

# MEMS Environmental Meter

## HM-AM1000 Series

The products are designed for air flow velocity measurement in a closed conduit or open space, with optional temperature and humidity sensing data. The sensing elements are made on a specially designed MEMS structure that enhances the measurement accuracy, response time and lowers the power consumption. The RS485 (Modbus), I<sup>2</sup>C and Bluetooth LE (reversed) options are ready for networking or remote communication. The formality is particularly in favor for residential HVAC or smart home applications.

The product is fully customizable for flow range and user interface and can be packaged into a complete meter with local display or with standalone battery power unit.



## Specifications

Model	AM1000	AM1100	
Flow range <sup>1)</sup>	0 ~ 3, 5, 10, 15, 20, 30		m/sec
Accuracy	±2.5		%FS
Repeatability	±1.0		%
Flow resolution (Digital)	0.001		m/sec
Flow output shift	±0.12		%/°C
Temperature	-10 ~ +65		°C
Temperature accuracy	±0.5		°C
Temperature resolution	0.04		°C
Humidity	0 ~ 100		%RH
Humidity accuracy	±2.0		%RH
Humidity resolution	0.04		%RH
Response time	10		msec
Output <sup>2)</sup>	0.5 ~ 4.5 Vdc linear; RS485 (Modbus), I <sup>2</sup> C		
Electrical interface	5 color coded cable, 1.0 m		
Power supply <sup>3)</sup>	8 ~ 24		Vdc
Supply current	<15		mA
Working temperature	-10 ~ +65		°C
Storage temperature	-20 ~ +70		°C
Calibration	Air, 20 °C, 101.325 kPa		
EMC	EN 61326 - 1/2/3		
Maximum overflow	70		m/sec
Maximum flow change	10		m/sec <sup>2)</sup>

Note: 1. Flow range is selectable from 0~3.....0~30 m/sec; for higher flow rate options, please contact the manufacturer.

2. 0.5 ~ 4.5 Vdc analog output correspond to flow velocity, while RS485 output flow velocity, humidity and temperature.

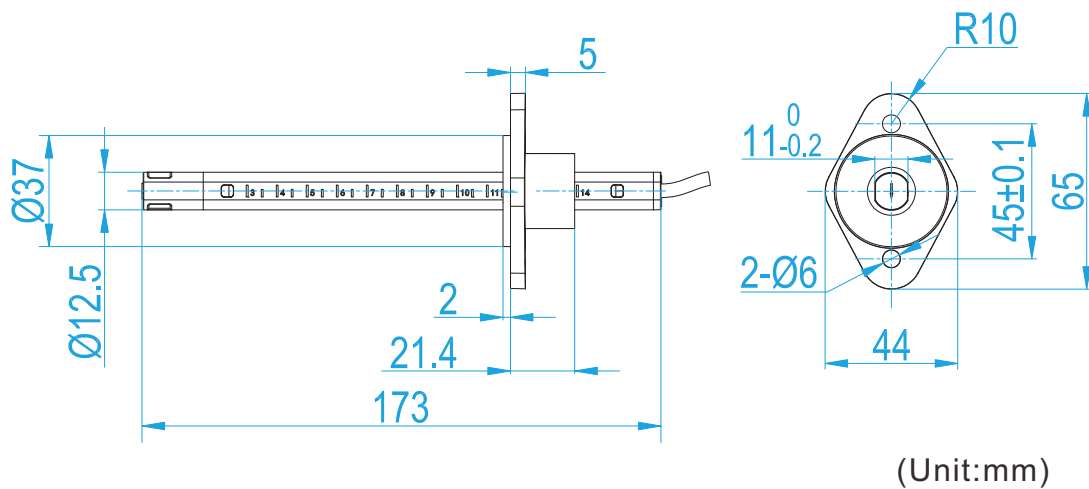
3. Battery power is optional.

## Additional Specifications (relative humidity)

Model	HM-AM1100	
Resolution	0.04	%RH
Accuracy		
20 ~ 80 %RH	±2.0	%RH
0~20; 80~100%RH	±5.0, max.	%RH
Response time		
63%; 25~75%RH	5	sec
Long term drifting	0.5	%RH/year
Temperature coefficient*		
0 ~ 80°C	-0.15	%/°C

\*Note: The humidity measurement is fully temperature compensated for 0~ 80°C.

## Mechanical Dimensions



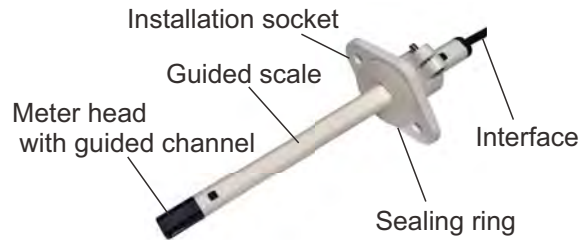
## Pin Definition\*

Pin Color	Definition
Red	VCC, power supply
Black	GND, ground
Yellow	RS485A / SCL (I <sup>2</sup> C)
Blue	RS485B / SDA (I <sup>2</sup> C)
Green	Vout, analog output

\* Please contact Hemomatik for other models.

# Installation

(1) The parts are illustrated as below:



(2) Opens space measurement:

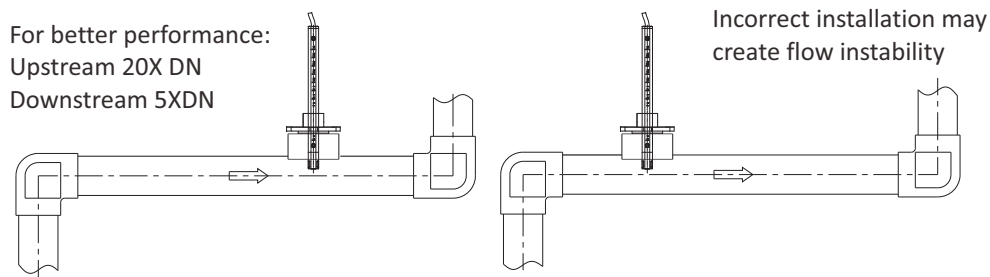
(2-1) The flow speed measured would be only for the direction where the meter head is pointed.

(2-2) The meter is not directional dependent for the installation, horizontal, vertical or any other direction shall not alter the performance of the accuracy of the reading.

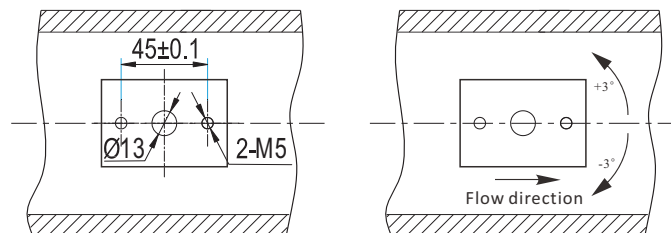
(3) Online measurement:

(3-1) Make sure there is no any hazardous gases present in the flow channel.

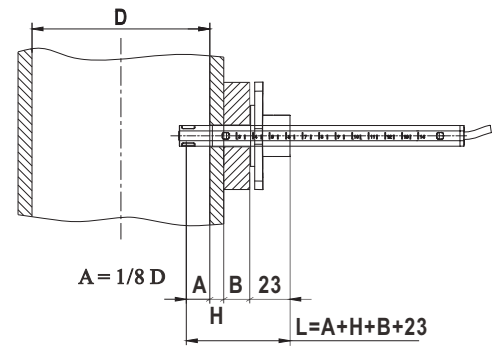
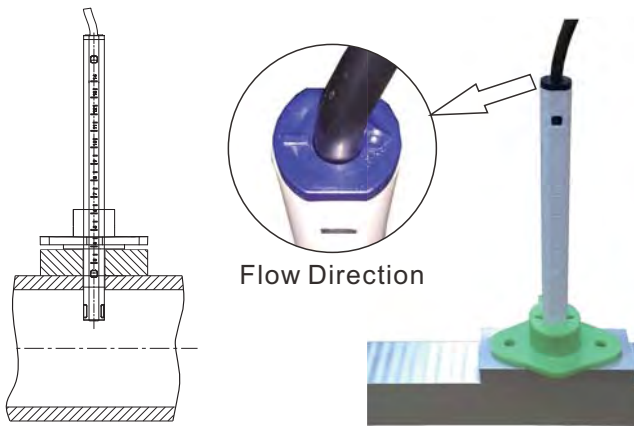
(3-2) The meter should be installed avoiding valves, sharp turns and other obstacles possibly presented in the system for flow instability.



(3-3) Prepare the installation hole in the flow channel (13mm), and the installing base as below:



(3-4) Install the sensor, the flow measurement direction indicated on the sensor should align with the flow direction in the flow channel. Adjust the probe depth in the flow channel according to the measurement



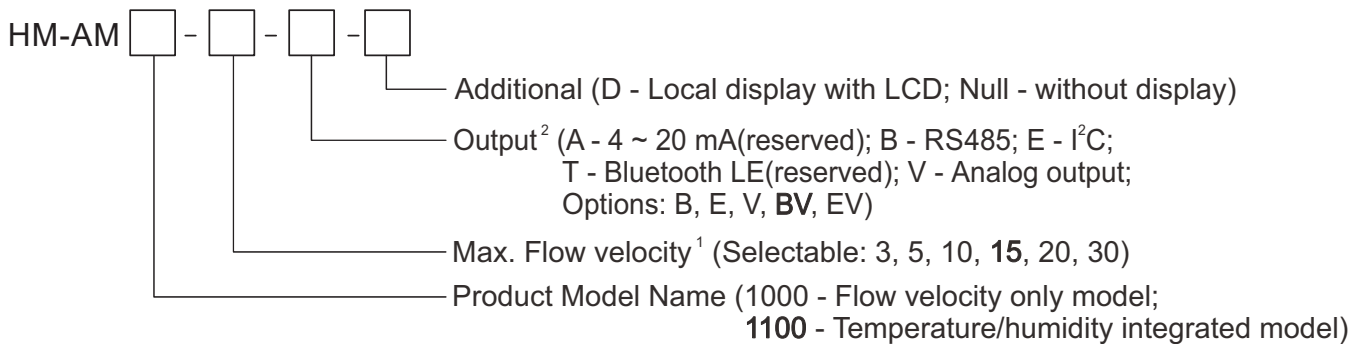
### Calculation of the probe depth, $L$

$$L = 1/8D + H + B + 23$$

where  $D$  is the flow channel diameter  
 $H$  is the flow channel wall thickness  
 $B$  is the base height.

## Product Selection

The sensor part number is composed of the model number and suffix indicating the full scale flow rate, output format as well as the calibration gas. Refer to the followings for details.



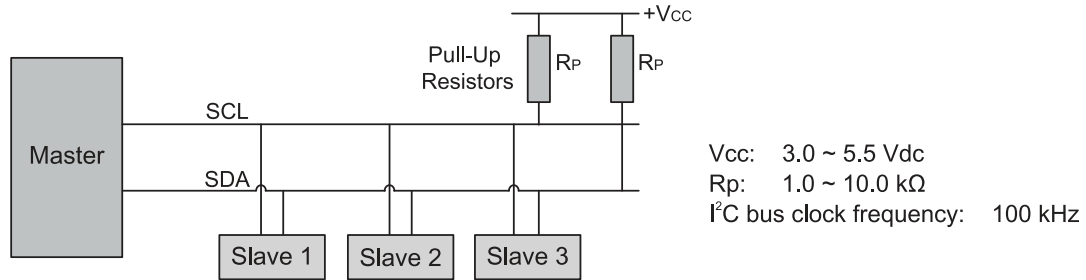
1. Max. flow velocity number only, for example, 10 meaning maximum flow velocity of 10 m/sec.
2. 4 ~ 20mA and bluetooth are reserved.

### Standard model: **HM-AM1100-15-BV**

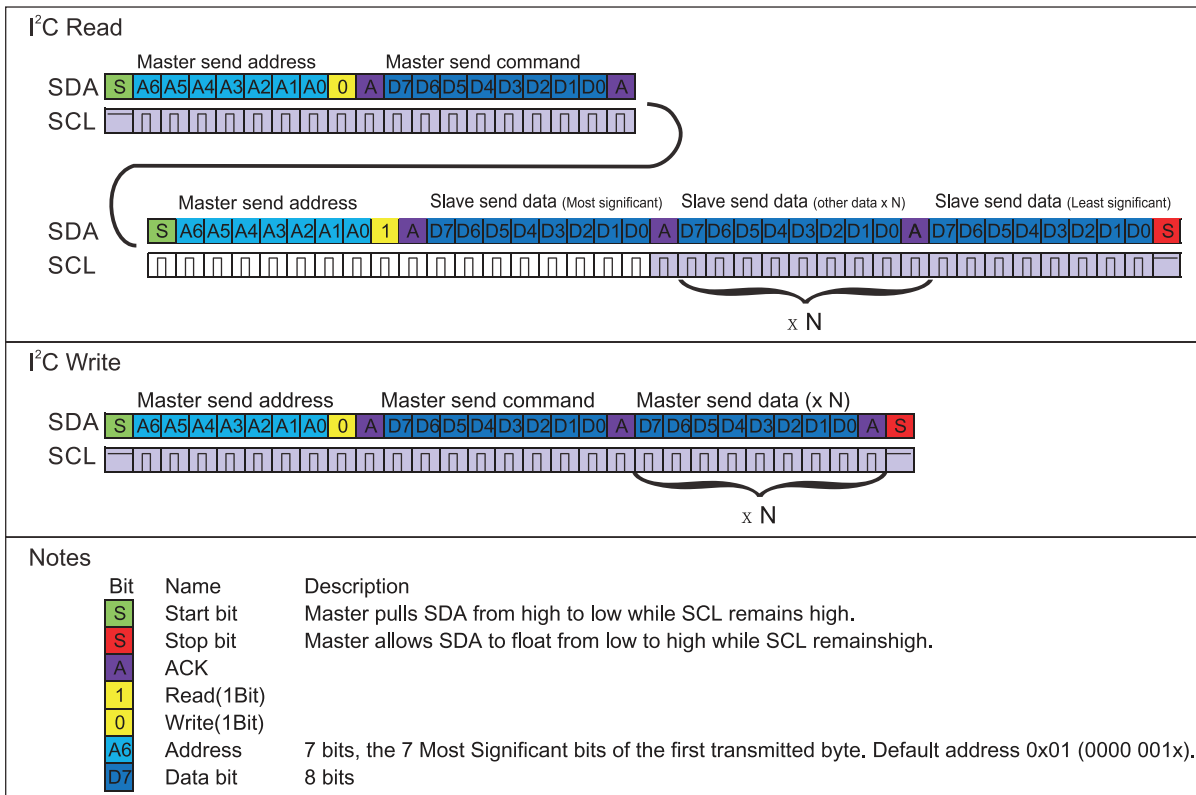
Flow velocity, temperature and humidity via RS485  
 Flow velocity via analogue 0,5-4,5 Vdc linear, 0-15 m/s

# I<sup>2</sup>C Communication Protocol

## 1. I<sup>2</sup>C Connection



## 2. I<sup>2</sup>C Read and Write Sequences



## 3. I<sup>2</sup>C Commands description

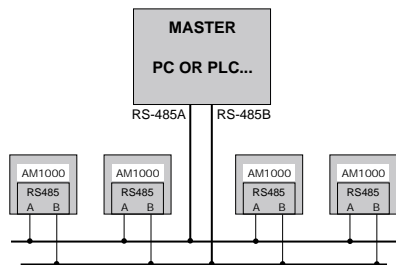
Command Byte (Hex)	Length	Command Name	Read / Write	Notes
05H	1	Set the I <sup>2</sup> C address	W	Bit7 ~ Bit1 can be set*
82H	12	Read the sensor SN	R	ASCII
83H	4	Read flow velocity	R	Int32/1000 m/sec
85H	1	Read the I <sup>2</sup> C address	R	Bit7 ~ Bit1
B2H	2	Read temperature	R	Int16/100 °C
B3H	2	Read humidity	R	Int16/100 %RH

\* The address is set with Bit7~Bit1. For instance, 08H (0000 100x) means address of 4.

# RS485 Communication Protocol

## 1. Hardware connection

HM-AM1000 protocol is based on standard Modbus RTU mode. A master (PC or PLC) can communicate with several slaves (HM-AM1000), setting parameter or getting data. The hardware layer is TIA/EIA-485-A. The connection is as below:



## 2. Communication parameter

The UART parameter is shown as below table:

Communication parameter	protocol
	RTU
Baud rate(Bits per second)	38400 bps
Start bits	1
Data bits	8
Stop bits	1
Even/Odd parity	None
Bits period	104.2 μs
Bytes period	1.1458 ms
Maximum data length	20
Maximum Node	247

## 3. Frame

The framing function is accord with The Standard Modbus RTU framing, which is shown as below:

Start_bits	Address	Function code	Data	CRC	Stop_bits
T1-T2-T3-T4	8Bit	8Bit	N 8Bit (20≥N≥0)	16Bit	T1-T2-T3-T4

Start\_bits: 4 periods bit time, to indicate a new frame.

Address: The address, can be set as 1 to 247, 0 is broadcast address.

Function code: Define the action that FS4000 should takes, or indicate that which code the FS4000 is responding.

Data: Including the address of register, length of data and the data.

CRC : CRC verify code, the low byte is flowed by high byte. For example, the 16bit CRC code is divide as BYTE\_H BYTE\_L, in the frame, the BYTE\_L goes first, then the BYTE\_H, at last, is the stop signal.

Stop\_bits: 4 periods bit time, to indicate that the current framing is over.

## 4. Function code

AM1000 Modbus Function-code is a subclass of Standard Modbus Function-code. By using these function-code, We can set or read the registers of AM1000. They are shown as below table:

Code	Name	Action
0x03	Read register	Read register (one or more)
0x06	Set single register	Write one single 16bit register
0x10	Set multi registers	Write multi registers

## 5. Registers

AM1000 has several registers. We can get the information (such as “address”, “flow rate” and so on) form reading these registers, or we can write into some of the registers for setting parameters of AM1000.

The registers are shown as below table: (Hex value)

Name	Description	Register
Address	The address of AM1000 (W/R)	0x0001
Flow Velocity	The current flow velocity (R)	0x0002~0x0003
baud Rate	The communication baud rate (W/R)	0x0015
Temperature	The gas temperature (R)	0x0025
Humidity	The gas humidity (R)	0x0026

\* R-read only, W/R-write and read.

<b>Address</b>	<b>0x0001</b>	WRITE	A
		READ	A
<b>Description</b>	The address of AM1000 in modbus protocol		
<b>Value Type</b>	UINT16		
<b>Detail</b>	Value from 1 to 255, 0 is broadcast address.		
<b>Flow Velocity</b>	<b>0x0002 ~ 0x0003</b>	WRITE	N
		READ	A
<b>Description</b>	The current flow velocity		
<b>Value Type</b>	UINT32		
<b>Detail</b>	Flow velocity = (value(0x0002) * 65536 + value(0x0003)) / 1000 Example: When we get “0” from register 0x0002 and “20340” from register 0x0003, the flow velocity will be (0*65536 + 20340)/1000= 20.34 m/s		
<b>Baud Rate</b>	<b>0x0015</b>	WRITE	A
		READ	A
<b>Description</b>	The communication baud rate		
<b>Value Type</b>	UINT16		
<b>Detail</b>	0 - 4800, 1 - 9600, 2 - 19200, 3 - 38400. The default value is 3. Example: When you get “2” from register 0x0015, the baud rate is 19200.		
<b>Temperature</b>	<b>0x0025</b>	WRITE	N
		READ	A
<b>Description</b>	The temperature of the measured gas		
<b>Value Type</b>	UINT16		
<b>Detail</b>	Temperature = value(0x0025) / 100, unit is °C.		
<b>Humidity</b>	<b>0x0026</b>	WRITE	N
		READ	A
<b>Description</b>	The humidity of the measured gas		
<b>Value Type</b>	UINT16		
<b>Detail</b>	Humidity = value(0x0026) / 100, unit is %RH.		



For more information and accessories, please contact Hemomatik AB

## Application Notes

This series of products are designed for acquiring the basic environmental data of air speed, temperature and humidity for better sensing and control scheme in applications such as smart residential HVAC system, environmental process probe, wind speed metering, gas flow media process monitor and control.

The air speed is calibrated with a system that has been correlated with data acquired in a wind tunnel for open space air speed and/or sonic nozzle for enclosed conduits with high precision. The special designed installation accessories shipped together with the product allow easy installation for the best performance. Please follow the installation guide to ensure the accuracy of the data acquisition.

For the measurement in an enclosed conduit, the meter blockage effects have been calculated and compensated. However, for the open space air speed measurement, the blockage, may not be completely eliminated as it shall be dependent on the actual measurement configuration. Various tests indicated that the blockage of the meter in an open space measurement may lead to a lower reading if the measured flow shall be laminar such as a wind tunnel, but in a turbulent condition, such an effect is much smaller.

## Safety and Maintenance

### Safety Precautions

The sensors cannot be used for gas metrology of fluoride or fluoride containing gases. For updates on the product certification information, please contact Hemomatik. Use for other gases such as extremely corrosive and toxic may cause the product malfunctioning or even severe damages. The product sealing is ensured to work under working pressure of 20 kPa and is leakage proof before shipment. But cautions and further leakage tests are important at installation as well since any leakage could cause severe safety issue.

### Maintenance

**Attention: Please do not attempt to alter any parts of the product as it may cause unrecoverable damages. If there are questions or doubts, please contact Hemomatik immediately before further action.**