

Digital Total Suspension Solid Sensor

User Manual

Attention

- Please follow the operating procedures and precautions of this manual when using.
- If you find that the instrument is working abnormally or damaged during use, please contact the manufacturer and do not repair it by yourself.
- In order to make the measurement more accurate, the sensor should be cleaned frequently and matched with the instrument for calibration; if your sensor has quality problems, please replace it with new one.
- Please powering on the sensor for 30 minutes before calibration .

1 Product configuration

Please confirm the sensor you purchased, the package is complete, if there is any damage to the package or any shortage of accessories, please contact the dealer as soon as possible. The configuration is as follows.

1.1 Standard configuration

- ◇ Digital sensor×1
- ◇ A user manual ×1

2 Product introduction

The sensor uses a specific infrared light processing technique. The light transmitted by the infrared emitter is transmitted through the medium and irradiated to the detector to obtain relevant data. Then, by analyzing the data signals, the accurate concentration of the suspended matter in the medium can be obtained. No matter for high range or low range, they share same accuracy and continuity. And the built-in photometric compensation of the sensor can effectively eliminate the deviation caused by some changes in the environment and can be used in more places. It is widely used in the monitoring of suspended solids concentration in chemical, electroplating, paper making, environmental water treatment engineering, pharmaceutical, food, tap water and other solutions. Especially suitable for use in the field and on the spot.

2.1 Main features

- ✧ The shell is made by 316L stainless steel, it has good corrosion resistance.
- ✧ The transmitted light adopts a stable invisible near-monochromatic infrared light source, which avoids the interference of the chromaticity of the liquid and the visible light of the outside on the sensor measurement; and the built-in photometric compensation improves the measurement accuracy.
- ✧ Quarts glass lens, which is good transparency, was used in light path, infrared light waves are more stable in transmission and reception.
- ✧ Wide range of measurement, stable measurement, high precision, good

Reproducibility, not affected by water flow rate and pressure

- ✧ Communication function: two optical isolation signal output, that is RS-485 communication interface (partially compatible with MODBUS-RTU protocol), the communication interval is up to 50ms; and 4~20mA current output, 4-20mA can be reverse output; it can directly connect to computers, PLC and other devices without controller with RS485/4-20mA signal interface for data acquisition. It is convenient for users to integrate the sensor into the industrial control environment such as the upper computer system and the physical connection system.
- ✧ The sensor can be set by RS485 communication, slave address and baud rate, online calibration, factory reset, 4-20mA output corresponding range, modified range, proportional coefficient and incremental compensation.
- ✧ Three-point correction.
- ✧ Watchdog function: make sure the meter doesn't crash.
- ✧ Power off protects > 10 years.

3 Technical indicators

- ✧ Measuring Range: 0-2000mg/L, measurement range can be customized up to 10000mg/l
- ✧ Accuracy: $\pm 1.0\%FS$
- ✧ Repeatability : $\pm 1.0\%$
- ✧ Signal output: equipped with RS485 communication (partially compatible with MODBUS-RTU protocol) and 4~20mA signal output, all of which are optocoupler isolation protection
- ✧ Working conditions: Ambient temperature is 0~60°C, Withstand voltage is $\leq 0.6MP$
- ✧ Output load: $< 300\Omega$ (4-20mA)

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- ◇ Working voltage: DC 5V, 12V, 24V
 - ◇ Size: Length 237mm, maximum outer diameter 64mm
 - ◇ Installation method: submerged
 - ◇ Mounting thread: G1 inch pipe thread
 - ◇ Weight: 3kg
 - ◇ Protection level: IP68

4 Sensor installation and maintenance

The sensor is generally calibrated before leaving the factory, and the user can directly put it into use; the general instrument has a low failure rate.

1. Sensors are required to be installed indoors or in places where sunlight is not exposed, as strong infrared rays in the sun can seriously affect sensor measurements.
2. Since the sensor case is made of 316L stainless steel, it has a certain weight; you need to use the mounting bracket when installing the sensor.
3. Use the instrument for the first time, please test it after 24 hours.
4. After the sensor is running normally, the output of 4-20mA corresponds to the range.
5. After the instrument is used for a period of time, the optical path lens of the sensor may be attached with dirt, causing a large error in the measured value, and the lens needs to be cleaned periodically. Cleaning operation: Clean the deposit on the optical path lens with a tweezers with an alcohol cotton ball until it is clean. After cleaning is completed, the sensor must be re-calibrated.
6. Do not disassemble the instrument to avoid affecting or damaging the performance of the instrument.

Installation method:

A--Junction box upper-cover

B--o-rings

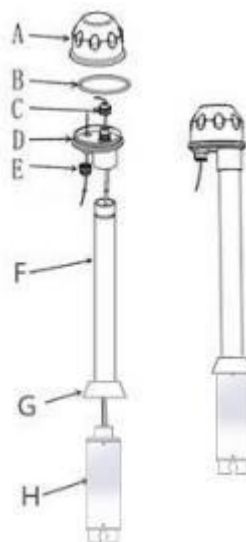
C--The electrode wire fastens the head

D--Junction box bottom cover

E--Electrode wire protection casing

F-G1 inch Pipe nipple

G--Turbidity sensor



Protocol

MODBUS-RTU

Baud rate	9600 (default)
Device No	1 (default)
Data bit	8 bytes
Parity	NO
Stop bit	1digit

Register setting

Register name	ADD	type of data	Length (byte)	read	explanation
Indication	R0	unsigned	1	R	
4ma value	R2	unsigned	1	R	
20ma value	R3	unsigned	1	R	
range	R4	unsigned	1	R	
Proportionality coefficient	R5	unsigned	1	R	(1 decimal)
increments	R6	signed	1	R	
Slave address	R8	unsigned	1	R	Range is 1-127
Baud rate	R9	unsigned	1	R	1200 2400 4800 9600 19200 38400 57600
Function call	R10	unsigned	1	W	See continued table for details.
Parameter 1	R11	unsigned	1	W	See continued table for details.
Parameter 2	R12	unsigned	1	W	See continued table for details.

5 MODBUS Instruction Format

This sensor is compatible with 0x03, 0x06, 0x10 function codes of MODBUS protocol.

0x03 command format

definition	ADD	Function code	Starting address	Number of register	CRC Check
Data	ADDR	0x03	Rstart	Rnum	CRC 16
bytes	1	1	2	2	2

0x03 return format:

definition	ADD	Function code	Number of data	data	CRC Check
data	ADDR	0x03	Rnum*2	Data	CRC 16
bytes	1	1	1	Rnum*2	2

0x06 command format

definition	ADD	Function code	ADD of register	data	CRC Check
data	ADDR	0x06	Raddr	Data	CRC 16
bytes	1	1	2	2	2

0x06 return format (same as command):

definition	ADD	Function code	ADD of register	data	CRC Check
data	ADDR	0x06	Raddr	Data	CRC 16
bytes	1	1	2	2	2

0x10 command format:

definition	ADD	Function code	Starting ADD	Number of register	Number of data	data	CRC check
data	ADDR	0x10	0x000A	0x0003	0x06	data	CRC 16
bytes	1	1	2	2	1	6	2

0x10 return format:

definition	ADD	Function code	Starting ADD	Number of register	CRC Check
data	ADDR	0x10	0x000A	0x0003	CRC 16
bytes	1	1	2	2	2

6 Data reading

This sensor data is read using the 0x03 function code of the MODBUS protocol.

For example, read TSS value

Send command: 01 03 00 00 00 01 84 0A

Return: 01 03 02 1A CC B3 71

Data part is: 1A CC

TSS value: 0x1ACC convert to decimal is 6860, convert to the corresponding value based on the resolution of the sensor. If resolution is 0.01, then value is 68.6; if resolution is 1, the value is 6860.

7 Parameter adjustment

- (1) Parameter adjustment of the sensor is using the 0x06 or 0x10 function code of the MODBUS protocol.
- (2) Use 0x06 function code to adjust parameters can be divided into 3 steps
 - 1) Write parameter 1 to the R11 register
 - 2) Write parameter 2 to the R12 register
 - 3) Write the function number to the R10 register
- (3) Using 0x10 function code, you need to write the function number, parameter 1, parameter 2 to the three registers starting from R10.(Equivalent to step-by-step writing)
- (4) When the function call is successful, the R10, R11, and R12 registers are reset to 0. If the function call fails or the parameters are incorrect, the R12 register will display -1.

Function call parameter list

Function	parameter1	parameter2	Function number
Zero calibration	Standard liquid value	1	1
Slope calibration	Standard liquid value	2	1
Correction calibration	Correction calibration value	Correct calibration point number(3-5)	1
Change the 4-20ma output range	4mA output representative value	20mA output representative value	3
Change range	Range value	Arbitrary value	4
Change correction factor	Proportionality coefficient	Incremental value	5
Change slave address	New slave number	Arbitrary value	7
Change baud rate	New baud rate	Arbitrary value	8
reset	Passcode: 20034	Arbitrary value	11

For example's calibration (use 0x10 function code)

Zero calibration: standard liquid is 10mg/L, sensor's resolution is 0.01 ,
 $10 \times 100 = 1000$, converted to hexadecimal 0x03E8, therefore, function code is
 0x0001, parameter 1 is 0x03E8, parameter 2 is 0x0001

Data part is 00 01 03 E8 00 01

Send command: 01 10 00 0A 00 03 06 00 01 03 E8 00 01 BA D0

Return: 01 10 00 0A 00 03 A0 0A

Slope calibration: standard liquid 200mg/L, sensor's resolution is 0.01,
 $200 \times 100 = 20000$, converted to hexadecimal 0x4E20, therefore, function

code is 0x0001, parameter 1 is 0x4E20, parameter 2 is 0x0002

Data part: 00 01 4E 20 00 02

Send command: 01 10 00 0A 00 03 06 00 01 4E 20 00 02 6C 43

Return: 01 10 00 0A 00 03 A0 0A