Appendix C

1:N Data Transmit/Receive (OPERATION MODE)

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■ LIST OF CONTENTS

1: N Data Transmission/Receive Method(Operation Mode)	3
1 OP_MODE0 (1:1 communication)	5
2 OP_MODE1 (Monitoring)	6
2-1 Set Up at Slave and Data Communication Method	6
2-1-1 How to Receive the Data	7
2-1-2 Data Transmit Method at TTL LEVEL(FB755)	8
2-1-3 Data Transmission Method at RS232 LEVEL(BMx001)	10
2-2 Setting Up at the Master	12
3 OP_MODE2 (Selective Two-Way Large Volume Communication)	14
3-1 Setting Up at the Slave	15
3-1-1 Data Tramsmit/Receive Method at TTL(FB755)	16
3-1-2 Data Tramsmit/Receive Method at RS232(BMx001)	18
3-2 Setting Up at the Master	20
4 How to Certify the Information	22
4-1 How to Identify at TTL LEVEL(FB755)	23
4-2 How to Identify at RS232 LEVEL(BMx001)	25

1 : N Data Transmission/Receive Method(Operation Mode)

Note : The type of products which allows N number of connections with Master include BM1001, BM2001, FB755AC, and FB755AS.





<Figure C-1 OPERATION MODE MENU>

Basically, 1 of 1:N communication of FIRMTECH products refers to Slave, N stands for Master which enable data communication of multiple Masters with single Slave connected to them.

With 1:N communication, if transmitted/received data processing capability is regarded as 1, and 1 (Slave) : 5 (Master) communication is assumed, the data capacity that could be processed with a Slave is 1, while 5 times of that capacity comes in as each Master sends out data simultaneously, which results in failure to process in Slave or panic condition.

OPERATION MODE is to control data stream of send/receive or limit sending out interval of the part of Master, to facilitate the Slave to process the data stream.

OPERATION MODE consists of three different modes of OP_MODE0 ~ OP_MOE2 as shown on <Figure C-1>.

Since the use is different by each OP_MODE, please make sure to understand and use following OP_MODE accordingly.

1 OP_MODE0 (1:1 communication)

- It is basis of 1:1 communication, other Bluetooth units (Bluetooth PDA, USB dongle) are interchangeable with Flow Control of CTR, RTS, DTR, and DSR.

2 OP_MODE1 (Monitoring)

- Supports 1:N communication method.

- Appropriate Mode of data stream processing coming in with specific intervals from Master(N).

2-1 Set Up at Slave and Data Communication Method

PIN CODE	REMOTE BD ADDR.
[MAX] : char [12]	[MAX] : char [12]
BTWIN	0000000000
	STATUS MESSAGE
ENABLE	ENABLE
ENCRYPTION	POWER SAVE
ENABLE	DISABLE
SERIAL SETUP	ROLE
Baud Rate 9600 💌	SLAVE 💌
Parity Bit None 💌	Operation(New Func.)
Stop Bit 1	Operation 1
BUFFER SIZE	- NUMBER OF DEVICE -
0 Range : 0 ~ 999	5 💌
	PIN CODE [MAX] : char [12] BTWIN AUTHENTICATION ENABLE ENCRYPTION ENABLE SERIAL SETUP Baud Rate 9600 Parity Bit None Stop Bit 1 BUFFER SIZE 0 Range : 0 ~ 999

====================================
1 => AUTHENTICATION ENABLE PINCODE[BTWIN] 2 => REMOTE BD ADDRESS 000000000000000000000000000000000000
[Back Spcae : Input data Cancel] [t : Move top menu]
Select(0 ~ 9) >

<Figure C-2 : OP_MODE1 as Slave>

2-1-1 How to Receive the Data

- If OP_MODE1 is selected, the number of devices to be connected as seen <Figure C-2>, and Buff Size which will output at one time can be determined.

- NUM OF CONNECTION DEV : Select the number of units to be connected.
- BUFF SIZE : Transmits the defined Bytes of Data to HOST connected with Slave



<Figure C-3 : OP_MODE1 Data Process Method and Process Time>

For example, if the **RX BUFF SIZE** is fixed at **30 Byte**, and 40 byte is transmitted at each Master simultaneously, then each unit of 30 byte will be output at the order of receipt.

- As shown on <Figure C-3>, the Slave shall process data received by multiple Masters. Each Master shall require about 400ms of data processing time. If 5 Masters are connected, it becomes 400ms * 5 = 2000ms(400ms * number of connected units). If a Master sends out data every 2 seconds, the Slave shall be able to process the data for output smoothly.

To get more fast transmission of data at Master, we recommend you take enough tests.

Notice : If you make the data transmission faster than the recommendation, the Slave may not receive the data properly.

- As the current OP_MODE1 has Slave(1) and multiple Master(N) connected, a Master shall be selected before a Slave starts to send out data to the Master. With OP_MODE1, and OP_MODE2, AT command language and signal of flow control are supported which enables to select a Master for data transmission regardless of connection mode.



2-1-2 Data Transmit Method at TTL LEVEL(FB755)

<Figure C-4 : Transmission Timing from Slave to Master at OP_MODE1 of TTL(FB755)>

The timing of data transmission at TTL(FB755) can transmit the data to the Master connected using STREAM CONTROL, STREAM STATUS, or AT command language as shown on <Figure C-4>. The procedures can be briefly explained as follows.

APPENDIX C VERSION 1.0.1

①HOST → BT : STREAM CONTROL HIGH (Enter HIGH at STREAM CONTROL port.)
②BT → HOST : STREAM STATUS HIGH (Output HIGH if normally processed)
③HOST → BT : ATO1, (Select the Master to send out)
④BT → HOST : STREAM STATUS LOW (Stream is low if normally connected.)
⑤HOST → BT : STREAM CONTROL LOW
⑥HOST → BT : Data Transmission



<Figure C-5 : Data Transmission Procedures at TTL level>



2-1-3 Data Transmission Method at RS232 LEVEL(BMx001)

<Figure C-6 : Transmission timing from Slave to Master at OP_MODE1 of RS-232 level>

The transmission timing of at the RS232 LEVEL(BMx001) enables to transmit the data to the Master connected, by using DSR(STREAM CONTROL), DTR(STREAM STATUS), or AT command language as shown on <Figure C-6>. The detailed procedures are as follows.

(1)HOST → BT : DSR LOW (enter LOW at the STREAM CONTROL port.)

- ②BT → HOST : DTR LOW (enter LOW if operates normally.)
- ③HOST → BT : ATO1 (Select Master to transmit)
- ④BT → HOST : DTR **HIGH** (enter HIGH if stream is connected normally)
- ⑤HOST → BT : DSR HIGH
- ⑥HOST → BT : Transmit Date

APPENDIX C VERSION 1.0.1



<Figure C-7 : The Procedures of Data Transmission at RS232(BMx001)>

	DETICE IMPILE	PINCODE	KENOTE DD ADDK.
	[MAX] : char [12]	[MAX] : char [12]	[MAX] : char [12]
	FB755v1.0.1	BTWIN	00000000000
	LOCAL BD ADDR.	AUTHENTICATION	STATUS MESSAGE
	00025800A6A6	DISABLE	ENABLE
		ENCRYPTION	POWER SAVE
	CONNECTION 3 💌	DISABLE	DISABLE
	Link Supervision Time	SERIAL SETUP	ROLE
	5 Range : 1 ~ 99	Baud Rate 9600 💌	MASTER
	ESC CHAR	Parity Bit None 💌	Operation(New Func.)
	0x 28 char [2]	Stop Bit 1	Operation 1
	DEBUG CHAR	BUFFER SIZE	- NUMBER OF DEVICE -
	0x 02 char [2]	30 Range : 0 ~ 999	2
 M V N N N N N N N N N N	======================================	======= ==============================	
3 => CONNE 4 => OTHER 5 => UART 6 => ROLE 7 => OPERA 8 => NUM 0 9 => TX BU	CTION MODE : CN PARAMETER : E,I CONFIG : 96 : MA: TION MODE : 0P F CONNECTION DEV: 2 FF SIZE : 30	T_MODE3 D,5,2B,2 DD,8,p,1 STER _MODE1 Byte	
3 => CONNE 4 => OTHER 5 => UART 6 => ROLE 7 => OPERA 8 => NUM 0 9 => TX BU [Back Spc [t : Move	CTION MODE : CN PARAMETER : E, CONFIG : 96 : MA: TION MODE : 0P. F CONNECTION DEV: 2 FF SIZE : 300 	T_MODE3 D,5,2B,2 DO,8,n,1 STER _MODE1 Byte el	
3 => CONNE 4 => OTHER 5 => UABT 6 => ROLE 7 => OPERA 8 => NUM 0 9 => TX BU [Back Spc [t : Move Select(0 ~	CTION MODE : CN PARAMETER : E, CONFIG : 96 I MA TION MODE : 0P F CONNECTION DEV: 2 FF SIZE : 3D Action menu top menu 9) > _	T_MODE3 D, 5, 2B, 2 00, 8, n, 1 STER _MODE1 Byte el]

2-2 Setting Up at the Master

<Figure C-8 : OP_MODE1 at Master>

NUM OF CONNECTION DEVICE : The number of connecting device to Master controls in sending out the date alternatively on the basis of (the number of connected devices * 400ms) so that Slave will receive data not being interrupted.

As an example, if the connected device is 2, once every 2 * 400ms = 800ms will transmit

the data.

- BUFF SIZE : The BUFF SIZE at the Master will send out the specified byte for a time.

- If the NUM OF CONNECTION DEV, and TX BUFF SIZE are established, however abundant data is transmitted through the multiple devices connected to the Master, the data will be transmitted as much as one BUFF SIZE fixed every (number of connected device * 400ms).

Note : Master(N) enables to send out data using OP_MODE0(1:1 basis) as well. At Master level, you will not have any problems in sending out the data by observing the interval designated as above (number of connected devices * 400ms).



3 OP_MODE2 (Selective Two-Way Large Volume Communication)

<Figure C-9 : OP_MODE2 Communication Method>

- OP_MODE2 is the mode where the Slave will perform two-way communication in volume with the connected status of 1(Slave):N(Master).

With OP_MODE1, there is limitation in time and volume of data since the Slave will process data received by multiple Masters, however OP_MOD2 would not be limited in time and data volume since the range of RX and TX stream is made by Slave as shown on <Figure C-9>.

- OP_MODE2 will perform flow control between Slave and Master, therefore if other Bluetooth device (such as PDA, or USB dongle) is to be connected, it is required to understand and follow instructions on **3-2 Setting Up at the Master** prior to use.

		PIN CODE	REMOTE BD ADDR.
	[MAX] : char [12]	[MAX] : char [12]	[MAX] : char [12]
	FB755v1.0.1	BTWIN	0000000000
	LOCAL BD ADDR.	AUTHENTICATION -	STATUS MESSAGE
	00025B00A6A6	DISABLE	ENABLE
		ENCRYPTION	POWER SAVE
	CONNECTION 3 💌	DISABLE	DISABLE
	Link Supervision Time	SERIAL SETUP	ROLE
	5 Range : 1 ~ 99	Baud Rate 9600 💌	SLAVE 💌
	ESC CHAR	Parity Bit None 💌	Operation(New Func.)
	0x 28 char [2]	Stop Bit 1	Operation 2
	DEBUG CHAR	BUFFER SIZE	
	0x 02 char [2]	0 Range : 0 ~ 999	1
	ч ====================================	=====	
ې ======	ersion : 4.0.0	:======	
=======	======================================		======
) => DEVIC 1 => AUTHE	ENAME : BM> NTICATION : ENA	001v4.0.0	
2 => REMOT	E BD ADDRESS : 000	181413E04	
3 => CONNE	CTION MODE : CNT	_MODE3	
4 => UIHER 5 => HART	CONFIG : 960),5,28,2)0.8.n.1	
6 => ROLE	SLA TION MODE - OP	VE NODE2	
7 -> 0FERA 8 => NUM 0	F CONNECTION DEV: 2		
[Back Spc [t : Move	ae : Input data Cance top menu		
Jerect(U ~	0// _		

3-1 Setting Up at the Slave

<Figure C-10 : Setting Up OP_MODE2 Slave>

- Following set up display as shown on <Figure C-10> will appear if you select OP_MODE2 at Slave.

- NUMBER OF DEVICE : Select the number of devices to be connected.



3-1-1 Data Tramsmit/Receive Method at TTL(FB755)

<Figure C-11 : Timing for Data Transmit/Receive OP_MODE2 Slave of TTL level>

The data transmit/receive will allow data transmission/receipt with the Master connected, by using STREAM CONTROL, STREAM STATUS, and AT command language as shown on <Figure C-11>. Following is the brief explanation on the procedures for transmission/ receipt.

①HOST → BT : STREAM CONTROL HIGH (enter HIGH on STREAM CONTROL port.)
②BT → HOST : STREAM STATUS HIGH (enter HIGH if it is executed normally.)
③HOST → BT : ATO1 (Select the Master to send out)
④BT → HOST : STREAM STATUS LOW (enter LOW if the Stream is normally connected.)
⑤HOST → BT : STREAM CONTROL LOW
⑥HOST → BT : Data Transmission/Receipt

APPENDIX C VERSION 1.0.1



<Figure C-12 : Data Transmission / Receipt Process at TTL(FB755)>



3-1-2 Data Tramsmit/Receive Method at RS232(BMx001)

<Figure C-13 : Timing for Data Transmit/Receive at OP_MODE2 Slave of RS-232 level>

The data transmit/receive will allow data transmission/receipt with the Master connected, by using DSR(STREAM CONTROL), DTR(STREAM STATUS), and AT command language as shown on <Figure C-13>. Following is the brief explanation on the procedures for transmission/receipt.

(1)HOST → BT : DSR LOW (enter LOW at DSR port.)

②BT → HOST : DTR LOW (enter LOW if it operates normally.)

③HOST → BT : ATO1 (Select Master to send out)

④BT → HOST : DTR **HIGH** (enter HIGH if Stream is connected normally.)

- ⑤HOST → BT : DSR HIGH
- ⑥HOST → BT : Data Transmit/Receive

APPENDIX C VERSION 1.0.1



<Figure C-14 : Data Transmit/Receive Process at RS232(BMx001)>

	MOTE BD ADDR.
[MAX] : char [12] [MAX] : char [12] [M	AX] : char [12]
FB755v1.0.1	000000000
LOCAL BD ADDR AUTHENTICATION ST	ATUS MESSAGE
00025B00A6A6 DISABLE	ABLE
	WER SAVE
CONNECTION 3 DISABLE DI	SABLE
Link Supervision Time SERIAL SETUP	
5 Range : 1 ~ 99 Baud Rate 9600 • M/	ASTER
ESC CHAR Parity Bit None	eration(New Func.)
0x 2B char [2] Stop Bit 1 ▼ 0	peration 2
0x 02 char [2] 0 Range : 0 ~ 999 1	.
Version : 4.0.0	
======================================	===
1 => AUTHENTICATION : ENABLE PINCODE[BTWIN] 2 => REMOTE BD ADDRESS : 00000000000	
LOCAL BD ADDRESS : OD11B1A13EOA	
$4 \Rightarrow$ OTHER PARAMETER : E, D, 5, 2B, 2	
6 => ROLE : MASTER	
77 => OPERATION MODE : OP_MODE2 B => NUM OF CONNECTION DEV: 2	
7 => OPERATION MODE : OP_MODE2 8 => NUM OF CONNECTION DEV: 2	:== 1
7 => OPERATION MODE : OP_MODE2 8 => NUM OF CONNECTION DEV: 2 [Back Spcae : Input data Cancel [t : Move top menu]

3-2 Setting Up at the Master

<Figure C-15 : Setting Up OP_MODE2 Master>

- The NUM OF CONNECTION DEV : OP_MODE2 Master does not have any meaning.

The Master of OP_MODE2 is not authorized to transmit/receive data stream until it is ready to send out/receive data as long as the Slave gives specific flow control signal.
If Slave sends out flow control signal and the DTR(STREAM STATUS) of Master becomes

HIGH(TTL LOW), now it is ready for data transmit/receive.

- If the data is entered when the DTR(STREAM STATUS) of Master is not on HIGH(TTL LOW), the entered data might be lost.

- Since the OP_MODE2 Master uses communication method which allows only flow control among the FIRMTECH products, if you are going to use OP_MODE2 as Slave, we recommend you use out products.

Caution : If you plan to use other Bluetooth (such as PDA, USB dongle) connected with OP_MODE2 Slave, be sure to take enough tests prior to use with flow control signal DSR to avoid any panic condition of OP_MODE2 Slave which might be occurred due to the communication during DSR is LOW (TTL HIGH).

Note : Please refer to 1:N communication test for 1:N tests.

4 How to Certify the Information

The Slave of OP_MODE1 and OP_MODE2 will allow to use AT command language for 1:N Control regardless of CONNECTION MODE

The useable command includes "ATOn,,", to form Stream Zone, and Information command to certify various information (refer to Appendix B – Table-2 AT Command Category). Since multiple Masters are connected to a Slave for Data transmission, if you enter the command "AT+BTINFDEV?A," at the Slave to identify the information of the Master connected currently, the response to the command and the data from the Master will be mixed up, which will prevent from understanding the response of the command language exactly.

To differentiate the response message and received data, MESSAGE CONTROL(CTS), or MESSAGE STATUS(RTS) might be used to receive exact message.



4-1 How to Identify at TTL LEVEL(FB755)

(Figure C-16 : Response Message Timing for Command Language at TTL(FB755))

On <Figure C-16>, if the MESSAGE STATUS becomes "HIGH", the Data transmitted from the Master will no longer be output, if MESSAGE STATUS becomes "LOW" automatically after the response to the command language transmitted, the Data can be received from the Master.

Following is the description to be more brief

```
(1)HOST → BT : MESSAGE CONTROL HIGH (Enter HIGH at the MESSAGE CONTROL port)

(2)BT → HOST : MESSAGE STATUS HIGH (Limit the data receiving from the Master)

(3)HOST → BT : AT+BTINFODEV?1, (Enter command to identify)

(4)BT → HOST : ∠123456789012∠ (Output the Master information connected at first)

(5)BT → HOST : MESSAGE CONTROL LOW (To complete the identification of information)

(6)HOST → BT : MESSAGE STATUS LOW

(The data received after the response sent to the command language is the data sent by
```

Master)

Caution : During the identification of information, if the "HIGH" message of MESSAGE CONTROL remains for rather long time, the data sent from Master could be lost.



4-2 How to Identify at RS232 LEVEL(BMx001)

<Figure C-17 : Status Message Output Timing at RS232(BMx001)>

On <Figure C-17>, if the RTS(MESSAGE STATUS) becomes "HIGH", the Data transmitted from the Master will no longer be output, if RTS(MESSAGE STATUS) becomes "LOW" automatically after the response to the command language transmitted, the Data can be received from the Master.

Following is the description to be more brief

```
(1)HOST \rightarrow BT : CTS LOW (Enter LOW at the CTS port)
```

 $(2)BT \rightarrow HOST : RTS LOW$ (Limit the data receiving from the Master)

③HOST → BT : **AT+BTINFODEV?1**, (Enter command to identify)

(4) BT → HOST : \angle **0123456789012** \angle (Output the Master information connected at first)

(5)HOST \rightarrow BT : CTS **HIGH** (To complete the identification of information)

```
⑥BT → HOST : RTS HIGH
```

(The data received after the response sent to the command language is the data sent by Master)

Notice : During the identification of information, if the "LOW" message of CTS (MESSAGE CONTROL) remains for rather long time, the data sent from Master could be lost.

Note : In 1:N communication mode, the CONNECT_CHECK(DCD) of the Slave will become "LOW" (RS2323 "HIGH") as all the Master are connected, if any one of the connected Master is released, the CONNECT_CHECK(DCD) will become "HIGH" (RS232 "LOW"), which will enable to certify the condition of the Master connected currently.