ATO

Multi-parameter Air Quality Sensor

User Manual

FS00802F

Dear users:

Thank you for using our products.

Before using this product, please read this manual carefully and follow the steps in the manual to operate it correctly.

If you have any problems during use, please contact us in time.

Thank you for your cooperation!

Chapter 1 Product Overview

1.1 Product introduction

FS00802F is an air quality detection product that integrates 10 types of sensors. A variety of sensor combinations meet the needs of different applications. The external temperature and humidity are more accurate and the screen cycle displays real-time data. Each type of environmental indicator adopts an independent sensor probe. It has a compact design, small footprint, complete functions, stable performance and extremely cost performance.It supports RS485 communication interface and Modbus-RTU communication protocol. Facilitate the development and application of environmental quality detection and internet of Things gas detection schemes.

Sensor Combination	1	Laser dust,TVOC,HCHO,CO2,Atmospheric pressure,4 types of special gas,Temperature and Humidity
	2	Laser dust,TVOC,HCHO,CO2,Atmospheric pressure,3 types of special gas,Noise,Temperature and Humidity
	3	Laser dust,TVOC,O3,CO2,Atmospheric pressure,4 types of special gas,Temperature and Humidity

1.2 Product features

- Powerful, Integrate 10 types of sensors at the same time.
- Easy to install, Support ceiling and wall-mounted installation.
- Flexible application, Free combination of multiple sensors
- Accurate detection and sensitive response.
- Support the standard Modbus protocol, which is convenient for customer debugging and docking.
- Real-time display on the screen.
- Support customer customized development.

1.3 Application scenarios

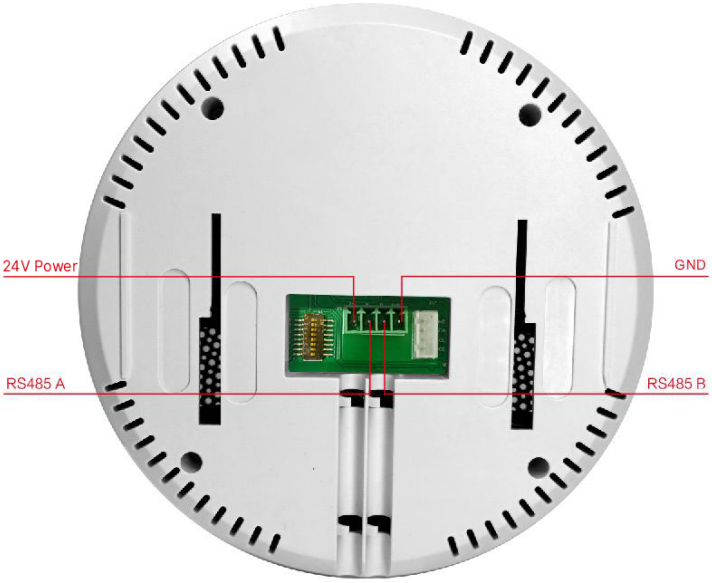
- Internet of Things equipment,air quality detection.
- Smart buildings, smart communities.
- Schools, hospitals, supermarkets,subways and other public places.

Chapter 2 Specification Parameters

Parameter type	Parameter indicators
Detect gas	See table 1 for details
Working voltage	DC 10V～30V(Standard 24V)
Working current	≤200mA
Screen parameters	2.0-inch tftp color screen resolution 320*240
Warm-up time	3min
Detection frequency	The date is updated once per second(default)
Output mode	Modbus-RS485
Reference size	Φ144*41.35mm
Product material	ABS shell
Installation method	Ceiling-mounted,Wall-mounted
Working temperature	-10℃～50℃
Working humidity	0%RH～95%RH (No-condensation)
Storage temperature	-30℃～ 60℃
Storage humidity	0～99%RH (No-condensation)

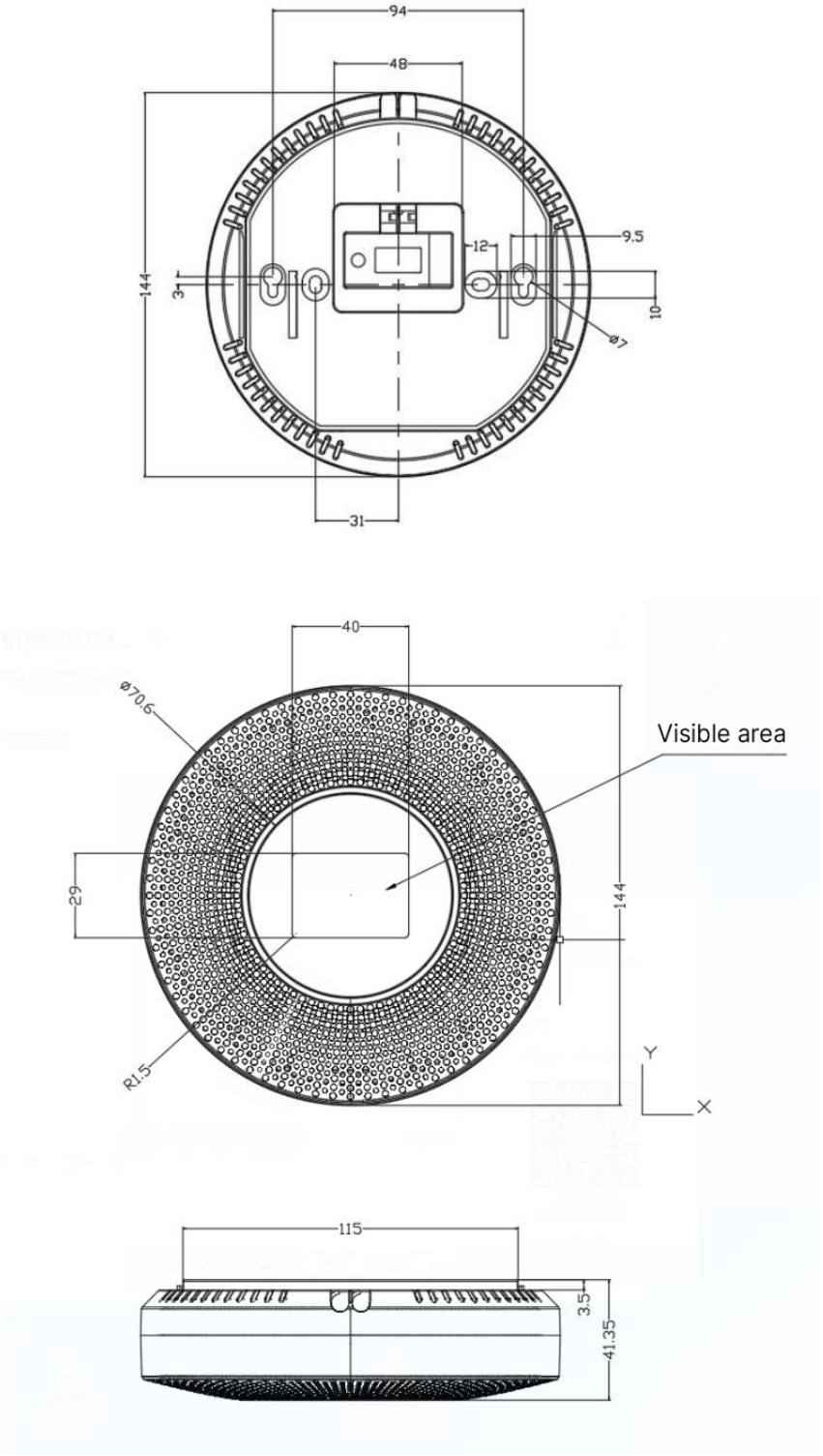
Kind	Type	Measuring range	Resolution	Precision	Service life(in the air)
Conventional gas	Temperature	-40℃~100℃	0.1℃	±0.3℃	10 years
	Humidity	0~99%RH	0.1%RH	±3%RH	10 years
	pm2.5	0~1000μg/m³	1μg/m³	±10% Reading	≥40000 hours
	CO2	400~5000ppm	1ppm	±（50ppm+3% Reading）	10 years
	HCHO	0~1500μg/m³	1μg/m³	±10% Reading	2 years
	TVOC	0~5000μg/m³	1μg/m³	±10% Reading	10 years
Special gas	Alcohol	0～500mg/100ml	0.1mg/100ml	±10% Reading	2 years
	O3	0~10ppm	0.001ppm	±2% Reading	2 years
	CH4	0~100%LEL	1%LEL	±5% Reading	3 years
	CO	0~1000ppm	1ppm	±3% Reading	2 years
	O2	0~30%Vol	0.1%Vol	±5%VOL	2 years
	NH3	0~100ppm	0.1ppm	±5% Reading	2 years
	H2S	0~100ppm	0.1ppm	±5% Reading	2 years
	CL2	0~10ppm	0.1ppm	±3% Reading	2 years
	NO2	0~1000ppm	0.1ppm	±3% Reading	2 years
	SO2	0~20ppm	0.1ppm	±3% Reading	2 years
No-gas	Atmospheric pressure	30~110Kpa	0.1Kpa	±0.15Kpa@25℃ 75Kpa	3 years
	Noise	30db~130db	0.1db	±1db	3 years
Note:For more detection gas types, please consult the relevant staff; support gas type and index customization service					

Chapter 3 Pin Definition



PIN	Definition	Explanation
24V	VIN	Power input +24V
GND	GND	Grounding terminal
A	485A	Modbus-RS485 A
B	485B	Modbus-RS485 B

Chapter 4 Appearance Size



Unit:mm; Error ±0.2mm; Terminal spacing 3.81mm

Chapter 5 Communication Protocol (Modbus)

5.1 Serial communication parameters	
Baud rate	9600bps（Default）
Data bit	8 bits
Stop bit	1 bit
Inspection position	No

5.2 The host reads the command frame (0x30 function code)				
Address code	Function code	Register address	Register number	CRC verification
1 Byte	1 Byte	2 Byte	2 Byte	2 Byte

5.3 Example of host reading command frame		
Example：01 03 00 00 00 08 44 0C		
0x01	Address code	The device address code can be set by command or dial code switch (0~255)
0x03	Function code	Read the register instructions
0x00 0x00	Register code	Read the data from the 00 00 address register
0x00 0x08	Register number	Read the values of 8 registers continuously
0x44 0x0C	CRC verification	CRC test code

5.4 Slam equipment response data frame					
Address code	Function code	Effective byte length	Register number	Register number	CRC verification
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte

5.5 Sample of data frame response from the slan device (read command is 5.3 example)		
Example：01 03 10 00 00 00 1C 00 00 02 6A 01 D6 00 00 00 15 00 20 DA 70		
0x01	Address code	The data returned by the device with address 1
0x03	Function code	Read the register instructions
0x10	Effective byte length	The device returns 16 bytes of data(8 registers)
0x00 0x00	Register number	0x00 sensor values stored in the register

0x00 0x1C	Register number	0x01 sensor values stored in the register
0x00 0x00	Register number	0x02 sensor values stored in the register
0x02 0x6A	Register number	0x03 sensor values stored in the register
0x01 0xD6	Register number	0x04 sensor values stored in the register
0x00 0x00	Register number	0x05 sensor values stored in the register
0x00 0x15	Register number	0x06 sensor values stored in the register
0x00 0x20	Register number	0x07 sensor values stored in the register
0xDA 0x70	CRC verification code	CRC verification
Note:Sensor numerical calculation method=high*256+low; temperature=(reading-500)/10;humidity=reading/10;other sensor values are calculated according to the resolution of the decimal places in Table 1,1 decimal place divided by 10, 2 decimal places divided by 100, 3 decimal places divided by 1000		

5.6 Set the parameter command frame of the device(0x60 function code)				
Address code	Function code	Register address	Write data	CRC verification
1 byte	1 byte	2 byte	2 byte	2 byte

5.7 Example of setting device parameter command frame		
Example：01 06 00 55 00 02 D9 DB		
0x01	Address code	The device address code can be set by command or dial code switch(0-255)
0x06	Function code	Write a single register
0x00 0x55	Register address	The register address to be written(85)
0x00 0x02	Register number	The value of the register to be written(2 represents baud rate 9600)
0xD9 0xDB	CRC verification	CRC verification code

5.8 Relationship table between register and sensor					
Serial number	Register address	Register definition	Explanation	Read/Write	Data type
0	0x00	HCHO		Read only	Unsigned sixteen-digit shaping number
1	0x01	PM2.5		Read only	Unsigned sixteen-digit shaping number
2	0x02	TVOC		Read only	Unsigned sixteen-digit shaping number

3	0x03	CO2		Read only	Unsigned sixteen-digit shaping number
4	0x04	Temperature		Read only	Unsigned sixteen-digit shaping number
5	0x05	Humidity		Read only	Unsigned sixteen-digit shaping number
6	0x06	PM1.0		Read only	Unsigned sixteen-digit shaping number
7	0x07	PM10		Read only	Unsigned sixteen-digit shaping number
8	0x08	SF6(Sulfur hexafluoride)		Read only	Unsigned sixteen-digit shaping number
9	0x09	NH3		Read only	Unsigned sixteen-digit shaping number
10	0x0A	O2		Read only	Unsigned sixteen-digit shaping number
11	0x0B	O3		Read only	Unsigned sixteen-digit shaping number
12	0x0C	H2S		Read only	Unsigned sixteen-digit shaping number
13	0x0D	SO2		Read only	Unsigned sixteen-digit shaping number
14	0x0E	Combustible gas EX		Read only	Unsigned sixteen-digit shaping number
15	0x0F	CO		Read only	Unsigned sixteen-digit shaping number
16	0x10	CL2		Read only	Unsigned sixteen-digit shaping number
17	0x11	H2		Read only	Unsigned sixteen-digit shaping number
18	0x12	Atmospheric pressure		Read only	Unsigned sixteen-digit shaping number
19	0x13	Llluminate		Read only	Unsigned sixteen-digit shaping number
20	0x14	Noise		Read only	Unsigned sixteen-digit shaping number
21	0x15	CH4		Read only	Unsigned sixteen-digit shaping number
22	0x16	NO		Read only	Unsigned sixteen-digit shaping number
23	0x17	NO2		Read only	Unsigned sixteen-digit shaping number
24	0x18	HCL		Read only	Unsigned sixteen-digit shaping

					number
25	0x19	HCN		Read only	Unsigned sixteen-digit shaping number
26	0x1A	PH3		Read only	Unsigned sixteen-digit shaping number
27	0x1B	CLO2		Read only	Unsigned sixteen-digit shaping number
28	0x1C	C2H4O		Read only	Unsigned sixteen-digit shaping number
29	0x1D	C6H6		Read only	Unsigned sixteen-digit shaping number
30	0x1E	C7H8		Read only	Unsigned sixteen-digit shaping number
31	0x1F	NOx		Read only	Unsigned sixteen-digit shaping number
32	0x20	Br2		Read only	Unsigned sixteen-digit shaping number
33	0x21	HF		Read only	Unsigned sixteen-digit shaping number
34~63	0x22~0x40	Reserve		Read only	Unsigned sixteen-digit shaping number
64	0x41	Sensor status	5.9 schedule	Read only	Unsigned sixteen-digit shaping number
65	0x42	Sensor status	5.9 schedule	Read only	Unsigned sixteen-digit shaping number
66	0x43	Sensor status	5.9 schedule	Read only	Unsigned sixteen-digit shaping number
67	0x44	Sensor status	5.9 schedule	Read only	Unsigned sixteen-digit shaping number
68~77	0x45~0x4D	Product model		Read only	Unsigned sixteen-digit shaping number
78	0x4E	Software version number	10=1.0	Read only	Unsigned sixteen-digit shaping number
79	0x4F	Hardware version number	10=1.0	Read only	Unsigned sixteen-digit shaping number
80	0x50	Release date -year		Read only	Unsigned sixteen-digit shaping number
81	0x51	Release date-month		Read only	Unsigned sixteen-digit shaping number
82	0x52	Release date-day		Read only	Unsigned sixteen-digit shaping number
83	0x53	The dial switch enables	0=Enable 1=Command	Read write	Unsigned sixteen-digit shaping number

			configuration		
84	0x54	Correspondence address	1~255	Read write	Unsigned sixteen-digit shaping number
85	0x55	Baud rate	0=2400 1=4800 2=9600 3=19200 4=38400 5=57600 6=115200	Read write	Unsigned sixteen-digit shaping number
86	0x56	Light control enables	0=disable 1=Turn on the red light 2=Turn on the green light 3=Turn on the blue light 4=Turn on the yellow light 5=Turn on the write light	Write only	Unsigned sixteen-digit shaping number
87	0x57	Temperature configuration	0=Exteral 1=Built-in		
88	0x58	Temperature calibration	Temperature value*10		
89	0x59	Reserve			
90	0x5A	Call the police to enable		Read write	Unsigned sixteen-digit shaping number
91	0x5B	High value of oxygen		Read write	Unsigned sixteen-digit shaping number
92	0x5C	Low value of oxygen		Read write	Unsigned sixteen-digit shaping number
93	0x5D	High value of CO		Read write	Unsigned sixteen-digit shaping number
94	0x5E	Low value of CO		Read write	Unsigned sixteen-digit shaping number

5.9 Schedule sensor status definition						
Register address	Bit	Description	Register address	Bit	Description	Definition
0x41	0	Formaldehyde module	0x42	0	SO2 module	0=offline 1=online
	1	Dust module		1	CO module	

	2	TVOC module		2	CL2 module	
	3	CO2 module		3	H2 module	
	4	Temperature and humidity sensor		4	CH4 module	
	5	Temperature and humidity sensor		5	NO module	
	6	Dust module		6	NO2 module	
	7	Dust module		7	HCL module	
	8	SF6 module		8	Combustible gas module	
	9	Atmospheric pressure sensor		9	HCN module	
	10	Llluminate sensor		10	PH3 module	
	11	Noise sensor		11	CLO2 module	
	12	NH3 module		12	C2H4O module	
	13	O2 module		13	C6H6 module	
	14	O3 module		14	C7H8 module	
	15	H2S module		15	NOX module	
0x43	0	Br2 module	0x44 (Reserve)	0		0=offline 1=online
	1	HF module		1		
	2			2		
	3			3		
	14			14		
	15			15		

Chapter 6 Reliability Test

Test items	Test conditions	Standard	Samples number:N Defects number:C
Low-temperature storage	Measure the error of the sensor in a normal temperature environment after 72 hours of storage in an environment of -30±2℃	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
High-temperature storage	Measure the error of the sensor in a normal temperature environment after 72 hours of storage in an environment of 60±2℃	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
Low-temperature work	Place the sensor in a low temperature environment of -10±2 ℃ ,apply the rated voltage,work for 72 hours and then measure the measurement error of the sensor in a normal temperature environment	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
High-temperature work	Place the sensor in a high temperature environment of 50±2 ℃ ,apply the rated voltage,work for 72 hours and then measure the measurement error of the sensor in a normal temperature environment	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
High and low temperature impact	After maintaining it at -30℃ for 60 minutes,switch to 60℃ within 10s and maintain it for another 60 minutes and repeat the cycle 10 times.During the test, the sample is not powered.	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
High temperature and high humidity work	Place the sensor in an environment of 45±2℃ and 90±5%RH and work for 72 hours at the maximum voltage(within the acceptable operating voltage range)	After 2 hours of recovery in a normal temperature environment,the sensor should be able to work normally.	N=5 C=0
Salt spray test	According to GB/T2423.17,place the sensor in a 35 ℃ salt spray chamber and spray with 5% sodium chloride salt water for 24 hours.After the experiment, wash it with distilled water and blow dry it with air.	In the standard environment,the recovery should be not less than 1 hour,no more than 2 hours, and the appearance should be free of defects and corrosion.	N=2 C=0
Vibrate	The vibration test on the X/Y/Z axis should be able to withstand the following conditions:frequency range:10-55-10Hz/min;amplitude:1.5mm;scanning cycle:2H.	After testing, the appearance is not bad. The sensor meets the basic performance test standards.	N=4 C=0
The package fell off	Falling height:Set the height according to the weight specified in GB/T4857.18.The test is carried out according to the GB/T4857.5packing transport packaging drop test method. The order of falling is one corner,three edges and six sides.	After the package drop test, the sensor should have no bad appearance,no parts falling off and the sensor should work normally.	N=1 C=0

Chapter 7 Notes

- The dust sensor on this module is suitable for the detection of dust particles in ordinary indoor environments. The actual use environment should try to avoid oil and smoke environments, excessive dust particles, high-temperature environments etc. Such as kitchens, somking rooms, outdoor and other environments. If used in such an environment, corresponfing protective measures should be added to the device to avoid sticky particles or large particles entering the sensor, forming deposits inside the sensor and affecting the performance of the sensor.
- Sensors avoid contact with organic solvents(including silicone and other adhesives),coatings,agents,oils and high-concentration gases.
- The sensor cannot be completely encapsulated with resin material, nor can it be immersed in an oxygen-free environment, otherwise it will damage the performance of the sensor.
- Sensors cannot be used in environments containing corrosive gases for a long time.Corrosive gases will damage the sensor.
- Some sensors need to be preheated for more than 3 minutes for the first time.
- Do not apply the sensor to systems involving personal safety
- If the sensor needs to be placed in a small space, the space should be well ventilated.
- Do not install the sensor in an environment with strong convection air.
- Do not place the sensor in high-concentration organic gas for a long time. Long-term placement will cause the sensor zero point to drift and recover slowly.
- Do not use hot melt adhesive or sealant with a curing temperature higher than 80℃ to encapsulate the sensor.
- The sensor should be kept away from heat sources and protected from direct sunlight or other heat radiation.
- The sensor should not be subjected to excessive shock or vibration.

Chapter 8 Model Naming Rules