

APPENDIX C

1:N Data Transmit/Receive (Operation Mode)

Version 1.1

FIRMTECH Co., Ltd,

B-606, Ssangyong IT Twin Tower, Sangdaewon-dong, 442-5
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea 462-120

Tel : +82-31-719-4812

Fax : +82-31-719-4834

www.firmtech.co.kr

Revision History

Revision	Date	Change Description
1.0	10-09-2007	Write a draft
1.1	15-12-2008	Image Change

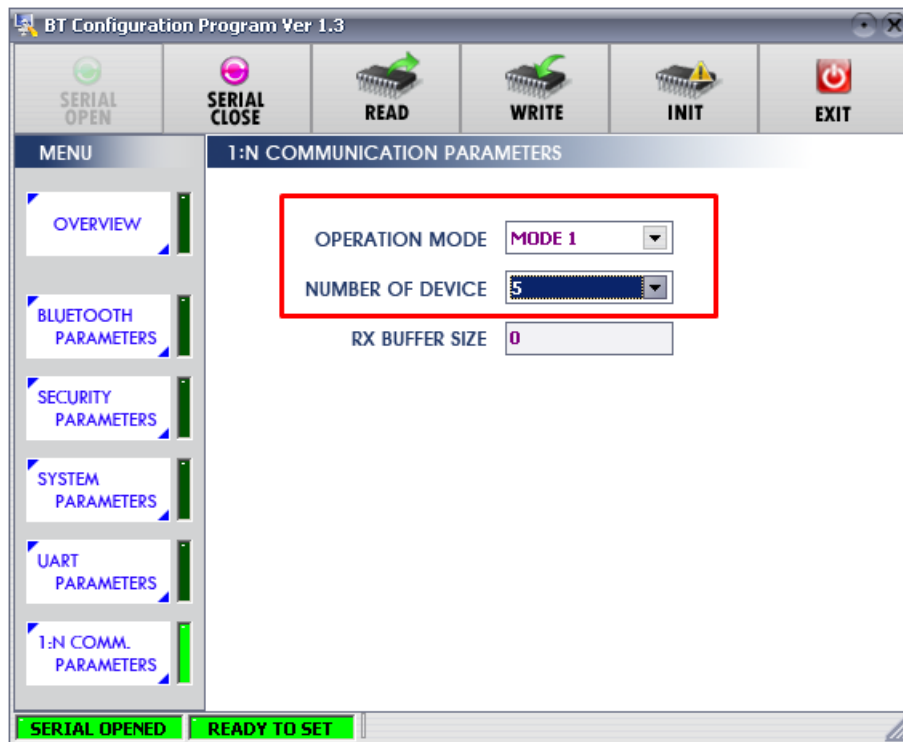
List of Contents

1 : N Data Transmission/Receive Method(Operation Mode)	4
1 OP_MODE0(1:1 communication)	6
2 OP_MODE1(Monitoring)	7
2.1 Set Up at Slave and Data Communication Method	7
2.2 Setting Up at the Master	12
3OP_MODE2(Selective Two-Way Large Volume Communication)	14
3.1 Setting Up at the Slave	15
3.2 Setting Up at the Master	19
4. How to Certify the Information	21
4.1 How to Identify at TTL LEVEL(FB755)	21
4.2 How to Identify at RS232 LEVEL(FB100AS, FB200AS)	22

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

Note :

The type of products which allows N number of connections with Master include FB100AS(BM2001), FB200AS(BM2001), FB755AC, and FB755AS.



```

===== MAIN MENU =====
1 => GO TO BLUETOOTH PARAMETER MENU
2 => GO TO SECURITY PARAMETER MENU
3 => GO TO SYSTEM PARAMETER MENU
4 => GO TO UART PARAMETER MENU
5 => GO TO 1:N COMMUNICATION PARAMETER MENU
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 5) > 5
===== COMMUNICATION PARAMETER MENU =====
1 => OPERATION MODE : OP_MODE0
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 1) > 1
Change Operation
1 : OP_MODE0 2 : OP_MODE1 3 : OP_MODE2
Select(1 ~ 3) >

```

<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_MODE2 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.

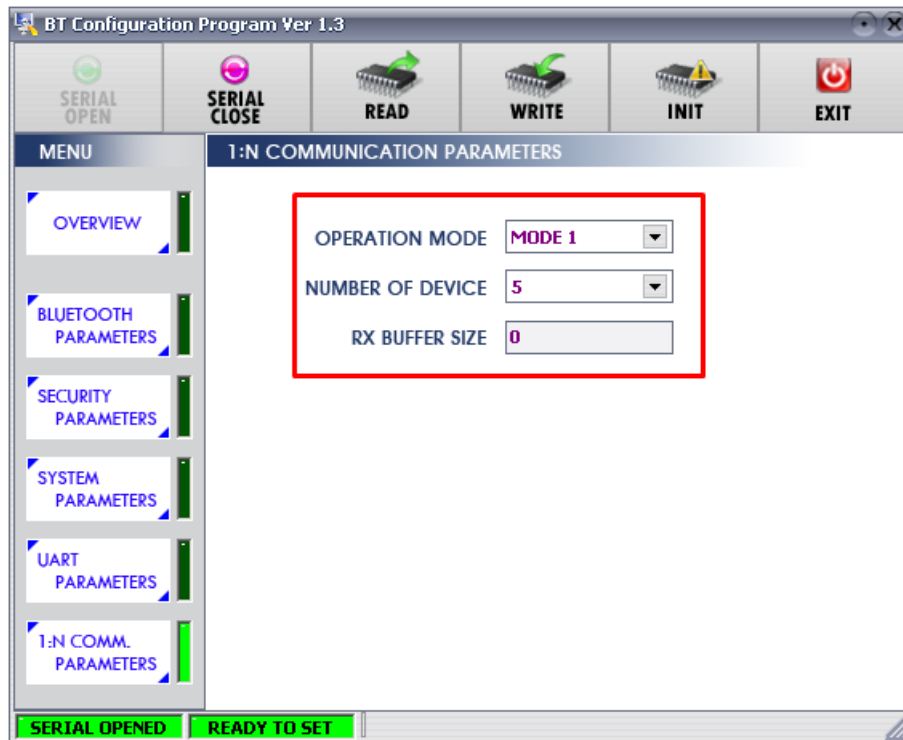
1 OP_MODE0(1:1 communication)

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



```

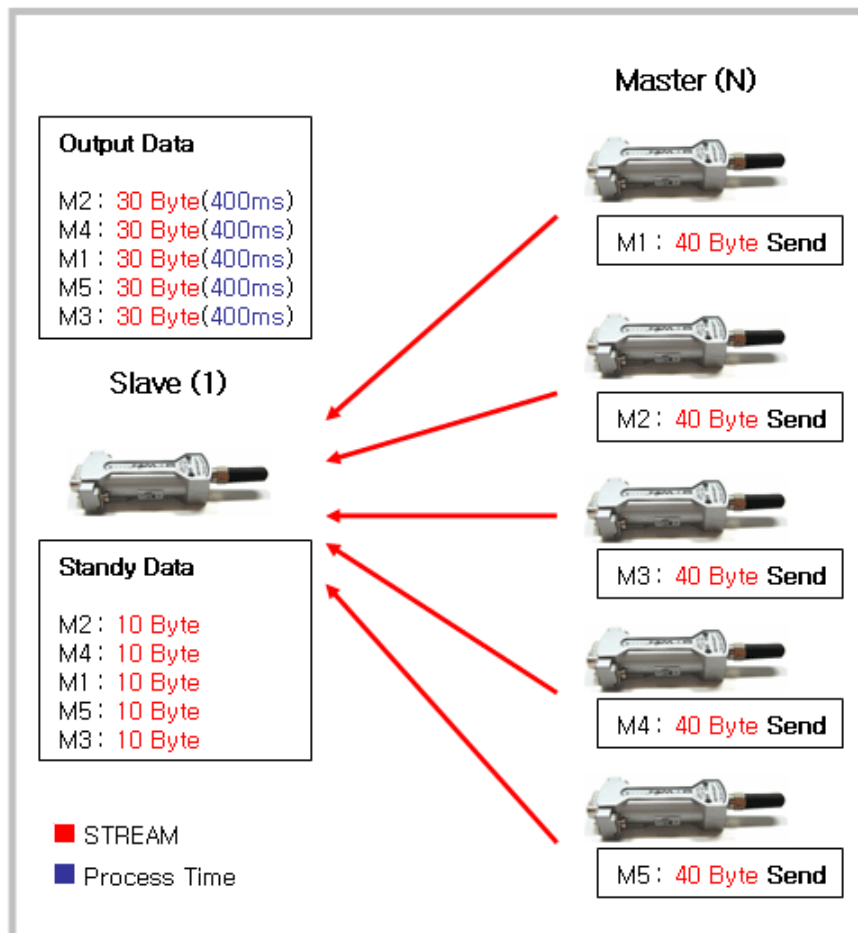
===== MAIN MENU =====
1 => GO TO BLUETOOTH PARAMETER MENU
2 => GO TO SECURITY PARAMETER MENU
3 => GO TO SYSTEM PARAMETER MENU
4 => GO TO UART PARAMETER MENU
5 => GO TO 1:N COMMUNICATION PARAMETER MENU
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 5) > 5
===== COMMUNICATION PARAMETER MENU =====
1 => OPERATION MODE : OP_MODE1
2 => NUMBER OF CONNECTION DEVICE : 5
3 => RX BUFF SIZE : 0 Byte
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 3) > _

```

<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 $400\text{ms} * 5 = 2000\text{ms}$ ($400\text{ms} * \text{number of connected units}$). If a Master sends out data every 2 seconds, the Slave shall be able to process the data for output smoothly.

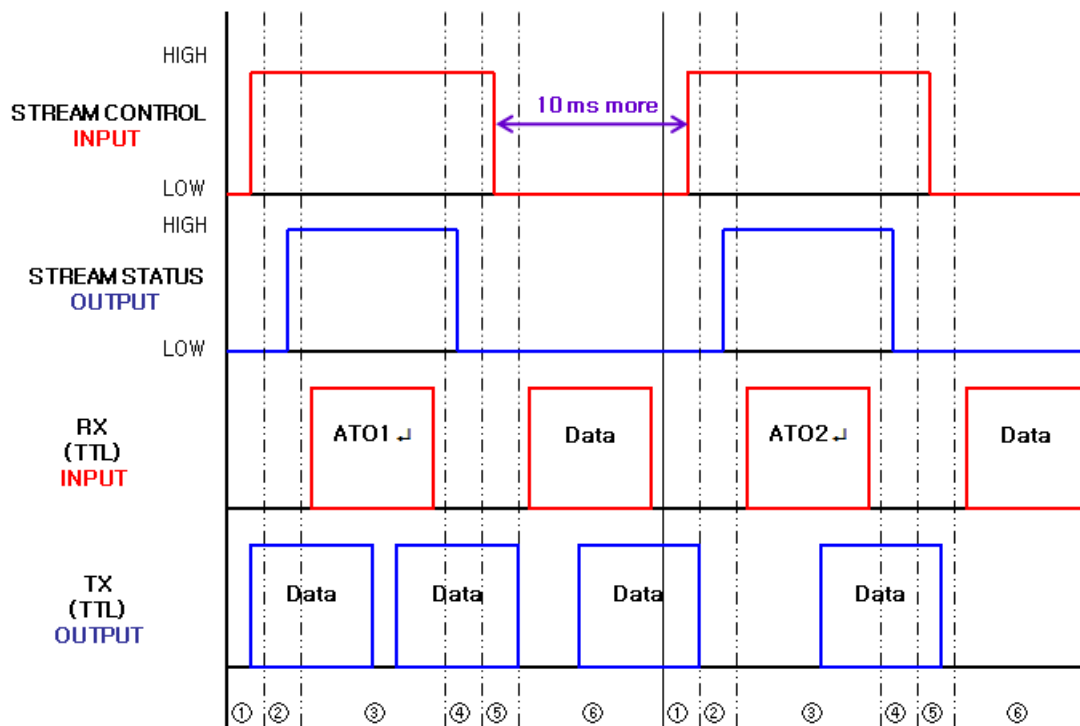
To get more fast transmission of data at Master, we recommend you take enough tests.

Note :

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.**

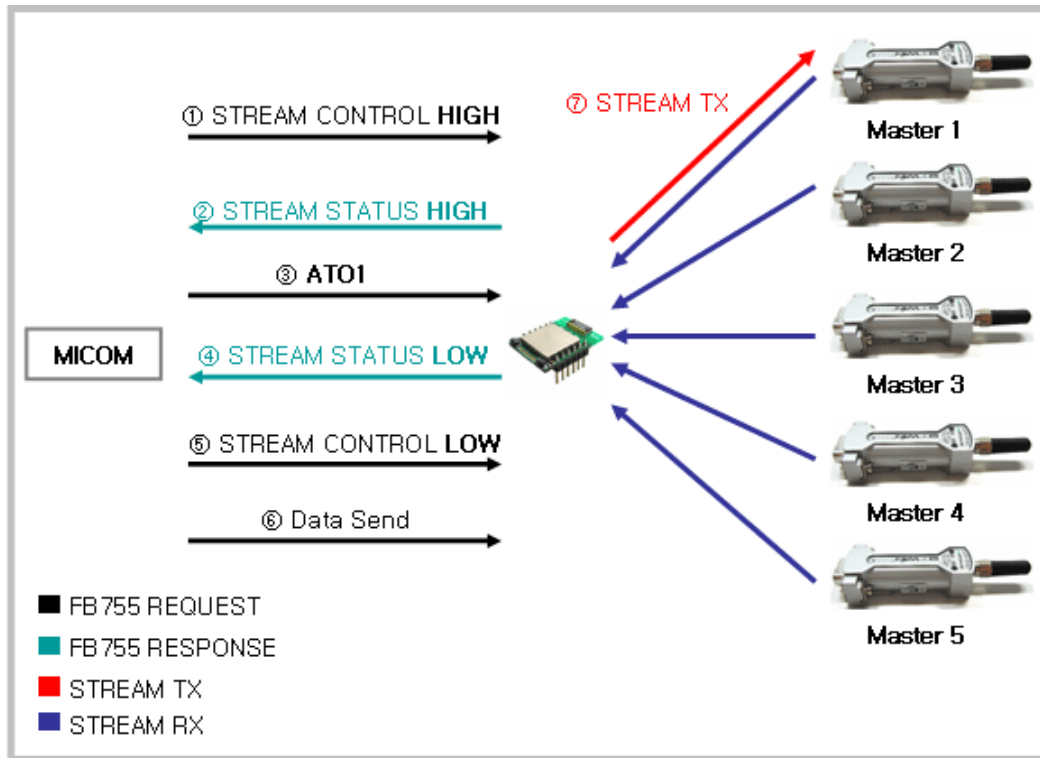
2.1.2 Data Transmit Method at TTL LEVEL(FB755)



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

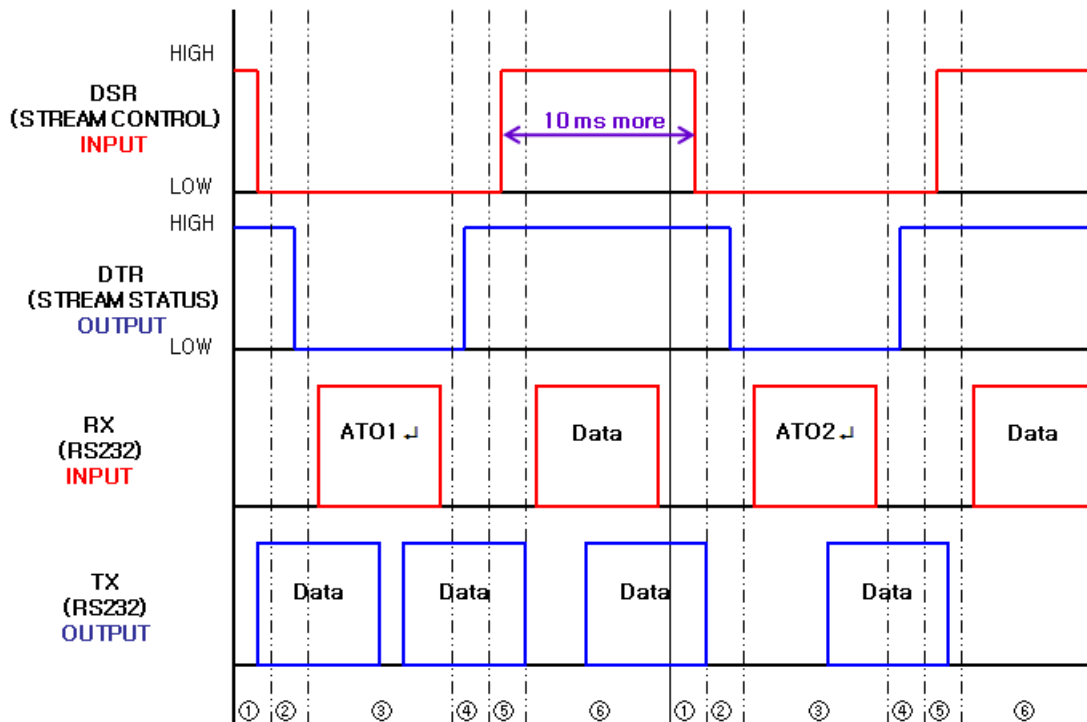
The timing of data transmission at TTL(FB755) can transmit the data to the Master connected using STREAM CONTROL, STREAM STATUS, or AT command language as shown on <Figure C-4>. The procedures can be briefly explained as follows.

- ① **HOST → BT : STREAM CONTROL HIGH** (Enter HIGH at STREAM CONTROL port.)
- ② **BT → HOST : STREAM STATUS HIGH** (Output HIGH if normally processed)
- ③ **HOST → BT : AT01** (Select the Master to send out)
- ④ **BT → HOST : STREAM STATUS(DTR) LOW** (Stream is low if normally connected.)
- ⑤ **HOST → BT : STREAM CONTROL(DSR) LOW**
- ⑥ **HOST → BT : Data Transmission**



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

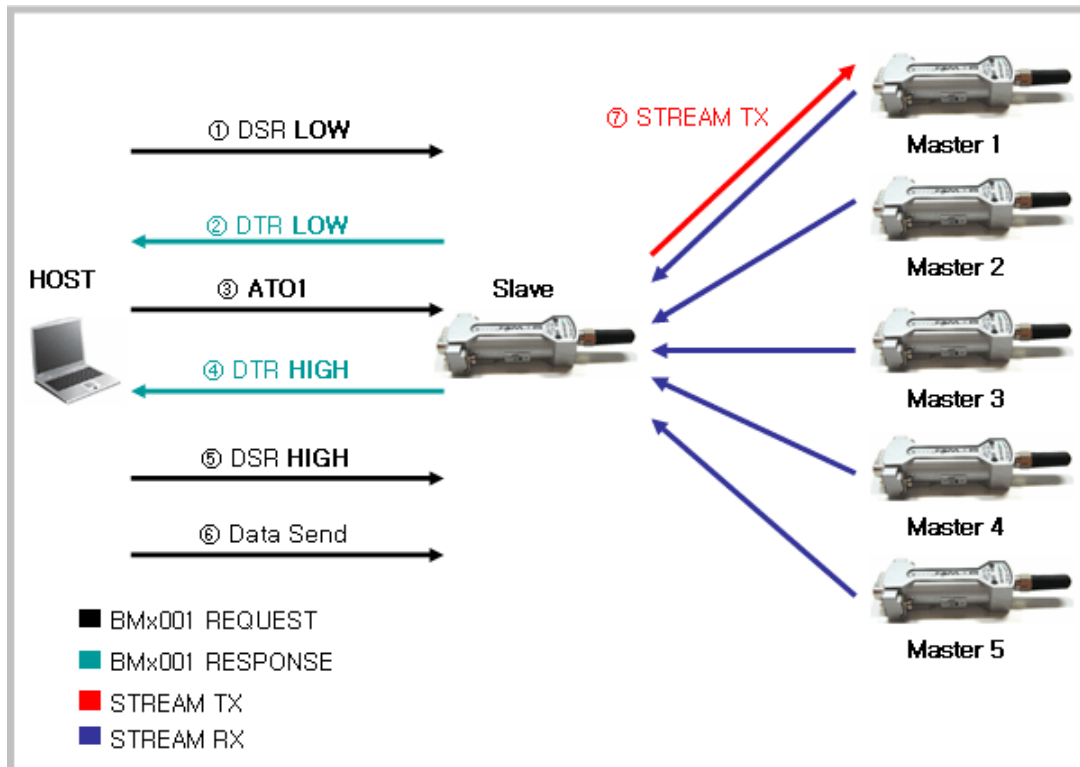
2.1.3 RS232 LEVEL(FB100AS, FB200AS) 에서의 데이터 송신 방법



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

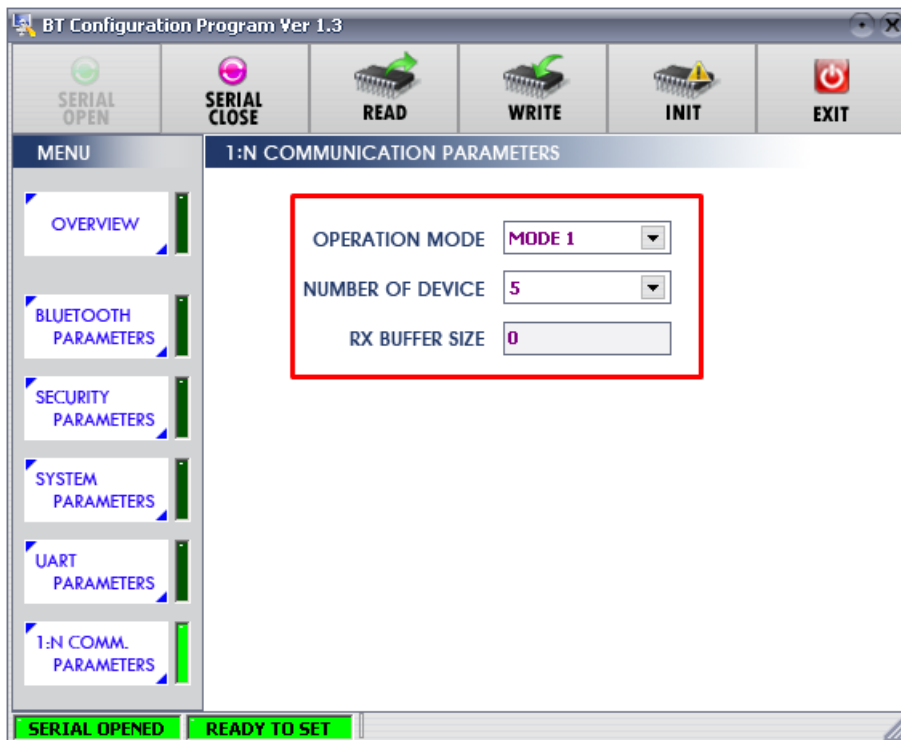
The transmission timing of at the RS232 LEVEL(FB100AS, FB200AS) enables to transmit the data to the Master connected, by using DSR(STREAM CONTROL), DTR(STREAM STATUS), or AT command language as shown on <Figure C-6>. The detailed procedures are as follows.

- ① **HOST → BT : DSR(STREAM CONTROL) LOW** (enter LOW at the STREAM CONTROL port.)
- ② **BT → HOST : DTR(STREAM STATUS) LOW** (enter LOW if operates normally.)
- ③ **HOST → BT : AT01↓** (Select Master to transmit)
- ④ **BT → HOST : DTR(STREAM STATUS) HIGH** (enter HIGH if stream is connected normally)
- ① **HOST → BT : DSR(STREAM CONTROL) HIGH**
- ② **HOST → BT : Transmit Date**



<Figure C-7 : The Procedures of Data Transmission at RS232(FB100AS, FB200AS)>

2.2 Setting Up at the Master



```

===== MAIN MENU =====
1 => GO TO BLUETOOTH PARAMETER MENU
2 => GO TO SECURITY PARAMETER MENU
3 => GO TO SYSTEM PARAMETER MENU
4 => GO TO UART PARAMETER MENU
5 => GO TO 1:N COMMUNICATION PARAMETER MENU
=====
[ Back Spcae : Input data Cancel ]
[ t : Move top menu ]
=====
Select(1 ~ 5) > 5
===== COMMUNICATION PARAMETER MENU =====
1 => OPERATION MODE : OP_MODE1
2 => NUMBER OF CONNECTION DEVICE : 5
3 => RX BUFF SIZE : 0 Byte
=====
[ Back Spcae : Input data Cancel ]
[ t : Move top menu ]
=====
Select(1 ~ 3) > _

```

<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 $2 * 400\text{ms} = 800\text{ms}$ will transmit the data.

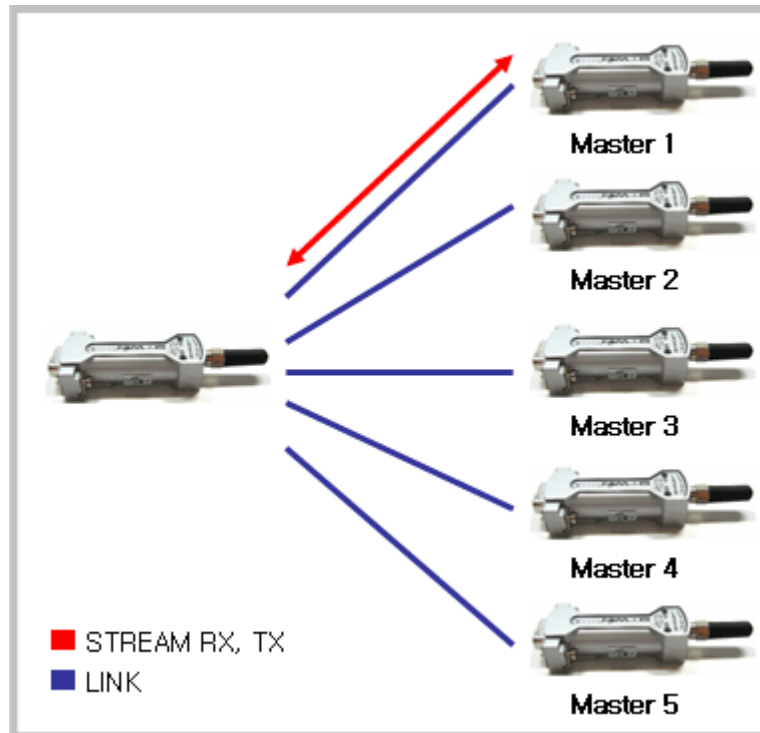
- BUFF SIZE : The BUFF SIZE at the Master will send out the specified byte for a time.

- 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).

3OP_MODE2(Selective Two-Way Large Volume Communication)



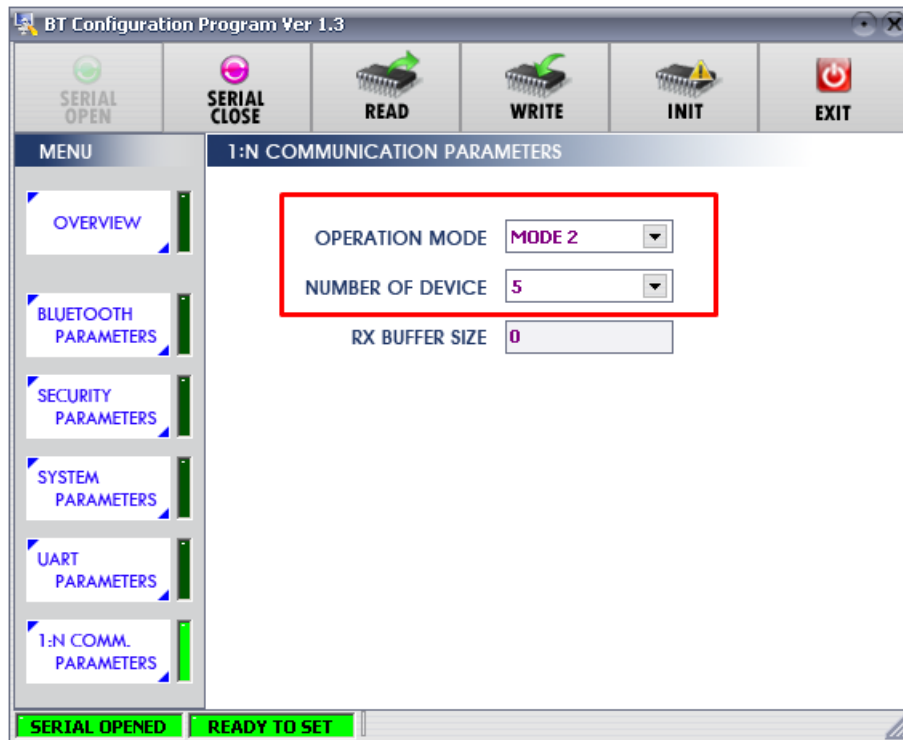
<Figure C-9 : OP_MODE2 Communication Method>

- 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_MODE2 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.

3.1 Setting Up at the Slave



```

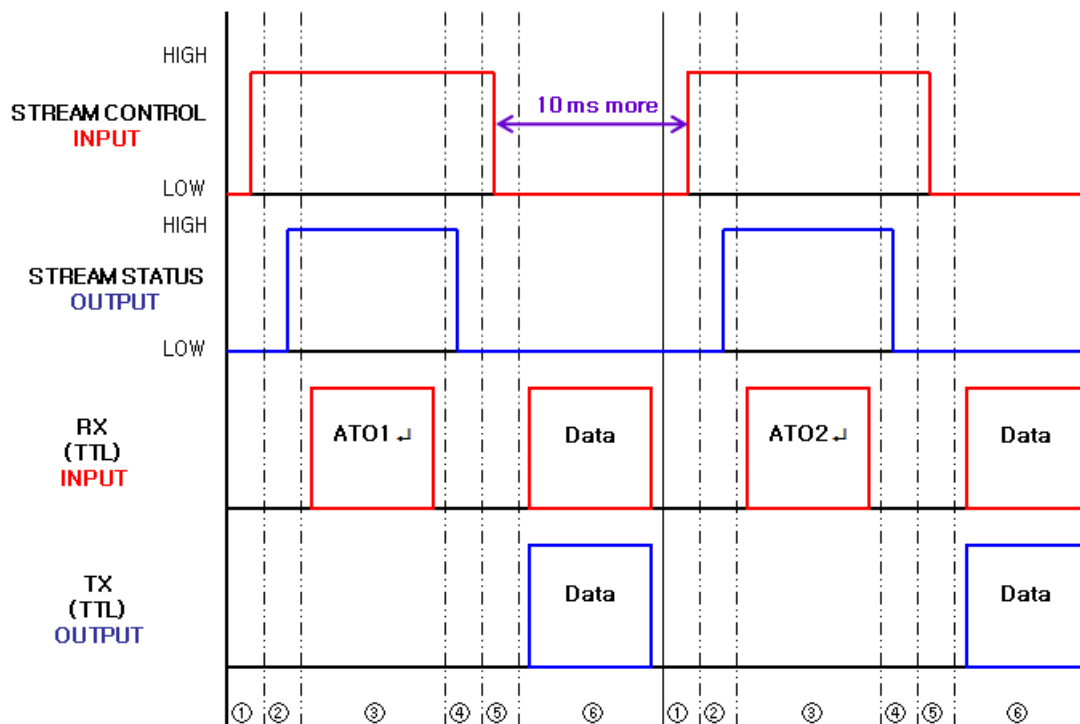
===== MAIN MENU =====
1 => GO TO BLUETOOTH PARAMETER MENU
2 => GO TO SECURITY PARAMETER MENU
3 => GO TO SYSTEM PARAMETER MENU
4 => GO TO UART PARAMETER MENU
5 => GO TO 1:N COMMUNICATION PARAMETER MENU
=====
[ Back Spcae : Input data Cancel ]
[ t : Move top menu ]
=====
Select(1 ~ 5) > 5
===== COMMUNICATION PARAMETER MENU =====
1 => OPERATION MODE : OP_MODE2
2 => NUMBER OF CONNECTION DEVICE : 5
=====
[ Back Spcae : Input data Cancel ]
[ t : Move top menu ]
=====
Select(0 ~ 2) >

```

<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.

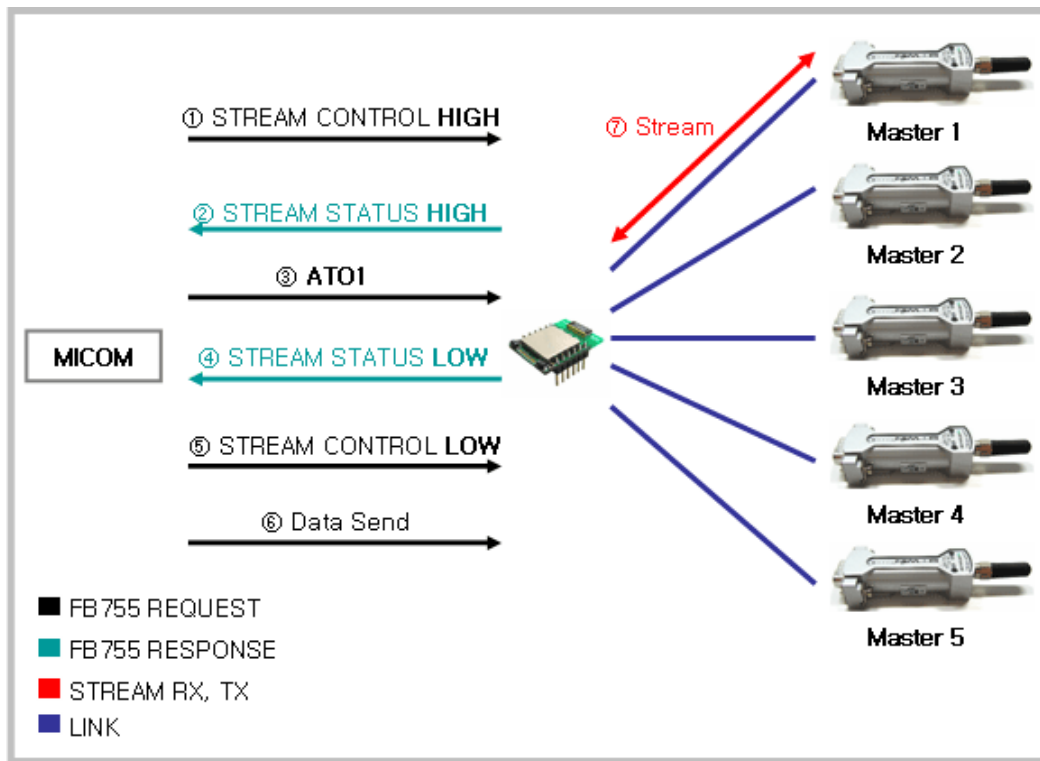
3.1.1 Data Transmit/Receive Method at TTL(FB755)



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

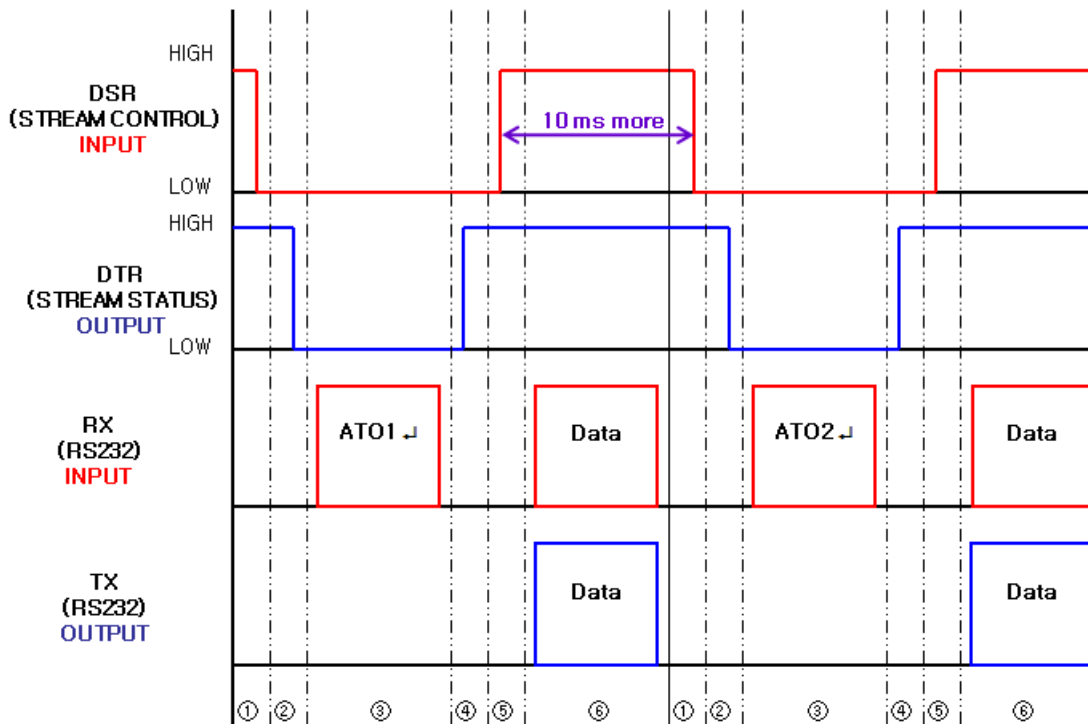
The data transmit/receive will allow data transmission/receipt with the Master connected, by using STREAM CONTROL, STREAM STATUS, and AT command language as shown on <Figure C-11>. Following is the brief explanation on the procedures for transmission/ receipt.

- ① **HOST → BT : STREAM CONTROL HIGH** (enter HIGH on STREAM CONTROL port.)
- ② **BT → HOST : STREAM STATUS HIGH** (enter HIGH if it is executed normally.)
- ③ **HOST → BT : AT01↓** (Select the Master to send out)
- ④ **BT → HOST : STREAM STATUS LOW** (enter LOW if the Stream is normally connected.)
- ⑤ **HOST → BT : STREAM CONTROL LOW**
- ⑥ **HOST → BT : Data Transmission/Receipt**



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

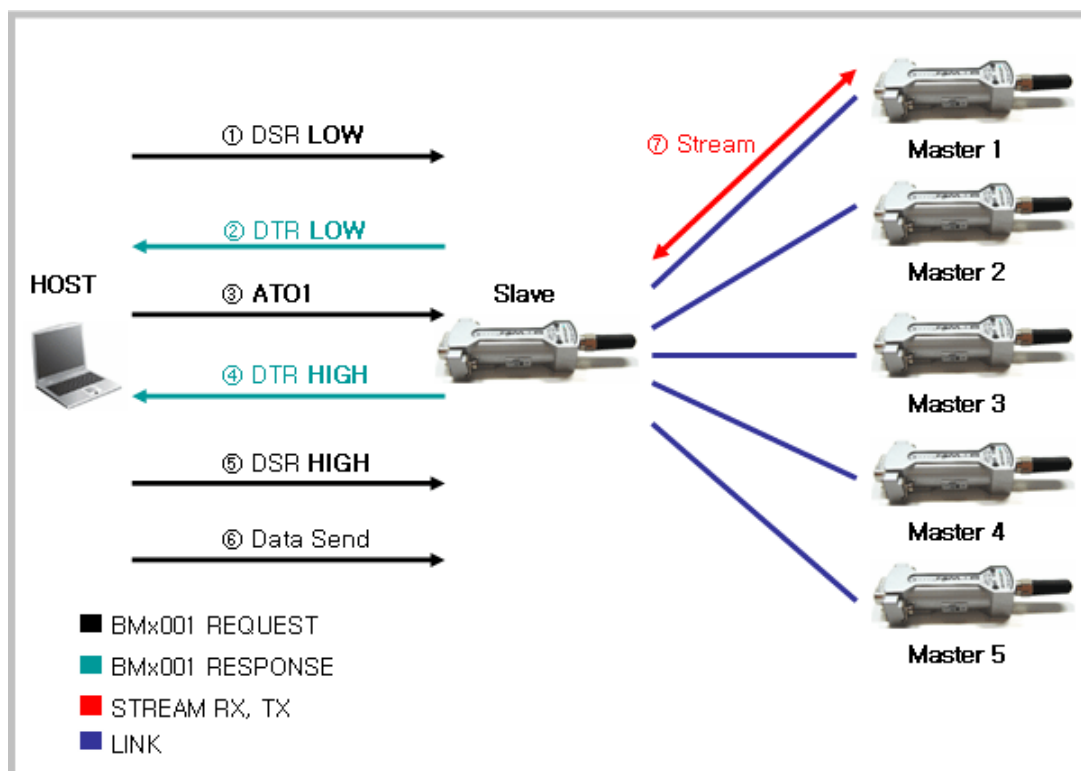
3.1.2 Data Transmit/Receive Method at RS232(FB100AS, FB200AS)



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

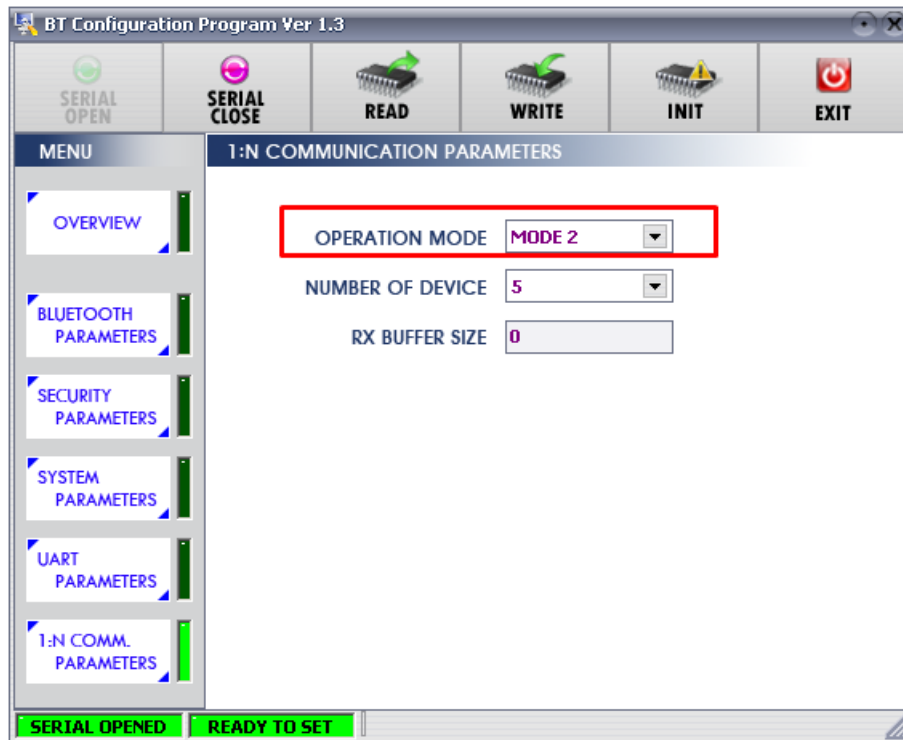
The data transmit/receive will allow data transmission/receipt with the Master connected, by using DSR(STREAM CONTROL), DTR(STREAM STATUS), and AT command language as shown on <Figure C-13>. Following is the brief explanation on the procedures for transmission/receipt.

- ① **HOST → BT : DSR(STREAM CONTROL) LOW** (enter LOW at DSR port.)
- ② **BT → HOST : DTR(STREAM STATUS) LOW** (enter LOW if it operates normally.)
- ③ **HOST → BT : AT01↓** (Select Master to send out)
- ④ **BT → HOST : DTR(STREAM STATUS) HIGH** (enter HIGH if Stream is connected normally.)
- ⑤ **HOST → BT : DSR(STREAM CONTROL) HIGH**
- ⑥ **HOST → BT : Data Transmit/Receive**



<Figure C-14 : Data Transmit/Receive Process at RS232(FB100AS, FB200AS)>

3.2 Setting Up at the Master



```

===== MAIN MENU =====
1 => GO TO BLUETOOTH PARAMETER MENU
2 => GO TO SECURITY PARAMETER MENU
3 => GO TO SYSTEM PARAMETER MENU
4 => GO TO UART PARAMETER MENU
5 => GO TO 1:N COMMUNICATION PARAMETER MENU
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 5) > 5
===== COMMUNICATION PARAMETER MENU =====
1 => OPERATION MODE : OP_MODE2
=====
[ Back Spcae : Input data Cancel
[ t : Move top menu
=====
Select(1 ~ 1) > _

```

<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 our products.

Note :

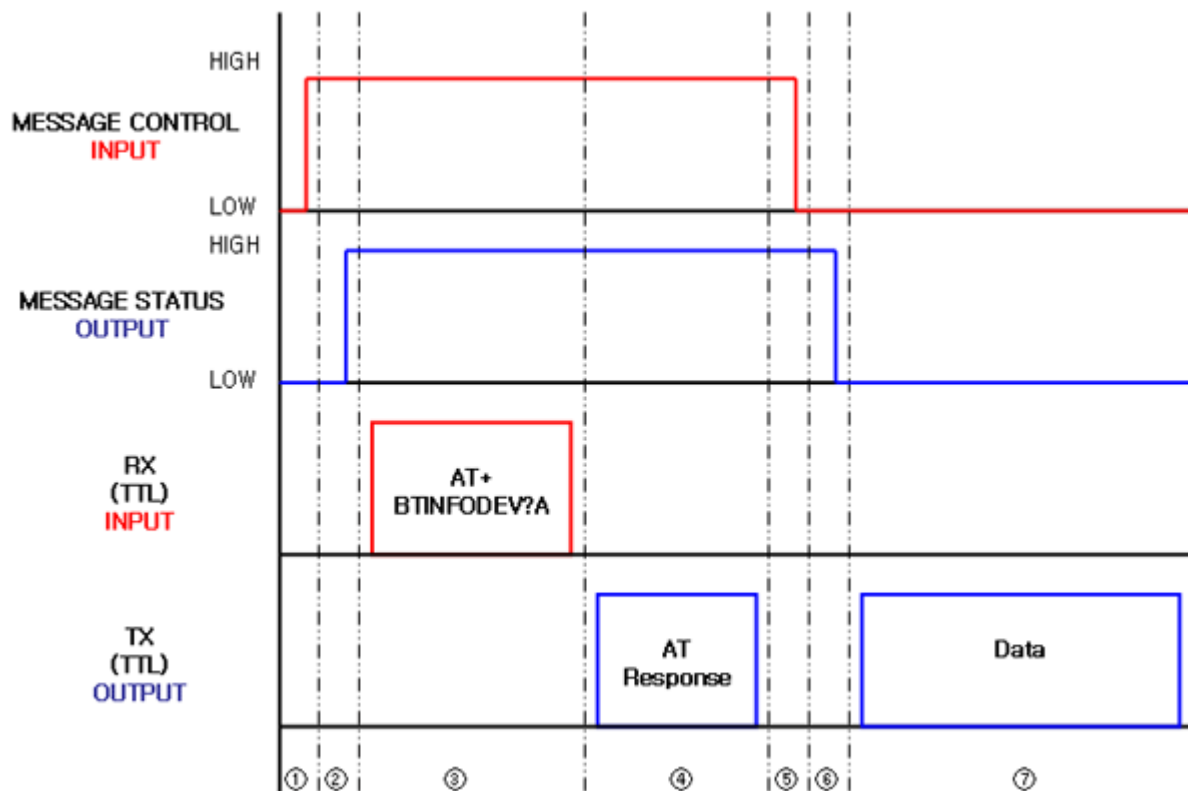
If you plan to use other Bluetooth (such as PDA, USB dongle) connected with OP_MODE2 Slave, be sure to take enough tests prior to use with flow control signal DSR to avoid any panic condition of OP_MODE2 Slave which might be occurred due to the communication during DSR is LOW (TTL HIGH). Please refer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

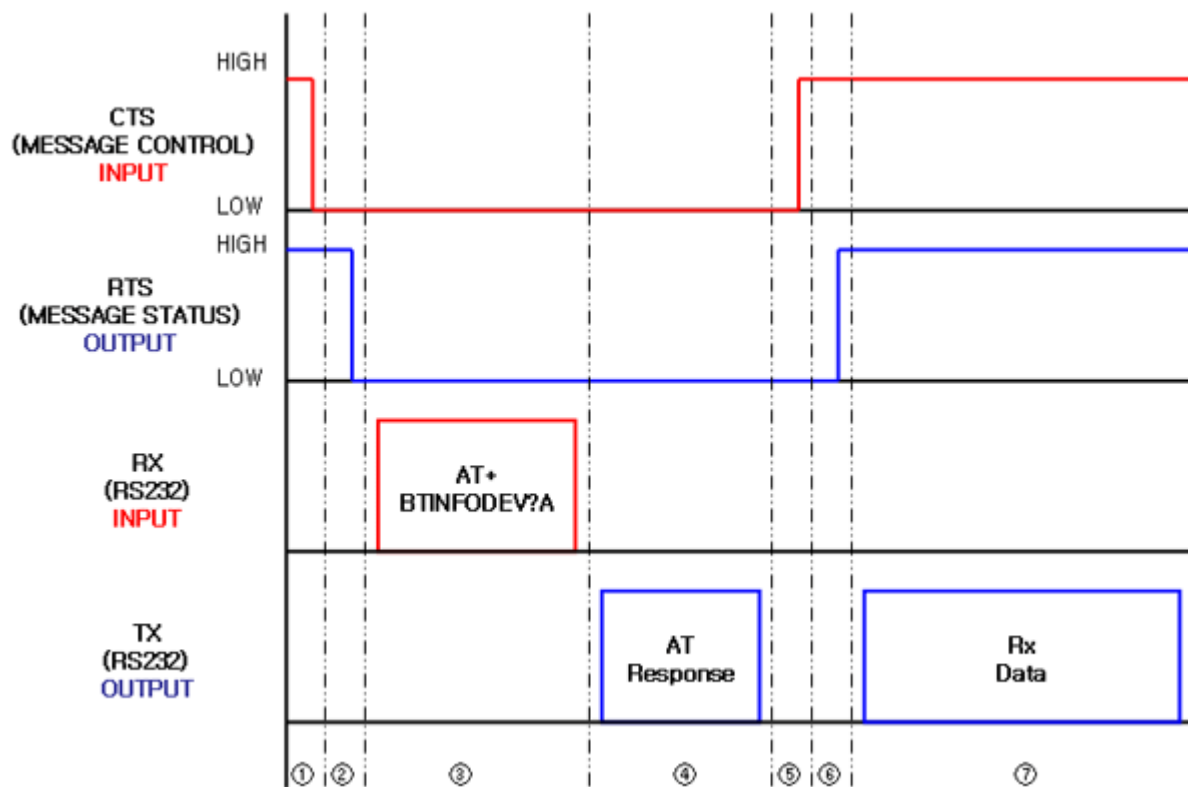
- ② **BT → HOST : MESSAGE STATUS HIGH** (Limit the data receiving from the Master)
- ③ **HOST → BT : AT+BTINFODEV?1↓** (Enter command to identify)
- ④ **BT → HOST : <0123456789012<** (Output the Master information connected at first)
- ⑦ **HOST → BT : MESSAGE CONTROL LOW** (To complete the identification of information)
- ⑧ **BT → HOST : MESSAGE STATUS LOW**

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

Note :

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(FB100AS, FB200AS)



<Figure C-17 : Status Message Output Timing at RS232(FB100AS, FB200AS)>

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 → BT : CTS LOW** (Enter LOW at the CTS port)
- ② **BT → HOST : RTS LOW** (Limit the data receiving from the Master)
- ③ **HOST → BT : AT+BTINFODEV?1↓** (Enter command to identify)

- ④ **BT → HOST : <0123456789012<** (Output the Master information connected at first)
- ⑤ **HOST → BT : CTS HIGH** (To complete the identification of information)
- ⑥ **BT → HOST : RTS HIGH**

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

Note :

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.

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.