SPECIFICATION

Product Name: Online Particle Counter

Item No.: OPC-6303M

Version: V0.6

OPC-6303M Particle Counter

Applications

- Power battery manufacturing
- Chip manufacturing
- Medical and pharmaceutical
- Precision machining

Description

The OPC-6303M online particle counter adopts the principle of optical scattering, which can accurately detect and calculate the number of suspended particles of different particle sizes in the air per unit volume. It can output the particle count of 6 channels of 0.3μm, 0.5μm, 1.0μm, 2.5μm, 5.0μm and 10μm at the same time (the default unit is pcs/m³, can be switched to pcs/L; pcs/28.3L).
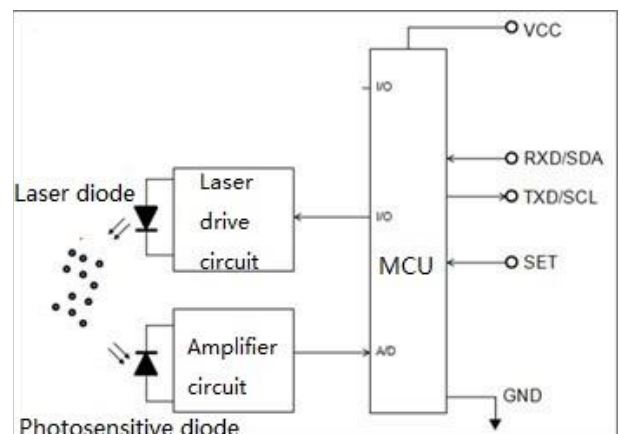
Features

- Efficient particle recognition rate
- Industrial grade laser with high reliability
- Constant flow gas sampling system to ensure stable sampling
- Simultaneous output of 6 channels 0.3μm, 0.5μm, 1.0μm, 2.5μm, 5.0μm and 10μm
- Wide temperature operating range

Working Principle

Air sampling is carried out by a fan. When the particles in the sampled gas pass through a light source (laser) and other beams, light scattering occurs; the scattered light is converted into an electrical signal (pulse) through a photoelectric converter, and the larger the particle, the pulse signal is obtained The larger the wave value (wave peak value), the number of particles with different particle sizes can be obtained through the wave peak value and the number of pulses at this time.

According to the block diagram on the right, the light source part of OPC-6303M consists of a laser tube that emits light to detect particles and a drive circuit, the detection part consists of a photosensitive element that receives reflected light and an amplifier circuit, and the data processing and communication output are completed by a microprocessor.

The particle detection of OPC-6303M is the gas flow generated by the operation of the fan, and the particles pass through the detection chamber. The light from the laser tube will be scattered by the particles and converted into electrical signals by the photosensitive device. After the electrical signal is processed by amplifying circuit, filtering and MCU, it will be converted into digital signal output.

Specification

Principle	Light Scattering
Detect particle diameter range	0.3~10μm
Counting efficiency	50%@0.3μm 100%@≥0.5μm(Use TSI9306 as reference,25±2℃, 50±10%RH environmental conditions)
Power-on stabilization time	≤8s
Data refresh rate	1s
Working conditions	0℃～45℃; 0～95%RH (non-condensing)
Storage conditions	-20~60℃, 0~95%RH (non-condensing)
Operating Voltage	DC 12V
Average operating current	≤1A
Communication Interface	RS485 interface (standard) RJ45 (standard) 4~20mA analog signal interface (standard)
Lifetime	≥3 years
Sampling flow	2.83L/min

Product Appearance and Pin Definition Function

1. Product dimensions (unit: mm, tolerance: ±2 mm)
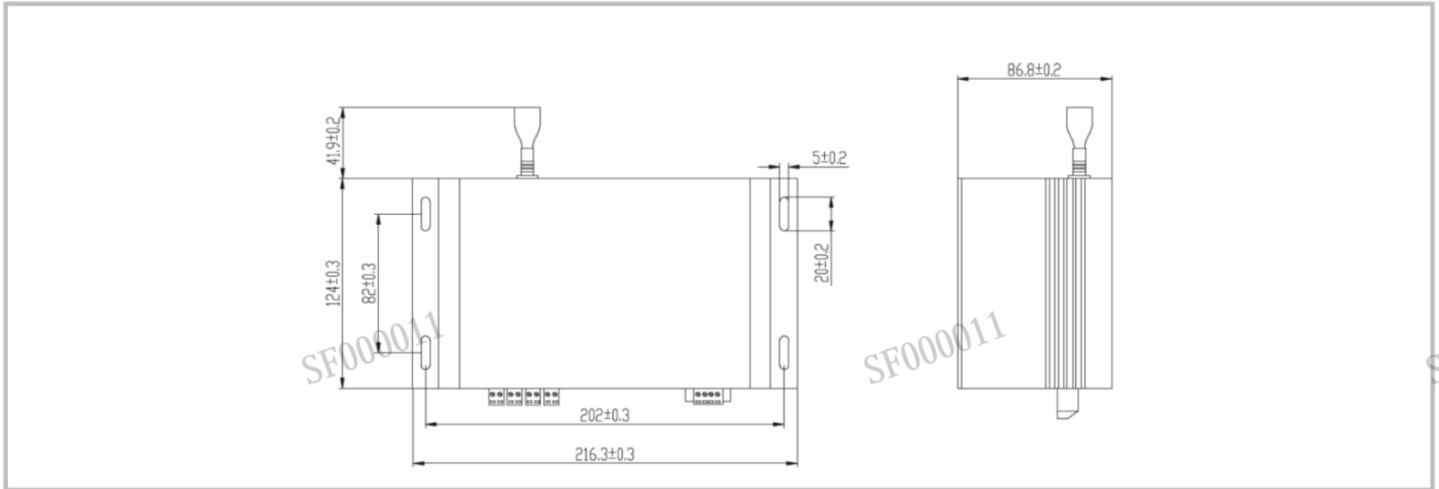

2. Pin Definition Diagram
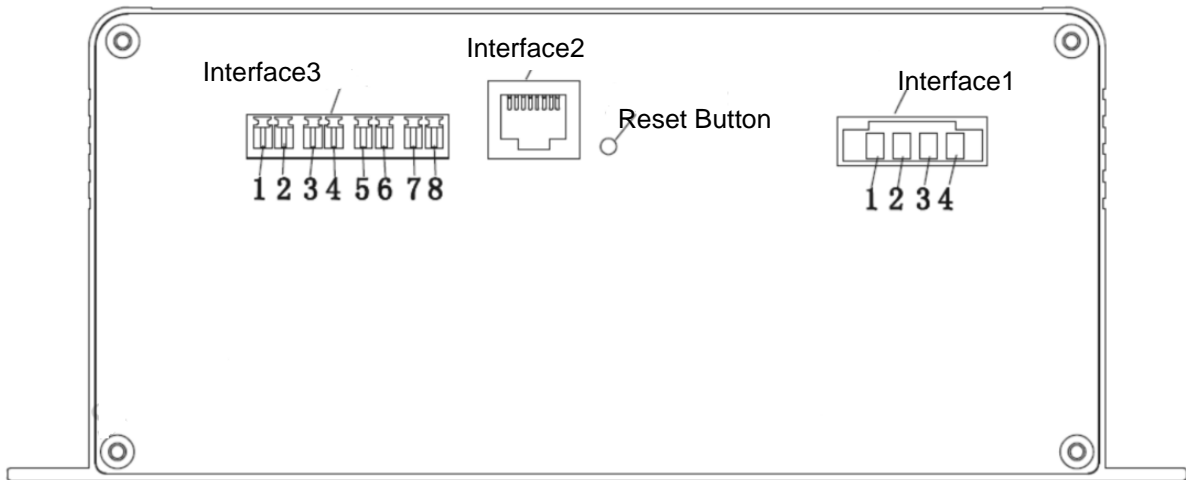
	No.	PIN	Description		
Interface 1	1	VCC	Power terminal (+12VDC)		Connector: KF2EDGRM-3.81-6P-14-curved needle
	2	GND	Power terminal (GND)		
	3	TB	Communication interface (RS485_TB)		Insertion: KF2EDGKM-3.81-6P-14
	4	TA	Communication interface (RS485_TA)		
Interface 2	**RJ45**				Connector: HR911105A (Fusida)
	1	I1 +	I1 Positive pole	**>0.5um channel**	
	2	I1 -	I1 Negative pole		
	3	I2 +	I2 Positive pole	**>1.0um channel**	

Interface 3	4	I2 -	I2 Negative pole		Connector: KF2EDGRM-3.81-6P-14-curved needle
	5	I3 +	I3 Positive pole	**>2.5um channel**	
	6	I3 -	I3 Negative pole		Insertion: KF2EDGKM-3.81-6P-14
	7	I4 +	I4 Positive pole	**>5.0um channel**	
	8	I4 -	I4 Negative pole		

Installation Instruction

When this product is installed and used in the system, the air flow of the air inlet and air outlet should be guaranteed to be smooth; in order to avoid the dust deposition on the surface of the sensitive device during use, which will affect the test accuracy of the sensor, it is recommended to install the sensor in the following way.

Recommended installation method:

Air Inlet
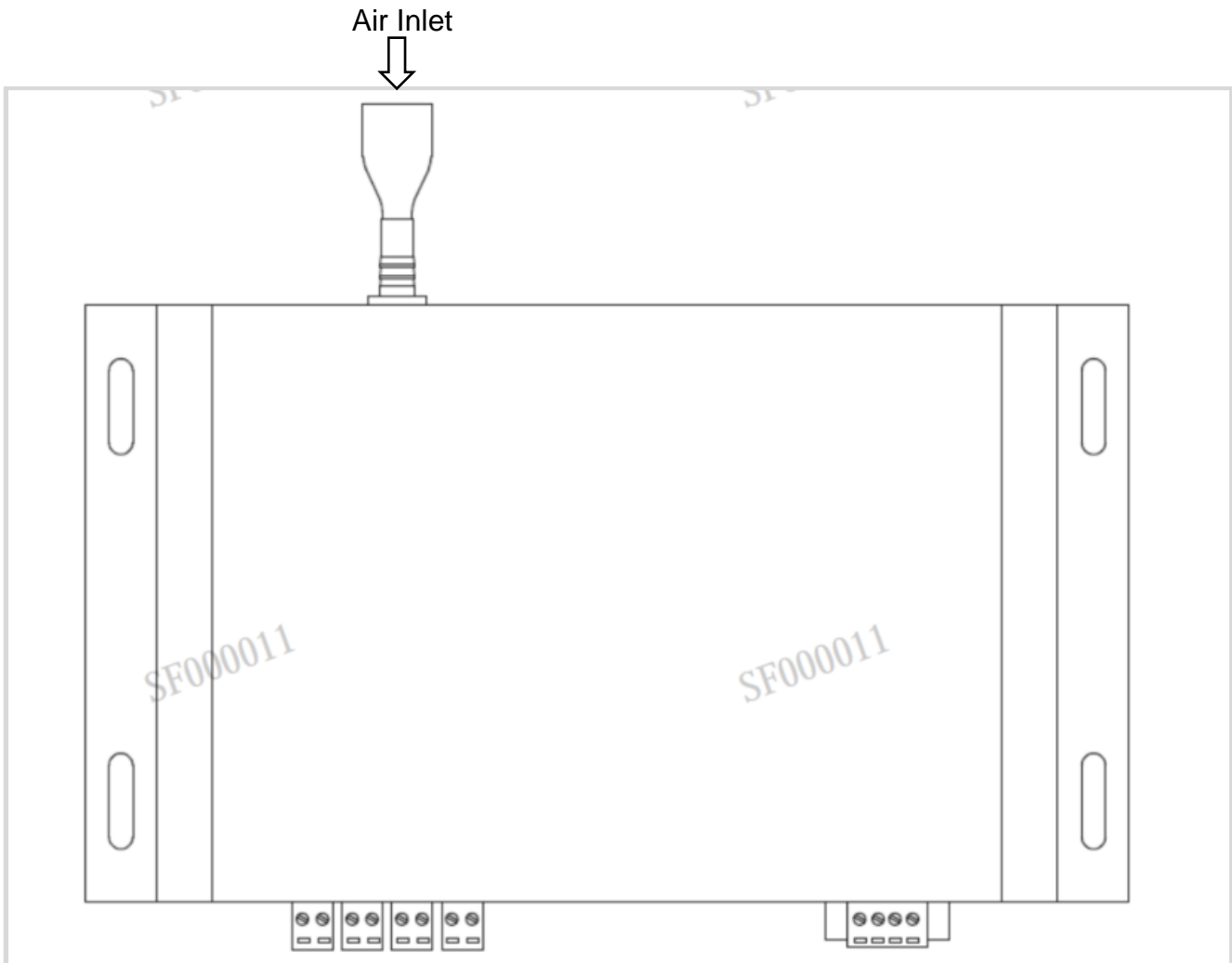
Precautions for Use

※ The instrument is forbidden to be used in environments with high dust concentration, environments containing moisture, oil and corrosive substances, and environments with high temperatures exceeding the allowable use.

※ Do not block the air inlet and outlet to avoid damage to the air pump.

※ The product is an integral part, users should not disassemble it to prevent irreversible damage.

※ Do not cause great vibration to the product, so as not to affect the internal air tightness.

※ The device cannot run continuously, which will shorten the service life of the product.

This product contains Class IIIB laser products, which contain laser radiation, avoid direct exposure to the eyes. Do not remove the case or cover. The warning signs are as following:

Communication Protocol

1. Protocol overview

1.1 Serial RS485 communication protocol

1) The data of this protocol are all hexadecimal data. For example, "46" is [70] in decimal.

2) [xx] is single-byte data (unsigned, 0-255); double-byte data high byte is in front and low byte is behind.

3) Baud rate: 9600b/s; data bits: 8 bits; stop bits: 1 bit; parity bit: none.

2. UART serial communication protocol format

The device adopts the Modbus RTU communication protocol, and the requirements are as follows:

1) The device acts as a slave;

2) The Modbus 03 function code (Read Holding Registers) can be used to read the device status and data; the Modbus 06 function code (Preset Single Register) can be used to set the device status.

3) If the function code in the sent message does not meet the requirements, the device will reply the error code 01 (ILLEGAL FUNCTION) through the 81 function code message; if the request address in the sent message does not meet the requirements, the device will report the 81 function code. The text reply error code 02 (ILLEGAL DATA ADDRESS) notification.

3. Device factory default settings

1) The factory address is 01 by default.

2) The factory default is intermittent working mode. (Work 1 min/ Sleep 4 min)

3) The factory defaults all user coefficients are 1.0000.

4) The factory default setting control flow rate is 2.83 L/min (cannot be changed at will).

4. Check code

CRC-16 (Modbus), high byte first, low byte after.

5. Register address table

Restriction Description

1) Read-only registers and readable and writable registers are not allowed to overlap.

2) Only function of writing a single register is implemented, and writing multiple registers is not available.

3) The total number of registers is limited, currently 32 input registers and 32 holding registers are supported.

4) The current version does not support file transfer with a large amount of data.

5) See Table 1 and Table 2 for register details, all registers are 16-bit word, and the register address is register number-1.

Table 1: Input Registers

Data No.	Address	Definition	Explanation
IR1	00H		Version No. (Enlarge 100)
IR2	01H		Reserve
IR3	02H		Reserve
IR4	03H	The number of particles >0.3μm	≥0.3μm particle quantity high byte
IR5	04H	The number of particles >0.3μm	≥0.3μm particle quantity low byte
IR6	05H	The number of particles >0.5μm	≥0.5μm particle quantity high byte
IR7	06H	The number of particles >0.5μm	≥0.5μm particle quantity low byte
IR8	07H	The number of particles >1.0μm	≥1.0μm particle quantity high byte
IR9	08H	The number of particles >1.0μm	≥1.0μm particle quantity low byte
IR10	09H	The number of particles >2.5μm	≥2.5μm particle quantity low byte
IR11	0AH	The number of particles >2.5μm	≥2.5μm particle quantity low byte
IR12	0BH	The number of particles >5.0μm	≥5.0μm particle quantity high byte
IR13	0CH	The number of particles >5.0μm	≥5.0μm particle quantity low byte
IR14	0DH	The number of particles >10μm	≥10μm particle quantity high byte
IR15	0EH	The number of particles >10μm	≥10μm particle quantity low byte
IR16	0FH		Reserve
IR17	10H		Reserve
IR18	11H		Reserve
IR19	12H		Reserve
IR20	13H		Reserve
IR21	14H		Reserve
IR22	15H		Reserve
IR23	16H		Reserve
IR24	17H	Gas flow value	Actual gas flow value multiplied by 100
IR25	18H		Reserve
IR26	19H		Reserve
IR27	1AH		Reserve
IR28	1BH		Reserve
IR29	1CH		Reserve
IR30	1DH		Reserve
IR31	1EH		Reserve
IR32	1FH		Reserve

Table 2: Holding Registers

Data No.	Address	Definition	Explanation
IR1	00H		Reserve
IR2	01H		Reserve
IR3	02H	Address setting register	Slave address (1-247)
IR4	03H		Reserve
IR5	04H		Reserve
IR6	05H		Reserve
IR7	06H	>0.3µm particles user coefficient	Reserve
IR8	07H	>0.5µm particles user coefficient	Reserve
IR9	08H	>1.0µm particles user coefficient	Reserve
IR10	09H	>2.5µm particles user coefficient	Reserve
IR11	0AH	>5.0µm particles user coefficient	Reserve
IR12	0BH	>10µm particles user coefficient	Reserve
IR13	0CH		Reserve
IR14	0DH	Device intermittent stop time	Set the device intermittent stop time (min)
IR15	0EH	Device control traffic size	Actual set gas flow value multiplied by 100
IR16	0FH		Reserve
IR17	10H		Reserve
IR18	11H		Reserve
IR19	12H		Reserve
IR20	13H	Output unit	3 output units: pcs/m^3 , pcs/L, pcs/28.3L
IR21	14H	Working mode	2 working modes: continues measurement, single accumulated count mode
IR22	15H		Reserve
IR23	16H		Reserve
IR24	17H		Reserve
IR25	18H		Reserve
IR26	19H		Reserve
IR27	1AH		Reserve
IR28	1BH		Reserve
IR29	1CH		Reserve
IR30	1DH		Reserve
IR31	1EH		Reserve
IR32	1FH		Reserve

6.   Host communication protocol format

Function code description

The OPC-6303M supports the following function codes:

0x03: read holding register

0x04: read input register

0x06: write a single register

7.   Command example

Application conditions

1) Assuming a single sensor.

2) All data are hexadecimal data, and DFX nee to be converted to decimal when calculating data.

3) Symbol description:

①   IP is the device address.

②   CRC16 is MODBUSCRC16 two-byte check, the high byte is in the front and the low byte is in the back.

③   CS is 0-ADD8 and check, the lowest byte of the previous data and +CS result is 0x00.

④   DF1 DF2 DF3 DF4 represent uncertain data.

7.1.   Read >0.3um, >0.5um, >1.0um, >2.5um >5.0um, >10um of particles in each channel

7.1.1   Read >0.3µm particle count:

Send: IP 04 00 03 00 02 CRC16

Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16

Description: >0.3µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/ m³)

7.1.2   Read >0.5µm particle count:

Send: IP 04 00 05 00 02 CRC16

Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16

Description: >0.5µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/ m³)

7.1.3   Read >1.0µm particle count:

 Send: IP 04 00 07 00 02 CRC16

Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16

Description: >1.0µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/ m³)

7.1.4   Read >2.5µm particle count:
Send: IP 04 00 09 00 02 CRC16
Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16
Description: >2.5µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/m³)

7.1.5   Read >5.0µm particle count:

Send: IP 04 00 0B 00 02 CRC16

Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16

Description: >5.0µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/ m³)

7.1.6   Read >10µm particle count:

Send: IP 04 00 0D 00 02 CRC16

Answer: IP 04 04 DF1 DF2 DF3 DF4 CRC16

Description: >10µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4（pcs/ m^3）

7.2. Read real-time gas flow value

Send: IP 04 00 17 00 01 CRC16

Answer: IP 04 02 DF1 DF2 CRC16
Description: Real-time gas flow value = (DF1*256+DF2)/100（L/min）

7.3. Continuously read input register data

Send: IP 04 00 03 00 15 CRC16

Answer: IP 04 2A DF1~DF46 CRC16

Description:

>0.3µm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4（pcs/m^3）

>0.5µm particle count = DF5*256^3+DF6*256^2+DF7*256+DF8（pcs/ m^3）

>1.0µm particle count = DF9*256^3+DF10*256^2+DF11*256+DF12（pcs/ m^3）

>2.5µm particle count = DF13*256^3+DF14*256^2+DF15*256+DF16（pcs/ m^3）

>5.0µm particle count = DF17*256^3+DF18*256^2+DF19*256+DF20（pcs/ m^3）

>10µm particle count = DF21*256^3+DF22*256^2+DF23*256+DF24（pcs/ m^3）

Real-time gas flow value = (DF41*256+DF42)/100 (L/min)

7.4. Read >0.3um, >0.5um, >1.0um, >2.5um >5.0um, >10um of particles user coefficient in each channel

7.4.1 Read >0.3µm particle count：

Send: IP 03 00 06 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >0.3µm particles user coefficient= (DF1*256+DF2)/10000

7.4.2 Read >0.5µm particle count：

Send: IP 03 00 07 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >0.5µm particles user coefficient= (DF1*256+DF2)/10000

7.4.3 Read >1.0µm particle count：

Send: IP 03 00 08 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >1.0µm particles user coefficient= (DF1*256+DF2)/10000

7.4.4 Read >2.5µm particle count：

Send: IP 03 00 09 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >2.5µm particles user coefficient= (DF1*256+DF2)/10000

7.4.5 Read >5.0µm particle count：

Send: IP 03 00 0A 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >5.0µm particles user coefficient= (DF1*256+DF2)/10000

7.4.6 Read >10µm particle count：

Send: IP 03 00 0B 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: >1.0µm particles user coefficient= (DF1*256+DF2)/10000

7.5 Read output unit

Send: IP 03 00 13 00 01 CRC16

Answer: IP 03 02 00 DF1 DF2 CRC16

Description: output particles number unit, when DF=0, output unit is pcs/L; when DF=1, output unit is pcs/m^3 ; when DF=2, output unit is pcs/28.3L.

7.6 Read working mode

Send: IP 03 00 14 00 01 CRC16

Answer: IP 03 02 00 DF1 CRC16

Description: DF1=0 is continuous measurement mode, and real-time measurement values will be continuously output. DF1 = 1 is the single cumulative counting mode. When the output unit is pcs/L, the detection value will be output after 21 seconds of reading; when the output unit is pcs/m^3 , the output detection value of 5 minutes can be read; when the output unit is pcs/28.3L, the output detection value of 60 seconds will be read. When working mode is set, the parameter is not saved after power off. After the device is powered on again, the default working mode is restored: Continuous measurement mode. In the single cumulative counting mode, the device carries out a fixed time measurement, and the output value of the device does not change after the single reading. If you need to measure again, you need to send the set working mode command again, or switch to continuous measurement mode

7.7 Read device address

Send: IP 03 00 02 00 01 CRC16

Answer: IP 03 02 00 DF1 CRC16

Description: Device address is DF1

7.8 Read the intermittent operation stop time of the device

Send: IP 03 00 0D 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: Equipment intermittent stop time = DF1*256+DF2 (min)

7.9 Read device setting flow size

Send: IP 03 00 0E 00 01 CRC16

Answer: IP 03 02 DF1 DF2 CRC16

Description: Device setting flow size=(DF1*256+DF2)/100 (L/min)

7.10 Continuously read input register data

Send: IP 03 00 02 00 0D CRC16

Answer: IP 03 1A DF1~DF26 CRC16

Description: Device address:DF2

>0.3μm particle count user coefficient = (DF9*256+ DF10)/10000

>0.5μm particle count user coefficient = (DF11*256+DF12) /10000

>1.0μm particle count user coefficient = (DF13*256+DF14) /10000

>2.5μm particle count user coefficient = (DF15*256+DF16) /10000

>5.0μm particle count user coefficient = (DF17*256+DF18) /10000

>10μm particle count user coefficient = (DF19*256+DF20) /10000

Device stop operation time= DF23*256+DF24 (min)

Control device setting flow rate=(DF25*256+DF26)/100 (L/min)

7.11 Modify >0.3um, >0.5um, >1.0um, >2.5um >5.0um, >10um of particles user coefficient in each channel

7.11.1 Modify >0.3um of particles user coefficient in each channel

Send: IP 06 00 06 DF1 DF2 CRC16

Answer: IP 06 00 06 DF1 DF2 CRC16

Description: >0.3μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.11.2 Modify >0.5um of particles user coefficient in each channel

Send: IP 06 00 07 DF1 DF2 CRC16

Answer: IP 06 00 07 DF1 DF2 CRC16

Description: >0.5μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.11.3 Modify >1.0um of particles user coefficient in each channel

Send: IP 06 00 08 DF1 DF2 CRC16

Answer: IP 06 00 08 DF1 DF2 CRC16

Description: >1.0μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.11.4 Modify >2.5um of particles user coefficient in each channel

Send: IP 06 00 09 DF1 DF2 CRC16

Answer: IP 06 00 09 DF1 DF2 CRC16

Description: >2.5μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.11.5 Modify >5.0um of particles user coefficient in each channel

Send: IP 06 00 0A DF1 DF2 CRC16

Answer: IP 06 00 0A DF1 DF2 CRC16

Description: >5.0μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.11.6 Modify >10um of particles user coefficient in each channel

Send: IP 06 00 0B DF1 DF2 CRC16

Answer: IP 06 00 0B DF1 DF2 CRC16

Description: >10μm particle quantity user coefficient =(DF1*256+DF2)/10000

7.12 Modify the device address (the address range that can be set is 1-254)

Send: IP 06 00 02 00 DF1 CRC16 (IP address indicates the device address before the change)

Answer: IP 06 00 02 00 DF1 CRC16 (IP address indicates the new device address)

Description: DF1 indicates the device address to be changed

7.13 Modify the operating stop time of the equipment (the time range that can be set is 1-10000)

Send: IP 06 00 0D DF1 DF2 CRC16

Answer: IP 06 00 0D DF1 DF2 CRC16

Description: Device stop time = DF1*256+DF2 (min)

7.14 Modify the flow rate set by the control device (the flow rate can be set in the range of 2.0L/min – 3.5L/min)

Send: IP 06 00 0E DF1 DF2 CRC16

Answer: IP 06 00 0E DF1 DF2 CRC16

Description: The modified flow rate=(DF1*256+DF2)/100 (L/min)

7.15 Set output unit

Send: IP 06 00 13 DF1 DF2 CRC16

Answer: IP 06 00 13 DF1 DF2 CRC16

Description: The modified output unit=(DF1*256+DF2)/100 (L/min),support 0 (pcs/L), 1 (default pcs/m^3), 2(pcs/28.3L); set output unit is restored after power off.

7.16　Set working mode

Send: IP 06 00 14 DF1 DF2 CRC16

Answer: IP 06 00 14 DF1 DF2 CRC16

Description: The modified working mode=(DF1*256+DF2), support 0 (continues measurement), 1 (single cumulative counting mode); set output unit is restored after power off. When working mode is set, the parameter is not saved after power off. After the device is powered on again, the default working mode is restored: Continuous measurement mode. In the single cumulative counting mode, the device carries out a fixed time measurement, and the output value of the device does not change after the single reading. If you need to measure again, you need to send the set working mode command again, or switch to continuous measurement mode

7.17　Query device address

Send: 11 02 55 FF CS

Answer: 16 02 55 DF1 CS

Description: In the running mode, the query device address is DF1

7.18　Print debugging information

Send: 11 02 FD 01 CS

Answer: 16 02 FD 01 CS

Description: If no printing information is output, send command to start printing. If there is printing information, send command to stop printing

7.19　Query the software version number

Send: 11 01 1E CS

Answer: 16 0E 1E DF1 DF2 DF3 DF4 DF5 DF6 DF7 DF8 DF9 DF10 DF11 DF12 DF13 CS

Description: The version number is DF1-DF13, the ASCII string is the software version number

7.20　Set 4 channel range of 4-20mA

Send: 11 06 F0 DF1 DF2 DF3 DF4 DF5 CS

Answer: 16 06 F0 DF1 DF2 DF3 DF4 DF5 CS

Description:

When DF1=0, current modified channel is PM0.5, corresponding measurement range of

4~20mA=DF2*256*256*256+DF3*256*256+DF4*256+DF5

When DF1=1, current modified channel is PM1.0, corresponding measurement range of

4~20mA=DF2*256*256*256+DF3*256*256+DF4*256+DF5

When DF1=2, current modified channel is PM2.5, corresponding measurement range of

4~20mA=DF2*256*256*256+DF3*256*256+DF4*256+DF5

When DF1=3, current modified channel is PM5.0, corresponding measurement range of

4~20mA=DF2*256*256*256+DF3*256*256+DF4*256+DF5

The range will automatically update the corresponding range according to the set unit. Therefore, it is

recommended to confirm (query) the current output unit before setting the measurement range. After

the range setting will be saved.

The default output unit is pcs/L, 4~ 20mA corresponding default output unit measurement ranges are:

PM0.5->35000000pcs/L, PM1.0->8000000pcs/L, PM2.5->3000000pcs/L, PM5.0->300000pcs/L

7.21　Query MQTT server IP and port number

Send: 11 01 67 CS

Answer: 16 07 67 DF1 DF2 DF3 DF4 DF5 DF6 CS

Description: MQTT server IP and port number format: [IP1]:[IP2]:[IP3]:[IP4]:[PORT]

IP1=DF1, IP2=DF2, IP3=DF3, IP4=DF4, PORT=DF5*256+DF6

7.22 Modify MQTT server IP and port number

Send: 11 07 66 DF1 DF2 DF3 DF4 DF5 DF6 CS

Answer: 16 01 66 83

Description: MQTT server IP and port number format: [IP1]:[IP2]:[IP3]:[IP4]:[PORT]

IP1=DF1, IP2=DF2, IP3=DF3, IP4=DF4, PORT=DF5*256+DF6

1. Protocol overview

- This device support DHCP protocol, can obtain the IP address automatically.
- Support the MQTT protocol version: MQTT V3.1.1.
- Using JSON data format.
- Support device calibration instructions.
- Default IP address and port number connected to the MQTT server: 39.108.78.19:1883 (which can be modified using RS485)

2. Topic List

Directions	Topic	Description
Server->MCU	/productID/deviceID/function/invoke	Server sen the instant command (CMD-1~CMD-10)
MCU->Server	/productID/deviceID/function/invoke/reply	Reply to the server 's sending command (ACK) : notifies the server of the received number According to (CMD-999)
MCU->Server	/productID/deviceID/properties/report	Device periodically reports data, cycle is intermittent operation cycle (configurable) (CMD-168) Repones to data sent by the server (CMD-101 ~ CMD-110)

3. Authentication Definition

Product ID: opc6303

deviceID: Device factory sn

secureId: sifangguangdian

secureKey: 123456

var clientId = deviceID(device SN)

var username = secureId+"|"+deviceID; // Concatenate user password

var password = md5(username+"|"+secureKey); // Use md5 to generate the abstract

4. Rule of Message

4.1. Messages are delivered in a uniform format where the inputs object is the content of the message.

All send instruction contents will be in inputs.

Key value	Types	Description
cmd	String	Command number
inputs	Object	Downlink message content
desired	Object	Uplink message content
messageId	Otring	Message Id

Note: All descending instructions must contain the "messageId" and "inputs" fields; and the "inputs" field must begin with cmd field. messageId of the uplink ACK = messageId of the downlink ACK

4.2. Command List

MCU->Server (Downlink)

Command	Description
CMD-1	Read particle count
CMD-2	Read the real-time gas flow value
CMD-3	/
CMD-4	Read the particle quantity coefficient
CMD-5	/
CMD-6	Read the intermittent operation & stop time of the device
CMD-7	Query the SN code and firmware version
CMD-8	Modify device parameters

MCU->Server (Uplink)

Command	Description
CMD-101	Upload the particle count
CMD-102	Upload Real-time gas flow value
CMD-103	/
CMD-104	Upload the particle quantity coefficient
CMD-105	/
CMD-106	Upload the intermittent operation stop time of the device
CMD-107	Upload SN code and firmware version
CMD-108	Modify the device parameter response
CMD-168	Periodically report the data automatically
CMD-999	Uplink ACK(Acknowledgement message of receiving the instruction, which informs the server that the instruction was received）

5. Instruction specification

5.1 Read particle count CMD-1

Description: Read >0.3um, >0.5um, >1.0um, >2.5um, >5.0um, >10um of particles count in each channel

Downlink command：

Parameter	Type	Description
–	–	–

Example：

topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId" :"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD1",
"messageType":"INVOKE_FUNCTION",
"inputs":[{"cmd":"CMD-1"}]
}

Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the instruction was received)：

TOPIC：/prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
}

Uplink data：

Parameter	Type	Description
particles_0.3um	Number	>0.3µm particle count
particles_0.5um	Number	>0.5µm particle count

particles_1.0um	Number	>1.0µm particle count
particles_2.5um	Number	>2.5µm particle count
particles_5.0um	Number	>5.0µm particle count
particles_10um	Number	>10µm particle count
Unit	String	Unit (pcs/m^3 by default)

```
topic : /prodcutID/deviceID/properties/report
{
"cmd": "CMD-101",
"desired":{
"particles_0.3um" : 123,
"particles_0.5um" : 123,
"particles_1.0um" : 123,
"particles_2.5um" : 123,
"particles_5.0um" : 123,
"particles_10um" : 123,
"unit":"pcs/m³ "
 }
}
```

5.2 Read the real-time gas flow value CMD-2

Description: Read the real-time gas flow value,Unit is (L/min)

Downlink command：

Parameter	Type	Description
-	-	–

```
topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId":"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD2",
"messageType":"INVOKE_FUNCTION",
"inputs":[{"cmd":"CMD-2"}]
}
```

Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the instruction was received)：

```
TOPIC: /prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
}
```

Uplink data：

Parameter	Type	Description
gas_flow	Number(Floating-point value)	real-time gas flow value
unit	String	real-time gas flow (Unit: L/min)

```
topic :/prodcutID/deviceID/properties/report
{
"cmd":"CMD-102",
"desired":{
"gas_flow" : 2.83
"unit" : "L/min"
}
}
```

5.3 Read the particle quantity coefficient CMD-4
Description: Read the particle quantity coefficient
Downlink command：

Parameter	Type	Description
-	**-**	–

```
topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId":"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD4",
"messageType":"INVOKE_FUNCTION",
"inputs":[{"cmd":"CMD-4"}]
}
```

Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the instruction was received)：

```
TOPIC: /prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
}
```

Uplink data：

Parameter	Type	Description
particles_coef_0.3um	Number-integer number	>0.3μm particle count user coefficient,10000 times larger
particles_coef_0.5um	Number- integer number	>0.5μm particle count user coefficient,10000 times larger
particles_coef_1.0um	Number- integer number	>1.0μm particle count user coefficient,10000 times larger
particles_coef_2.5um	Number- integer number	>2.5μm particle count user coefficient,10000 times larger
particles_coef_5.0um	Number- integer number	>5.0μm particle count user coefficient,10000 times larger
particles_coef_10um	Number- integer number	>10μm particle count user coefficient,10000 times larger

```
topic : /prodcutID/deviceID/properties/report
{
        "       cmd": "CMD-104",
        "desired":{
                "particles_coef_0.3um" : 123,
                "particles_coef_0.5um" : 123,
                "particles_coef_1.0um" : 123,
                "particles_coef_2.5um" : 123,
                "particles_coef_5.0um" : 123,
                "particles_coef_10um" : 123
        }
}
```

5.4 Read the intermittent operation stop time of the device CMD-6
Description: Read the intermittent operation stop time of the device
Downlink command：

Parameter	Type	Description
–	–	–

```
topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId":"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD6",
"messageType":"INVOKE_FUNCTION",
"inputs":[{"cmd":"CMD-6"}]
}
```

Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the

instruction was received）：
TOPIC: /prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
} Uplink data：

Parameter	Type	Description
work_stop_time	Number-Shaping number	Available to set, unit is minute. Cannot set it to be 0, otherwise the setting value is invalid.
Work_run_time	Number- Shaping number	The value is set to 1min. Actively upload MQTT data once the run time is over

```
topic : /prodcutID/deviceID/properties/report
{
      "cmd": "CMD-106",
      "desired":{
            "work_stop_time"     : 10,
            "work_run_time"    : 1
      }
}
```

5.5 Query the SN code and firmware version CMD-7
Description: Query the SN code and firmware version
Downlink command:

Parameter	Type	Description
–	–	–

```
topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId":"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD7",
"messageType":"INVOKE_FUNCTION",
"inputs":[{"cmd":"CMD-7"}]
}
```
Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the instruction was received）：
TOPIC: /prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
}
Uplink data：

Parameter	Type	Description
sn	String	Device sn
sw_version	String	sw version

```
topic : /prodcutID/deviceID/properties/report
{
      "cmd": "CMD-107",
      "desired":{
"sn"    : "123456789",
"sw_version"    : "xxx"
}
}
```

5.6 Modify device parameters CMD-8
Description: Modify device parameters
Downlink command:

Parameter	Type	Description
particles_coef_0.3um	Number	>0.3µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
particles_coef_0.5um	Number	>0.5µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
particles_coef_1.0um	Number	>1.0µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
particles_coef_2.5um	Number	>2.5µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
particles_coef_5.0um	Number	>5.0µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
particles_coef_10um	Number	>10µm particle count user coefficient, range 1000~65000,10000 times larger, actual coefficient is 0.1~6.5
work_stop_time	Number	Device stop time ,unit is min.

```
topic : /prodcutID/deviceID/function/invoke
{
"messageId":"1574326733176995841",
"deviceId":"173072083110001",
"timestamp":1664183717422,
"functionId":"CMD8",
"messageType":"INVOKE_FUNCTION",
"inputs":[
{"cmd":"CMD-8"},
{"particles_coef_1.0um":12345},
{"work_stop_time": 2}
]
  }
```
Uplink ACK (Acknowledgement message of receiving the instruction, which informs the server that the instruction was received):
```
TOPIC: /prodcutID/deviceID/function/invoke/reply
{
"messageId":"1574326733176995841",
"cmd": "CMD-999",
"output":"success"
}
```
Uplink data:

Parameter	Type	Description
result	String	success or failed

```
topic : /prodcutID/deviceID/properties/report
{
"sn" : "123456789",
"cmd": "CMD-108",
"desired":{
"result" : "success"
}
}
```

5.7 Automatically report the data periodically CMD-168

The device will automatically report data periodically without the server sending request data packets
The automatic report period is the intermittent operation period (set by CMD-8). After one working period is complete, the automatic report is uploaded once
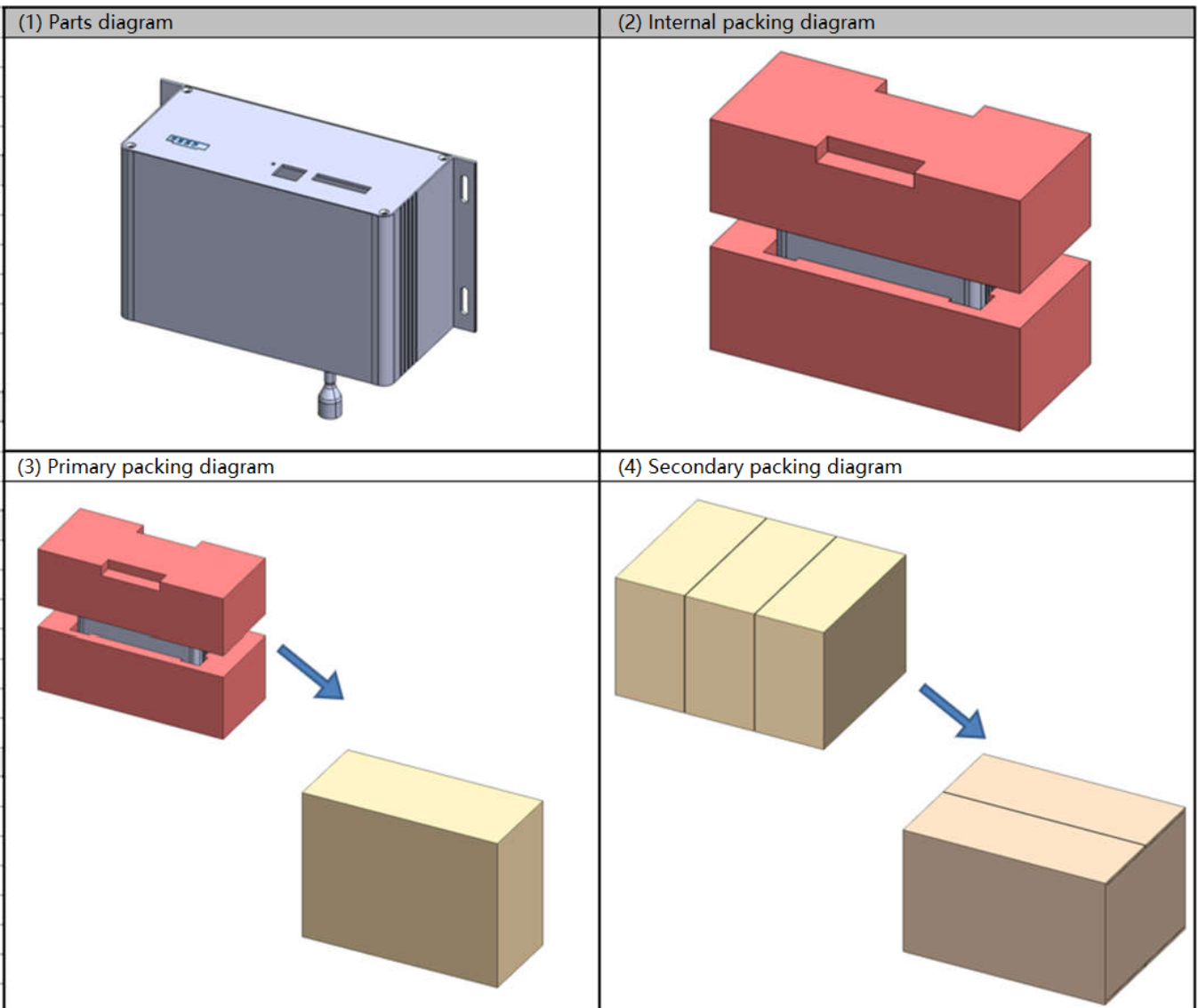Uplink data list:

Parameter	Type	Description
particles_0.3um	Number	>0.3μm particle count
particles_0.5um	Number	>0.5μm particle count
particles_1.0um	Number	>1.0μm particle count
particles_2.5um	Number	>2.5μm particle count
particles_5.0um	Number	>5.0μm particle count
particles_10um	Number	>10μm particle count
Unit	String	Unit (pcs/m^3 , default)

```
topic : /prodcutID/deviceID/properties/report
{
"cmd": "CMD-168",
      "desired":{
             "particles_0.3um" : 123,
             "particles_0.5um" : 123,
             "particles_1.0um" : 123,
             "particles_2.5um" : 123,
             "particles_5.0um" : 123,
             "particles_10um" : 123,
             "unit": "pcs/m3",
      }
}
```

Packing Information

(1) Parts diagram	(2) Internal packing diagram
(3) Primary packing diagram	**(4) Secondary packing diagram**

After-sales service and consultation

Cubic Sensor and Instrument Co., Ltd.

Tel: +86 (0) 2781628827   Fax: +86 (0) 2781628821

Address: Fenghuang No.3 Road, Fenghuang Industrial Park, Eastlake Hi-tech Development Zone, Wuhan 430205, Hubei, China

Website: www.gassensor.com.cn

Email: info@gassensor.com.cn