



USER MANUAL

AVC-ES105-M Multi-Parameter Meteorological Sensor

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Multi-Parameter Meteorological Sensor User Manual (RS485 Type)

Document Version: V1.0 AVCOMM Technologies

1. Product Introduction

1.1 Overview

The AVC-ES105-M is an all-in-one multi-parameter meteorological sensor designed for environmental monitoring. It integrates noise level, PM2.5/PM10 particulate matter, temperature and humidity, barometric pressure, and light intensity measurement in a single weatherproof housing. The unit is designed for mounting inside a louvered radiation shield, communicates over standard Modbus-RTU protocol via RS485, and supports a communication distance of up to 2000 m (field-tested). It is suitable for environmental temperature/humidity monitoring, noise level monitoring, air quality monitoring, atmospheric pressure, and light intensity applications, offering reliable performance, a compact form factor, and easy installation.

1.2 Features

- Compact, lightweight, UV-resistant housing for long service life
- High-sensitivity probes with stable signal output and high accuracy
- Imported key components; wide measurement range, good linearity, strong water resistance
- Noise level monitoring, range 30dB–130dB
- Simultaneous PM2.5/PM10 acquisition, range 0–1000 $\mu\text{g}/\text{m}^3$, 1 $\mu\text{g}/\text{m}^3$ resolution, laser scattering measurement principle, dual-frequency data acquisition with auto-calibration
- Temperature/humidity sensing element imported from Switzerland, range -40 to 120°C
- Wide barometric pressure range of 0–120kPa, suitable for all altitudes
- High-sensitivity photodiode, light intensity range 0–200,000 Lux
- Dedicated RS485 circuit, stable communication, wide-voltage 10–30V power input

1.3 Key Technical Specifications

Item	Parameter
DC power supply (default)	10–30VDC
Max. power consumption (RS485 output)	0.8W

Accuracy

Parameter	Accuracy
Humidity	$\pm 3\% \text{RH}$ (at 60%RH, 25°C)
Temperature	$\pm 0.5^\circ\text{C}$ (at 25°C)
Light intensity	$\pm 7\%$ (at 25°C)

Parameter	Accuracy
Atmospheric pressure	±0.15kPa @25°C, 101kPa
Noise	±0.5dB (reference tone, 94dB@1kHz)
PM2.5	Particle counting efficiency: 50%@0.3µm, 98%@≥0.5µm. PM2.5 accuracy: ±3%FS (@0–100µg/m³, 25°C, 50%RH)

Measurement Range

Parameter	Range
Humidity	0%RH–99%RH
Temperature	-40°C to +120°C
Light intensity	0–200,000 Lux
Atmospheric pressure	0–120kPa
Noise	30dB–130dB
PM10 / PM2.5	0–1000µg/m³

Long-term Stability

Parameter	Stability
Temperature	≤0.1°C/year
Humidity	≤1%/year
Light intensity	≤5%/year
Atmospheric pressure	-0.1kPa/year
Noise	≤3dB/year
PM10 / PM2.5	≤1%/year

Response Time

Parameter	Response time
Temperature	≤25s (at 1m/s airflow)
Humidity	≤8s (at 1m/s airflow)
Light intensity	≤2s
Atmospheric pressure	≤2s
Noise	≤3s
PM10 / PM2.5	≤90s

Note: Temperature/humidity response time is τ_{63} . Airflow refers to the velocity at the sensing element inside the sensor; when the test-environment airflow is 10²m/ms directed perpendicular to the sensor inlet, the velocity at the internal sensing element is approximately 1m/s.

Output signal

RS485 (standard Modbus protocol)

2. Installation

2.1 Pre-installation Checklist

Package contents:

- 1 × transmitter unit
- 1 × USB-to-RS485 adapter (optional)
- Warranty card, certificate of conformity, after-sales service card, etc.

2.2 Interface

Wide-voltage power input range: 10–30V DC. When wiring the RS485 signal lines, ensure the A and B lines are not reversed, and that no two devices on the same bus share the same address.

Category	Wire color	Description
Power	Brown	Power + (10–30V DC)
Power	Black	Power –
Communication	Yellow	485-A
Communication	Blue	485-B

2.3 RS485 Bus Wiring Notes

When multiple RS485 devices share a single bus, follow standard RS485 network wiring practice (proper termination resistance, local power supply, and limits on bus length/device count). Refer to the AVCOMM RS485 Field Wiring Guide for details.

2.4 Installation Example

The unit mounts onto the radiation shield bracket via its base plate. See Section 7 (Appendix) for mounting hole dimensions.

3. Configuration Software

3.1 Software

Use the AVCOMM 485 Parameter Configuration Tool to commission and configure the device.

3.2 Parameter Setup

- 1 Select the correct COM port (check under Device Manager → Ports).
- 2 Connect only one device, power it on, and click "Test Baud Rate" in the tool — it will automatically detect the device's baud rate and address. Factory default baud rate is 4800bit/s, and factory default address is 0x01.
- 3 Modify the device address and baud rate as needed, and query the device's current status.
- 4 If the test fails, re-check the wiring and confirm the RS485 driver is properly installed.

4. Communication Protocol

4.1 Basic Communication Parameters

Item	Parameter
Coding	8-bit binary
Data bits	8
Parity	None
Stop bits	1
Error check	CRC
Baud rate	1200–115200bit/s configurable, factory default 4800bit/s

4.2 Data Frame Format

Standard Modbus-RTU protocol:

- Start: ≥4-byte idle time
- Address code: 1 byte
- Function code: 1 byte
- Data field: N bytes
- Error check: 16-bit CRC
- End: ≥4-byte idle time

The address code is the device's unique bus address (factory default 0x01). The function code indicates the requested operation. In the data field, the high byte of each 16-bit value is transmitted first. The CRC is a 2-byte checksum.

Master query frame

Address	Function	Register start address	Register count	CRC low	CRC high
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave response frame

Address	Function	Byte count	Data 1	Data 2	Data N	CRC
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

4.3 Register Map

Data registers (function codes 0x03/0x04)

Register (dec)	PLC/SCADA address	Description	Function code
497	40498	Atmospheric pressure (hPa, actual value ×10)	0x03/0x04
500	40501	Humidity (actual value ×10)	0x03/0x04
501	40502	Temperature (actual value ×10)	0x03/0x04
502	40503	Noise level (actual value ×10)	0x03/0x04
503	40504	PM2.5 (actual value)	0x03/0x04
504	40505	PM10 (actual value)	0x03/0x04
505	40506	Atmospheric pressure (kPa, actual value ×10)	0x03/0x04
506	40507	Light intensity (0–200,000 Lux), high 16 bits	0x03/0x04
507	40508	Light intensity (0–200,000 Lux), low 16 bits	0x03/0x04

Address & baud rate registers (function codes 0x03/0x04/0x06/0x10)

Register (dec)	PLC/SCADA address	Description	Operation
2000	42001	Device address (1–254, factory default 1)	0x03/0x04/0x06/0x10
2001	42002	Baud rate: 0=2400, 1=4800, 2=9600, 3=19200, 4=38400, 5=57600, 6=115200, 7=1200	0x03/0x04/0x06/0x10

Calibration registers (function codes 0x03/0x04/0x06/0x10)

Register (dec)	PLC/SCADA address	Description	Function code
80	40081	Temperature calibration value (actual value ×10)	0x03/0x04/0x06/0x10
81	40082	Humidity calibration value (actual value ×10)	0x03/0x04/0x06/0x10
82	40083	Noise calibration value (actual value ×10)	0x03/0x04/0x06/0x10

Register (dec)	PLC/SCADA address	Description	Function code
83	40084	PM2.5 calibration value (actual value)	0x03/0x04/0x06/0x10
84	40085	PM10 calibration value (actual value)	0x03/0x04/0x06/0x10
85	40086	Atmospheric pressure calibration value (kPa, actual value ×10; also syncs hPa register)	0x03/0x04/0x06/0x10
86	40087	Light intensity calibration value (actual value)	0x03/0x04/0x06/0x10

4.4 Protocol Example

Query temperature/humidity (device address 03)

Address	Function	Start address	Data length	CRC low	CRC high
0x03	0x03	0x01 0xF4	0x00 0x02	0x85	0xE7

Response (example: temperature = -10.1°C, humidity = 65.8%RH)

Address	Function	Byte count	Humidity	Temperature	CRC low	CRC high
0x03	0x03	0x04	0x02 0x92	0xFF 0x9B	0x79	0xFD

Temperature: values below 0°C are transmitted as two's complement. 0xFF9B (hex) = -101 → temperature = -10.1°C

Humidity: 0x0292 (hex) = 658 → humidity = 65.8%RH

5. Troubleshooting

Device cannot connect to a PLC or PC — possible causes:

- 1 Multiple COM ports on the PC; the wrong port is selected.
- 2 Incorrect device address, or duplicate addresses on the bus (factory default is 1 for all units).
- 3 Baud rate, parity, data bits, or stop bits mismatch.
- 4 Master polling interval or response timeout too short — set both to at least 200ms.
- 5 RS485 bus disconnected, or A/B lines reversed.
- 6 Too many devices or bus run too long — power devices locally, add an RS485 repeater, and add a 120Ω termination resistor.
- 7 USB-to-RS485 driver not installed or corrupted.
- 8 Device hardware failure.

6. Precautions

- 1 Warning: Risk of personal injury. This device must not be used as a safety device, emergency stop device, or for any application where a device failure could result in personal injury. Use only for its intended, authorized purpose. Consult the technical manual before installation, operation, or maintenance. Failure to follow this guidance may result in death or serious injury.
 - 2 The humidity sensor uses a capacitive sensing principle. Avoid use in environments containing volatile organic compounds (VOCs).
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7. Appendix: Housing Dimensions

- Outer diameter: $\Phi 138\text{mm}$
 - Body height: 78mm
 - Overall height (including cable/connector section): 61mm
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8. Contact Us

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This document is compiled and published by AVCOMM Technologies, based on tested product parameters and the standard Modbus-RTU protocol. Specifications are subject to change without notice — please refer to the latest revision.