yateks®

YFJ-4 Particle Counter Sensor

User Manual

Warning: Please read this Manual carefully before using this instrument.

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1. Product overview

YFJ-4 Particle Counter developed by the principle of Light Shading (Blockage light), used for on-line real-time monitoring of particle pollution in oil circuit of hydraulic system. It can be widely used in aviation, aerospace, electric power, petroleum, chemical industry, traffic, port, metallurgy, machinery, automobile manufacturing and other fields. It detect pollution of solid particle for oil, such as Hydraulic oil, lubricating oil, transformer oil (insulating oil), turbine oil (turbine oil), gear oil, engine oil, aviation kerosene, water-based hydraulic fluid, and test insoluble particles for organic liquid and polymer solution.

2. Technical Specifications

Sensor Measurements

Indicator	Measurement range	Accuracy
Particle size	1～100μm 4～70μm(c)	/
Particle size channel	1μm, 2μm, 5μm, 10μm, 15μm, 25μm, 50μm, 100μm; 4μm(c), 4.6μm(c), 6μm(c),10μm(c), 14μm(c), 21μm(c), 38μm(c), 70μm(c)	Particle count:±20%; CODE/Level: ±1 level

Velocity range	10～300mL/min (Recommend 25mL/min)
Detect period	5～60 seconds (5 seconds / level)
Measurement repeatability	RSD ＜ 5%
Measurement Standards	NAS1683, ISO4406 (Calibration standard: ISO4402 or ISO11171)

Notes: The measurement accuracy must ensure that the test environment is within the range of 20±5℃ and the flow rate is 25mL/min.

Sensor Specifications

Signal output	RS485 ModBus RTU (4-20mA analog signal for optional)
Power voltage	DC 24V±10%
Working current	＜200mA
Working temperature	-20～60℃
Fluid temperature	0～80℃
Storage temperature	-40～85℃
Maximum oil pressure	Default version ≤2MPa; 2～40MPa (require equip with pressure reduce device)

IP rate	IP65
Light source	Semiconductor laser
Threaded interface	G1/8, ¢6mm oil pipe
Weight	950g
Dimension	100×75×71 mm

3. Features

1. Using the principle of shading method (photoresist method);
2. Built-in particle pollution level standards such as GJB420B-06, GJB420A-96, NAS1638, ISO4406:1999 (GB/T14039-2002), etc., can give the particle count and pollution level of the measured sample in real time;
3. Can be calibrated according to ISO4402 or ISO11171;
4. With a standard serial RS485 interface, an external computer can be used to complete control and storage of test results;
5. An external U disk can be used to store the test results;
6. Real-time data, able to grasp and analyze the wear trend of the hydraulic system in real time.

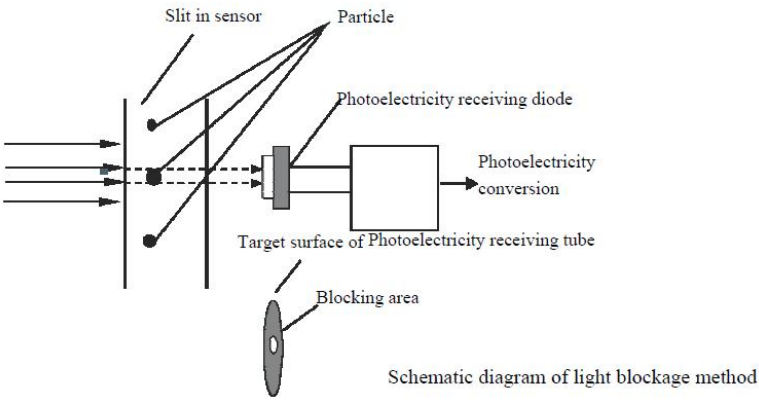
4. Measurement principle and structure

Measurement principle

YFJ-4 Particle Counter performs oil pollution detection by adopting Light Extinction method (also known as light shading method or light blockage method) stipulated by ISO4402/ISO11171. Light Extinction

method, also known as Light Blockage method or Light Sheltering method. Light Extinction method provides high test speed, strong anti-jamming capability, high accuracy, outstanding repeatability and other advantages.

Working principle of light Extinction method is shown in figure 2-1 below. Collimated light beams pass through sample circulation cell, sectional area of which is A, and reach to photoelectric receiver. Where no particle in liquid flow, the circuit will output voltage E; where a particle with a projected area of “a” passes through sample circulation cell, blocks collimated light beams, and attenuates transmitted light, the circuit will output a negative pulse with an amplitude of E:



Schematic diagram of light blockage method

$$E_{。}=(a/A)\times E \quad (2.1)$$

Where the particle is spherical or equivalent diameter “d” is used for describing it, and E equals to 10v,

$$E_{。}=7.854\times d^{2}/A \quad (2.2)$$

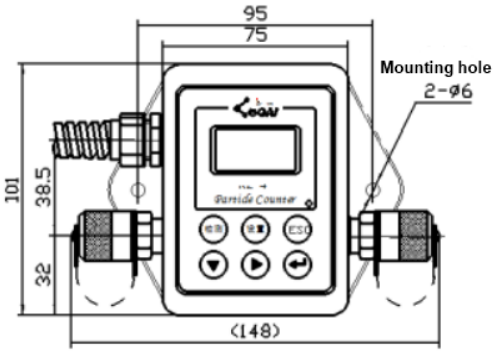
This means that projected area of the particle is in linear relation with impulse voltage amplitude.

Sensor Structure

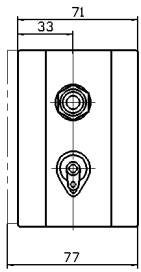
YFJ-4 Particle counter is mainly composed of the instrument subject, liquid inlet interface, liquid outlet interface, cable interface, display screen and panel, as shown in below pictures:

Sensor dimensions

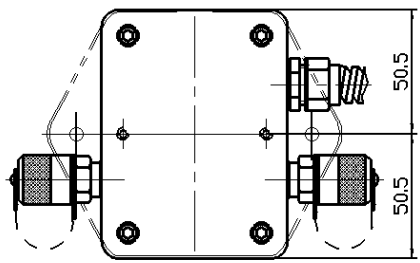
The dimension of the instrument case and the size of the mounting hole are shown in below pictures.



a) Instrument front view



b) Instrument lateral view



c) Instrument back view

Sensor mechanical interfaces:

Notes:

(1) It is recommended to connect the pipeline with a pressure less than 0.6MPa to obtain a more accurate and stable measurements, Maximun pressure is 2Mpa.

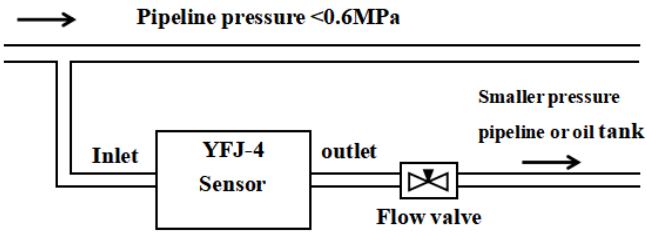
(2) It is recommended to connect to a smaller pressure pipeline or connect to a oil tank.

(3) Instructions for connecting power and signal communication cables:

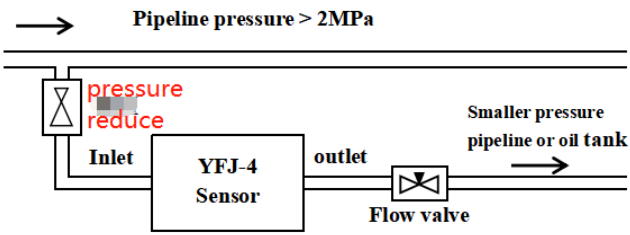
Cable type	Indicator	Cable color
Power	DC24V+	Red
	DC24V- (GND)	Black
RS485 signal	RS485 A/+	Brown
	RS485 B/-	Blue

Online installation instructions:

(1) When the inlet pipeline pressure is less than 0.6MPa, the installation diagram is shown in below picture:



(2) When the inlet pipeline pressure higher than 2MPa, a pressure reducing valve should be installed before the inlet to reduce the pipeline pressure to fit for YFJ-4 sensor. the installation diagram as shown in below:



Precautions for online installation

(1) The sensor should be connected to the piping using a bypass tee joint. pipeline pressure ensures that the sensor detects the required flow, and a flow regulator must be installed behind the sensor to keep giving a accurate and stable measurements.

(2) For the convenience of observation, the sensor installation pipe line shoduld be as short as possible. Larger size particles increases the risk of deposits with line length.

(3) If the outlet is connected to a pressurized system pipeline, it must be ensured that the pressure of the outlet is lower than the pressure of the inlet.

(4) The sensor should be installed in the measuring position where the pressure is relatively stable in the circuit. Strong fluctuations in the measurement process can lead to inaccurate detection. In order to ensure the accuracy of detection, it is recommended that the flow rate in the pipeline keep stable at around 25ml/min.

(5) The flow adjustment device must be connected to outlet, because the particles (or air bubbles) produced by the cavity in the flow adjustment device may affect the measurement results.

(6) In the pipeline with no pressure or low pressure, a pump needs to be installed to generate flow. The pump should be connected to outlet pipe, and the pulsation should be limited as much as possible, because the particles (or air bubbles) generated by the pump will cause inaccurate detection .

(7) In order to ensure the accuracy of the detection, as much as possible to ensure that the oil in the system pipeline does not contain air bubbles and free water, avoid the measurments accuracy.

5. Sensor display interface

The instrument itself has a bright OLED display screen, and the collection results can be transmitted to other devices via the RS485 serial interface. The following will introduce the operation process and matters need attention in use for panel and the display screen interface of the instrument .

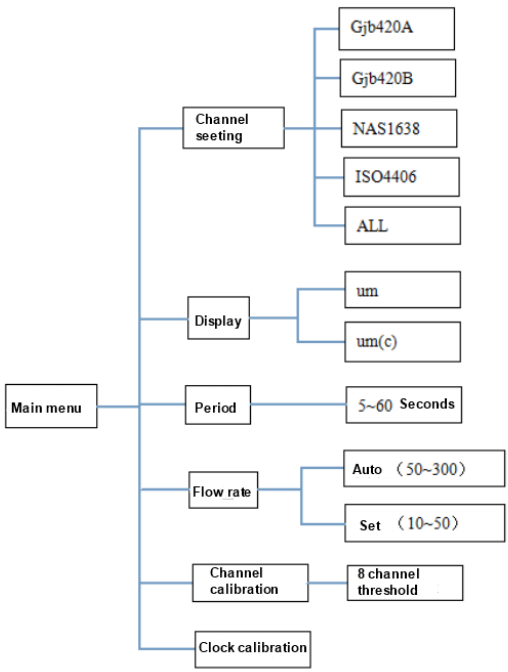
5.1 Sensor panel description

There are 6 buttons on the YFJ-4 instrument panel，they are respectively: "=Test", "=Set", "=ESC", "▼", "▶" and " □ "，as shown in below picture.

- "" : Start testing operation

- " ▼ " : Switching between instrument interfaces
- " ⚙ " : Instrument settings
- " ↩ " : Undo operation, Return
- " ↵ ": Confirm the operating（Note: press this button after each step）
- " ▶ ": Other operation options

5.2 Operation process of instrument display interface



The main interface of the instrument is mainly composed of four options:

"Channel setting", "Display", "Period" and "Flow rate". Detection operation will be based on the above four Settings. Setting method: press the "▼" button on the instrument panel. To elect the item that need to be set up, and then press the "▶" button to set the content in the option.

1. Channel settings: To switch from standard Gjb420A、Gjb420B、NAS1638、ISO4406 & ALL.

The instrument default support Gjb420A、Gjb420B、NAS1638、ISO4406 & ALL four pollution degree assessment criteria. Specific setting method that is click and press the "Set" button after the instrument is powered on. When the channel set is the reverse color display (i.e. white) on the right side, it means that standard switch can be performed, continue to press the "▶" button, standard selection is available, press "↵" button to complete after selection. In addition to the default standards above, other display standards can be also customized according to user requirements.

Note: After setting, if not to press"↵ "button，the setting has no effect.

2. Display：um / um(c)

When setting is "um"，the particle size unit of all test standards is "um ". When setting is "um(c)",the particle size unit of all test standards is "um(c)".

3. Period: The time setting range is 5~60 seconds.

4. Flow rate: Automatic/manual setting

The "flow rate" setting function is embedded in the instrument, which can usually meet the measurement accuracy of the sensor itself. Flow rate can be set to "automatic" or be set to "set" depending on the device flow rate. When "flow rate" is set to "automatic", the flow rate range is 50~300ml/min. When there is a flow stabilizing device in the pipeline

and the flow rate is lower than 50ml/min, the "flow rate" can be set to "set" state, and the flow rate value can be inputted as accurate as possible to improve the measurement accuracy of the instrument.

The instrument calibration options mainly include "channel calibration" and "time calibration". These two items can be calibrated during a certain period (usually one year) in order to maintain the accuracy of the instrument.

5. Channel calibration

There are 8 channels threshold can be set under this option. The steps to enter the "channel calibration" interface are: when the instrument is power off, press and hold the "test" button for a long time, and power the instrument, the channel particle size value and threshold are displayed, Press "▼" button to switch to the threshold that needs to be adjusted.

6. Clock calibration

This interface can calibrate the built-in time of the instrument. The steps to enter the "clock calibration" interface are as follows: when the instrument is in the state of off-position, press and hold the "set" button for a long time and power the instrument, then the "clock calibration" interface will be displayed. Press the "▼" button to switch to the clock item that needs to be adjusted.

7. For the above two items, the "▶" button increases the value and the" "setting" button decreases the value. After all adjustments are completed, press "↵ " button to save the setting data, and press "ESC" to exit.

6. Communication protocol

6.1 RS485 Modbus Protocol

The sensor works in Modbus RTU communication mode, and its serial port default settings are:

Specification	Property
Address	01
Baud rate	9600
Data Bit	8
Stop bit	1
Check bit	None

6.2 Communication settings:

Press and hold the "SET" button before powering on, wait for the interface to display the address and baud rate, then release the button, the sensor default value, ModBus ID: 1; baud rate: 9600. The upper computer RS485 communication settings are: baud rate 9600; data bit 8; stop bit 1; parity bit None.

Address setting:

The address range is 0-128, press the "▶" to increase the address, press the "  " to decrease the address, press the "↵" to save the setting, press the "↵" key and wait for 5 seconds, the

screen will display -Set OK-, set After the completion, power off and restart, and the device starts to use the new address.

Baud rate setting:

Press the "▼" to switch the address and baud rate, press "▶" to increase the baud rate, press the key to decrease the baud rate, press the "↵ " key to save the setting, press the "↵ "key and wait for 5 seconds, the screen will display Set OK, set After the completion, power off and restart.

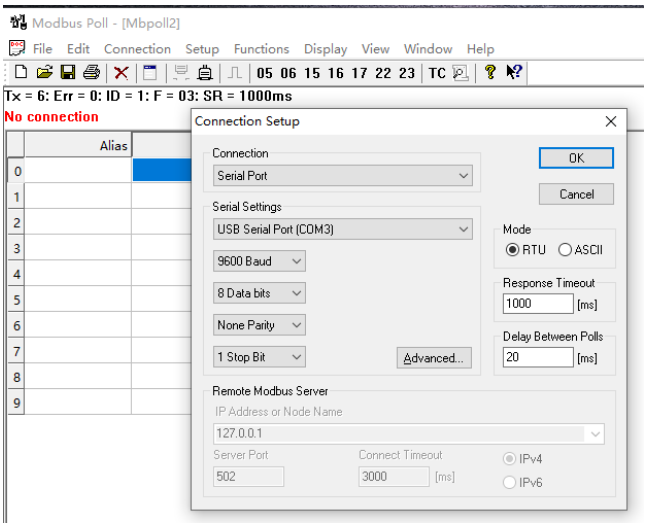
the baud rate setting range is 9600-57600.

Note: After completing the above settings, the sensor must be powered off first, and then powered on again, the settings will take effect.

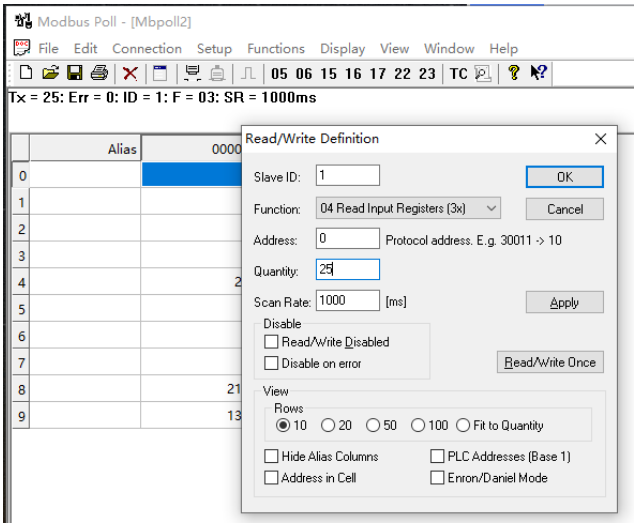
6.3 ModBus PollCommunication test

Connect the sensor communication cable to the computer and power on, make sure the sensor works in the "protocol 2" mode, press the "TEST"

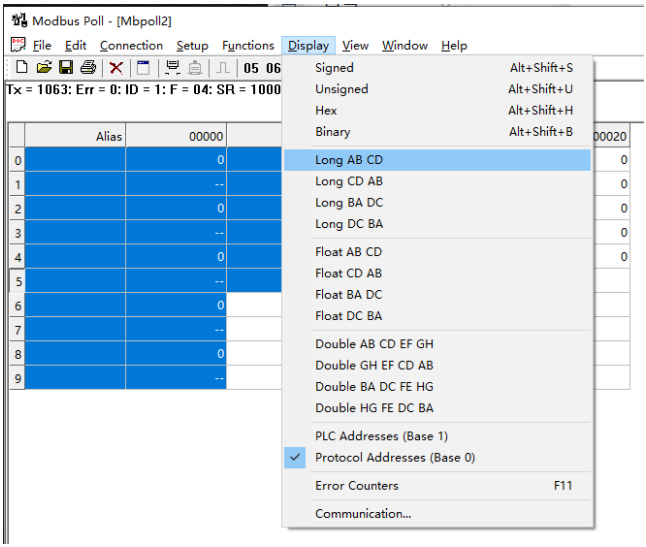
button to make the sensor in the detection mode. Open the Modbus Poll software, click the "Connection" item in the menu, select the "Connect" item in the drop-down menu, and select the communication port. Other settings are as follows:

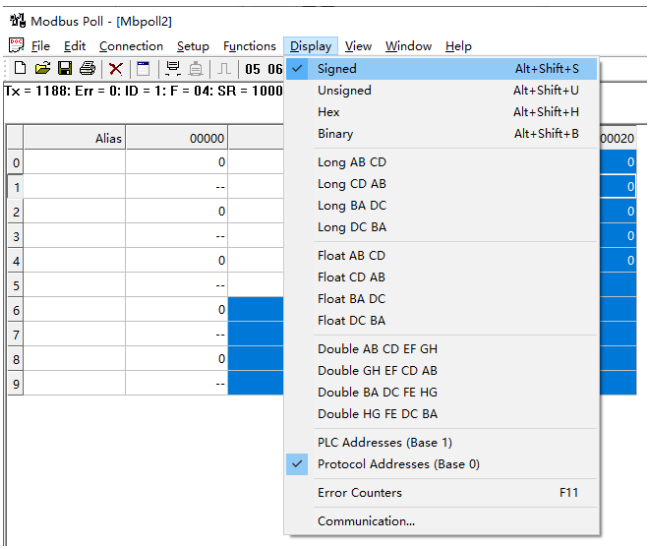


Then click the "Setup" item in the menu, select the "Read/Write Definition" option in the drop-down menu, enter the sensor ID, and other settings are as shown below:

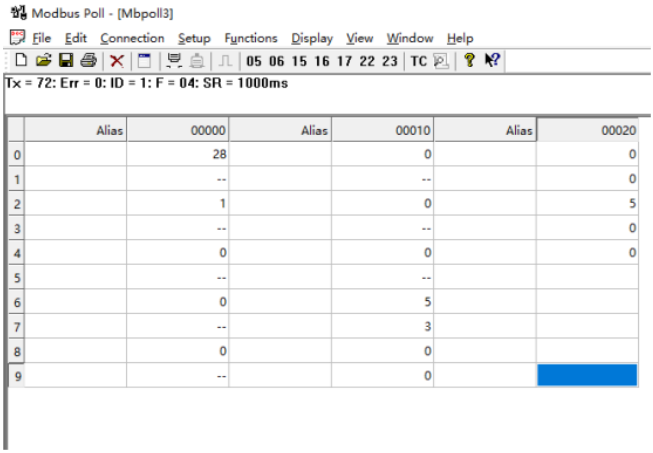


Set the data format of the first 15 lines to "long ABCD", and the data format of the last 10 lines to "Signed".


Modbus Poll - [Mbpoll2]
File Edit Connection Setup Functions Display View Window Help
05 06
Tx = 1063: Err = 0: ID = 1: F = 04: SR = 1000
Alias
00000
00020
Signed Alt+Shift+S
Unsigned Alt+Shift+U
Hex Alt+Shift+H
Binary Alt+Shift+B
Long AB CD
Long CD AB
Long BA DC
Long DC BA
Float AB CD
Float CD AB
Float BA DC
Float DC BA
Double AB CD EF GH
Double GH EF CD AB
Double BA DC FE HG
Double HG FE DC BA
PLC Addresses (Base 1)
Protocol Addresses (Base 0)
Error Counters F11
Communication...


Modbus Poll - [Mbpoll2]
File Edit Connection Setup Functions Display View Window Help
05 06
Tx = 1188: Err = 0: ID = 1: F = 04: SR = 1000
Alias
00000
00020
Signed Alt+Shift+S
Unsigned Alt+Shift+U
Hex Alt+Shift+H
Binary Alt+Shift+B
Long AB CD
Long CD AB
Long BA DC
Long DC BA
Float AB CD
Float CD AB
Float BA DC
Float DC BA
Double AB CD EF GH
Double GH EF CD AB
Double BA DC FE HG
Double HG FE DC BA
PLC Addresses (Base 1)
Protocol Addresses (Base 0)
Error Counters F11
Communication...

The sensor detection output data is as follows:



	Alias	00000	Alias	00010	Alias	00020
0		28		0		0
1		--		--		0
2		1		0		5
3		--		--		0
4		0		0		0
5		--		--		
6		0		5		
7		--		3		
8		0		0		
9		--		0		

6.4 ModBus Communication Protocol

Function code	Address (Decimal)	Content	Data Instruction
Read command:			
01	00	Detection status	Detection status: 01 Non-detection state: 00
04	00	Register value Hi (channel 1 particle counting)	The data analysis type is Long AB CD
	01	Register value Lo	The data analysis type is

Function code	Address (Decimal)	Content	Data Instruction
		(channel 1 particle counting)	Long AB CD
	02	Register value Hi (channel 2 particle counting)	The data analysis type is Long AB CD
	03	Register value Lo (channel 2 particle counting)	The data analysis type is Long AB CD
	04	Register value Hi (channel 3 particle counting)	The data analysis type is Long AB CD
	05	Register value Lo (channel 3 particle counting)	The data analysis type is Long AB CD
	06	Register value Hi (channel 4 particle	The data analysis type is Long AB CD

Function code	Address (Decimal)	Content	Data Instruction
		counting)	
	07	Register value Lo (channel 4 particle counting)	The data analysis type is Long AB CD
	08	Register value Hi (channel 5 particle counting)	The data analysis type is Long AB CD
	09	Register value Lo (channel 5 particle counting)	The data analysis type is Long AB CD
	10	Register value Hi (channel 6 particle counting)	The data analysis type is Long AB CD
	11	Register value Lo (channel 6 particle counting)	The data analysis type is Long AB CD

Function code	Address (Decimal)	Content	Data Instruction
	12	Register value Hi (channel 7 particle counting)	The data analysis type is Long AB CD
	13	Register value Lo (channel 7 particle counting)	The data analysis type is Long AB CD
	14	Register value Hi (channel 8 particle counting)	The data analysis type is Long AB CD
	15	Register value Lo (channel 8 particle counting)	The data analysis type is Long AB CD
	16	CODE (channel 1)	The data analysis type is signed int
	17	CODE (channel 2)	The data analysis type is signed int

Function code	Address (Decimal)	Content	Data Instruction
	18	CODE(channel 3)	The data analysis type is signed int
	19	CODE (channel 4)	The data analysis type is signed int
	20	CODE (channel 5)	The data analysis type is signed int
	21	CODE (channel 6)	The data analysis type is signed int
	22	Maximum CODE	The data analysis type is signed int
03	00	Standards	00 00（hexadecimal）：NAS1638 00 01（hexadecimal）：GJB420A-96 00 02（hexadecimal）：GJB420B-06 00 03（hexadecimal）：ISO4406-99

Function code	Address (Decimal)	Content	Data Instruction
			00 04（hexadecimal）：ALL 00 05（hexadecimal）：ROCT17216
	01	Particle size unit	00 00（hexadecimal）：unit is “um” 00 01（hexadecimal）：unit is “umc”
	02	Detection period	Unit: second; The setting value should be a multiple of 5, or it will be automatically modified to a multiple of 5.
	03	Flow rate	00 00：Automatic 00 01：Manual setting
	04	Flow rate setting	Rnage: 12～50 ml/min

Function code	Address (Decimal)	Content	Data Instruction
	05	Detection mode	0：Continuous 1：Single
	06	Power on mode	0：power on and waiting 1：power on and start testing
Write command：			
05	00	Detection status	FF 00（hexadecimal）Start detection 00 00（hexadecimal）Stop detection
06	00	Standards	00 00（hexadecimal）：NAS1638 00 01（hexadecimal）：GJB420A-96 00 02（hexadecimal）：GJB420B-06 00 03（hexadecimal）：ISO4406-99

Function code	Address (Decimal)	Content	Data Instruction
			00 04（hexadecimal）：ALL 00 05（hexadecimal）：ROCT17216
	01	Particle size unit	00 00（hexadecimal）：unit is “um” 00 01（hexadecimal）：unit is “umc”
	02	Detection period	Unit: second； The setting value should be a multiple of 5, or it will be automatically modified to a multiple of 5.
	03	Flow rate	00 00：Automatic 00 01：Manual setting
	04	Flow rate setting	Range: 12～50 ml/min

Function code	Address (Decimal)	Content	Data Instruction
	05	Detection mode	0：Continuous； 1：Single
	06	Power on mode	0：power on and waiting 1：power on and start testing

Modbus Protocol function code example (The sensor address is 1)：

Start detection: (The function code is 05)

Tx: 01 05 00 00 FF 00 8C 3A

01	05	00	00	FF	00	8C	3A
ID	Function code	Address Hi	Address Lo	Value Hi	Value Lo	CRC16 Lo	CRC16 Hi

Rx: 01 05 00 00 FF 00 8C 3A

01	05	00	00	FF	00	8C	3A
ID	Function code	Address Hi	Address Lo	Value Hi	Value Lo	CRC16 Lo	CRC16 Hi

Stop detection：（The function code is 05）

Tx: 01 05 00 00 00 00 CD CA

01	05	00	00	00	00	CD	CA
ID	Function code	Address Hi	Address Lo	Value Hi	Value Lo	CRC16 Lo	CRC16 Hi

Rx: 01 05 00 00 00 00 CD CA

01	05	00	00	00	00	CD	CA
ID	Function code	Address Hi	Address Lo	Value Hi	Value Lo	CRC16 Lo	CRC16 Hi

Read test status

Tx: 01 01 00 00 00 01 FD CA

01	01	00	00	00	01	FD	CA
ID	Function code	Starting Address Hi	Starting Address Lo	No. of registers Hi	No. of registers Lo	CRC 16 Lo	CRC 16 Hi

Rx: 01 01 01 00 51 88

01	01	01	00	51	88
ID	Function code	Byte count	Non-detection state: 00	CRC16 Lo	CRC16 Hi

Rx: 01 01 01 01 90 48

01	01	01	01	90	48
ID	Function code	Byte count	Detection status: 01	CRC16 Lo	CRC16 Hi

Read connection status: (function code is 02)

Tx: 01 02 00 00 00 01 B9 CA

01	02	00	00	00	01	B9	CA
ID	Function code	Starting Address Hi	Starting Address Lo	No. of registers Hi	No. of registers Lo	CRC 16 Lo	CRC 16 Hi

Rx: 01 02 01 01 60 48

01	02	01	01	60	48
ID	Function code	Byte count	01：successfully connected	CRC 16 Lo	CRC16 Hi

Rx: 01 02 01 00 A1 88

01	02	01	00	A1	88
ID	Function code	Byte count	00：failed connected	CRC16 Lo	CRC16 Hi

Note: In the detection state, the online state is not online.

Read setting parameters: (function code is 03)

Tx: 01 03 00 00 00 05 85 C9

01	03	00	00	00	05	85	C9
ID	Function code	Starting Address Hi	Starting Address Lo	No. of registers Hi	No. of registers Lo	CRC 16 Lo	CRC16 Hi

Rx: 01 03 0A 00 01 00 00 00 05 00 01 00 0F F4 E2

01	03	0A	00	01	00	00	00	05	00	01	00	0F	F4	E2
ID	Function code	Byte count	Standard 01：GJB420A		Particle size unit 00:μm		Detection period 05：5 seconds		Flow rate 01：Manual setting		Flow rate value 0F：15 ml/min		CRC 16 Lo	CRC16 Hi

Configuration setting parameters: (function code is 06)

Tx: 01 06 00 00 00 04 88 09

01	06	00	00	00	04	88	09
ID	Function code	Address Hi	Address Lo	Value Hi	Address Hi	CRC 16 Lo	CRC16 Hi

Rx: 01 06 00 00 00 04 88 09

01	06	00	00	00	04	88	09
ID	Function code	Address Hi	Address Lo	Value Hi	Address Hi	CRC16 Lo	CRC16 Hi

Read detection data: (function code is 04)

Send:

Tx: 01 04 00 00 00 19 31 C0

01	04	00	00	00	19	31	C0
ID	Function code	Starting Address Hi	Starting Address Lo	No. of registers Hi	No. of registers Lo	CRC 16 Lo	CRC 16 Hi

Receive:

Rx: 01 04 32 00 00 00 14 00 00 00 0F 00 00 00 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 04 00 05 00 04 00 00 00 00 00 00 00 05 00 00 00 00 3C 44

01	04	32	00	00	00	14	00	00	00	0F	00	00	00	02
ID	Function code	Byte count	Register value Hi (channel 1 particle		Register value Lo (channel 1 particle		Register value Hi (channel 2 particle		Register value Lo (channel 2 particle counting) ：15		Register value Hi (channel 3 particle counting)		Register value Lo (channel 3 particle counting)：2	

			counting)	counting) ：20	counting)			

00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
Register value Hi (channel 4 particle counting)：0		Register value Lo (channel 4 particle counting)：0		Register value Hi (channel 5 particle counting)		Register value Lo (channel 5 particle counting)：0		Register value Hi (channel 6 particle counting)		Register value Lo (channel 6 particle counting)：0		Register value Hi (channel 7 particle counting)		Register value Lo (channel 7 particle counting)：0	

00	00	00	00	00	04	00	05	00	04	00	00	00	00	00	00

Register value Hi (channel 8 particle counting)	Register value Lo (channel 8 particle counting) : 0	channel 1 CODE : 4	channel 2 CODE : 5	channel 3 CODE : 4	Channe 14 CODE : 0	channel 5 CODE : 0	channel 6 CODE : 0

00	05	00	00	00	00	3C	44
Maximum CODE：5		N.A.		N.A.		CRC16 Lo	CRC16 Hi

6.5 4-20mA Analog signal communication

The 4-20mA analog output adopts protocol 4 (RULE4), which is suitable for 4-20mA analog output.

Output channel particle size comparison table

Output channel	ISO4406	NAS1638	ROCT17216
OUT1 (channel 1)	≥4μm(c)	5～15μm	>1～2μm
OUT2 (channel 2)	≥6μm(c)	15～25μm	>2～5μm
OUT3 (channel 3)	≥14μm(c)	25～50μm	>5～10μm

YFJ-4 Sensor 4-20mA corresponds to each standard level

Current(mA)	ISO4406	NAS1638	ROCT17216
4.0	0	00	00
4.5	1	—	0
5.0	2	0	1
5.5	3	—	2
6.0	4	1	3
6.5	5	—	4
7.0	6	2	5
7.5	7	—	6

8.0	8	3	7
8.5	9	—	8
9.0	10	4	9
9.5	11	—	10
10.0	12	5	11
10.5	13	—	12
11.0	14	6	13
11.5	15	—	14
12.0	16	7	15
12.5	17	—	16
13.0	18	8	17
13.5	19	—	—
14.0	20	9	—
14.5	21	—	—
15.0	22	10	—
15.5	23	—	—
16.0	24	11	—
16.5	25	—	—
17.0	26	12	—
17.5	>26	—	—

7. Common troubleshooting methods

The common fault phenomena and troubleshooting methods of the instrument are shown in table 6-1.

Table 6-1 common faults and troubleshooting methods

Fault phenomena	Troubleshooting methods
1. The system cannot be turned on or the display cannot be lit after the system is turned on.	1. Check whether the power cord is plugged in and whether the bulge and the pit are aligned.
2. No oil is coming out of the outlet when the instrument is measuring.	1. Whether the inlet pipe is connected to the tested system. 2.Whether the pressure provided by the system which will be tested meets the normal working pressure requirements of the instrument. 3. It is possible that the instrument detection area is blocked (the detection area needs to be cleaned).

3.Detection prompt “Baseline high”	1.It is possible that the detection area of the instrument is blocked (the detection area needs to be cleaned). 2. The oil is so dirty that it hardly penetrates light.

Here is a simple list of common faults and troubleshooting methods of the instrument. In case of special faults, user do not disassemble the instrument by yourself for maintenance. Please contact the manufacturer's service personnel in time.

Appendix 1 Cleaning method of instrument and filter

I. Filter cleaning method

1. Composition of the inlet filter:
The inlet filter is located at the inlet junction of the instrument (as shown in figure. 2-2), which is mainly composed of a metal filter net (as shown in figure 1). The aperture diameter of metal filter net is 120μm, which can intercept the particle pollutants more than 120μm, and avoid the instrument from easy blockage.

2. Cleaning method of inlet filter:

① To block the high-pressure joint with the appropriate wrench, to remove it by counterclockwise rotation, and then use the appropriate

inner hexagon wrench to take down the metal filter net by counterclockwise rotation (as shown in figure 1), and then clean the metal filter net with phase solution.

② At first install the metal filter net according to the reverse order of the above steps after cleaning, and then install the high-pressure joint, and clockwise tighten it.

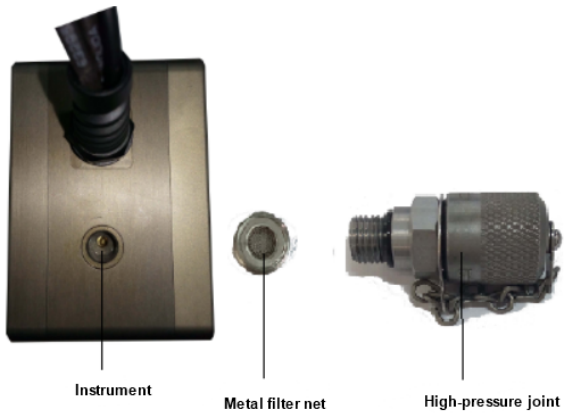


Figure 1

✧ Note: The sampling quantity is less than 10ml each time when performing the test operation, or some of the sample that can be suctioned originally but it can't be suctioned now, or there is bubble phenomenon in liquid inlet tube during the suction, The liquid inlet filter should be cleaned in time. Please perform the test operation again to observe whether the fault is eliminated after cleaning.

The user can clean the liquid inlet filter regularly according to the frequency of using instrument and the contamination degree of the test

sample in order to keep the instrument in the best condition.

II. Instrument cleaning method

According to the above the steps in the filter cleaning method, first remove the high pressure connector, and then remove the metal filter net, a small diameter round hole will be seen.

① Slowly through the round hole back and forth a few times by "rod" which is equipped with the instrument, and then change rubber pipette bulb to blow downward, repeated the operation can be done for several times. To point the round hole to the light and see if there are clear round holes (as shown in figure 2).

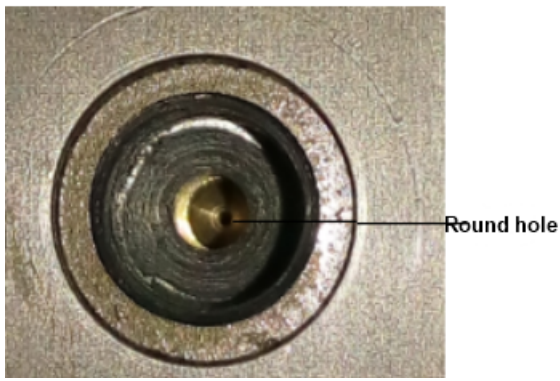


Figure 2

② If the fault is still not eliminated, use a metal wire with a diameter of less than 100um (or hair) , pass both ends of the wire through the round hole from one end of the liquid inlet interface, at this time, two wire ends are exposed at one end of the liquid outlet interface, and form a circle. Take another piece

of cotton thread and run it through the wire ring and flatten the ring, then pull the two metal wire ends at the end of the outlet interface. Take the cotton thread through the hole, hold both ends of the cotton thread and pull it back and forth several times (a few drops of clean petroleum ether can be added to the round hole to remove the plug in the round hole), point the hole to the light again, see if there is clear.

③ If fault phenomenon still can not be eliminated after the above treatment, please contact the factory service personnel.

After cleaning, install the high-pressure joint and metal filter net that be removed, perform the cleaning operation, and then perform the detection operation to see whether the fault is eliminated.

Appendix 2. Pollution Levels Codes of Common Standards Solid Particle

NAS1638 (particles number per 100 ml)

Pollution Level	Particle size range （μm）				
	5-15	15-25	25-50	50-100	>100
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1000	178	32	6	1
3	2000	356	63	11	2
4	4000	712	126	22	4
5	8000	1425	253	45	8
6	16000	2850	506	90	16

7	32000	5700	1012	180	32
8	64000	11400	2025	360	64
9	128000	22800	4050	720	128
10	256000	45600	8100	1440	256
11	512000	91200	16200	2880	512
12	1024000	182400	32400	5760	1024

ISO4406 Grade of oil cleanliness (Particle number per 1 ml)

Particles number in 1 ml		Label
>	≤	
160,000	320,000	>24
80,000	160,000	24
40,000	80,000	23
20,000	40,000	22
10,000	20,000	21
5,000	10,000	20
2,500	5,000	19
1,300	2,500	18
640	1,300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9

GJB

1.3	2.5	8
0.64	1.3	7
0.32	0.64	6
0.16	0.32	5
0.08	0.16	4
0.04	0.08	3
0.02	0.04	2
0.01	0.02	1
0.00	0.01	0

420A-96 (Particle number per 100 ml)

Pollution Level	Particle size range （μm）				
	>2	>5	>15	>25	>50
000	164	76	14	3	1
00	328	152	27	5	1
0	656	304	54	10	2
1	1310	609	109	20	4
2	2620	1220	217	39	7
3	5250	2430	432	76	13
4	10500	4860	864	152	26
5	21000	9730	1730	306	53
6	42000	19500	3460	612	106
7	83900	38900	6920	1220	212
8	168000	77900	13900	2450	424
9	336000	156000	27700	4900	848
10	671000	311000	55400	9800	1700

11	1340000	623000	111000	19600	3390
12	2690000	1250000	222000	39200	6780

GJB

Measured oil sample pollution levels can be confirmed according to the measured particle number more than 5μm size range corresponding to pollution level. If test is demanded by entrust organization, The tested sample pollution levels also can be confirmed in accordance with the measured particle number more than 2μm, or 15μm range corresponding to pollution level.

420B-2006 (Particle number per 100 ml)

Size Code		A	B	C	D	E	F
Size		>1 μm >4 μm (c)	>5 μm >6 μm (c)	>15 μm >14 μm (c)	>25 μm >21 μm (c)	>50 μm >38 μm (c)	>100 μm >70 μm (c)
Level	000	195	76	14	3	1	0
	00	390	152	27	5	1	0
	0	780	304	54	10	2	0
	1	1560	609	109	20	4	1
	2	3120	1220	217	39	7	1
	3	6250	2430	432	76	13	2
	4	12500	4860	864	152	26	4
	5	2500	9730	1730	306	53	8
	6	50000	19500	3460	612	106	16
	7	100000	38900	6920	1220	212	32
	8	200000	77900	13900	2450	424	64
	9	400000	156000	27700	4900	848	128
	10	800000	311000	55400	9800	1700	256

	11	1600000	623000	111000	19600	3390	512
	12	3200000	1250000	222000	39200	6780	1020
Note: Using ACFTD standard substances to calibrate or using measuring size of optical microscope, the unit of measurement is micron, expressed in μm; Using ISOMTD standard substances or using measuring size of the scanning electron microscopy, the unit of measurement is micron too, expressed in μm (c).							

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