YGC-BG-M

Wall-Mounted Multi-in-One Sensor

User Manual V.04

Please read this manual carefully before use and keep it properly.

SMS-10

Thank you for choosing our product!

Due to continuous improvements to our products, the product you purchased may differ slightly from the illustrations in this manual. No additional notice will be provided. Please refer to the actual product for details.

Product Overview

The YGC-BG-M Wall-Mounted Multi-in-One Sensor is an integrated device designed to measure environmental factors such as illuminance, temperature, humidity, and CO_2. This sensor features a high-protection-grade enclosure with an IP65 rating, providing excellent resistance to rain and snow while maintaining good breathability. The product utilizes an industrial-grade microprocessor chip imported from the USA and a high-precision temperature and humidity chip imported from Switzerland, ensuring outstanding reliability, high accuracy, and interchangeability. The sensor supports RS485/RS232 output interfaces and the standard Modbus protocol, enabling easy connection with other data collection devices for data acquisition. Additionally, the device can output up to four analog signals (current and voltage outputs). The digital signal output uses the standard Modbus or ASCII protocol and supports secondary development. It is stable, reliable, and easy to install.

Applications

This product is suitable for agricultural greenhouses, underground utility tunnels, industrial workshops, telecommunication equipment rooms, warehouses, buildings, and automated control systems, as well as other places requiring monitoring.

Product Features

1、Adopts high-quality temperature and humidity probes and transmitter housing, waterproof and dustproof, resistant to condensation, and reaching IP65 protection level.

2、Core components use imported chips with high accuracy and good stability.

3、The communication part adopts a dedicated RS485 circuit for stable communication.

The circuit adopts a modular design, making it compact and lightweight.

5、Supports a wide voltage range for power supply, with multiple signal output options, and is easy to install.

6、Customers can select various sensors according to actual needs and combine them into single-element, two-element, three-element, or four-element sensors, such as: Temperature and

humidity two-element integrated sensor; Temperature, humidity, and illuminance three-element integrated sensor.

7、Customers can select suitable temperature and humidity probes according to the product's usage environment to meet special requirements, such as: High-temperature environments; High-dust environments; Outdoor rain and snow environments.

Element Options and Technical Specifications

<table>
<tr><th>Measurement Element</th><th>Range</th><th>Accuracy</th><th>Resolution</th><th>Power Consumption</th></tr>
<tr><td>□ Illuminance</td><td>□ 0~200000Lux
□ 0~65535Lux</td><td>±4%</td><td>1 Lux</td><td>0.1mW
0.4mW</td></tr>
<tr><td rowspan="2">□ Atmospheric Temperature</td><td>-20~50℃
(Analog Signal Output)</td><td rowspan="2">±0.3℃（Standard）
±0.2℃（High Precision）</td><td rowspan="2">0.1℃</td><td rowspan="3">1mW</td></tr>
<tr><td>-40~100℃
（Digital Signal Output）</td></tr>
<tr><td>□ Atmospheric Humidity</td><td>0~100%RH</td><td>±5%RH（Standard）
±3%RH（High Precision）</td><td>0.1%RH</td></tr>
<tr><td>□ CO2</td><td>0~5000ppm</td><td>±（50ppm+5%）</td><td>1ppm</td><td>85mW</td></tr>
<tr><td>Power Supply Options</td><td colspan="4">□ DC5V □ DC9-30V □ Other</td></tr>
<tr><td rowspan="2">Output Options</td><td colspan="4">□ 4-20mA □ 0-20mA □ 0-5V □ 0-10V □ 0-2.5V □ 1-5V</td></tr>
<tr><td colspan="4">□ RS485（Modbus-RTU） □ RS232（Modbus-RTU）
□ RS485（ASCII Proprietary Protocol） □ RS232（ASCII Proprietary Protocol）</td></tr>
<tr><td>Cable Length</td><td colspan="3">□ Standard 2 meters</td><td>□ Other</td></tr>
<tr><td rowspan="3">Probe Types</td><td rowspan="3">Built-In Probes</td><td>□ Standard Built-In Probe</td><td colspan="2">Suitable for most scenarios, waterproof but not dustproof.</td></tr>
<tr><td>☐ PE Built-In Probe</td><td colspan="2">Resistant to condensation, waterproof, and dustproof.</td></tr>
<tr><td>☐ Metal Built-In Probe</td><td colspan="2">Suitable for high-dust environments, waterproof, dustproof, and highly sensitive.</td></tr>
</table>

	External Probes	□ Standard External Probe	Suitable for most scenarios, waterproof but not dustproof.	
		□ PE External Probe	Resistant to condensation, waterproof, and dustproof.	
		☐ Metal External Probe	Suitable for high-dust environments, waterproof, dustproof, highly sensitive, and capable of withstanding high temperatures.	
		□ External 4-Point Threaded Probe	Designed for measuring the environment inside containers with matching threads.	
Load Capacity	500Ω (12V power supply)		Protection Level	IP65
Operating Environment	-40℃~+75℃		Net Weight	
Shipping List	Product Certificate of Conformity: 1 copy Product Manual and Installation Accessories: 1 set Wall-Mounted Multi-in-One Sensor: 1 unit			

Product Model Table

Model	Power Supply	Output	Description
YGC-BG-M			Wall-mounted multi-in-one sensor
	5V		5V power supply
	KV		9-30V power supply
		W1	RS232 (Default Modbus Protocol, ASCII Proprietary Protocol Optional)
		W2	RS485 (Default Modbus Protocol, ASCII Proprietary Protocol Optional)
		A1	4-20mA
		A2	0-20mA
		V	0-5V
		V10	0-10V
		V1	1-5V
		V2	0-2.5V
Example: YGC-BG-M-5V-W2 Wall-mounted multi-in-one sensor, 5V power supply, RS485 output (default Modbus-RTU), built-in sensor types as per the physical label.			

Wiring Method

Wall-Mounted Multi-in-One Sensor Wiring Sequence Explanation

Wire Color	Wiring Sequence		
	RS485 Signal	RS232 Signal	Voltage/Current Analog Signal
Red	VCC Power Positive	VCC Power Positive	VCC Power Positive
Green	GND Power Negative	GND Power Negative	GND Power Negative
Black	485-A	TX (Connect to PC Port Pin 2 RX)	Signal Line 1 Temperature
Yellow	485-B	RX (Connect to PC Port Pin 3 TX)	Signal Line 2 Humidity
White			Signal Line 3 Illuminance
Brown			Signal Line 4 CO2

Note: Communication can only be established if the wiring is done correctly. For specific wiring, refer to the cable label definitions or consult our company.

Analog Output Calculation Formulas

Current Type	
4-20mA	Formula：Sensor_Value=(I-4)/16*Range+Sen_lower
0-20mA	Formula：Sensor_ Value =I/20*Range+Sen_lower
Voltage Type	
0-2.5V	Formula：Sensor_ Value =V/2.5*Range+Sen_lower
0-5V	Formula：Sensor_ Value =V/5*Range+Sen_lower
0-10V	Formula：Sensor_ Value =V/10*Range+Sen_lower
1-5V	Formula：Sensor_ Value =（V-1）/4*Range+Sen_lower

Note: In the formulas, Sensor_Value represents the value measured by the sensor, and I and V represent the current and voltage detected on the signal lines, respectively.

Sen_lower is the lower limit of the sensor's measurement range, which can be positive or negative. For example: For temperature (range -20~50℃), the lower limit Sen_lower = -20; For humidity (range 0~100%RH), the lower limit Sen_lower = 0.

Range is the measurement range of the sensor, calculated as the upper limit minus the lower limit. For example: For temperature (-20~50℃), Range = 50 - (-20) = 70.

Example: The customer purchased a 4-20 mA temperature and humidity sensor. Signal line 1 detects current I = 8

mA, signal line 2 detects current I = 15 mA.

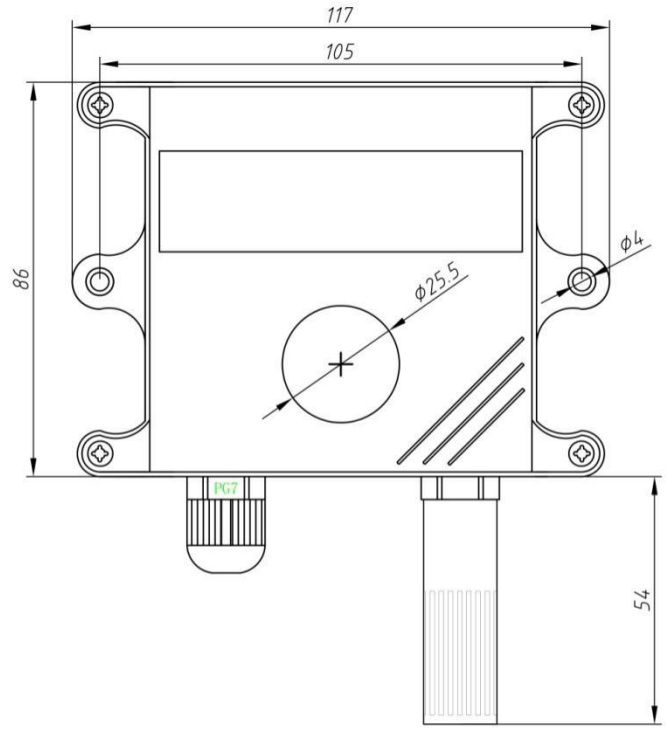
（1）Temperature range Range = 70, temperature lower limit Sen_lower = -20.

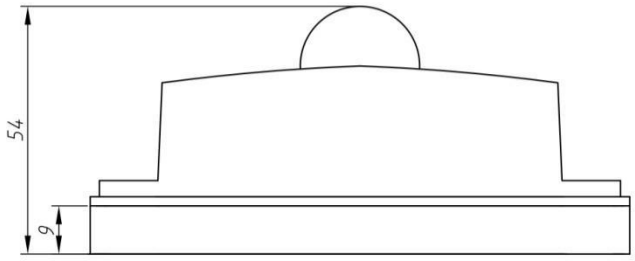
The temperature calculation value: Sensor_V=(I-4)/16*Range-Sen_lower=（8-4）/16*70+（-20）=-2.5℃

（2） Humidity range Range = 100, humidity lower limit Sen_lower = 0.

The humidity calculation value: Sensor_V=(I-4)/16*Range-Sen_lower=（15-4）/16*100+0=68.7%RH

Product Dimensions and Installation Method

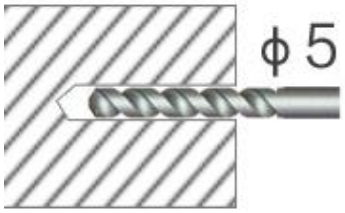




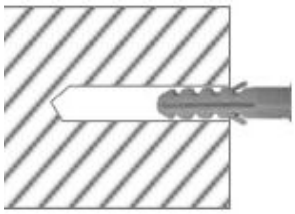
Wall-Mounted Installation Method

1、Place the sensor on the wall, and use a pen to mark the positions of the installation holes (hole spacing: 105 mm):

2、Use a φ5 impact drill to drill holes at the marked positions, with a depth ≥ the length of the plastic expansion bolts:



3、Insert the expansion bolts fully into the holes:



4、Install the sensor, tighten the screws, and complete the installation.

Communication Protocol

The communication utilizes an RS485 communication bus, following the standard MODBUS-RTU protocol. The baud rate is set to 9600, with 8 data bits, 1 stop bit, and no parity. The interval between two data frames should be at least 500 ms. The default address is 1, and the communication format is as follows:

Field	Address	Command	Register Address	Data	Checksum
Bytes	byte	1 byte	2 bytes	Data	2 bytes

（I）Register Address

he wall-mounted multi-in-one sensor integrates three meteorological elements: digital temperature, digital humidity, and indoor/outdoor illuminance. Each sensor has its own register address.

The correspondence between register addresses and channels in the MODBUS protocol is as follows:

Register Address	Channel	Data Description
0x0000	Digital Temperature Signed integer（-40~100℃）	0x7FFF (invalid/not connected) 0x01 0x2C=30.0℃
0x0001	Digital Humidity Unsigned integer（0~100%RH）	0x7FFF (invalid/not connected) 0x02 0x8D=65.3%RH
0x0002	Outdoor Illuminance Range（0-200000 Lux）	0x7FFF (invalid/not connected) Unit: 10Lux 0x01 0xF4=5000 Lux
0x0003	Outdoor Illuminance (Units Place) Unsigned integer0-9 Lux	0x00 (invalid/not connected). 0x00 0x09=9 Lux
0x0004	Indoor Illuminance Unsigned integer（0~65535 Lux）	0x7FFF (invalid/not connected) unit: 10 Lux 0x0B 0xCD=30210 Lux
0x0005	CO2 Signed integer（0~5000ppm）	0x7FFF (invalid/not connected) unit:1 ppm 0x0B 0xCD=3021 ppm
0x000D	Single Temperature (Metal Casing) Signed integer（-40~100℃）	0x7FFF (invalid/not connected) 0x01 0x2C=30.0℃

（II）Configuration of Device Address and Baud Rate

The command to write the device address of the wall-mounted multi-sensor, for example, set the device address to 1.

Send	00	06	00	20	00	01	48	11
Description	Address	Write Command	Register		New Device		CRC Checksum	

					Address CRC	
Response	00	06	00	20	E1	FD
Description	Address	0x86 = Failure	Register		CRC Checksum	

If the response is 00 06 00 20 E1 FD, the command is successfully executed. If the response is 00 86 00 20 E0 15, the configuration is unsuccessful.

The command to write the baud rate of the wall-mounted multi-sensor, for example, set the baud rate to 9600.

Send	01	06	00	10	00	02	09	CE
Description	Address	Write Command	Register		New Device Baud Rate		CRC Checksum	
Response	01	06	00	10	E0		15	
Description	Address	0x86 = Failure	Register		CRC Checksum			

Baud rate = Data * 4800. For example, if Data = 00 02, then Baud Rate = 4800 * 2 = 9600. Supported baud rates include 4800, 9600, 14400, 19200, 38400, 57600, and 115200.

If the response is 01 06 00 10 E0 15, the command is successfully executed. If the response is 01 86 00 10 E1 FD, the configuration is unsuccessful.

（III）Retrieving Sensor Values

The wall-mounted multi-in-one sensor's command to write the device address, for example, sets the device address to 1. The wall-mounted multi-in-one sensor's command to write the baud rate, for example, sets the baud rate to 9600. The wall-mounted multi-in-one sensor can integrate up to 4 different sensors. By reading the values of Modbus register addresses, the real-time values of each sensor can be obtained. You can read one or multiple register values at a time. For example, send 01 03 00 00 00 01 84 0A to read only the temperature value of the digital temperature sensor. For example, send 01 03 00 00 00 02 C4 0B to read a total of 2 registers, from register 0 to register 1, including the sensor values for digital temperature and digital humidity.

Below are the detailed command instructions for retrieving sensor values. All sensors have a default device address of 1.

（1）、Digital Temperature Sensor

To retrieve the digital temperature value, read the data from register 0. The retrieval format for a sensor with device address 1 is as follows:

Send	01	03	00	00	00	01	84	0A
Description	Address	Read Command	Register		Points to Read		CRC Checksum	
Response	01	03	02		00	26	39	9E
Description	Address	Read Command	Data Length		Sensor Data		CRC Checksum	

The sensor returns a value of 0x0026. Converting it to decimal gives 38, which means the temperature value is 3.8°C, with 1 decimal place.

（2）、Atmospheric Humidity Sensor

To retrieve the atmospheric humidity value, read the data from register 1. The retrieval format for a sensor with device address 1 is as follows:

Send	01	03	00	01	00	01	D5	CA
Description	Address	Read Command	Register		Points to Read		CRC Checksum	
Response	01	03	02		02	8D	79	41
Description	Address	Read Command	Data Length		Sensor Data		CRC Checksum	

The sensor returns a value of 0x028D. Converting it to decimal gives 653, which means the atmospheric humidity value is 65.3% RH, with 1 decimal place.

（3）、Combined Atmospheric Temperature and Humidity

To retrieve both temperature and humidity values, read the data from registers 0 and 1. The retrieval format for a sensor with device address 1 is as follows:

Send	01	03	00	00	00		02		C4	0B
Description	Address	Read Command	Register		Points to Read				CRC Checksum	
Response	01	03	04		01	2C	02	8D	FB	03
Description	Address	Read Command	Data Length		Digital Temperature		Atmospheric Humidity		CRC Checksum	

The sensor returns data for registers 0 and 1 as 0x012C and 0x028D. Converting them to decimal gives 300 and 653, respectively. With 1 decimal place, they represent a temperature value of 30.0°C and a humidity value of 65.3% RH.

（4）、Indoor Illuminance Sensor

The range of the indoor illuminance sensor is 0-65535 Lux. The indoor illuminance value is read from register addresses 3 and 4, where register 3 contains the unit value of the indoor illuminance, and the data in register 4 is the value multiplied by 10.

Send	01	03	00	03	00		02		34	0B
Description	Address	Read Command	Register		Points to Read				CRC Checksum	
Response	01	03	04		00	09	01	F4	2A	26

Description	Address	Read Command	Data Length	The ones place of the illuminance value	10 times the illuminance value	CRC Checksum

The sensor returns data as 0x0009 and 0x01F4, which are converted to decimal as 9 and 500. The illuminance value is calculated as 500 * 10 + 9 = 5009 Lux.

（5）、Outdoor Illuminance Sensor

The range of the outdoor illuminance sensor is 0–200,000 Lux. The outdoor illuminance value is read from registers 2 and 3, where the data in register 2 is the value multiplied by 10, and register 3 contains the remaining unit value of the outdoor illuminance.

Send	01	03	00	02	00	02	65	CB
Description	Address	Read Command	Register		Points to Read		CRC Checksum	
Response	01	03	04		01	F4	00	09	7A	3B
Description	Address	Read Command	Data Length		10 times the illuminance value		The ones place of the illuminance value		CRC Checksum	

The sensor returns data 0x01F4 and 0x0009. Converting to decimal gives 500 and 9, respectively. The outdoor illuminance value is calculated as 500 × 10 + 9 = 5009 Lux.

（6）、CO_2 Sensor

The CO_2 sensor measures in the range 0–5000 ppm, and the CO_2 value is read from register 5. The reading format of sensor device address 1 is as follows:

Send	01	03	00	05	00	01	94	0B
Description	Address	Read	Register		Points to Read		CRC Checksum	
Response	01	03	02		01	26	38	0E
Description	Address	Read	Data Length		Sensor Data		CRC Checksum	

The sensor returns data 0x0126. Converting to decimal gives 294, indicating a CO_2 concentration value of 294 ppm.

（7）、Single Temperature Sensor (Metal Casing)

The single temperature sensor value is read from register 13. The reading format of sensor device address 1 is as follows:

Send	01	03	00	0D	00	01	15	C9
Description	Address	Read Command	Register		Points to Read		CRC Checksum	
Response	01	03	02		00	26	39	9E

Description	Address	Read Command	Data Length	Sensor Data	CRC Checksum

The sensor returns data as 0x0026, which is converted to decimal as 38. The temperature value is 3.8℃ with 1 decimal place.

（8）、Three-Element Sensor

To read the values of three elements (temperature, humidity, and outdoor illuminance), read 4 registers.

Send	01	03	00	00	00	04	44	09
Description	Address	Read Command	Starting Register		Points to Read		CRC Checksum	
Response	01	03	08	00 26	02 8D	01 F4	00 09	7F E0
Description	Address	Read Command	Data Length	Temperature Value	Humidity Value	10 times the illuminance value	The ones place of the illuminance value	CRC Checksum

The sensor returns temperature data 0x0026. Converting to decimal gives 38, indicating a temperature value of 3.8°C, with 1 decimal place.

The sensor returns humidity data 0x028D. Converting to decimal gives 653, indicating a humidity value of 65.3%RH, with 1 decimal place.

The sensor returns illuminance data 0x01F4 and 0x0009. Converting to decimal gives 500 and 9, respectively. The outdoor illuminance value is calculated as 500 × 10 + 9 = 5009 Lux.

（9）、Four-Element Sensor

To read the values of four elements (temperature, humidity, outdoor illuminance, and CO_2), read 6 registers.

Send	01	03	00	00	00	06	C5	C8
Description	Address	Read Command	Register		Points to Read		CRC Checksum	
Response	01	03	0C		00 26	02 8D	01	F4
Description	Address	Read Command	Data Length		Temperature Value	Humidity Value	10 times the illuminance value	
Response	00	09	07		FF	01 26	A7	A8

Description	The ones place of the illuminance value	Indoor Illuminance (0x07FF invalid)	CO_2 Value	CRC Checksum

The sensor returns temperature data 0x0026. Converting to decimal gives 38, indicating a temperature value of 3.8°C, with 1 decimal place.

The sensor returns humidity data 0x028D. Converting to decimal gives 653, indicating a humidity value of 65.3%RH, with 1 decimal place.

The sensor returns illuminance data 0x01F4 and 0x0009. Converting to decimal gives 500 and 9, respectively. The outdoor illuminance value is calculated as 500 × 10 + 9 = 5009 Lux.

The sensor returns CO_2 data 0x0126. Converting to decimal gives 294, indicating a CO_2 concentration value of 294 ppm.

ASCII Company's Proprietary Communication Protocol

(I) Serial Port Format

Data bits: 8 bits, Stop bits: 1 bit, Parity: None, Baud rate: 9600bps, Minimum interval between two communications: at least 1000ms

(II) Communication Format

【1】Writing a New Address to the Device (e.g., Writing Address 01)

Send	AA	00	10	00	01
Description	Start	Broadcast Address	Write	Write Address	New Address
Response	OK				
Description	New address written successfully				

【2】Reading the Device Address

Send	AA	00	03	00	00
Description	Start	Broadcast Address	Read	Read Address	
Response	Address=001				
Description	The address read is 1				

【3】Reading Real-Time Data

Send	AA	01	03	0F	00
Description	Start	Device Address	Read	Read Data	
Response	T= -5.0℃,H=87.2%RH,I= 1503Lux				
Description	Returned temperature: -5°C, humidity: 87.2%RH, illuminance: 1503Lux				

Spaces and other transitional characters are omitted in the above instructions.

In the serial port software (e.g., SSCOM3.3), enable "HEX Send" and disable "HEX Display." Upon powering on, the device will return "Start."

ModBus CRC Verification Steps

1. Initialize a 16-bit register to hexadecimal FFFF, referred to as the CRC register.
2. XOR the first 8-bit data with the lower 8 bits of the CRC register, and store the result in the CRC register.
3. Shift the contents of the register one bit to the right (towards the least significant bit), fill the most significant bit with 0, and check the least significant bit.
4. If the least significant bit is 0: repeat step 3 (shift again). If the least significant bit is 1: XOR the CRC register with the polynomial A001 (1010 0000 0000 0001).
5. Repeat steps 3 and 4 until 8 shifts have been completed, processing the entire 8-bit data.
6. Repeat steps 2 to 5 for the next 8-bit data.
7. The final value of the CRC register is the CRC code (the resulting CRC code is in low-byte-first, high-byte-last order).

Installation Site Requirements

1. Ensure good air circulation around the device.
2. Keep away from exhaust outlets, motors, and other machinery.
3. Avoid areas with standing water, fountains, and sprinklers.

Precautions

1. Check whether the packaging is intact and verify that the product model matches the selected specification.
2. Do not connect wiring while powered. Ensure the wiring is correct before powering on.
3. The length of the sensor cable may affect the output signal. Do not modify the product without authorization. If modification is needed, contact the manufacturer.
4. The sensor is a precision component. Do not disassemble it, or use sharp objects or corrosive liquids to contact the sensor surface, as this may damage the product.
5. Keep the calibration certificate and compliance certificate. Return them with the product for repairs.

Warranty Instructions：

1. One-year warranty: This product comes with a 12-month warranty from the date of purchase. Free repairs will be provided for quality issues confirmed by after-sales personnel, provided the product is used normally and has not been disassembled or repaired.

2. Repairs will be charged for damages caused by improper use, abnormal conditions, or repairs/disassembly performed by unauthorized personnel.

3. For calibration or repair needs, return the product along with this card and proof of purchase to the company for handling.

Warranty Procedure：

1. In case of product failure, contact the company's salesperson to arrange for the product to be returned for repair.

2. When returning a product for warranty service, fill out the repair record form completely and include it with the product. Shipping costs are to be borne by the customer.

3. Properly package and transport the product for repair. The company is not responsible for loss or damage during transportation.