Duct Air Flow Sensor Communication Protocol

1. Basic Communication Parameters

Coding	8-bit binary
Data bits	8-bit
Parity bit	none
Stop bit	1 bit
Error Validation	CRC (Cyclic Redundancy Code)
Baud rate	1200bit/s, 2400bit/s, 4800bit/s, 9600bit/s, 19200bit/s, 38400bit/s, 57600bit/s and 115200 bit/s settings are available; the factory default is 4800 bit/s.

2. Data Frame Format Definition

The ModBus-RTU communication protocol is adopted, with the following format:
Initial structure ⩾ 4 bytes (time)
Address code = 1 byte
Function code = 1 byte
Data area = N bytes
Error check = 16-bit CRC code
End structure ⩾ 4 bytes (time)
Address code: The transmitter's address, unique in the communication network (factory default 0x01).
Function code: The function indication of the command sent by the host.
Data area: The data area contains the actual communication data; note that the high byte of the 16-bit data is first!
CRC code: A two-byte checksum.

Host query frame structure:

Address code	Function code	Start address register	Length checksum	Low byte checksum	High byte checksum
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave response frame structure:

Address code	Function code	Number of valid bytes	First data zone	Second data zone	Nth data zone	Check code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

www.ato.com sales@ato.com 800-585-1519 Global Shipping

3. Register Address

Register Address	PLC or Configuration Address	Content	Supported Function Codes	Description
0000 H	40001	Current wind speed (meters per second)	0x03/0x04	Actual value 10 times
0001 H	40002	Current air volume (integer value, m^3/h)	0x03/0x04	Range 0~65535, maximum 65535, displays 65535 if exceeding 65535
0002 H	40003	Current air volume (floating value, high 16 bits, m^3/h)	0x03/0x04	Actual value
0003 H	40004	Current air volume (floating value, low 16 bits, m^3/h)		
004E H	40079	Coefficient A (floating value, high 16 bits)	0x03/0x04/0x06/0x10	Offset register y=Ax+B, coefficient A (x is current wind speed)
004F H	40080	Coefficient A (floating value, low 16 bits)		
0050 H	40081	Wind speed calibration value	0x03/0x04/0x06	Offset register y=Ax+B, coefficient B (actual value 10 times)
0200 H	40513	Current pipe cross-sectional area (cm^2)	0x03/0x04/0x06	Range 0~65535

07D0 H	42001	Address code	0x03/0x04/0x06/0x10	1~254 (factory default 1)
07D1 H	42002	Baud rate	0x03/0x04/0x06/0x10	0 represents 2400 1 represents 4800 2 represents 9600 3 represents 19200 4 represents 38400 5 represents 57600 6 represents 115200 7 represents 1200

4. Device Address Setting Method

The device address supports both software configuration and DIP switch settings; only one method can be selected.

When all four DIP switches are set to the "OFF" position, the address can be set via the configuration software.

When one of the four DIP switches is in the "ON" position, the device address can only be represented by the DIP switch; the address set via software is invalid. The address range for DIP switch settings is 1 to 15.

The address setting methods using DIP switches are as follows: 1 represents ON, 0 represents OFF.

ModBus address	1	2	3	4
Address set by software	0	0	0	0
1	0	0	0	1
2	0	0	1	0
.....	.....	.....	.....	.....
15	1	1	1	1

5. Examples and Explanations of Communication Protocols

5.1 Read the wind speed value at device address 0x01

Query frame (hexadecimal):

Address code	Function code	Start address	Data length	Low byte checksum	High byte checksum
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

www.ato.com sales@ato.com 800-585-1519 Global Shipping

Response frame (hexadecimal): (e.g., reading wind speed as 10.8 m/s)

Address code	Function code	Returns the number of valid bytes	Wind speed value	Low byte checksum	High byte checksum
0x01	0x03	0x02	0x00 0x06C	0XB8	0x69

Wind speed calculation:
Wind speed: 006C H (hexadecimal) = 108 => Wind speed = 10.8 m/s

5.2 Read the current pipe cross-sectional area at device address 0x01

Query frame (hexadecimal):

Address code	Function code	Start address	Data length	Low byte checksum	High byte checksum
0x01	0x03	0x02 0x00	0x00 0x01	0x85	0XB2

Response frame (hexadecimal): (e.g., reading that the pipe cross-sectional area is 100 square centimeters)

Address code	Function code	Returns the number of valid bytes	Wind speed value	Low byte checksum	High byte checksum
0x01	0x03	0x02	0x00 0x64	0X89	0x99

Pipe cross-sectional area calculation:
Wind speed: 0064 H (hexadecimal) = 100 => Pipe cross-sectional area = 100 square centimeters

5.3 Set the pipe cross-sectional area of device address 0x01 to 200 square centimeters

Request frame (hexadecimal):

Address code	Function code	Start address	Data content	Low byte checksum	High byte checksum
0x01	0x06	0x02 0x00	0x00 0XC8	0x89	0XE4

www.ato.com sales@ato.com 800-585-1519 Global Shipping

Response frame (hexadecimal): (e.g., reading that the pipe cross-sectional area is 100 square centimeters)

Address code	Function code	Start address	Data content	Low byte checksum	High byte checksum
0x01	0x06	0x02 0x00	0x00 0XC8	0x89	0XE4

Set up pipe cross-sectional area calculation:

Wind speed: 00C8 H (hexadecimal) = 200 => Pipe cross-sectional area = 200 square centimeters

5.4 Read the current airflow integer value from device address 0x01

Current air volume calculation formula:

Current air volume = Current wind speed (in meters per second) × Pipe cross-sectional area (in square centimeters) × 3600÷10000.

Query frame (hexadecimal):

Address code	Function code	Start address	Data length	Low byte checksum	High byte checksum
0x01	0x03	0x00 0x01	0x00 0x01	0XD5	0XCA

Response frame (hexadecimal): (e.g., reading an integer value of 545 m³/h for air volume)

Address code	Function code	Returns the number of valid bytes	Integer airflow value	Low byte checksum	High byte checksum
0x01	0x03	0x02	0x02 0x21	0X79	0x3C

Calculation of integer values for air volume:

Integer value of air volume: 0221 H (hexadecimal) = 545 => Integer value of air volume = 545 m³/h

5.5 Read the current airflow floating-point value at device address 0x01

Current air volume calculation formula:

Current air volume = Current wind speed (in meters per second) × Pipe cross-sectional area (in square centimeters) × 3600 ÷ 10000.

Floating-point data retains one significant decimal place.

Query frame (hexadecimal):

Address code	Function code	Start address	Data length	Low byte checksum	High byte checksum
0x01	0x03	0x00 0x02	0x00 0x02	0X65	0XCB

Response frame (hexadecimal): (e.g., reading a floating-point value of airflow of 545.2 m³/h)

Address code	Function code	Returns the number of valid bytes	Air volume floating-point (high 16 bits)	Air volume floating-point (low 16 bits)	Low byte checksum	High byte checksum
0x01	0x03	0x04	0x44 0x08	0x4C 0xCD	0X9A	0x54

Air volume floating-point value calculation:

Air volume floating-point value: 44084CCD H (hexadecimal) = 545.2 => Air volume floating-point value = 545.2 m³/h

5.6 Read the floating-point value of the device offset register coefficient A

Request frame (hexadecimal):

Address code	Function code	Start address	Data length	Low byte checksum	High byte checksum
0x01	0x03	0x00 0x4E	0x00 0x02	0XA4	0X1C

Response frame (hexadecimal):

Address code	Function code	Returns the number of valid bytes	Coefficient A is a floating-point type, high 16 bits	Coefficient A is a floating-point type, low 16 bits	Low byte checksum	High byte checksum
0x01	0x03	0x04	0x3F 0x80	0x00 0x00	0XF7	0xCF

Floating-point value calculation for coefficient A:

The floating-point value of coefficient A is 3F800000 H (hexadecimal) = 1, therefore coefficient A is 1.