

## The Embeded Multicenter Low Power Data Transfer Modules APC230-43

APC230-43 is highly integrated semiduplex low power Wireless data transfers modules, It was embeded high speed mcu and high capability RF IC. The anti-interference and sensitivity are improved greatly for using the high-efficiency forward error correction channel encoding technology , it can correct series random errors of 24bits. The technique has arrived the highest level in the data transfers area.

APC230-43 supply many channels for users, it can transmit any long or short data and need not user make any



setting and transfers program. It is small bulk and wide range of input voltage at the same time. The modules are used in many areas for the long communication distance and it's parameters are set by our company's convenient software.

### Application:

- Wireless transducer
- Industrial Automation
- The control of traffic signal
- Automated Meter Reading (AMR)
- Wireless handheld terminal
- Remote control and monitoring
- The management of cars
- Wire Replacement
- Oil and Gas Detection.
- The control of robots

## Characters:

- 2000 meters of communication distance (2400bps)
- Frequency is from 418 to 455MHz
- More than 100 channels
- GFSK modulation
- The convenient software for setting parameters
- UART/TTL interface
- Exceed 256 bytes data buffer
- fit to large data transfers
- embeded watch dog, make sure running reliable for a long time
- 24bit CRC data checking

APC230-43 is the newest era multicenter embeded wireless data transfers modules, it can work at many channels, the output power is 100 mW only consume low power, bulk is 39.5mm x 18.3mm x 7.0mm (not contain the antenna pedestal and pin), it is small enough to be embedded into consumer' s terminal.

Modules using the high-efficiency forward error correction channel encoding technology creatly, it can correct series random errors of 24bits and it is better than other normal codes, the code gain reach 3dBm, it has improved the anti-interference and sensitivity greatly. The code correct mistakes and false messages automatically and come ture the transparence transfers. So the modules is good at the bad circumstance with stronge interference, for example industry field.

256 bytes buffer implies user can transmit 256 bytes at one time in any condition. modules can transmit any long data at one time when the series rates is lower than the RF transmit rates, and modules supply the standard UART and seven kinds of series rates: 1200/2400/4800/9600/19200/38400/57600bps. The data of APC230-43 receive is the data of APC230-43 transmit , it is the transparent transfer, so APC220-43 can be used with all the protocols.

Wireless network use series COM to set all the paramters by the software Rf-APC220 which is supplied by our company, the parameters include work frequency、the series data rate、rf data rate、checkout fashion and so on. If

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you want to know how to set parameters, please read following.

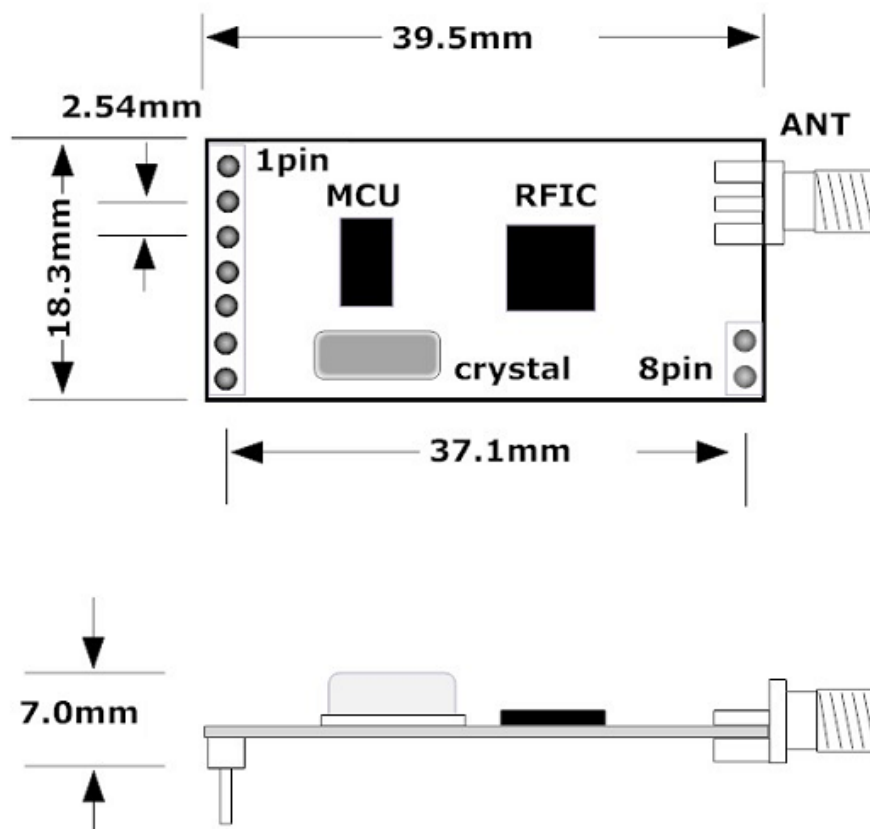
### Pin define:

APC230-43 module has seven pins.the detail is showed in the table 1:

<b>APC220-43</b>		
pin	define	introduction
1	GND	ground 0V
2	VCC	3.3V-5.5V
3	EN	Power enable, $\geq 1.6V$ or empty, $\leq 0.5V$ sleep.
4	RXD	URAT input, TTL
5	TXD	URAT output, TTL
6	MUX	The pin is expanded for other functions
7	SET	Setting parameters enable online

Table 1 the define of APC230-43' s pin

Size of production:



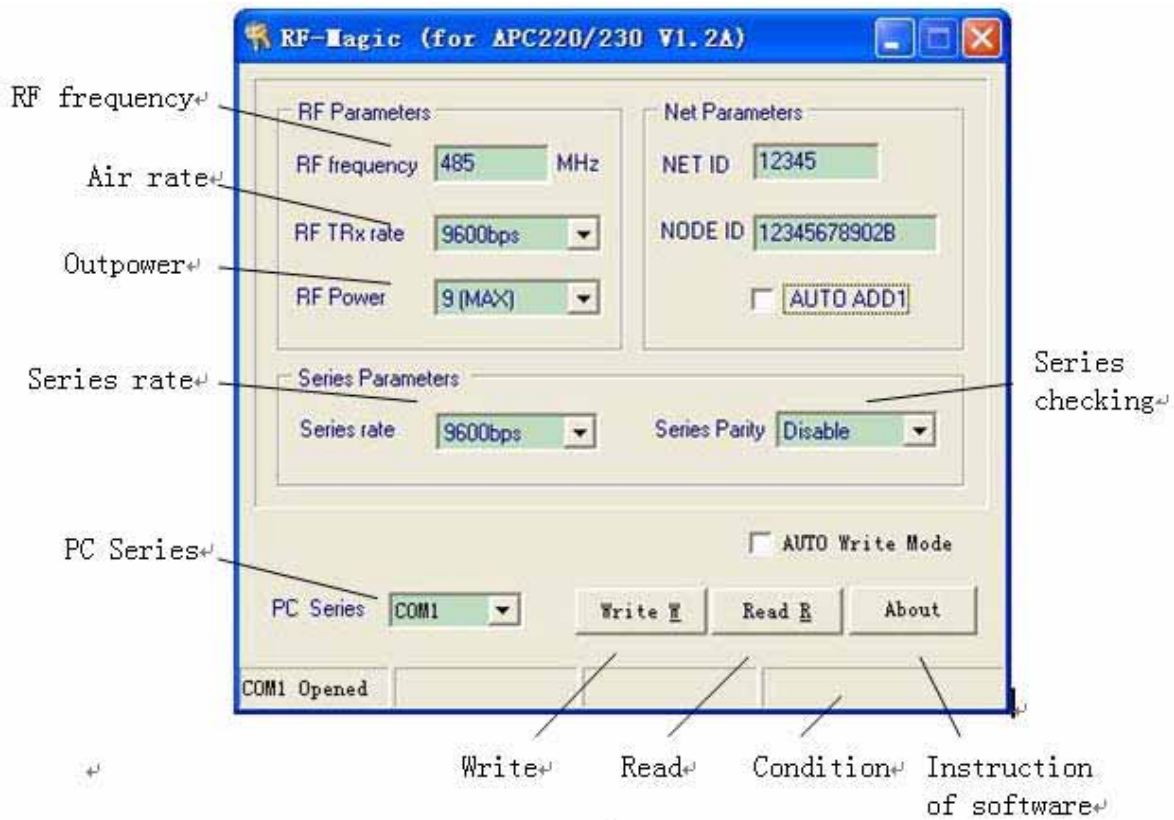
picture 1: size of module(not contain the antenna pedestal and pin)

### Set the parameters of module APC230-43:

It is very convenient of APC230-43 to be used. different options can be selected base on the need of user. please look picture 2.

The instruction of setting parameters of module APC230-43		
Setting	options	default
Series Rate	1200, 2400, 4800, 9600b, 19200, 38400, 57600	9600bps
Series Parity	Disable, Even Parity, Odd Parity	Disable
RF Frequency	418MHz-455MHz	434 MHz
RF Rate	2400bps, 4800bps, 9600bps, 19200bps	9600bps
RF Power	0-9(9 for 100mw)	9(100mw)

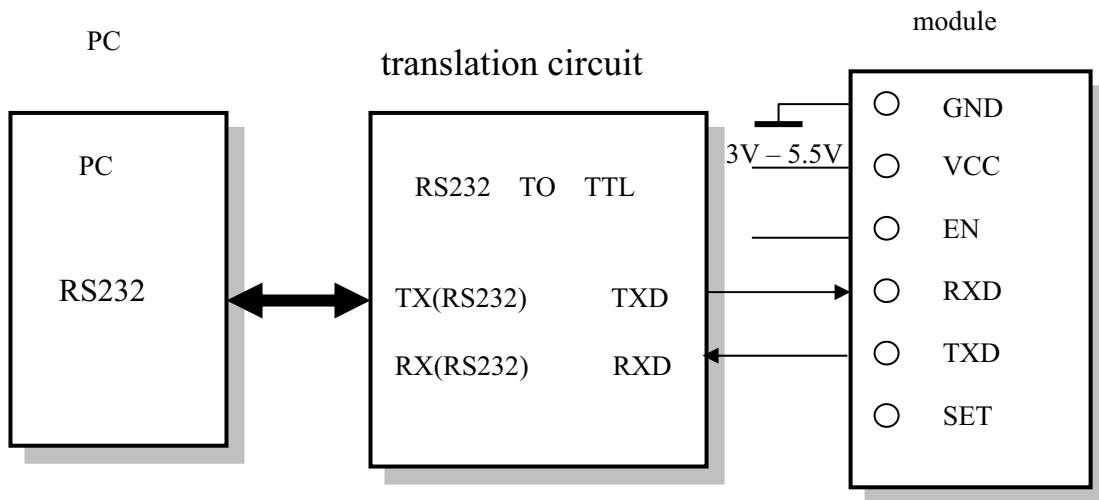
Table 2 setting parameters of modules



Picture2 the software of RF-APC220

There are two ways to set the parameters of APC230-43. one way is use the Rf-APC220 to do it by PC, please see the picture 3

### UART/TTL TO RS232



Picture 3 the connection of setting parameters

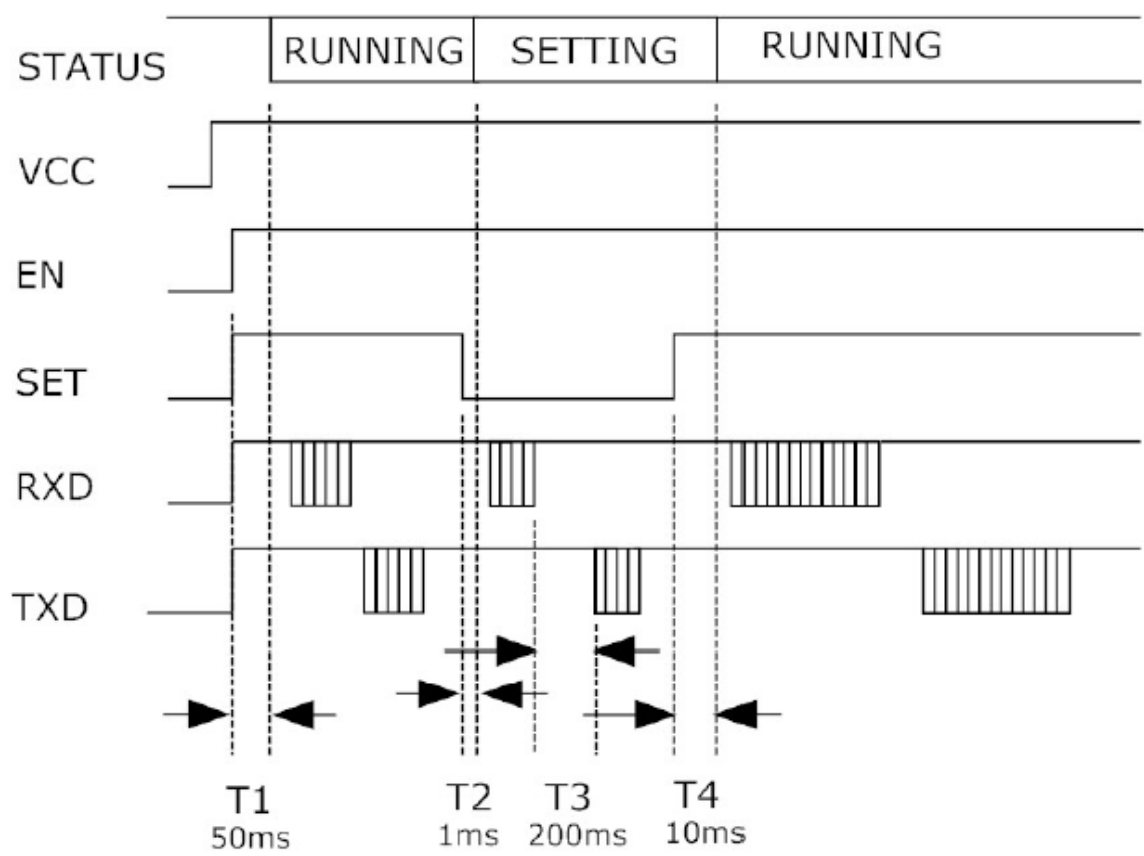
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To set the parameters of APC230-43, It need a UART/TTL to RS232 translation circuit to connect APC230-43 and PC. First connect the APC230-43 and PC by translation circuit, then run the software Rf-APC220 and plug APC230-43 into the translation circuit and supply +5V to the circuit, you will see "Found Device" at the bottom of Rf-APC220. Now, you can write the parameter which you select to the APC230-43.

The second way of setting parameters of module by terminal. The parameters were set by TTL/UART (4, 5PIN) and the pin of SET, Please see the picture3. APC230-43 will come in normal working(T1) fashion after the voltage of SET was run up after 50ms. Put down the voltage of SET first when user want to set parameters, and APC230-43 will set the series data rate at 9600bps and no checkout fashion and it will be at setting fashion(T2) after 1ms, user sent the parameters command and checkout fashion to the module by RXD, the pin TXD will return the parameter information(T3) in 200ms. user run up the voltage of SET after check the information, APC230-43 will run base on the new parameters in 10ms(T4). It is noticed user sent the command to APC230-43 only one time when APC230-43 at the setting fashion, if the command is wrong or setting parameters is completed, or want to set again, It must be run up the voltage of the pin of SET, and come into the setting fashion again.

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The format of setting parameters online:



Picture 3 the picture of setting parameters online

APC230-43 is set by ACSII and series rate is 9600bps and no checkout, there are two setting commands. It is capitalization, if there are parameters which is to be comparted by space, the enter express end.

**The command of reading parameters:**

RD

ANSWER:PARA\_frequency\_rf data rate\_output power\_series data rate\_series checkout

**The command of writing parameters:**

WR\_frequency\_rf data rate\_output power\_series data rate\_series checkout

ANSWER:PARA\_frequency\_rf data rate\_output power\_series data rate\_series checkout

## The parameters table:

The parameters table		
parameters	bytes	instruction
frequency	6	Unit is KHz, for example 434MHz is 434000
Rf data rate	6	1, 2, 3, 4 express 2400, 4800, 9600, 19200bps
Output power	1	0 to 9, 0 express -1dBm, 9 express 13dBm(20mW)
Series data rate	1	0, 1, 2, 3, 4, 5, 6 express 1200, 2400, 4800, 9600, 19200, 38400, 57600bps
Series checkout	1	Series checkout 0 express no checkout, 1 express even parity, 2 express odd parity

For example one APC230-43 is set to 434MHz, rf data rate is 9600bps, output power is 20mW, series data rate is 1200bps, no checkout.

WR\_434000\_3\_9\_0\_0

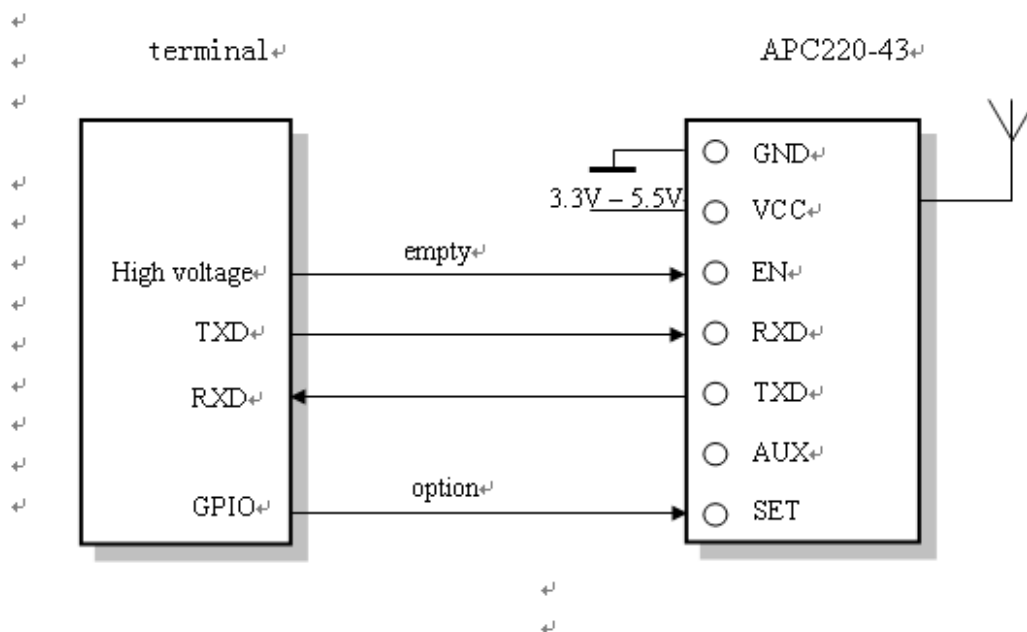
(HEX code: 0x57, 0x52, 0x20, 0x34, 0x33, 0x34, 0x30, 0x30, 0x30, 0x20, 0x33, 0x20, 0x39, 0x20, 0x30, 0x20, 0x30, 0x0D, 0x0A)

ANSWER: PARA\_434000\_3\_9\_0\_0 ✓

(HEX code: 0x50, 0x41, 0x52, 0x41, 0x20, 0x34, 0x33, 0x34, 0x30, 0x30, 0x30, 0x20, 0x33, 0x20, 0x39, 0x20, 0x30, 0x20, 0x30, 0x0D, 0x0A)



The connection between module and terminal(UART/TTL):



Picture 4 The connection between module and terminal

The technical specification of APC230-43:

The technical specification of APC230-43:	
Work frequency	418MHz to 455MHz
modulation	GFSK
Frequency interval	200KHz
transmitted power	100mw (10 levels)
Received sensitivity	-117dBm@9600bps
air rate	2400 - 19200bps
series data rate	1200 - 57600bps
The parity of series COM	8E1/8N1/8O1
The buffer of COM	256bytes
humidity	10%~90%
temperature	-20℃ - 70℃

Supply voltage	3.3 - 5.5V (the ripple is $\pm 50\text{mV}$ )
Transmit current	$\leq 100\text{mA}@100\text{mW}$
Receive current	$\leq 32\text{mA}$
Sleep current	$\leq 5\mu\text{A}$
Transfers distance	2000m (wide and viewed distance)
Dimension	39.5mm x 18.3mm x 7.0mm

Table3 The technical specification of APC230-43

### The application of APC230 modules in constructing network:

APC230-43 is semiduplex modules, it can communicate by point to point or one point to multipoint. In the second mode, it need to set a host module, others are subordinate modules. Every module must has the only ID. The communication protocol is controled by host module, it sent data or command with ID. All the modules can receive the data frame, and compare the ID with it' s ID, If they are same, the module will deal with the frame, otherwise discard it. It must that one module at transmitting condition when the network at the constructing for avoiding intereference each other. APC230-43 can be set at many frequencies, so that many networks can work in the same place and the same time.

### User should notice following questions based on the complex transfers in the air and some inherency characteristic of wireless communication:

#### 1) The data delay of wireless communication

Because the wireless terminal receive some data or wait for a while for no other data, there will be tens to hundreds milliseconds delay form transmit terminal to receive terminal(the detailed delay base on the series data rate and air rate and the length of data packet), it will be spent some time form module to terminal in addition, but the delay time is the same in the same condition.

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## 2) The control of data flux

Although there are 256 bytes buffer in the wireless module, if the series data rate is higher than the air rate, there will be a problem about the data flux. It may be lose some data for the data overflow from the buffer. In this condition, it must be made sure the average series data rate lower the air rate 60 percent. for instance, the series rate is 9600bps, the air rate is 4800. if terminal transmit 100bytes to series every time, it will spend 104ms every time.

$(104\text{ms}/0.6) * (9600/4800) = 347\text{ms}$ , so the interval of terminal transmit 100bytes to the series higher than 347ms every time can avoid above problem.

## 3) The control of error

The wireless network module have stronge anti-interference because of the high-efficiency forward error correction channel encoding technology, But in the bad circumstance with the stronge electric intensity, the data may be lost or receiving error data. User can increase the link layer protocol of system, for instance, increase TCP/IP slip window and repeat to transmit when lose data and so on, it will increase the reliability and agility of wireless network communication.

## 4) the choice of antenna

Antenna is important to the communication system. The quality of antenna influence the capability of communication system. So consumer must consider the quality of antenna when choice it. user must consider two points when choicing the antenna: the kind of antenna and its electric capability. The antenna must be matching on the frequency of communication system. User want to consider the gain and size of antenna too.

Question and answer:

questions and answers	
can not communicate between two devices	1. The communication protocol is different between two modules, for instance: data rate and parity.
	2. The frequency and rf data rate is different between two communicated terminal
	3. It is not the same production
	4. The connection between module and terminal is wrong.
	5. the module is destroyed
	6. The setting of EN is wrong
	7. The communication distance is exceed the range, or the contact of antenna is badness
Short communication distance	1. The supply voltage is exceed range
	2. The ripple of power is too big
	3. The antenna contact is badness or the wrong kind of antenna
	4. Antenna is too near the surface of metal or the ground
	5. Receiving circumstance is very bad, for instance the thick building and strong interference
	6. There is interference of the same frequency
Receive wrong data	1. Wrong setting of COM, for example, Baud rate is wrong
	2. The connection is wrong of COM
	3. The cable of COM is too long