

Parani-SD200L

User Guide

Version 1.0.0

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User Guide for the Parani-SD200L

Version 1.0.0

Firmware version 1.0.X

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Do not place heavy objects on the product. Damage to your products may result from improper use.

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1. Introduction

1.1. Overview

Parani-SD200L is a terminal device for wireless serial communication using Bluetooth technology that is an international standard of short range wireless communications. Parani-SD200L can communicate with other Bluetooth devices; user may connect other Bluetooth devices that support the Serial Port Profile.

Parani-SD200L's communication range is about 30m for various applications.

Parani-SD200L has a compact design, which allows it to be placed conveniently into various devices or equipment. Its detachable antenna has the ability to optimize the quality and distance of wireless communications.

Parani-SD200L supports FHSS (Frequency Hopping Spread Spectrum), which is a technique, native to Bluetooth that allows the Parani-SD200L minimize radio interference while decreasing the likelihood of over-air hijacking. Parani-SD200L also supports authentication and Bluetooth data encryption.

Parani-SD200L can be configured and controlled by a set of AT commands. Users can easily configure Parani-SD200L on a terminal program, such as HyperTerminal, and configure for wireless communication without modifying user's existing serial communication program. User friendly ParaniWIN can also be used for easy setup on Microsoft Windows.

1.2. Package Check List

1.2.1. Single Unit Package

- Parani-SD200L
- Stub Antenna
- Power Cable
- USB Power Cable
- DC Power Adapter
- DB9 Female to DB9 Male Gender
- A hardcopy of Quick Start Guide
- CD-ROM including Configuration SW and User Guide

1.2.2. Bulk-Pack Package

- Parani-SD200L
- Stub Antenna
- Power Cable

1.3. Product Specification

SD200L	
Serial Interface	One female DB9 serial port for data communication Serial speeds 1200bps to 230400bps Flow Control: None, Hardware (RTS/CTS) Signals: Rx, Tx, RTS, CTS, DTR, DSR, GND, DCD
Bluetooth Interface	Bluetooth v1.2 * Protocol: RFCOMM, L2CAP, SDP Profile: Serial Port Profile
	Class 2
	Level: Max. 4dBm
	Working distance: Default–Default Antenna 30m Default–Dipole Antenna 50m Dipole–Dipole Antenna 80m Patch–Dipole Antenna 150m Patch–Patch Antenna 300m
Configuration	ParaniWIN, Modem AT command set
Firmware Update	ParaniUpdater
Diagnostic LED	Power Standby Connect Serial Rx/Tx
Power	Supply voltage: 5V ~ 12V DC Supply current - minimum 150mA Nominal power consumption - 58mA@9600bps, 66mA@115Kbps
	Common Power supply options: Power via a standard AC-plug DC-adapter Power via USB power cable Power via DC power cable Power via pin 9 of DB9 connector Built in Battery
Battery Usage Time	When using built in battery - 190mAh - Avg. 4hr@9600bps Full charging time – Avg. 2hr
Environmental	Operating temperature: -10 ~ 55 °C Storage temperature: -20 ~ 70 °C Humidity : 90% (Non-condensing)
Physical properties	Dimension 96 mm L (3.8 in.) 31 mm W (1.2 in.) 16 mm H (0.6 in.)
	Weight 25 g
Approvals	FCC(A)
Warranty	3-year limited warranty



Note * :

Bluetooth v1.2 supports improved AFH function. AFH function is to mitigate the interference between WiFi and Bluetooth radios by automatically avoiding the active WiFi channel from Bluetooth link. However, AFH does not provide a complete solution making WiFi and Bluetooth work together in harmony. It is highly recommended for users to test their wireless system enough before deployment since the overall system performance is affected by various environmental factors such as distance between them.

2. Getting Started

This chapter describes how to set up the Parani-SD200L for the first time.

- 2.1 *Panel Layout* explains the panel layout.
- 2.2 *Connecting the Hardware* describes how to connect the power, the serial device to the Parani-SD200L.

Following items are required to get started:

- One DC power adapter, USB power cable or DC power cable (included in the package).
- One PC with RS232 serial port.
- Terminal emulation program running on the PC

2.1. Panel Layout

This section describes the panel layout of the Parani-SD200L.

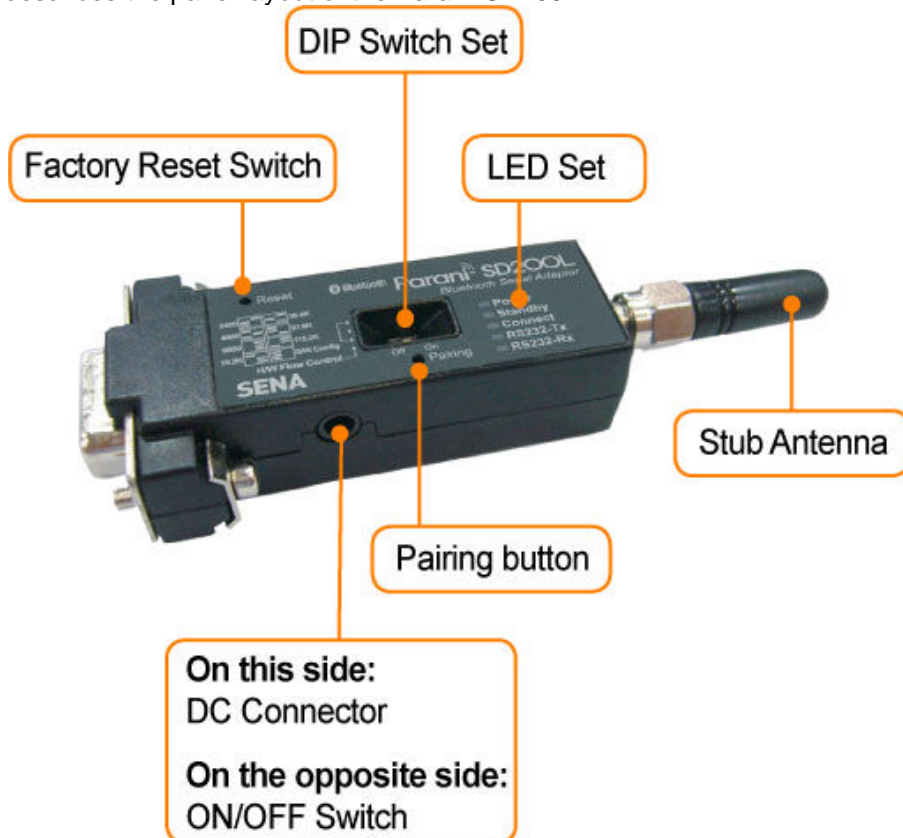


Figure 2-1 The panel layout of Parani-SD200L

2.2. Connecting the Hardware

This section describes how to connect the Parani-SD200L to the serial device.

- Connect a power source to the Parani-SD200L.
- Connect the Parani-SD200L to a serial device.

2.2.1. Connecting Power to Parani-SD200L

Connect the power jack to the power connector of the Parani-SD200L using the DC power adapter,

USB power cable or DC power cable that is included in the package. If power is properly supplied, the [Power] lamp will display a blink green color.

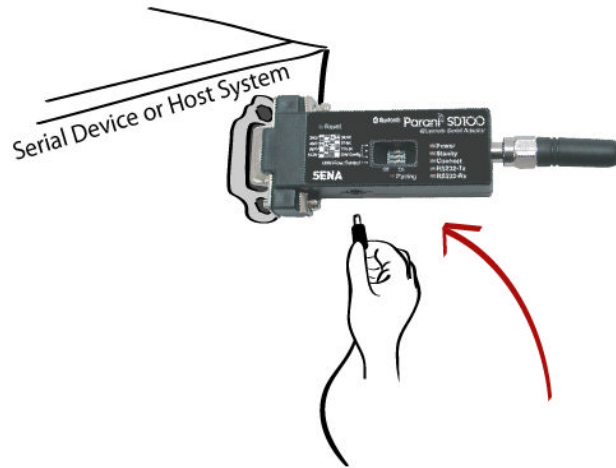


Figure 2-2 Connecting Power to Parani-SD200L

2.2.2. Connecting Device to Parani-SD200L

Connect the serial device to the Parani-SD200L

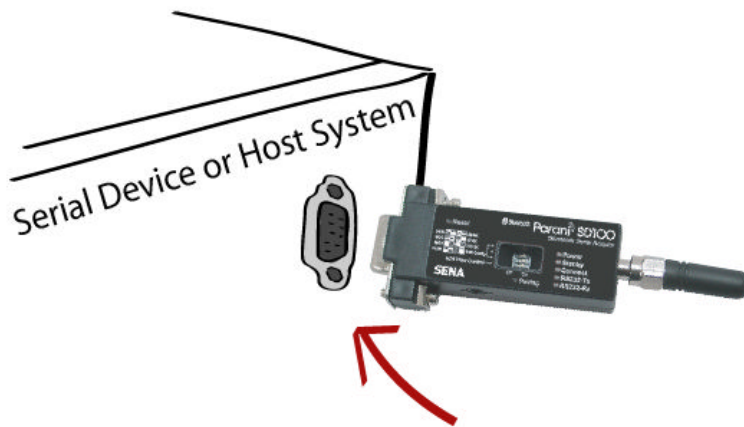


Figure 2-3 Connecting a Serial Device to Parani-SD200L

3. Configuration

3.1. Operation Modes

In addition to the serial port configurations, the Parani-SD200L requires also includes some settings for Bluetooth. For getting the most out of Parani-SD200L, user should understand the following Bluetooth connection schemes.

A Bluetooth device can play a role as a master or slave. Master tries to connect itself to other Bluetooth devices, and slave is waiting to be connected from other Bluetooth devices. A Bluetooth connection is always made by a pair of master and slave devices. A slave can be in two modes, Inquiry Scan or Page Scan mode. Inquiry Scan mode is waiting for a packet of inquiry from other Bluetooth device and Page Scan mode is waiting for a packet of connection from other Bluetooth device. Every Bluetooth device has its unique address, called BD (Bluetooth Device) address, which is composed of 12 hexa-decimal numbers.

Parani-SD200L has 4 operation modes as follows. Each mode can be identified with LED indicators as illustrated in next section.

Table 3-1 The Parani-SD200L Operation Modes

Mode	Description
Mode0	<p>In this mode, there is no response when power on or software reset, and Parani-SD200L is just waiting for AT command input. Neither master nor slave is assigned to Parani-SD200L in mode0. User can change the configuration parameters of Parani-SD200L in this mode.</p> <p>Parani-SD200L must be in Mode0, when it is directly controlled by AT commands.</p> <p>The factory default is set to Mode0.</p>
Mode1	<p>Parani-SD200L tries to connect the last connected Bluetooth device.</p> <p>Parani-SD200L in Mode1 is to be a master and tries to connect the last connected Bluetooth device. Parani-SD200L always stores the BD address of the Bluetooth device to which Parani-SD200L has connected last. When Parani-SD200L is initially used or after hardware reset, there is no BD address stored in Parani-SD200L. In this case, Mode1 will not be able to work properly. The mode change to Mode1 can be made after Parani-SD200L succeeds to connect to one other Bluetooth device. Once changed to Mode1, Parani-SD200L will try to connect automatically the last connected Bluetooth device whenever the unit is powered on or software reset.</p> <p>Parani-SD200L in Mode1 cannot be discovered or connected by other Bluetooth devices.</p>
Mode2	<p>Parani-SD200L is waits for a connection from the last connected Bluetooth device.</p> <p>Parani-SD200L in Mode2 is to be a slave and waiting for the connection only from the last connected Bluetooth device. Just like Mode1, if there is no BD address stored in Parani-SD200L, the mode change from other operation modes to Mode2 is not work properly. Once changed to Mode2, Parani-SD200L will wait for the connection from the last connected Bluetooth device whenever the unit is powered on or software reset.</p> <p>Parani-SD200L in Mode2 cannot be discovered or connected to Bluetooth devices other than the last connected device.</p>
Mode3	<p>Parani-SD200L is waiting for the connection from any other Bluetooth devices. In Mode 3 the Parani-SD200L is discoverable and can be connected to by other Bluetooth devices.</p>

3.2. LED Indicators

RS232-Tx and RS232-Rx LED will flash accordingly when data is transmitted. For small data transmissions, it may be hard to recognize the quick flashing action of the LED.

Table 3-2 The Parani-SD200L LED Indicators

Indicator	Power LED	Standby LED	Connect LED
Mode0	Green (every 0.5 sec) □	Red (every 0.5 sec) □	Off
Mode1	Green (every 0.5 sec) □	Off	Green (every 1 sec) □
Mode2	Green (every 0.5 sec) □	Off	Green (every 3 sec) □□
Mode3	Green (every 0.5 sec) □	Off	Green (every 3 sec) □□
Connected	Green (every 0.5 sec) □	Off	Green □—————
Low Battery	Green (every 0.5 sec) □	Red (every 0.2 sec) □	
charging	Green (every 0.5 sec) □	Red □—————	
Full charging	Green □—————	Red (every 0.5 sec) □	

3.3. Serial Ports

The applicable settings for serial ports are as follows.

Table 3-3 The Parani-SD200L Serial Port Settings

Serial Port Settings	Values
Baud rate	1200, 2400, 4800, 9600 , 19200, 38200, 57600, 115200, 230400
Data bite	8
Parity	No parity , Even parity, Odd parity
Stop bit	1 , 2
Hardware Flow Control	Use, No Use

The values in box are the factory defaults. The flow control setting is configurable only through dip switch.

3.4 Data Bit

Parani-SD200L supports only 8 data bit. In the case of 7 data bit and even/odd parity, use SD 8 data bit and none parity. At this time, master and slave are SD, ESD or MSP series. But 7 data bit and none parity is not support.

3.5 Hardware Flow Control

Parani-SD200L plugged into its host system transmits data from host to the other side Bluetooth device. This data is saved temporarily in the internal buffer of Parani-SD200L and sent repeatedly until the transmission is completed packet by packet. When the radio transmission condition is not good enough to send data promptly, it can cause a transmission delay. If the host sends more data when the buffer is full, buffer overflow will make Parani-SD200L malfunction consequently. In order to prevent this buffer overflow, Parani-SD200L works as follows.

When using hardware flow control, Parani-SD200L disables RTS so that it stops receiving any further data from the host when the buffer becomes full. RTS will be re-enabled again to begin receiving data from the host when the buffer has created more room for more data.

When hardware flow control is not being used, the Parani-SD200L clears the buffer to secure room for

the next data when the buffer becomes full. This can mean a loss of data may occur. As the transmission data becomes large, the possibility of data loss becomes greater.

For large data transmissions, the use of hardware flow control is highly recommended.

3.6 Reset to Factory Defaults

To set all the configuration settings to its factory default parameters, press the reset button, depicted in Fig. 1-3. Press and hold (for at least 1 sec) the reset button with a narrow pointed tool like paper clip. Reset works only when power is on.

3.7 Dipswitch

With the combination of 4 slot dipswitches, baud rate and hardware flow control can be set.

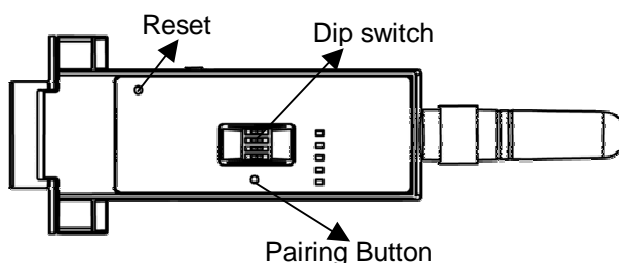


Figure 3-1 The Parani-SD200L Dipswitch

Upper 3 dipswitches are used for setting the baud rate, and bottom dipswitch is used for setting hardware flow control option. If the baud rate needs to a baud rate not shown below, ParaniWIN or terminal program should be used to set these speeds. To set a baud rate not shown below the dipswitches should be in the S/W Config setting. When in the S/W Config setting the baud rate will go back to 9600 as default.

Table 3-4 Baud rate Settings by Dipswitches

Baud rate	2400	4800	9600	19.2K	38.4K	57.6K	115.2K	S/W Config

Table 3-5 Hardware Flow Control Settings by Dipswitches

Hardware Flow Control Handshaking	No Use	Use

* Note: You cannot set the Parani-SD200L to a Baud rate of 1200 and 230K by way of the Dipswitch. If you want to use them, to set these speeds, please configure the dipswitch to S/W Config setting and use ParaniWIN or AT commands. Please refer to ParaniWIN and Appendix B.3.4 AT+UARTCONFIG,Baudrate,Paraty,Stopbit.

3.8 Pairing Button

Parani-SD200L provides Pairing Button for instant configuration without a PC to make an automatic connection between two Parani-SDs. In this example we will refer to the two Parani-SDs as SD1 and

SD2, respectively.

Step 1. Turn off all the nearby Parani-SD's

Step 2. Turn on SD1 and SD2 and hardware reset both of them by pressing Reset Button.

Step 3. Press the Pairing Button of SD1 for 2 seconds until Standby LED turns off and Connect LED blinks 3 times every 2 seconds. Keep the power ON.

Step 4. Press the Pairing Button of SD2 for 2 seconds until Standby LED turns off and Connect LED blinks 3 times every 2 seconds. Now press again the Pairing Button for 2 seconds until Connect LED blinks every 0.5 second.

Step 5. Wait for SD1 & SD2 to connect to each other until the Connect LED's of SD1 and SD2 are fully solid green. It takes about 10 seconds to make a connection. If there are many Bluetooth devices nearby, it may take longer.

Step 6. Turn SD1 off and on. Connect LED blinks twice in green every 3 seconds.

Step 7. Turn SD2 off and on. Connect LED blinks once in green every 1 second.

Step 8. Now SD1 and SD2 are configured to make automatic connection to each other, whenever they are powered on.

Using a pair of Parani-SD200L in this fashion is similar to that of using a wireless serial cable.

* Note: When using the pairing buttons, the Command Response option will be deactivated automatically. The Parani-SD200L will not send the response messages such as OK, Connect and Disconnect.

Table 3-6 Pairing Process by Pairing Button

SD1	Status	LED	SD2	Status	LED
1. Hard reset	Mode0	Standby LED blinks 2 times every 1 seconds	1. Hard reset	Mode0	Standby LED blinks 2 times every 1 seconds
2. Push pairing button	Mode3	Connect LED blinks 3 times every 2 seconds	2. Push pairing button	Mode3	Connect LED blinks 2 times every 2 seconds
			3. Push pairing button again	Mode1	Connect LED blinks every 0.5 seconds
4. Connected	Slave	Connect LED is lit in green	4. Connected	Master	Connect LED is lit in green

3.9 Software and Utility

This configuration software and utility for firmware update is included with the product, which also can be downloaded from <http://www.sena.com>

Table 3-7 Configuration Software

Software	Purpose	Operating System
ParaniWIN	Configuration	MS Windows 98SE or Higher
ParaniUpdater	Firmware Update	MS Windows 98SE or Higher

3.10 ParaniWIN

ParaniWIN is a program that runs on Microsoft Windows for the configuration of Parani-SD200L. Install ParaniWIN on your computer. Plug a Parani-SD200L into the serial port of the computer and turn on the power. Run ParaniWIN.

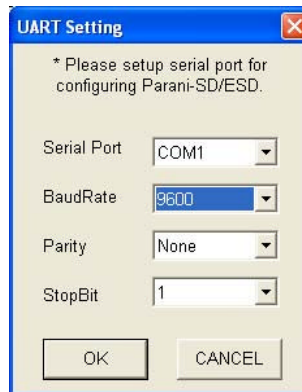


Figure 3-2 Serial Port Setting

Set each option properly and click [Confirm]. If the settings of the Parani-SD200L are different from the ParaniWin, an error message will pop up. If the Parani-SD200L is in the status of connection, warning message will pop up. Then the current connection can be cancelled by [Disconnect] button on the main window.

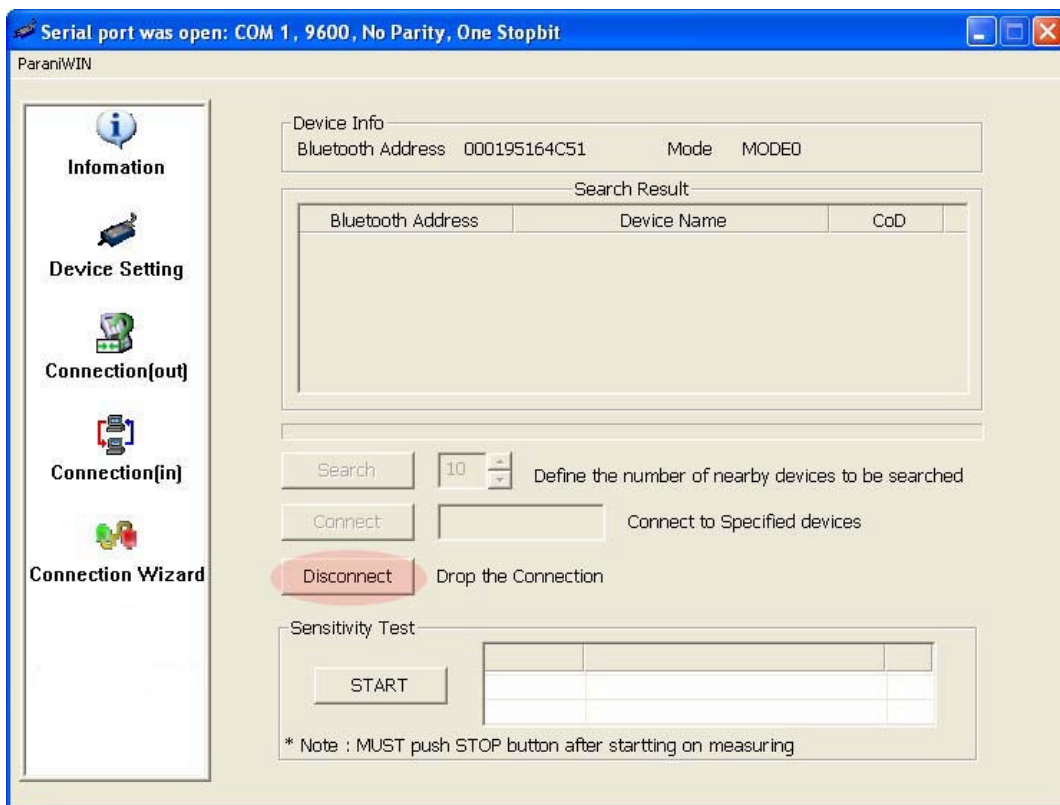


Figure 3-3 Main Window

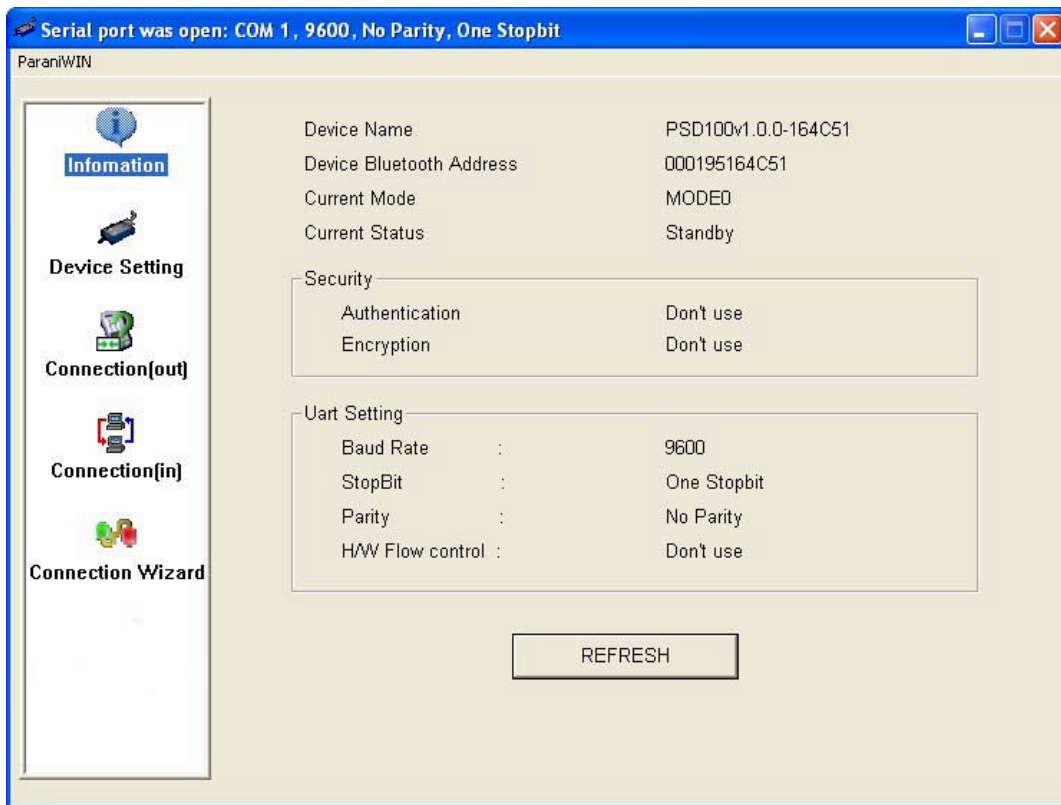


Figure 3-4 Information Window

Serial port settings can be changed by <Start Configuration> and <ParaniWIN Configuration> of ParaniWIN in the menu bar at upper left corner of the window without re-running the ParaniWIN program.

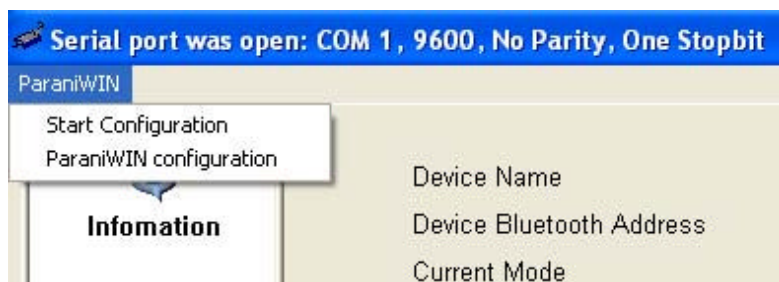


Figure 3-5 Menu Bar at Upper Left corner of ParaniWIN

When the ParaniWin software is able to access the Parani-SD200L properly, the icons in the left side window come will become available for use.

In device configuration window, hardware reset can be executed or operation mode and RS232 can be configured as well. Security option also can be configured in this window.

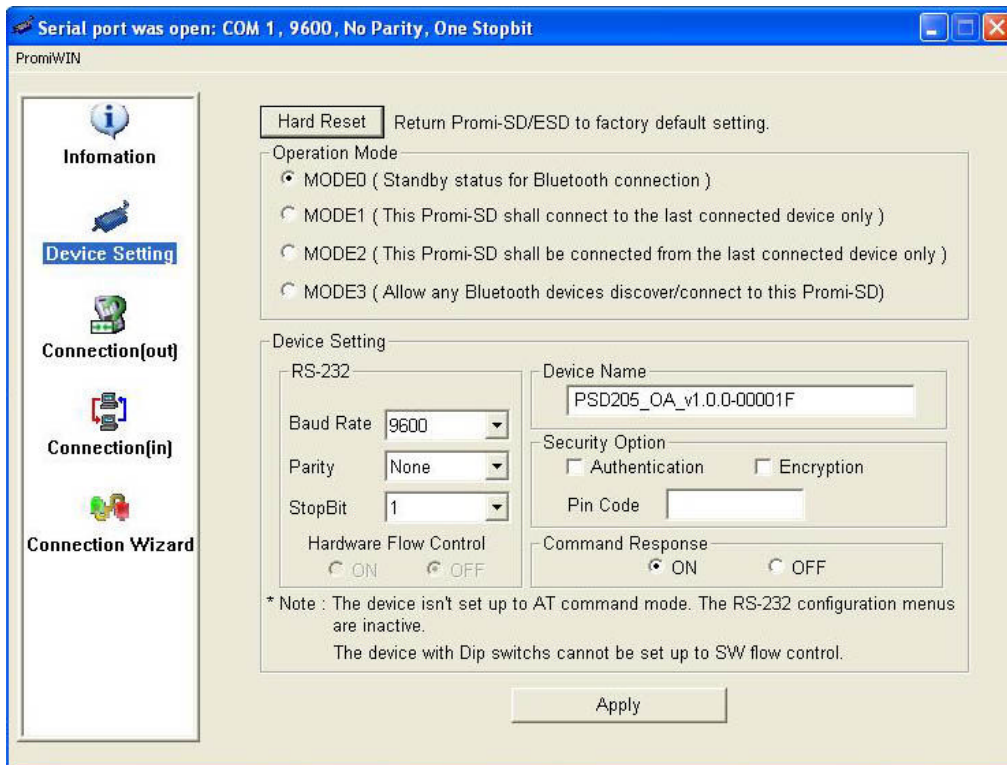


Figure 3-6 Device Setting Window

Parani-SD200L supports two security options, Authentication and Encryption. If you enable the Authentication option, you must also enter a Pin Code value. If the authentication is enabled, the connection, between the Master and Slave device must share the same Pin Code. In case that Parani-SD200L connects to another Bluetooth device, that requires authentication, you must know the other device's Pin Code. In general, most Bluetooth devices have a pincode of 1234 or 0000. If you check Encryption option, the Parani-SD200L will encrypt packets and sent to the device. The Encryption options works well in case that only one of the devices between Master and Slave use the Encryption option.

Parani-SD200L has 4 response messages, 'OK', 'ERROR', 'CONNECT', and 'DISCONNECT'. In some cases, these responses can affect the host system unexpectedly. To prevent this, user can set the Command response to ON or OFF.

For Parani-SD200L, hardware flow control can be configured only by dip switch. Thus H/W Flow Control option will not work in this case. When the dipswitch value isn't ATcommand mode, the Baud Rate menu will be disabled.

Click [Apply] button to apply any changes made to the Parani-SD200L.

Connection(out) icon will show the following window to search and connect other Bluetooth devices.

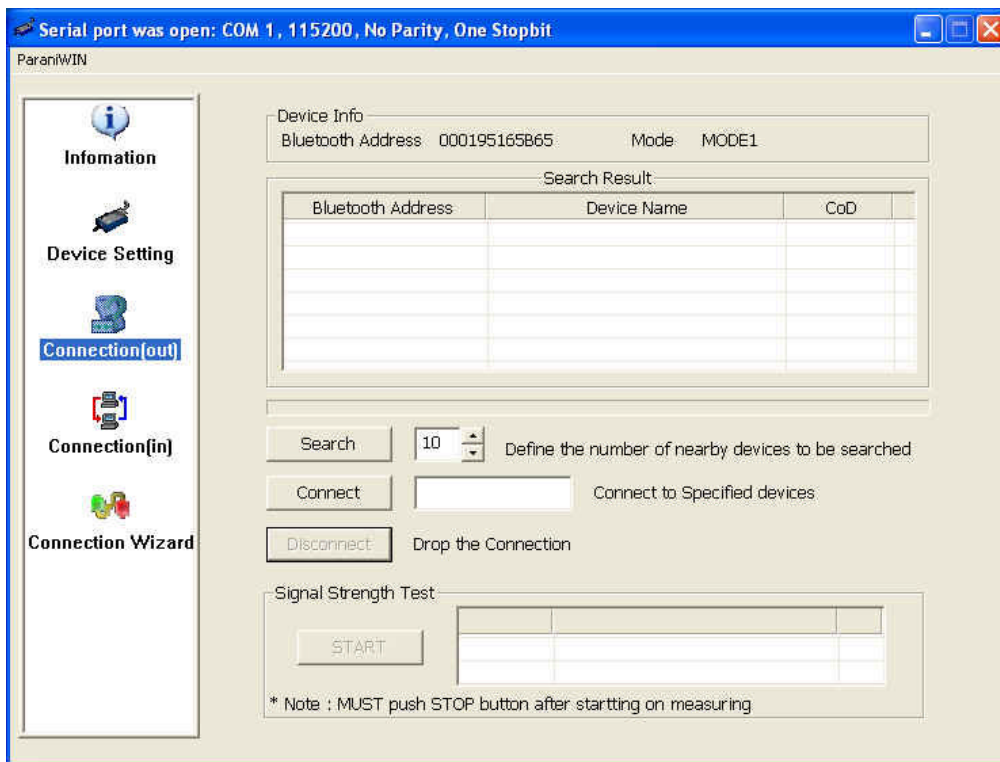


Figure 3-7 Connection(out) Window

Click [Search] button to search nearby Bluetooth devices. Once several Bluetooth devices has been found, select one of the devices and click the [Connect] button. The selected Bluetooth device must be discoverable and connectable. Click [Disconnect] button to cancel the connection.

After the connection has been established, you will be able to test signal strength by pushing the START button.

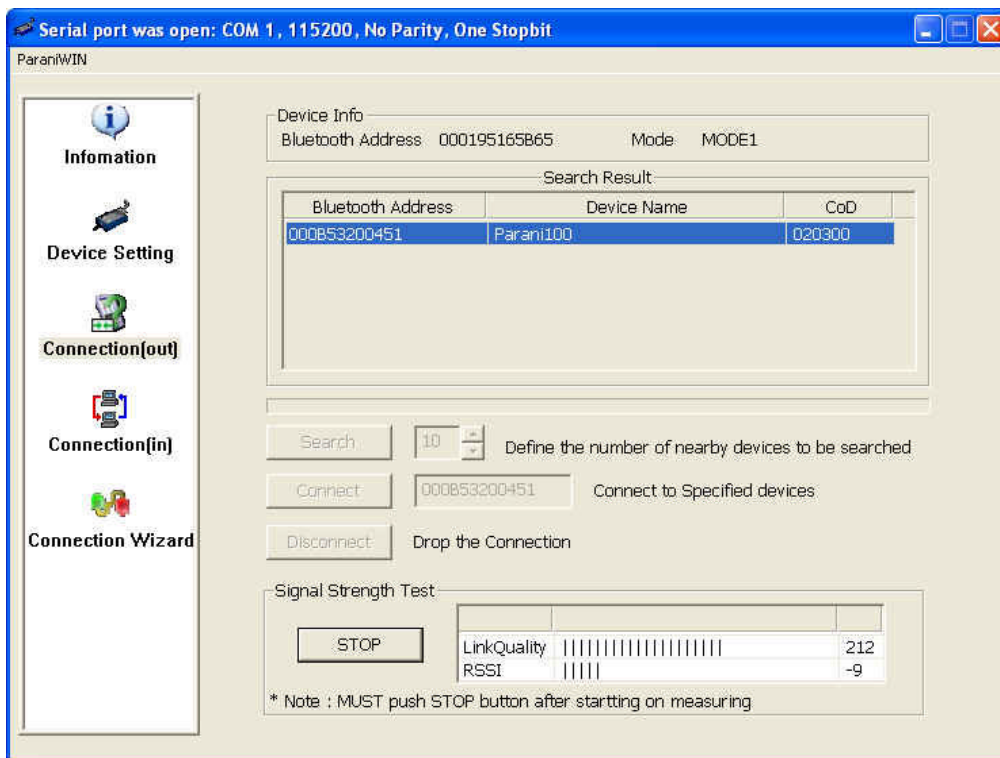


Figure 3-8 Signal Strength Test

The signal strength test shows LinkQuality and RSSI values. The closer LinkQuality is to 255 and RSSI is to 0, this means the Parani-SD200L has a good connection to the connected Bluetooth device. In general, the wireless connectivity is at its best within 10 meters. You can push the STOP button at anytime in order to terminate the signal strength test. The signal strength test will continue until the STOP button is pushed. If you close the ParaniWIN Window without pushing the STOP button, you must restart Parani-SD200L to terminate the test.

Connection(in) icon will show the following window, which enables the Parani-SD200L to wait for a connection from another Bluetooth device. If the waiting time is set to 0, Parani-SD200L will continually wait for connection until [Cancel] button is clicked.

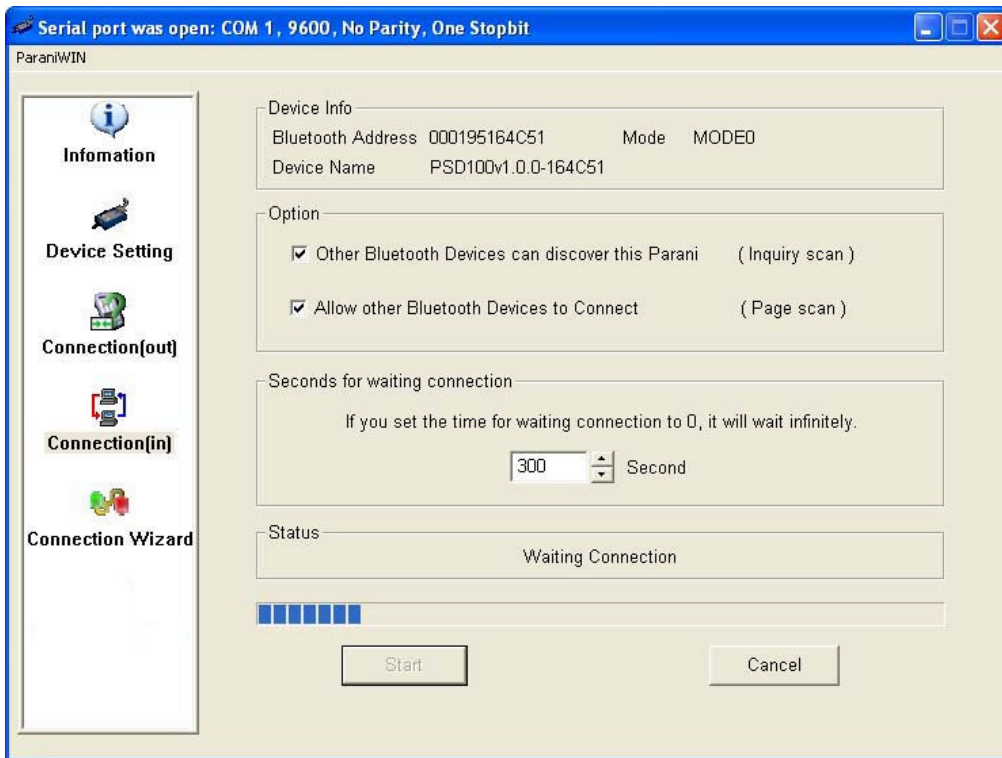


Figure 3-9 Connection(in) Window

If the Connection Wizard icon is clicked, an easy to use pairing menu will appear:

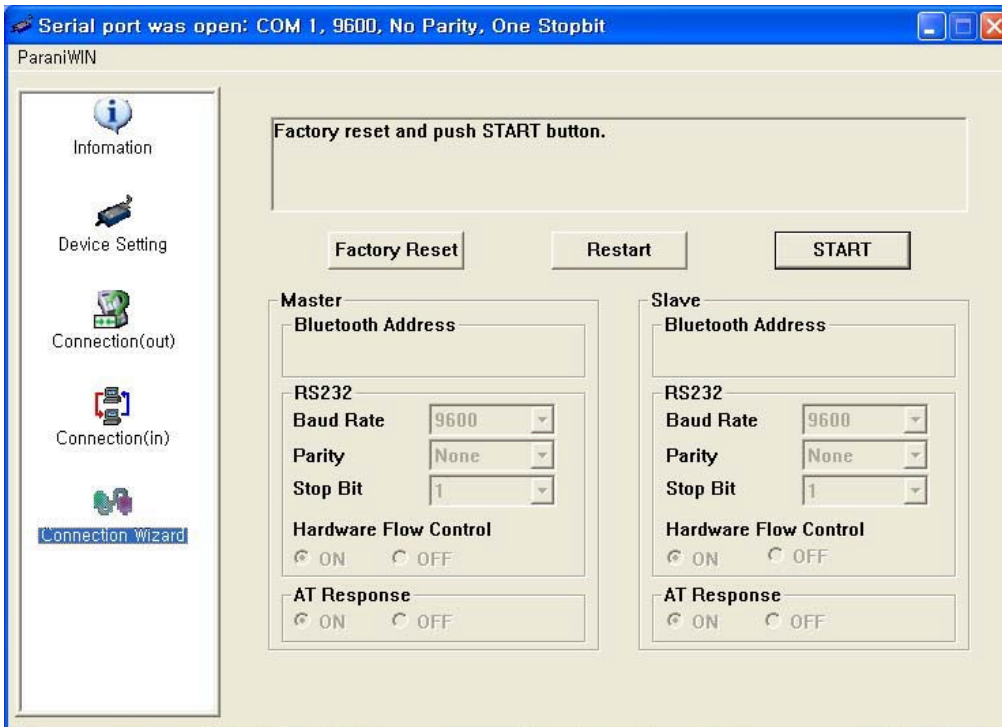


Figure 3-10 Connection Wizard Window

In this example we will refer to the two Parani-SDs as SD1 and SD2 respectively. To use this menu, please do the following:

Step 1. Connect the first SD and then push the START button.

Step 2. Disconnect the first SD, connect the second SD and then push the Next button after setting up Slave configuration. At this time, the dip switch value should be ATcmd mode. The flow control setting can be changed only through dip switch.

Step 3. Disconnect the second SD, once again connect the first SD and then push the Finish button. The pairing configuration should be completed. Make sure that each SD's connect LED is on. At this point, when both SD's restart the connection will be established automatically.

3.11 ParaniUpdater

Parani-SD200L supports firmware updates. You can download new firmware images for the Parani-SD200L at <http://www.sena.com>. With the ParaniUpdater, you can update the firmware of Parani-SD200L by selecting the firmware image file and pushing Start button.

* Note: DO NOT power off Parani-SD200L while the firmware update is progressing, this may damage the Parani-SD200L.

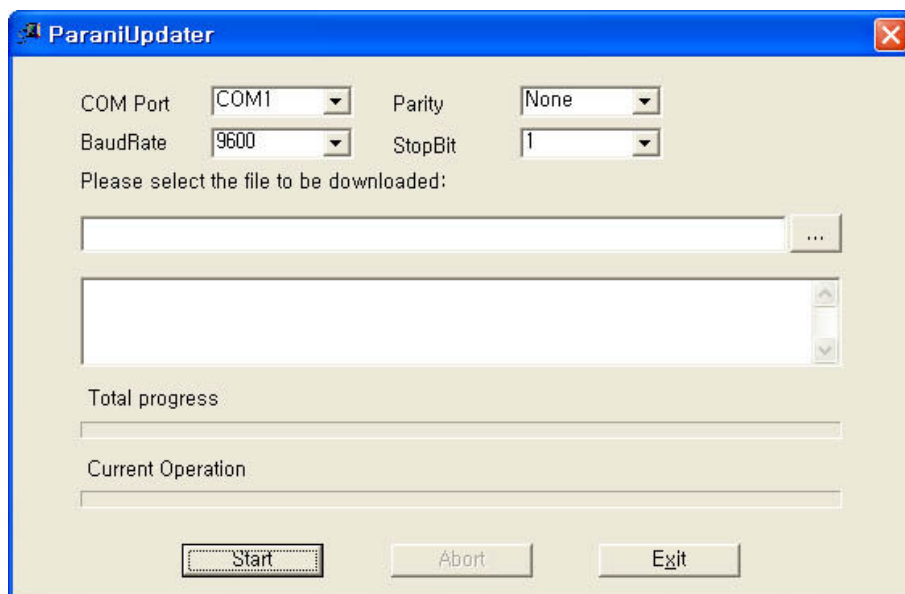


Figure 3-11 ParaniUpdater Window

3.12 Terminal Program

A terminal program is typically an application that will enable a PC to communicate directly with a modem. If you are using Windows 98SE or higher version of Windows, HyperTerminal program is included as part of the operating system. Parani-SD200L provides some extended AT commands for configuration of the Parani-SD200L.

This manual will explain the method using HyperTerminal. If you need to install HyperTerminal, click start>setting>control panel>add/remove programs. For more precise details on HyperTerminal installations, please refer to Microsoft Windows Help section.

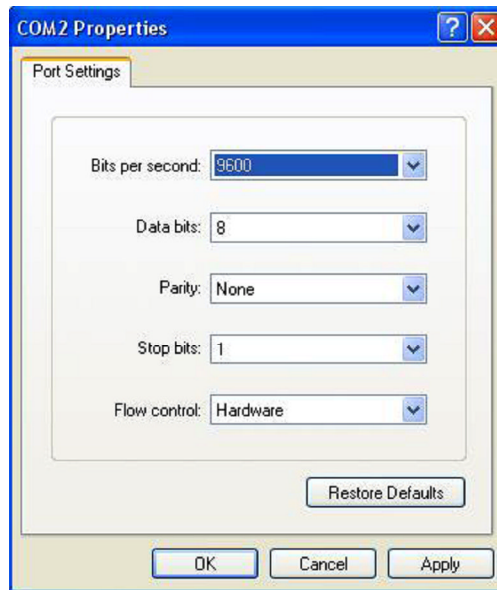


Figure 3-12 HyperTerminal

Attach Parani-SD200L to serial port of host computer and power on the Parani-SD200L. Check Connect LED and Standby LED

Their status may be as follows:

Table 3-8 Connect LED and Standby LED status

Connect LED	Standby LED	Meanings
On	Off	Connected to somewhere
Blinking	Off	Connecting to somewhere or waiting for incoming connection.
Off	Blinking	Waiting for AT commands.

Make sure that the Connect LED is turned off and the Stanby LED is turned on before attempting to send any kind of AT commands to the Parani-SD200L. Then launch HyperTerminal, it can usually be found in start >programs >accessories >communication >HyperTerminal. Select the Serial port that Parani-SD200L is connected to.

Select the Serial port setting in the window displayed, please make sure the serial settings in Hyperterminal are set to the same settings as the Parani-SD200L's serial settings.

To view the AT commands that are being typed, you will need to enable the local echo option. Go to File->Properties->Settings->ASCII setup and select the "Echo typed characters locally" option.

For expanded AT commands, please refer to Appendix A. AT commands.

Example of AT commands:

```

at+btinfo?

000195000002,PSD200Lv1.0.0-000002,MODE0,STANDBY,0,0,NoFC

OK
atd 000195000001
OK

CONNECT 000195000001

```

4. Approval Information

4.1. FCC

4.1.1. FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received,
Including interference that may cause undesired operation

4.1.2. RF Exposure Statement

The equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

4.1.3. Do not

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

5. RF Information

5.1. Radio Frequency Range

2.402~2.480GHz

5.2. Number of Frequency Channel

79 channels

5.3. Transmission Method

FHSS(Frequency Hopping Spread Spectrum)

5.4. Modulation Method

GFSK(Gaussian-filtered Frequency Shift Keying)

5.5. Radio Output Power

Products	Radio Output Power
SD200L	+4dBm

5.6. Receiving Sensitivity

Products	Radio Output Power
SD200L	-80dBm

5.7. Power Supply

Products	Radio Output Power
SD200L	DC5.0~12V

Appendix A: Connections

A.1. Serial Port Pin Outs

Parani-SD200L is a DCE device compatible with the RS232 standard, a DB9 female interface.

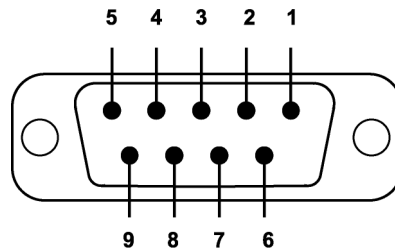


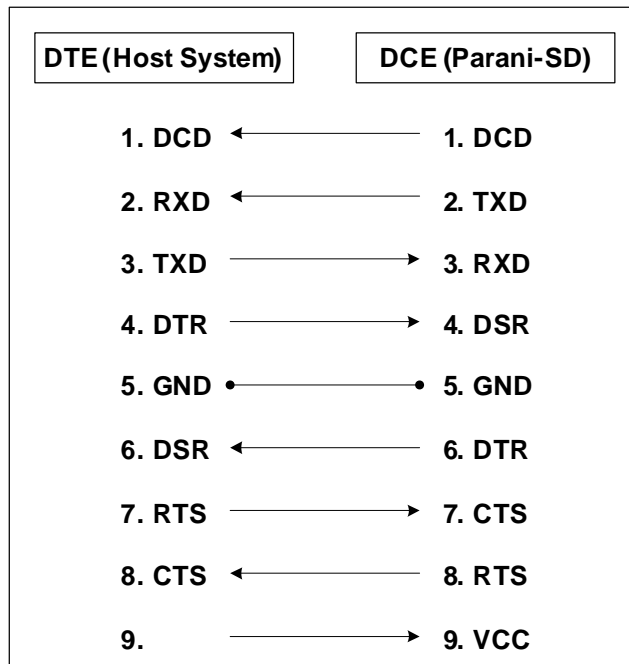
Figure A-1 Pin layout of the DB-9 female connector

Table A-1. Pin assignment of the DB-9 female connector

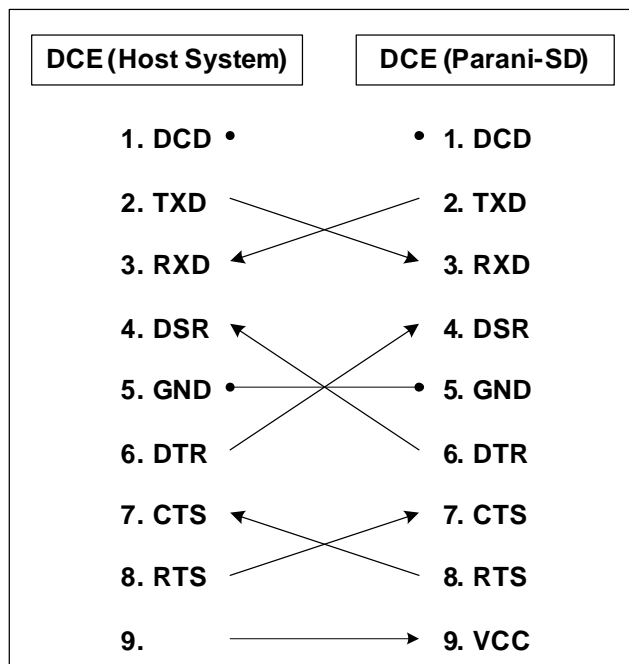
Pin #	Signal	Direction	Description
1	DCD	Output	Bluetooth Connect Detect
2	TxD	Output	Transmitted Data
3	RxD	Input	Received Data
4	DSR	Input	DTE Ready
5	GND	-	Signal Ground
6	DTR	Output	DCE Ready
7	CTS	Input	Clear to Send
8	RTS	Output	Request to Send
9	Vcc	Input	(5V~12V)

A.2. Serial Wiring Diagram

A.2.1. To Host with DTE Interface



A.2.2. To Host with DCE Interface



Appendix B: AT Commands

B.1. Terminology

B.1.1. AT Command

AT command set is the in fact standard, language for controlling modems. The AT command set was developed by Hayes and is recognized by virtually all personal computer modems. Parani-SD200L provides the extended AT command set to control and configure the serial parameters and Bluetooth connection.

B.1.2. AT Response

Parani-SD200L replies to AT commands with 4 kinds of message, 'OK', 'ERROR', 'CONNECT' and 'DISCONNECT'.

B.1.3. Operation Mode

Mode	Description
Mode0	Waiting for AT commands
Mode1	Attempting to connect the last connected Bluetooth device
Mode2	Waiting for the connection from the last connected Bluetooth device
Mode3	Waiting for the connection from any other Bluetooth device

B.1.4. Operation Status

Status	Description
Standby	Waiting for AT commands
Pending	Executing tasks
Connect	Transmitting data

B.1.5. Security

Security	Description
Authentication	Pin Code (or Pass key)
Encryption	Data encryption

B.1.6. Symbols

The symbols are used for the description of command syntax as follows:

Symbols	Meaning	ASCII Code
↵	Carriage return	0x0D
↵	Line feed	0x0A
↵↵	Carriage return + Line feed	
112233445566	Bluetooth device address	
N or m	One digit decimal number	
to	Timeout in seconds	

B.2. Command Category

Command Category	Index	AT Commands			
RESET	1 2	ATZ AT&F			
SERIAL PORT	3 4	AT AT+UARTCONFIG,b,p,s			
BLUETOOTH	Information	5 6 7 8 9	AT+USEDIP? AT+BTINFO? AT+BTINQ? AT+BTLAST? AT+BTVER?		
		Mode	10	AT+BTMODE,n	
		Status	11 12 13 14 15 16 17	+++ AT+SETESC,nn ATO AT+BTCANCEL AT+BTSCAN AT+BTSCAN,n,to AT+BTSCAN112233445566,to	
			Connection	18 19 20	ATD ATD112233445566 ATH
				Security	21 22 23 24 25
	Miscellaneous				26 27 28
		S-REGISTER	29 30 31		AT&V ATSnn? ATSnn=mm

B.3. Command Description

B.3.1. ATZ↵

SD Response	↵OK↵
Purpose	Software Reset
Description	This has the same effects as Powercycling the unit. This command disconnects any connected Bluetooth device, and stops ongoing tasks. After rebooting, the status will be decided by the preset operation mode. Some AT commands require the ATZ command be run so that the commands can take effect.
Reference	AT&F, AT+BTCSD, AT+UARTCONFIG

B.3.2. AT&F↵

SD Response	↵OK↵
Purpose	Hardware reset
Description	This has the same effect as initialization by pressing the factory reset button. All parameters are initialized to factory defaults.
Reference	ATZ

B.3.3. AT↵

SD Response	↵OK↵
Purpose	Check the connection status with host equipment
Description	Check if the connection to host equipment is operating normally. The serial parameters of Parani-SD200L must be same as those of host equipment. If not, the SD will not respond or 'ERROR' message will appear or an abnormal sequence of strings will appear.
Reference	AT+UARTCONFIG, ATZ, AT&F

B.3.4. AT+UARTCONFIG,Baudrate,Parity,Stopbit↵

SD Response	↵OK↵
Purpose	Set Serial parameters
Parameters	Baudrate=1200/2400/9600/14400/19200/38400/57600/115200/230400 (Default=9600) Parity=N/E/O (Default=N) Stopbit=1/2 (Default=1)
Description	The Serial parameters can be set or changed only if SW config mode is selected in dip switch. The factory default is 9600, N, 1. To take effect the ATZ command must be used or Powercycle the unit.
Reference	AT, ATZ, AT&F, ATS
Example	AT+UARTCONFIG,9600,N,1

B.3.5. AT+USEDIP?↵

SD Response	↵m↵
Purpose	Check the Baud rate set by the dip switch
Description	m=0: Dip switches are set to 'S/W Config' m=1: Please view the dipswitches to view your baud rate.
Reference	AT, ATZ, AT&F, ATS

B.3.6. AT+BTINFO?↵

SD Response	↵112233445566,DeviceName,Mode,Status,Auth,Encryp,FlowControl↵ ↵OK↵
Purpose	Display Bluetooth settings
Description	The current Bluetooth settings are displayed including BD address, Device name, Operation mode, Operation status, Authentication, Data Encryption, and Hardware Flow Control. The initial value of Device name is 'PSD200Lv1.0.0-445566'. PSD200L stands for Parani-SD200L, v1.0.0 for the version of firmware, and 445566 for the last 6 digits of BD address. Mode=MODE0/MODE1/MODE2/MODE3 Status=STANDBY/PENDING/CONNECT Auth=0/1 (Authentication is not activated when 0) Encrypt=0/1 (Encryption is not activated when 0) FlowControl=HWFC/NoFC
Reference	AT+BTNAME, AT+BTMODE, AT+BTSEC, ATS14?

B.3.7. AT+BTINQ?↵

SD Response	↵112233445566,FriendlyName,CoD↵ ↵112233445566,FriendlyName,CoD↵ ↵112233445566,FriendlyName,CoD↵ ↵OK↵
Purpose	Search Bluetooth devices nearby
Description	The Bluetooth devices in Inquiry scan mode nearby are displayed with their BD addresses, Device names, and Class of device. Maximum 15 devices are scanned for 30 seconds. (Default 10 value in S-register 6)
Reference	AT+BTSCAN, ATD, AT+BTINFO?

B.3.8. AT+BTLAST?↵

SD Response	↵112233445566↵
Purpose	Display the BD address of the last connected device
Description	The Bluetooth device last connected to this Parani-SD200L is displayed with its BD address.
Reference	AT+BTSCAN, ATD, AT+BTINFO?, AT+BTINQ?

B.3.9. AT+BTVER?↵

SD Response	↵SD100v1.0.0↵ ↵OK↵
Purpose	Display device firmware version
Description	Display device firmware version
Reference	AT+BTINFO?

B.3.10. AT+BTMODE,n↵

SD Response	↵OK↵
Purpose	Set operation mode
Parameters	n=0: MODE0 (Default) n=1: MODE1 n=2: MODE2 n=3: MODE3
Description	When the operation status is 'Pending' currently, change the status to 'Standby' with AT+BTCANCEL prior to this command. To take effect the ATZ must be executed or Powercycle the unit
Reference	AT+BTINFO?
Example	AT+BTMODE,2 ↵OK↵ ATZ

B.3.11. +++↵

SD Response	↵OK↵
Purpose	Convert the operation status of 'Connect' to 'Standby'
Description	In 'Connect' status, data from host is transmitted to the other side Bluetooth device, and any AT command is not accepted but this command, which is not echoed on the screen. When Parani-SD200L encounters a character '+' from host, it stops the data transmission and waits for next 2 characters. If the next 2 characters aren't both '+', it restart to transmit data including the first '+' as well. If not, it converts the operation status to 'Standby'. If the data from host includes '+++', it will convert the operation status to 'Standby'. Notice that Parani-SD200L holds data transmission when it encounters '+', until receiving next character. '+' is an escape sequence character by default, which is changeable by AT+SETESC.
Reference	AT+SETESC, ATO, AT+BTCANCEL

B.3.12. AT+SETESC,nn↵

SD Response	↵OK↵
Purpose	Change the escape sequence character
Description	Escape sequence character set to '+' by default is changeable.

	The parameter nn must be a printable character.
Reference	+++ , ATO
Example	AT+SETESC,42

B.3.13. ATO↵

SD Response	None
Purpose	Convert the operation status of 'Standby' to 'Connect'
Description	You can convert the operation status of 'Standby' to 'Connect' ready to transmit data.
Reference	+++ , AT+SETESC

B.3.14. AT+BTCANCEL↵

SD Response	↵OK↵
Purpose	Terminate the current task
Description	This terminates a current executing task, such as Inquiry scan and Page scan, then converts the operation status to 'Standby'
Reference	AT+BTSCAN, ATD, AT+BTINQ?

B.3.15. AT+BTSCAN↵

SD Response	↵OK↵ ↵CONNECT 112233445566↵
Purpose	Wait for inquiry and connection from other Bluetooth devices
Description	This allows the inquiry and connection from the other Bluetooth devices. The operation status will be in 'Pending' after this command. When connection is made and released, the operation status is back set to 'Pending'. To convert the operation status to 'Standby' AT+BTCANCEL must be used. This has the same effect as AT+BTSCAN,3,0. When a connection is made with another Bluetooth device, SD response will be 'CONNECT' with its BD address.
Reference	ATD, AT+BTINQ?, AT+BTCANCEL

B.3.16. AT+BTSCAN,n,to↵

SD Response	↵OK↵ ↵CONNECT 112233445566↵ or ↵OK↵ ↵ERROR↵
Purpose	Wait for inquiry and connection from other Bluetooth devices for a given duration
Parameters	n=1: Allows Inquiry scan n=2: Allows Page scan n=3: Allows both of Inquiry scan and Page scan

	to= Time duration in seconds
Description	For the given to, Parani-SD200L is waiting for the inquiry and connection from other Bluetooth devices. If the parameter of to is 0, it will wait forever. When connection is made with other Bluetooth device, SD response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, SD response is 'ERROR' and the operation status becomes to 'Standby'.
Reference	ATD, AT+BTINQ?, AT+BTCANCEL
Example	AT+BTSCAN,2,30

B.3.17. AT+BTSCAN112233445566,to

SD Response	OK CONNECT 112233445566 or OK ERROR
Purpose	Wait for connection by a Bluetooth device with a given BD address
Parameters	112233445566=BD address to= time duration in seconds
Description	Parani-SD200L will wait to be connected to by the Bluetooth device with the given BD address. If the parameter of to is 0, it will wait forever. When connection is made with the Bluetooth device, SD response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, SD response is 'ERROR' and the operation status becomes 'Standby'.
Reference	ATD, AT+BTINQ?, AT+BTCANCEL
Example	AT+BTSCAN000B530011FF,30

B.3.18. ATD

SD Response	OK CONNECT 112233445566 or OK ERROR
Purpose	Connect to the last connected Bluetooth device
Description	Parani-SD200L saves the BD address of the Bluetooth device most recently connected to. If it fails to make a connection, SD response will display an 'ERROR'.
Reference	AT+BTINQ?, AT+BTSCAN

B.3.19. ATD112233445566

SD Response	OK CONNECT 112233445566 or OK ERROR
Purpose	Connect to a specific Bluetooth device with a given BD address

Parameters	112233445566 = BD address
Description	Parani-SD200L attempts to connect to the Bluetooth device with the given BD address. To make successful connection, the Bluetooth device must be in Page scan mode. This attempt continues for 5 minutes. If it fails to make connection, SD response is 'ERROR '.
Reference	AT+BTINQ?, AT+BTSCAN
Example	ATD000B530011FF

B.3.20. ATH←

SD Response	↵OK↵ ↵DISCONNECT↵
Purpose	Release the current connection
Description	The current Bluetooth connection will be disconnected. It takes about 30 seconds to detect an abnormal disconnection such as power off and moving out of service range.
Reference	ATD, AT+BTSCAN

B.3.21. AT+BTKEY=\$string←

SD Response	↵OK↵
Purpose	Change pin code
Parameters	\$string= New pin code (Default="1234")
Description	Pin code is a string, which allows up to 16 alpha-numeric characters. Based on this pin code, Parani-SD200L generates a link key which is used in actual authentication process
Reference	AT+BTCSD, AT+BTFP, AT+BTSD?, AT+BTSEC, ATZ, AT&F
Example	AT+BTKEY="apple"

B.3.22. AT+BTSD? ←

SD Response	↵112233445566↵ ↵OK↵
Purpose	Display a list of Bluetooth devices sharing the same pin code
Description	Once a connection is made with a pin code, Parani-SD200L saves the Bluetooth device with its link key, generated by the pin code. The connection to a device listed in Parani-SD200L can be made automatically without the authentication process. The maximum number kept on the list is 5.
Reference	AT+BTCSD, AT+BTFP, AT+BTKEY, AT+BTSEC, ATZ, AT&F

B.3.23. AT+BTCSD←

SD Response	↵OK↵
Purpose	Clear the list of Bluetooth devices sharing the same pin code

Description	This clears the list of Bluetooth devices linked with the same key in flash memory. To take effect the ATZ command must be used or Powercycle the unit.
Reference	AT+BTFTP, AT+BTKEY, AT+BTSD?, AT+BTSEC, ATZ, AT&F

B.3.24. AT+BTFTP,*n*

SD Response	↵OK↵
Purpose	Set generation of link key every time of connection
Parameters	<i>n</i> =0: Inactivate (Default) <i>n</i> =1: Activate
Description	If <i>n</i> is set to 1, Parani-SD200L asks for the pin code every time a connection is made. This can be used to increase security.
Reference	AT+BTCSO, AT+BTKEY, AT+BTSD?, AT+BTSEC, ATD, ATZ, AT&F

B.3.25. AT+BTSEC,Authentication,Encryption

SD Response	↵OK↵
Purpose	Set authentication and data encryption
Parameters	<i>Authentication</i> =0: Inactivate (Default) <i>Authentication</i> =1: Activate <i>Encryption</i> =0: Inactivate (Default) <i>Encryption</i> =1: Activate
Description	If the authentication is activated, the pin code must be set by AT+BTKEY command. Data encryption cannot be used when authentication is not enabled, i.e. <i>Authentication</i> =0 and <i>Encryption</i> =1 will not work properly.
Reference	AT+BTCSO, AT+BTFTP, AT+BTSD?, AT+BTSD?, ATZ, AT&F

B.3.26. AT+BTNAME=*\$string*

SD Response	↵OK↵
Purpose	Change device name
Parameters	<i>\$string</i> = New device name (Default="PSDv3b-445566")
Description	Parani-SD200L can have a user friendly name for easy identification. The name allows up to 30 alpha-numeric characters.
Reference	AT+BTINFO?, AT+BTINQ?
Example	AT+BTNAME="My-Parani-SD"

B.3.27. AT+BTLPM,*n*

SD Response	↵OK↵
Purpose	Set low power mode

Parameters	n=0: Inactivate (Default) n=1: Activate
Description	During no data transmission, Parani-SD200L can be in low power mode to save the power. It takes a few seconds to wake the Parani-SD200L out of low power mode.

B.3.28. AT+BTRSSI,n↵

SD Response	↵OK↵ ↵0,255,0,0↵ (repeatedly)
Purpose	Test signal strength
Parameters	n=0: Stop signal strength test n=1: Start signal strength test
Description	When Bluetooth connection is established, you can use this command in Standby status. The signal strength will be displayed repeatedly in order of Status, LinkQuality, Status, RSSI. If the LinkQuality is close to 255 and RSSI is close to 0, the signal strength is in good standing.
Example	+++ AT+BTRSSI,1 ↵OK↵ 0,255,0,0

B.3.29. AT&V↵

SD Response	↵S0:m0;S1:m1; ...Sn:mn↵ ↵OK↵
Purpose	Display all the S-registers
Description	All parameters are stored at S-register in flash memory. These values are sustained until a hardware reset.
Reference	ATS

B.3.30. ATSnn? ↵

SD Response	↵value↵ ↵OK↵
Purpose	Display a given S-register
Parameters	nn= Address of S-register
Description	A specific S-register will be displayed.
Reference	AT&V

B.3.31. ATSnn=mm↵

SD Response	↵OK↵
Purpose	Change S-register value

Parameters	nn= Address of S-register mm= New value of S-register
Description	Some S-registers are optimized for the overall performance and protected and cannot be changed. When users try to change these S-registers, SD response is 'ERROR'. For details of S-register, refer Appendix. B.
Reference	AT&V
Example	ATS10=0

B.4. Command Validity

AT Command	Operation Status		
	Standby	Pending	Connect
AT	○	○	
ATZ	○	○	
AT&F	○	○	
AT+BINQ?	◎		
ATD112233445566	◎		
ATD	◎		
AT+BTSCAN	◎		
AT+BTSCAN,n,to	◎		
AT+BTSCAN112233445566,to	◎		
AT+BTCANCEL		○	
+++			○
AT+SETESC	◎		
ATO	●		
ATH	●		
AT+BTSEC,Auth,Encr	◎		
AT+BTLAST?	○	○	
AT+BTMODEn	◎		
AT+BTNAME="Name"	◎		
AT+BTKEY="nnnn"	◎		
AT+BTINFO?	○		
AT+BTLPM,n	◎		
AT+BTSD?	○	○	
AT+BTCSD	◎		
AT+BTFP,n	◎		
AT+UARTCONFIG,b,p,s	◎		

AT+USEDIP?	<input type="radio"/>	<input type="radio"/>	
AT+BTVER?	<input type="radio"/>	<input type="radio"/>	
AT+BTRSSI,n	<input checked="" type="radio"/>		

⊙ Valid only when Parani-SD200L is not connected to other Bluetooth device.

● Valid only when Parani-SD200L is connected to other Bluetooth device.

Appendix C: S-Register

S-registers contains 46 parameters for the Parani-SD200L. These are stored in flash memory and the values will be saved unless hardware reset is executed. The value of S-register can be accessed and changed with ATS command. Some S-registers not shown below are set to maximize the performance of Parani-SD200L. Thus it is not recommended to change these S-registers.

Changing the values of S-register can only be done in the Standby mode. Turn SD off and on.

C.1. S1: Force to Reconnect (default 1)

S1=0, Parani-SD200L in Mode1 does not try to reconnect when disconnected.

S1=1, Parani-SD200L in Mode1 keeps trying to reconnect when disconnected.

C.2. S3: Stream UART Policy (default 0)

S3=0, the priority of UART streaming is throughput.

S3=1, the priority is latency, which minimizes the delay of data transmission. This is useful in case of transmitting very small data quickly.

When this value is 1, in order to minimize latency, SD sends the received data immediately. When this value is 0, the SD maximizes throughput, the SD stores received data for a short time and sends a large data packet. If the packet length is less than 100 bytes, having latency being the priority is recommended. If the packet length is more than 100 bytes, having throughput as the priority is recommended. Also, if you want to use high baudrate, throughput priority will be more effective. Just for reference, the buffer length for receiving data is 2 Kbytes.

C.3. S4: Enable Remote Name Query (default 1)

S4=0, Parani-SD200L will query only the BD address. This speeds up the inquiry process.

S4=1, Parani-SD200L will query the BD address, device name and class of device.

When this value is 1, SD finds not only BD address but also friendly name. When this value is 0, SD finds only BD address. When set to 0 this will make queries much faster. When using the pairing button, finding friendly name will be omitted automatically.

C.4. S6: Enable Low Power Mode (default 0)

S6=0, deactivate Low Power Mode.

S6=1, activate Low Power Mode.

This value decides whether SD works in Low Power Mode or not. When this value is 0, SD works only in active power mode. When SD works in Low Power mode, delay in transferring data may occur.

C.5. S10: Enable Response Message (default 1)

S10=0, Parani-SD200L does not send response messages to the host system.

S10=1, Parani-SD200L sends response messages to host system.

This value decides whether SD sends response messages such as OK, ERROR, CONNECT, DISCONNECT or not. When this value is 0, SD will not send any response messages. If the response messages conflicts with your host programs or devices that is connected to SD, change this value to 0.

C.6. S11: Enable Escape (default 1)

S11=0, Parani-SD200L does not allow escape sequence characters. The operation status of Connect cannot be changed to Standby. Since the Parani-SD200L skips the process of detecting escape sequence characters, more efficient data transmission can be had.

S11=1, Parani-SD200L allows for the escape sequence characters. Whenever it is needed, the Connect status can be changed to Standby.

C.7. S12: Clear Data Buffer When Disconnected (default 0)

S12=0, Parani-SD200L does not clear the data buffer when disconnected.
S12=1, Parani-SD200L clears the data buffer when disconnected.

C.8. S13: Enable DCD Signal (default 1)

S13=0, DCD signal off
S13=1, DCD signal on

C.9. S14: Enable DTR Transfer (default 1)

S14=0, DTR/DSR signal is transferred in a loop-back fashion.
S14=1, DTR signal is transferred to DSR of remote device.

C.10. S15: Enable Disconnect by DTR (default 0)

S15=0, DTR signal cannot release the connection.
S15=1, The Bluetooth connection can be released when DTR signal is off.
This value decides whether Bluetooth connection is released when DTR signal drops or not. If this value is 1, you can use DTR signal in order to disconnect Bluetooth connection.

C.11. S22: Faster Connection (default 0)

S22=0, none
S22=1, page scan
S22=2, inquiry scan
S22=3, page/inquiry scan
Connecting time is average 1.5sec faster than normal mode.

C.12. S24: Maximum Number of Inquiry Result (default 10)

The maximum number of inquiry list can be controlled. This value is up to 15.

C.13. S28: Escape Sequence Character (default 43)

The decimal number of the ASCII code of escape sequence character can be controlled. The initial value is 43, the ASCII code of '+'.
The decimal number of the ASCII code of escape sequence character can be controlled. The initial value is 43, the ASCII code of '+'.

C.14. S31: Page Timeout (default 300)

This is the timeout in seconds to attempt connection with the ATD command. After this timeout expires, the SD will restart automatically. If this value is 0, SD will attempt to connect without restarting

C.15. S33: Inquiry Timeout (default 30)

This is the timeout in seconds to execute inquiry scan.

C.16. S37: Supervision Timeout (default 16000)

This is the timeout in 625μsec to presume disconnection, which is set to 16000 initially. (16000×625μsec=10sec)
The smaller the value becomes, the more quickly Parani-SD200L can detect an abnormal disconnection. But when the communication is suspended, it may be regarded as disconnection.

C.17. S46: BD Address of Last Connected Device

This saves the BD address of the Bluetooth device connected most recently.

Appendix D: Trouble Shooting

D.1. No Data Transmission

D.1.1. COM Port Settings

Check whether the Baud rate of Parani-SD200L matches that of its host equipment.

Check whether the host equipment has a Data bit setting of 8. Parani-SD200L supports only 8 Data bit settings. If your host equipment uses 7 Data bit and even or odd parity, it may work with a 8 Data bit and No parity setting. This is valid only when both DCE devices are the Parani-SD200L. In this case, set both Parani-SDs to 8 Data bit and No parity. If one of DCE devices is another Bluetooth device such as Bluetooth USB dongle, 7 bit data configurations will not work.

Check whether the Parity and Stop bit of Parani-SD200L match those of your host equipment. Parani-SD200L supports No parity, Even parity and Odd parity, 1 and 2 Stop bit configurations.

Check whether the host equipment of Parani-SD200L uses Hardware Flow Control. Parani-SD200L is initially set to Use of Hardware Flow Control. If your host equipment does not use Hardware Flow Control, please disable the Hardware flow control option by way of the dipswitch.

Parani-SD200L does not support RS-232 break signal.

D.1.2. Pin Assignment

Parani-SD200L is a DCE device. If your host equipment is DTE, plug Parani-SD200L directly to the host equipment or use straight RS-232 cable. If your host equipment is DCE, use will need to use a cross over RS-232 cable (Null modem cable) or a Male to Male DB9 Null Modem adapter.

D.2. Data Loss or Malfunctioning

D.2.1. Hardware Flow Control

When transmitting large amounts of data with No Hardware Flow Control, Parani-SD200L may clear the data buffer unexpectedly. The possibility becomes greater as the RF transmission environment becomes worse.

D.2.2. Response Message

AT response messages from the Parani-SD200L may affect the host system unexpectedly. Do not use Parani-SD200L if your applications cannot allow for this wireless time delay.

D.3. Transmission Delay

D.3.1. RF Processing Delay

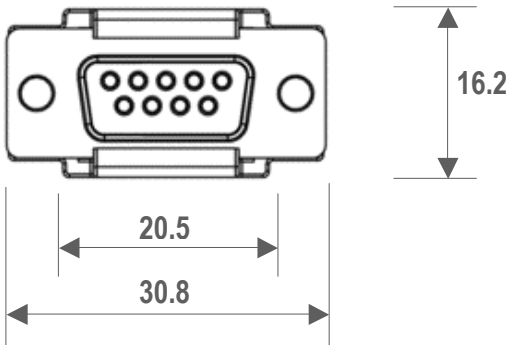
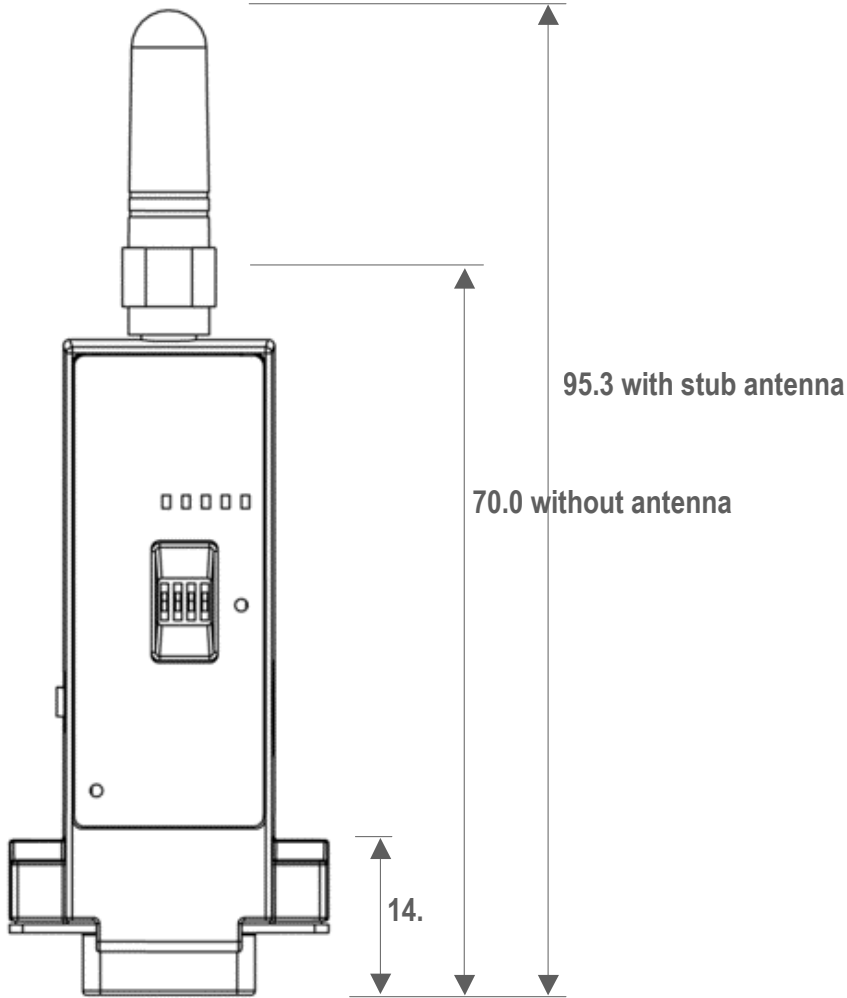
It takes 30msec approximately for a Parani-SD200L to complete a data transmission to the other Bluetooth device. This time delay cannot be reduced and may enlarge as the RF transmission environment becomes worse. Do not use Parani-SD200L if your applications cannot allow for this time delay.

D.3.2. RF Transmission Environment

If there are many Bluetooth devices working in a small area and/or the RF communication distance is too great and/or there are some obstacles affecting RF performance, the Parani-SD200L repeats the transmission packet by packet due to interferences and/or low RF performance. This may lead to increased data transmission time delays.

Appendix E: SD200L mechanical drawing

E.1. SD200L mechanical drawing



Appendix F: Warranty

F.1. GENERAL WARRANTY POLICY

Sena Technologies, Inc. (hereinafter referred to as SENA) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at SENA's discretion, of defective or non-conforming Product, and SENA shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misapplication or misuse of the Product; (b) failure of Customer to adhere to any of SENA's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by SENA.

Limited warranty service may be obtained by delivering the Product to SENA or to the international distributor it was purchased through and providing proof of purchase or receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to SENA, and to use the original shipping container or equivalent.

F.2. LIMITATION OF LIABILITY

EXCEPT AS EXPRESSLY PROVIDED HEREIN, SENA MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY EQUIPMENT, PARTS OR SERVICES PROVIDED PURSUANT TO THIS AGREEMENT, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NEITHER SENA NOR ITS DEALER SHALL BE LIABLE FOR ANY OTHER DAMAGES, INCLUDING BUT NOT LIMITED TO DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION IN CONTRACT OR TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), SUCH AS, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR BENEFITS RESULTING FROM, OR ARISING OUT OF, OR IN CONNECTION WITH THE USE OF FURNISHING OF EQUIPMENT, PARTS OR SERVICES HEREUNDER OR THE PERFORMANCE, USE OR INABILITY TO USE THE SAME, EVEN IF SENA OR ITS DEALER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL SENA OR ITS DEALERS TOTAL LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT.

F.3. HARDWARE PRODUCT WARRANTY DETAILS

WARRANTY PERIOD: SENA warranties embedded hardware Product for a period of one (1) year, and external hardware Product for a period of three (3) or five (5) years according to the Product type.

WARRANTY PROCEDURE: Upon return of the hardware Product SENA will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of SENA. If SENA determines that the Product is not under warranty, it will, at the Customers option, repair the Product using current SENA standard rates for parts and labor, and return the Product at no charge in or out of warranty.

WARRANTY EXCLUSIONS: Damages caused by

- Accidents, falls, objects striking the SENA product,
- Operating the Product in environments that exceed SENA's temperature and humidity specifications,
- Power fluctuations, high voltage discharges,
- Improper grounding, incorrect cabling,
- Misuse, negligence by the customer or any other third party,
- Failure to install or operate the product (s) in accordance to their SENA User Manual,
- Failure caused by improper or inadequate maintenance by the customer or any other third party,
- Floods, lightning, earthquakes,

- Water spills,
- Replacement of parts due to normal wear and tear,
- Hardware has been altered in any way,
- Product that has been exposed to repair attempts by a third party without SENA's written consent,
- Hardware hosting modified SENA Software, or non-SENA Software, unless modifications have been approved by SENA.
- Battery component capacity degradation due to usage, aging, and with some chemistry, lack of maintenance.

F.4. SOFTWARE PRODUCT WARRANTY DETAILS

WARRANTY PERIOD: SENA warranties software Product for a period of one (1) year.

WARRANTY COVERAGE: SENA warranty will be limited to providing a software bug fix or a software patch, at a reasonable time after the user notifies SENA of software non-conformance.

F.5. THIRD-PARTY SOFTWARE PRODUCT WARRANTY DETAILS

The warranty policy of the third-party software is conformed to the policy of the corresponding vendor