

# FC-201/SA Micropower Audio/Data RF Module(433MHz)

## USER MANUAL



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## TABLE OF CONTENTS

|  |   |
|--|---|
| TABLE OF CONTENTS-----                   | 1 |
| FEATURES-----                            | 2 |
| APPLICATION-----                         | 2 |
| HOW TO USE FC-201/SA-----                | 3 |
| APPLICATION OF FC-201/SA NETWORKING----- | 6 |
| TECHNICAL SPECIFICATION-----             | 7 |
| DESCRIPTION OF TYPE-----                 | 8 |
| DEFINITION OF SERIAL NUMBER-----         | 8 |
| COMMAND SET OF PRARMETER SETTING-----    | 8 |
| DEFAULT SETTING AND ACCESSORIES-----     | 9 |

## I .Features of FC-201/SA

### 1. Micro power transmission

The maximum transmission power is 300 mW.

### 2. Built-in and modularized design

FC-201/SA can be embedded into the system of user as an independent communication unit.

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

Based on the MSK modulation mode, the high-efficiency FEC channel encoding technology is used to enhance data's resistance to both burst interference and random interference.

### 4. Super long transmission distance

In the open field, the reliable transmission distance is up to 800m when the antenna height is greater than 2m (BER=10<sup>-3</sup>@1200bps). And the reliable transmission distance is up to 1000m when the antenna height is greater than 3m (BER=10<sup>-3</sup>@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 FC-201/SA configuration provides 16 channels. If the user needs, it can be extended to 32 channels, meeting the multiple communication combination mode of the user.

### 7. Three interface modes

FC-201/SA can provide three transparent interfaces: RS232, RS485, UART/TTL The interface data rate is 1200~9600Bps optional and its format is 8N1/ 8E1/ 8o1 user-defined. It's convenient to directly connect with computer, user's RS-485 device, monolithic processor and other UART components for application.

### 8. Large data buffer

FC-201/SA can transmit more than 214 bytes long data frames at one time in any case. .if the RF data rate is greater than the interface rate, It can transmit infinitely long data frames.

### 9. Low power consumption

Receiving current is <40mA, transmitting current is <200mA, and sleep current is <5mA in mode one and <100uA in mode two respectively (UART/TTL interface)

### 10. Providing RSSI and SQ output

FC-201/SA can offer SQ (Output is high if signal in-band is detected, low if no signal detected) and RSSI (analog output with range of 60dB) to user for deep development or route testing.

### 11. High reliability, small and light

TCXO and all-metal housing structure used in FC-201/SA for high reliability and low failure rate.

### 12. Multiple antenna optional to meet user's various structure requirement

## II .Application of FC-201/SA

FC-201/SA is suitable for:

- ◆ Wireless meter reading
- ◆ Industrial remote control and telemetry

- ◆ Automatic data collecting system
- ◆ Building automation, safety and security, powerhouse equipment wireless monitor, entrance control system
- ◆ POS system, wireless keyboard, mouse
- ◆ Traffic, under-well locating ,alarm

### III. How to use FC-201/SA

#### 1. Power supply

FC-201/SA uses DC power supply with voltage of +3.6~5.0V. It can also share power supply with other equipment. However, the high quality power supply with desirable ripple factor should be selected. If possible, a manostat of 5V should be used for separate power supply. In addition, the reliable grounding must be ensured 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. The power consumption will increase with the rising of work voltage. Generally standby current (in reception status) is about 25mA with a 5V voltage, and standby current (in reception status) is about 20mA with a 3.6V voltage. High data rate products with low consumption can be customized for the need of users.

#### 2. Definition of FC-201/SA connecting to terminal

FC-201/SA can provide one 10-pin connector (JP1), and its definitions as well as connection method with terminals are shown in table 1.

Table 1: Definition of connecting pins and connection method (from left to right)

| Item | Definition | Description  |
|------|------------|--|
| 1    | GND        | Signal Grounding   |
| 2    | RXD        | RXD of RS232, TTL  |
| 3    | TXD        | TXD of RS232, TTL  |
| 4    | CTS        | PTT Control, valid while in low level.                         |
| 5    | RSSI       | Audio Input , Connected With MIC                               |
| 6    | SQ         | Audio Output , Connected with External Audio Amplifier Circuit |
| 7    | 485B       | B of RS485   |
| 8    | 485A       | A of RS485   |
| 9    | VCC+       | +5VDC  |
| 10   | GND        | Power Supply Grounding   |

### 3. FC-201/SA connected with terminal

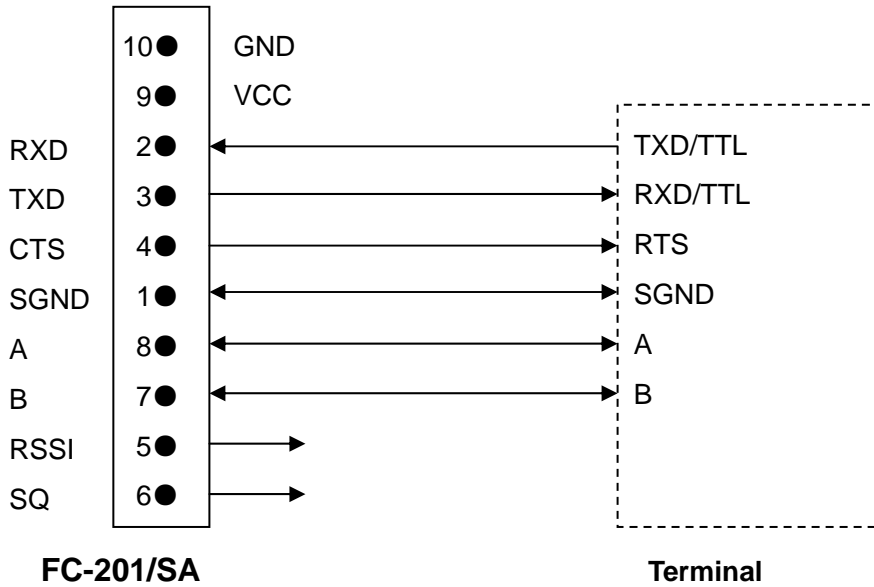


Fig 1.

FC-201/SA connected with terminal schematics

### 4. Setting of channel, interface and data format

Before using FC-201/SA, user should determine the parameters of the following items based on its own needs.

#### A. Interface

FC-201/SA can provide three interfaces. User should determine one kind of interface while making an order.

#### B. Communication data rate

The communication data rate of FC-201/SA is 1200bps-9600bps optional, which can be set up with software by user.

#### C. Channel selection

FC-201/SA offers 4MHz frequency band, which can store 16 (can be extended to 32)channels of same or different frequency. User can change the frequency of each channel as well as just keep the default frequency.

#### D. Channel switching

Channel switching of FC-201/SA can be done with software.

#### E. Check mode

FC-201/SA interface supports check mode of 8E1, 8O1 or 8N1.10-bit data transmission needs to be customized if necessary.

**Note:** The communication data rate greater than 9600bps can not be set by user . It has been set in the factory according to user's requirement in his order.

### 5. Protocol and transmission capacity

The standard FC-201/SA provides transparent protocol to support various applications of user. Some special functions such as addressing, data collection and command explanation can be added on the base of transparent protocol to reduce cost or to lessen workload of terminal's CPU.

If interface data rate is less than RF data rate, infinitely long data can be transmitted at one time. (It is suggested to transmit data in packet).

If interface data rate is greater than RF data rate, 214 bytes of data can be transmitted at one time.  
 If interface data rate is equal to RF data rate, please refer to the following table.

Table 2.

| Interface /<br>RF data rate | Bytes transmitted at one time |                               |
|-----------------------------|-------------------------------|-------------------------------|
|                             | Low consumption<br>mode open  | Low consumption<br>mode close |
| 1200/1200                   | Infinite length               | Infinite length               |
| 2400/2400                   | >4K                           | >10K                          |
| 4800/4800                   | >1K                           | >5K                           |
| 9600/9600                   | 214                           | About 1K                      |

### 6. Description of low power consumption (sleep) function

FC-201/SA can work in sleep mode for less power consumption. The module alternates between work(standby reception status) and sleep status and it will delay 180ms for receiving after opening sleep function. The ratio of work/sleep time is 80ms/160ms.

There are two sleep modes known as sleep mode one and sleep mode two. The power supply is cut off in receiving circuit, but some hardware units of CPU keeps working in sleep mode one with consumption current of 5mA. If the interface has any data, the module will receive the data correctly and exit from sleep mode one and begin to transmit data in the air.

All the peripheral circuit is power down and CPU is out of work in sleep mode two with the least consumption of 100uA.If the interface has any data, the module will exit from this mode but will not receive the first byte of data correctly. A low pulse should be sent to wake up CPU on pin RXD, after an interval of 10ms the correct transmission is ensured.

#### A. Usage of low power consumption function

The beginning and ending of low power consumption function can be set by command of software via interface. It's easy for user's MCU to manage consumption dynamically. It can be set with the delivered software of Friendcom.

#### B. Notes:

It will delay 180ms for receiving in sleep mode. Furthermore, In sleep mode two, A low pulse should be sent to wake up CPU on pin RXD of FC-201/SA, after an interval of 10ms the correct transmission is ensured. Sleep mode two is not available in default cases, this function should be declared if user needs.

### 7. Structural size schematics

The following figure describes the structural size of standard FC-201/SA. Non-standard FC-201/SA of smaller size or distinct figure can be customized for various structural requirement of user.

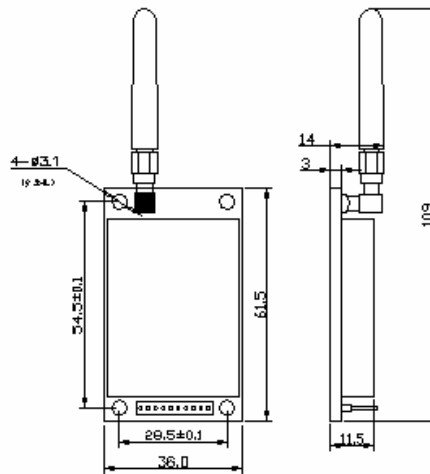


Fig.2. Structural size schematics

## 8. Antenna configuration

FC-201/SA can meet diverse antenna requirement of user. External helical antenna with SMA and SMT printed antenna are offered for user. In addition, various other antennas for micro power RF module are available too.

### a. SMA antenna

80mm helical antenna with SMA, high gain, low cost, transmitting long distance.

35mm magnetic antenna with SMA, high gain small, beautiful(like mobile antennas).

### b. SMT printed antenna

SMT antenna is small with size of 30mm×7mm. It can be sealed on FC-201/SA PCB. The total length just adds 25mm for the antenna overlaps 5mm on PCB. The structure of FC-201/SA is more compact owing to the lessened size and thickness.

### c. Customization for special antenna

Various performance antenna can be designed and customized for special requirement.

## IV. Application of FC-201/SA networking

The communication channel of FC-201/SA 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 response data. 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 moment so as to avoid the cross-interference.

FC-201/SA can also be used in point-to-point communication with easier operation. As to 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 FC-201/SA

Modulation mode: MSK  
 Carrier frequency: 487.00~491.00MHz, 433~434.MHz.  
 Frequency stability: ±2.5PPM  
 RF power: 200mW /300mW optional  
 Channel Spacing: 12.5kHz/25kHz  
 Receiving sensitivity: -119dBm  
 Interface data rate: 1200~9600bps  
 Interface data format: 8E1/8N1/8O1  
 RF data rate: 1200~9600 bps  
 Temperature: -20°C~70°C(Ordinary)  
                   -35°C~70°C(Industrial )  
 Power supply: DC +3.6~+5.0V  
 Dimension: 61.5mm×36mm×12mm  
 Weight: 30g  
 Transmitting current: ≤200mA  
 Receiving current: ≤40mA  
 Humidity: 10%~90%RH, non-condensing

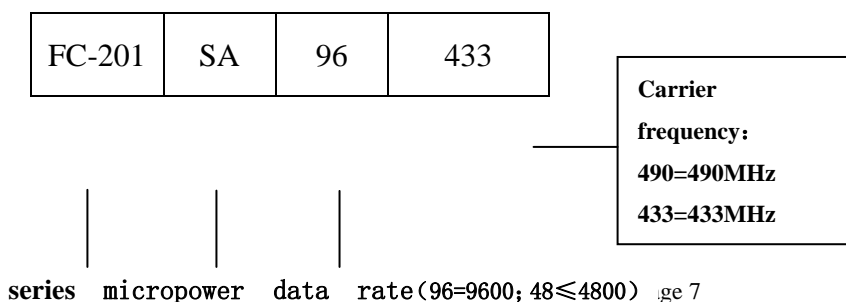
**Table 3: Corresponding frequency points of 1~16 channels**

| Channel No. | Frequency | Channel No. | Frequency |
|-------------|-----------|-------------|-----------|
| 1           | 433.00MHz | 9           | 433.80MHz |
| 2           | 433.10MHz | 10          | 433.90MHz |
| 3           | 433.20MHz | 11          | 434.00MHz |
| 4           | 433.30MHz | 12          | 434.10MHz |
| 5           | 433.40MHz | 13          | 434.20MHz |
| 6           | 433.50MHz | 14          | 434.30MHz |
| 7           | 433.60MHz | 15          | 434.40MHz |
| 8           | 433.70MHz | 16          | 434.50MHz |

**Note:** The corresponding frequency of each channel can be adjusted for user’s need with setting software provided by Friendcom. The frequency must be multiple of 12.5kHz/25KHz (Channel spacing is 12.5kHz/25kHz), or the setting is incorrect.

## VI. Description of type

FC-201 indicates product series of Shenzhen Friendcom Technology Development Co., Ltd., SA indicates micor power, i.e transmission power is 200mW, 96 indicates interface data rate 9600bps, 433 indicates carrier frequency 433M, the detailed definition is shown below:



### VII. Definition of serial number

Every FC-201/SA has an exclusive serial number of 10 figures as its ID. As an example, Its definition is shown below :

|    |    |    |      |
|----|----|----|------|
| 04 | 09 | 01 | 0001 |
|----|----|----|------|

- 04: two figures, indicating year
- 09: two figures, indicating month
- 01: two figures, indicating day
- 0001: four figures, indicating sequence number.

### VIII. Command set of parameter setting.

User can read or set the parameters of FC-201/SA with the delivered software such as interface data rate, RF data rate ,channel number and address code etc. Also you can configure FC-201/SA based on the following command set by programming.

**Command frame format:**

Table 4

|                         |                 |                 |              |
|-------------------------|-----------------|-----------------|--------------|
| Command<br>frame header | Frame<br>length | Command<br>word | Check<br>sum |
|-------------------------|-----------------|-----------------|--------------|

- Command frame header: 55H AAH
- Frame length = Command word length +1
- Command word: less than 8 bytes
- Check sum (2 bytes): Frame length +command data 1+...+command data n
- All of the command word expressed in hex.

**Table 5.**

| Command type                        | Frame header | Frame length | Command word                           | Check sum | remarks   |
|-------------------------------------|--------------|--------------|--|-----------|---|
| Channel No.                         | 55 AA        | 06           | 07 XX 00<br>00 00                      |           | XX=01-10(16 channels)   |
| RF data rate setting                | 55 AA        | 04           | 20 05 XX                               |           | XX=24: 2400;<br>12: 1200; 48: 4800;<br>96: 9600   |
| Interface data rate setting         | 55 AA        | 03           | 28 XY                                  |           | X=0: no check; X=2 odd check;<br>X=3: even check;<br>Y=0: 9600; Y=1: 4800; Y=2:<br>2400; Y=3: 1200; Y=4: 600;<br>Y=6: 19200   |
| Channel No. reading                 | 55 AA        | 03           | 24 00                                  |           | return: 24 XX<br>XX=01~10(16 channels)  |
| RF data rate reading                | 55 AA        | 03           | 23 00                                  |           | return: 23 XX<br>XX refers to the setting of RF data rate   |
| Serial number reading               | 55 AA        | 03           | 61 00                                  |           | return: 61 S1 S2 S3 S4 S5 S6 S7 S8;<br>S1~S8 indicates serial number  |
| Version No. reading                 | 55 AA        | 04           | 27 00 00                               |           | Return:27 1A XX<br>XX: version No. 1A indicates FC-201/SA   |
| frequency setting                   | 55 AA        | 0B           | 58 XX T1<br>T2 T3 T4<br>R1 R2 R3<br>R4 |           | XX=01~16, indicates channel 1 ~ 16 ; T1 ~ T4 indicates transmission frequency;R1~R4 indicates receiving frequency. e.g. if transmission frequency=483.0125MHz, T1~T4=48301250 |
| frequency reading                   | 55 AA        | 04           | 59 XX 00                               |           | return:<br>59XXT1T2T3T4R1R2R3R4<br>refers to frequency setting  |
| Sleep mode setting                  | 55 AA        | 04           | 58 00 XX                               |           | XX=b7b6b5b4b3b2b1b0<br>b7=1 sleep mode open<br>b7=0 sleep mode close  |
| Sleep mode reading                  | 55 AA        | 04           | 59 00 00                               |           | return: 59 00 XX<br>XX refers to sleep mode setting   |
| Response to all the correct setting | 55 AA        | 02           | 20                                     |           | This command will response to a correct setting such as channel No., air data rate ,interface data rate, frequency and sleep mode setting.                                    |

## IX. Default setting and Accessories.

### Factory default setting

|                     |         |
|---------------------|---------|
| Channel No.         | 10      |
| Interface data rate | 9600bps |
| RF data rate        | 9600bps |
| Parity              | None    |

### Accessories

|               |          |
|---------------|----------|
| User's manual | Optional |
| 10-pin cable  | 1        |
|               |          |
|               |          |

