

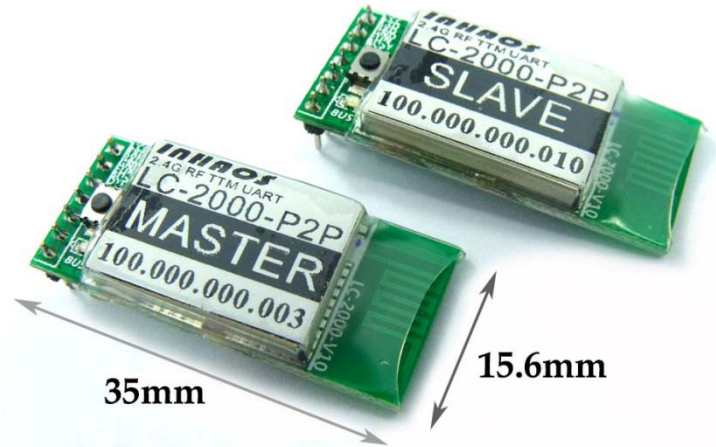
LC-2000(PA)-P2P

High performance P2P TTM 2.4G RF UART Module

INHAOS™
Everything done inhouse

Features

- 1, Low Cost , easy to use , **zero RF knowledge request for wireless communication design.**
- 2, Transparent Transmission Mode (TTM), save MCU resource, **implement wireless communication over the wired UART programming.**
- 3, Per to Per communication (P2P)
- 4, Full duplex working , max support baud rate 512Kpbs.
- 5, Max continuous bi-direct baud rate up to 115Kpbs.
- 6, **DTR signal support used for Arduino for remote upload sketch.**
- 7, Power Save Mode (PSM) current consumption down to.
- 8, Sleep mode current consumption down to 150uA.
- 9, **LC-2000-P2P:** 0dBm, Low power , 20 to 30m distance
LC-2000PA-P2P: 20dBm , 200 to 300 distance
The RF communication is very depended on it's working environment, the distance is out door clear environment and only for reference.



Pin description

Pin No.	Pin Name	I/O	Function	Remark
1	VCC	P	Power supply, DC 3.3V	
2	TXD	O	UART TXD	
3	RXD	I	UART RXD	
4	GND	P	Power Ground	
5	FUN	I	PAIR/CONFIG	Active LOW, Pull LOW and hold over 3 sec to enter PAIRING MODE
6	BUSY	O	Busy Status Indication	Active LOW, Before sent data to TX pin , ensure BUSY pin is High
7	DTR	*	DTR signal, Used for Arduino Upload sketch	The direction is :MASTER->Slave Master: INPUT Slave: OUTPUT

Important Notes:

The LC-2000(PA)-P2P serial module is working under per to per mode , a Pairs of LC-2000(PA)-P2P has contained two unis , one is MASTER and the other one is SLAVE, the module will mark it on it's label.

LC-2000(PA)-P2P Working mode

The LC-2000(PA)-P2P have below working modes:

1, Normal mode:

In this mode, the module will be standby after power on , user can be sent or receive data at any time, this mode have least delay and highest power consumption, this mode can be used on minimum data delay request applications.

2, Power Save Mode (PSM):

In this mode , module will be working on 10% proportion of intermittent mode, user can be sent data at anytime but other side maybe receive data a little bit delay , the delay time is depended on the working mode of receive side, the max delay time is 2sec.

This mode only consumption 10% of power and also ensure the data transmission with a little bit delay.

3, Sleep Mode:

In this mode , the module will stay in sleep mode , it will not sent or receive any data , user need to pull “FUN” pin low to wake up the module , and then send data , after data transmitted the module will be going to sleep mode again, this mode have minimum power consumption but user need to make application protocol to ensure communication ok.

The module will be delivered with Normal mode , user can be switch the mode by config command.

PAIRING

Before using the module , user need to pairing it , then the module can be communication to each other , to pairing the module , user need to notice beow:

1, Only one MASTER and one SLAVE can be pairing.

2, To Pairing the module , press and hold the “PAIRING” button one the moude , or pull the “FUN” pin low and hold it over 3sec , the module will be entry PAIRING mode , the LED will be flash to indication the status.

3, Do same thing on other side, once both module entry PAIRING mode , they will be pair very quickly and the LED will be OFF , that mean the module is paired and ready to communication to each other.

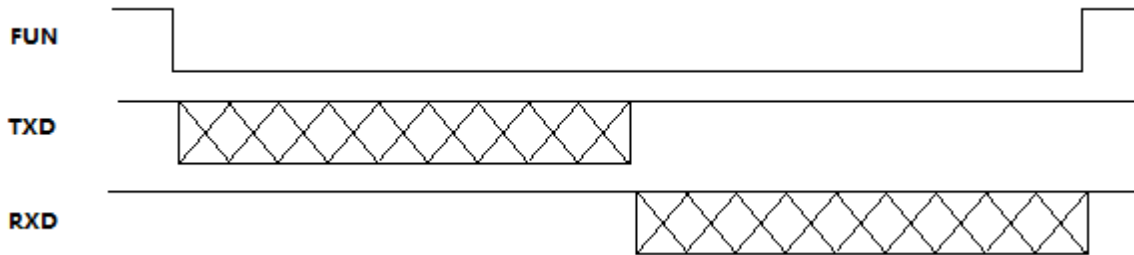
4, One MASTER only can paired with one SLAVE and the smae for SLAVE , that means if one module paired with a new module , the old paired module will be lost paired and they will not communication anymore.

5, To ensure the module was paired , pull low the DTR pin of MASTER side , the SLAVE side will be follow the status, please note that the DTR is unidirectional working , that means only the SLAVE’s DTR pin follow the MASTER ‘s DTR status.

If you sent configuration command after pull low the FUN pin , the module will entry CONFIG mode , not PAIRING mode .

Configuration Command

If user to configuration the module , user need to pull "PAIR/CFG" pin low , module will be entry CONFIG mode , then sent configuration command via TXD , after configuration , pull "PAIR/CFG" pin high. The timing as below:



In CONFIG mode , user can be sent command with any baud rate , the module will auto apply the baud rate , after exit the CONFIG mode , the module will apply baud rate as the configuration data (may be difference as the CONFIG mode).

In both normal operating mode and pairing mode, the baud rate is the same and determined by the configuration data.

The configuration command is full text mode, the format as below:

Fixed token: "="

Command Value: 3 digitals with ASCII character (Range 000 to 999)

Fixed separators : ":"

Parameter: max 240 ASCII character

Fixed end symbol: "\r\n"

For the example:

MCU send command to LC-2000-P2P: "=801:\r\n" // Read local Address

LC-2000-P2P reponce: "=801:100.000.000.001\r\n" // This module's Address is : 100.000.000.001

Arduino reference Code:

LC-2000(PA)-P2P

High performance P2P TTM 2.4G RF UART Module



The detailed command list as below:

No.	Function	Directional	Fixed token	Command Value	Fixed separators	Parameters	Fixed end symbol
1	Set working mode	MCU to Module	=	902	:	Working Mode: "0" : Normal Mode "1" : PSM Mode "2" : Sleep Mode	\r\n
		Module to MCU	=	902	:		\r\n
2	Clear Device List	MCU to Module	=	906	:		\r\n
		Module to MCU	=	906	:		\r\n
3	Set PAIRING Mode	MCU to Module	=	909	:	PAIRING Mode: "0" : Exit pairing Mode "1" : Entry pairing Mode	\r\n
		Module to MCU	=	909	:		\r\n
4	Set Baud Rate The Baud rate config only used for Master side, the slave side will be follow the Master side automatic	MCU to Module	=	910	:	Baud Rate (bps): 2400 4800 9600 14400 19200 38400 56000 57600 115200 128000 256000 512000	\r\n
		Module to MCU	=	910	:		\r\n
5	Set Uploading Mode	MCU to Module	=	914	:	Uploading Mode, "0" : Exit uploading Mode "1" : Entry uploading Mode Timeout "1"~"65535", Unit: s	\r\n
		Module to MCU	=	914	:		\r\n
6	Read UID	MCU to Module	=	801	:		\r\n
		Module to MCU	=	801	:	Local UID DDD.DDD.DDD.DDD	\r\n
7	Read working mode	MCU to Module	=	802	:		\r\n
		Module to MCU	=	802	:	Working Mode: "0" : Normal Mode "1" : PSM Mode "2" : Sleep Mode "3" : Pairing Mode "4" : Uploading Mode	\r\n
8	Read paired other side UID	MCU to Module	=	805	:	Index "0"(Fixed to "0")	\r\n
		Module to MCU	=	805	:	Enable Flag, "1"(Reserved, fixed to "1"),	\r\n

LC-2000(PA)-P2P

High performance P2P TTM 2.4G RF UART Module



						<u>Other side's UID,</u> DDD.DDD.DDD.DDD, <u>Priority</u> D(Reserved)	
9	Read Version number	MCU to Module	=	807	:		\r\n
		Module to MCU	=	807	:	<u>FW (DDD),</u> <u>HW(DDD)</u> <u>Protocl Version (DDD),</u> <u>M/S(D)</u> S: Slave M: Master	\r\n
10	Read Pairing State	MCU to Module	=	808	:		\r\n
		Module to MCU	=	808	:	<u>Pairing State</u> "0": Idle "1": Busy "2": Success "3": Fail	\r\n
11	Read baud rate	MCU to Module	=	810	:		\r\n
		Module to MCU	=	810	:	<u>Baud Rate (bps):</u> 2400 4800 9600 14400 19200 38400 56000 57600 115200 128000 256000 512000	\r\n

Error Code:

- "700" – Command format error
- "701" – Command value error
- "702" – Parameter error
- "703" – Execution error
- "704" – Buffer overflow
- "705" – Set working mode failed
- "706" –Invalid Group number
- "707" – Time out (Only for Arduino Lib)

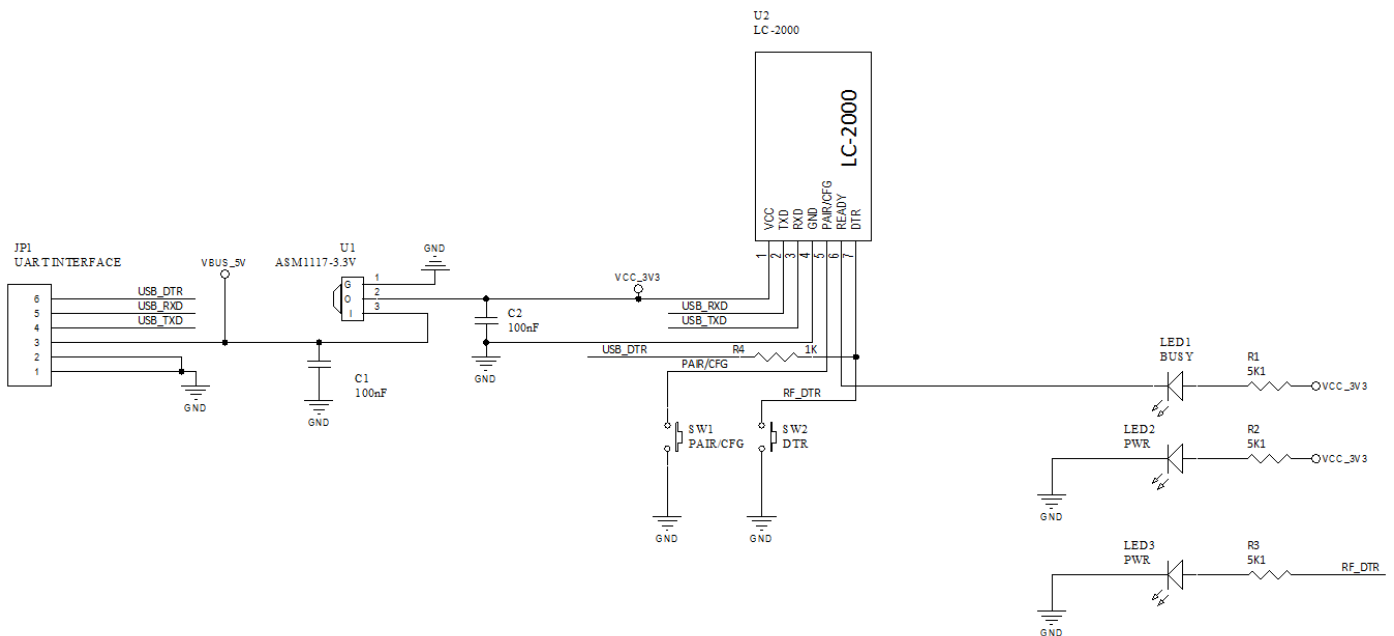
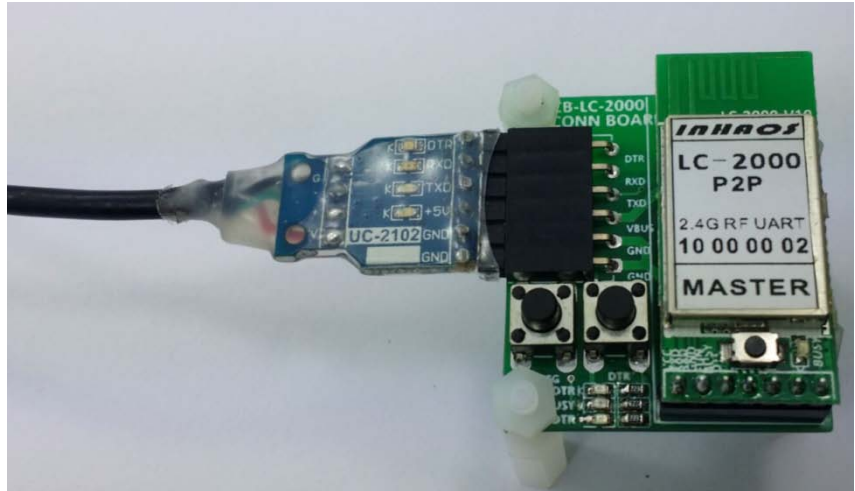
LC-2000(PA)-P2P

High performance P2P TTM 2.4G RF UART Module

INHAOS™
Everything done inhouse

CB-LC-2000 --- Connection Board for LC-2000(PA)-P2P

CB-LC-2000 provided a easy connection between LC-2000(PA)-P2P and the PC via UC-2102 USB to Serial convertor.



On the CB-LC-2000, here we have two buttons and 3 LEDs, the function as below:

- 1, **DTR Button**: press this button to pull DTR pin low, in SLAVE side you should see DTR LED is OFF. When you connected SLAVE to a UNO R3, you can reset the UNO by press this button.
- 2, **CFG button**: this button is connected to FUN pin, when you want sent configuration command from PC to Module, you can press and hold this button, and then sent command from the PC. Long press this button, the module will entry pairing mode.
- 3, **DTR LED**: indication DTR pin's status, when you press DTR button on MASTER side, the SLAVE side LED will be OFF.
- 4, **BUSY LED**: indication BUSY status, this LED light means module is busy.
- 5, **POWER LED**: when module powered the LED will be light.

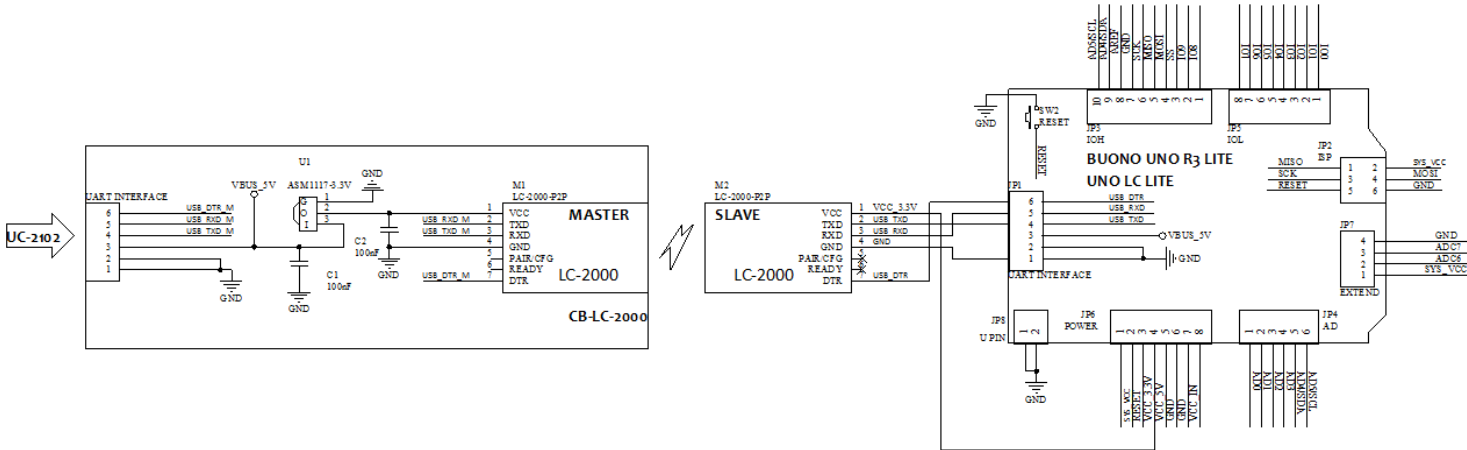
LC-2000(PA)-P2P

High performance P2P TTM 2.4G RF UART Module

Remote upload sketch for Arduino

INHAOS released some Arduino product without USB connect , we call it LITE version , for those module , it's very easy to connected to LC-2000(PA)-P2P, the module include: [BUONO UNO R3 LITE](#) and [BUONO UNO LC LITE](#) and [Mega2560-Core](#) and so on.

The Connection as below :

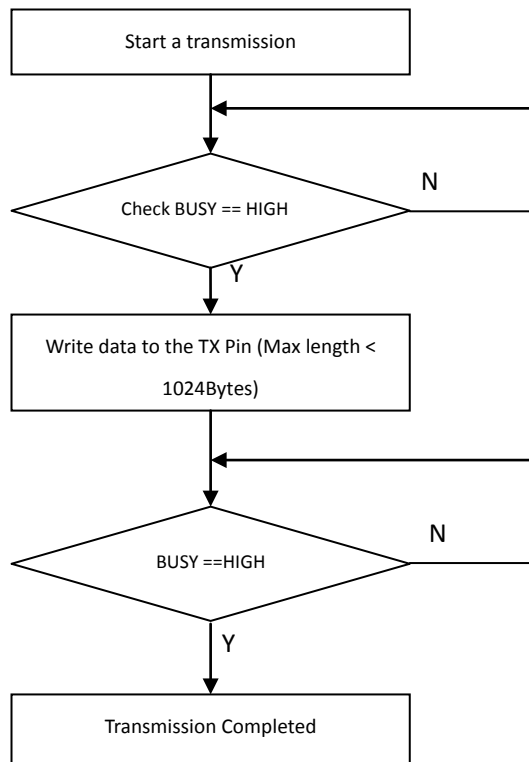


If the Slave side working in Sleep mode, you need to wake up the Slave by press the “FUN” pin for 100mS, then you can uploading sketch.

To Uploading sketch , the operation is same as the wired connection uploading operation.

Bulk data transmission

When you transmission bulk data via LC-2000(PA)-P2P, please combined the BUSY pin , to ensure the data integrity.



About the Busy pin

We setup a pin named “Busy” , in fact it’s a multi function pin. The onboard LED is indication the Busy Pin status, when Busy pin is high (3.3V) , the LED will be light.

1, After power up the module , if the module is paired and other side also power ON , the LED will be turned off , in this case , user can be sent and read data at any time.

2, If module did not paired , after power on , the LED will be light , in this case , user can not sent data , until one user pair to another module and both module is powered.

3, If module is paired , but other side did not powered , the LED also be light , in this case , user need to powered other side and the LED will be turned off.

4, When user long press “PAIR” button (pull PAIR/CONFIG low) , the module will be entry PAIRING mode , in this case , the LED will be flash , and it will be turned off after paired. To paired two module , user need to make two module entry PAIRING mode .

5, The LED will be light during transmit or receive data , and will be turned off after finish data transmit or receive, if the LED is always on , it means the data is not completed transmit , or RF connection is lost.

In the application, user can be read the BUSY pin status by a GPIO.

About the PAIR/CFG pin

The PAIR/CFG pin have two function , one onboard tack switch is connected to this pin , when press the switch , the pin will be pull low , here have to function for this pin:

1, Config module parameter: pull low the “PAIR/CFG” pin , and sent config command within 100mS , the module will be entry config mode , after config finish , pull this pin high , the module will be entry TTM (Transparent Transmission Mode),

Please notes , during PAIR/CFG pin is low , all data will be process as command , valid command will be execution and invalid command will be discard , the data will not sent to other side.

During PAIR/CFG pin is high , all data will be process in TTM and sent to other side, it will not execution config function even it’s valid format command.

2, Enter PAIRING mode: long press the button, the module will be entry PAIRING mode , in this mode , the LED will fast flash until paired , and then the module will be exit PAIRING mode and back to TTM mode.

About Remote Upload sketch

The remote upload sketch is a very special function of LC-2000(PA)-P2P, this feature support stand Arduino and the operation is very simple, in arduino system , the DTR pin is connected to RESET pin of the MCU via a capacitor , if user need to upload sketch , the Arduino IDE will be pull low the DTR pin , the RESET will get a negative pulse and the MCU will be reset and enter bootloader mode, then IDE will sent sync word to MCU , the MCU sent ACK and then Arduino IDE will start a data transmission.

The LC-2000(PA)-P2P will sent DTR signal from Master to Slave side , this will allow user to upload sketch by remote , most RF module like Bluetooth UART / WIFI UART can not support this function.

To implement this feature , user need to connected Master to PC side ,and Slave to Arduino side, and the periphery of the necessary parts in DTR to RESET patch is required.

The [BUONO UNO R3 LITE](#) and [BUONO UNO LC LITE](#) and [Mega2560-Core](#) is not included USB to UART chip , It will very easy to connect to LC-2000(PA)-P2P and implement remote upload sketch feature.

Order Information

Please notice the LC-2000(PA)-P2P have to working in pairs, one Master and one Slave , the main difference between Master and Slave are in below:

1, Baud Rate: The master side can be config baud rate by config command (=911) ,and the slave side's baud rate will be follow the master side , for the example , if master set baud rate to 115Kbps , the slave side will be change to 115Kbps automatic. So in the application , user need to notes that have to keep slave side's MCU's baud rate setting same as the master's side's MCU baud rate setting.

2, DTR signal direction: In the master side , the DTR pin is a input pin . In slave side , the DTR pin is a output pin , the slave side's DTR signal will be follow the master side's DTR signal .

Please notice :

If you only use LC-2000(PA)-P2P for normal UART communication , it no matter who is master and who is slave ,
If user use it with Arduino and want to upload sketch by remote , the PC side must use Master and Arduino side must use Slave.

For LC-2000(PA)-P2P , we provide below purchase option:

No.	Purchase code	Package List	RF Power	Reference outdoor distance	Remark
1	LC-2000-P2P	LC-2000-P2P Master * 1 LC-2000-P2P Slave * 1	0dBm	20 to 30m	
2	LC-2000PA-P2P	LC-2000PA-P2P Master * 1 LC-2000PA-P2P Slave * 1	20dBm	200 to 300m	
3	CB-LC-2000	CB-LC-2000 * 1 UC-2102 * 1	---	---	Used for connect LC-2000(PA)-P2P to PC

INHAOS Headquarter :

1111 Oakmont Drive #C, San Jose, CA 95117
E-mail : support@inhaos.com

INHAOS China office :

Room305, Building 1,17# GuangMing RD.Dongguan CityGuangdong
China 523779

E-mail: Support@inhaos.com