Working Principle of Wireless Data Receiving for Humidifier

General:

This product is composed of an emitter and a data receiver-displayer. As one of the main units of the humidifier, it transits wirelessly and displays data of temperature and humidity as well as data of working conditions. Its transmitting unit meets the requirement on electromagnetic compatibility, and its receiving-displaying unit meets the requirement of low power consumption as required by battery-powering.

Key words: Low power consumption; 433M wireless receiving

I. Composition and working principle

This product consists of two units: 1. A transmitting module composed of an encoder unit and a wireless transmitting unit (1). 2. A receiving unit composed of wireless receiving unit (2), decoding unit (3) and LCD (4).

As shown in Fig.1, via an emulating SPI communication interface CON (5), information from the mainframe is transmitted to the encoder circuit board “Encode” at a communication speed of 122Hz. When the MCU on the encoder board identifies the starting position of the data, it outputs Manchester code in an encode format of “header code + address code + condition + check code”. The Manchester code output is wirelessly transmitted by the transmitting module of 433MHz frequency. Use of 433MHz communication frequency is because it is the public communication channel used in many countries and areas.

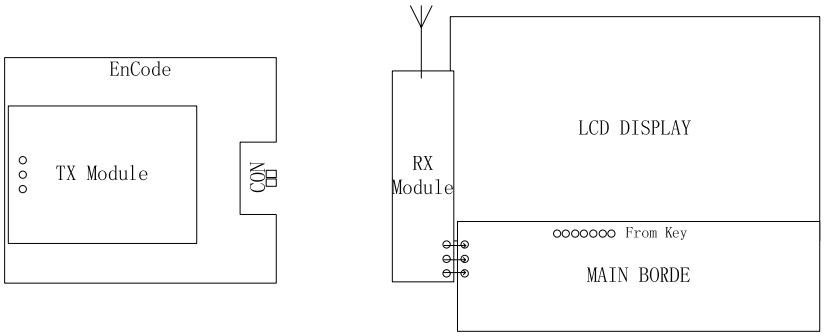


FIGURE 1

To lessen the bit error rate of the receiving module, the following operating mode is used: the transmitting module transmits several sets of identical data in one second, then, after 1.5 seconds of pause, receives data again from the mainframe and repeats the above transmitting process.

The transmitting module must be so designed as to meet the requirement on radio control.

Table 1 is the main characteristic parameters of the transmitting module.

Parameter	Symbol	Condition	Value			unit
			min	typ	max	
PowerSupply Modulation input Voltage	Vcc		3.0	12	18	V
Output Power	Pout			+10		dBm
Supply current	Idd			18		mA
Supply voltage Range						
Data Rate	Ddate			10		Kbps
Work Ffrequency	Frf			433.92		MHz
Modulate			ASK			
Operating temperature			-20℃～+60℃			

Table1

After the Manchester code transmitted by the transmitting module is received by the wireless receiving unit and decoded by the receiving terminal MCU, what obtained are data of temperature, humidity and working conditions. After processed by the receiving terminal MCU, these data are displayed on the LCD screen.

Since the receiving module is powered by battery, to have the battery lasting longer, the hardware and the software of the receiving module are of low power consumption design. However, during operation, the wireless receiving unit is relatively high in power consumption, so time interval between two encoding operation is specified as 20 seconds and when the receiving unit is not in data receiving, power supply to it is cut off.

To be compatible with the early versions of transmitting module that are of 20 seconds in transmission frequency but of high frequency error (low as 18 seconds), lessen problems of bit error and code missing, automatic synchronization is used for the receiving and decoding software.

Table 2 is the main characteristic parameters of the receiving module.

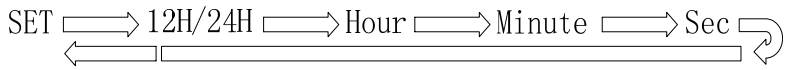
Parameter	Symbol	Condition	Value			unit
			min	typ	max	
PowerSupply Modulation input Voltage	Vcc		2.2	3	3.5	V
Receiver Sensitivity	Pmin			-80	-75	dBm
Work current	Idd			1.2		mA
standby current	Idv			0.07		mA
Data Rate	Ddate			1		Kbps
Work Ffrequency	Frf			433.92		MHz
Modulate			ASK			
Operating temperature			-20℃～+60℃			

Table 2

The receiving module performs the following functions:

1. Timing clock and adjustment

When key SET is pressed, 2 seconds later, the system will enter the mode of clock time adjustment. The corresponding digit to be adjusted flashes. Digits that may be adjusted include: changeover between 12H/24H system, setting of clock hour, minute and second.



When key “+” or “-“ is pressed, the digit being adjusted flashes and increases or decreases by 1 accordingly.

When key “+” or “-“ is kept pressed, the digit being adjusted flashes and continuously increase or decrease accordingly.

When adjustment is finished, if key SET is pressed again, the system will exit from the clock time adjusting mode.

When the system is in clock time adjusting mode, if no key operation is made within 4 seconds, the system will exit from the clock time adjusting mode.

2. Display of version information

When key SET is kept pressed for more than 3 seconds, version information “U2” is displayed; five seconds later, the system will exit from the display mode.

3. Display of temperature and humidity

The data display on the LCD screen is renewed every interval of 20 seconds.

4. Mainframe condition display and alarming

Information of “FULL”, “AUTO”, “E0-E3”, etc. is displayed. The buzzer gives alarming sound if it is already switched on.

1) Appurtenance A, Working Principle of the transmitting module, PCB
2) Appurtenance B, Working Principle of the encoding board, PCB
3) Appurtenance C, Working Principle of the receiving unit
4) Appurtenance C, Drawing of LCD
5) Appurtenance C, SPI transmission protocol of the main frame

6. Circuit description

This product Fan Motor device that remove moisture of use air be.
All, input is inputted AC 115V 60Hz by Connector CN11 of MAIN PCB.
Because inputted AC power flows FUSE (F 1) Transformer (CN 12) to link.
Linked Transformer lowers power by AC 12V and supplies to PCB by CN12.
AC 12V voltage that is low by Transformer is changed to DC 14V by rectifier circuit D2 ~ D5.
DC 12 by constant voltage IC 7812 (U 1) increasing DC 14V.By 0V stable voltage relay (2, 3) or act pump (CN13).
DC 12V uses to makes DC 5.0 and operates Micom & LED by constant voltage IC 7805 (U 2).
To operate Compressor from micom to Transistor (Q 1) ON → Relay (RY 1) ON → CN 18, 19
Relationship monad operates Compressor doing Switch ON.
Fan Motor that inhale air controls manners of river (CN 16)/medicine (CN16) second-stage by Relay (RY 2, 3).
Sensor that sense temperature sensor (CN 5), humidity sensor (CN 5), defrost sensor (CN 7), level (CN4) of water pail
There is level sensor.
Change to voltage in circuit if Jeohangcha changes according to temperature at temperature sensor, Jesangsen and passes to micom
It changes that humidity sensor resists power of DC 5V according to humidity if deliver ON/OFF in sensor by alternating current repeatedly
Changes to voltage that do this resistance and passes in micom.
It is Switch that sense On or Off at Suwisen.
Act Compressor & Fan-motor because micom confirms each sensor.