

Parani-ESD100/110/200/210

User Guide

Version 1.0.0

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User Guide for the Parani-ESD100/110/200/210

Version 1.0.0

Firmware version 1.0.X

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Notice to Users

When a system failure may cause serious consequences, protecting life and property against such consequences with a backup system or safety device is essential. The user agrees that protection against consequences resulting from system failure is the user's responsibility.

This device is not approved for life-support or medical systems.

Changes or modifications to this device not explicitly approved by Sena Technologies will void the user's authority to operate this device.

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Electricity

Use only the supplied AC adapter. Use of unauthorized power adapter is not recommended. Electrical shock may result.

Do not kink or crease the power cable or place heavy objects on the power cable. Fire can result from damaged power cables.

Do not handle power plug and adapter with wet hands. Electrical shock may result.

Immediately power off the product and unplug the AC adapter if smoke or odors emit from the product and adapter. Fire can result from improper use.

Immediately power off the product and unplug the AC adapter if water or other liquids are present. Fire can result from improper use.

Product

Parani-ESD meets the RS-232 standards. Do not wire with non-standard products. Damage to your products may result from improper use.

Do not drop or subject the device to impact. Damage to your products may result from improper use.

Keep away from harsh environments including humid, dusty, and smoky areas. Damage to your products may result from improper use.

Do not use excessive force on the buttons or attempt to disassemble the device. Damage to your products may result from improper use.

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-ESD is a module device for wireless serial communication using the Bluetooth technology that is international standard of short range wireless communications. Parani-ESD accomplishes more reliable wireless communication. As Parani-ESD can communicate with other Bluetooth devices, user may construct various communications with it.

Parani-ESD provides several models with different communication ranges from 30m (Parani-ESD200/210) up to 100m (Parani-ESD100/110) for user's various applications. In terms of noise, Parani-ESD delivers better quality of communication than standard RS232 cables.

Parani-ESD has the most compact design of the same kind devices and can be placed conveniently into any devices or equipments. Its detachable antenna of variety optimizes the quality and distance of wireless communications.

Parani-ESD can be configured and controlled by typical AT commands. User can easily configure Parani-ESD on the terminal program such as HyperTerminal and implements the wireless communication without modifying user's existing serial communication program. In addition to the basic AT commands, Parani-ESD provides some expanded AT commands for its various functions. User friendly ParaniWizard and ParaniWIN are also provided for easy setup on Microsoft Windows.

The FHSS (Frequency Hopping Spread Spectrum) technique of Bluetooth lets Parani-ESD have less radio interference and no danger of hacking in air. Parani-ESD also supports authentication and data encryption.

1.2. Package Check List

- Parani-ESD100/110/200/210
- [A hardcopy of Quick Start Guide](#)
- CD-ROM [including the HelloDevice Manager and User Guide](#)

1.3. Product Specification

	ESD100/110	ESD200/210
Serial Interface	Serial speeds 1200bps to 230400bps Flow Control: None, Hardware RTS/CTS	
	2.54mm Header 2X6	2.54mm Header 1X4X2
Bluetooth Interface	Bluetooth v1.2	
	Protocol: RFCOMM, L2CAP, SDP	
	Profile: General Access Profile, Serial Port Profile	
	Class 1	Class 2
	Level: 18dBm	Level: 2dBm
	ESD100-Working distance: Nominal 100m ESD110-Working distance: Up to 100m	ESD210-Working distance: Nominal 30m ESD210-Working distance: Up to 30m
Configuration	ParaniWIN, ParaniWizard, Modem AT command set	
Firmware Update	ParaniUpdater for SD&ESD	
Power	Supply voltage: DC3.3V	
Environmental	Operating temperature: -20 ~ 70 °C Humidity : 95% (Non-condensing)	
Physical properties	Dimension - ESD100 27.5 mm L (1.08 in.) 27.7 mm W (1.09 in.) 14.0 mm H (0.55 in.) - ESD110 27.5 mm L (1.08 in.) 30.0 mm W (1.18 in.) 14.0 mm H (0.55 in.)	Dimension - ESD200 18.0 mm L (0.7 in.) 20.0 mm W (0.78 in.) 11.7 mm H (0.47 in.) - ESD210 18.0 mm L (0.7 in.) 20.0 mm W (0.78 in.) 11.7 mm H (0.47 in.)
	Weight 5 g	Weight 2 g
Approvals	FCC, MIC	
Warranty	1-year limited warranty	

2. Getting Started

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

- 2.1 *Panel Layout* explains the panel layout.
- 2.2 *Connecting the Hardware* describes how to connect the Parani-ESD Series, the power, and the serial device to the Jig Board.

Following items are pre-required to get started.

- One Jig Board (included in the Starter Kit package).
- One DC power adapter or one USB power cable (included in the Starter Kit package).
- One serial console cable for configuration (included in the Starter Kit 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 Jig Board.

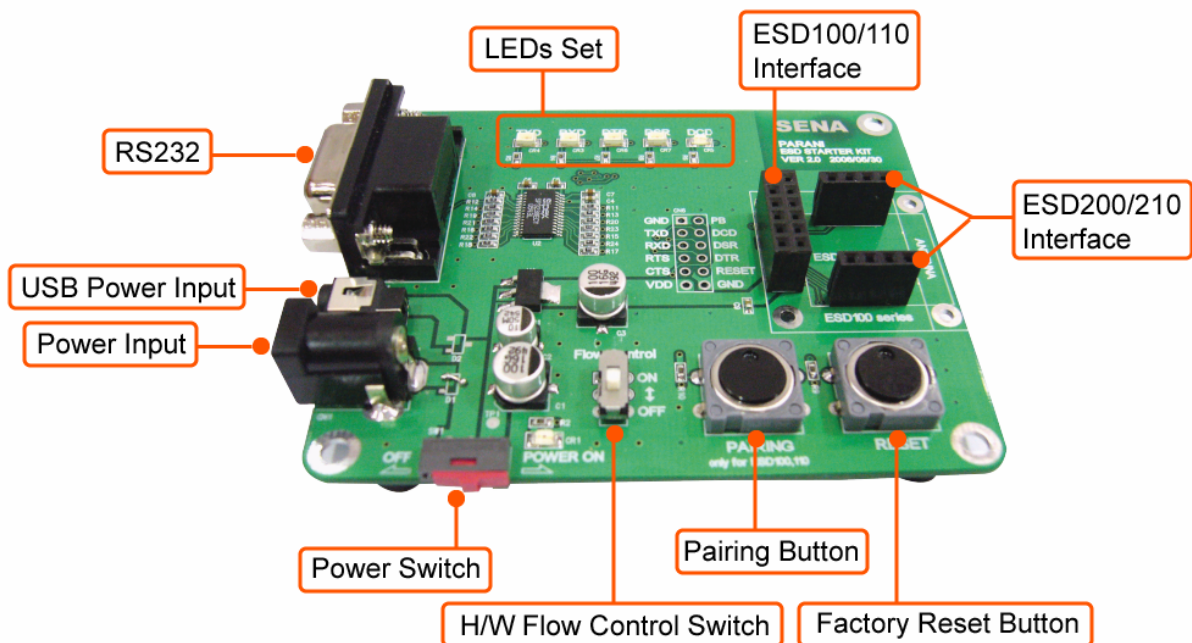


Figure 2-1 The panel layout of Jig Board

2.2. Connecting the Hardware

This section describes how to connect the Parani-ESD Series to the Jig Board and the Jig Board to the serial device for initial testing.

- Connect the Parani-ESD Series to Jig Board.
- Connect a power source to Jig Board for the Parani-ESD Series.
- Connect Jig Board for the Parani-ESD Series to a serial device.

2.2.1. Connecting Parani-ESD to Jig Board

Connect the Parani-ESD Series to the Jig Board as shown below.

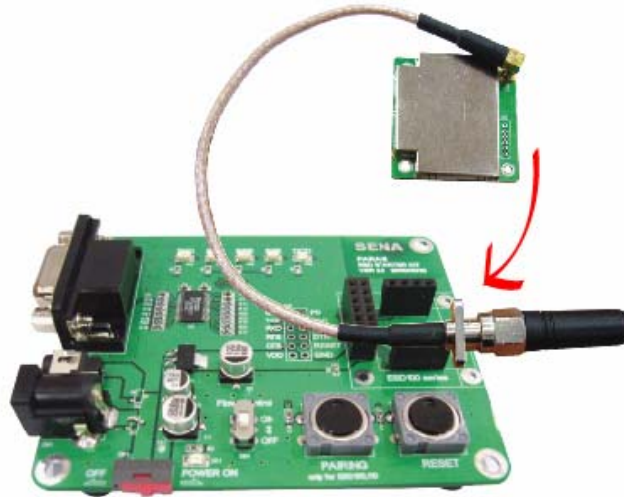


Figure 2-2 Connecting Parani-ESD to Jig Board

2.2.2. Connecting Power to Jig Board

Connect the power jack to the power connector of the Jig Board for the Parani-ESD Series using the DC power adapter or USB power cable that is included in the package.

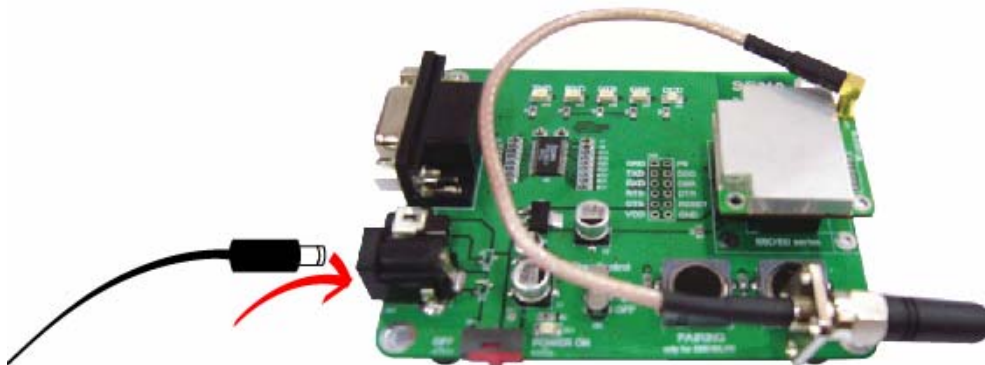


Figure 2-3 Connecting Power to Jig Board

2.2.3. Connecting a Device to Jig Board

Connect the serial data cable between the Jig Board and the serial device. If necessary, supply the power to the serial device attached to the Jig Board.

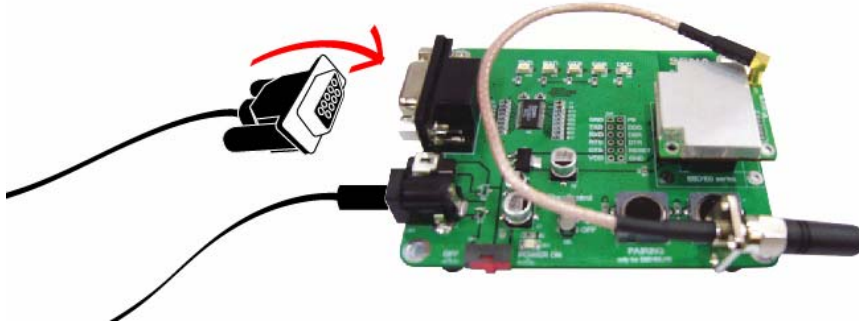


Figure 2-4 Connecting a Device to Jig Board

3. Configuration

3.1. Operation Modes

In addition to the serial port configurations such as bit/second, data bit, parity, stop bit, flow control, Parani-ESD has some configurations for Bluetooth. For getting the most out of Parani-ESD, 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 device, and slave is waiting to be connected from other Bluetooth devices. A Bluetooth connection is always made by a pair of master and slave. A slave can be in two modes, Inquiry Scan or Page Scan mode. Inquiry Scan mode is waiting the packet of inquiry from other Bluetooth devices and Page Scan mode is waiting the packet of connection from other Bluetooth devices. Every Bluetooth device has its unique address, called BD (Bluetooth Device) address, which is composed of 12 hexa-decimal numbers.

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

Table 3-1 The Parani-ESD Operation Modes

Mode	Description
Mode0	Parani-ESD must be in Mode0, when it is directly controlled by AT commands. In this mode, there is no response when power on or software reset, and Parani-ESD is just waiting for AT command input. Neither master nor slave is assigned to Parani-ESD in mode0. User can change the configurations of Parani-ESD in this mode. The factory default is set to Mode0.
Mode1	Parani-ESD tries to connect the last connected Bluetooth device. Parani-ESD in Mode1 is to be a master and tries to connect the last connected Bluetooth device. Parani-ESD always stores the BD address of the Bluetooth device to which Parani-ESD has connected last time. When Parani-ESD is initially used or after hardware reset, there is no BD address stored in Parani-ESD. In this case, Mode1 does not make any sense and mode change from other operation modes to Mode1 is not allowed. The mode change to Mode1 can be made after Parani-ESD succeeds to connect to other Bluetooth device in Mode0. Once changed to Mode1, Parani-ESD will try to connect automatically the last connected Bluetooth device whenever power on or software reset. Parani-ESD in Mode1 cannot be discovered or connected by other Bluetooth devices.
Mode2	Parani-ESD is waiting for the connection from the last connected Bluetooth device. Parani-ESD 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-ESD, the mode change from other operation modes to Mode2 is not allowed. Once changed to Mode2, Parani-ESD will wait for the connection from the last connected Bluetooth device whenever power on or software reset. Parani-ESD in Mode2 cannot be discovered or connected to Bluetooth devices other than the last connected device.
Mode3	Parani-ESD is waiting for the connection from any other Bluetooth devices. Parani-ESD in Mode3 acts like in Mode2, but allows any connection from other Bluetooth device. Most of general Bluetooth device is set to Mode3. Parani-ESD in Mode3 can be discovered and connected from any other Bluetooth devices.

3.2. Serial Ports

The applicable settings for serial ports are as follows.

Table 3-2 The Parani-ESD 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.

3.2.1. Data Bit

Parani-ESD supports only 8 data bit. In the case of 7 data bit, please contact the technical support.

3.2.2. Hardware Flow Control

Parani-ESD plugged into its host system transmits data from host to the other side Bluetooth device. These data is saved temporarily in the internal buffer of Parani-ESD 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 the transmission delay. If the host sends more data when the buffer is full, buffer overflow will make Parani-ESD malfunction consequently. In order to prevent this buffer overflow, Parani-ESD works as follows.

In case of using hardware flow control, Parani-ESD makes RTS be 'disable' to stop receiving further data from the host when the buffer becomes full. RTS will be 'able' to begin receiving data again from the host when the buffer has some room for more data.

In case of not using hardware flow control, Parani-ESD clears the buffer to secure the room for next data when the buffer becomes full. This means the loss of data. As the transmission data becomes large, the possibility of data loss goes higher.

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

3.2.3. Software and Utility

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

Table 3-3 Configuration Software

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

3.2.4. ParaniWIN

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

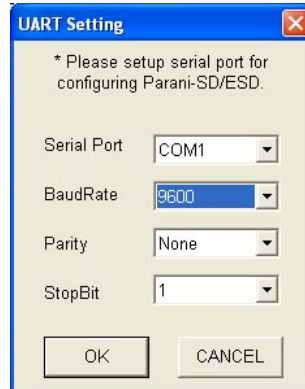


Figure 3-1 Serial Port Setting

Set each option properly and click [Confirm]. If the settings are different from the host computer, error message will pop up. If the Parani-ESD 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 3-2 Error Message Box

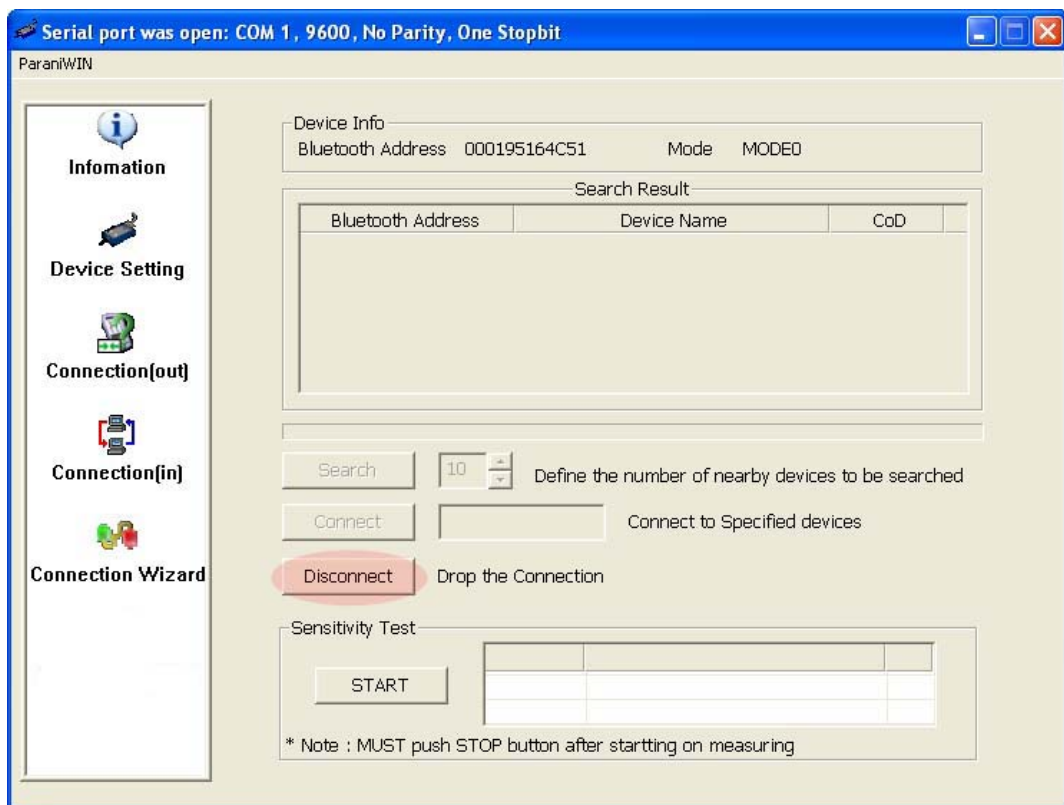


Figure 3-3 Main Window

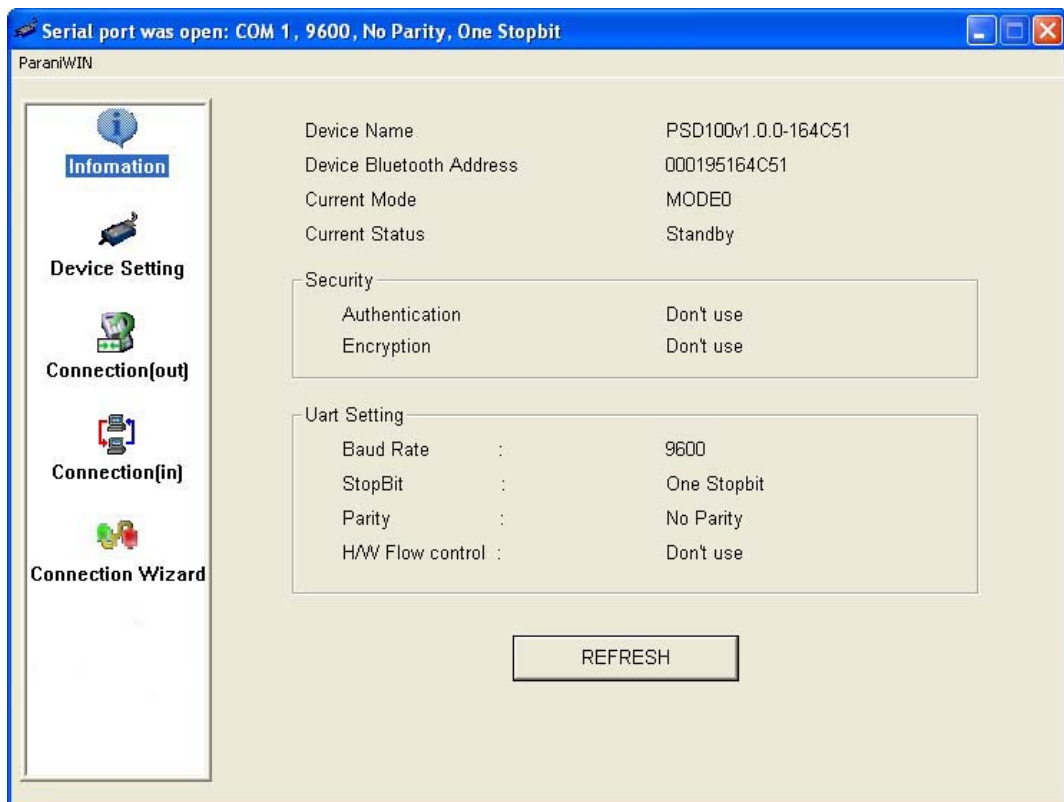


Figure 3-4 Information Window

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.

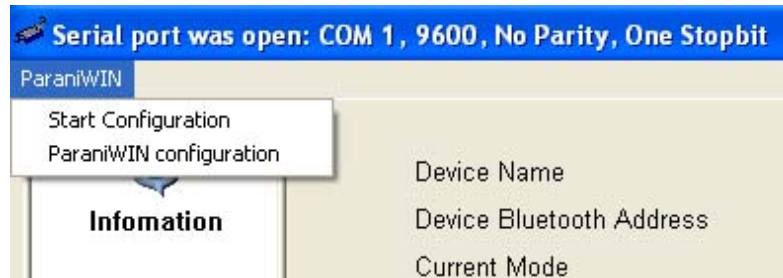


Figure 3-5 Menu Bar at Upper Left corner of ParaniWIN

The icons in the left side window come to the corresponding windows. 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.

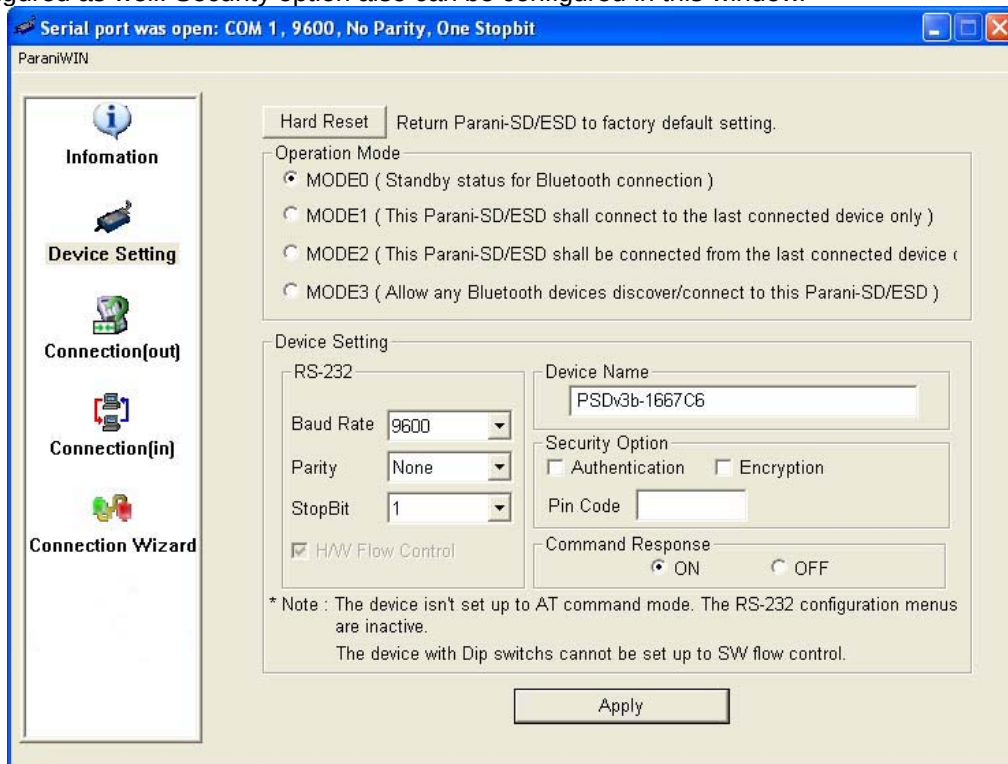


Figure 3-6 Device Setting Window

Parani-ESD supports two security options, Authentication and Encryption. If you check the Authentication option, you must also enter the Pin Code value. If the authentication is activated, the connection, only between the Master and Slave device that share the same Pin Code, is established. In case that Parani-ESD connects to other Bluetooth device that enables authentication, you must know the other device's Pin Code. In general Bluetooth devices, 1234 or 0000 is used as a default

value. If you check Encryption option, the Parani-ESD encrypts packets and sends them. The Encryption options works well in case that only one between Master and Slave uses this option.

Parani-ESD 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.

Click [Apply] button to reflect the given options to Parani-ESD actually.

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

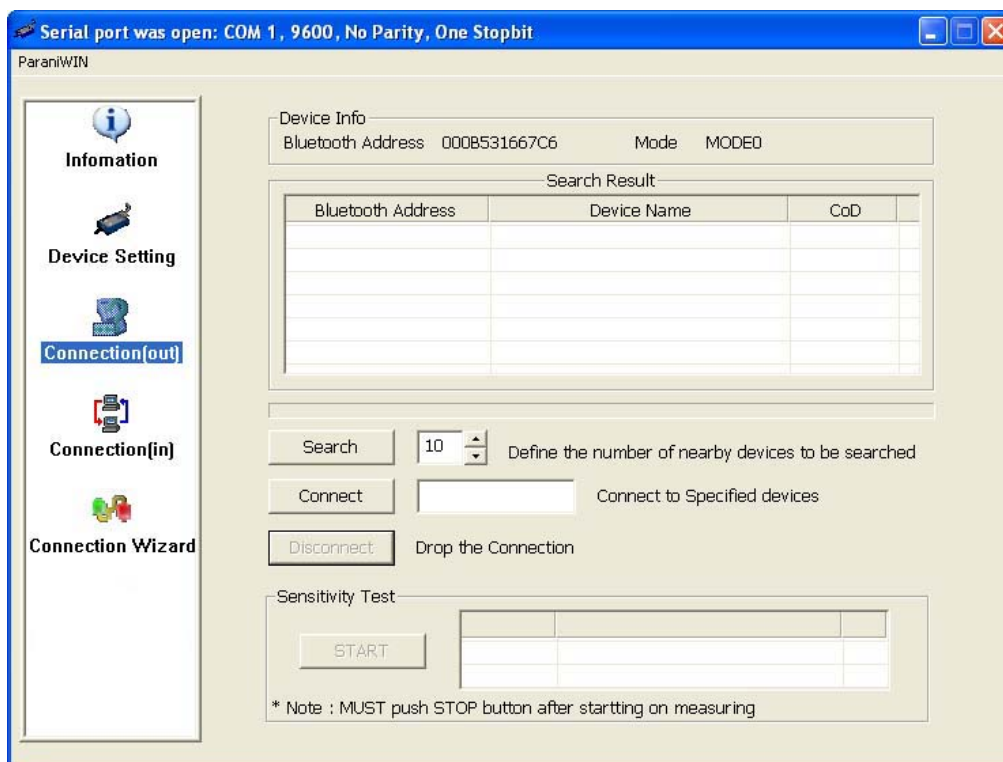


Figure 3-7 Connect(out) Window

Click [Search] button to search nearby Bluetooth devices. The maximum number of devices to be searched can be controlled. Select one of the devices searched and click [Connect] button. The selected Bluetooth device must be in Page scan mode. Click [Disconnect] button to cancel the connection normally.

After the connection is established, you are able to test sensitivity by pushing the START button.

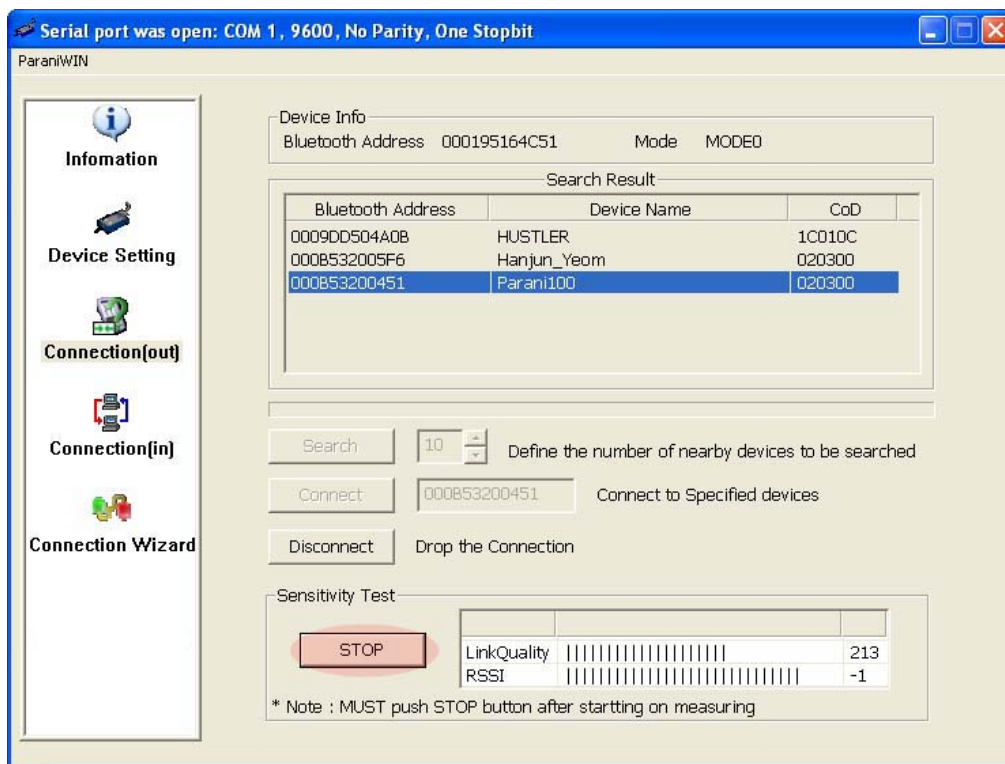


Figure 3-8 Sensitivity Test

The sensitivity test shows LinkQuality and RSSI values. The sensitivity is fine, If the LinkQuality is closer to 255 and RSSI is closer to 0. In general, the sensitivity is the best when the distance is 10 meters. You can push the STOP button in order to terminate the sensitivity test. The sensitivity test will continue until the STOP button is pushed. If you close the ParaniWIN Window without pushing the STOP button, you must restart Parani-ESD to terminate the test.

Connection(in) icon will show the following window to make Parani-ESD wait to a connection from the other Bluetooth device. The waiting time in seconds can be controlled. With 0 input for this waiting time, Parani-ESD keeps waiting for connection until [Cancel] button is clicked.

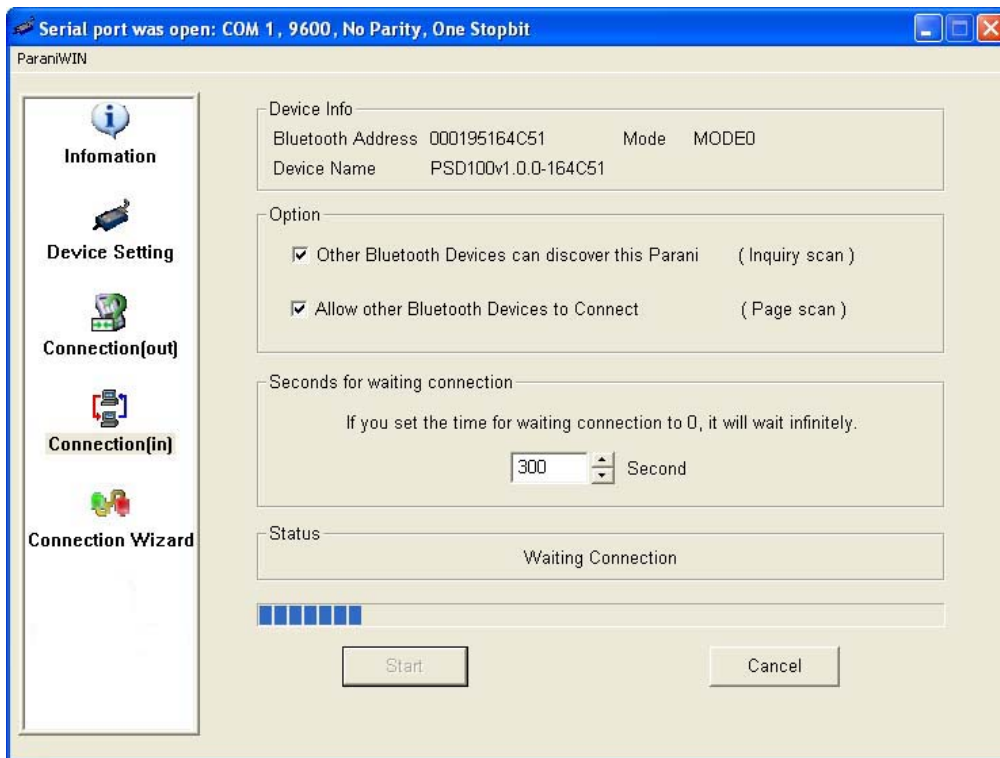


Figure 3-9 Connection(in) Window

If the Connection Wizard icon is clicked, an easy pairing menu to use appears as follows:

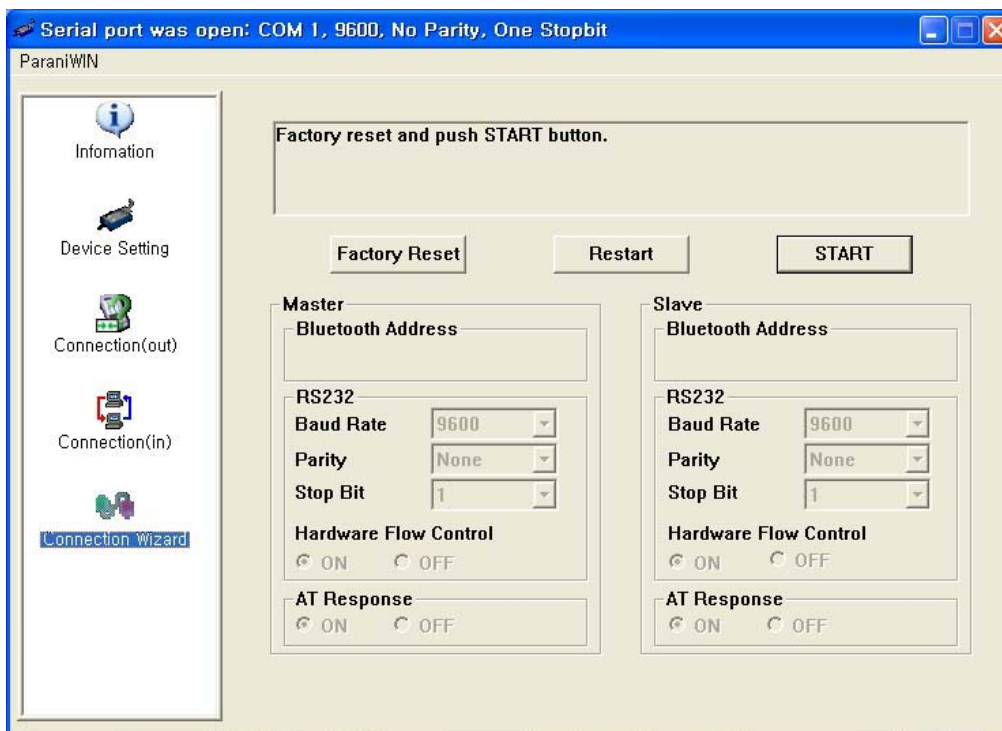


Figure 3-10 Connection Wizard Window

This menu make easy pairing configuration of Parani-ESD. To use this menu, follow next steps.

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

Step 2. Disconnect the first ESD, connect the second ESD and then push the Next button after setting up Slave configuration.

Step 3. Disconnect the second ESD, once again connect the first ESD and then push the Finish button. The pairing configuration finished. From now, when the ESD restarts the pairing connection will be established automatically.

3.2.5. ParaniUpdater

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

* Note: DO NOT power off Parani-ESD while the firmware update is progressing. It may damage the firmware seriously.

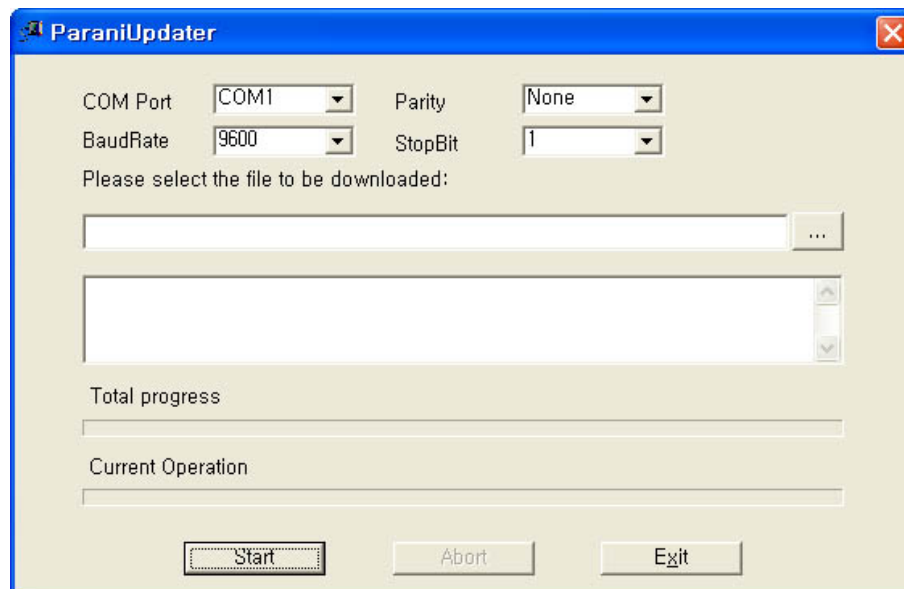


Figure 3-11 ParaniUpdater Window

3.2.6. Terminal Program

A terminal program is 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 as it is included as part of the operating system. Parani-ESD provides some extended AT commands for its configurations on terminal program.

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 information, please refer to Help of Microsoft Windows.

Attach Parani-ESD to serial port of host computer and power on.

Launch HyperTerminal. It can be found in start >programs >accessories >communication >HyperTerminal. Select the Serial port that Parani-ESD will be connected to.

Input the same settings into Serial port configuration window as Parani-ESD settings.

The settings need to be set correctly, otherwise, error message may be shown up on the screen or cause malfunctioning of Parani-ESD.

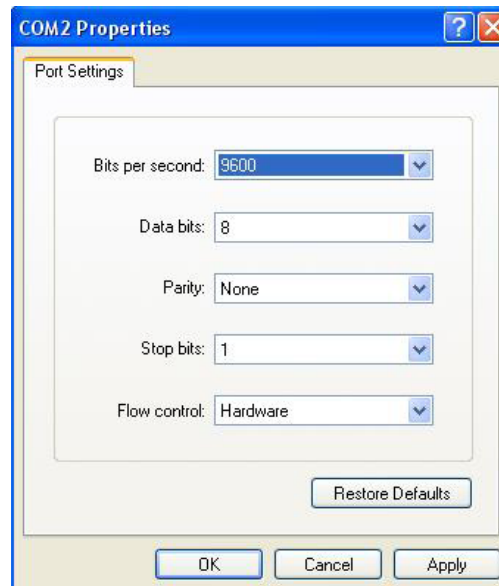


Figure 3-12 HyperTerminal

Choose the settings in File->Properties->Settings->ASCII setup that let you turn echo on in HyperTerminal; this will show the response Parani-ESD sends on the screen.

You now get the HyperTerminal window where you are able to control Parani-ESD with AT commands. For expanded AT commands that Parani-ESD provides, please refer to Appendix A. AT commands. Example of AT commands:

```
AT+BTINFO?
000B53000509,PSDv3b-000509,MODE0,STANDBY,0,0,HWFC

OK
AT+BTINQ?
000B5320007E,PSDv2a-20007E,001F00

0004B300E205,AP2002:1 #0,020300

OK
ATD000B53000509
OK

CONNECT 000B53000509
```

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

Information to User

This equipment has been tested and found to comply with the limits for a Class B digital device, Pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio Frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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.

4.2. CE

4.2.1. EC-R&TTE Directive

EN 50385
EN 60950
EN 301 489-1/-17
EN 300 328

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
ESD100	+18dBm
ESD110	+18dBm
ESD200	+4dBm
ESD210	+4dBm

5.6. Receiving Sensitivity

Products	Radio Output Power
ESD100	-88dBm
ESD110	-88dBm
ESD200	-80dBm
ESD210	-80dBm

5.7. Power Supply

Products	Radio Output Power
ESD100	DC3.3V
ESD110	DC3.3V
ESD200	DC3.3V
ESD210	DC3.3V

Appendix A: Connections

A.1. Pin Assignment

A.1.1. Parani-ESD100/110

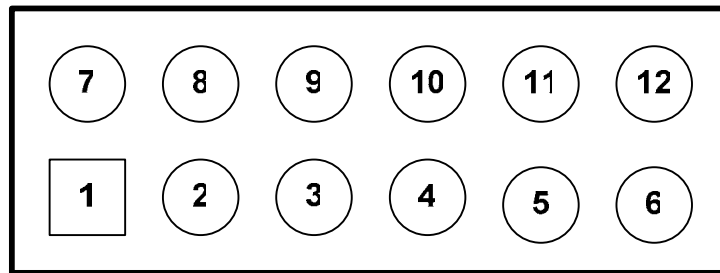


Figure A-1 Pin Assignment of Parani-ESD100/110

Table A-1. Pin Assignment of Parani-ESD100/110

Pin #	Signal	Direction	Description	Signal Level
1	GND	-	Power Ground	Ground
2	TxD	Output	UART Data Output	TTL
3	RxD	Input	UART Data Input	TTL
4	RTS	Output	UART Ready to Send	TTL
5	CTS	Input	UART Clear to Send	TTL
6	VDD	Input	DC Input (3.0~3.3V)	Ground
7	Pairing	Input	Pairing Input	TTL
8	Status	Output	Bluetooth Connect Detect (Active Low)	TTL
9	DSR	Input	Data Set Ready	TTL
10	DTR	Output	Data Terminal Ready	TTL
11	RST	Input	Reset (Active Low)	TTL
12	GND	-	Power Ground	Ground

A.1.2. Parani-ESD200/210

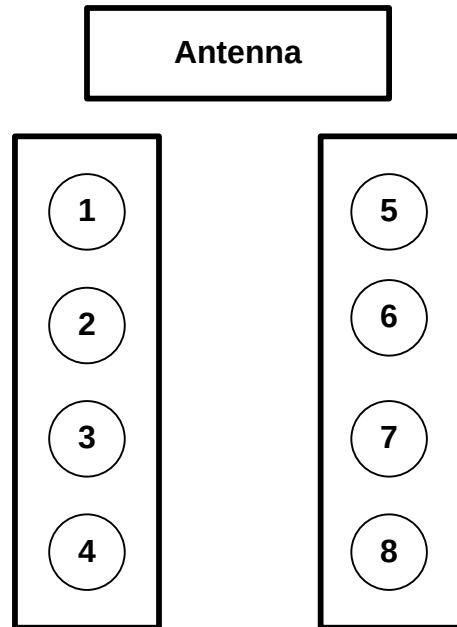


Figure A-2 Pin Assignment of Parani-ESD200/210

Table A-2 Pin Assignment of Parani-ESD200/210

Pin #	Signal	Direction	Description	Signal Level
1	GND	-	Power Ground	Ground
2	VDD	Input	DC Input (3.0~3.3V)	Ground
3	Status	Output	Bluetooth Connect Detect (Active Low)	TTL
4	RST	Input	Reset (Active Low)	TTL
5	CTS	Input	UART Clear to Send	TTL
6	RTS	Output	UART Ready to Send	TTL
2	TxD	Output	UART Data Output	TTL
3	RxD	Input	UART Data Input	TTL

A.1.3. DCD Signal

Status of Bluetooth connection will be delivered to Host PC via DCD line. When Bluetooth connection is made, DCD signal will be in state OFF. For disconnection of Bluetooth, DCD signal will become state ON.

Connection Module → low signal

A.1.4. RST Signal

RST signal will be used for initialization of Parani-ESD. RST should be on 0V status for at least 1 second for this.

A.1.5. Pairing Signal (only for Parani-ESD100/110)

Parani-ESD100/110 provides pairing signal input for instant configuration without PC to make an automatic connection between two Parani-ESDs. For convenience sake, name two Parani-ESDs as ESD1 and ESD2 respectively.

Step 1. Turn off all the nearby Parani-ESD

Step 2. Turn on ESD1 and ESD2 and hardware reset both of them by using RST signal.

Step 3. Drop the pairing signal of ESD1 to low state and keep it for 2 seconds. Keep the power ON.

Step 4. Drop the pairing signal of ESD2 to low state and keep it for 2 seconds. Raise the pairing signal of ESD2 to high state and keep it for 2 seconds. Now drop again the pairing signal of ESD2 to low state and keep it for 2 seconds

Step 5. Wait for ESD1 & ESD2 to be connected for a while. It takes about 10 seconds to make a connection. If there are many Bluetooth devices nearby, it will take a little bit more.

Step 6. Now a pair of Parani-SD is configured to make automatic connection, whenever power off and on.

Just use this pair of Parani-SD like virtual serial cable.

* Note: While pairing is progressing by the pairing signal, the Command Response will be inactivated automatically. Then, Parani-ESD will not send the response messages such as OK, Connect and Disconnect.

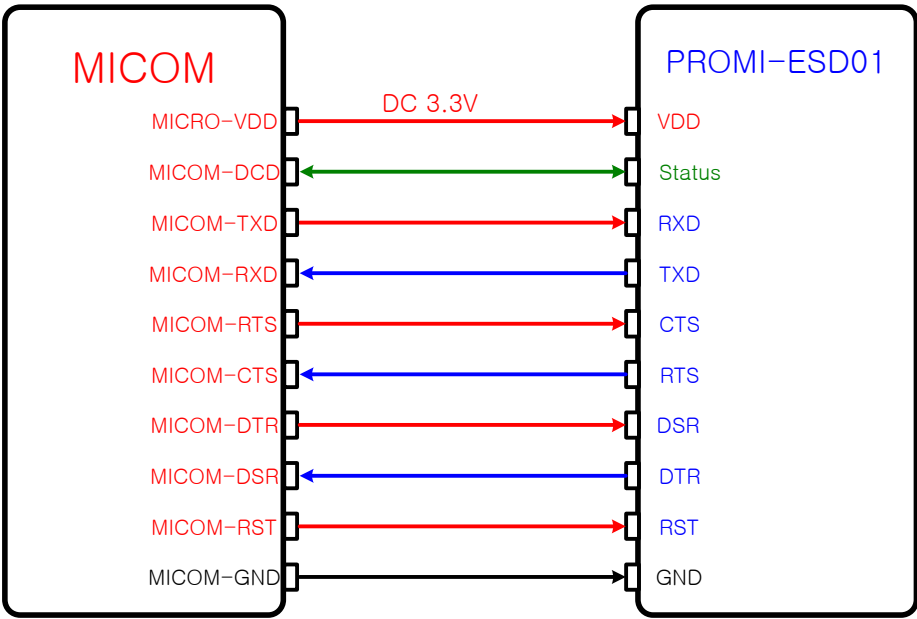
Table 0-1 Pairing Process by Pairing Signal

ESD100/110	Status	Pairing Signal	ESD200/210	Status	Pairing Signal
1. Hard reset	Mode0	HIGH	1. Hard reset	Mode0	HIGH
2. Drop pairing signal	Mode3	LOW	2. Drop pairing signal	Mode3	LOW
3.Restore pairing signal	Mode3	HIGH	3.Restore pairing signal	Mode3	HIGH
			4. Drop pairing signal	Mode1	LOW
			5.Restore pairing signal	Mode1	HIGH
6. Connected	Slave	HIGH	6. Connected	Master	HIGH

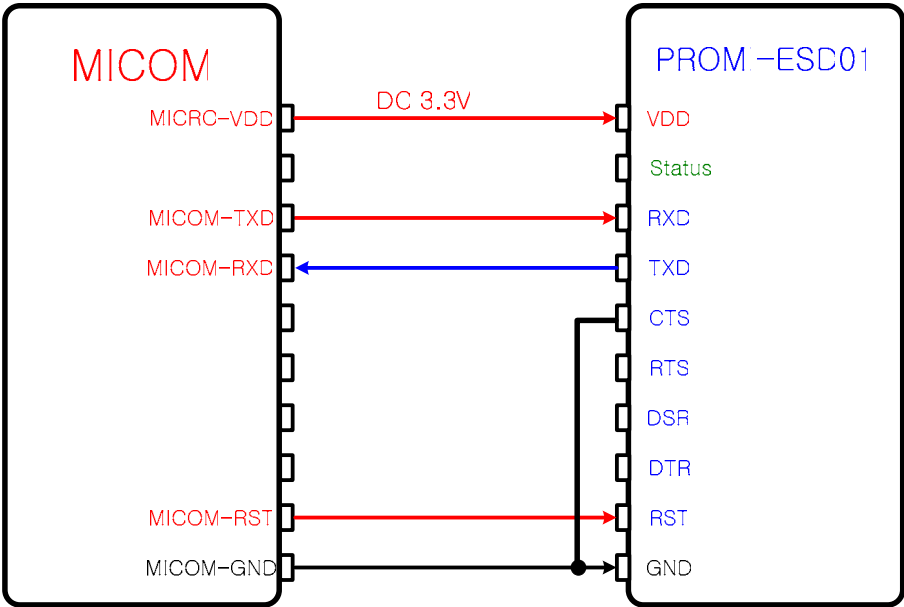
A.2. Connection Diagram

A.2.1. Parani-ESD100/110

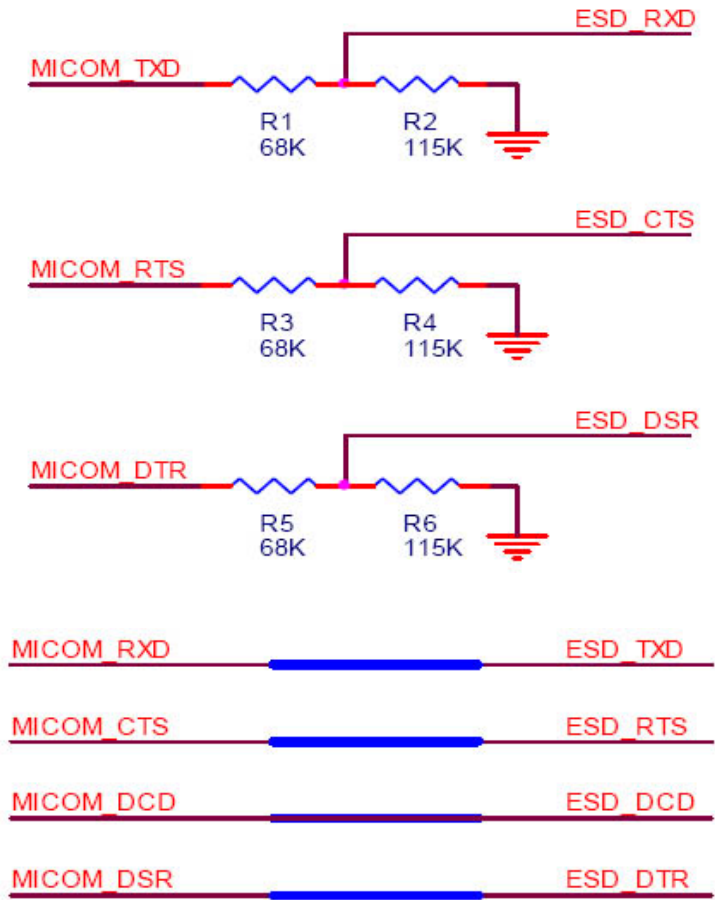
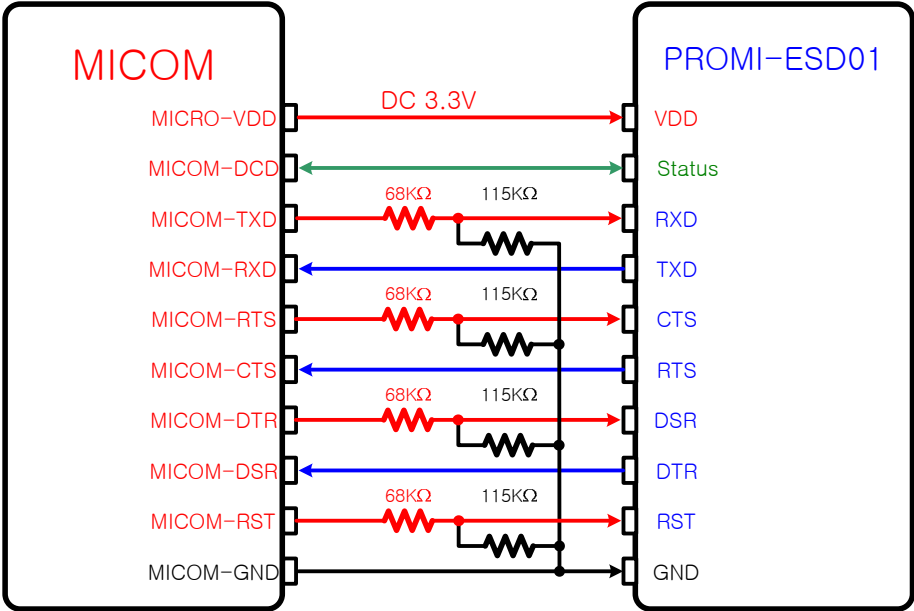
A.2.1.1. When TTL level of MICOM is 3.3V

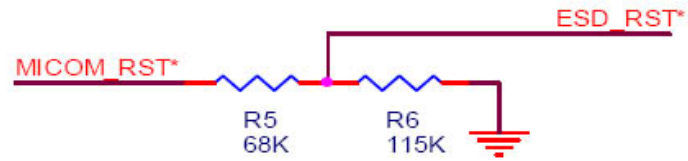


A.2.1.2. When TTL level of MICOM is 3.3V and Hardware Flow Control is not used



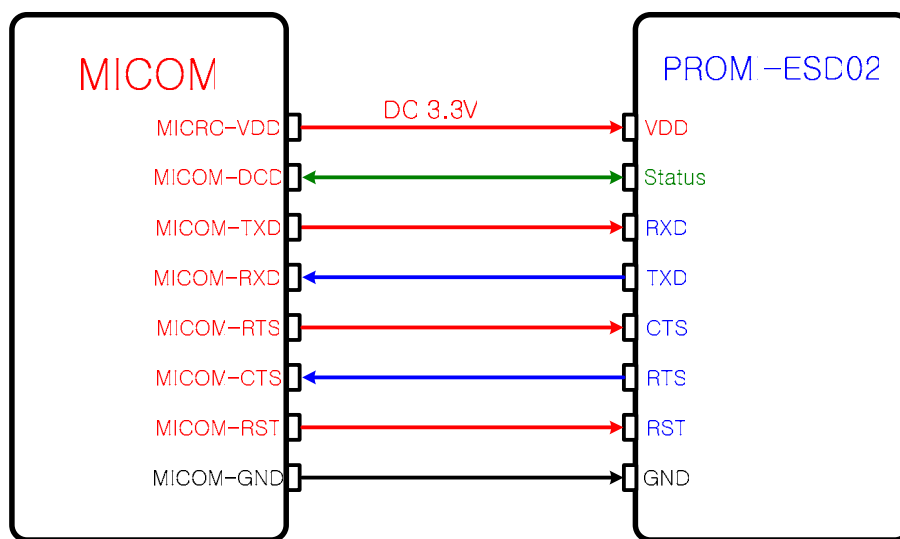
A.2.1.3. When TTL level of MICOM is 5V



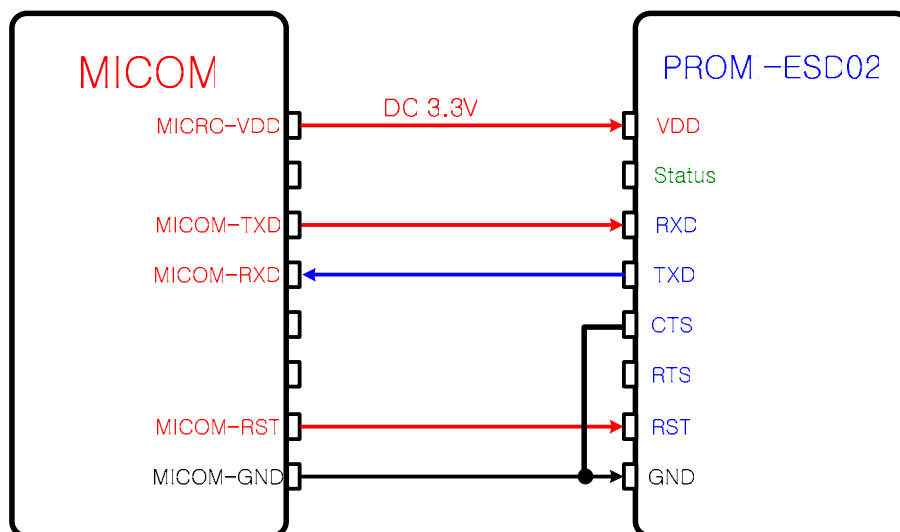


A.2.2. Parani-ESD200/210

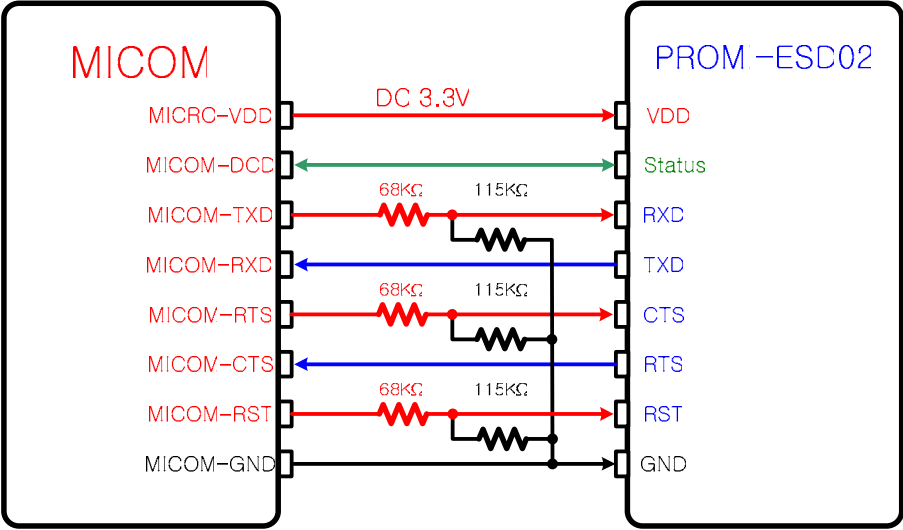
A.2.2.1. When TTL level of MICOM is 3.3V



A.2.2.2. When TTL level of MICOM is 3.3V and Hardware Flow Control is not used



A.2.2.3. When TTL level of MICOM is 3.3V and Hardware Flow Control is not used



Appendix B: AT Commands

B.1. Terminology

B.1.1. AT Command

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

B.1.1. AT Response

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

B.1.2. 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.1.3. Operation Status

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

B.1.4. Security

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

B.1.5. 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	
⚡	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 5	AT AT+UARTCONFIG,b,p,s,h AT+USEDIP?
BLUETOOTH	Information	6 7 8	AT+BTINFO? AT+BTINQ? AT+BTLAST
		9	AT+BTMODEn
	Status	10 11 12 13 14 15 16	+++ AT+SETESC,nn ATO AT+BTCANCEL AT+BTSCAN AT+BTSCAN,n,to AT+BTSCAN112233445566,to
	Connection	17 18 19	ATD ATD112233445566 ATH
	Security	20 21 22 23 24	AT+BTKEY=\$string AT+BTSD? AT+BTCSD AT+BTFTP,n AT+BTSEC,a,e
	Miscellaneous	25 26	AT+BTNAME=\$string AT+BTLPm,n
	S-REGISTER		27 28 29
			AT&V AT\$nn? AT\$nn=mm

B.3. Command Description

B.3.1. ATZ↵

SD Response	↵OK↵
Purpose	Software Reset
Description	This is the same effect as power off and on. This command disconnects Bluetooth device, and stops ongoing task. After rebooting, the status is decided by the preset operation mode. Some AT commands need ATZ to take effect.
Reference	AT&F, AT+BTCSD, AT+UARTCONFIG

B.3.2. AT&F↵

SD Response	↵OK↵
Purpose	Hardware reset
Description	This is the same effect as initialization by reset button. All parameters are initialized to factory defaults. The storage of Parani-ESD is cleared completely.
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 normal. The serial parameters of Parani-ESD must be same as those of host equipment. If not, SD response is none or 'ERROR' or abnormal sequence of strings.
Reference	AT+UARTCONFIG, ATZ, AT&F

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

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) Hwfc(Hardware Flow Control)=0/1 (Default=1)
Description	The Serial parameters can be set or changed. The factory default is 9600, N, 1. To take effect of this command, ATZ or power off and on.
Reference	AT, ATZ, AT&F, ATS
Example	AT+UARTCONFIF,9600,N,1

B.3.5. AT+USEDIP?

SD Response	↵m↵
Purpose	Check the Baud rate set by dip switch
Description	m=0: Set to 'AT cmd' m=1: Set to other than 'AT cmd'
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 'PSD100v1.0.0-445566'. PSD stands for Parani-ESD, 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?
Example	↵000B530011FF,SENA,MODE0,PENDING,1,1,HWFC↵

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 10 devices are scanned for 30 seconds.
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 connected to this Parani-ESD last time 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+BTRSSI,n

SD Response	↵OK↵ ↵0,255,0,0↵ (repeatedly)
Purpose	Test sensitivity
Parameters	n=0: Start sensitivity test n=1: Stop sensitivity test
Description	When Bluetooth connection is established, you can use this command in Standby status. The sensitivity 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 sensitivity is not bad.
Example	+++ AT+BTRSSI,1 ↵OK↵ 0,255,0,0

B.3.11. 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 of this command, ATZ or power off and on
Reference	AT+BTINFO?
Example	AT+BTMODE,2 ↵OK↵ ATZ

B.3.12. +++

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-ESD 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' unexpectedly. Notice that Parani-ESD 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.3.13. 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.3.14. 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.3.15. AT+BTCANCEL

SD Response	↵OK↵
Purpose	Terminate a current executing 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.3.16. 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 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 connection is made with other Bluetooth device, SD response will be 'CONNECT' with its BD address.
Reference	ATD, AT+BTINQ?, AT+BTCANCEL

B.3.17. 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-ESD 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.3.18. AT+BTSCAN112233445566,to

SD Response	OK CONNECT 112233445566 or OK ERROR
Purpose	Wait for connection by the Bluetooth device with given BD address
Parameters	112233445566=BD address to= time duration in seconds
Description	For the given to, Parani-ESD is waiting for the connection from 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 to 'Standby'.
Reference	ATD, AT+BTINQ?, AT+BTCANCEL
Example	AT+BTSCAN000B530011FF,30

B.3.19. ATD

SD Response	OK CONNECT 112233445566 or
--------------------	----------------------------------

	↵OK↵ ↵ERROR↵
Purpose	Connect to the last connected Bluetooth device
Description	Parani-ESD saves the BD address of the Bluetooth device most recently connected. ATD can make connection to it without input its BD address. If it fails to make connection, SD response is 'ERROR'.
Reference	AT+BTINQ?, AT+BTSCAN

B.3.20. ATD112233445566↵

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

B.3.21. ATH↵

SD Response	↵OK↵ ↵DISCONNECT↵
Purpose	Release the current connection
Description	The current Bluetooth connection is released normally. 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.3.22. 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 16 alpha-numeric characters maximum. Based on this pin code, Parani-ESD 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.3.23. AT+BTSD? ↵

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

B.3.24. AT+BTCSD ↵

SD Response	↵OK↵
Purpose	Clear the list of Bluetooth devices sharing the pin code
Description	This clears the list of Bluetooth devices with link key in flash memory. To take effect of this command, ATZ or power off and on because the main memory still has the list.
Reference	AT+BTFP, AT+BTKEY, AT+BTSD?, AT+BTSEC, ATZ, AT&F

B.3.25. AT+BTFP,n ↵

SD Response	↵OK↵
Purpose	Set generation of link key every time of connection
Parameters	n=0: Inactivate (Default) n=1: Activate
Description	If n is set to 1, Parani-ESD asks pin code every time of connection. This is used to level up the security.
Reference	AT+BTCSD, AT+BTKEY, AT+BTSD?, AT+BTSEC, ATD, ATZ, AT&F

B.3.26. 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 activated, i.e. <i>Authentication</i> =0 and <i>Encryption</i> =1 is not valid.
Reference	AT+BTCSD, AT+BTFP, AT+BTSD?, AT+BTSEC?, ATZ, AT&F

B.3.27. AT+BTNAME=\$string ↵

SD Response	↵OK↵
Purpose	Change device name
Parameters	\$string= New device name (Default="PSDv3b-445566")
Description	Parani-ESD can have a user friendly name to identify easily. The name allows 30 alpha-numeric characters maximum.
Reference	AT+BTINFO?, AT+BTINQ?
Example	AT+BTNAME="My-Parani-ESD"

B.3.28. 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-ESD can be in low power mode to save the power consumption. It takes a few seconds to wake up Parani-ESD in low power mode.

B.3.29. AT+DFU↵

SD Response	(Display garbage messages repeatedly)
Purpose	Device firmware update
Description	DO NOT use this command in console. Because the Parani-ESD enter into firmware update mode, garbage messages will appear. This command is used by ParaniWIN's firmware update menu.

B.3.30. AT&V↵

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

B.3.31. ATSn? ↵

SD Response	↵value↵ ↵OK↵
--------------------	-----------------

Purpose	Display a given S-register
Parameters	nn= Address of S-register
Description	A specific S-register is displayed.
Reference	AT&V

B.3.32. 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 from an arbitrary change by user. 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,h	⊙		
AT+USEDIP?	○	○	
AT+BTVER?	○	○	
AT+DFU	⊙	⊙	
AT+BTRSSI,n	●		

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

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

Appendix C: S-Register

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

Change the value of S-register only in Standby status.

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

S1=0, Parani-ESD in Mode1 does not try reconnection when disconnected.

S1=1, Parani-ESD in Mode1 keeps trying reconnection when disconnected.

C.2. S2: Enable Hardware Flow Control (default 1)

S2=0, Parani-ESD's hardware flow control is off.

S2=1, Parani-ESD's hardware flow control is on.

In case of SD Series, it can be changed only through dip switch.

C.3. 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.

This value decides the way of handling stream data from UART. When this value is 1, in order that SD minimizes the latency, SD sends the received data immediately. When this value is 0, in order that SD maximizes throughput, SD stores received data for a short time and sends a large packet. If the packet length is less than 100 bytes, latency-oriented way is better. But if the packet length is more than 100 bytes, throughput-oriented way is recommended. Also if you want to use high baudrate, throughput-oriented way is more effective. Just for reference, the buffer length for receiving is 2 Kbytes.

C.4. S4: Enable Remote Name Query (default 1)

S4=0, Parani-ESD inquires only BD address. This speeds up the inquiry process.

S4=1, Parani-ESD inquires BD address, device name and class of device.

This value decides whether SD finds friendly name of Bluetooth device or not. 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. Without finding friendly name, a searching is quick to respond. If you want to search the other Bluetooth devices quickly, set this value to 0. In case of using pairing button, finding friendly name will be omitted automatically.

C.5. S6: Enable Low Power Mode (default 0)

S10=0, deactivate Low Power Mode.

S10=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.6. S10: Enable SD Response (default 1)

S10=0, Parani-ESD does not send SD responses to host system.

S10=1, Parani-ESD send SD responses 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 sends no response messages. If the response messages cause troubles in host programs or devices that is connected to SD, change this value to 0.

C.7. S11: Enable Escape (default 1)

S11=0, Parani-ESD does not allow escape sequence character. The operation status of Connect cannot be changed to Standby. As Parani-ESD skips the process detecting escape sequence character, the more efficient data transmission is expected.

S11=1, Parani-ESD allow escape sequence character. Whenever it is needed, the Connect status can be changed to Standby.

C.8. S12: Clear Data Buffer When Disconnected (default 0)

S12=0, Parani-ESD does not clear the data buffer received from host system when disconnected.

S12=1, Parani-ESD clears the data buffer when disconnected.

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

S14=0, DTR/DSR signal is transferred to loop-back.

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: Fast Connect (default 0)

S22=0, none

S22=1, page scan

S22=2, inquiry scan

S22=3, page/inquiry scan

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 '+'.

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

This is the timeout in seconds to attempt connection with 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-ESD can detect an abnormal disconnection. But when the communication is suspended for some environmental reasons, 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-ESD is same as that of its host equipment. **If you don't know the current Baud rate, initialize it to 9600 by resetting**

Check whether the Data bit is set to 8. Parani-ESD supports only 8 Data bit. If your host equipment uses 7 Data bit and even or odd parity, it can work as if it uses 8 Data bit and No parity. This is valid only when both DCE devices are Parani-ESD. In this case, set both Parani-ESDs to 8 Data bit and No parity. If one of DCE devices is other Bluetooth device such as Bluetooth USB dongle, please contact Technical Support.

Check whether the Parity and Stop bit of Parani-ESD are same as those of its host equipment. Parani-ESD supports No parity, Even parity and Odd parity, 1 and 2 Stop bit.

Check whether the host equipment of Parani-ESD uses Hardware Flow Control. Parani-ESD is initially set to Use of Hardware Flow Control. If your host equipment does not use Hardware Flow Control, set the Hardware Flow Control of Parani-ESD to No use.

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

D.2 Data Loss or Malfunctioning

D.2.1 Hardware Flow Control

When transmitting large data with No use of Hardware Flow Control, Parani-ESD will clear the data buffer unexpectedly. This possibility goes higher as the RF transmission environment is bad.

D.2.2 SD Response

The messages of AT response may affect the function of host system. Set AT+SD10=0 not to send AT response to host system and try again. Refer Appendix B. for details.

D.3 Transmission Delay

D.3.1 RF Processing Delay

It takes 30msec approximately for a Parani-ESD to complete the data transmission to the other side Bluetooth device. This time delay cannot be reduced and would be bigger as the RF transmission environment is bad. Do not use Parani-ESD If your applications cannot allow this time delay.

D.3.2 RF Transmission Environment

If there are lots of Bluetooth device working in a small area and/or the RF communication distance is too long and/or there are some obstacles affecting RF performance, Parani-ESD repeats the transmission packet by packet due to interferences and/or low RF performance. This leads the transmission time delay.

Appendix E: How make a RS232 interface Jig Board

