GI Instruments
Québec Inc.

SC7340 Turbidity Sensor

User Manual

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1 Principle

SC7340 using near-infrared（880nm）LED light sources, it meets ISO7027/EN27027 standard and sensors designed by scattered light principles.

Scattering method is a detector source emits lights (the measurement light) met suspended solids in sample water scattering occurs，And a light source into an optical detector at a 90 degree angle can detected scattered light (scattered light). Suspended solids or turbidity measurements according to the intensity of the detected scattered light . This is called the 90 ° scattered light method. This sensor with high sensitivity, simple optical structure, particles of various sizes have a balanced sensitivity. More turbid water, stronger the intensity of reflected light of suspended matter.

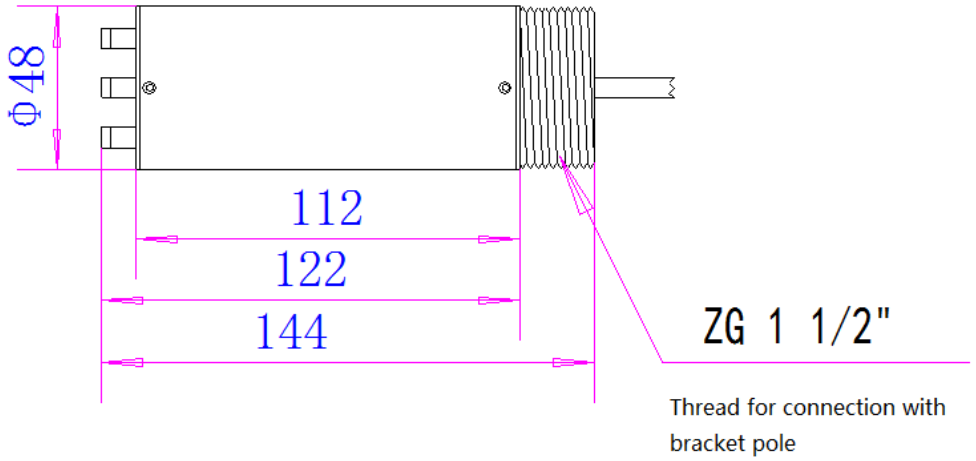
Smart digital sensors: Calibration data and measurement values are embedded in the sensor, with a diagnostic capability, Standard Modbus RTU protocol via RS485 transmit to GDC controller.

2 Specification

Measuring principle	90°scattered light	130°scattered light
Range	0~1000NTU 0~1250 mg/L	0~50000mg/L
Resolution	0.1NTU	10mg/l
Power supply voltage	DC 24V±10%	
power consumption	Normal：50mA ，clearing ：240mA	
Output	Modbus RS485	
Cleaning system	Automatic wiper cleaning system	
Cleaning interval	Cleaning interval should be greater than 10 minutes	
Operating temperature	0~40°C no freezing	
Material	Housing ：SUS 316L， Optical window： sapphire glass，Cable ：PVD	
IP rating	IP68 , maximum depth of 2 meters	
Cable length	Standard 10m	

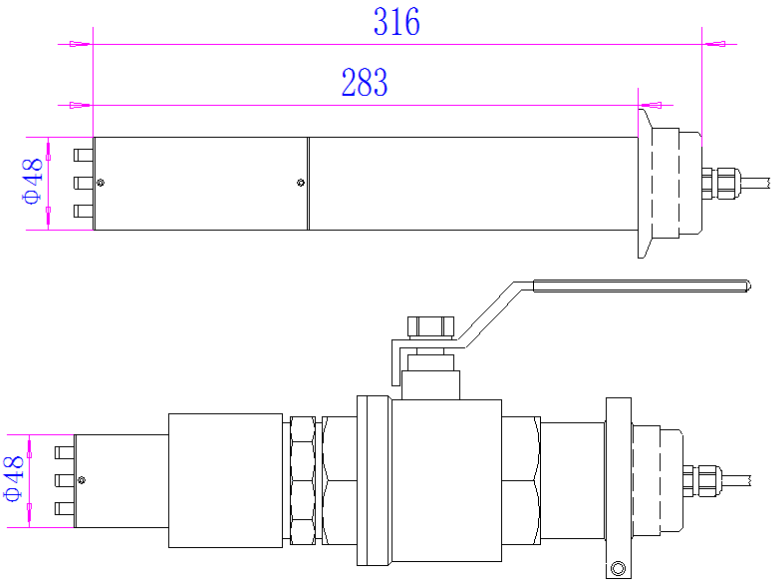
3 Dimension and wiring

3.1 Figure1: Standard



Unit：mm

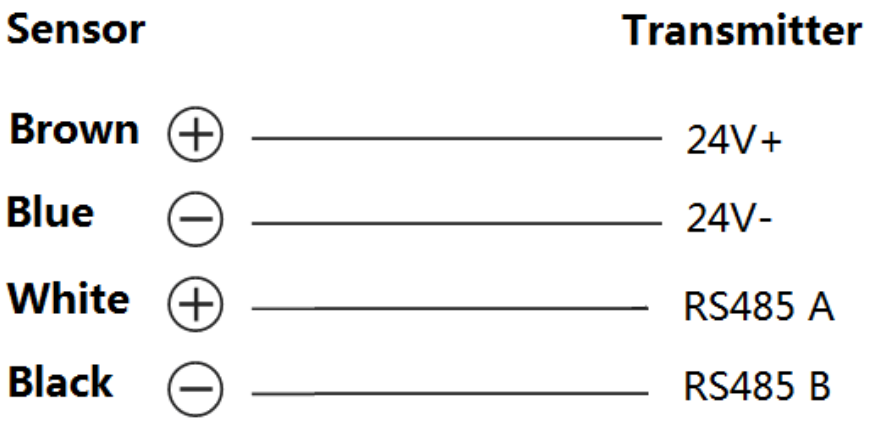
3.2 Figure2: Insertion



Unit：mm

3.3 Wiring

Warning: 1 RISK OF ELECTRICAL SHOCK
2 Disconnect power before opening instrument



Connecting sensor also refer the table below

No. of wire	1	2	3	4
Color of wire	Brown	Blue	White	Black
Function	+24VDC	GND	RS485 A	RS485 B

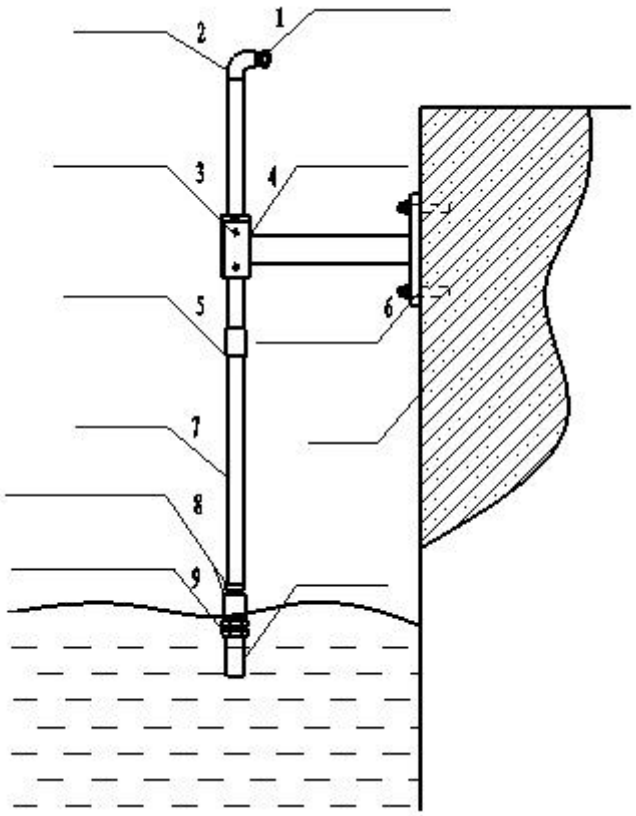
4 Installation

4.1 Location requirements

1: Installation location should be accessed for maintenance and cleaning
2: Measurement point should be typical, not stagnant water for avoiding producing bubbles places
3: If the sensor installed outside in order to keep away sunlight on the optical window.

4.2 Sensor Mounting

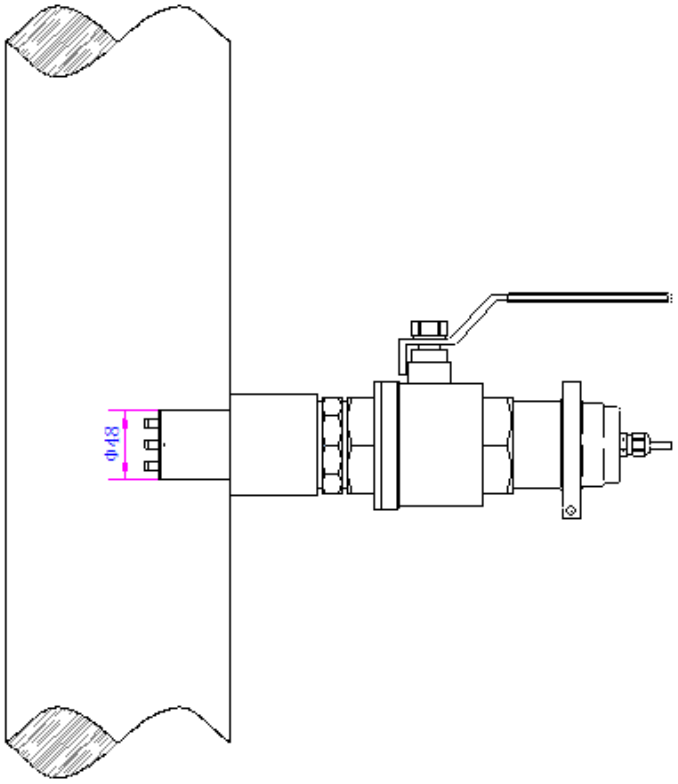
4.2 .1 Immersion assembly



1 3/4 “cable gland	2 3/4 “ angle head	3 hex bolts
4 bracket	5 3/4 “pipe collar	6 expansion bolts
7 bracket pole	8 3/4”to1”pipe fitting	9 1”compression fitting

Attention: 1.The Sensor should be installed fixed position for avoiding vibration
2: Brackets pole and each connection of the connecting rod must be tightened securely.
3. The Sensor install on the bracket pole in order to avoiding cable force
4. The sensor must be consider water level when immersion depth.
(water level: 30cm under the lowest level , the highest level less than 2 meters)

4.2.2 Insertion assembly



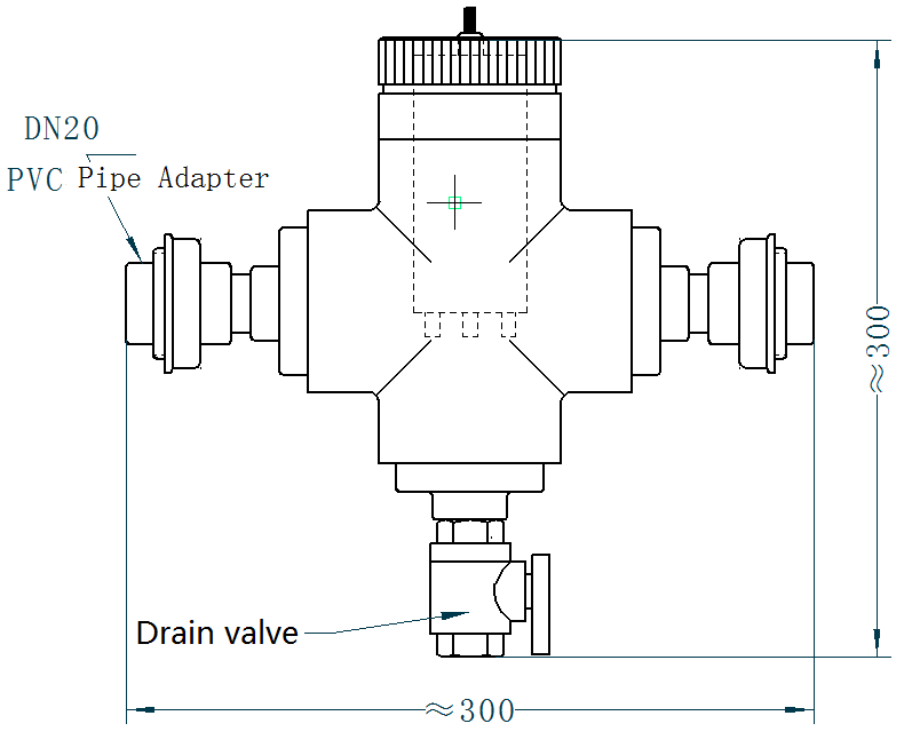
Notice :

1 The Sensor should be installed fixed position for avoiding vibration

2 If the horizontal pipe should be installed vertically. Installation depth should avoid the top and bottom of the pipe. Prevent dissatisfied or bubble too much on the top of pipe, sludge at the bottom.

3 The sensor insertion depth should be 3-5 cm.

4.2.3 Flow-Through Assembly



5 Maintenance

5.1 Cleaning and Maintenance (standard: once a month)

Wash and flush with tap water

Detection of the optical windows and cleaning wiper

Checking whether the optical window is scratched or poor performance.

Checking whether the wiper is broken or deformed .

Checking whether the wiper is firmly fixed .

5.2 Long-term storage

Please treat it as follows if sensor do not be used for long time

Disconnect the power.

Remove the sensor from the water and clean it.

Keep the sensor away from sunshine.

5.3 Calibration

Prepare two standard solutions with different concentrations , generally use pure water as the 1st solution (0 NTU) and the other one with known concentration as the 2nd solution. If the sensor will be used for measurement of SS , recommend using the solution from process as the 2nd solution

1 Place the sensor into a vessel with the 1st solution after cleaning and wiping well , waiting several minutes for stable reading ,then perform the first point calibration.

2 Place the sensor into a vessel with the 2nd solution after cleaning and wiping it well again, waiting several minutes for stable reading, then perform the second point calibration.

Please refer manual of the transmitter to be connected for detailed operating steps.

Note for performing zero and span calibration

(1) It is best to use a container that is larger than 30cm x 40 (DXH) and dark color to hold the standard solution.

(2) Place the sensor in the center of the standard solution and do not shake it during calibration.

(3) It is highly recommended NOT to adjust the existing span coefficient because it is difficult to get accurate and stable standard solution.

6. Troubleshooting

Check the sensor as to the following steps If it fails

1Checking whether connection of the sensor is correct .reconnect it if isn't.
2 Checking whether the sensor cable is disconnected, damaged or aged. please contact the factory If it is .
3 Checking whether the power supply is DC24V .
4 Checking whether the optical windows is polluted, clean it if it is.

7 Repair and return

Please contact local office or our service center if have any technical question.

If it is necessary to return the sensor for repair, calibration or maintenance, please follow the requirements below :

1 Please pack the sensor into original package or good material to prevent damage during transportation

2 Please attach a paper document together with the sensor into package, the document should include failed information, contacting information and detailed posting information .

3 The customer has to bear the costs for return consignment.

SC7340 Modbus Communication Protocol

1 Communication Settings

Sensor ID : 1-247, default of high range sensor is 1, and low range sensor is 2.
Baud rate: 9600-38400, default is 9600bps
Data bits: 8
Stop bits: 1
Parity: None

2 Function Code (FC) Introduction

FC 0x03：it is used for reading data from the holding registers

Request Command：

Sensor ID +FC + starting address （high byte, low byte) + total number of registers to read (high byte, low byte) + CRC
Where,
CRC stands for Cyclic Redundancy Check; it is a 2-byte code for error checking.

Response command：

Sensor ID +FC + byte count of data + Data1 (high byte, low byte)+ Data2(high byte, low byte) +….. Data(n) +CRC

FC 0x06：it is used for writing data into a single holding register

Request command：

Sensor ID + FC +starting address (high byte, low byte) + data (high byte, low byte) + CRC

Response command：
Getting the command as same as the sent means it is acknowledged by the sensor.

FC 0x10：it is used for writing data into multiple holding registers

Request command：

Sensor ID + FC +starting address (high byte, low byte) +count of registers to be written(high byte, low byte) + byte count of data+data1 (high byte, low byte) + data2 (high byte, low byte)+…… CRC

Response command：

Sensor ID + FC +starting address (high byte, low byte) + byte count of registers to be written(high byte, low byte) + CRC

3. List of Addresses of Registers

Holding registers (FC 0x03, FC 0x06 and FC 0x10)

3.1 Register map

Modbus address DEC 和 (HEX)	Number of register	R/W	Data format	Read code (0x03)	Write code (0x06/0x10)	Content	Function
0301((0x012D)	1	R/W	ushort	0x03	0x06	Refer 3.2 (1)	Baud rate
0305((0x0131)	1	R/W	ushort	0x03	0x06	Refer 3.2 (2)	Parity
0350(0x015E)	1	R/W	ushort	0x03	0x06	1-247	ID number
4000-4007 (0x0FA0-0x0FA7	8	R	character	0x03	----	ASCII	Serial number
4132 (0x1024)	1	R	ushort	0x03	----	Refer 3.2 (3)	Error item
4133 (0x1025)	1	R	ushort	0x03	----	Refer 3.2 (3)	Detailed error contents
4200-4201 (0x1068-0x1069)	2	R	Float (Inverse)	0x03	----		Measured reading
4249-4250 0x1099-0x109A)	2	R/W	Float (Inverse)	0x03	0x10	0.30-3.00	SPAN Coefficient
6582(0x19B6)	1	R/W	ushort	0x03	0x06	Cleaning=0xFFFF, No Cleaning=0x0000 Write 0xFFFF to start cleaning	Cleaning control
6600 (0x19C8)	1	R/W	ushort	0x03	0x06	Zero Calibrating=0xFFFF, No zero calibrating =0x0000 Write 0xFFFF to Start zero calibration	Zero calibration control
6671(0x1A0F)	1	R/W	ushort	0x03	0x06	Measuring=0xFFFF, No measuring=0x0000 Write 0xFFFF to start measurement Write 0x0000 to stop measurement	Measuring control

3.2 Explanation of data stored in some registers

(1) Baud rate (stored in register 0x012D)

Data	Baud rate
0xAA02	9600
0xAA03	14400
0xAA04	19200
0xAA05	38400

(2) Parity (stored in register 0x0131)

Data	Parity
0xAA00	None
0xAA01	ODD
0xAA02	Even

(3) Error item and detailed error content (error item stored in 0x1024 , detailed content stored in 0x1025)

Error item (0x1024)	Detailed content (0x1025)	Meaning
0x0000	0x0000	No error
0x0805	0x0101	out of allowable calibration
0x0401	0x0102	out of allowable measurement
0x0402	0x0200	out of allowable temperature
0x0403	0x0400	out of allowable humidity in sensor

4. Examples of a communication between a sensor and a remote device.

4.1 Communication process for measurement

Start measurement

Reading data1after measuring for 5 seconds
Reading data2 after measuring for 5 seconds

……..

Reading data$_n$ after measuring for 5 seconds

Stop measurement
Start cleaning
Check if the cleaning is done

Start measurement
Reading data again after measuring for 5 seconds

4.2 Details of commands

The communication mode is Modbus RTU, Sensor ID is 1

Start measurement
PC → Sensor: the PC sends 0x01 0x06 0x1A 0x0F 0xFF 0xFF 0xBF 0x61 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x06 – FC for writing data into a single register
0x1A 0x0F – Starting address (high byte, low byte) which is for starting the measurement.
0xFF 0xFF – Data (high byte, low byte) in which 0xFFFF is the number for external control

0xBF 0x61 – CRC code

Sensor -> PC, the PC gets 0x01 0x06 0x1A 0x0F 0xFF 0xFF 0xBF 0x61sent by the sensor for acknowledgement

Reading data
PC → Sensor: the PC sends 0x01 0x03 0x10 0x68 0x00 0x02 0x41 0x17 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x10 0x68 – Starting address (high byte, low byte) which is used for storing the measured data.
0x00 0x02 – Total number of registers to read (high byte, low byte) in which 2 registers will be read.
0x41 0x17 – CRC code

Sensor -> PC, the PC gets 0x01 0x03 0x04 BYTE1 BYTE2 BYTE3 BYTE4 +CRC code sent by the

sensor

Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 –FC for reading data from the holding registers
0x04 – Total number of bytes of data to follow, 4 bytes of data from 2 registers
BYTE1 BYTE2 BYTE3 BYTE4 – 4 bytes of data. This 32-bit single precision hexadecimal data can be converted to decimal floating point value by the IEEE754 standard.
CRC code

Stop measurement

PC → sensor: the PC sends 0x01 0x06 0x1A 0x0F 0x00 0x00 0xBE 0XD1to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x06 – FC for writing data into a single register
0x1A 0x0F – Starting address (high byte, low byte) which is for stopping the measurement.
0x00 0x00 – Data (high byte, low byte) in which 0x0000 is the number for external control

0xBE 0XD1 – CRC code

Sensor -> PC, the PC gets 0x01 0x06 0x1A 0x0F 0x00 0x00 0xBE 0XD1 sent by the sensor for acknowledgement

Start cleaning
PC → sensor: the PC sends0x01 0x06 0x19 0XB6 0xFF 0xFF 0x6E 0XC0 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x06 – FC for writing data into a single register
0x19 0XB6 – Starting address (high byte, low byte) which is for cleaning the optical window
0xFF 0xFF – Data (high byte, low byte) in which 0xFFFF is the number for external control

0x6E 0XC0 – CRC code

Sensor -> PC, the PC gets 0x01 0x06 0x19 0XB6 0xFF 0xFF 0x6E 0XC0 sent by the sensor for acknowledgement

Check if the cleaning is done
PC → Sensor: the PC sends 0x01 0x03 0x19 0XB6 0x00 0x01 0x62 0XB0 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x19 0XB6 – Starting address (high byte, low byte) which is used for checking if the window cleaning is completed.
0x00 0x01 – Total number of registers to read (high byte, low byte) in which 1 register will be read.
0x62 0XB0– CRC code

If the optical window cleaning is completed,

Sensor -> PC, the PC gets 0x01 0x03 0x02 0x00 0x00 0xB8 0x44 sent by the sensor

Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x02 – Total number of bytes of data to follow, 2 bytes of data from 1 input register
0x00 0x00– 2 bytes of data. The value of 0x0000 means the optical window cleaning is done.
0xB8 0x44 – CRC code

4.3 Zero calibration

Check if the sensor is under cleaning, if it is, continue to wait .If the sensor had stopped cleaning , then stop measurement to perform zero calibration

Stop measurement
PC → sensor: the PC sends 0x01 0x06 0x1A 0x0F 0x00 0x00 0xBE 0XD1 to the sensor
Sensor -> PC, the PC gets 0x01 0x06 0x1A 0x0F 0x00 0x00 0xBE 0XD1sent by the sensor for acknowledgement

Start zero calibration
PC → sensor: the PC sends 0x01 0x06 0x19 0xC8 0xFF 0xFF 0x0E 0xD8 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x06 – FC for writing data into a single register
0x19 0xC8 – Starting address (high byte, low byte) which is for starting zero calibration
0xFF 0xFF – Data (high byte, low byte) in which 0xFFFF is the number for external control
0x0E 0xD8 – CRC code

Sensor -> PC, the PC gets 0x01 0x06 0x19 0xC8 0xFF 0xFF 0x0E 0xD8 sent by the sensor for acknowledgement

Check if zero calibration task is done

PC → Sensor: the PC sends 0x01 0x03 0x19 0xC8 0x00 0x01 0x02 0xA8 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x19 0xC8 – Starting address (high byte, low byte) which is used for checking if the zero calibration is completed
0x00 0x01 – Total number of registers to read (high byte, low byte) in which 1 register will be read.
0x02 0xA8 – CRC code

If the zero calibration is completed

Sensor -> PC, the PC gets 0x01 0x03 0x02 0x00 0x00 0xB8 0x44 sent by the sensor

Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x02 – Total number of bytes of data to follow , 2 bytes of data from 1 input register
0x00 0x00 – 2 bytes of data. The value of 0x0000 means the zero calibration is done and successful
0xB8 0x44 – CRC code

4.4 Span calibration

Read the current span coefficient stored in the sensor
PC → Sensor: the PC sends 0x01 0x03 0x10 0x99 0x00 0x02 0x10 0xE4 to the sensor
Where,
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x10 0x99 – Starting address (high byte, low byte) which is used for storing the current span coefficient.
0x00 0x02–Total number of registers to read (high byte, low byte) in which 2 registers will be read.
0x10 0xE4 –0x60 0x0A

Sensor -> PC, the PC gets 0x01 0x03 0x04 0xXX 0xXX 0xXX 0xXX +CRC code sent by the sensor
Where,
0x01 – Sensor ID, *the Turbidity sensor*
0x03 – FC for reading data from the holding registers
0x04 – Total number of bytes of data to follow, *4 bytes of data from 2 registers*
0xXX 0xXX *– 4 bytes of data. The value is current span coefficient, its range is 0.3-3.00 in decimal*
CRC code

Adjust the coefficient to change readings

PC → Sensor: the PC sends0x01 0x10 0x10 0x99 0x00 0x02 0x04 0xXX 0xXX 0xXX 0xXX +

CRC code to the sensor

Where,
0x01 – Sensor ID, the Turbidity sensor
0x10 – FC for writing data into the multiple holding registers
0x10 0x99 – Starting address (high byte, low byte) which is used for storing the span coefficient. 0x00 0x02– Total number of register to write ((high byte, low byte)
0x04– Byte count of data to write
0xXX 0xXX 0xXX 0xXX – Data to write into the single register, its format is Hex. convert it to decimal floating point value by the IEEE754 standard , it is span coefficient and its range is 0.3-3.00.
CRC code

Sensor → PC the PC gets 0x01 0x10 0x10 0x99 0x00 0x02 0x95 0x27 from sensor, it means the operation is completed .

Calculate the span coefficient to write into register as the formula below :

New coefficient= old coefficient x (concentration of standard solution/ reading)

Then read the data stored in register 0x10 0x99 again, check if it is the value you wrote. If it is , it means the span calibration is successful.

For example :

(1) The old span coefficient is 1.00, the standard solution is 100NTU and the reading is 110, so the new coefficient = 1.00 x100/110, it is 0.91.

(2) Sends 0x01 0x10 0x10 0x99 0x00 0x02 0x04 0x3F 0x68 0xF5 0xC3 0x7D 0xA0 to sensor ,

after then, will get the returned data 0x01 0x10 0x10 0x99 0x00 0x02 0x95 0x27, it means the writing operation is acknowledged

The command "0x3F 0x68 0xF5 0xC3" which are data in HEX converted by 0.91.

(3) Sends 0x01 0x03 0x10 0x99 0x00 0x02 0x10 0xE4

Returned data: 0x01 0x03 0x04 0x3F 0x68 0xF5 0xC3 0x70 0xFA

Where:
0x01 – Sensor ID, the Turbidity sensor
0x03 – FC for reading data from the holding registers
0x04 –Byte count of data, 4 bytes of data from 2 registers

0x3F0x680xF50xC3 – 4 bytes of data, the value is current span coefficient, it is 0.91 in decimal

0x70 0xFA - CRC code

When returned the new coefficient is same as the value you wrote, it means the adjusting span coefficient is successful .

Note for performing zero and span calibration

（1） It is best to use a container that is larger than 30cm x 40 (DXH) and dark color to hold the standard solution.

（2） Place the sensor in the center of the standard solution and do not shake it during calibration.

（3） It is highly recommended NOT to adjust the existing span coefficient because it is difficult to get accurate and stable standard solution.