M3H Group(1)
Application Note
I^2C Interface
(I2C-B)
MASTER/SLAVE

Outlines

This application note is a reference material for developing products using the Master/Slave function in I2C interface (I2C) functions of M3H Group(1).
This document helps the user check operation of the product and develop its program.

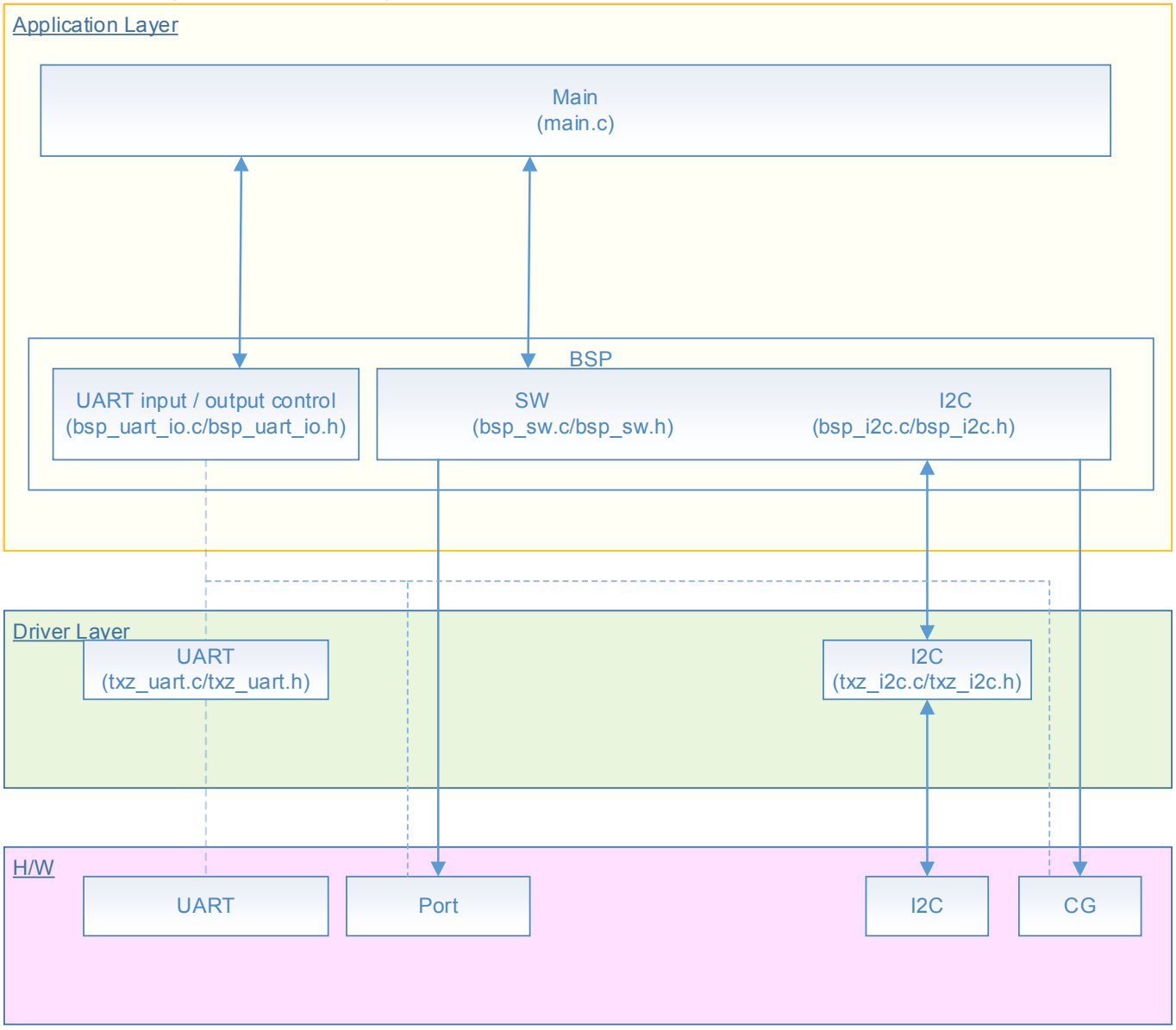
Target sample program: I2C_MASTER_SLAVE

Table of Contents

1. Preface

This sample program is used to check the operation of the I2C communication function.
Data transmission and reception by I2C Master / Slave is performed by terminal software on the host PC via USB-UART.

Structure diagram of Sample program



2. Reference Document

- Datasheet
  TMPM3H group (1) datasheet Rev2.0 (Japanese edition)
- Reference manual
  I2C interface (I2C-B) Rev2.0 (Japanese edition)
- Other reference document
  TMPM3H(1) Group Peripheral Driver User Manual (Doxygen)

3. Function to Use

IP	Channel	Port	Function / operation mode
I2C interface	ch0	PC0 (I2C0SCL) PC1 (I2C0SDA)	I2C mode
Asynchronous communication	ch0	PA1 (UT0TXDA) PA2 (UT0RXD)	UART mode

4. Target Device

The target devices of application note are as follows.

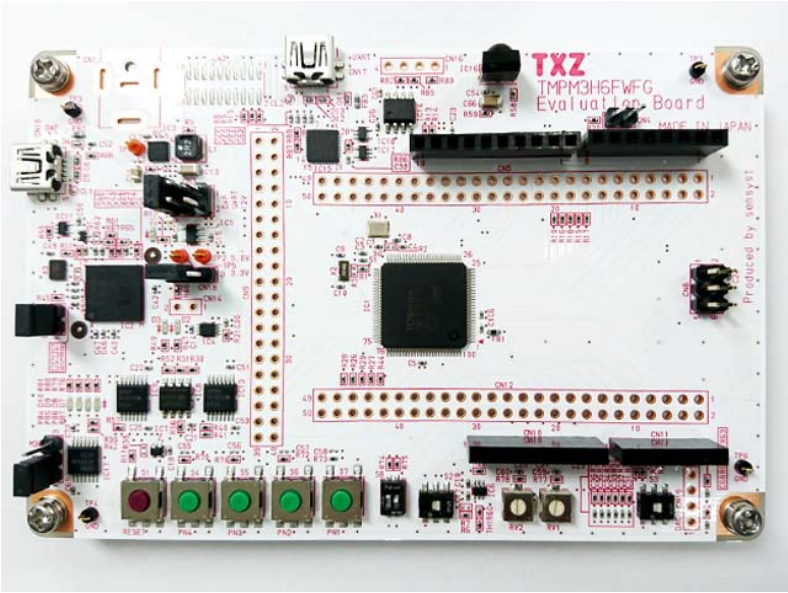
TMPM3H6FWFG	TMPM3H6FUFG	TMPM3H6FSFG
TMPM3H6FWDFG	TMPM3H6FUDFG	TMPM3H6FSDFG
TMPM3H5FWFG	TMPM3H5FUFG	TMPM3H5FSFG
TMPM3H5FWDFG	TMPM3H5FUDFG	TMPM3H5FSDFG
TMPM3H4FWUG	TMPM3H4FUUG	TMPM3H4FSUG
TMPM3H4FWFG	TMPM3H4FUFG	TMPM3H4FSFG
TMPM3H3FWUG	TMPM3H3FUUG	TMPM3H3FSUG
TMPM3H2FWDUG	TMPM3H2FUDUG	TMPM3H2FSDUG
TMPM3H2FWQG	TMPM3H2FUQG	TMPM3H2FSQG
TMPM3H1FWUG	TMPM3H1FUUG	TMPM3H1FSUG
TMPM3H1FPUG	TMPM3H0FSDUG	TMPM3H0FMDUG

* This sample program operates on the evaluation board of TMPM3H6FWFG.
If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and IO header file) should be changed properly.
The BSP related file is dedicated to the evaluation board (TMPM3H6). If other function than the TMPM3H6 one is checked, the BSP related file should be changed properly.

5. Conditions for Correct Operation

Used microcontroller TMPM3H6FWFG
Used board TMPM3H6FWFG Evaluation Board (Product of Sensyst)
Unified development environment IAR Embedded Workbench for ARM 8.11.2.13606
Unified development environment µVision MDK Version 5.24.2.0
Terminal software Tera Term V4.96
Sample program V1100

Evaluation board (TMPM3H6FWFG Evaluation Board) (Top view)



For purchasing the board, refer to the following homepage. (http://www.chip1stop.com/)

6. Evaluation Board Setting

The following pin connections should be done on the evaluation board.
Two evaluation boards are used for Master and Slave.
There are three kinds of connection as follows.

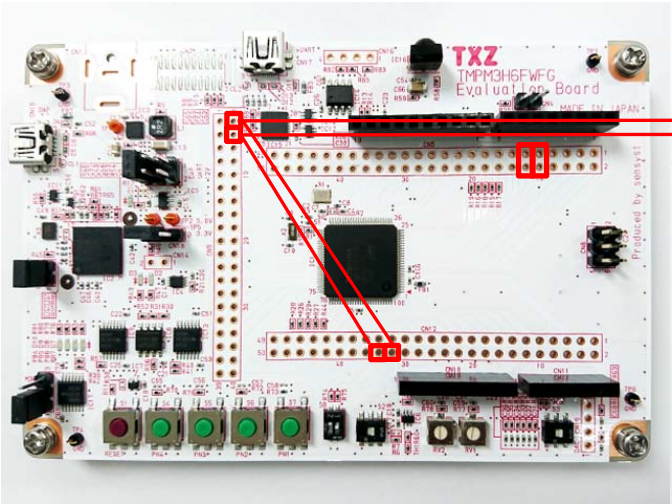
Common to board A and board B

CN5		
Use	Through-hole No.	Setting
UART (RXD)	9-10	Connection
UART (TXD)	11-12	Connection

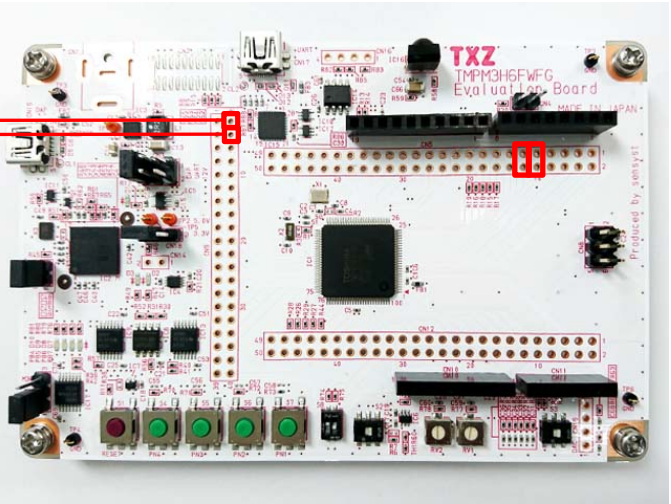
Connection between CN in board A
Connect “CN9 No.2” and “CN12 No.32”
Connect “CN9 No.4” and “CN12 No.34”

Connection between boards
Connect “board A CN9 No.2” and “board B CN9 No.2”
Connect “board A CN9 No.4” and “board B CN9 No.4”

Board A



Board B



7. Operation of Eveluation Board

Connect the PC with the USB_UART terminal of the evaluation board with a USB cable.
After start-up the terminal software (Tera Term), performs communication setting on the terminal software.
Press the reset button on the evaluation board.
Communication starts according to command input.
For details of command input operation, refer to the sample program main operation.

8. Outline of I^{2}C Interface function

The I2C can operate as a transceiver circuit of 1ch (SCL, SDA) in 1 unit circuit.

8.1. Clock Supply

When using I2C, please set a clock enabling bit corresponding with the fsys supply on/off register A (***[CGFSYSENA]***) or B (***[CGFSYSENB]***) and fc supply on/off register (***[CGFCEN])*** as “1” (clock supply). Please refer to "Clock Control and Operation Mode" of the reference manual for the details.

9. Sample Program

According to the command input in the terminal software, Master and Slave are operated.

9.1. Initialization

The following initialization is done after power is supplied.
The port setting is executed after the initialization of each clock setting, the watchdog timer setting and the clock setting.

9.2. Sample program main operation

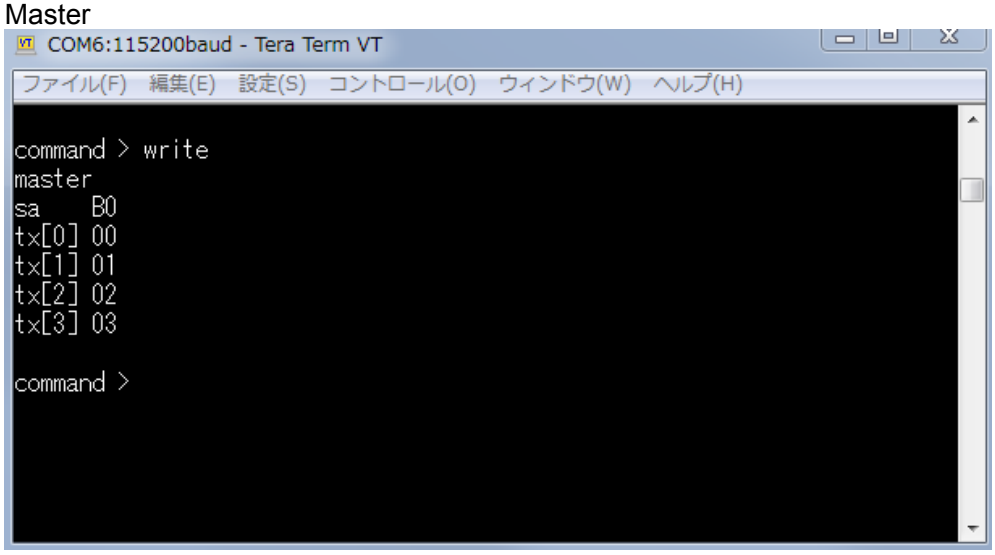
After the initialization operation, shift to the main function and perform the following initialization。
1 Initialization of BSP (Board Support Package)
2 Initialize the application
3 Initialization of the I2C interfaces for Master and Slave.

After the above processing, perform the following operations on PC terminal software (Tera Term).
"Command>" is displayed on Tera Term.
The command “slave” should be set to the board which should be used as Slave.
The command “write” or “read” should be input to the board which should be used as Master.
When “write” is input, the slave address and the transmission data are displayed for the Master board. And the address and the reception data are displayed for the Slave one.
When “read” is input, the slave address and the transmission/reception data are displayed for the Master board. The address and the reception/transmission data are displayed for the Slave one.
For the displayed image, refer to Section 9.3 “Output Example of Sample Program”.

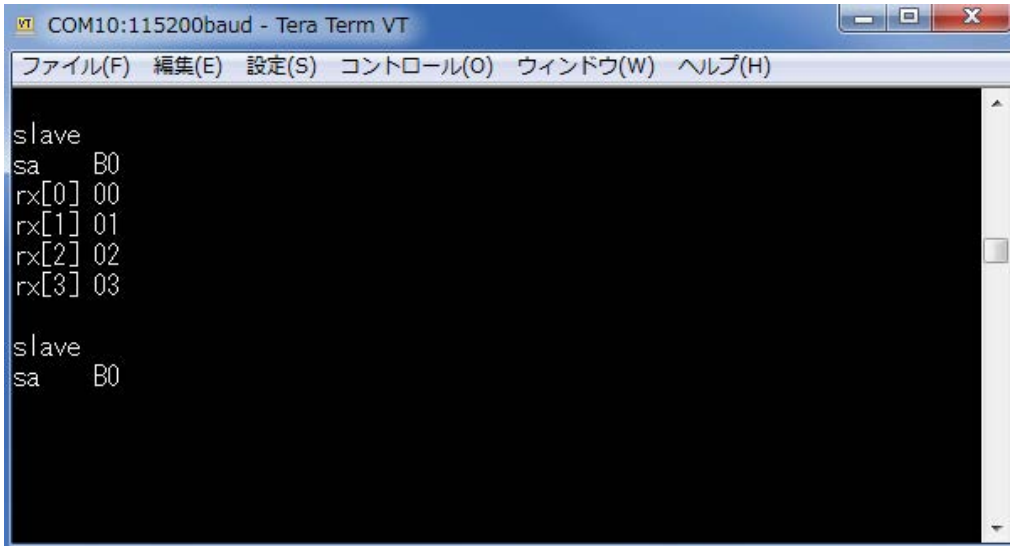
9.3. Output Example of Sample Program

When the sample program operates, the command results are shown as follows;

Master

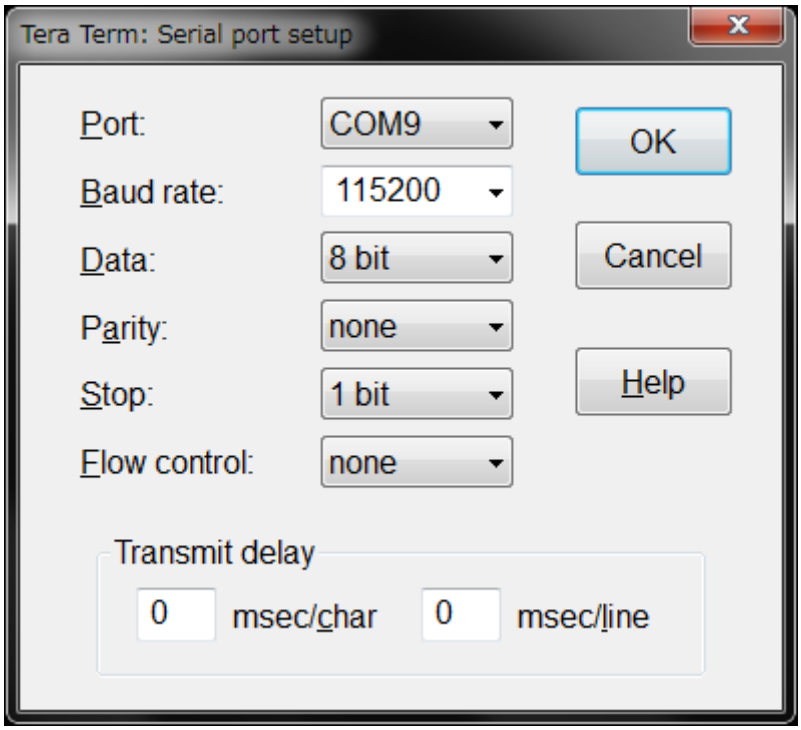


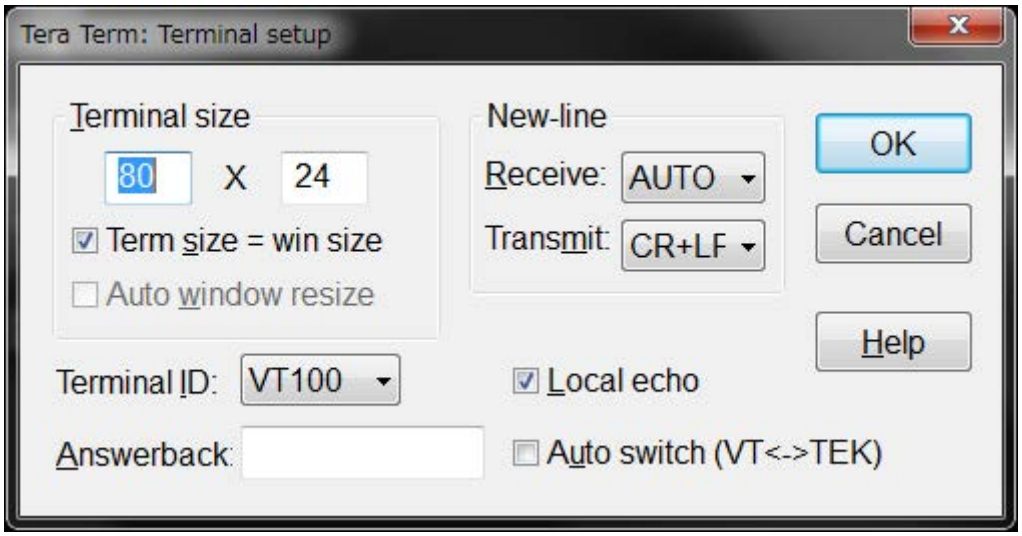
Slave



9.3.1. Setting Example of Terminal Software

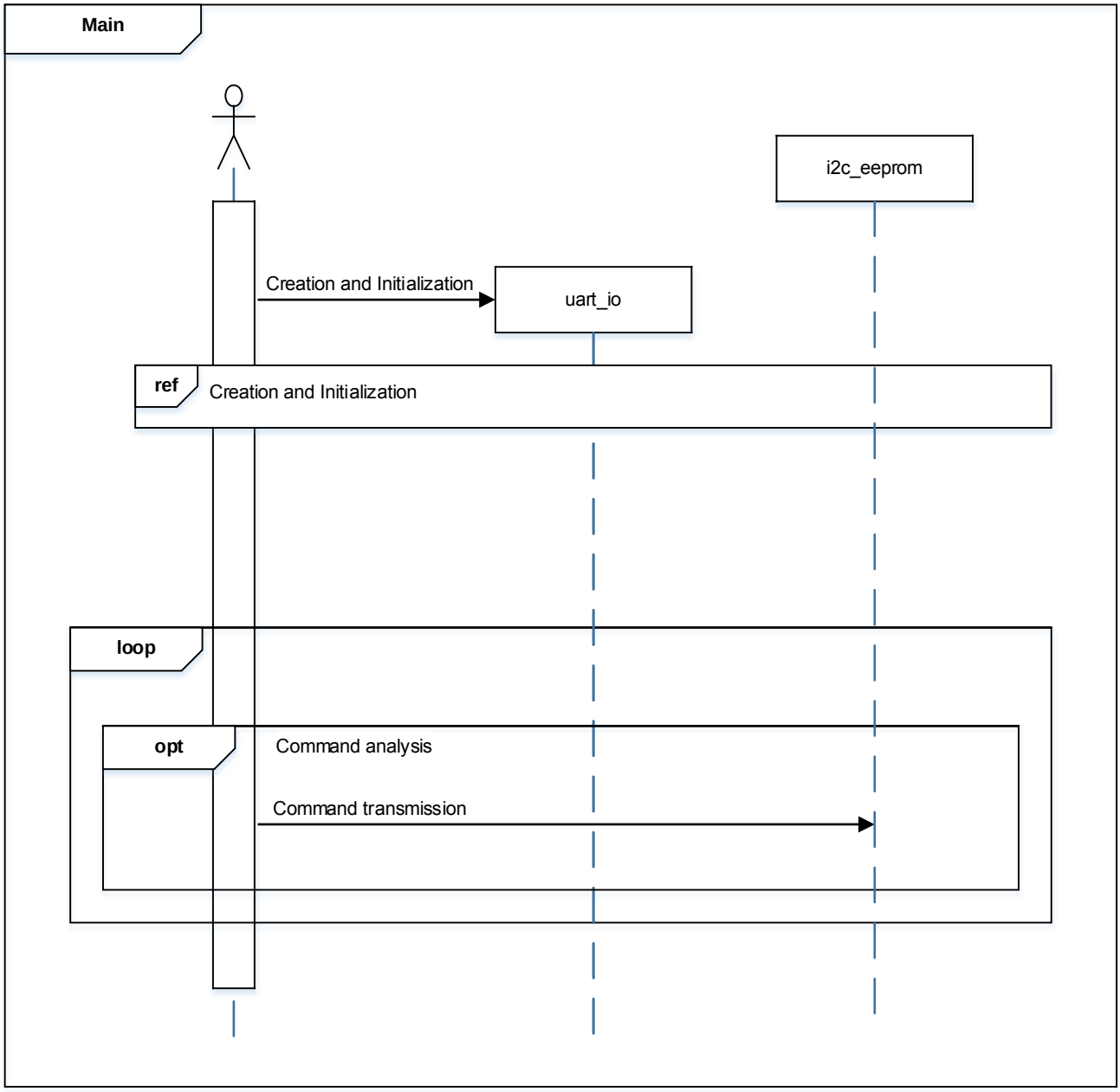
The operation of the terminal software (Tera Term) has been checked with the following settings.

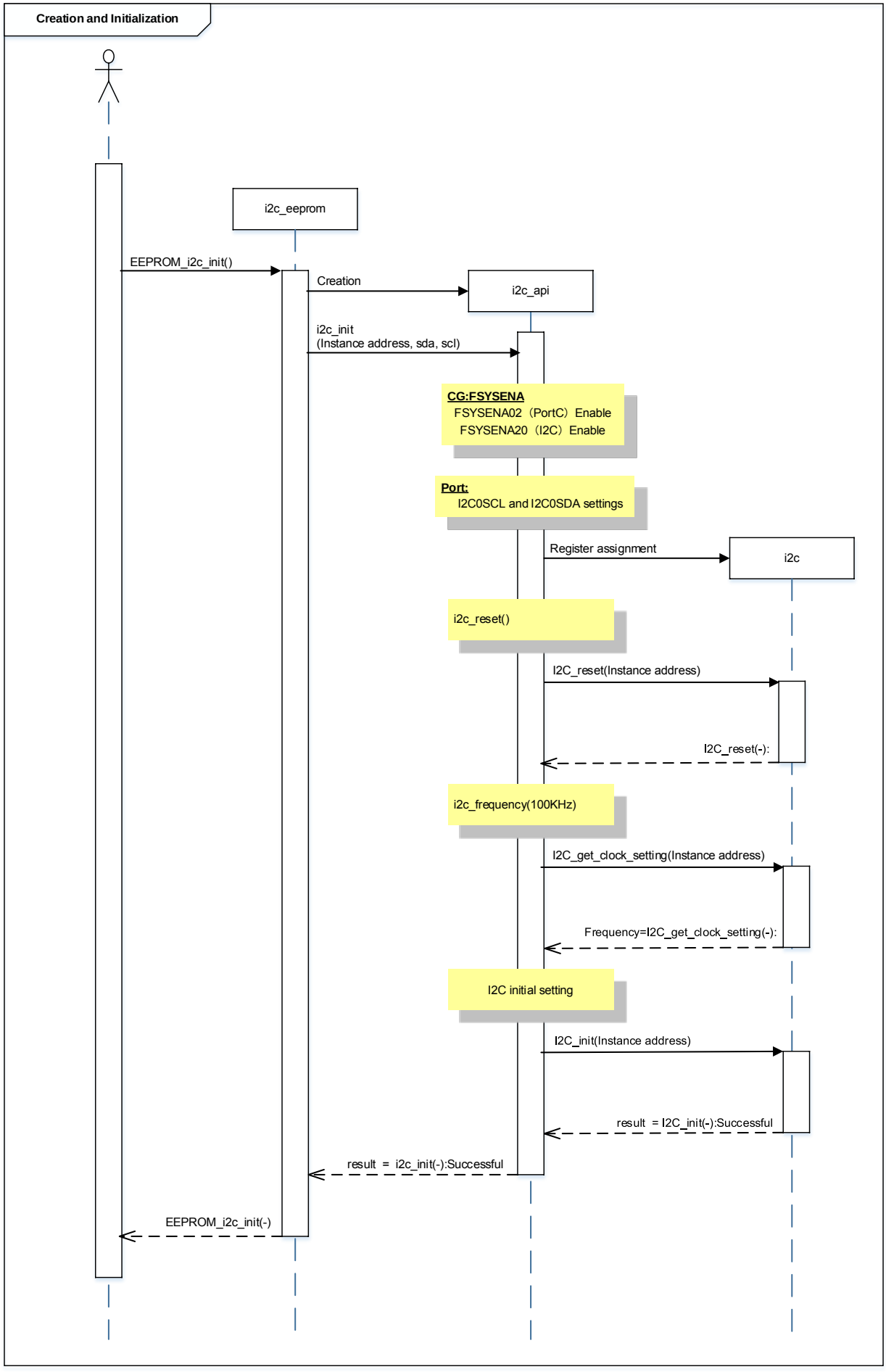




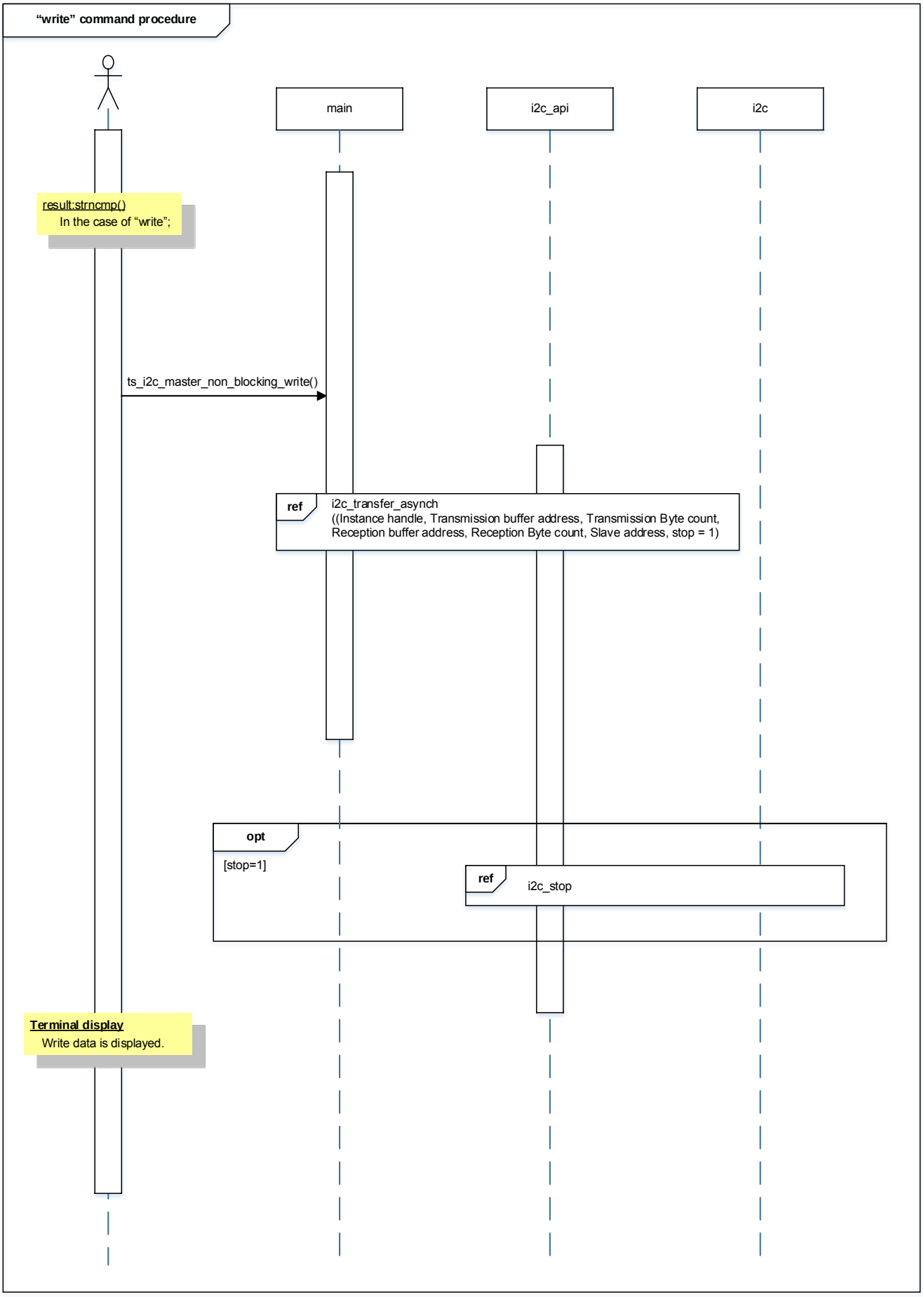
9.4. Operating Flow of Sample Program

The operating flows of the sample program are shown in the following;

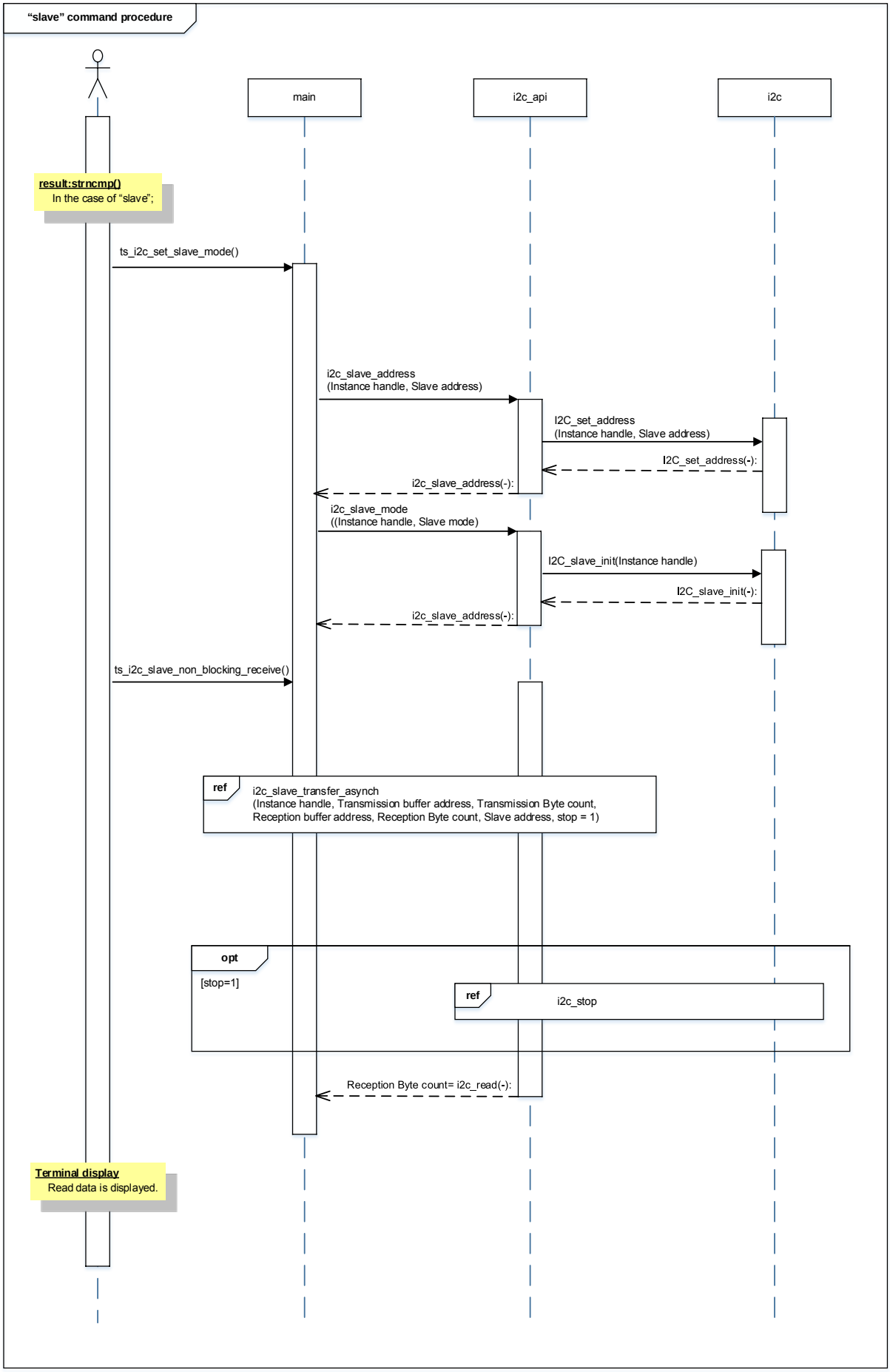



Creation and Initialization
i2c_eeprom
EEPROM_i2c_init()
Creation
i2c_api
i2c_init
(Instance address, sda, scl)
CG:FSYSENA
FSYSENA02（PortC）Enable
FSYSENA20（I2C）Enable
Port:
I2C0SCL and I2C0SDA settings
Register assignment
i2c
i2c_reset()
I2C_reset(Instance address)
I2C_reset(-):
i2c_frequency(100KHz)
I2C_get_clock_setting(Instance address)
Frequency=I2C_get_clock_setting(-):
I2C initial setting
I2C_init(Instance address)
result = I2C_init(-):Successful
result = i2c_init(-):Successful
EEPROM_i2c_init(-)

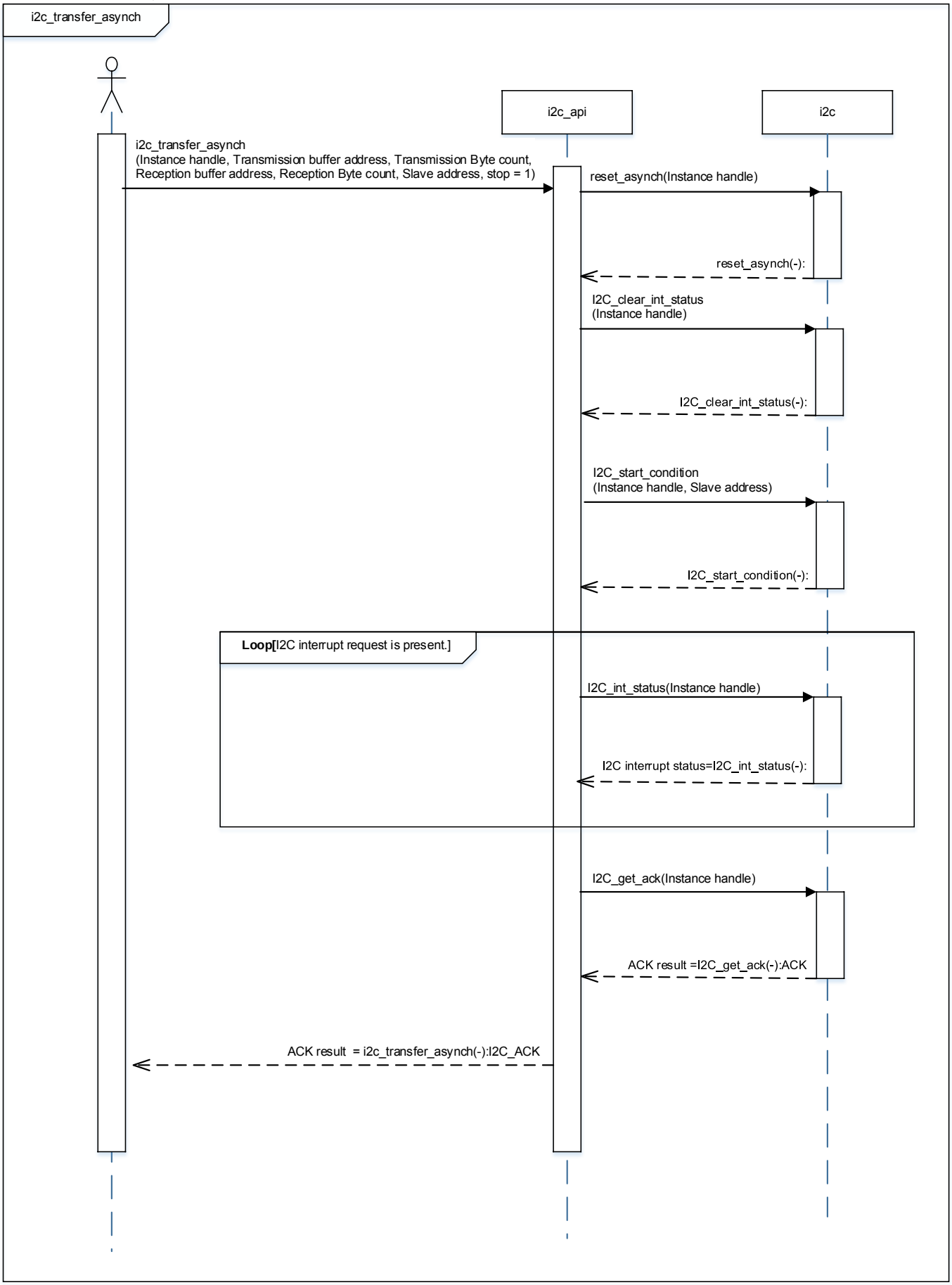
"write" command procedure



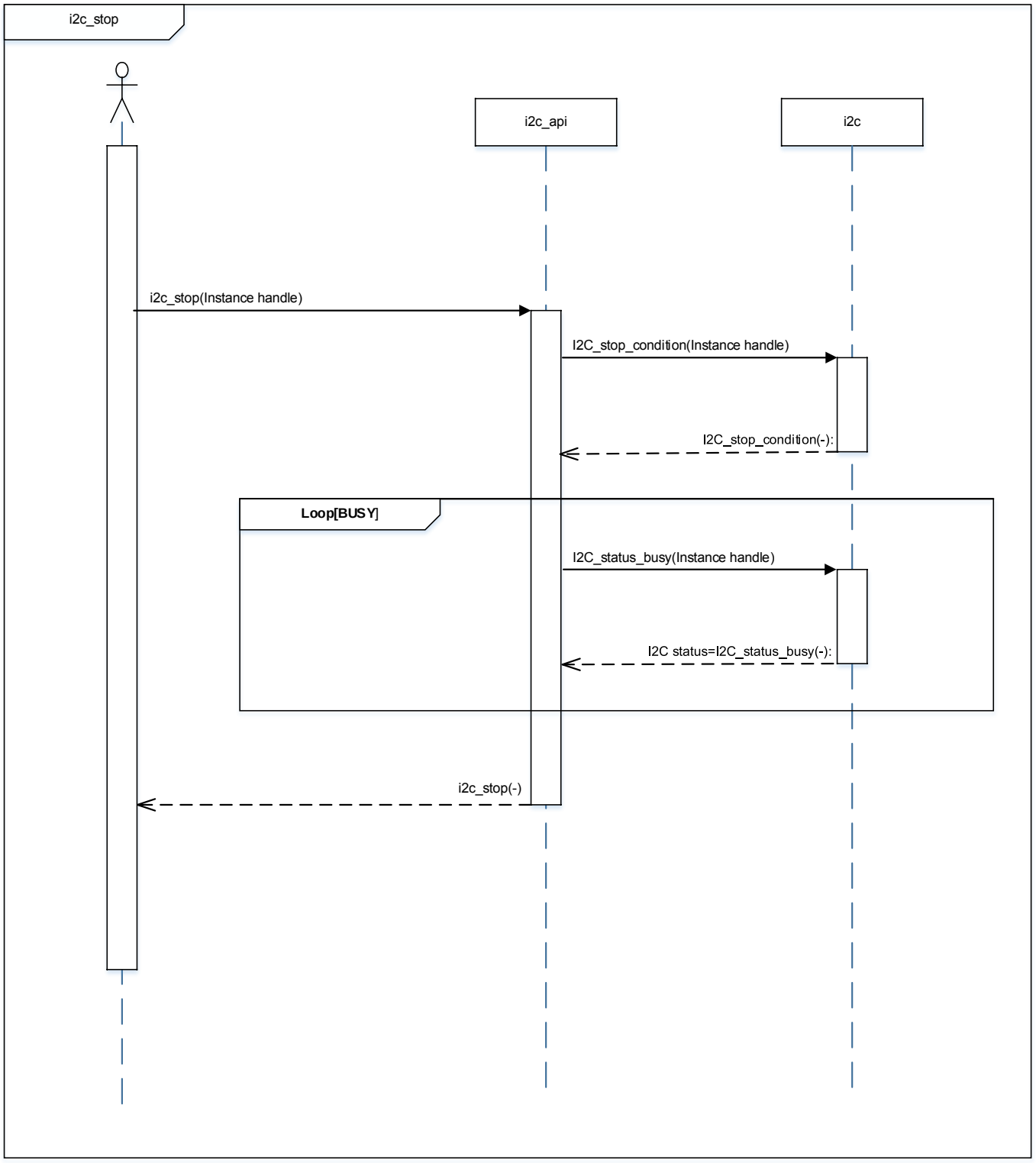
“slave” command procedure



i2c_transfer_asynch



i2c_stop


i2c_stop
i2c_api
i2c
i2c_stop(Instance handle)
I2C_stop_condition(Instance handle)
I2C_stop_condition(-):
Loop[BUSY]
I2C_status_busy(Instance handle)
I2C status=I2C_status_busy(-):
i2c_stop(-)

10. Precaution

When using the sample program with CPU other than TMPM3H6, please check operation sufficiently.

11. Revision History

Rev	Date	Page	Description
1.0	2018-03-08	-	First release

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