Serial(RS232) to Wireless Converter
BT-232
User Manual

Version 2.1
(Software version 3.2)

1. Introduction

BT-232 converts RS-232 serial signals to Bluetooth RF signals.

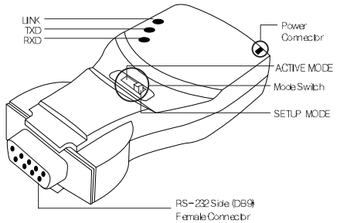
■ Product box contains
- Serial(RS232) to Wireless Converter 2EA - User Manual
- A/C Power Supply (110/220V AC to DC) - USB Power cable

2. Specifications

Model Name	BT-232
Type	Serial(RS232) to Wireless Converter
Distance	100 M
Voltage	5V ~ 12V/DC
Wireless interface	Bluetooth Specification Version 1.2
Frequency bandwidth	2402 ~ 2480 MHz
Radio mode	Frequency hopping
Channels	7
Modulation	GFSK
Current	Max 200 mA (5V DC)
Temperature	-20 ~ 70 ∝C
Antenna	Internal Chip Antenna
Antenna gain	Max 1.5 dBi
Antenna directivity	Non-directional
Antenna polarization characteristics	None
Serial communication	1200 BPS – 115200 BPS Full Duplex 8 Data bits/Odd, Even, No Parity/1,2 Stop bits
Flow Control	RTS/CTS ON/Off possible, DTR/DSR/DCD Loop back connected
Serial buffer size	760 Bytes

3. Architecture

1) External View

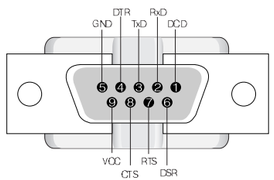


2) Mode Switch

SETUP ACTIVE : Active Mode
SETUP ACTIVE : Setup Mode

3) LED
- LINK : Turns green when remotely linked with the other party
- TxD : Turns on when data is transmitting (turns on faintly only if linked)
- RxD : Turns on when data is receiving

4) Connector



DB-9 Connector Pin-out

4. Installation Procedures

1) Connection

There is no need to install additional programs in your computer or communication devices to use the BT-232.
Connect the BT-232 to a serial port at your computer or communication device and supply it with power. Then you can easily access it as if you were using the existing serial port.
BT-232 can be powered by the following methods: DC power supply, PC USB port through USB cable or DB9 pin connector (available only if special serial ports are used).
A Bluetooth connection between two devices using the BT-232 is automatically established when both BT-232 are powered on. After that, you are free to use the serial port.

2) Environment Setting

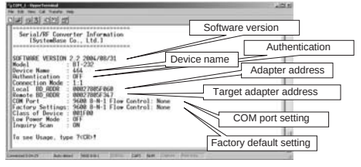
Since BT-232s are connected onto the serial port of your PC or communication device, you should specify the serial port environment information (Baud rate, data bits, parity bit, stop bit, flow control, etc.) and the RF connection (device name, operating mode, target address, etc.) for mutual communication.
RF connection setting is required only if you communicate with other manufacturer's Bluetooth devices instead of the BT-232 or change the initial setting.
For environment setting, please use "HyperTerminal" included in your Windows operating system.

5. Operating Environment Setting

1) Procedures

BT-232 can set baud rate, parity, stop bit, device name, target adapter and operating mode using HyperTerminal.
(1) Connect one BT-232 to the PC serial port and power it on.
(2) Run Windows' HyperTerminal program.
(3) Set baud rate, data bits, parity and stop bit to 9600-8-NONE-1 (Initial Factory Setting) at HyperTerminal.
(4) Select setup mode at the BT-232 mode switch.

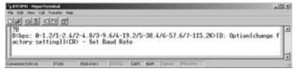
(5) Press <Enter>key after 5 seconds. The software version information will be displayed.



※ The software version in this manual can be different from your device

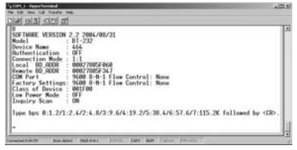
(6) Set up serial port.
(7) Setup RF connection.
(8) After completing the setting, be sure to execute 'X' command and save, and then the Mode Switch to 'Active'.

■ Reference:
If you enter '?', the list for all commands is displayed, and if '?<command>', how to use the requested command is displayed. All commands should be typed with capital letter. All commands and setting values are case-sensitive.



2) Serial Settings

■ Example of Baud Rate setting (9600 bps -> 19200 bps)
(1) Type 'B'.



(2) Type '4' to select 19200 bps.

(3) The set value is shown on the screen again. (All the same in the next procedures)

■ Example of Flow control setting (None -> Hardware)

(1) Type 'F'.
(2) Type '1' to use hardware flow control.

■ Example of Stop bit setting (1 bit -> 2 bits)
(1) Type 'S'.
(2) Type '1' to change a stop bit to 2 bits.

■ Example of Parity bit setting (None -> Even)
(1) Type 'P'.

(2) Type '2' to change to even parity.

3) RF Connection setting

This is necessary only if you communicate with other manufacturer's Bluetooth devices instead of the BT-232 or change the initial settings.

■ Example of Target Address setting
(00:02:78:01:EF:BB -> 00:02:78:01:EF:BC)
(1) Type 'A'.

(2) Type the target address to be changed. You have to enter the 12-digit hexadecimal address. After typing "00027801EFBC", press 'Enter' key.

■ Example of connection mode setting (1:1 -> Wait)
(1) First, enter '?M' to display the way to use the requested command. To set the connection mode at Wait mode, the input value shall be '1.
(2) Type 'M'.

(3) Type '1'.

■ Device name setting
(1) Type 'N'.

(2) Enter the desire device name and press 'Enter' key (however, up to 11 alphanumeric characters possible).

■ PIN setting
(1) Type 'E'.

(2) Enter the desire PIN value and press 'enter' key. (however, up to 11 alphanumeric characters possible)

■ Power save setting
(1) Enter 'K' If you want to enable power save mode, enter 'E', or if not, enter 'D'.

■ Inguiry scan setting inquiry scan
(1) Enter 'J.' If you want to activate the search response for an adapter, enter 'E', or if not, enter 'D'.

■ Display Device Information

(1) Type 'V'.
(2) All current information is displayed. At this time, verify that the values are identical to the ones you have once set.

■ BT-232 Pair Setting
BT-232 always perform 1:1 communication in pairs.
The following example shown how to set up the destination BT-232 address.
(1) Set baud rate, data bits, parity and stop bit to 9600-8-NONE-1 at Hyper Terminal.
(2) Connect one of BT-232s to your PC serial port and put 'Mode Switch' to Setup Mode. and Record displayed BD_ADDR.

(3) Remove BT-232(Used at stage (2)) from your PC serial port, and connect the target BT-232 and then set the registered BD_ADDR using 'A' command.

(4) Save the setting using 'X' command and then put the 'Mode Switch' to 'Active'.

(5) Apply stage (2)~(4) procedures to the target BT-232, and set the opposite BD_ADDR of two BT-232 devices to TARGET_ADDR.

6. Add-Ons

■ Multipoint Mode function

This chapter describes network topologies in the BT-232 network. There are Point-to-Point, Star, and Tree topology.
(*This special function is supported from the software version 3.2 and above.)

[Reference] Acronyms

Acronym	Definition
CoD	Class of Device
DCE	Data Circuit-Terminating Equipment
DTE	Data Terminal Equipment
EN	End Node
ENm	Master End Node
SN	Sub Node
MN	Master Node

1) Network Topology

Ⅰ. **Point-to-Point Topology**

This topology supports peer-to-peer network and full duplex hierarchy.

< Point-to-Point Topology >

Ⅱ. **Star Topology**

B-1. SN Repeater Network

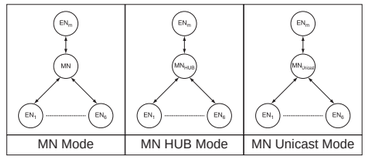
This network supports peer-to-peer network and full duplex hierarchy. SN repeater can be cascaded in the network.

< SN Repeater >

< SN Repeater Cascade Network >

B-2. Up to 7 Nodes Master-Slave Network

A device, DTE or DCE, is connected to the ENm which is in charge of this network. The MN and MN HUB mode support master-slave network and half duplex. MN Unicast mode supports master-slave network and full duplex.



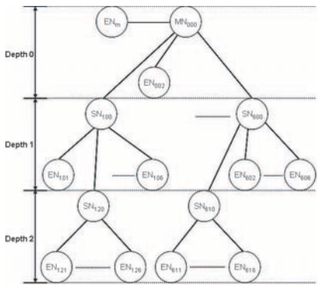
< Node Master-Slave >

Ⅲ. **Tree Topology**

C-1. Architecture

The tree topology in BT-232 network consists as follows :

- Depth 0 : 1 ENm, 1 MN and up to 6 ENs and / or SNs
- Depth 1 : Up to 36 ENs or up to 36 ENs and / or SNs or up to 36 SNs
- Depth 2 : Up to 216 ENs



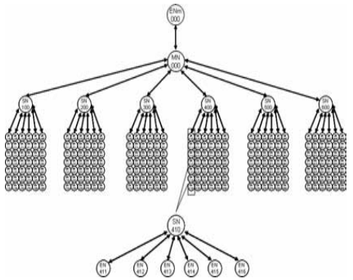
< Tree Topology >

* **MN** ; The MN can accommodate 1 ENm and up to 6 SNs and/or ENs. It has to connect to 1 ENm.
* **SN** ; The SN can accommodate 1 MN or upper SN and up to 6 SNs and/or ENs. It has to connect to 1 MN or upper SN. The SN in depth 2 can have up to 6 ENs only.
* **EN** ; The EN can be connected to a DTE or DCE. And it can connect to a MN or SN.

C-2. Up to 260 nodes Master-Slave network

The BT-232 network can have max. 260 nodes as follows:

- 1 ENm
- 1 MN
- 42 SN
- 216 EN



< Max Network Size >

2) Network Node

There can be a master end node (ENm), a master node (MN), several sub nodes (SN), and end nodes (EN) in BT-232 Network. This chapter describes network nodes in BT-232 Network.

Ⅰ. **Master End Node (ENm)**

The ENm has following features.

- Can make a connection with MN only
- Must be in WAIT Mode
- 1 incoming connection allowed

Ⅱ. **Master Node (MN)**

The master node (MN) has following features.

- Must be 1 in network
- Can have 1 ENm and up to 6 EN and/or SN
- Must be in Register & Connect Mode
- 1 outgoing and 6 incoming connections allowed
- Shall connect to a ENm

There are 3 master nodes, MN, MN HUB, and MN Unicast

Ⅲ. **Sub Node (SN)**

The sub node (SN) has following features.

- Can be several in network
- Must have 1 MN or 1 SN
- Can have up to 6 EN and/or SN (In case of Repeater, can have 2 EN only)
- Must be in Register & Connect Mode
- 1 outgoing and 6 incoming connections allowed

There are 4 sub nodes, SN Repeater, SN, SN HUB, and SN Unicast

Ⅳ. **End Node (EN)**

The sub node (SN) has following features.

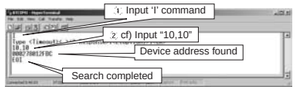
- Can make a connection with MN or SN
- Must be in Register & Connect Mode
- 1 outgoing connection allowed

Appendix-A : Wait for user command mode

The Wait mode that waits for a command by a user performs search and connection of accessories. The correspondent adapter shall be set up in Wait mode.

■ Scan

It searches Bluetooth devices connected and serviced in the same coverage.



After execution of the command, the adapter address searched is displayed

■ Connect

Connection to a specific device

After execution of the command, the Setup mode is ended and the communication state is ready.

Appendix-B : Command

Items	Commands	Descriptions	Remarks
1. Connection Setting	A(addr)	Setting for the address of device to be connected addr: 12 numbers in Hex	Effective in connection mode 0 and 2.
2. Baud Rate Setting	B(BR[D])	Setting for baud rate. BR(Baudrate): 0 ~ 7 D: Factory default setting	0: 1200, 1: 2400 2: 4800, 3: 9600 4: 19200, 5: 38400 6: 57600, 7: 115200
3. COM Port Assignment	C(COM port)	Assigning the priority of a COM port requested for the connection. COM port: 1 ~ 7	Effective in connection mode 2.
4. PIN Number Setting	E[PIN / Enter)	Setting for authentication / ciphering. PIN: 11 letters (max) Enter: deactivated	After authentication and ciphering, two adapters are to be connected if their PIN numbers are the same.
5. Flow Control Setting	F(FC[D])	Setting for flow control FC: 0 ~ 2 D: Factory default setting	Available for flow-control enabled model. 0 : None, 1 : RTS/CTS, 2 : DTR/DSR
6. Search Timeout Setting	G(TO)	Setting for search timeout TO(timeout): 0 ~ 999	Effective in connection mode 3. Default: 10 seconds
7. Maximum Search Setting	H(NO)	Setting for the maximum number of devices to be searched NO(Respondents): 0 ~ 999	Effective in connection mode 3. Default: 10
8. Search Execution	I(TO,NO)	Search for Bluetooth devices connected TO(timeout): 0 ~ 999 NO(correspondents): 0 ~ 999	Effective in connection mode 3. Search will be completed when it reaches either timeout or the maximum number of correspondents.
9. Search Response Setting	J(E/D)	Setting whether to respond to search request E: Enabled D: Disenabled	Effective in connection mode 1.
10. Power save setting	K(E/D)	Setting for power save mode E: Enabled D: Disenabled	
11. Connection Mode Setting	M(mode)	Setting for connection mode The default setting for BT-232 is connection mode 0, and connection modes 1,2,3 are used for the connection with other Bluetooth devices. Mode: 0 ~ 3	0: 1:1 connection 1: connection waiting 2: automatic connection after registration 3: wait for user command
12. Name Setting	N(name)	Setting for friendly name. Name: 11 letters (max.)	Along with the address, it is available for ID.
13. Parity Bit Setting	P(PA[D])	Setting for parity bit. PA: 0 ~ 2 D: Factory default setting	0: None 1: Odd 2: Even
14. Connection Timeout Setting	Q(TO)	Setting for timeout connection. TO(timeout): 0 ~ 999	Effective in connection mode 3
15. Stop Bit Setting	S(ST[D])	Setting for stop bit. ST: 0 ~ 1 D: Factory default setting	0: 1 Stop 1: 2 Stop
16. Connection Execution	T(addr[,TO])	Connection to a specific device. addr: 12 numbers in Hex [TO](timeout): 0 ~ 999	Effective in connection mode 3
17. Execution Cancellation	U	Cancellation of device search and connection command.	Effective in connection mode 3
18. Setting Confirmation	V	Displays current setting.	Software version information included
19. CoD Setting	W(CoD)	Setting for class of device. CoD: 6 numbers in Hex	Default: "001F00" Critical factor for search
20. Setting Change Save	X	Applies edited settings.	After command, BT-232 shall be rebooted.
21. Status Display	Z	Displays the status of BT-232.	S: Idle P: Pairing C: Connecting A: RF on I: Inquiring
22. Help	?([command])	Displays command list and help.	Commands shown are depending on the Current Mode.

※ User should change hyper terminal setting value as like Baud rate, Parity bit, Stop bit to assigned factory default value in the Set-up mode, If user has changed factory default's setting value.

Appendix – C : Multipoint Mode Command

Items	Commands	Descriptions	Remarks
1. Address mode setting	LAm<CR>	If Address Mode is ON at MN and SN, a device that is connected to ENm shall make a packet, and send it to ENm for every data. In case of EN, Operation Mode will be changed to the Extended Command Mode, if Address Mode is ON.	m: - '0': OFF - '1': ON For EN, MN, and SN / Not for ENm
2. Print nodes status	AT+ZLC	Print an address of MN or SN, the number of connected nodes, and the status of lower nodes.	For MN and SN
3. Search mode setting	LFm<CR>	If it is ON, the command for setting the Node Level will be executed. And the CoD for searching will be changed accordingly.	m: - '0': OFF - '1': ON For EN and SN/ON: executing L
4. Node Level setting	LLm<CR>	It is valid only if the Search Mode is ON.	m: - '0': Connecting to MN - '1': Connecting to Level 1 SN - '2': Connecting to Level 2 SN For EN and SN / Required activating F
5. Multipoint mode setting	LMm<CR>	The Operation Mode will be changed accordingly. '0' : Button Mode (Point-to-Point) '1' ~ '7' : Extended Command Mode	m: - '0': OFF - '1': SN Repeater - '2': MN - '3': MN HUB - '4': SN - '5': SN HUB - '6': MN Unicast - '7': SN Unicast
6. Unicast Path setup	AT+ZLO #1, #2, #3 <CR>	The BT-232 shall be in the Extended Command Mode to use this command. This command will use at device that is connected to ENm in Unicast Network. The logical address shall be for EN only. You shall send the Escape Mode Sequence ("+++") to ENm to enter the command mode. Escape Mode Sequence breaks the existing path setup.	- '': 0x2C - #1/ #2 / #3 : '0' ~ '6' For ENm in Extended Command mode < To change Extended Command mode > 1. Enter Setup mode 2. Input LW1742<CR> 3. Input X and set switch to ACTIVE
7. Packet Size setting	LPm<CR>	If the packet size is fixed, the BT-232 will send data after reaching that size. Therefore, you should be very carefully using this command. You should use this function when same size of data is used every time. You can verify the changed packet size with LR.	m: - '0': OFF - '1' ~ "121": ON For EN (Address Mode shall be ON)
8. Searching CoD setting	LQm<CR>	It is valid only if Search Mode is ON. It is changed accordingly when you set the Node Level. If you change this value improperly, the BT-232 will not make a connection with the desired Node. Therefore, you shall handle this command with caution.	m: 6 Characters ('0' ~ 'F') For EN and SN
9. Print Operation Mode	LR	Print the operation parameters.	
10. Print all of nodes status	AT+ZLVm <CR>	You shall send the Escape Mode Sequence ("+++") first at the device that is connecting to ENm to enter the command mode. The MN and SNs will send its status with lower nodes information.	m: - '0': Only once - '1': Periodic ON (1/min.) - '2': Periodic OFF For ENm in Extended Command mode
?: Print Help	L?	Print helps	