PCE-CPC 100

Dust Meter

PCE-CPC 100 Particle Counter

Description

The PCE-CPC 100 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 5 channels of 0.3μm, 0.5μm, 1.0μm, 5.0μm and 10μm at the same time (default unit is pcs/28.3L, available to switch unit to be pcs/m³).

Features

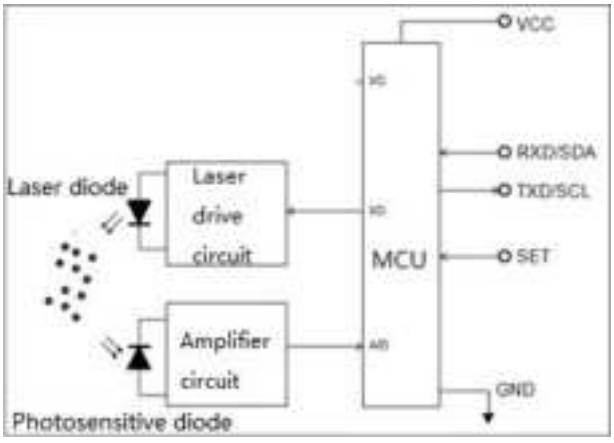
- Real-time output particle quantities of 0.3μm, 0.5μm, 1.0μm, 5.0μm, 10μm in pcs/28.3L or pcs/m³.
- Sound and light alarm once particle quantity exceeds the set threshold.
- ModBus communication protocols available.
- Real-time display cleanroom ISO 14644-1 grade level.
- Output units switchable between pcs/28.3L and pcs/m³.
- Constant flow gas sampling system to ensure stable sampling.
- Industrial grade laser for high reliability.

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 diagramme, the light source part of PCE-CPC 100 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 PCE-CPC 100 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

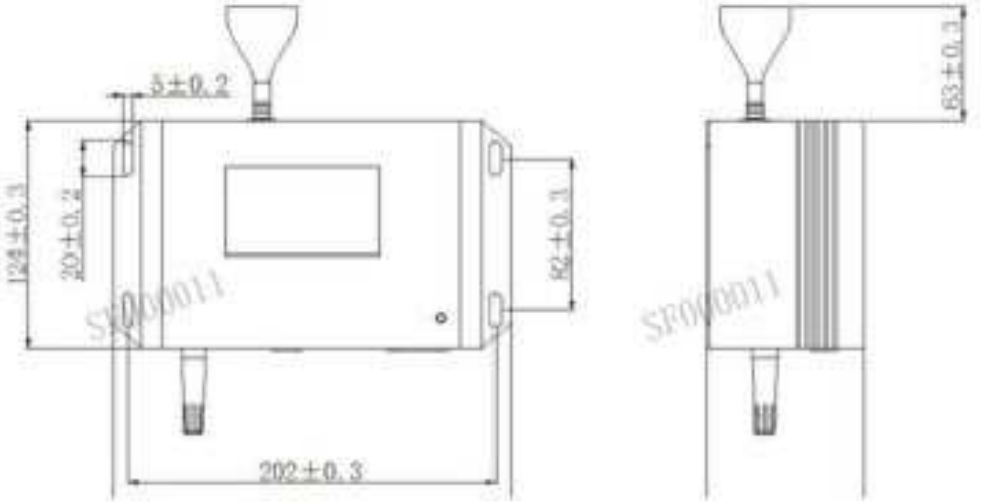
Principle	Light Scattering
Number of channels	5 channels (>0.3μm, >0.5μm, >1.0μm, >5.0μm, >10μm)
Counting efficiency	50%@0.3μm 100%@≥0.5μm (25±2℃, 50±10%RH environmental conditions)
Detection range	0~1,000,000 pcs / 28.3L
Time to first reliable reading	≤8s
Sampling interval	1s
Working conditions	0℃～45℃; 0～95%RH (non-condensing)
Storage conditions	-20~60℃, 0~95%RH (non-condensing)
Operating voltage	DC 24V±15%
Average working current	≤3A
Communication Interface	RS485 interface (standard) RJ45 (standard)
Lifetime	≥3 years (continuous working)
Sampling flow	28.3L/min
Sampling head	Isokinetic Sampling Probe
External sampling tube	Inner diameter: Φ10mm Length: ≤3m
Working mode	Adjustable (Default: Work 2min/Sleep 28min)
Display	3.5 inch color screen
Calibration	JJF1190-2008

Packing Information

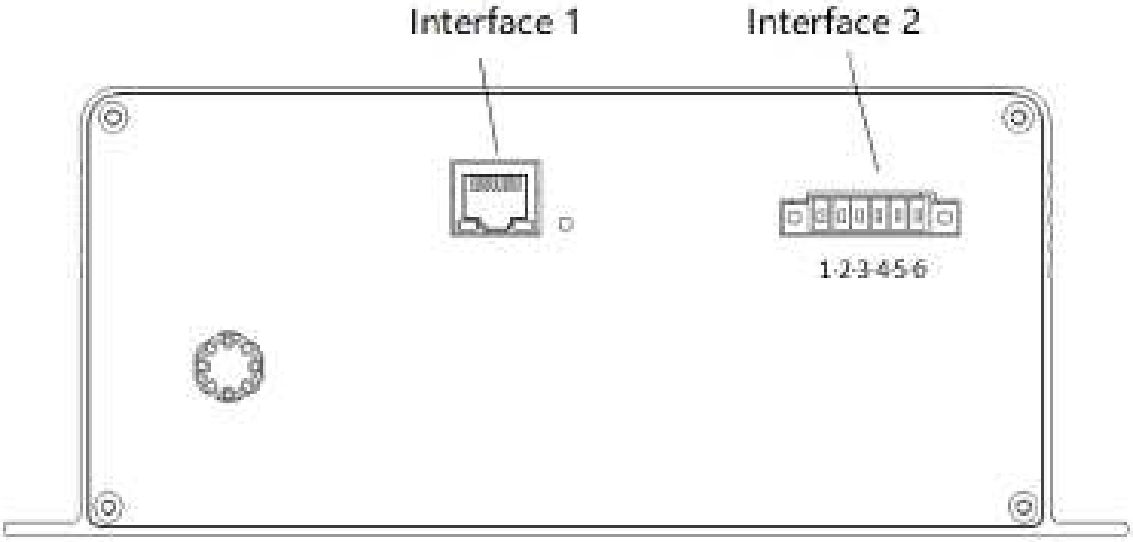
1 x dust meter PCE-CPC 100
1 x isokinetic probe
1 x hose approx. 3 m
1 x mains cable
1 x mains adaptor 24 V / 5 A
1 x user manual

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 (+24VDC)	Connector： KF2EDGRM-3.81-6P-14-curved needle Insertion： KF2EDGKM--3.81-6P-14
	2	GND	Power terminal (GND)	
	3	TB	Communication interface（RS485_TB）	
	4	TA	Communication interface（RS485_TA）	
	5	A2	original signal output	
	6	A3	original signal output	
Interface 2	RJ45			Connector： HR911105A (Fusida)

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

Air Outlet

Temperature/humidity Sensor

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:

Interface Note

The touch screen interface supports the counting display of particles in five channels of 0.3μm, 0.5μm, 1.0μm, 5.0μm and 10μm, as well as the determination of environmental grade. Also, it shows buzzer alarm and status display when exceeding the range of alarm thresholds.

Main Interface:

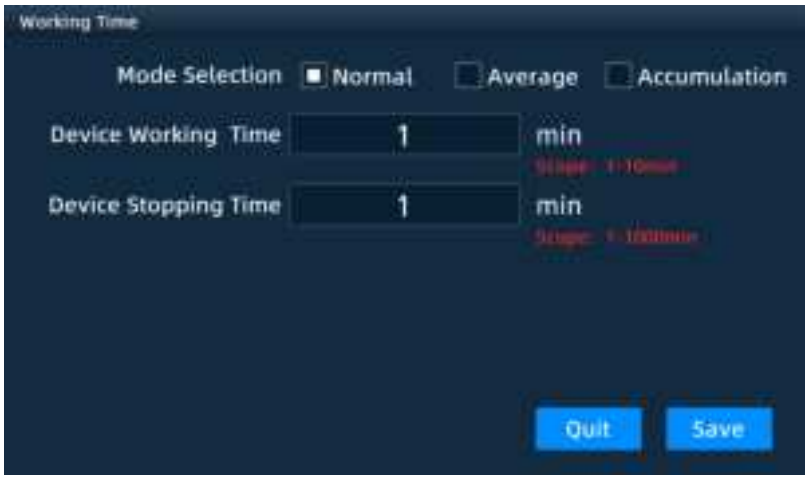
- Display cleanliness class, according to ISO14644-1
- Display alarm status (normal in green; abnormal in red flashing)
- Display internet connection status
- Display particle numbers of 0.3 μm, 0.5 μm, 1.0 μm, 5.0 μm, 10 μm
- Display particle unit
- Display environmental temperature, humidity, sampling flow.

Login Interface:

Input default user login password to enter setting interface: 1

Setting Interface:
There are 9 sub-function menus:

- MQTT - ***without function***
- Working time
- Channel display
- Alarm threshold values
- Correction factor
- Screen brightness
- Language setting
- Unit setting
- Device information



Working time interface:

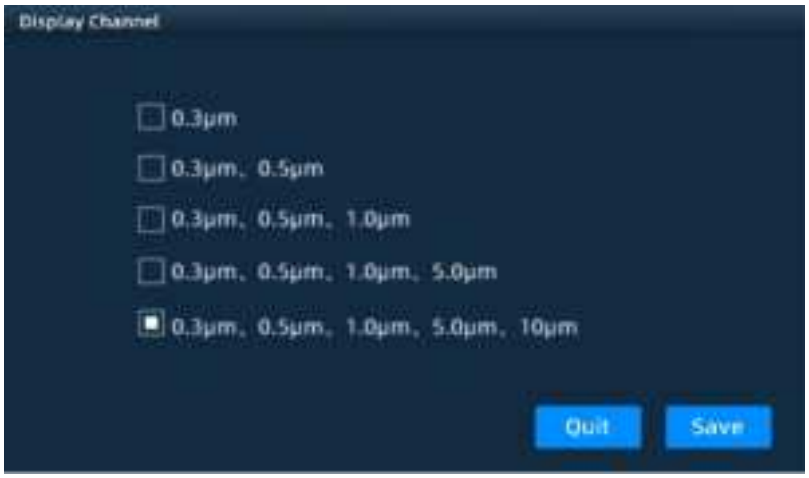
● Device working time,

the default status is to work for 2 min, and stop for 28 min,

The limit is 2-10 minutes.

●Device stop time,

the value ranges from 2-1000 minutes



Display Setting Interface:

●The displayed particle channel can be set through this interface

Alarm threshold interface:

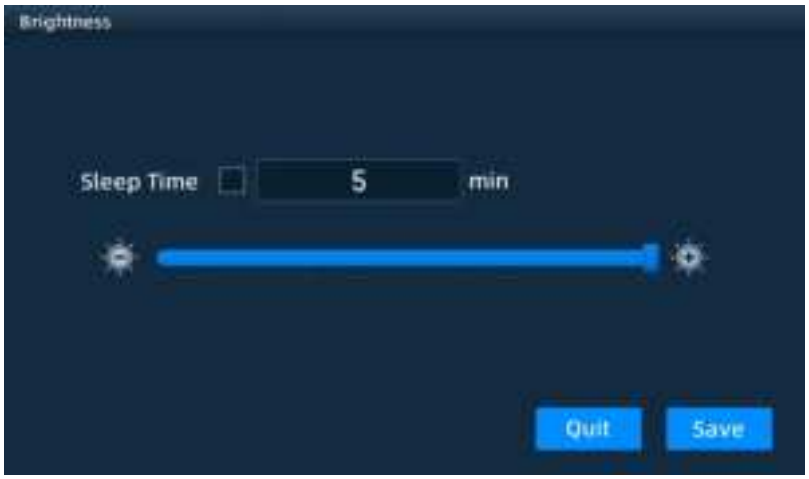
Alarm threshold is default set based on CLASS 4, customer can set it according to the actual needs

Alarm strategy:

1. The "Close Alarm" button will be added to the main interface.
2. When the particle concentration exceeds the set alarm value, the status lamp will display abnormal and red light flashing, buzzer alarm, until the concentration is below the alarm value for 2 minutes, the alarm status light and buzzer alarm will turn off, display normal and light will keep steady green.
3. When the "Close Alarm" is enabled, the buzzer will stop alarm for 5 minutes, the status light is still abnormal and the red light flashes, if the concentration still exceeds the standard after 5 minutes, it will continue to activate the alarm.

Correction Coefficient Interface:

● The correction coefficient is used for the calibration and adjustment of the particle channel parameters. This must only be carried out at a laboratory with certified reference devices.



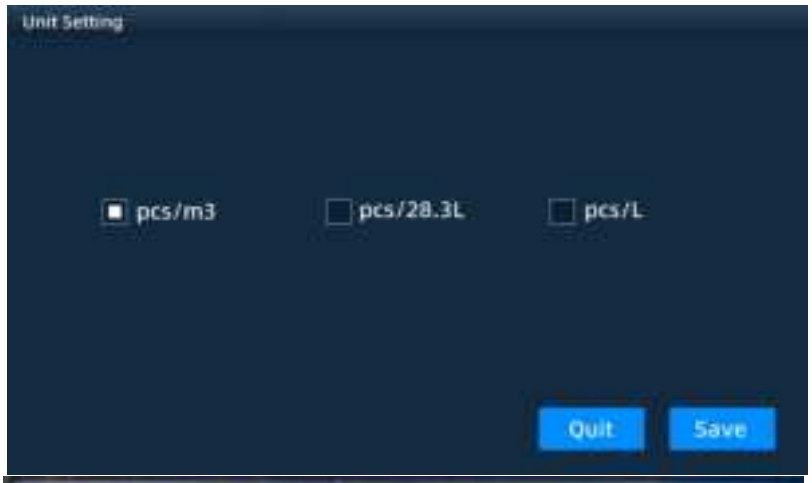
Other Settings:

Screen brightness interface:

● It is used to adjust the brightness of the display in accordance with the environment

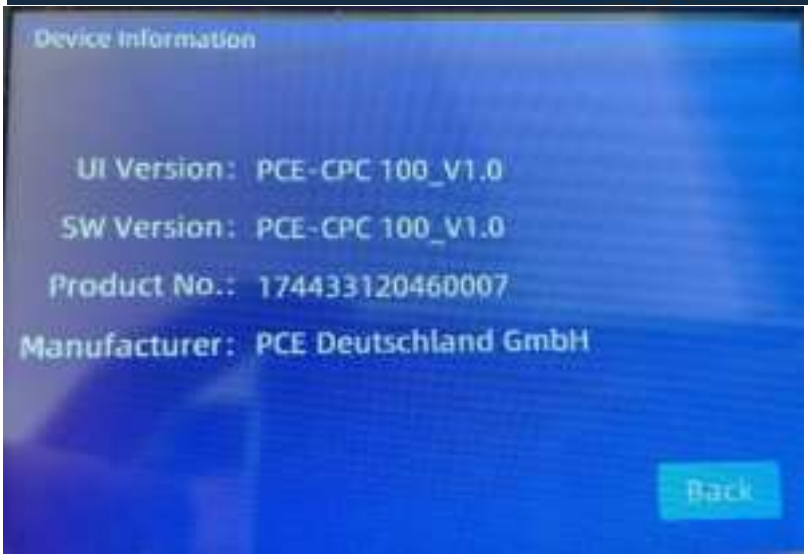
Language setting interface:

● Support Chinese and English switching display.



Unit setting interface:

- Support unit PCS/m³ and PCS/28.3L



Device information interface:
Info can be obtained from this interface:
UI version, software version, product number and manufacturer

RS485 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. 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 2min/Sleep 28 min)

3) The factory defaults all user coefficients are 1.0000.

4) The factory default setting control flow rate is 28.3 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 words, 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		Reserve
IR11	0AH		Reserve
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	Temperature value	Actual temp. value multiplied by 100
IR26	19H	Humidity value	Actual humidity value multiplied by 100
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		Reserve
IR8	07H		Reserve
IR9	08H		Reserve
IR10	09H		Reserve
IR11	0AH		Reserve
IR12	0BH		Reserve
IR13	0CH		Reserve
IR14	0DH	Device intermittent stop time	Set device intermittent stop time (min)
IR15	0EH	Device control flow rate	Set gas flow rate multiplied by 100
IR16	0FH	Device intermittent working time	Set the equipment intermittent working time (min)
IR17	10H		Reserve
IR18	11H		Reserve
IR19	12H		Reserve
IR20	13H		Reserve
IR21	14H		Reserve
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 PCE-CPC 100 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 needs 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 >0.3μm, >0.5μm, >1.0μm, >5.0μm, >10μm 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/28.3L)

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/28.3L)

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/28.3L)

7.1.4 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/28.3L)

7.1.5 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/28.3L)

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 Read real-time temperature value

Send: IP 04 00 18 00 01 CRC16

Answer: IP 04 02 DF1 DF2 CRC16
Description: Real-time temperature value = (DF1*256+DF2)/100(℃)

7.4 Read real-time humidity value

Send: IP 04 00 19 00 01 CRC16

Answer: IP 04 02 DF1 DF2 CRC16
Description: real time humidity value = (DF1*256+DF2)/100(%)

7.5 Continuously read input register data

Send: IP 04 00 03 00 17 CRC16

Answer: IP 04 2E DF1~DF46 CRC16

Description:

>0.3μm particle count = DF1*256^3+DF2*256^2+DF3*256+DF4 (pcs/28.3L)

>0.5μm particle count = DF5*256^3+DF6*256^2+DF7*256+DF8 (pcs/28.3L)

>1.0μm particle count = DF9*256^3+DF10*256^2+DF11*256+DF12 (pcs/28.3L)

>5.0μm particle count = DF17*256^3+DF18*256^2+DF19*256+DF20 (pcs/28.3L)

>10μm particle count = DF21*256^3+DF22*256^2+DF23*256+DF24 (pcs/28.3L)

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

Real-time temperature value =(DF43*256+DF44)/100(℃)

Real time humidity value = (DF45*256+DF46)/100(%)

7.6 Read device address

Send: IP 03 00 02 00 01 CRC16

Answer: IP 03 02 00 DF1 CRC16

Description: Device address is DF1

7.7 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)

7.8 Read the intermittent working time of the device

Send: IP 03 00 0F 00 01 CRC16

Answer: IP 03 02 DF1 DF2CRC16

Description: Equipment intermittent working 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 Modify the device address (the address range that can be set is 1-254)

Send: IP 06 00 02 00 DF1 CRC16 (IP is the device address before modification)

Answer: IP 06 00 02 00 DF1 CRC16 (IP is the modified device address)

Description: DF1 is the device address that needs to be modified

7.11 Modify the equipment running stop time (the time range that can be set is 0-10000)

Send: IP 06 00 0D DF1 DF2 CRC16

Answer: IP 06 00 0D DF1 DF2 CRC16

Description:

1. Device stop time = DF1*256+DF2 (min)

2. When the intermittent stop time is set to 0, the device keeps running;

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

Send: IP 06 00 0F DF1 DF2 CRC16

Answer: IP 06 00 0F DF1 DF2CRC16

Description: Equipment working time = DF1*256+DF2 (min), when the intermittent stop time is set to 0, the equipment will keep running, working time setting value is invalid.

7.13 Modify the flow rate set by the control device (the flow rate can be set in the range of 15.0L/min – 35L/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)

7.14 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

7.15 Query the software version number

Send: 11 02 1E IP CS

Answer: 16 11 1E IP DF1 DF2 DF3 DF4 DF5 DF6 DF7 DF8 DF9 DF10 DF11 DF12 DF13 DF14 DF15 CS

Description: The version number is DF1-DF15, the ASCII string is the software version number