Foreword

Welcome to use the ultrasonic weather instrument produced by our company. In order to use the instrument better, we recommend that you carefully read the product manual before use.

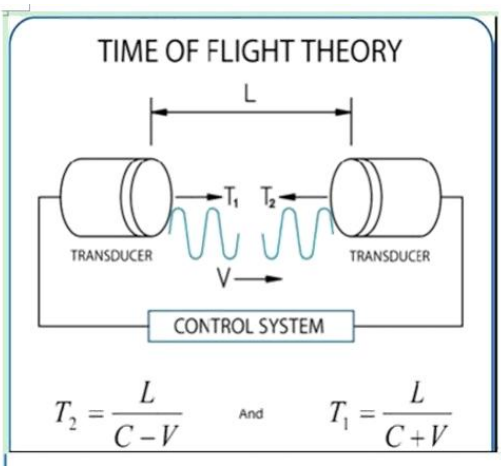
The company has been in the process of continuous exploration and research and development, without prior notice, we reserve the right to improve some performance and design.

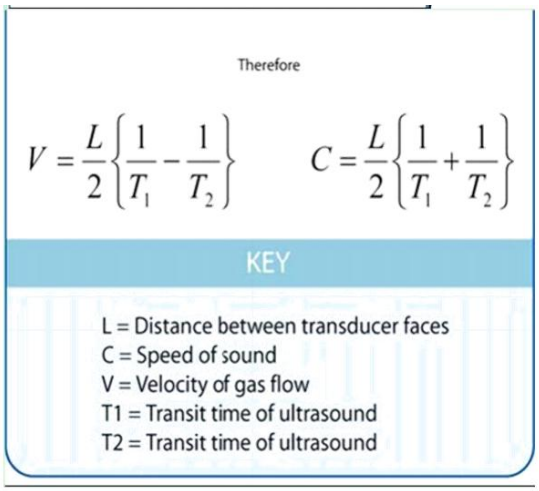
Product Introduction

NBL-W-51MUWS 5 in 1 ultrasonic sensor is a fully digital detection, high-precision sensor, which is integrated by ultrasonic principle wind speed and direction sensor, high-precision digital temperature, humidity and air pressure sensor. It can accurately and quickly detect wind speed, wind direction, atmospheric temperature, atmospheric humidity and atmospheric pressure, and the built-in signal processing unit can output corresponding signals according to user needs. The high-strength structural design can work reliably in harsh weather environments, with compact appearance, high integration, light weight, and durability; it can be widely used in meteorology, ocean, environment, airports, ports, laboratories, industry, agriculture, and transportation.

Principle

Measure the transit time of ultrasonic waves from N sensor to S sensor and compare with the transit time from S sensor to N sensor. Similarly, compare the time from W to E with the time from E to W. (N=North, S=South, E=East, W=West). For example: when the wind blows from the north, the time from N to S for ultrasonic waves will be shorter than the time from S to N, and the time from W and E is the same as the transmission time from E to W. By calculating the difference in transit time of ultrasonic waves between two points, the wind speed and direction of the wind can be calculated. This method of calculation has no relationship to other factors such as temperature.





Technical Parameters

Model No		NBL-W-51MUWS
voltage		DC12-24V
Output		RS485
Communication protocol		MODBUS
Baud Rate		9600
Average power consumption		0.3W
Operating temperature		-40-80℃
Operating humidity		0-95%RH
Standard cable length		2.5m
Material		ABS
IP rate		IP65
wind speed	Range	0-40m/s
	Accuracy	±0.5+2%FS
	Resolution	0.01m/s
wind direction	Range	0-359°
	Accuracy	±3°
	Resolution	1°
temperature	Range	-40-100℃
	Accuracy	±0.5℃
	Resolution	0.1℃
humidity	Range	0-100%RH
	Accuracy	±5%RH
	Resolution	0.1%RH
pressure	Range	10-1100hPa
	Accuracy	±1.5hPa
	Resolution	0.1hPa

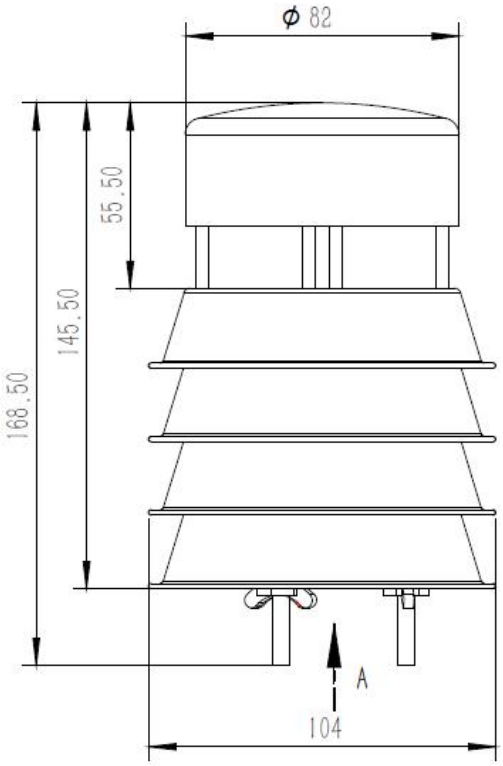
Connection method

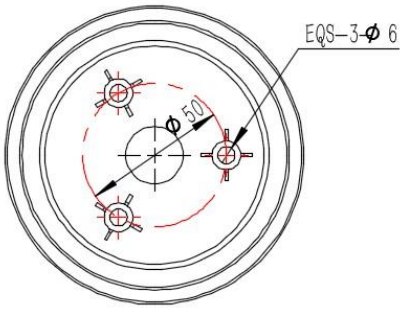
(1) There is an 8-pin aviation plug at the bottom of the sensor, and its pins correspond to the pin definition:
①-Power + ②-485 + ③-485 - ④-GND
(2) If only the sensor is purchased separately, the line sequence of the supporting line of the sensor is as follows:

Line color	Output signals
	RS485
Red	+
Black	-
Yellow	RS485+
Blue	RS485-

Note: The marking on the wiring label on the communication cable shall prevail.

Dimensions



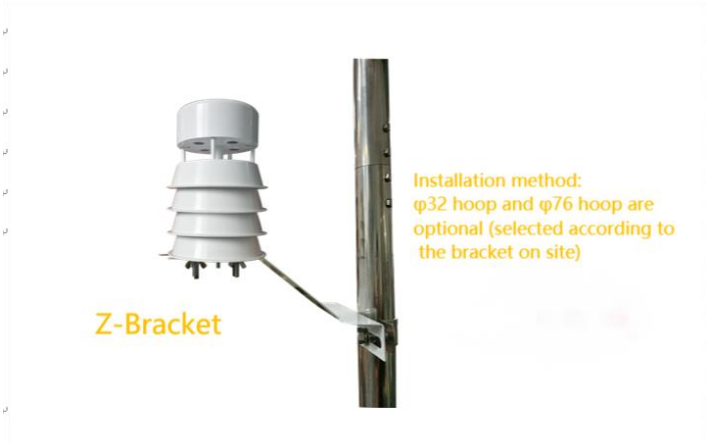


Notice:

(1) For M5 screws and studs, the angle between the mounting holes is 120 degrees;

(2) The installation diameter is 50mm;

Installation



Installation Precautions

The ultrasonic 5-parameter integrated sensor can meet multiple specifications and can be used in different environments around the world without complicated maintenance and calibration on site.

- Check frequently to make sure the sensor is not being interfered by other running equipment which may not fully comply with common standards, such as radio/radar transmitters, ship engines, motors, etc.;
- Do not install on a plane with any radar scanning device, at least keep a distance of 2M or more;
- It is recommended to keep a distance from some radio receiving antennas around;
- Use the cable recommended by our company;
- If the cable is not connected correctly after cutting, or the cable shielding wire is not connected correctly, there is no need to create a ground loop, just perform wiring according to the installation instructions;
- Ensure that the equipment is powered continuously during operation;
- Avoid the flocculation generated by surrounding buildings such as trees, utility poles, tall buildings, etc., which can affect the accuracy of the ultrasonic anemometer;

The World Meteorological Organization recommends the following:

- Meteorological instrument installation standard: 10 meters above the ground in an open area; the definition of an open area is that the meteorological instrument is more than 10 meters above the height of any obstacle;
- If it is installed on a building, theoretically the installation height of the meteorological instrument should be 1.5 times the height of the building;
- If mounted on a boom on a mast, tower or branch of a mast, the length of the boom or branch must be twice the minimum diameter or diagonal of the tower. The boom needs to be installed on the side of the prevailing wind;

Installation Method

The installation method is as follows:

Positioning: General equipment is installed on a vertical installation pipe to ensure measurement on the same horizontal plane;

For indoor use, the sensor can be installed in any desired direction, and the weather instrument measures the wind speed and direction on different wind surfaces;

Alignment: The detector should be fixedly installed with the pointing point pointing north.

Note: When installing, use a standard compass to determine the direction of the geographic North Pole, and it is ideal to keep the north direction of the instrument consistent with the direction of the compass;

Installation: The installation pipe needs 3 equidistant holes, tap M5 screws, the position is 7.5mm from the top of the pipe, and pass the cable through the installation pipe;

Notice: The user must provide proper strain relief for the cables. Rotate the plug and apply light pressure to connect the plug to the plug on the device. When the plug is connected, turn the outer sleeve clockwise to lock the plug. The device can be fixed to the mounting tube with 3 stainless steel screws. The customer must

ensure that the equipment is installed in an open area, so that the surrounding buildings do not obstruct the airflow. Do not install the equipment near radar or radio transmitters.

MODBUS communication protocol

Communication parameters:
Baud rate 9600
Data bit 8 bits
no check digit
The interval between two communications should be at least 1000ms

【1】Write the device address

Send: 00 10 Address CRC (5 bytes)
Return: 00 10 CRC (4 bytes)
Note:
1. The address bit of the read and write address command must be 00
2. Address is 1 byte, the range is 0-255
Example: send 00 10 01 BD C0
Return: 00 10 00 7C

【2】Read the device address

Send: 00 20 CRC (4 bytes)
Return: 00 20 Address CRC (5 bytes)
Description: Address is 1 byte, the range is 0-255
Example: Send 00 20 00 68
Return: 00 20 01 A9 C0

A. Read real-time data:

Suppose the device address is: 0X01, the effective range is 0~254, and 0 is the broadcast address.
For example: 01 03 00 00 00 05 85 C9

No	Meaning	Data offset	Number of bytes	Description
1	Device address	0	1	Device Unique Address
2	opcode (read)	1	1	Fixed value 0x03
3	Register start number	2	2	The first register number read
4	Read the number of registers	4	2	5 sensors
5	CRC16 Check	6	2	Low Front High Back

The device returns:
01 03 0A xx xx xx xx xx xx xx xx xx xx CRC16

No	Meaning	Data offset	Number of bytes	Description
1	Address field	0	1	Address(0x01)
2	Opcode	1	1	Read only(0x03)
3	Data length field	2	1	
4	Data field	3	2	Wind speed: 0x7FFF table invalid/missing
		5	2	Wind direction: 0x7FFF table is invalid/missing
		7	2	Temp: 0x7FFF table invalid/missing
		9	2	Humidity: 0x7FFF table invalid/missing
		11	2	Air pressure: 0x7FFF table invalid/missing
5	Check field	13	2	Low Front High Back

Operation code: fixed to 0x03, that is, read operation, other operations are not supported.

Start number: range 0-15, indicating the first register number to be read.

Number of registers: range 1-16, means read the last register number + 1, the read data does not include the register content of this number, it is only used as an end mark, and its value must be guaranteed to be ≥ "start number".

B. The device returns a data frame:

C. 01 03 0A xx xx xx xx xx xx xx xx xx xx CRC16

Data length: not including itself, only the number of bytes in the data field.

MAX: 10,Min: 0.

It is determined according to the "start number" and "number of registers" of the read instruction sequence.

Data length = (End number – Number of registers)*2

Communication example (acquire data from 5 sensors):

Send: 01 03 00 00 00 05 D4 09

Return: 01 03 0A 01 1000 B000 FA02 8A27 ACEA B3

01 10 is the wind speed data, which is a hexadecimal integer, converted to decimal is 272, and the wind speed resolution is 0.01, which is 2.72m/s

00 B0 is the wind direction data, which is a hexadecimal integer, converted to decimal is 176, and the wind direction resolution is 1, that is, the wind direction is 176 degrees.

00 FAIt is temperature data, which is a hexadecimal integer, converted to decimal is 250, and the temperature resolution is 0.1, which is 25.0℃;

The temperature has negative numbers, and the returned negative numbers are expressed in the form of hexadecimal complement. For example, if the temperature is FF 65 converted to decimal, it is -155, and the temperature resolution is 0.1, which is -15.5℃.

02 8A is Humidity data, which is a hexadecimal integer, converted to decimal is 650, and the humidity resolution is 0.1, which is 65.0%RH.

27 AC is air pressure, which is a hexadecimal integer, converted to decimal is 10156, and the resolution of the air pressure sensor is 0.1, which is 1015.6hPa。

C. Calculation of CRC16 check code

1) Preset a 16-bit register as hexadecimal FFFF (all 1); this register is called the CRC register;
2) XOR the first 8-bit binary data(the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register, and put the result in the CRC register;
3) Shift the content of the CRC register to the right by one bit (towards the lower bit), fill the highest bit with 0, and check the shifted out bit after the right shift;
4) 4) If the shifted bit is 0: repeat step 3 (shift right again);
   If the shifted out bit is 1: XOR the CRC register with the polynomial A001 (1010 0000 0000 0001);
5) Repeat steps 3 and 4 until the right shift is 8 times, so that the entire 8-bit data is processed;
6) Repeat steps 2 to 5 to process the next byte of the communication information frame;
7) After all the bytes of the communication information frame are calculated according to the above steps, the high and low bytes of the obtained 16-bit CRC register are exchanged;
8) The finally obtained CRC register content is the CRC16 code. (Note: The obtained CRC code is in the order of low first and high last)

D. Channel data conversion

For example 1: the temperature hexadecimal code is **"00 C3"**, converted into binary is **"0000000 11000011"**. The first binary bit is **"0",** so its value is a positive number. At this time, the decimal value **"195"** can be converted by the method in **1**. Finally multiply it by **0.1** to get the final result **"19.5"**.

For example 2: The temperature hexadecimal code is **"FF 3D"**, converted into binary is **"11111111 00111101"**, the first bit of the binary is **"1"**, so its value is negative.

The specific conversion steps are as follows:

(1) Replace the first bit of its binary with **"0"** to get: **"01111111 00111101"**

(2) After inverting the last 15 digits, get: **"00000000 11000010"**
(3)Add **"1"** to get: **"00000000 11000011"**
(4)According to the positive number representation method in 1, the decimal value **"195"** is obtained
(5)Because it is a negative value, the result is **"-195"**
(6)The result is divided by 10 and the final result is "-19.5"
So: **00 C3** → **19.5**℃
FF 3D → **-19.5**℃

After-sales service

- The device has no moving parts and does not require complex routine maintenance on site.
- If the user opens the device by himself or damages the safety seal on it, he will no longer enjoy our quality assurance and guarantee.
- If there is any problem with the equipment, you can contact the company's staff to analyze and answer the problem;
- If the equipment needs to be returned, please pack the instrument carefully according to the original packaging, mail it to our company, and attach the detailed fault instructions of the instrument.

Attached table: wind speed rating table

Rate	Characteristics of terrestrial objects	Wind speed (m/s)
0	The smoke goes straight up	0～0.2
1	The smoke can indicate the direction of the wind, and the leaves sway slightly	0.3～1.5
2	The human face feels the wind, and the leaves move slightly	1.6～3.3
3	Leaves and twigs swayed, flags spread, tall grass swayed	3.4～5.4
4	Can blow dust and paper from the ground, shake branches, and undulate tall grass	5.5～7.9
5	Small leafy trees sway, inland water surface has small waves, tall grass has distinct undulating waves	8.0～10.7
6	The big branches are shaking, the wires are whistling by the wind, it is difficult to hold an umbrella, and the tall grass falls to the ground from time to time	10.8～13.8
7	The whole tree shakes, the big branches bend down, and it is inconvenient to walk in the wind	13.9～17.l
8	Small branches can be broken, and people feel great resistance when moving against the wind	17.2～20.7
9	The thatched house is damaged, the roof tiles are lifted, and the big branches can be broken。	20.8～24.4
10	Trees can be blown down and buildings in general damaged	24.5～28.4
11	Large trees can be blown down, and general buildings are severely damaged	28.5～32.6
12	There are few on land, and its destructing power is extremely large	>32.6

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