

44 0C: CRC Checksum

Slave Returns (Hex):

01 03 10 3F AE 14 7B C0 1E 14 7B 44 79 23 D7 41 40 CC CD [CRC_L] [CRC_H]

10: Number of bytes returned (16 Bytes)

3F AE 14 7B: Axis A Data (1.36)

C0 1E 14 7B: Axis B Data (-2.47)

44 79 23 D7: Axis Z Data (996.56)

41 40 CC CD: Voltage Data (12.05V)

(Note: Data example is taken from v2026 proprietary protocol example 11111111)

5.2 Modify Modbus Slave Address

Scenario: Modify the device's Modbus ID from 01 to 02.

Host Sends (Hex):

01 06 00 66 00 02 E8 14

00 66: Modbus ID Configuration Register Address (40103)

00 02: New ID value

Slave Returns (Hex):

01 06 00 66 00 02 E8 14

Returning the original message indicates successful writing. Subsequent access must use address 02.

5.3 Read Device Long Address (Unique ID)

Scenario: Read the device's factory unique long address (e.g., 21140001).

Host Sends (Hex):

01 03 00 64 00 02 85 D5

00 64: Long Address Start Register

00 02: Read 2 registers (32 bits)

Slave Returns (Hex):

01 03 04 21 14 00 01 [CRC]

21 14: Long Address High Word

00 01: Long Address Low Word

Merges to 0x21140001

6. Notes

- **Protocol Coexistence:** When the device is in a powered-on listening state, it will automatically identify the received message header. If it receives **0xCC**, it parses according to the proprietary protocol; if it receives the local Modbus ID, it parses according to the Modbus protocol.
- **Sleep Mechanism:** In Modbus mode, the device defaults to continuous working mode (similar to proprietary protocol **00 5A**) to ensure the latest data can be read at any time. For low power consumption, write a command to register **0x0067** to control sleep.
- **Exception Response:** If the host requests an illegal register address, the device will return Modbus exception code **02** (Illegal Data Address).