

# ST-730SS Series Turbidity Probe Modbus Communication User's Guide



USER GUIDE

## DEFAULT COMMUNICATION SETTINGS

- Baudrate: 9600bps
- Databit: 8-bit
- Stopbit: 1-bit
- Parity Check: Even
- Bus Type: RS485

## MODBUS RTU PROTOCOL SETTINGS

- Byte Order: CDAB
- Address Mode: Base 0
- Supported Function Code:
  - 03 – Read Holding Register
  - 06 – Write Single Register
  - 16 – Write Multiple Registers

## ST-730SS REGISTER MAP

Modbus Address: **15**

Product Number: **50262**

Turbidity Range: **0–100NTU**

Turbidity Unit: **NTU**

<b>Register Name</b>	<b>Register Address</b>	<b>Data Length</b>	<b>Data Type</b>
Turbidity Value	1006	32bit	Float
Cleanliness Index <sup>[1]</sup>	1010	32bit	Uint32
4-20mA Output	1014	32bit	Float
4-20mA Range	1016	16bit	Uint16
Calibration Command	1025	16bit	Uint16
Calibration Result	1031	16bit	Uint16
Calibration Solution	1050	32bit	Float
Modbus Address	1037	16bit	Uint16
Parity Check	1039	16bit	Uint16
Baudrate	1040	32bit	Uint32
System Command	1044	16bit	Uint16
Smoothing Factor	1046	32bit	Float
Product Number	41005	32bit	Uint32
System Error	41007	32bit	Uint16

[1] Cleanliness Index Range is 0–100, Higher Values indicate Cleaner Probe

## ZERO CALIBRATION

1. Rinse the probe with DI Water a few times
2. Fill the probe flow cell with DI Water via a pipette
3. Wait for Turbidity reading to stabilize
4. Write value 4 to calibration command register (1025), and wait for 1 second
5. Read from calibration result register (1031)
  - 0 – Calibration Success
  - Other – Calibration Failed

## LOW RANGE CALIBRATION

1. Rinse the probe with Turbidity Solution (e.g., 2NTU) a few times
2. Fill the probe flow cell with Turbidity Solution via a pipette
3. Wait for Turbidity reading to stabilize
4. Write Turbidity solution value (e.g., 2.0) to calibration solution register (1050) and wait for 1 second
5. Write value 3 to calibration command register (1025) and wait for 1 second
6. Read from calibration result register (1031)
  - 0 – Calibration Success
  - 2 – Calibration Failed, Invalid Low Range Slope

## HIGH RANGE CALIBRATION

1. Rinse the probe with Turbidity Solution (e.g., 100NTU) a few times
2. Fill the probe flow cell with Turbidity Solution via a pipette
3. Wait for Turbidity reading to stabilize
4. Write Turbidity solution value (e.g., 100.0) to calibration solution register (1050) and wait for 1 second
5. Write value 3 to calibration command register (1025) and wait for 1 second
6. Read from calibration result register (1031)
  - 0 – Calibration Success
  - 2 – Calibration Failed, Invalid High Range Slope

## PROCESS CALIBRATION

1. Write actual turbidity value to calibration solution register (1050), and wait for 1 second
2. Write value 6 to calibration command register (1025), and wait for 1 second
3. Read from calibration result register (1031)
  - 0 – Calibration Success
  - 1 – Calibration Failed



## RESTORE FACTORY DEFAULT CALIBRATION SETTINGS

1. Write 16 to system command register (1044)
2. Read from system error register (41007)
  - 517 – Restore Success
  - Others – Restore Failed

## CHANGE MODBUS ADDRESS

1. Write new Modbus address to Modbus address register (1037), and wait 1 second
2. Power cycle the probe to make the new address effective
  - **Note: Valid Modbus addresses range from 1 to 247**

## CHANGE MODBUS ADDRESS

1. Write new parity check value to parity check register (1039), and wait 1 second
2. Power cycle the probe to make the new parity check effective
  - **Note: Valid parity check values are 0, 1 and 2**
  - 0 - No Parity Check
  - 1 – ODD Parity Check
  - 2 – EVEN Parity Check

## CHANGE BAUDRATE

1. Write new baudrate value to baudrate register (1040), and wait 1 second
2. Power cycle the probe to make the new address effective
  - **Note: Valid Baudrate values are 9600, 19200, 38400, 57600 and 115200**



## ST-730SS MODBUS RTU EXAMPLE

Read Product Number

Modbus Request Packet (HEX Format) [0F 03 A0 2C 00 02 26 EC]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Starting Address</b>	2 Bytes	0xA02C
<b>Quantity of Registers</b>	2 Bytes	0x0002
<b>CRC</b>	2 Bytes	0x26EC

Modbus Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Byte Count</b>	1 Byte	0x04
<b>Registers Value</b>	4 Bytes	0xC4560000
<b>CRC</b>	2 Bytes	CRC Data

NOTE: Probe returns 4 bytes data 0xC4 0x56 0x00 0x00 in CDAB format, convert to ABCD format get 0x0000C456, further convert to Uint32 50262.

Read Turbidity Value

Modbus Request Packet (HEX Format) [0F 03 03 ED 00 02 55 54]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Starting Address</b>	2 Bytes	0x03ED
<b>Quantity of Registers</b>	2 Bytes	0x0002
<b>CRC</b>	2 Bytes	0x5554

Modbus Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Byte Count</b>	1 Byte	0x04
<b>Registers Value</b>	4 Bytes	0xC52C3FE2
<b>CRC</b>	2 Bytes	CRC Data

NOTE: Probe returns 4 bytes data 0xC5 0x2C 0x3F 0xE2 in CDAB format, convert to ABCD format get 0x3FE2C52C, further converts to float get 1.7716 NTU.

### Write Calibration Solution Value

Modbus Request Packet (HEX Format) [0F 10 04 19 00 02 04 00 00 40 00 05 21]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Starting Address</b>	2 Bytes	0x03ED
<b>Quantity of Registers</b>	2 Bytes	0x0002
<b>CRC</b>	2 Bytes	0x5554

### Modbus Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x03
<b>Byte Count</b>	1 Byte	0x04
<b>Registers Value</b>	4 Bytes	0xC52C3FE2
<b>CRC</b>	2 Bytes	CRC Data

*NOTE: Probe returns 4 bytes data 0xC5 0x2C 0x3F 0xE2 in CDAB format, convert to ABCD format get 0x3FE2C52C, further converts to float get 1.7716 NTU.*

### Write Zero Calibration Command

Request Packet (HEX Format) [0F 06 04 00 00 04 88 17]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Register Value</b>	2 Bytes	0x0004
<b>CRC</b>	2 Bytes	0x8817

### Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Byte Count</b>	2 Bytes	0x0400
<b>Registers Value</b>	2 Bytes	0x0004
<b>CRC</b>	2 Bytes	CRC Data

### Write Low Range Calibration Command

Request Packet (HEX Format) [0F 06 04 00 00 03 C9 D5]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Register Value</b>	2 Bytes	0x0003
<b>CRC</b>	2 Bytes	0xC9D5

### Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Registers Value</b>	2 Bytes	0x0003
<b>CRC</b>	2 Bytes	CRC Data

### Write High Range Calibration Command

Request Packet (HEX Format) [0F 06 04 00 00 03 C9 D5]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Register Value</b>	2 Bytes	0x0003
<b>CRC</b>	2 Bytes	0xC9D5

### Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Registers Value</b>	2 Bytes	0x0003
<b>CRC</b>	2 Bytes	CRC Data

### Write High Range Calibration Command

Request Packet (HEX Format) [0F 06 04 00 00 03 C9 D5]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Register Value</b>	2 Bytes	0x0006
<b>CRC</b>	2 Bytes	0x09D6

### Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0400
<b>Registers Value</b>	2 Bytes	0x0006
<b>CRC</b>	2 Bytes	CRC Data

### Write Restore Factory Default Calibration Command

Request Packet (HEX Format) [0F 06 04 13 00 10 79 DD]

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0413
<b>Register Value</b>	2 Bytes	0x0010
<b>CRC</b>	2 Bytes	0x79DD

### Response Packet

<b>Modbus Address</b>	1 Byte	0x0F
<b>Function Code</b>	1 Byte	0x06
<b>Starting Address</b>	2 Bytes	0x0413
<b>Registers Value</b>	2 Bytes	0x0010
<b>CRC</b>	2 Bytes	CRC Data