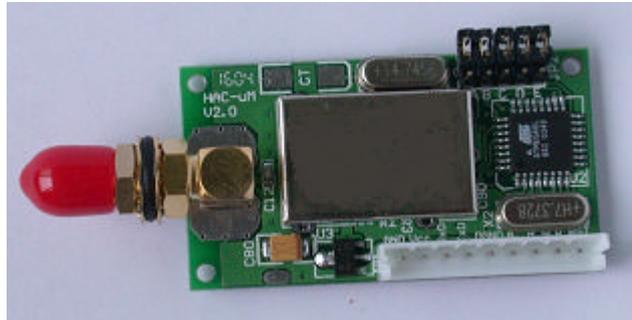


HAC-UM12 Ultra Low Power Data Radio Module



I. Features of HAC-UM12 ultra Low Power Data Radio Module

1. Ultra low power transmission with the transmission power of 10mW
2. ISM frequency band, requiring on application of frequency point.

Carrier frequency of 433MHz, also capable of providing 450~470MHz carrier frequency.

3. High anti-interference and low BER(Bit error Rate)

Based on the GFSK modulation mode, the high-efficiency forward error correction channel encoding technology is used to enhance data's resistance to both burst interference and random interference and the actual bit error rate of $10^{-5} \sim 10^{-6}$ can be achieved when channel bit error rate is 10^{-2} .

4. Long transmission distance

Within the range of visibility, the reliable transmission distance is >800m when the height is greater than 2m (BER= 10^{-3} @1200bps).

Within the range of visibility, the reliable transmission distance is >1000m when the height is greater than 5m (BER= 10^{-3} @1200bps).

5. Transparent data transmission

Transparent data interface is offered to suit any standard or nonstandard user protocol. Any false data generated in the air can be filtrated automatically (What has been received is exactly what has been transmitted).

6. Multi-channel

The standard HAC-UM12 configuration provides 8 channels. If the user needs, it can be extended to 16/32 channels, meeting the multiple communication combination mode of the user.



7. Dual serial port, 3 interface modes

HAC-UM12 provides 2 serial ports and 3 interfaces, with COM1 as the TTL level UART interface and COM2 as user defined standard RS-232/RS-485 interface (user only needs to plug/pull 1 bit short circuiter and energize it to make the definition).

8. Large data buffer zone

Interface baud rate which is set before ex-factory is 1200/4800/9600/19200/38400bps with format of 8N1/8E1 and user self-definition, allowing the transmission of long data frames at one time for more flexible programming by users. (If the user needs, it can also transmit the data in unlimited length at one time).

9. Intelligent data control and the user doesn't need to prepare excessive programs

Even for semi duplex communication, the user doesn't need to prepare excessive programs, only receiving/transmitting the data from the interface. HAC-UM96 will automatically complete the other operations, such as transmission/receiving conversion in the air, control, etc.

10. Low power consumption and sleeping function

For receiving, current is <30mA, transmitting current is <40mA, and sleep current is <20uA.

11. High reliability, small and light

Single chip radio-frequency integrated circuit and single chip MCU are used for lessened peripheral circuits, high reliability, and low failure rate.

II. Application of series HAC-UM12 ultra low power data radio module

Series HAC-UM12 Ultra low power data radio module is suitable for:

Wireless meter reading

Industrial remote control and remote test

Automatic data collecting system

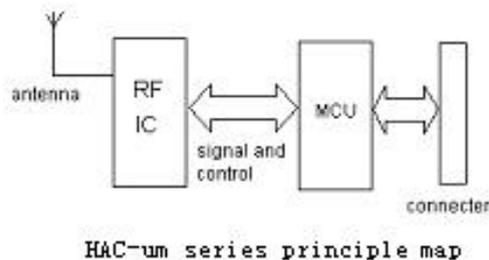
Building automation, safety and security, powerhouse equipment wireless monitor, entrance control system

POS system, wireless keyboard, mouse

III. How to use series HAC-UM12 ultra low power data radio module

Series HAC-UM12 ultra low power data radio module provides three interface modes including standard RS-232, RS-485 and UART/TTL levels allowing direct connection with

computer, user's RS-485 device, monolithic processor and other UART components for application. The schematic circuit of HAC-UM12 is shown below:



1. Power supply

HAC-UM12 uses DC power supply with voltage of +3.3~5.5V. The working voltage can be reduced down to 3V based on the user's needs. It can also share power supply with other equipment, however, the high quality power supply with desirable ripple factor should be selected. If possible, 7805 chip or other voltage-stabilizing chip should be used for separate power supply. In addition, the reliable grounding must be used if there is other device in the system equipment. In case of failure to connect with the earth, it can form its own grounding but it must be absolutely separated from the municipal electric supply.

Under working condition, transmission current is 40mA, receiving current is 30mA and sleeping current is 20uA.

2. Definition of HAC-UM12 connecting terminal

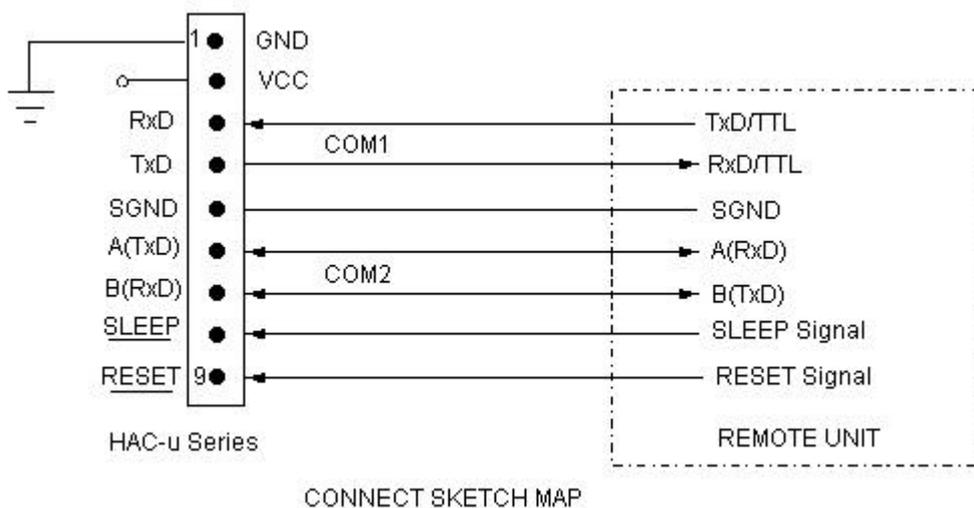
HAC-UM12 can supply one 9-pin connector (JP1), and its definitions as well as connection method for terminals are shown in Table 1.

Table 1: Definition of connecting pins and connection method

Pin No	Pin Name	Description	Level	Connected to the terminal	Remarks
1	GND	Grounding of power supply		Grounding of power supply	
2	Vcc	Power supply DC	+3.3~5.5V		
3	RxD/TTL	Serial data receiving end	TTL	TxD	COM1
4	TxD/TTL	Serial data transmitting end	TTL	Rxd	
5	SGND	Grounding of the signal			

6	A(TxD)	A of RS-485 or TxD of RS-232		A(RxD)	COM2 See Page 3,4
7	B(RxD)	B of RS-485 or RxD of RS-232		B(TxD)	
8	<u>SLEEP</u>	Sleep control (input)	TTL	Sleep signal	Low efficiency $t > 15ms$
9	<u>RESET</u>	Reset (input)	TTL	Reset signal	Negative impulse reset

3. Sketch map of connection between HAC-UM12 and terminal equipment (see below)



4. Setting of channel, interface and data format:

Before using HAC-UM12, the user needs to make simple configuration based on its own needs to determine the channel, interface mode and data format.

There is one group of 5-bit short-circuit jumper wire (JP2) on the upper right corner of HAC-UM96, defined as ABCDE respectively. Assuming the open circuit of jumper wire (without short circuiter) is mode 1 and short circuit of jumper wire (with short circuiter) is mode 0, then the configuration is as follows:

a. Channel configuration:

ABC jumper wires of JP2 provide 8 options, and the user can choose to use 0-7 channels through ABC jumper wires. Within one small communication network, as long as ABC jumper wire mode is same, there can be mutual communication.

Table 2: Corresponding frequency points of 0~7 channels

Channel No.	Frequency	Channel No.	Frequency
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CBA=000(0)	430.2000 MHz	CBA=100(4)	434.6940 MHz
CBA=001(1)	431.4288 MHz	CBA=101(5)	434.2332 MHz
CBA=010(2)	431.7360 MHz	CBA=110(6)	433.1580 MHz
CBA=011(3)	430.5072 MHz	CBA=111(7)	433.9260MHz

Note: The frequency points corresponding to each channel can be adjusted based on the user's needs.

A=1,B=1,C=1 (without short circuiter)

A=0,B=0,C=0 (with short circuiter)

b. Selection of interface mode:

HAC-UM96 provides 2 serial ports. COM1 (Pin3 and Pin4 of JP1) is fixed as UART serial port of TTL level; COM2 (Pin6 and Pin7 of JP1) can choose interface mode through D of JP2:

D=1 (without short circuiter) COM2 = RS-485

D=0 (with short circuiter) COM2 = RS-232

The following attention should be paid for the two serial ports provided by HAC-UM96:

- i. For the data received from the air, when HAC-UM96 transmits it to the terminal equipment through serial port, COM1 and COM2 output simultaneously, i.e. if the user connects one device at COM1 and COM2 respectively, they can receive the data simultaneously.
- ii. For the data transmitted from the terminal equipment and ready to transmit to the air, HAC-UM96 can only receive the data sent from either COM1 or COM2 but not simultaneously.

Suggestion: The user only connects to use one serial port of COM1 or COM2.

c. Parity mode selection:

HAC-UM12 can support no-parity or even parity modes of the serial communication UART, i.e. 8N1/8E1. It can choose parity mode through E of JP2:

E=1 (without short circuiter) Parity: 8E1 (even parity)

E=0 (with short circuiter) Parity: 8N1 (no parity)

If jumper is altered, it become effective after electrify.

5.Transparent data transmission

Transparent data interface is offered to suit any standard or nonstandard user protocol. Any

false data generated in the air can be filtrated automatically (What has been received is exactly what has been transmitted).

6. Low Power Consumption (Sleep State) Function:

HAC-UM12 module supports the Sleep function that can further reduce its power consumption. In sleep state, the supply current consumption can be less than 20uA. We always disable this function as the factory default setting if it is not required. As the result, HAC-UM never enters a sleep state mistakenly in that case. If the sleep function is necessary, customers should indicate this in order so we can enable it before delivery.

a. Using the Sleep function:

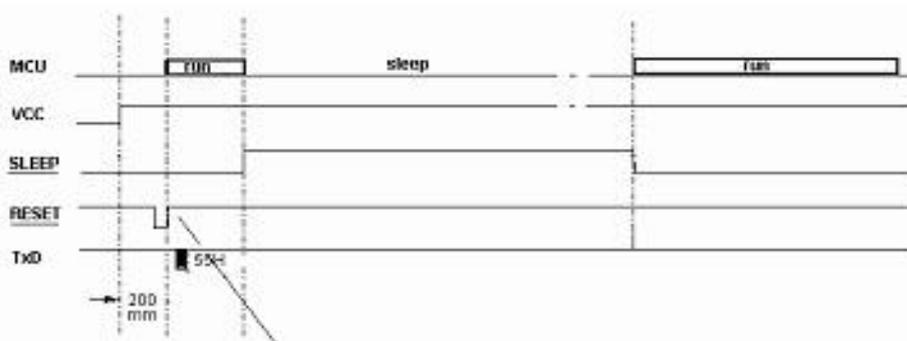
When the SLP (SLEEP) signal on JP1 pin 8 is continuously high, HAC-UM keeps in sleep state. The SLP signal can convert HAC-UM from idle to sleep state in 10us after its rising edge. If the SLP signal reaches on HAC-UM receiving or transmitting data, this module cannot enter sleep state until this data group transmission completed.

If the SLP (SLEEP) signal is continuously high, HAC-UM keeps in active state. The SLP signal can convert HAC-UM from sleep to active state in 1ms after its falling edge in order to ensure that CPU clock works stably again.

To disable the sleep function for HAC-UM, the SLEEP pin should be ground or zero.

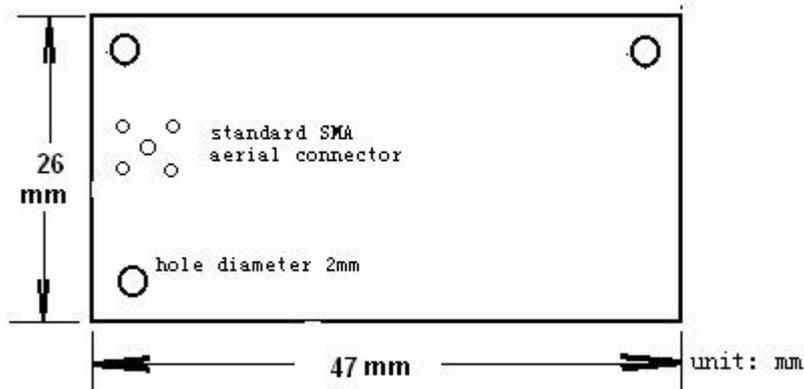
b. Application Notes:

For those HAC-UM12 modules with the sleep function enabled, they may enter sleep state by error in case of improper power on. So we recommend that an additional reset signal is required for HAC-um after at least 150 ms of main CPU program delay when the module is powered on.



the start and sleep sequence map

7. Sketch map of structural size (see below):



IV. Application of series HAC-UM12 networking

The communication channel of HAC-UM12 is semi duplex, which is most suitable for the communication mode of point to multi-point. Under this mode, one master station must be set, and all of the rest are slave stations. A unique address is given to each station. The coordination of communication is controlled by master station that uses data frames containing address code to transmit data or command. Slave station will receive all of the data and command and compare the received address code with local address code. If they are different, the data will be deserted without any response. If those address codes are the same, it means the data is sent to the local. Slave station will make different responses according to the transmitted data or command and send back the data of response. All these jobs must be performed by upper protocol, and it is assured that there is only one transmitter-receiver in the state of transmission in the communication network at any instant moment so as to avoid the cross-interference.

HAC-UM12 can also be used for point-to-point communication with easier operation. For the programming of serial port, all you have to do is to remember that its communication mode is semi duplex while always observing the time sequence of come-and-go for receiving and transmitting.

V. Technical specification of HAC-UM12

Modulation mode: GFSK

Working frequency: 429.00~433.30MHz (customization for 450~470MHz)

Transmission power: 10dBm



Interface data format: 8E1/8N1
Receiving sensitivity : -118dBm@1200bps
Working temperature: -10 ~60 (customization for -30 ~70)
Power supply: +3.3 ~ 5.5VDC
Dimension: 47 × 26 × 10mm
Transmitting current: 40mA
Receiving current: 30mA
sleep current : <20uA
Interface velocity: 1200bps
Working humidity: 10%~90% relative humidity without condensation

VI. Description of type

For HAC-UM12 product type, HAC- indicates the name of manufacturer Shenzhen HAC Technology Co., Ltd., UM12 indicates ultra low power, i.e. transmission power is 10dBm, and 12 indicates that interface baud rate is 1200bps, and 9600bps is HAC-UM96.

Note: The user can't set the communication rate of HAC-UM96 itself. The user chooses when placing the order and it is already set when delivered from the factory.