Parani-SD1100

User Guide

Version 1.1.0

2011-12-26

User Guide for the Parani-SD1100
Version 1.1.0
Firmware version 1.1.X
Printed in Korea

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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.

Precautions and Safety
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-SD1100 meets the RS-422/485 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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Revision History

Revision	Date	Name	Description
V1.0.0	2010-07-20	Yh Moon	Initial Writing
V1.0.1	2011-03-10	JH Park	Modify S-Register 24. Add Remote Configuration.
V1.0.2	2011-10-12	JH PARK	Modify invalid contents of serial port connection
V1.1.0	2011-12-26	HR Zo	Package does not contain CD-ROM

Contents

1. Introduction

1.1. Overview

Parani-SD1100 is a terminal device for wireless serial communication using Bluetooth 2.0+EDR technology that is an international standard of short range wireless communications. Parani-SD1100 can communicate with other Bluetooth devices; user may connect other Bluetooth devices that support the Serial Port Profile.

The working distance of Parani-SD1100 with default antenna is 100m

Parani-SD1100 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-SD1100 supports FHSS (Frequency Hopping Spread Spectrum), which is a technique, native to Bluetooth that allows the Parani-SD1100 minimize radio interference while decreasing the likelihood of over-air hijacking. Parani-SD1100 also supports authentication and Bluetooth data encryption.

Parani-SD1100 can be configured and controlled by a set of AT commands. Users can easily configure Parani-SD1100 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

SD1100-A1 (Stub antenna NOT included)
- Parani-SD1100

SD1100-00
- Parani-SD1100
- Stub Antenna
- DC Power Cable
- USB Power Cable
- DB9-Terminal Block

SD1100-01
- Parani-SD1100
- Stub Antenna
- DC Power Cable
- USB Power Cable
- DC Power Adapter
- DB9-Terminal Block

1.2.2. Bulk-Pack Package

SD1100-B10
- Parani-SD1100 x 10 EA
- Stub Antenna x 10 EA
- DC Power Cable x 10EA

1.3. Product Specification

	Parani-SD1100
Serial Interface	One male DB9 serial port for data communication Serial UART speed up to 921.6kbps RS422 : TXD+, TXD-, RXD+, RXD- RS485 - TRXD+. TRXD-
Bluetooth Interface	Bluetooth v2.0 + EDR
	Profile: Serial Port Profile
	Class 1
	Working distance: Stub Antenna - Stub Antenna 100 meters Stub Antenna - Dipole Antenna 150 meters Dipole Antenna - Dipole Antenna 200 meters Dipole Antenna - Dipole Antenna 300 meters Dipole Antenna - Patch Antenna 500 meters Dipole Antenna - Dipole Antenna 400 meters Dipole Antenna - Patch Antenna 600 meters Patch Antenna - Patch Antenna 1,000 meters
Configuration	ParaniWIN, ParaniMultiWizard, Modem AT command set
Firmware Update	ParaniUpdater
Diagnostic LED	Power, Standby, Connect, Serial Rx/Tx
Power	Supply voltage: 5V ~ 12V DC Power consumption: 80mA@5VD Max
Environmental	Operating temperature: -20 ~ 70 ^{o}C Storage temperature: -40 ~ 85 ^{o}C Humidity : 90% (Non-condensing)
Physical properties	- Dimension (L x W x H) 74 x 31 x 16 (mm) - Weight: 24g
Approvals	FCC, CE, TELEC, KCC, SIG
Warranty	3-year limited warranty

Note *:

Bluetooth v2.0 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-SD1100 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-SD1100.

Following items are required to get started:
- One DC power adapter, USB power cable or DC power cable (included in the package).
- RS232-422/485 Converter

Users may need to use specific type of adapter to fit for the RS232-422/485 converter he may have. If users' converter is DB9 female type to connect to SD1100, then he may not need additional adapter. The following picture is an example of the adapter that is fir for RS232-422/485 Converter whose connector for the SD1100 wiring has a terminal block interface. If the connector with same type has the different location of the serial signals, it needs to be wired properly according to the serial signals.

* Users need to wire the serial signals matching the Pin outs of SD1100 to make RS422/485 communication possible. (Refer to A.1. Serial Port Pin Outs) User can also do it using the accessory with DB9-Terminal Block type as below.
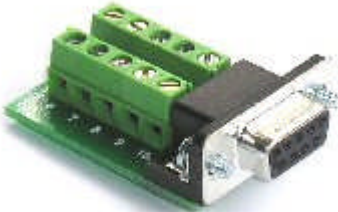
Figure 2-1 DB9-Terminal Block

- 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-SD1100.
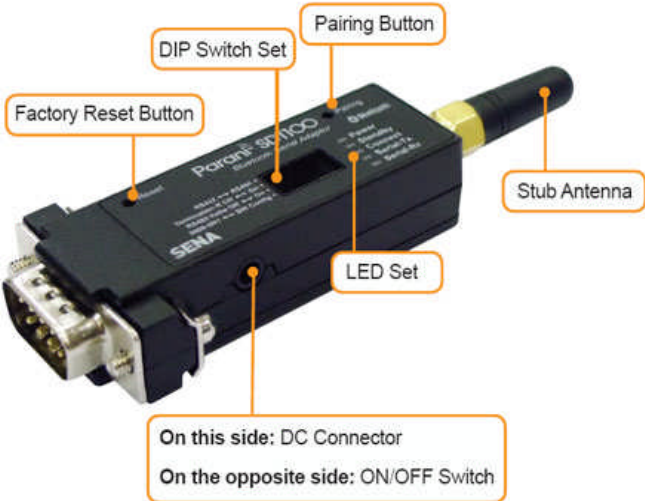
*Figure **Error! Style not defined.**-2 The panel layout of Parani-SD1100*

2.2. Connecting the Hardware

This section describes how to connect the Parani-SD1100 to the serial device.
- Connect a power source to the Parani-SD1100.
- Connect the Parani-SD1100 to a serial device.

2.2.1. Connecting Power to Parani-SD1100

Parani-SD1100 can be powered from either external DC power adaptor/external power source. To power the SD1100 from the external DC power adaptor or external power source, connect the power jack to the power connector of the Parani-SD1100 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 green color.
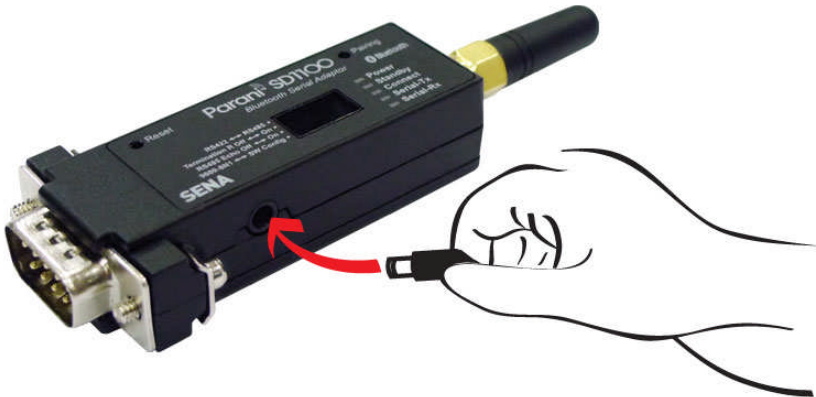
*Figure **Error! Style not defined.**-3 Connecting Power to Parani-SD1100*

2.2.2. Connecting Device to Parani-SD1100

On connecting users' serial device, users may wire it as to its interface and users may use wiring adapter.
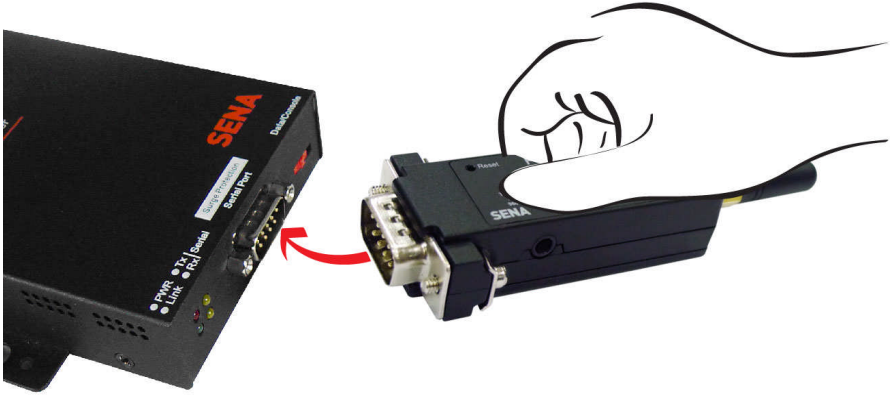
*Figure **Error! Style not defined.**-4 Connecting a Serial Device to Parani-SD1100*

3. Configuration

3.1. Operation Modes

In addition to the serial port configurations the Parani-SD1100 also requires some settings for Bluetooth. For getting the most out of Parani-SD1100, 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-SD1100 has 4 operation modes as follows. Each mode can be identified with LED indicators as illustrated in next section.
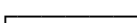
Table 3-1 The Parani-SD1100 Operation Modes

Mode	Description
Mode0	In this mode, there is no response when power on or software reset, and Parani-SD1100 is just waiting for AT command input. Neither master nor slave is assigned to Parani-SD1100 in mode0. User can change the configuration parameters of Parani-SD1100 in this mode. Parani-SD1100 must be in Mode0, when it is directly controlled by AT commands. The factory default is set to Mode0.
Mode1	Parani-SD1100 tries to connect the last connected Bluetooth device. Parani-SD1100 in Mode1 is to be a master and tries to connect the last connected Bluetooth device. Parani-SD1100 always stores the BD address of the Bluetooth device to which Parani-SD1100 has connected last. When Parani-SD1100 is initially used or after hardware reset, there is no BD address stored in Parani-SD1100. In this case, Mode1 will not be able to work properly. The mode change to Mode1 can be made after Parani-SD1100 succeeds to connect to one other Bluetooth device. Once changed to Mode1, Parani-SD1100 will try to connect automatically the last connected Bluetooth device whenever the unit is powered on or software reset. Parani-SD1100 in Mode1 cannot be discovered or connected by other Bluetooth devices.
Mode2	Parani-SD1100 is waits for a connection from the last connected Bluetooth device. Parani-SD1100 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-SD1100, the mode change from other operation modes to Mode2 is not work properly. Once changed to Mode2, Parani-SD1100 will wait for the connection from the last connected Bluetooth device whenever the unit is powered on or software reset. Parani-SD1100 in Mode2 cannot be connected to Bluetooth devices other than the last connected device.
Mode3	Parani-SD1100 is waiting for the connection from any other Bluetooth devices. In Mode 3 the Parani-SD1100 is discoverable and can be connected to by other Bluetooth devices.

3.2. LED Indicators

Serial-Tx and Serial-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-SD1100 LED Indicators

Indicator	Power LED	Standby LED	Connect LED
Mode0	Green ▭	Red ▭	
Mode1	Green ▭		Green (every 1 sec) ⊓
Mode2	Green ▭		Green (every 3 sec) ⊓⊓
Mode3	Green ▭		Green (every 3 sec) ⊓⊓⊓
Connected	Green ▭		Green ▭

3.3. Serial Ports

The applicable settings for serial ports are as follows.

Table 3-3 The Parani-SD1100 Serial Port Settings

Serial Port Settings	Values
Baudrate	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, 460800, 921600
Data bite	8
Parity	No parity, Even parity, Odd parity
Stop bit	1, 2
Hardware Flow Control	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-SD1100 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 Parani-SD, Parani-ESD or Parani-MSP series. But 7 data bit and none parity is not support.

3.5. Reset to Factory Defaults

To set all the configuration settings to its factory default parameters, press the reset button, depicted in Fig. 3-1. 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.

3.6. Dipswitch

With the combination of 4 slot dipswitches, RS422/485 select, Termination resistor on/off, RS485 echo on/off and UART configuration can be set.
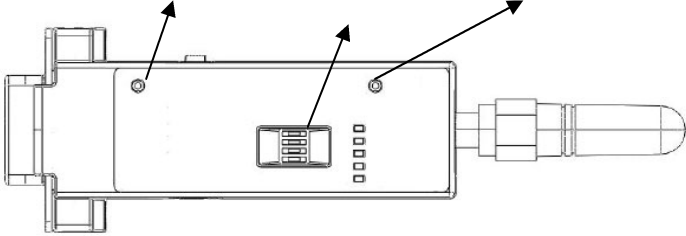
Figure 3-1 The Parani-SD1100 Dipswitch

Table 3-4 RS422/485 Select by Dipswitch

RS422 ↔ RS485	422	485
	▭	▭

Table 3-5 Termination Resistor Select by Dipswitch

Termination R Off ↔ On	Off	On
	▭	▭

Table 3-6 RS485 Echo Control by Dipswitch

RS485 Echo Off ↔ On	Off	On
	▭	▭

Table 3-7 UATR Configuration by Dipswitch

9600-8N1 ↔ SW Config	9600-8N1	SW Config
	▭	▭

* Note 1: You can set the Parani-SD1100 to of the default UART configuration of 9600-8N1 by way of the Dipswitch. If you want to use other than the default UART configuration, please configure the dipswitch to SW Config setting and use ParaniWIN or AT commands. Please refer to 3.9. ParaniWIN and Appendix B.3.4. AT+UARTCONFIG, Baudrate,Paraty,Stopbit.

*Note 2: If you use 485 Echo option when you use both master and slave units as SD1100, then it may cause data loss or conflict with various control messages such as AT response messages, i.e. OK, ERROR, CONNECT, DISCONNECT. Please refer to Appendix C.5. S10: Enable Response Message and turn off the corresponding option.

3.7. Pairing Button

Parani-SD1100 provides Pairing Button for instant configuration without a PC to make an automatic connection between two Parani-SD1100s. In this example we will refer to the two Parani-SD1100s as SD1 and SD2. (Only single connection mode)

Step 1. Turn on SD1 and SD2 and reset both of them by pressing Factory Reset Button.
Step 2. Press the Pairing Button of SD1 for 2 seconds until Connect LED blinks 3 times every 3 seconds. Keep the power ON.
Step 3. Press the Pairing Button of SD2 for 2 seconds until Connect LED blinks 3 times every 3 seconds. Now press again the Pairing Button for 2 seconds until Connect LED blinks every second.
Step 4. Wait for SD1 & SD2 to connect to each other until the Connect LED's of SD1 and SD2 blink every 1 second. It takes about 10 seconds to make a connection. If there are many Bluetooth devices nearby, it may take longer.
Step 5. Turn SD1 off and on. Connect LED blinks twice in green every 3 seconds.
Step 6. Turn SD2 off and on. Connect LED blinks in green every second.
Step 7. Now SD1 and SD2 are configured to make automatic connection to each other, whenever they are powered on.

Using a pair of Parani-SD1100 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-SD1100 will not send the response messages such as OK, ERROR, Connect and Disconnect.

Table 3-8 Pairing Process by Pairing Button

SD1	Status	LED	SD2	Status	LED
1. Factory reset	Mode0	Standby LED turns on.	1. Factory reset	Mode0	Standby LED turns on.
2. Push pairing button	Mode3	Connect LED blinks 3 times every 3 sec.	2. Push pairing button	Mode3	Connect LED blinks 3 times every 3 sec.
			3. Push pairing button again	Mode1	Connect LED blinks every second.
4. Connected	Slave	Connect LED is lit in green	4. Connected	Master	Connect LED is lit in green

Using pairing button, users can make a pairing connection between a Parani-SD unit and other Bluetooth devices.

Step 1. Turn on SD1 and reset it by pressing Factory Reset Button.
Step 2. Press the Pairing Button of SD1 for 2 seconds until Connect LED blinks 3 times every 3 seconds. Keep the power ON.
Step 3. Users can discover and connect to SD1 by using the software or user interface of other Bluetooth device that they want to connect from.
Step 4. When they are connected, the Connect LED of SD1 blinks every 1 second.
Step 5. Turn off and on. Connect LED blinks twice in green every 3 seconds.
Step 6. Now SD1 is waiting for a connection from the last connected Bluetooth device. The last connected Bluetooth device can connect to SD1.

Table 3-9 Pairing Process with other Bluetooth device by Pairing Button

SD1	Status	LED	Other Bluetooth Device	Status
1. Factory reset	Mode0	Standby LED turns on.		
2. Push pairing button	Mode3	Connect LED blinks 3 times every 3 sec.		
			3. Inquiry and connect to SD1	
4. Connected	Slave	Connect LED is lit in green	4. Connected	Master

3.8. Remote Configuration

Parani-SD1100 supports remote configuration. After connecting to the Parani-SD1100 through Bluetooth, before sending any other character, send three escape character (default :+). Then, the Parani-SD1100 will enter remote configuration mode and print "Please Enter Password". You have to enter the password with "AT+PASS" command within 2 minutes. After the password authentication, you are able to enter any at command except "ATH", "ATO", "ATD", "AT+BTSCAN", "AT+BTINQ?" and "AT+BTCANCEL". The default password is "0000" and it is configurable with "AT+CHPASS" command.

Example of remote configuration:

```
CONNECT 000195000001

+++

Please Enter Password

AT+PASS=0000

Remote Configuration Enabled

AT+BTINFO?

000195000001,SD1100v1.1.0-095515,MODE0,CONNECT,0,0,HWFC
```

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 3-10 Configuration Software

Software	Purpose	Operating System
ParaniWIN	Configuration	MS Windows 98SE or Higher
ParaniMultiWizard	Multiple Connection 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-SD1100. Install ParaniWIN on your computer. Plug a Parani-SD1100 into the serial port of the computer to use RS232 ⇔ RS422/485 converter (SENA LTC 100) and turn on the power. Run ParaniWIN.
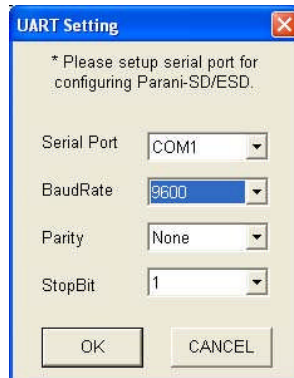
Figure 3-2 Serial Port Setting

Set each option properly and click [OK], then the Main Window appears displaying the configuration of SD1100. If the settings of the Parani-SD1100 are different from that of the ParaniWin, an error message will pop up.

If the Parani-SD1100 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.
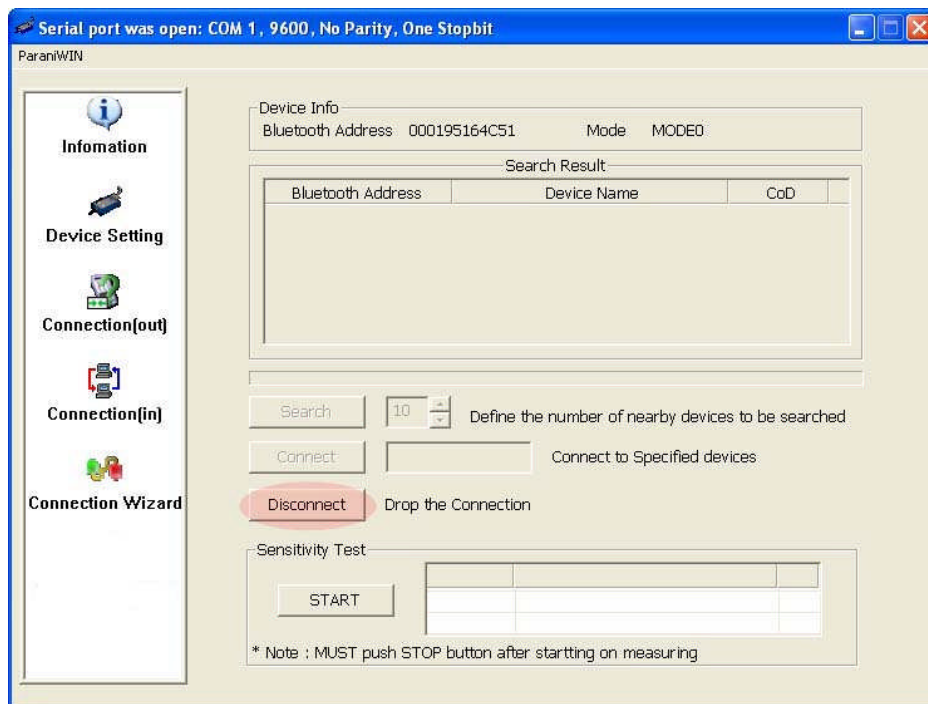
Figure 3-3 Disconnect Window
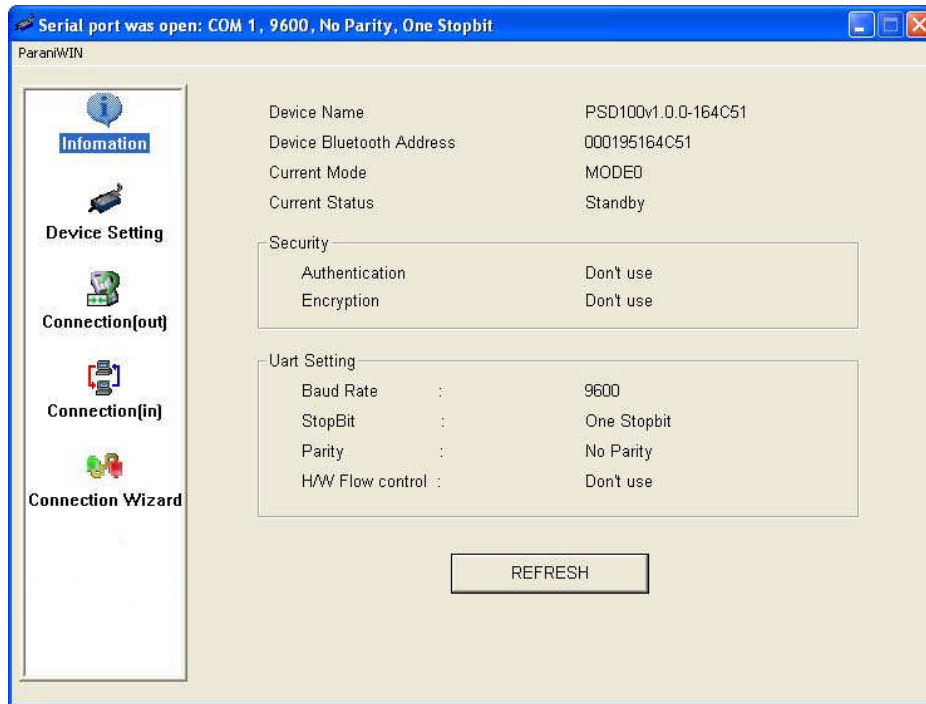
Figure 3-4 Information Window

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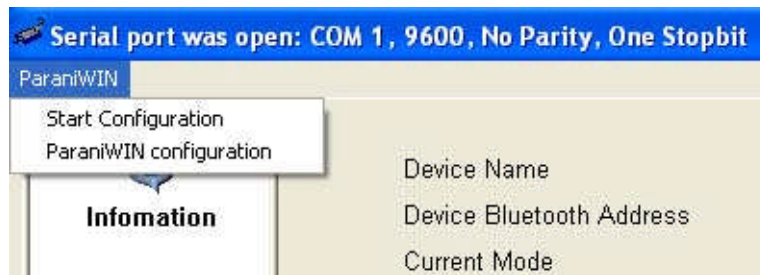
Figure 3-5 Menu Bar at Upper Left corner of ParaniWIN

When the ParaniWin software is able to access the Parani-SD1100 properly, the icons such as Device Setting, Connection(out), Connection(in) and Connection Wizard in the left side window will become available for use.

In Device Setting 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.
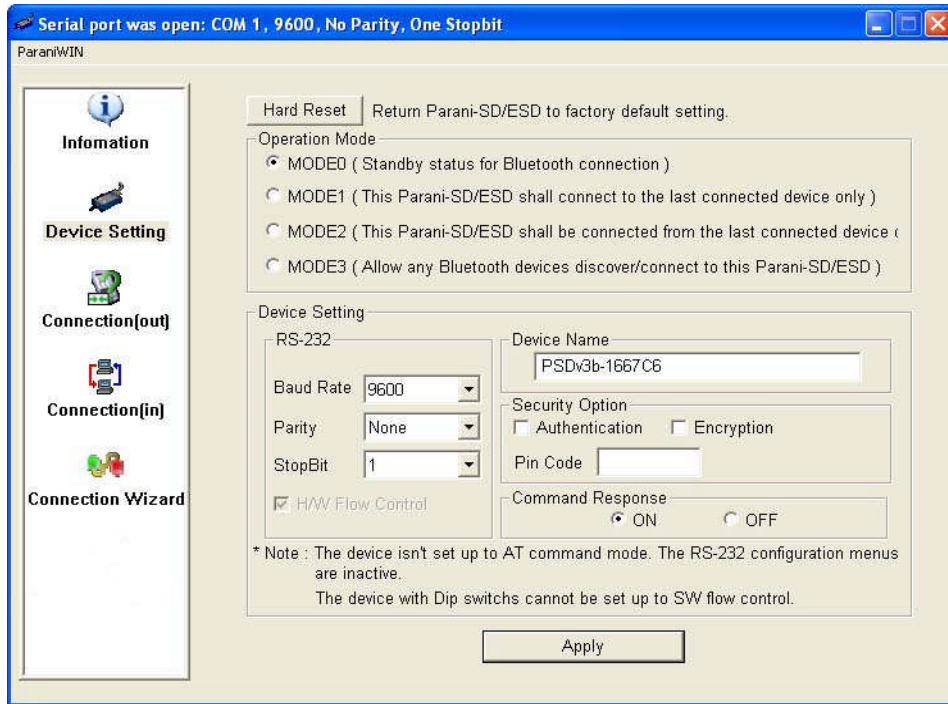
Figure 3-6 Device Setting Window

Parani-SD1100 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-SD1100 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-SD1100 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-SD1100 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.

If dipswitch for UART Configuration is put at 9600-8N1, Baudrate, Parity and Stopbit cannot be set. They are configurable at SWConfig mode. The options which are not configurable are deactivated according to the model of Parani series.

Click [Apply] button to apply any changes made to the Parani-SD1100.

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

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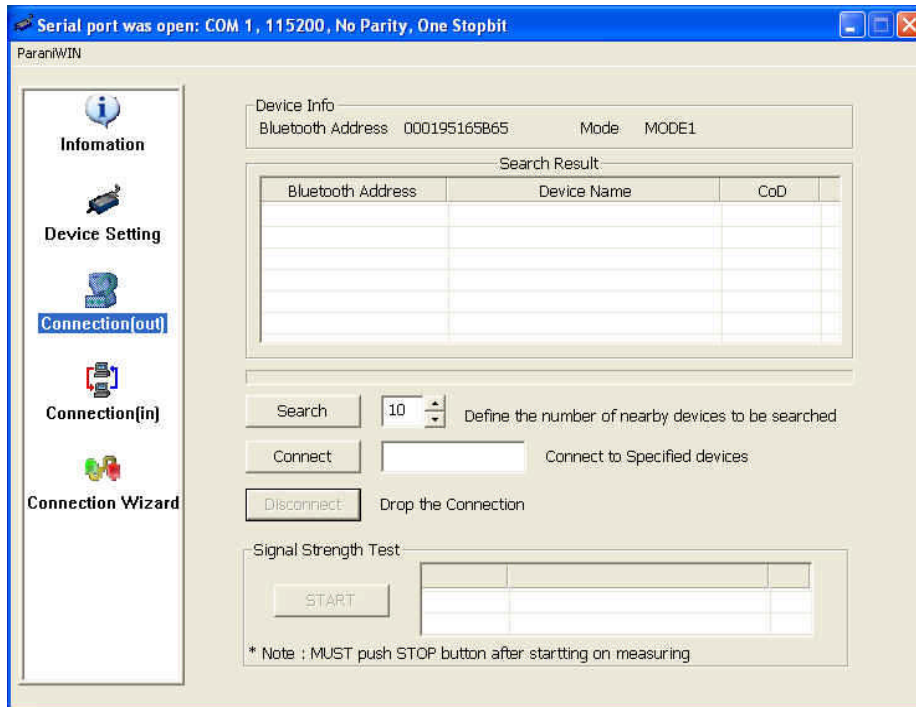
Figure 3-7 Connection (out) Window

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 close the connection.

After the connection has been established, you will be able to test signal strength by pushing the [START] button.
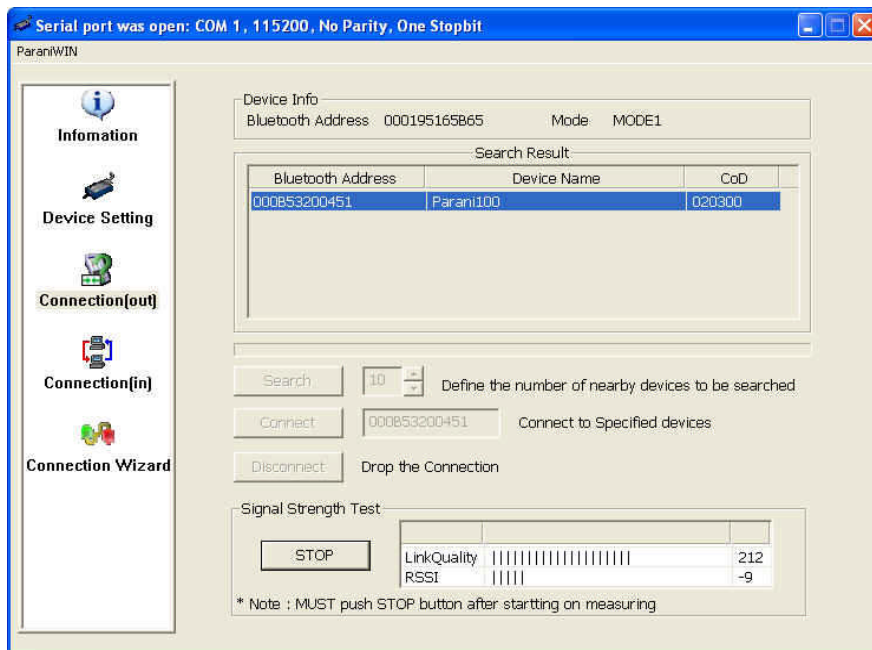
Figure 3-8 Signal Strength Test

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The signal strength test shows LinkQuality and RSSI values. The closer LinkQuality is to 255 and RSSI is to 0, this means the Parani-SD1100 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-SD1100 to terminate the test.

Connection(in) icon will show the following window, which enables the Parani-SD1100 to wait for a connection from another Bluetooth device. If the waiting time is set to 0, Parani-SD1100 will continually wait for connection until [Cancel] button is clicked.
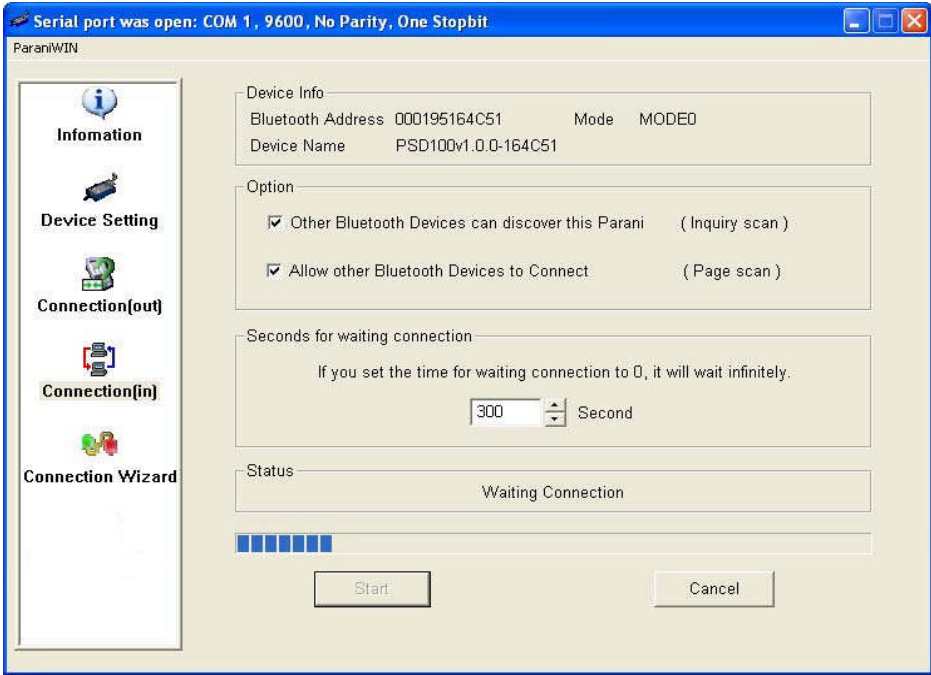
Figure 3-9 Connection (in) Window

If the Connection Wizard icon is clicked, an easy to use pairing menu will appear:
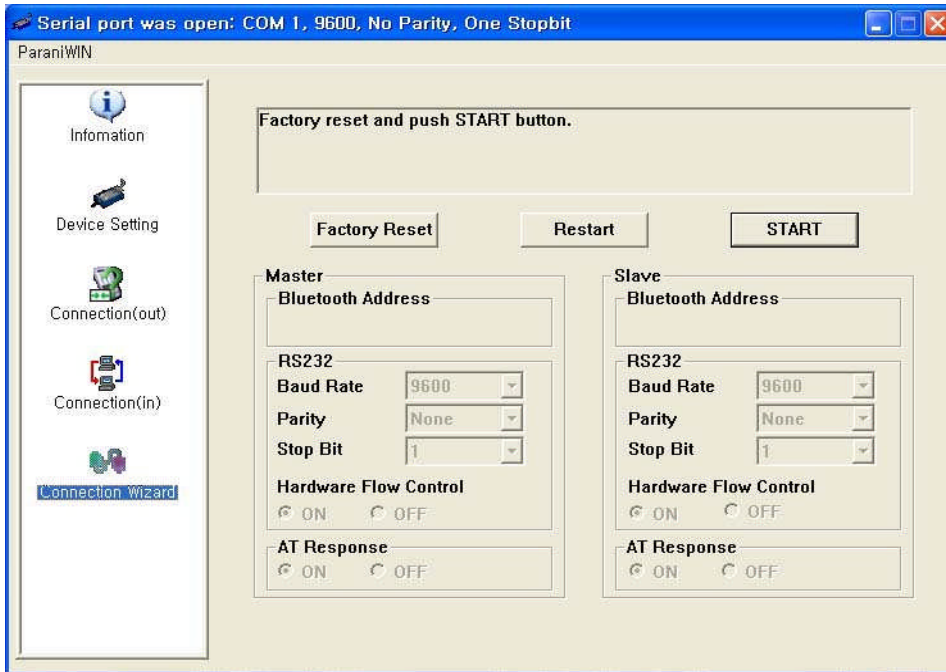
Figure 3-10 Connection Wizard Window

In this example we will refer to the two Parani-SD1100s as SD1 and SD2 respectively. To use this menu, please do the following:

Step 1. Connect SD1 and then push the [START] button.
Step 2. Disconnect SD1, connect SD2 and then push the [Next] button after setting up Slave configuration. At this time, the dip switch value should be SW Config mode. The flow control setting can be changed only through dip switch.
Step 3. Disconnect SD2, once again connect SD1 and then push the Finish button. The pairing configuration should be completed. Make sure that each Parani-SD1100's connect LED is on. At this point, when both Parani-SD1100's restart, the connection will be established automatically.

3.11. Parani Multi Wizard

Parani Multi Wizard is the software tool for multiple connection mode configurations of the Parani-SD and Parani-ESD products.

Parani Multi Wizard supports the Wizard mode and the Manual mode. The Wizard mode provides the user step-by-step instructions for multiple mode configurations. To run the Wizard mode, select "Multiple connection mode setting" and "1:N setting", press "Start" button and follow the instructions.
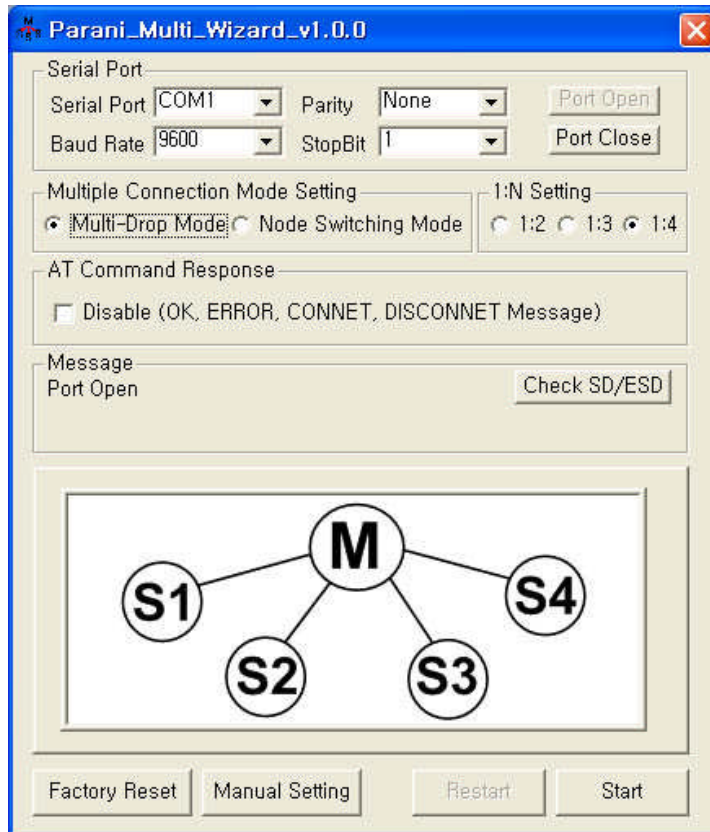
Figure 3-11 Parani Multi Wizard Window
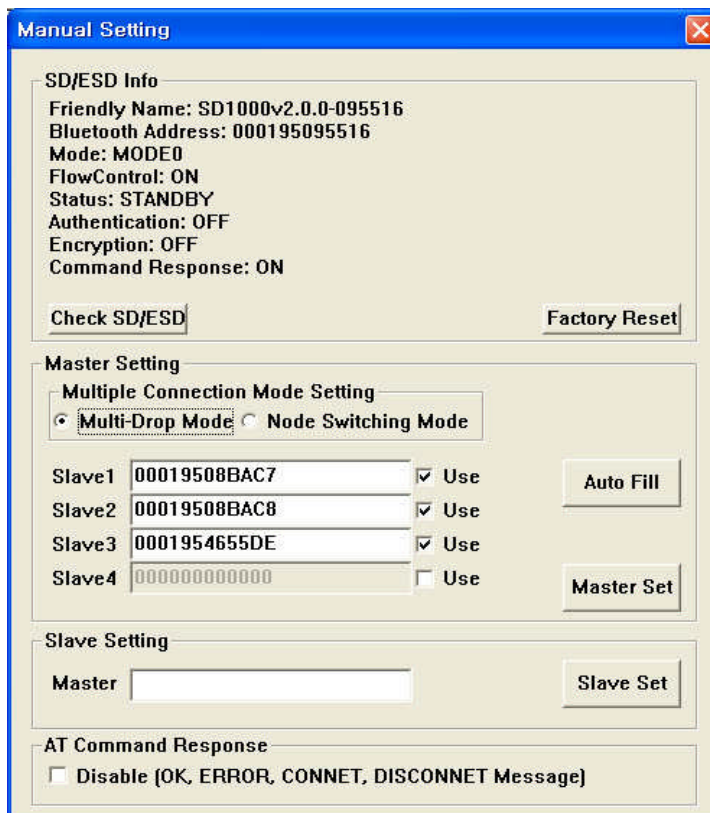
Figure 3-12 Manual Setting Window

In the Manual mode, all settings for the multiple connection mode can be configured in one window. If a Use field is unchecked or a slave address is entered as 000000000000, it is excluded from the Slave settings.

The Auto Fill button will load the existing multiple connection mode settings from the Parani-SD/ESD connected, which can be useful when only some parts of the settings are changed.

If the AT Command Response Disable check box is checked on, the AT command responses such as OK, ERROR, CONNECT, DISCONNECT are suppressed.

3.12. ParaniUpdater

Parani-SD1100 supports firmware updates. You can download new firmware images for the Parani-SD1100 at http://www.sena.com. With the ParaniUpdater, you can update the firmware of Parani-SD1100 by selecting the firmware image file and pushing Start button. You can make SD1100 work by turning off and on twice after finishing updating.
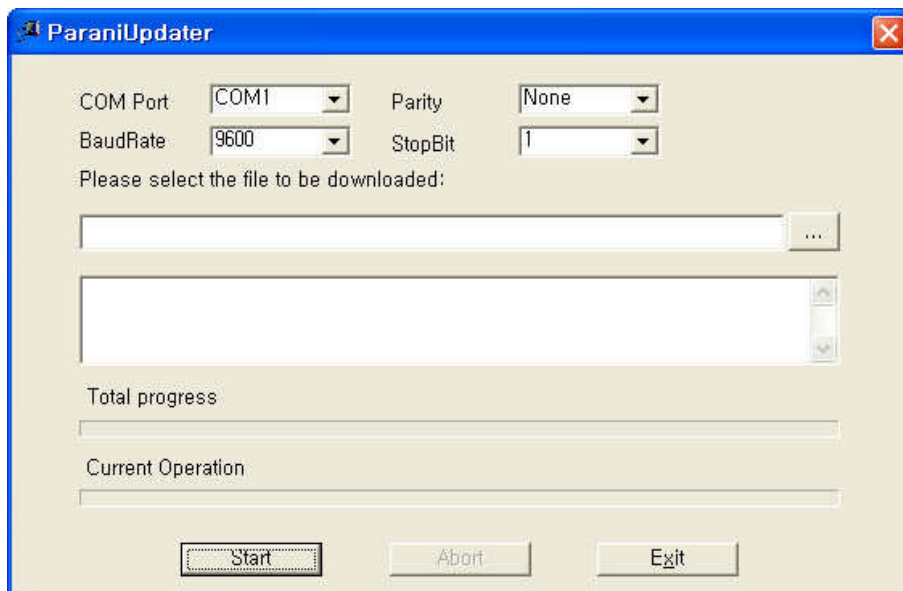
Figure 3-13 ParaniUpdater Window

* Note: Firmware update can be possible after connecting CTS pin with RTS pin. Because there is no CTS/RTS pins with SD1100, users need to shortcircuit the CTS/RTS at PC serial side before updating firmware (Refer to Figure 3-14). Users can use the Firmware Update Kit - an accessory for SD1100 - which is already wired for firmware update. (Refer to Figure 3-15)
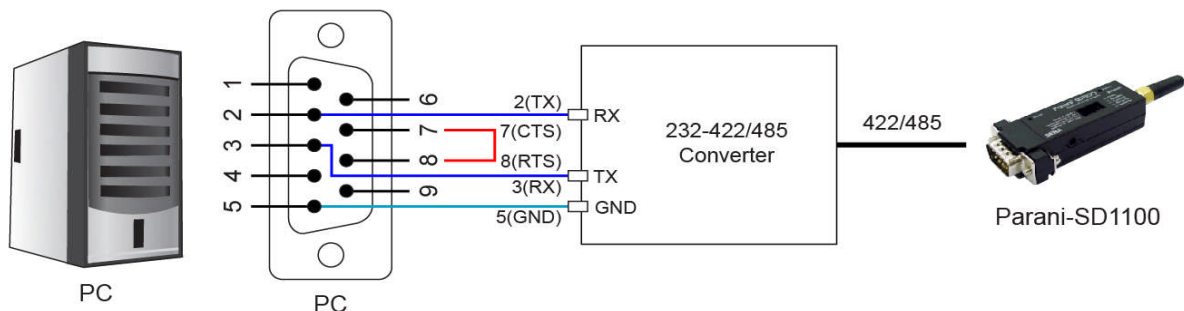
Figure 3-14 Serial Wiring for Firmware Update

24
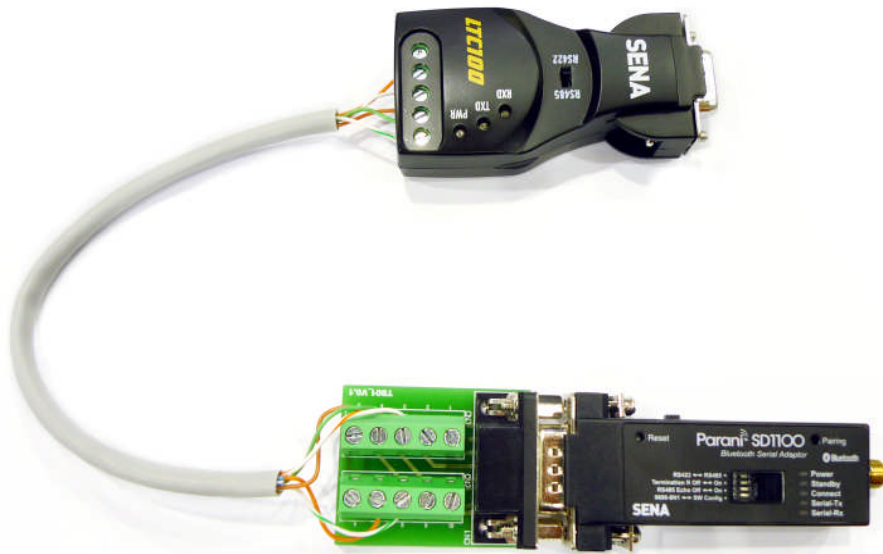
Figure 3-15 Firmware Update Kit

* Note: DO NOT power off Parani-SD1100 while the firmware update is progressing, this may damage the Parani-SD1100.

3.13. 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-SD1100 provides some extended AT commands for configuration of the Parani-SD1100.

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. SD1100 does not support Flow Control.
.
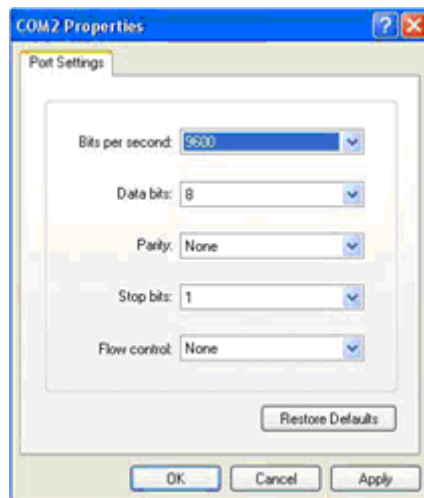
Figure 3-16 HyperTerminal

Attach Parani-SD1100 to serial port of host computer and power on the Parani-SD1100. Check Standby LED. (See 3.2. LED Indicators)

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-SD1100. Then launch HyperTerminal, it can usually be found in start >programs >accessories >communication >HyperTerminal. Select the Serial port that Parani-SD1100 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-SD1100'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?

00015B446655,SD1100v1.0.0-446655,MODE0,STANDBY,0,0,NoFC

OK
atd 000195000001

OK

CONNECT 000195000001
```

4. Multiple Connection Mode

4.1. Overview

Parani-SD1100 supports multiple connections up to 4 slave units. There are two types of multiple connection modes: Multi-Drop Mode and Node Switching Mode.
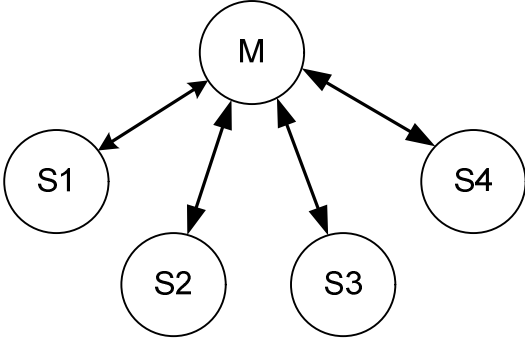
Figure 4-1 Multi-Drop Mode

In Multi-Drop Mode a master unit can connect to maximum 4 slave units at the same time and they transfer data bi-directionally as in Figure 4-1.
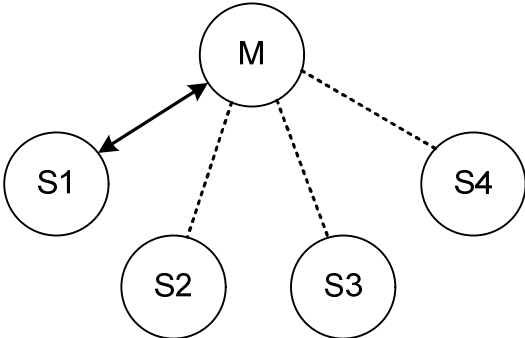
Figure 4-2 Node Switching Mode

In Node Switching Mode, the master unit maintains multiple connections with maximum 4 slave units but only one connection with one slave unit is active and data is transferred as shown in Figure 4-2. Active slave is selected by AT commands.

```
On communication after connecting

+++

OK

ATO1 – Communicating with #1 Slave

+++

OK

ATO000195000003 – Communicating with slave of BD 000195000003
```

4.2. Configuration

All the slaves should be in the status of waiting for connection either in Mode 2 or Mode 3 and the master unit tries to connect to the slave units. The master unit needs to be configured to work in a multiple connection mode using AT+MULTI,x command, which makes master reboots after execution.

Table 4-1 AT+MULTI,x

AT+MULTI,0	Single Connection Mode
AT+MULTI,1	Multi-Drop Mode
AT+MULTI,2	Node Switching Mode

Table 4-2 Configuration of a Multiple Connection Mode

Manual Connection	Automatic Connection
ATD000195000001 CONNECT000195000001 +++ OK ATD000195000002 CONNECT000195000002 +++ OK ATD000195000003 CONNECT000195000003 +++ OK ATD000195000004 CONNECT000195000004 +++	ATS46=000195000001 OK ATS54=000195000002 OK ATS55=000195000003 OK ATS56=000195000004 OK AT+MULTI,1 or AT+MULTI,2 OK AT+BTMODE,1 After rebooted automatically master tries to connect to slaves

After input the BD addresses of the slave units into 4 S-registers S46, S54, S55 and S56 and then set operation mode as MODE1, users can use multiple connection function. If S-registers have available slaves' address, AUTO CONNECT message will be displayed following corresponding TASK.

```
TASK1 OK – AUTO CONNECT

TASK2 OK

TASK3 OK – AUTO CONNECT

TASK4 OK
```

4.3. AT Commands

4.3.1. AT+MULTI,n

Select a multiple connection mode. Refer to Table 4-1 for descriptions.

4.3.2. AT+MLIST?

It shows the current mode, the connection status and the BD addresses of slaves.

```
at+mlist?

CURRENT MODE: MULTI DROP

TASK1 – 000195000001

TASK2 – 000195000002

TASK3 – DISCONNECT

TASK4 - 000195000004

OK
```

4.3.3. ATHx, ATHbdaddr

Using the ATH command, connections with all slaves or only connections with specific slaves can be disconnected selectively

Table 4-3 ATH

ATH	Disconnect all the slaves.
ATHx (ATH1, ATH2, ATH3, ATH4)	Disconnect the slave which belongs to the TASK x.
ATHbdaddr (ATH000195000001)	Disconnect the slave with specified BD address.

4.3.4. ATOx, ATObdaddr

Using the ATO command, the communication status with the last active slave or a specific slave can be set to online (only in Node Switching Mode).

Table 4-4 ATO

ATO	Communicate with the slave recently communicated.
ATOx (ATO1, ATO2, ATO3, ATO4)	Communicate with the slave which belongs to the TASK x.
ATObdaddr (ATO000195000001)	Communicate with the slave with specified BDaddress.

4.4. Notes

When large data exchange occurs in Multi-drop mode without flow-control enabled, the master unit may experience data loss. It may also experience occasional disconnections and/or system rebooting especially when bi-directional communication happens. It is strongly recommended to perform extensive performance test before any real world field applications.
The master unit would try to connect all slave units specified by S-register 46, 54, 55 and 56. If non-existing or inactive slave addresses are entered in these S-registers, the overall performance will degrade due to frequent connection trials to non-existing/inactive slaves. It may also force disconnections for overall performance and outputs disconnect messages repeatedly.

Node-switching mode provides nearly equivalent performance as single connection mode. It is always recommended to use flow-control for both of Multi-Drop Mode and Node Switching Mode.

5. Approval Information

5.1. FCC

FCC Part 15 Subpart C Section 15.247
FCC ID: S7APARANISD1100

5.1.1. 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

5.1.2. 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.

5.1.3. 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.

5.2. CE

CE1177 (!)
EN 60950-1: 2001
EN 62311: 2008
ETSI EN 301 489-1 V1.6.1
ETSI EN 301 489-17 V1.2.1
ETSI EN 300 328 V1.6.1

5.3. KCC

Type Registration
Certification No: SNA-Parani-SD1100

5.4. TELEC

Type Registration
Certification No: 010WWBT0041

5.5. SIG

Specification Version: 2.0/2.0 + EDR
QDID: B016862

6. RF Information

6.1. Radio Frequency Range

2.402~2.480GHz

6.2. Number of Frequency Channel

79 channels

6.3. Transmission Method

FHSS (Frequency Hopping Spread Spectrum)

6.4. Modulation Method

GFSK (Gaussian-filtered Frequency Shift Keying)
Pi/4 DQPSK (pi/4 rotated Differential Quaternary Phase Shift Keying)
8DPSK (8 phase Differential Phase Shift Keying)

6.5. Radio Output Power

Products	Transmit Power
Parani-SD1100	+18dBm

6.6. Receiving Sensitivity

Products	Receive Sensitivity
Parani-SD1100	-88dBm

6.7. Power Supply

Products	Power supply
Parani-SD1100	DC5.0 ~ 12V

Appendix A: Connections

A.1. Serial Port Pin Outs

Parani-SD is compatible with the RS422/485 standard, a DB9 Male interface.
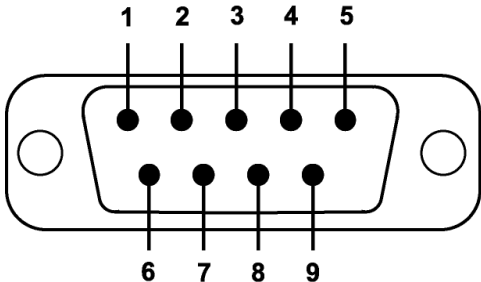
Figure A-1 Pin layout of the DB-9 male connector

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

Pin #	Signal	Direction	Description
1	VCC	Input	Power Supply 5V~12V
2	-	-	-
3	RXD- TRXD-	Input In/Output	RS422 Received Data Negative RS485 TX/RX Data Negative
4	TXD+	Output	RS422 Transmit Data Positive
5	GND	-	Signal Ground
6	VCC	Input	Power Supply 5V~12V
7	RXD+ TRXD+	Input In/Output	RS422 Received Data Positive RS485 TX/RX Data Positive
8	TXD-	Output	RS422 Transmit Data Negative
9	GND	-	Signal Ground

A.2. RS422/485 Serial Wiring Diagram
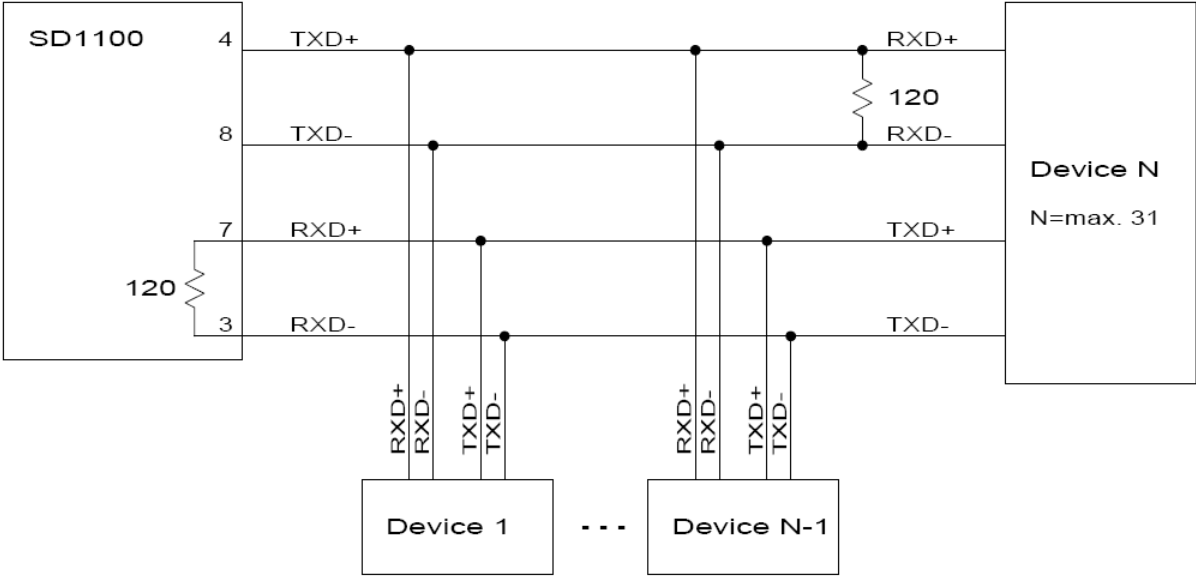
Figure A-2 RS422 wiring diagram
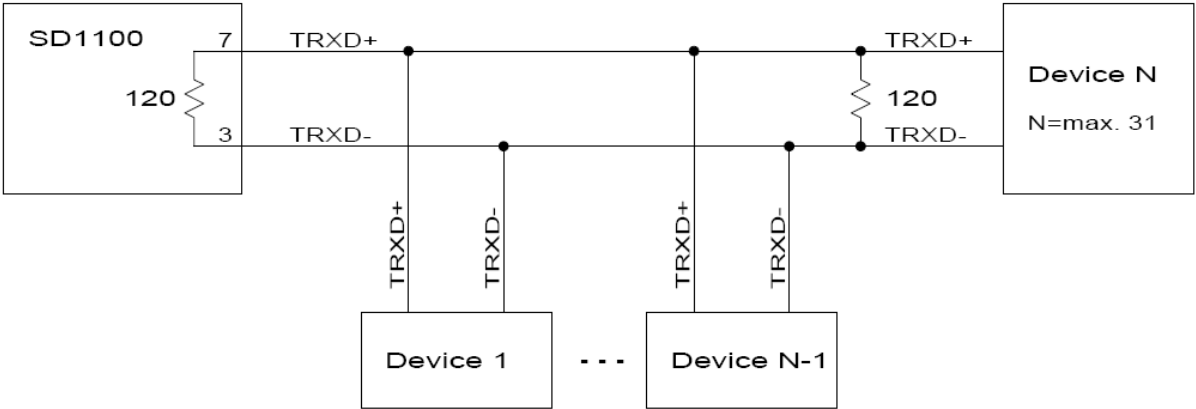
Figure A-3 RS485 wiring diagram

※ SD1100 has the dipswitch to set Termination Resistor On/Off.

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-SD provides the extended AT command set to control and configure the serial parameters and Bluetooth connection.

B.1.2. AT Response

Parani-SD 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 10	AT+USEDIP? AT+BTINFO? AT+BTINQ? AT+BTLAST? AT+BTVER? AT+MLIST?
	Mode	11 12	AT+BTMODE,n AT+MULTI,n
	Status	13 14 15 16 17 18 19	+++ AT+SETESC,nn ATO AT+BTCANCEL AT+BTSCAN AT+BTSCAN,n,to AT+BTSCAN112233445566,to
	Connection	20 21 22	ATD ATD112233445566 ATH
	Security	23 24 25 26 27	AT+BTKEY=$string AT+BTSD? AT+BTCSD AT+BTFP,n AT+BTSEC,a,e
	Miscellaneous	28 29 30	AT+BTNAME=$string AT+BTLPM,n AT+BTRSSI,n
S-REGISTER		31 32 33	AT&V ATSnn? ATSnn=mm
REMOTE CONFIGURATION		34 35	AT+PASS="nnnnnnnn" AT+CHPASS="nnnnnnnn"

B.3.   Command Description

B.3.1. ATZ↵

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.

B.3.2. AT&F↵

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.

B.3.3. AT↵

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-SD must be same as those of host equipment. If not, the Parani-SD will not respond or 'ERROR' message will appear or an abnormal sequence of strings will appear.

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

Response	�↯OK↯
Purpose	Set Serial parameters
Parameters	Baudrate = 1200/2400/9600/14400/19200/38400/57600/115200/230400/460800/ 921600 (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.
Example	AT+UARTCONFIG,115200,N,1

B.3.5. AT+USEDIP?↵

Response	�↯m↯
Purpose	Check if the default UART configuration is used by the dip switch
Description	m=0: The UART Configuration Dipswitch is set to 'S/W Config' m=1: The UART Configuration Dipswitch is set to 9600-8N1 of the default UART configuration.

B.3.6. AT+BTINFO?↵

Response	↯112233445566,DeviceName,Mode,Status,Auth,Encryp,NoFC↯ ↯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 'PSD1100v1.0.0-445566'. PSD stands for Parani-SD, 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= NoFC
Example	↯000B530011FF,SENA,MODE0,PENDING,1,1,NoFC↯

B.3.7. AT+BTINQ?↵

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 15 value in S-register 24)

B.3.8. AT+BTLAST?↵

Response	↯112233445566↯
Purpose	Display the BD address of the last connected device
Description	The Bluetooth device last connected to this Parani-SD is displayed with its BD address.

B.3.9. AT+BTVER?↵

Response	↯SD1100v1.0.0↯ ↯OK↯
Purpose	Display device firmware version
Description	Display device firmware version

B.3.10. AT+MLIST?↵

Response	↯CURRENT MODE:SINGLE CONNECTION MODE↯ ↯OK↯
Purpose	Display the current multiple connection mode and connected slave's Bluetooth addresses.
Description	Display current mode(SINGLE CONNECTION MODE, MULTI-DROP MODE, NODE SWITCHING MODE) and connected slave Bluetooth address.
Example	AT+MLIST?

	CURRENT MODE: MULTI-DROP MODE TASK1 – 000195000001 TASK2 – DISCONNECT TASK3 – DISCONNECT TASK4 – 000195000004

B.3.11. AT+BTMODE,n⏎

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
Example	AT+BTMODE,2 ⚡OK⚡ ATZ

B.3.12. AT+MULTI,n⏎

Response	⚡OK⚡
Purpose	Set multiple connection mode
Parameters	n=0: Single Connection Mode (Default) n=1: Multi-Drop Mode n=2: Node Switching Mode
Description	Set single connection mode, multi-drop mode or node switching mode.

B.3.13. +++⏎

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-SD 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-SD holds data transmission when it encounters '+', until receiving next character. '+' is an escape sequence character by default, which is changeable by AT+SETESC.

B.3.14. AT+SETESC,nn⏎

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.

Example	AT+SETESC,42

B.3.15. ATO↵ (ATOx, ATObdaddr)

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. In Node Switching mode, a specific slave can be specified to become an active connection by specifying the connection number or the Bluetooth address.
Example	ATO ATO3 ATO000195000001

B.3.16. AT+BTCANCEL↵

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'

B.3.17. AT+BTSCAN↵

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, response will be 'CONNECT' with its BD address.

B.3.18. AT+BTSCAN,n,to↵

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-SD 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, response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, response is 'ERROR' and the operation status becomes to 'Standby'.

Example	AT+BTSCAN,2,30

B.3.19. AT+BTSCAN112233445566,to↵

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-SD 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, response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, response is 'ERROR' and the operation status becomes 'Standby'.
Example	AT+BTSCAN000B530011FF,30

B.3.20. ATD↵

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

B.3.21. ATD112233445566↵

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-SD 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, response is 'ERROR '.
Example	ATD000B530011FF

B.3.22. ATH↵ (ATHx, ATHbdaddr)

Response	⚡OK⚡ ⚡DISCONNECT⚡
Purpose	Release the current connection

Description	The current Bluetooth connection will be disconnected. It takes about Supervision Timeout(S37) to detect an abnormal disconnection such as power off and moving out of service range. In multiple connection modes, a specific connection can be specified to be disconnected by specifying the connection number or the Bluetooth address The response message of 'DISCONNECT' may be displayed on disconnection depending on the disconnection condition. You can make it not displayed using S10 register.
Example	ATH ATH3 ATH000195000001

B.3.23. AT+BTKEY=$string↵

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-SD generates a link key which is used in actual authentication process
Example	AT+BTKEY="apple"

B.3.24. AT+BTSD? ↵

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-SD saves the Bluetooth device with its link key, generated by the pin code. The connection to a device listed in Parani-SD can be made automatically without the authentication process. The maximum number kept on the list is 7.

B.3.25. AT+BTCSD↵

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.

B.3.26. AT+BTFP,n↵

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-SD asks for the pin code every time a connection is made. This can be used to increase security.

B.3.27. AT+BTSEC,Authentication,Encryption↵

Response	↯OK↯

Purpose	Set authentication and data encryption
Parameters	Authentication=0: Inactivate (Default) Authentication=1: Activate Encryption=0: Inactivate (Default) Encryption=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. Authentication=0 and Encryption=1 will not work properly.

B.3.28. AT+BTNAME=$*string*↵

Response	⚡OK⚡
Purpose	Change device name
Parameters	$string= New device name (Default="PSDv2.0.0-445566")
Description	Parani-SD can have a user friendly name for easy identification. The name allows up to 30 alpha-numeric characters.
Example	AT+BTNAME="My-Parani-SD"

B.3.29. AT+BTLPM,n↵

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

B.3.30. AT+BTRSSI,n↵ (Single Connection Mode Only)

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.3.31. AT&V↵

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 hardware reset.

B.3.32. AT+PASS=$string↵

Response	Remote Configuration Enabled↯
Purpose	Input password in remote configuration mode.
Parameters	$*string*= Password (Default="0000")
Description	Input password for authentication in remote configuration mode.
Example	AT+PASS=1234

B.3.33. AT+CHPASS=$string↵

Response	↯OK↯
Purpose	Change password used in remote configuration mode.
Parameters	$*string*= New password
Description	Change password used in remote configuration mode. Password length is up to 8.
Example	AT+CHPASS=12345678

B.3.34. ATSnn?↵

Response	↯value↯ ↯OK↯
Purpose	Display a given S-register
Parameters	nn= Address of S-register
Description	A specific S-register will be displayed.

B.3.35. ATSnn=mm↵

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, response is 'ERROR'.* *For details of S-register, refer Appendix. B.*
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?	○	○	
AT+BTVER?	○	○	
AT+BTRSSI,n	●		

◎ Valid only when Parani-SD is not connected to other Bluetooth device.
● Valid only when Parani-SD is connected to other Bluetooth device.

Appendix C: S-Register

S-registers contain 52 parameters for the Parani-SD Series. 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-SD Series. Thus it is not recommended to change these S-registers.

Changing the values of S-register can only be done in the Standby mode. It is not recommended to change S-registers other than ones listed here. Turn Parani-SD off and on to apply the change of S-register.

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

S1=0, Parani-SD in Mode1 does not try to reconnect when disconnected.
S1=1, Parani-SD 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, Parani-SD sends the received data immediately. When this value is 0, the Parani-SD maximizes throughput, the Parani-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-SD will query only the BD address. This speeds up the inquiry process.
S4=1, Parani-SD will query the BD address, device name and class of device.

When this value is 1, Parani-SD finds not only BD address but also friendly name. When this value is 0, Parani-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 Parani-SD works in Low Power Mode or not. When this value is 0, Parani-SD works only in active power mode. When Parani-SD works in Low Power mode, delay in transferring data may occur.

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

S10=0, Parani-SD does not send response messages to the host system.
S10=1, Parani-SD sends response messages to host system.

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

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

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

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

C.7. S12: Clear Data Buffer When Disconnected (default 1)

S12=0, Parani-SD does not clear the data buffer received from host system when disconnected.
S12=1, Parani-SD clears the data buffer when disconnected.

C.8. 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.9. S23: Intercharacter Timeout Setting (default 0)

S23=0 : Not used
S23=1 : 1 x S26
S23=2 : 10 x S26
S23=3 : 100 x S26

C.10. S24: Maximum Number of Inquiry Result (default 15)

The maximum number of inquiry list can be controlled. If value is 0, maximum number of inquiry list is limitless.

C.11. S26: Intercharacter Timeout (default 0)

This value describes time interval between characters used to separate the data from serial port. If there is no more data coming from serial port in this value, data is sent to client.
S23=1 x S26=50 : Timeout-> 50msec
S23=2 x S26=50 : Timeout-> 500msec
S23=3 x S26=3 : Timeout-> 300msec

Intercharacter Timeout	* Optimal Value(S23 x S26)
50ms	180
100ms	235
200ms	340

* When 10 bytes data are sent every intercharacter timeout, they are sent separately by 10 bytes at the optimal value. If the intercharater timeout is set below the optimal value, the date will be put together and sent by 20, 30, 40 bytes or more.

C.12. 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.13. S31: Page Timeout (default 20)

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

C.14. S33: Inquiry Timeout (default 30)

This is the timeout in seconds to execute inquiry scan.

C.15. S37: Supervision Timeout (default 5)

This is the timeout to presume disconnection, which is set to 5 seconds initially. The smaller the value becomes, the more quickly Parani-SD can detect an abnormal disconnection. But when the communication is suspended, it may be regarded as disconnection. This value should be greater than the Slave Disconnect Timeout(S57). (Slave unit depends on the value of master unit.)

C.16. S43: COD (default 001F00)

This value describes the sort of the bluetooth device and is editable.

C.17. S44: COD Filter (default 0)

This value is used to filter the sort of the bluetooth devices on inquiring. All the bluetooth devices are inquired in case of 0. In case of 3E0100, bluetooth devices with COD 3E0100 are inquired.

C.18. S45: Inquiry Access Code (default 0x9E8B33)

Inquiry access code is used during inquiry state. The reserved IAC addresses are 0x9E8B00 ~ 0x9E8B3F. The general inquiry IAC is 0x9E8B33.
Parani-SD is able to find the Bluetooth devices that are configured as the same IAC

C.19. S46: BD Address of Last Connected Device

This saves the BD address of the Bluetooth device connected most recently in single connection mode. This saves the Task1 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.20. S48: Low Power Max Interval (default 5000)

This is the max interval value to use low power mode, which is set to 5000 initially. (5000 x 625µsec = 3125msec)

C.21. S49: Low Power Min Interval (default 4500)

This is the min interval value to use low power mode, which is set to 4500 initially. (4500 x 625µsec = 2812msec)
A small interval increases power consumption, a large interval increases latency.

C.22. S52: Low Power Timeout (default 5)

This is the low power timeout value, which is set to 5 initially. (5sec)
During no data transmission in the timeout, Parani-SD will be in low power mode to save the power. Therefore, it takes a few seconds to wake the Parani-SD out of low power mode.

C.23. S54: BD Address of Last Connected Device

This saves the Task2 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.24. S55: BD Address of Last Connected Device

This saves the Task3 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.25. S56: BD Address of Last Connected Device

This saves the Task4 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.26. S57: Slave Disconnect Timeout (default 3)

This S57 register value defines the time period in seconds that a master unit waits in case a slave unit does not receive the data sent from the master. For this time period, the master unit will not send data to all slave units if any slave unit does not receive the data. If the slave unit does not receive the data after this time period elapses, the master unit will disconnect the connection with the problematic slave unit. The value should be greater than 0 and smaller than the Supervision Timeout(S37).

C.27. S58: MAX TX POWER (default 0)

This value describes the peak output power. Setting this causes rebooting and applying. (There can be a little deviation depending on the each device.)

Parameter	dBm
0	Use chip setting.
1	-12
2	-8
3	-4
4	0
5	4
6	8
7	12
8	16

C.28. S59: Current Slave in Communication (default 0)

This value shows the current slave number in communication. The value is automatically stored when the slave is selected for communication. This value can also be set by user so the master unit connects to a specific slave to connect first in case the master unit reboots. The value range is 0~4. 0 means the maser unit never connected to a slave. The master will connect to a slave whatever responses first.

C.29. S60: Reconnect Time Interval (default 5)

This value defines reconnect time interval in case a slave is disconnected in multiple connection mode. The actual reconnect time interval will be the value multiplied by two in seconds. For example, if the value is set to 5, the reconnect time interval will be 10 seconds. The value should be greater than or equal to 5. The master unit will only try to reconnect when its mode is set to Mode1.

Appendix D: Trouble Shooting

D.1. No Data Transmission

D.1.1. COM Port Settings

Check whether the Baudrate of Parani-SD matches that of its host equipment.
Check whether the host equipment has a Data bit setting of 8. Parani-SD 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-SD. 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-SD match those of your host equipment. Parani-SD supports No parity, Even parity and Odd parity, 1 and 2 Stop bit configurations.

D.1.2. Pin Assignment

Even though the specification in RS422/485 is established by EIA , that in the physical connector and pit outs is not established yet. Wire users' serial device properly according to DB-9 pin outs of SD1100 before use. RS422 consists of TXD+, TXD-, RXD+ and RXD- and SD1100 is wired crossed with serial device. For example, TXD+(4) of SD1100 is to wire to RXD+ of serial device and TXD-(8) to RXD-. RS485 consists of two lines such as TRXD+ and TRXD- and SD1100 is wired in same signals with serial device. For example, TRXD+(7) of SD1000 is to wire to TRXD+ and TRXD-(3) to TRXD-. Refer to Appendix A: Connections before connecting serial device to SD1100.

D.2. Data Loss or Malfunctioning

D.2.1. Response Message

AT response messages from the Parani-SD may affect the host system unexpectedly. Do not use Parani-SD 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-SD 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-SD 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-SD 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: Parani-SD1100 mechanical drawing

E.1. Parani-SD1100 mechanical drawing (mm)

101 with stub antenna

74 without antenna

15

16

21

31
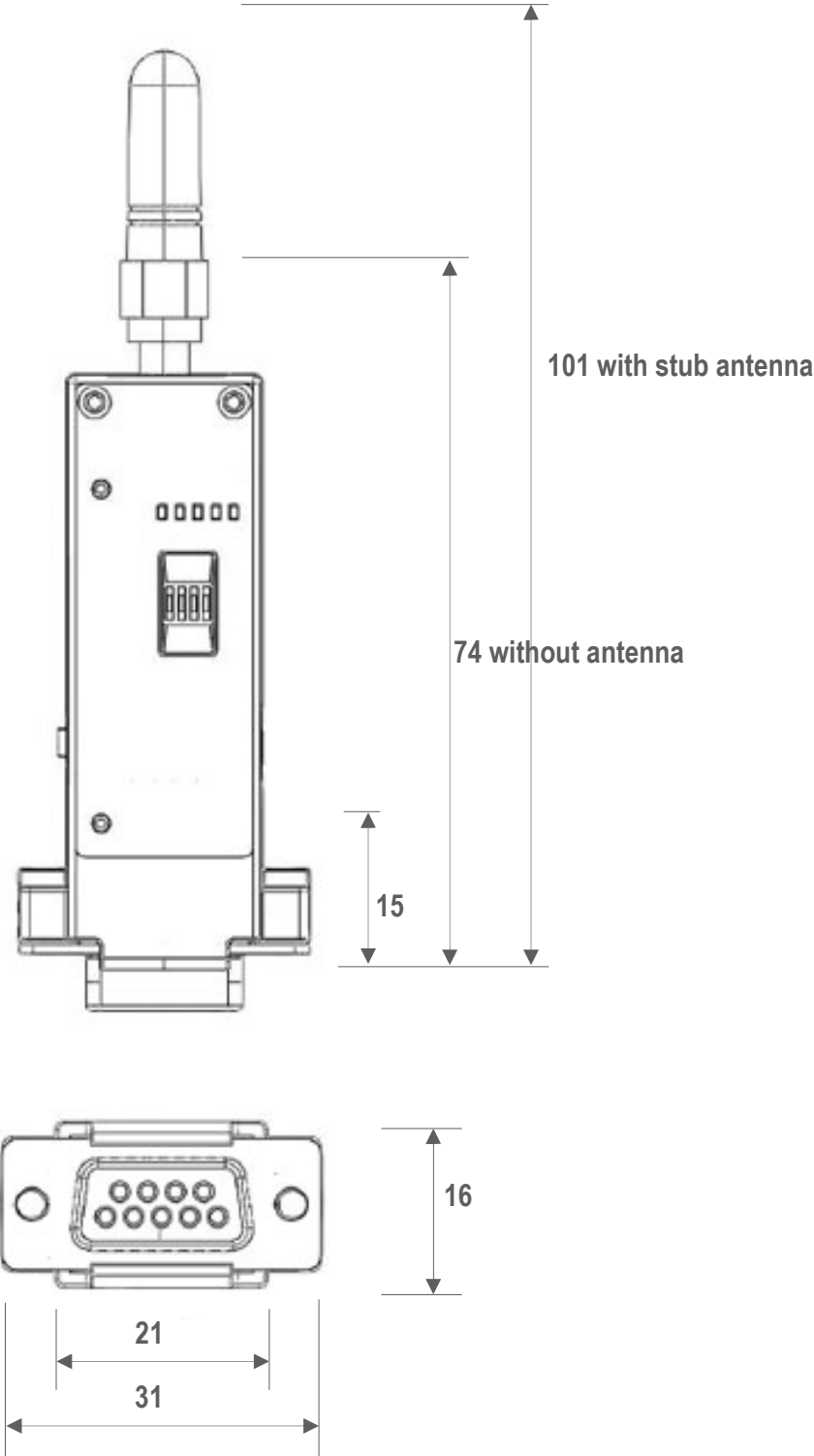
Appendix F: Warranty

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.

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