Ultrasonic Wind Speed and Direction Sensor

FST200-208

Product Manual

(V1.2)

● Important statement

Thank you very much for choosing our products, we will serve you sincerely forever. The company pursues excellent quality and pays more attention to excellent after-sales service.

Operation errors will shorten the life of the product, reduce its performance, and may cause accidents in severe cases. Please hand over this manual to the end user and read it carefully before using the product. And please keep it in a safe place for reference when needed. The company reserves the right to modify this manual due to product technology and process updates. If there is any change, no further notice will be given, and the final interpretation of this manual is reserved.

● Order model

Note: Some models with special functions can be customized.

Serial number	Model	Illustrate	Remark
1	FST200-208	Wind speed, wind direction	RS485 output 0~5/10V output 4~20mA output

● Product overview

The ultrasonic wind speed and direction sensor uses the ultrasonic time difference method to measure wind speed and direction. It has high measurement accuracy, reliable performance, is easy to carry, does not have any moving parts, and generally does not require maintenance or on-site calibration. It is a relatively advanced instrument for measuring wind speed and direction. Because it overcomes the inherent shortcomings of mechanical wind speed and direction instruments, it can work normally all day long and for a long time, and is increasingly used. It will be a powerful substitute for mechanical wind speed and wind direction instruments.

● Features

◇ Multiple ultrasonic probes send and receive ultrasonic signals in real time within the measurement space to ensure real-time and efficient parameters.

◇ High measurement accuracy, wide range, good stability, low power consumption, strong resistance to external interference, can work around the clock, is not affected by weather changes, and does not require calibration.

◇ Precision craftsmanship, high strength, weather resistance and waterproofness, long service life.

◇ Professional integrated installation method, small size, easy to carry and install.

● Scope of application

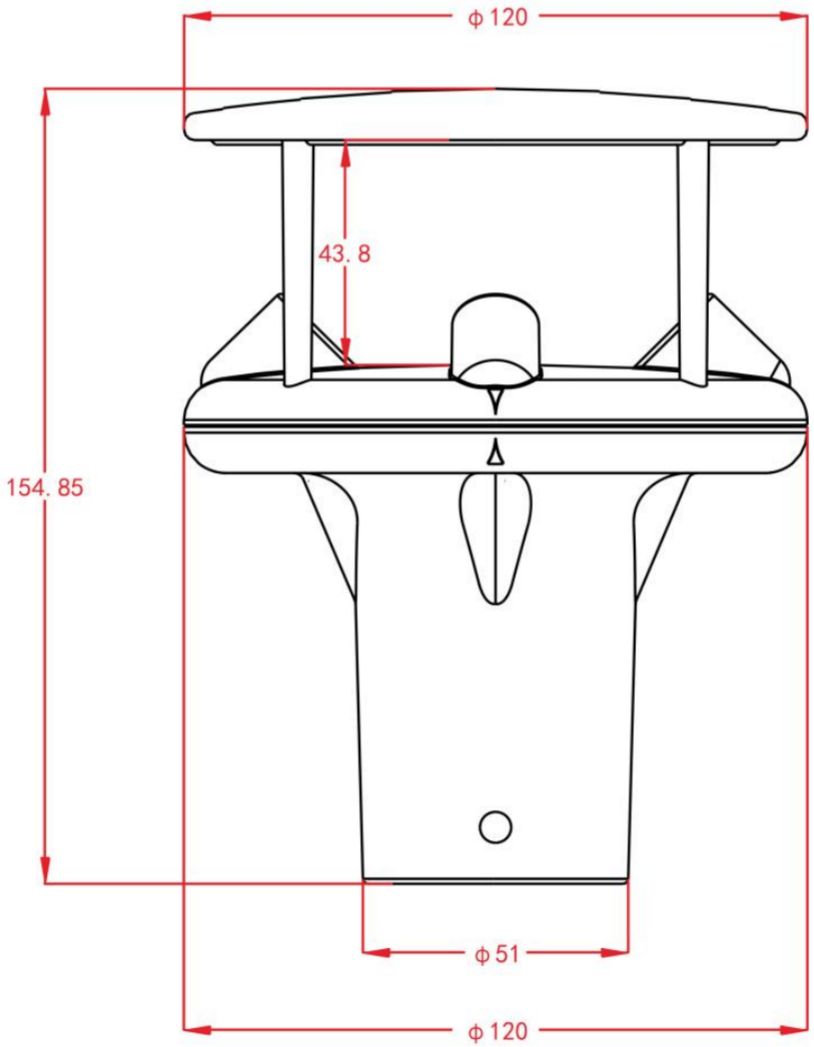
◇ The application of ultrasonic wind speed and direction meter is convenient and accurate, and can be used flexibly in many fields. It is widely used in urban environment monitoring, meteorological monitoring, bridges and tunnels, subways, tunnels and mining, various fan manufacturing industries, etc. that require ventilation and exhaust systems. industries, etc.

● Working principle

The working principle of the ultrasonic wind speed and direction meter is to use the ultrasonic time difference method to measure wind speed. The speed of sound propagating in the air will be superimposed with the speed of the airflow in the wind direction. If the ultrasonic wave propagates in the same direction as the wind, its speed will increase; conversely, if the ultrasonic wave propagates in the opposite direction to the wind, its speed will slow down. Therefore, under fixed detection conditions, the speed of ultrasonic waves propagating in the air can correspond to the wind speed function. Accurate wind speed and direction can be obtained through calculation. Since sound waves propagate in the air, their speed is greatly affected by temperature; the anemometer detects two opposite directions on two channels, so the effect of temperature on the speed of sound waves is negligible.

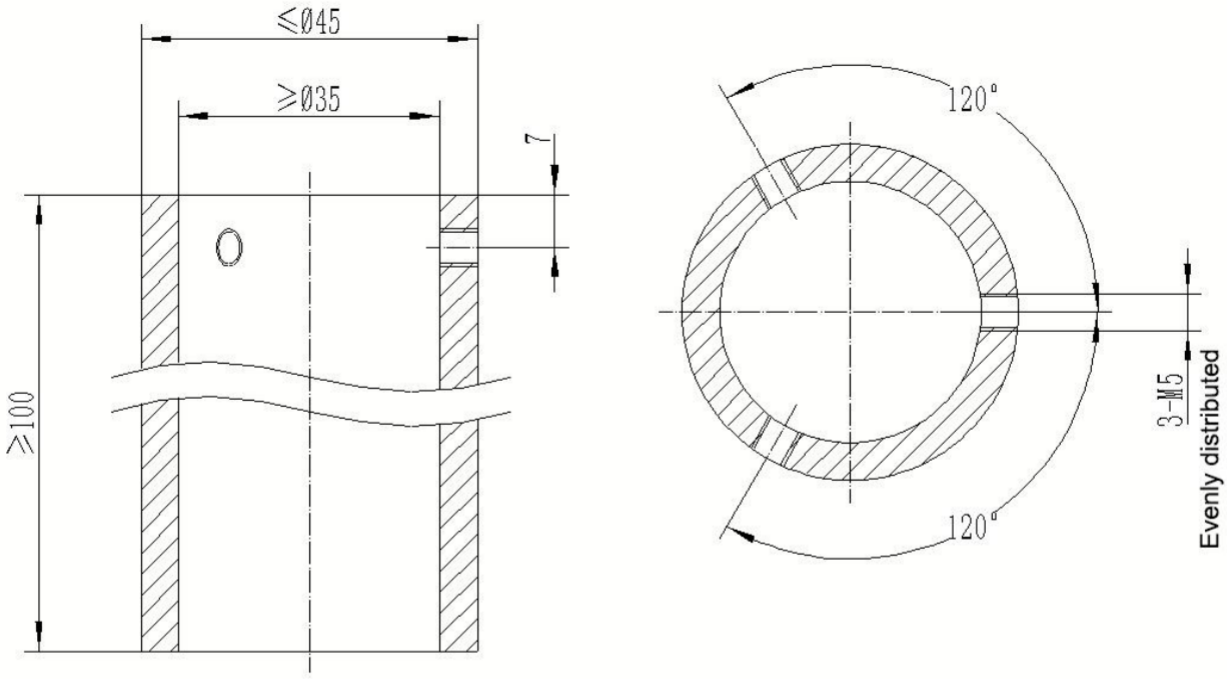
● Installation structure dimensions and wiring definitions

1. Sensor dimensions



2. Installation method

Suggestions for making sensor bracket dimensions are as follows:



Note: When the sensor mounting bracket is fixed, one of the threaded holes on the side needs to point north to determine the sensor installation direction.

The sensor bracket is designed to be mounted on the mast. The following tools are required for installation:

(1) Open-end wrench or torx wrench;

(2) Compass, used to adjust wind measurement to point north (or manual observation positioning);

(3) Loosen the screws;

(4) Position the sensors and arrange them facing north;

(5) Push the sensor from top to bottom into the upper end of the mast;

(6) Use even force and tighten the nut. At this time, the sensor can be slightly adjusted to keep it level;

(7) Fasten the screws tightly.

3. Wind direction positioning

In order to display wind direction correctly, the sensor must be aligned facing north, with the 'N' arrow indicating north direction.

Note: The magnetic north pole indicated by the compass and the geographical north pole are not exactly the same, so the deviation (error) of the location must be taken into account when arranging the sensors.

4. Select the installation location

(1) In order to extend the service life of the equipment and ensure the normal operation of the equipment, please pay attention to the following matters when selecting the installation location of the

equipment:

The ground where the mast is installed should be solid and stable;

The equipment installation location should be convenient for maintenance;

The installation height is at least 5 meters from the ground;

There should be clear space around the sensor.

Note: Buildings, bridges, levees, and trees may affect wind measurements. Likewise, wind gusts kicked up by passing vehicles can affect wind measurements.

(2) The power supply should be stable and reliable to meet the requirements of long-term operation.

(3) When transmitting data through a wireless communication network, good network coverage should be ensured.

Note: The calculation results of the measured values are only applicable to the equipment installation location and cannot be extended to other areas or the entire road.

(4) When installing equipment on the mast, only certified and tested devices (wires and risers, etc.) are allowed.

(5) All regulations related to working at this height must be followed.

(6) Choose the mast size reasonably and fix it correctly.

(7) The mast must be grounded in accordance with regulations.

(8) When working on the roadside or near the highway, relevant safety regulations must be followed.

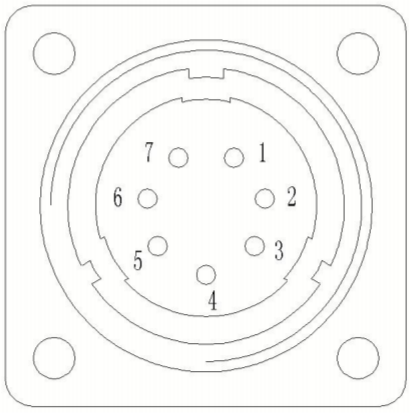
(9) If the device is installed incorrectly:

Equipment may not work;

Equipment may be permanently damaged;

Danger or injury may occur if the device falls.

5. Signal outlet and wire color definition



Pin assignment:

Needle size	Thread color	definition
1	Red	Supply voltage positive (+24V)
2	Green	RS485_A

3	Black	Supply voltage negative pole
4	White	RS485_B
5	Yellow	Wind speed 0~5/10V (voltage output) or wind speed 4~20mA (current output)
6	Blue	Wind direction 0~5/10V (voltage output) or wind direction 4~20mA (current output)
7	Shielded wire	/

6. Maintenance

Generally, the equipment requires no maintenance. However, it is recommended to perform functional testing once a year. When performing functional testing, please note the following:

(1) Visually inspect the equipment for sludge;

(2) Send a measurement request signal and check the sensor.

● Technical indicators

Wind speed parameters	Measuring range	0~50m/s (other ranges need to be customized)
	Start wind speed	0.1m/s
	Response time	<3s
	Resolution	0.1m/s
	Accuracy	±0.3m/s or ±3% (0~30m/s) or ±5% (30~50m/s) whichever is greater
Wind direction parameters	Measuring range	0~360°
	Start wind speed	0.1m/s
	Accuracy	±2°
	Resolution	0.1°
Basic parameters	Digital signal	RS485
	Analog signal	0~5/10V or 4~20mA
	Baud rate	2400~115200
	Voltage	12V~24V DC
	Working current	Ordinary type: <35mA (12VDC)
	Operating temperature	-20℃~60℃

	Working humidity	0%~95%RH
	Protection	IP65

● Protocol

1. Communication interface

The device has an industry standard half-duplex two-wire RS485 interface.

Baud rate	9600
Data bits	8
Stop bit	1
Parity	none
Adjustable baud rate	2400~115200 (9600 baud rate is recommended)

2. Data transmission method

The communication method is RS485 serial communication. The default configuration is 8 data bits, 1 stop bit, and no parity bit. The command subset of the MODBUS-RTU protocol is adopted, and the read register command (03) (06) is used.

If there is no explanation below, it will be expressed in hexadecimal by default.

3. Data transmission rate and device address

The default baud rate is 9600bps, the address is 2 (the universal address is 200), and the supported baud rate is: 2400~115200.

Note: The baud rate range will affect the communication effect. It is recommended to use 9600, 4800, and 2400 baud rates. The baud rate is too high and the data line is too long, which may cause communication failure.

4. Data message format

(1) Function code 0x03---query the contents of the slave device register

Master device message	Correct message from the device
Slave device address (0x01-0x7F 1 byte)	Slave device address (0x01-0x7F 1 byte)
Function code (0x03 1 byte)	Function code (0x03 1 byte)
Starting register address (2 bytes)	Number of bytes in the data area (2*number of registers 1 byte)
Number of registers (2 bytes)	Data area (register content 2*register number 1 byte)

CRC check code (2 bytes)	CRC check code (2 bytes)

(2) Function code 0x06---set the slave device register

Master device message	Correct message from the device
Slave device address (0x01-0x7F 1 byte)	Slave device address (0x01-0x7F 1 byte)
Function code (0x06 1 byte)	Function code (0x06 1 byte)
Starting register address (2 bytes)	Number of bytes in the data area (2*number of registers 1 byte)
Data written to the register (2* number of registers 1 byte)	Data area (register content 2* register number 1 byte)
CRC check code (2 bytes)	CRC check code (2 bytes)

Note: The CRC check code has the low byte first and the high byte last. The register address, register number and data are all high byte first and the low byte last; the register word length is 16 bits (two bytes).

5. Register description and command format

Parameter data register definition table

Register address (Hex)	Register contents	Register status	Data range	Corresponding range
0x002A	Wind speed	Read only	0~700	0~70.0
0x002B	Wind direction	Read only	0~3600	0~360.0
0x2000	Device address	Read and write	1~127	1~127
0x2001	Baud rate (actual value/100)	Read and write	24,48,96,144,192,384,560,576,1152	24,48,96,144,192,384,560,576,1152

Address definition instructions

(1) Wind speed (0x002A)

The unit is 0.1m/s. That is, if the read value is 100 (or 0x64), it means that the wind speed value is 10.0m/s

(2) Wind direction (0x002B)

The unit is 0.1 degrees. That is, if the read value is 100 (or 0x64), it means that the wind direction is 10.0 degrees

(3) Device number (0x2000)

Range: 1~127. After modifying the device number, the data is only saved and does not take effect immediately. It will take effect after restarting.

(4) Baud rate (0x2001)

Configurable baud rate: 24, 48, 96, 144, 192, 384, 560, 576, 1152 (corresponding to 2400, 4800, 9600, 14400, 19200, 38400, 56000, 57600, 115200 respectively). After modification, the data is only saved and does not take effect immediately. It will take effect after restarting.

6. Command examples:

All register address bytes, register number bytes, and data bytes in the command have the high byte in front and the low byte in the back; the CRC check code low byte in the front and the high byte in the back;

(1) Read the wind speed value:

Slave device address No. 02, baud rate 9600, N, 8, 1

Slave device address	Function code	The high 8 bits of the starting register address	The lower 8 bits of the starting register address	Register number high 8 bits	The lower 8 bits of the register number	CRC lower 8 bits	CRC high 8 bits
0x02	0x03	0x00	0x2A	0x00	0x01	0xA5	0xF1

Response from the device (assuming the current wind speed value is 0x0064, which means the wind speed value is 10.0m/s)

Slave device address	Function code	Data area Number of bytes	Wind speed value is 8 digits higher	Wind speed value is 8 digits lower	CRC lower 8 bits	CRC high 8 bits
0x02	0x03	0x02	0x00	0x64	0xFD	0xAF

(2) Read the wind direction value:

Slave device address No. 02, baud rate 9600,N,8,1

Slave device address	Function code	The high 8 bits of the starting register address	The lower 8 bits of the starting register address	Register number high 8 bits	The lower 8 bits of the register number	CRC lower 8 bits	CRC high 8 bits
0x02	0x03	0x00	0x2B	0x00	0x01	0xF4	0x31

Response from the device: (Assume the current wind direction value is 0x0384, which is 90.0°)

Slave device address	Function code	Number of bytes in data area	Wind direction value is 8 digits higher	Wind direction value is 8 digits lower	CRC lower 8 bits	CRC high 8 bits
0x02	0x03	0x02	0x03	0x84	0xFC	0xD7

(3) Continuously read wind speed and direction values:

Slave device address No. 02, baud rate 9600, N,8,1

Slave device address	Function code	The high 8 bits of the starting	The lower 8 bits of the starting	Register number high 8 bits	The lower 8 bits of the	CRC lower 8 bits	CRC high 8 bits

		register address	register address		register number		
0x02	0x03	0x00	0x2A	0x00	0x02	0xE5	0xF0

The slave device responds (assuming the current wind speed value is 10.0m/s and the wind direction value is 90.0°)

Slave device address	Function code	Number of bytes in data area	Wind speed value is 8 digits higher	Wind speed value is 8 digits lower	Wind direction value is 8 digits higher	Wind direction value is 8 digits lower	CRC lower 8 bits	CRC high 8 bits
0x02	0x03	0x04	0x00	0x64	0x03	0x84	0x88	0x7F

(4) Modify the device address:

The slave device address No. 02 is changed to No. 03.

Slave device address	Function code	The high 8 bits of the starting register address	The lower 8 bits of the starting register address	Register number high 8 bits	The lower 8 bits of the register number	CRC lower 8 bits	CRC high 8 bits
0x02	0x06	0x20	0x00	0x00	0x03	0xc2	0x38

Slave device address	Function code	The high 8 bits of the starting register address	The lower 8 bits of the starting register address	Register number high 8 bits	The lower 8 bits of the register number	CRC lower 8 bits	CRC high 8 bits
0x02	0x06	0x20	0x01	0x00	0x60	0xD3	0xD1

(5) Modify the baud rate to 9600:

The baud rate is an integer multiple of 100. For example, if the baud rate is 9600, it should be set to 96, which is 0x0060.

Note: Modifying the baud rate and device address will not take effect until the power is turned off and restarted.

7. CRC check calculation method

```
//---------------------------------------------- -------------------------
// DESCRIPTION: High byte table of CRC-16 check
// ----------------------------------------------------------------------
static const unsigned char HiCRCTable[] = {
0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40,
0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41,
```

```
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81, 0X40, 0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80,
0X41,
    0X00, 0XC1, 0X81, 0X40, 0X01, 0XC0, 0X80, 0X41, 0X01, 0XC0, 0X80, 0X41, 0X00, 0XC1, 0X81,
0X40 };

    // ----------------------------------------------------------------------
    // DESCRIPTION: CRC-16Check low byte table
    // ----------------------------------------------------------------------
    static const unsigned char LoCRCTable[] = {
    0X00, 0XC0, 0XC1, 0X01, 0XC3, 0X03, 0X02, 0XC2, 0XC6, 0X06, 0X07, 0XC7, 0X05, 0XC5,
0XC4, 0X04,
    0XCC, 0X0C, 0X0D, 0XCD, 0X0F, 0XCF, 0XCE, 0X0E, 0X0A, 0XCA, 0XCB, 0X0B, 0XC9, 0X09,
0X08, 0XC8,
    0XD8, 0X18, 0X19, 0XD9, 0X1B, 0XDB, 0XDA, 0X1A, 0X1E, 0XDE, 0XDF, 0X1F, 0XDD, 0X1D,
0X1C, 0XDC,
    0X14, 0XD4, 0XD5, 0X15, 0XD7, 0X17, 0X16, 0XD6, 0XD2, 0X12, 0X13, 0XD3, 0X11, 0XD1,
```

```
0XD0, 0X10,
    0XF0, 0X30, 0X31, 0XF1, 0X33, 0XF3, 0XF2, 0X32, 0X36, 0XF6, 0XF7, 0X37, 0XF5, 0X35, 0X34,
0XF4,
    0X3C, 0XFC, 0XFD, 0X3D, 0XFF, 0X3F, 0X3E, 0XFE, 0XFA, 0X3A, 0X3B, 0XFB, 0X39, 0XF9,
0XF8, 0X38,
    0X28, 0XE8, 0XE9, 0X29, 0XEB, 0X2B, 0X2A, 0XEA, 0XEE, 0X2E, 0X2F, 0XEF, 0X2D, 0XED,
0XEC, 0X2C,
    0XE4, 0X24, 0X25, 0XE5, 0X27, 0XE7, 0XE6, 0X26, 0X22, 0XE2, 0XE3, 0X23, 0XE1, 0X21, 0X20,
0XE0,
    0XA0, 0X60, 0X61, 0XA1, 0X63, 0XA3, 0XA2, 0X62, 0X66, 0XA6, 0XA7, 0X67, 0XA5, 0X65, 0X64,
0XA4,
    0X6C, 0XAC, 0XAD, 0X6D, 0XAF, 0X6F, 0X6E, 0XAE, 0XAA, 0X6A, 0X6B, 0XAB, 0X69, 0XA9,
0XA8, 0X68,
    0X78, 0XB8, 0XB9, 0X79, 0XBB, 0X7B, 0X7A, 0XBA, 0XBE, 0X7E, 0X7F, 0XBF, 0X7D, 0XBD,
0XBC, 0X7C,
    0XB4, 0X74, 0X75, 0XB5, 0X77, 0XB7, 0XB6, 0X76, 0X72, 0XB2, 0XB3, 0X73, 0XB1, 0X71, 0X70,
0XB0,
    0X50, 0X90, 0X91, 0X51, 0X93, 0X53, 0X52, 0X92, 0X96, 0X56, 0X57, 0X97, 0X55, 0X95, 0X94,
0X54,
    0X9C, 0X5C, 0X5D, 0X9D, 0X5F, 0X9F, 0X9E, 0X5E, 0X5A, 0X9A, 0X9B, 0X5B, 0X99, 0X59,
0X58, 0X98,
    0X88, 0X48, 0X49, 0X89, 0X4B, 0X8B, 0X8A, 0X4A, 0X4E, 0X8E, 0X8F, 0X4F, 0X8D, 0X4D, 0X4C,
0X8C,
    0X44, 0X84, 0X85, 0X45, 0X87, 0X47, 0X46, 0X86, 0X82, 0X42, 0X43, 0X83, 0X41, 0X81, 0X80,
0X40 };

    // ****************************************************************************
    // Design Notes:
    // pMsg: the first address of the data buffer to be verified
    // iSize: length of data bytes to be verified
    // ----------------------------------------------------------------------
    unsigned short QuickCRC16( unsigned char * pMsg, unsigned short iSize )
    {
        unsigned char iHiVal;                   // high byte of CRC initialized
        unsigned char iLoVal;                   // low byte of CRC initialized
        unsigned char index;                    // will index into CRC lookup table
        // Initial value for the CRC
        iHiVal = 0xff;
        iLoVal = 0xff;
        while ( iSize-- )
```

```
    {
        // Calculate the CRC
        index = iLoVal ^ ( unsigned char )( *pMsg++ );

        iLoVal = iHiVal ^ HiCRCTable[index];
        iHiVal = LoCRCTable[index];
    }
    return ( iHiVal << 8 | iLoVal );
}
```

● Precautions

This instrument is a precision electronic product. Correct maintenance and upkeep can help protect the performance of the instrument and extend its service life. Please pay attention to the following points:

1. Please refer to the instructions for use and use the instructions correctly. Wrong wiring may cause damage to the instrument;
2. Do not wipe the instrument with volatile liquids, otherwise it may cause discoloration and deformation of the instrument; wipe with a soft cloth to avoid scratches on the external protective film of the instrument and extend the service life of the instrument;
3. The instrument should be handled with care and should not be dropped or pressed heavily, otherwise it will cause deformation of the instrument and damage to the internal circuit board;
4. Do not touch the sensing part when the instrument is powered on, as this may affect the measurement result or cause damage to the internal circuit of the instrument;
5. Please do not disassemble or modify the instrument without permission to avoid damage to the instrument;
6. The instrument should be firmly fixed with screws when using it, otherwise the instrument may be damaged;
7. Regularly check the power supply voltage of the instrument to ensure normal operation of the instrument;
8. Please do not modify the internal parameters of the equipment without permission to avoid abnormal operation of the instrument. If modifications are required, please operate under the guidance of the manufacturer's technical personnel.

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