

Parani-SD1000U

User Guide

Version 1.0.0

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User Guide for the Parani-SD1000U

Version 1.0.0

Firmware version 1.0.X

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- 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.

Caution

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FCC Compliance Information : 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

IMPORTANT NOTE:

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This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device has been designed to operate with the antennas listed below, and having a maximum gain of 8.92dB. Antennas not included in this list or having a gain greater than 8.92 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Antenna list :

Antenna type	Model name	Max gain(dBi)
Patch Antenna	HIF-2400	Max Gain 8.92 dBi
Dipole Antenna	R-AN2400-1901RS	Max Gain 5.37 dBi
Dipole Antenna	R-AN2400-5801RS	Max Gain 3.27 dBi
Dipole Antenna	AN2400-3306RS	Max Gain 1.40 dBi

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

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1. Introduction

1.1. Overview

Parani-SD1000U 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-SD1000U can communicate with other Bluetooth devices; user may connect other Bluetooth devices that support the Serial Port Profile.

The working distance of SD1000U with default antenna is 100m

SD1000U 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.

SD1000U supports FHSS (Frequency Hopping Spread Spectrum), which is a technique, native to Bluetooth that allows the SD1000U minimize radio interference while decreasing the likelihood of over-air hijacking. SD1000U also supports authentication and Bluetooth data encryption.

SD1000U can be configured and controlled by a set of AT commands. Users can easily configure SD1000U 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. Product Specification

	Parani-SD1000U
Bluetooth Interface	Bluetooth v2.0 + EDR
	Class 1
	Working distance: Dipole Antenna - Dipole Antenna 150 meters Dipole Antenna - Dipole Antenna 200 meters Dipole Antenna - Dipole Antenna 300 meters
Configuration	ParaniWIN, Modem AT command set
Firmware Update	ParaniUpdater
Diagnostic LED	Mode, Connect, Serial Rx/Tx
Environmental	Operating temperature: -20 ~ 70 °C Storage temperature: -40 ~ 85 °C Humidity : 90% (Non-condensing)
Physical properties	- Dimension (L x W x H) 68 x 22 x 11.5 (mm) - Weight 14g
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

2.1. USB Driver Installation

In case the USB interface is used for the communication between the development board and the computer, the corresponding software driver needs to be installed on the computer. Windows XP and later versions already include the USB driver. When Windows asks for the location of the USB driver, you can select the option to “install the software automatically” as shown in Figure 2-7. You can also choose to install the driver from the CD included if the driver is not installed correctly for some reason.

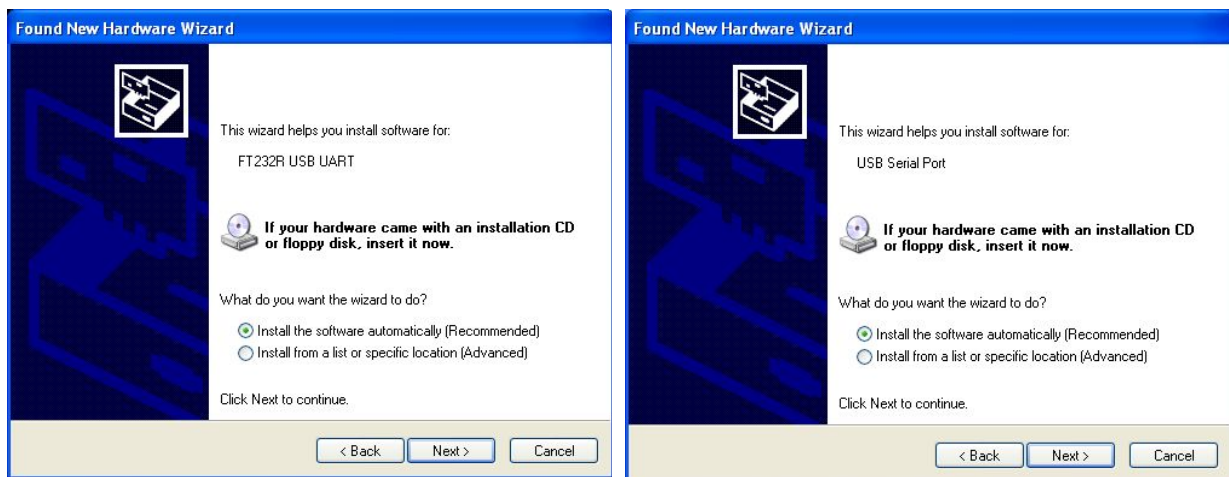


Figure 2-1 USB Driver Installation

2.2. Operation Modes

In addition to the serial port configurations the SD1000U also requires some settings for Bluetooth. For getting the most out of SD1000U, 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.

SD1000U has 4 operation modes as follows. Each mode can be identified with LED indicators as illustrated in next section.

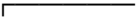
Table 2-1 SD1000U Operation Modes

Mode	Description
Mode0	In this mode, there is no response when power on or software reset, and SD1000U is just waiting for AT command input. Neither master nor slave is assigned to Parani-SD1000 U in mode0. User can change the configuration parameters of Parani-SD1000 in this mode. SD1000U must be in Mode0, when it is directly controlled by AT commands. The factory default is set to Mode0.
Mode1	SD1000U tries to connect the last connected Bluetooth device. SD1000U in Mode1 is to be a master and tries to connect the last connected Bluetooth device. SD1000U always stores the BD address of the Bluetooth device to which SD1000U has connected last. When Parani-SD1000 is initially used or after hardware reset, there is no BD address stored in SD1000U. In this case, Mode1 will not be able to work properly. The mode change to Mode1 can be made after SD1000U succeeds to connect to one other Bluetooth device. Once changed to Mode1, SD1000U will try to connect automatically the last connected Bluetooth device whenever the unit is powered on or software reset. SD1000U in Mode1 cannot be discovered or connected by other Bluetooth devices.
Mode2	SD1000U is waits for a connection from the last connected Bluetooth device. SD1000U 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 SD1000U, the mode change from other operation modes to Mode2 is not work properly. Once changed to Mode2, SD1000U will wait for the connection from the last connected Bluetooth device whenever the unit is powered on or software reset. SD1000U in Mode2 cannot be discovered or connected to Bluetooth devices other than the last connected device.
Mode3	SD1000U is waiting for the connection from any other Bluetooth devices. In Mode 3 the SD1000U is discoverable and can be connected to by other Bluetooth devices.

2.3. 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 2-2 The SD1000U LED Indicators

Indicator	Mode LED	Connect LED
Mode 0	Green 	
Mode 1	Green (every 1 sec) 	
Mode 2	Green (every 3 sec) 	
Mode 3	Green (every 3 sec) 	
Connected		Green (every 1 sec) 

2.4. Serial Ports

The applicable settings for serial ports are as follows.

Table 2-3 The SD1000U Serial Port Settings

Serial Port Settings	Values
Baud rate	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	Use, No Use

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

2.5. Data Bit

SD1000U 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.

2.6. Hardware Flow Control

SD1000U plugged into its host system transmits data from host to the other side Bluetooth device. This data is saved temporarily in the internal buffer of SD1000U and sent repeatedly until the transmission is completed packet by packet. When the radio transmission condition is not good enough to send data promptly, it can cause a transmission delay. If the host sends more data when the buffer is full, buffer overflow will make SD1000U malfunction consequently. In order to prevent this buffer overflow, SD1000U works as follows.

When using hardware flow control, SD1000U disables RTS so that it stops receiving any further data from the host when the buffer becomes full. RTS will be re-enabled again to begin receiving data from the host when the buffer has created more room for more data.

When hardware flow control is not being used, the SD1000U clears the buffer to secure room for the next data when the buffer becomes full. This can mean a loss of data may occur. As the transmission data becomes large, the possibility of data loss becomes greater.

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

2.7. 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.

2.8. Dipswitch

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

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

Table 2-4 Baud rate Settings by Dipswitches

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

Table 2-5 Hardware Flow Control Settings by Dipswitches

Hardware Flow Control Handshaking	No Use	Use
		

* Note: You cannot set the SD1000U to a Baud rate of 1200 and 230K by way of the Dipswitch. If you want to use them, to set these speeds, please configure the dipswitch to S/W Config setting and use ParaniWIN or AT commands. Please refer to ParaniWIN and Appendix 0 AT+UARTCONFIG, Baud rate, Paraty, Stopbit.

2.9. Pairing Button

SD1000U provides Pairing Button for instant configuration without a PC to make an automatic connection between two SD1000Us. In this example we will refer to the two SD1000Us 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 Mode LED blinks 3 times every 3 seconds. Keep the power ON.

Step 3. Press the Pairing Button of SD2 for 2 seconds until Mode LED blinks 3 times every 3 seconds. Now press again the Pairing Button for 2 seconds until Mode 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. Mode LED blinks twice in green every 3 seconds.

Step 6. Turn SD2 off and on. Mode 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 SD1000U 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 SD1000U will not send the response messages such as OK, Connect and Disconnect.

Table 2-6 Pairing Process by Pairing Button

SD1	Status	LED	SD2	Status	LED
1. Factory reset	Mode0	Mode LED turns on	1. Factory reset	Mode0	Mode LED turns on
2. Push pairing button	Mode3	Mode LED blinks 3 times every 3 seconds	2. Push pairing button	Mode3	Mode LED blinks 3 times every 3 seconds
			3. Push pairing button again	Mode1	Mode LED blinks every second
4. Connected	Slave	Connect LED blinks every second	4. Connected	Master	Connect LED blinks every second

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 Mode 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. Mode 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 2-7 Pairing Process with other Bluetooth device by Pairing Button

SD1	Status	LED	Other Bluetooth Device	Status
1. Factory reset	Mode0	Mode LED turns on		

2. Push pairing button	Mode3	Mode LED blinks 3 times every 3 seconds		
			3. Inquiry and connect to SD1	
4. Connected	Slave	Connect LED blinks every second	4. Connected	Master

2.10. 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 2-8 Configuration Software

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

2.11. ParaniWIN

ParaniWIN is a program that runs on Microsoft Windows for the configuration of SD1000U. Install ParaniWIN on your computer. Plug a SD1000U into the serial port of the computer and turn on the power. Run ParaniWIN.

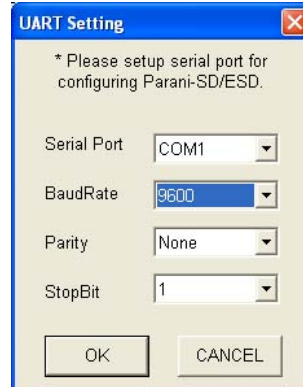


Figure 2-1 Serial Port Setting

Set each option properly and click [Confirm]. If the settings of the SD1000U are different from the ParaniWin, an error message will pop up. If the SD1000U 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.

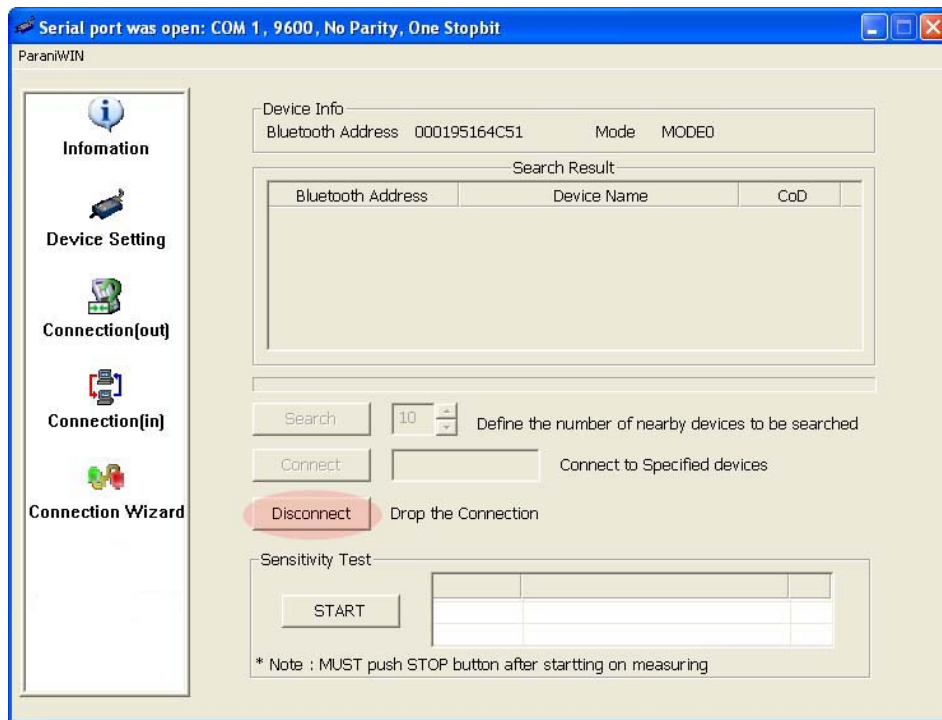


Figure 2-3 Main Window

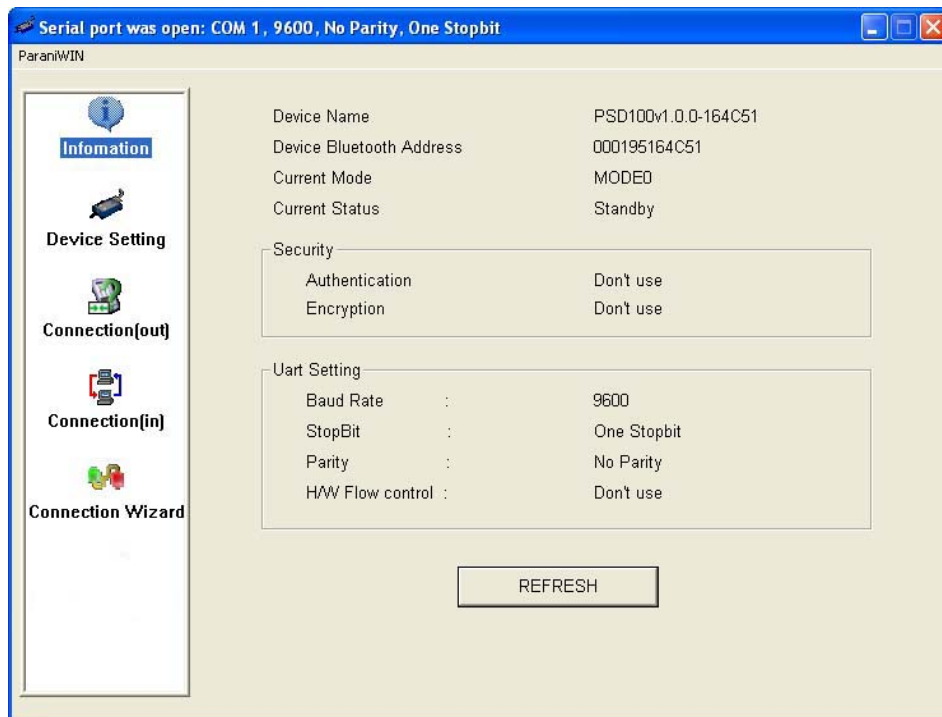


Figure 2-4 Information Window

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.

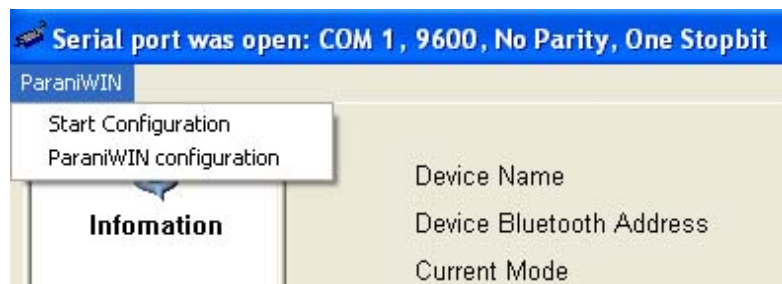


Figure 2-5 Menu Bar at Upper Left corner of ParaniWIN

When the ParaniWin software is able to access the SD1000U properly, the icons in the left side window come will become available for use.

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

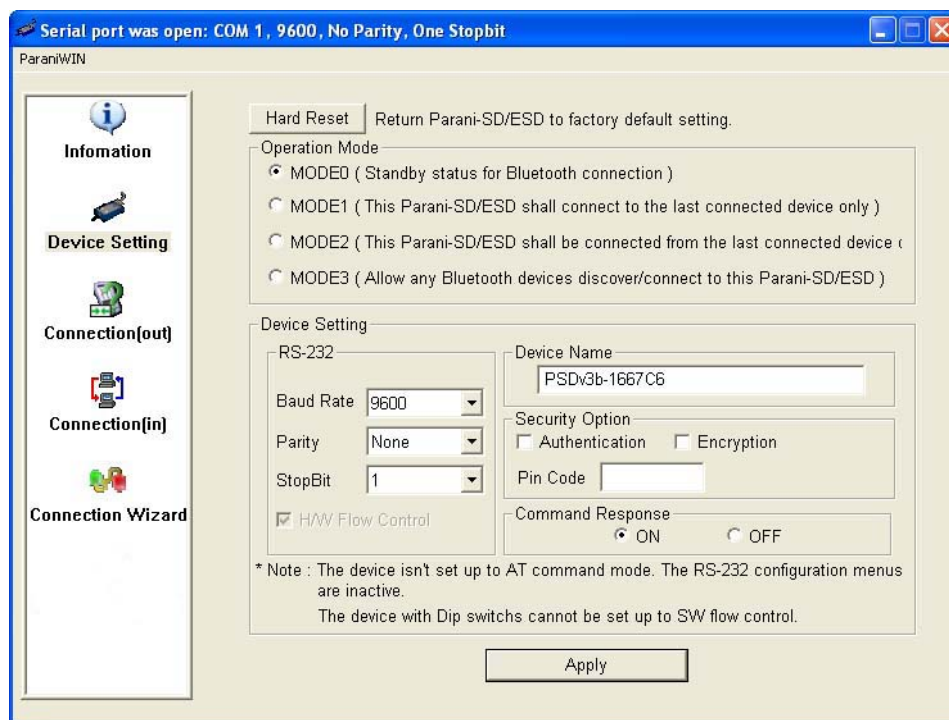


Figure 2-6 Device Setting Window

SD1000U 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 SD1000U 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 SD1000U 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.

SD1000U has 4 response messages, 'OK', 'ERROR', 'CONNECT', and 'DISCONNECT'. In some cases, these responses can affect the host system unexpectedly. To prevent this, user can set the Command response to ON or OFF.

For SD1000U, hardware flow control can be configured only by dip switch. And parity, stop bit can be configured only SW config mode. Thus H/W Flow Control option will not work in this case. When the dipswitch value isn't ATcommand mode, the Baud Rate menu will be disabled.

Click [Apply] button to apply any changes made to the SD1000U.

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

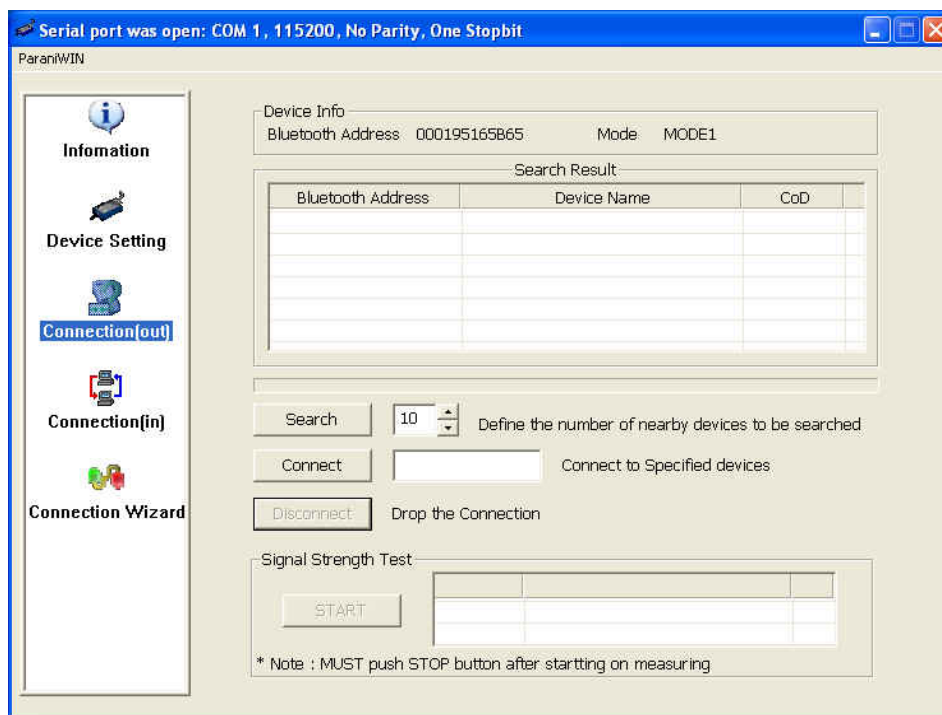


Figure 2-7 Connection (out) Window

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

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

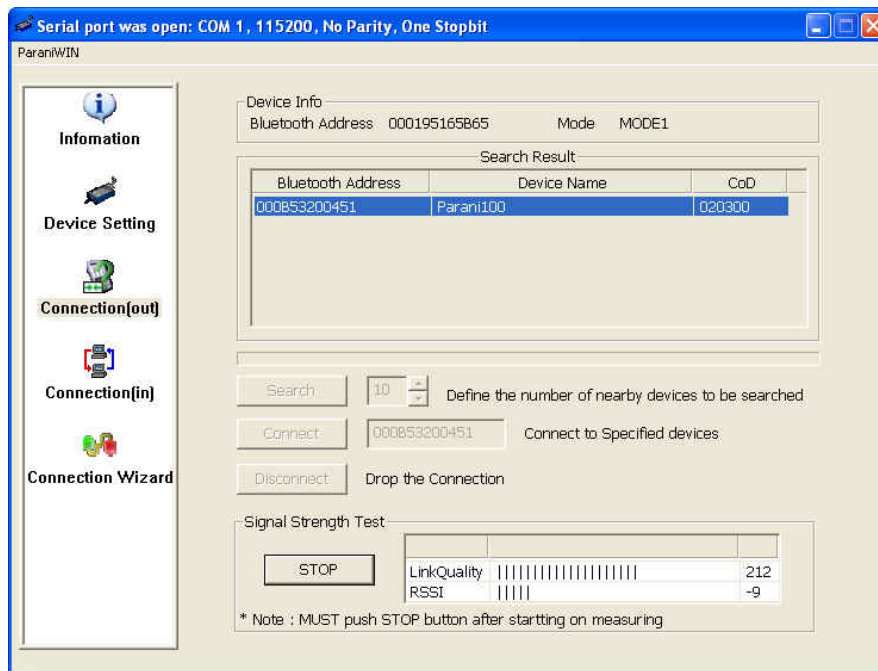


Figure 2-8 Signal Strength Test

The signal strength test shows LinkQuality and RSSI values. The closer LinkQuality is to 255 and RSSI is to 0, this means the SD1000U 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 SD1000U to terminate the test.

Connection(in) icon will show the following window, which enables the SD1000U to wait for a connection from another Bluetooth device. If the waiting time is set to 0, SD1000U will continually wait for connection until [Cancel] button is clicked.

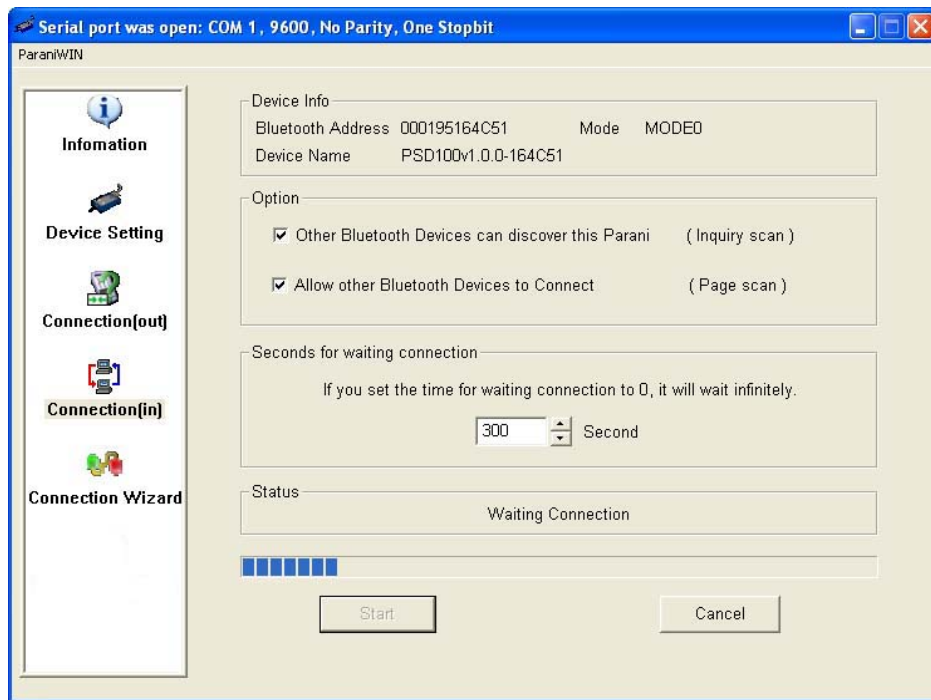


Figure 2-9 Connection (in) Window

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

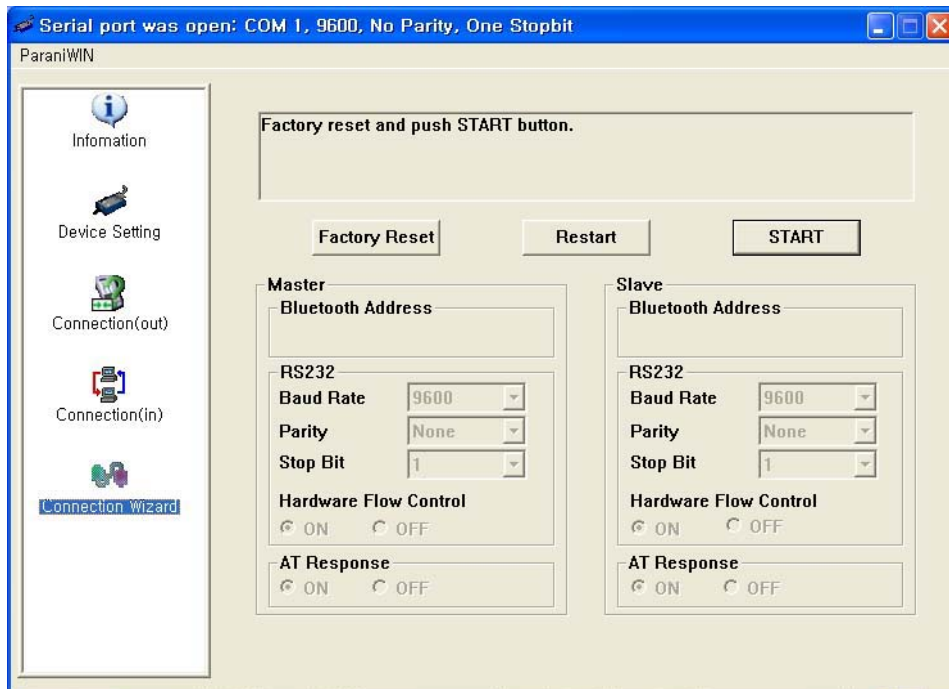


Figure 2-10 Connection Wizard Window

In this example we will refer to the two SD1000Us 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 ATcmd 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 SD1000U's connect LED is on. At this point, when both SD1000U's restart the connection will be established automatically.

2.12. Parani Multi Wizard

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

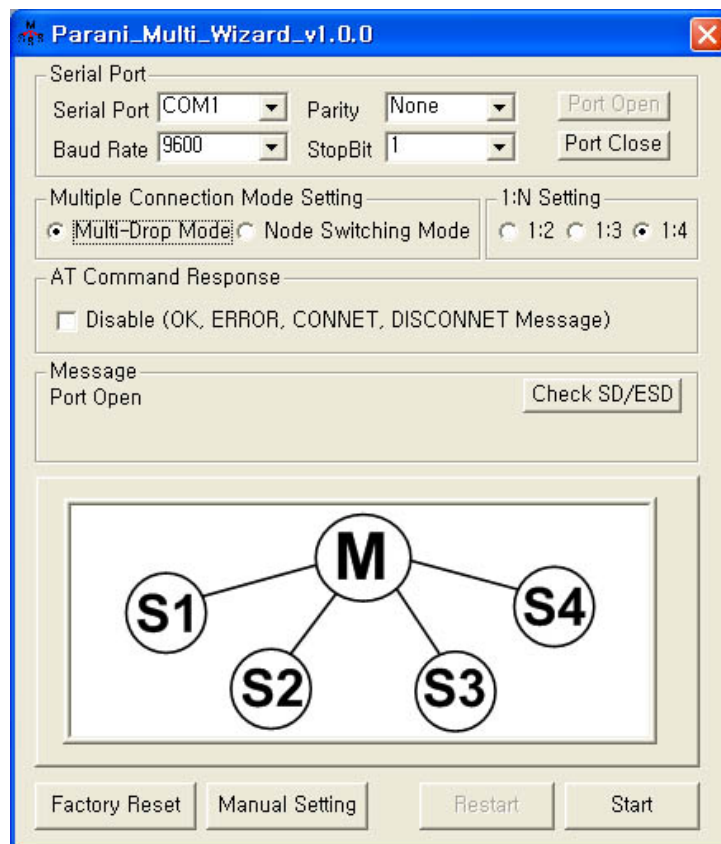
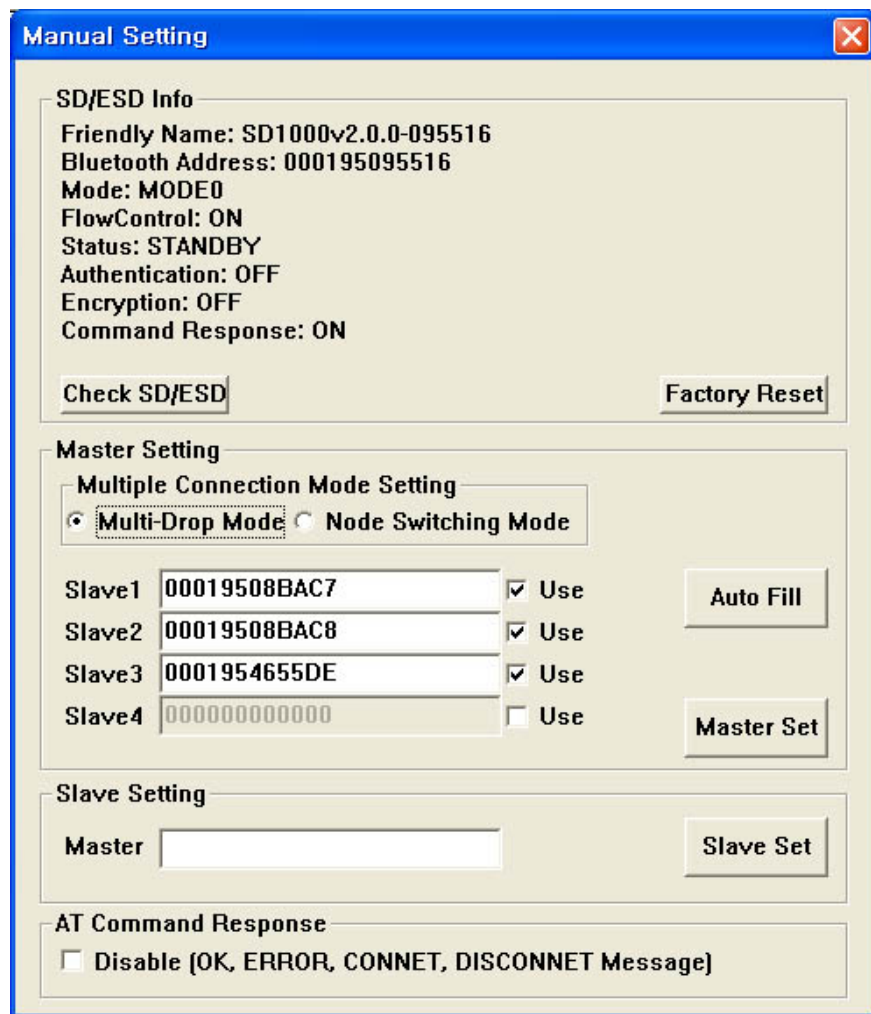


Figure 2-11 Parani Multi Wizard Window

Parani Multi Wizard supports the Wizard mode and the Manual mode. The Wizard mode provide 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.



Manual Setting

SD/ESD Info

Friendly Name: SD1000v2.0.0-095516
 Bluetooth Address: 000195095516
 Mode: MODE0
 FlowControl: ON
 Status: STANDBY
 Authentication: OFF
 Encryption: OFF
 Command Response: ON

Master Setting

Multiple Connection Mode Setting

☒ Multi-Drop Mode ☐ Node Switching Mode

Slave1	00019508BAC7	☒ Use	Auto Fill
Slave2	00019508BAC8	☒ Use	
Slave3	0001954655DE	☒ Use	
Slave4	000000000000	☐ Use	

Slave Setting

Master

AT Command Response

☐ Disable (OK, ERROR, CONNET, DISCONNET Message)

Figure 2-12 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.

2.13. ParaniUpdater

SD1000U supports firmware updates. You can download new firmware images for the SD1000U at <http://www.sena.com>. With the ParaniUpdater, you can update the firmware of SD1000U by selecting the firmware image file and pushing Start button.

* Note: DO NOT power off SD1000U while the firmware update is progressing, this may damage the SD1000U.

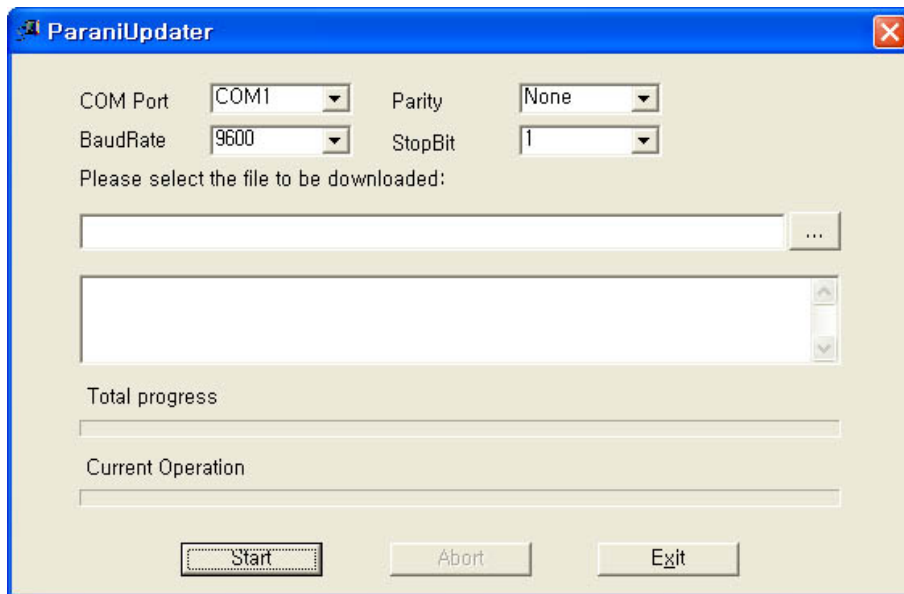


Figure 2-13 ParaniUpdater Window

2.14. 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-SD1000 provides some extended AT commands for configuration of the SD1000U.

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

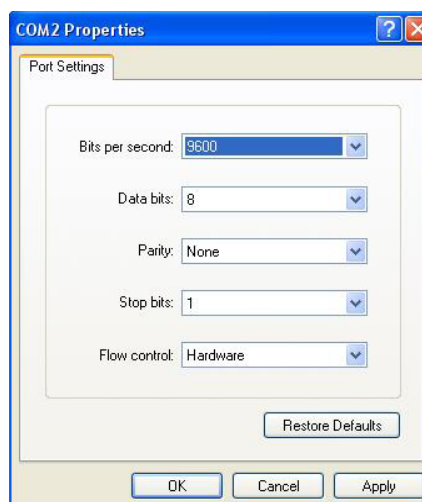


Figure 2-14 HyperTerminal

Attach SD1000U to serial port of host computer and power on the SD1000U. Check Mode LED. (See 3.2)

Make sure that the Connect LED is turned off and the Standby LED is turned on before attempting to send any kind of AT commands to the SD1000U. Then launch HyperTerminal, it can usually be found in start >programs >accessories >communication >HyperTerminal. Select the Serial port that SD1000U 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 SD1000U'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:



3. Multiple Connection Mode

3.1. Overview

SD1000U supports multiple connections up to 4 slave units. There are two types of multiple connection modes: Multi-Drop Mode and Node Switching Mode.

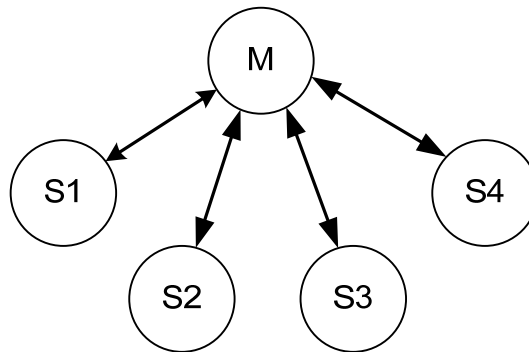


Figure 3-1 Multi-Drop Mode

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 3-1.

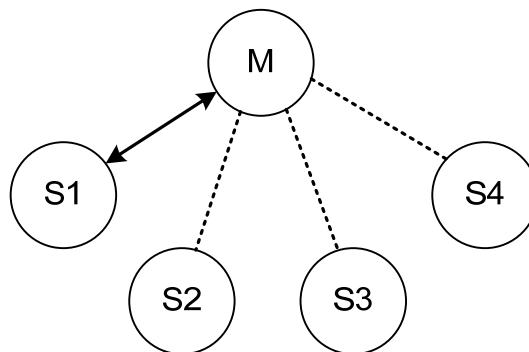


Figure 3-2 Node Switching Mode

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 3-2. Active slave is selected by AT commands.

0
K
CONNECT 000195000001
Reset
31

3.2. 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 3-1 AT+MULTI,x

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

Table 3-2 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.

101 with stub antenna

at+btinfo?

00

3.3. AT Commands

3.3.1. AT+MULTI,n

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

3.3.2. AT+MLIST?

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

```
ting
+++
OK
AT01 -
Comm
unic
atin
a with #1 Slave
```

3.3.3. ATHx, ATHbdaddr

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

Table 3-3 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.

3.3.4. 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 3-4 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 BDAaddress.

3.4. 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.

4. RF Information

4.1. Radio Frequency Range

2.402~2.480GHz

4.2. Number of Frequency Channel

79 channels

4.3. Transmission Method

FHSS (Frequency Hopping Spread Spectrum)

4.4. 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)

4.5. Radio Output Power

Products	Radio Output Power
Parani-SD1000U	+14dBm

4.6. Receiving Sensitivity

Products	Receiving Sensitivity
Parani-SD1000U	-88dBm

4.7. Power Supply

Products	Power Supply
Parani-SD1000U	USB 5.0V