

M4K Group (1)
Application Note
Flash Memory
(FLASH256-B)

Outlines

This application note is a reference material for developing products using the Flash memory (FLASH) of M4K Group (1).

This document helps the user check operation of the product and develop its program.

Target sample program: Flash_Userboot

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1. Preface

This sample program is used to exchange 2 data each other in the Code Flash memory.
 This sample program lights on and off the LED's using the 2 data stored in the Code Flash memory.
 The 2 data in the Code Flash memory are replaced each other by push-down of a push switch.
 The LED lighting and lights-off are controlled by the content in the data table.

2. Reference Document

1. Datasheet
 TPM4K Group (1) datasheet Rev2.0 (Japanese edition)
2. Reference manual
 Flash Memory (FLASH256-B) Rev1.1
 Asynchronous Serial Communication Circuit (UART-C) Rev3.0 (Japanese edition)
 Input/Output Ports (PORT-M4K(1)) Rev2.0 (Japanese edition)
3. Application note
 M4K Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
4. Other reference document
 TPM4KxA Group Peripheral Driver User Manual (Doxygen) V1.0.4.0

3. Function to Use

IP	Channel	Port	Function/Operation mode
Asynchronous Serial Communication Circuit	ch0	PK0 (UT0RXD) PK1 (UT0TXDA)	UART mode
Flash Memory	-	-	Code Flash memory
Input/Output Ports	-	PJ0 (Output Port)	Output
	-	PJ2 (Output Port)	
	-	PJ4 (Output Port)	
	-	PL4 (Output Port)	
	-	PE2 (Input port)	Input

4. Target Device

The target devices of this application note are as follows;

TMPM4K4FYAUG	TMPM4K4FWAUG	TMPM4K4FUAUG	TMPM4K4FSAUG
TMPM4K4FYAFG	TMPM4K4FWAFG	TMPM4K4FUAFG	TMPM4K4FSAFG
TMPM4K2FYADUG	TMPM4K2FWADUG	TMPM4K2FUADUG	TMPM4K2FSADUG
TMPM4K1FYAUG	TMPM4K1FWAUG	TMPM4K1FUAUG	TMPM4K1FSAUG
			TMPM4K0FSADUG

* This sample program operates on the evaluation board of TMPM4K4FYAUG.

If other function than the TMPM4K4 one is checked, it is necessary that CMSIS Core related files (the startup file and I/O header file) should be changed properly.

Additionally, the name of microcontroller which is set to the project should be changed.

The BSP related file is dedicated to the evaluation board (TMPM4K4FYAUG). If other function than the TMPM4K4 one is checked, the BSP related file should be changed properly.

5. Operation Confirmation Condition

Used microcontroller	TMPM4K4FYAUG
Used board	TMPM4K4 evaluation board (Product of ESP-kikaku Co. Ltd.)
Integrated development environment	IAR Embedded Workbench for ARM 8.22.2
Integrated development environment	Arm® Keil® MDK Version 5.24.2.0
Terminal software	Tera Term V4.96
Sample program	v1.0.0

6. Evaluation Board Operation

The USB_UART connector on the evaluation board should be connected to a PC.

Data A and Data B are prepared in the sample program.

The Data A and the Data B are exchanged each other to change the reference data when a corresponding push switch is pushed down.

The following table shows the outputs of the ports when each data is referred.

Table 6-1 Data reference and Port outputs

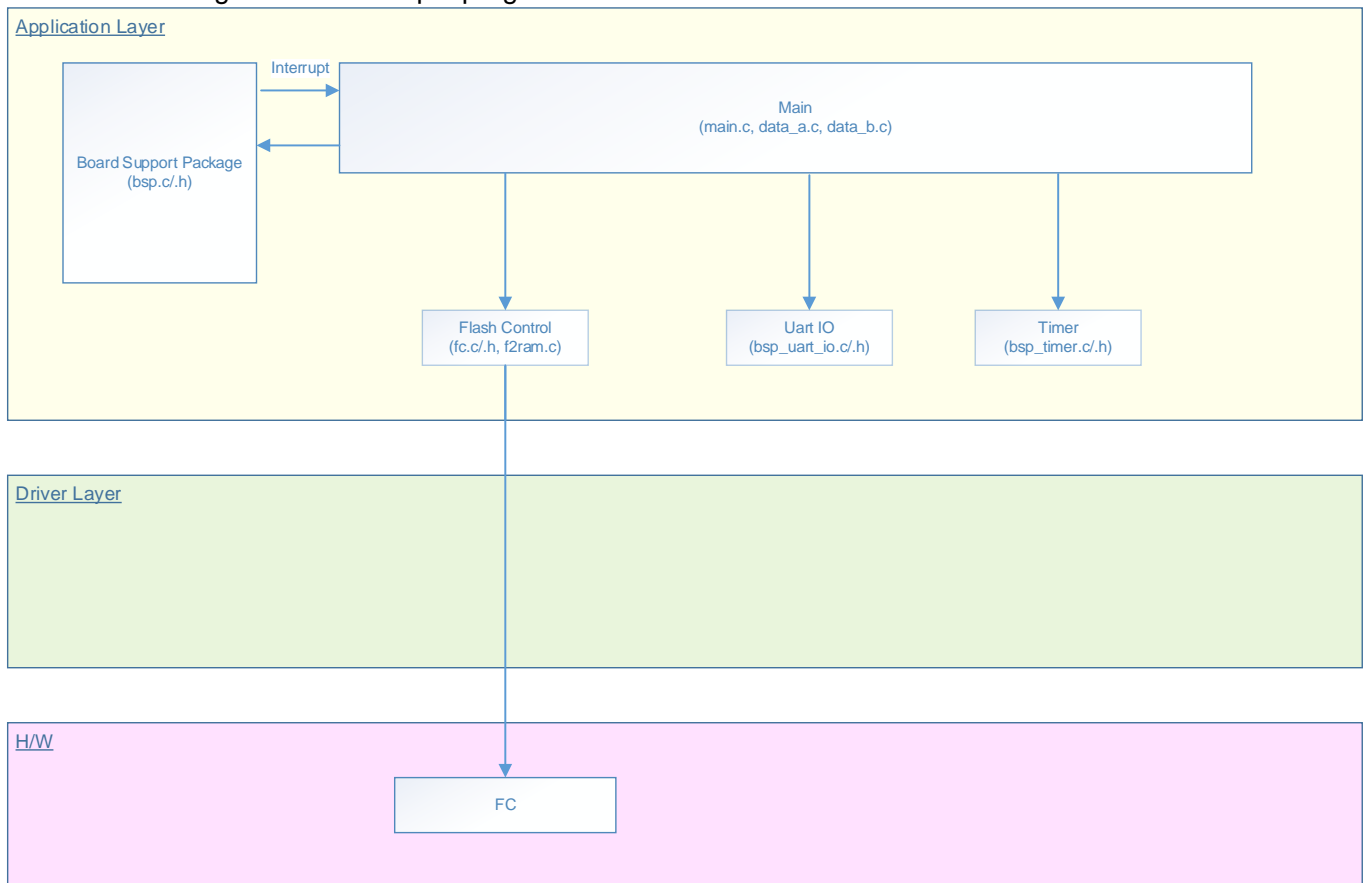
Data reference	PJ0	PJ2	PJ4	PL4
Data A	L/H	H	L/H	H
Data B	H	L/H	H	L/H

Note: The PJ0, the PJ2, and the PJ4 are connected to the LED1, the LED2, and the LED3, respectively.

7. Sample Program

7.1. Structure Diagram of Sample Program

The structure diagram of the sample program is shown below.



7.2. Startup Routine

The following initialization is done after power is supplied.

The initialization of each clock setting and the initialization of the watchdog timer setting are done.

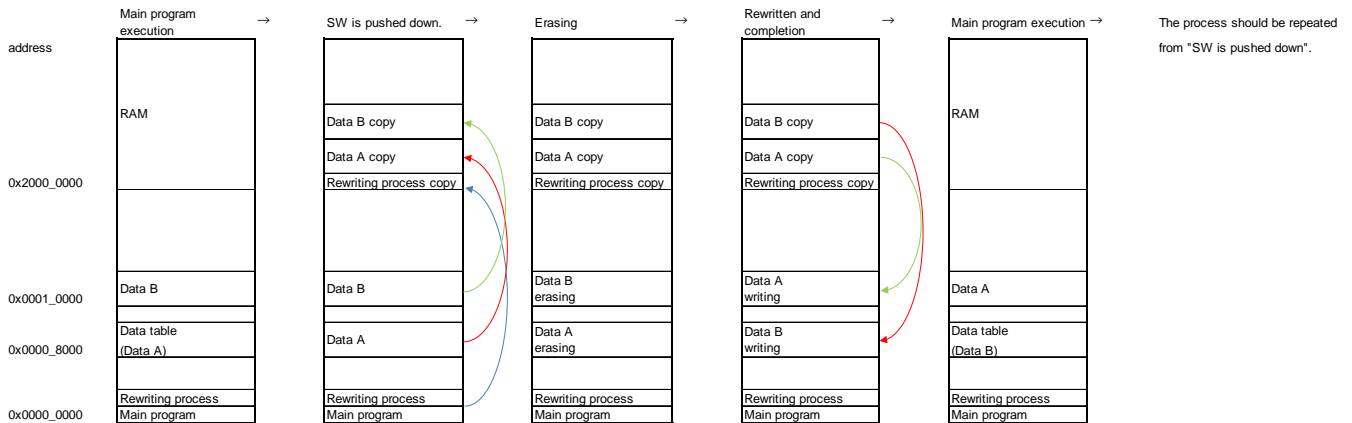
7.3. Main Operation

The initialization of the BSP is done.

The initialization of the driver is done.

The initialization of the application software is done.

The initialization of the timer, the initialization of the LED's, the initialization of the push switch, and the initialization of the UART are done as the initialization of the application software.



- **Main program execution**
The Code Flash memory has Data region and Data table region.
- **SW is pushed down**
When the push switch is pushed down, the Data A and the Data B in the Code Flash memory are copied to the RAM.
- **Erasing**
The Code Flash memory is erased after the copy completes.
- **Re-write and completion**
The Data B in the RAM is written to the region where the Data A used to be stored in the Code Flash memory. And the Data A is written to the region where the Data B used to be stored in the Code Flash memory.
- **Main program execution**
After the process completes, the data table is read again, and the content of the Data B is executed.

The same process is done whenever the push switch is pushed down.

The main program controls the output port referring to the data table.

The Data A and Data B interchange each other in the data table.

The output of each port is toggled between High and Low levels by the timer interrupt. (Refer to Table 6-1.)

It is toggled every 1 second.

Since the data are written to the Code Flash memory, for example, if the reset switch is pushed down with storing the Data B in the table region, the ports are controlled referring to the Data B.

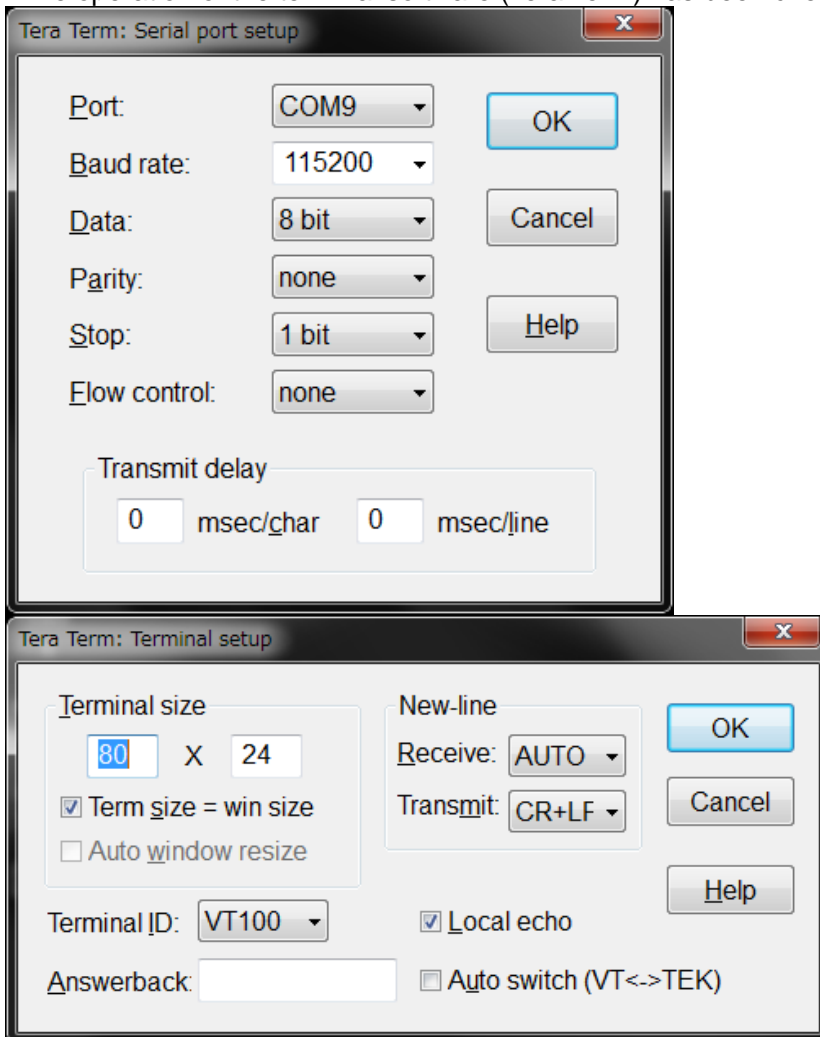
7.4. Output Example of Terminal Software

When the sample program is executed, the re-write log of the Flash memory is output as shown in the following figure.

```
*****  
Execute Data A  
*****  
Please press the S7  
RAM transferring.  
Erasing.  
Rewriting.  
Finished.  
*****  
Execute Data B  
*****  
Please press the S7  
RAM transferring.  
Erasing.  
Rewriting.  
Finished.  
*****  
Execute Data A  
*****  
Please press the S7
```

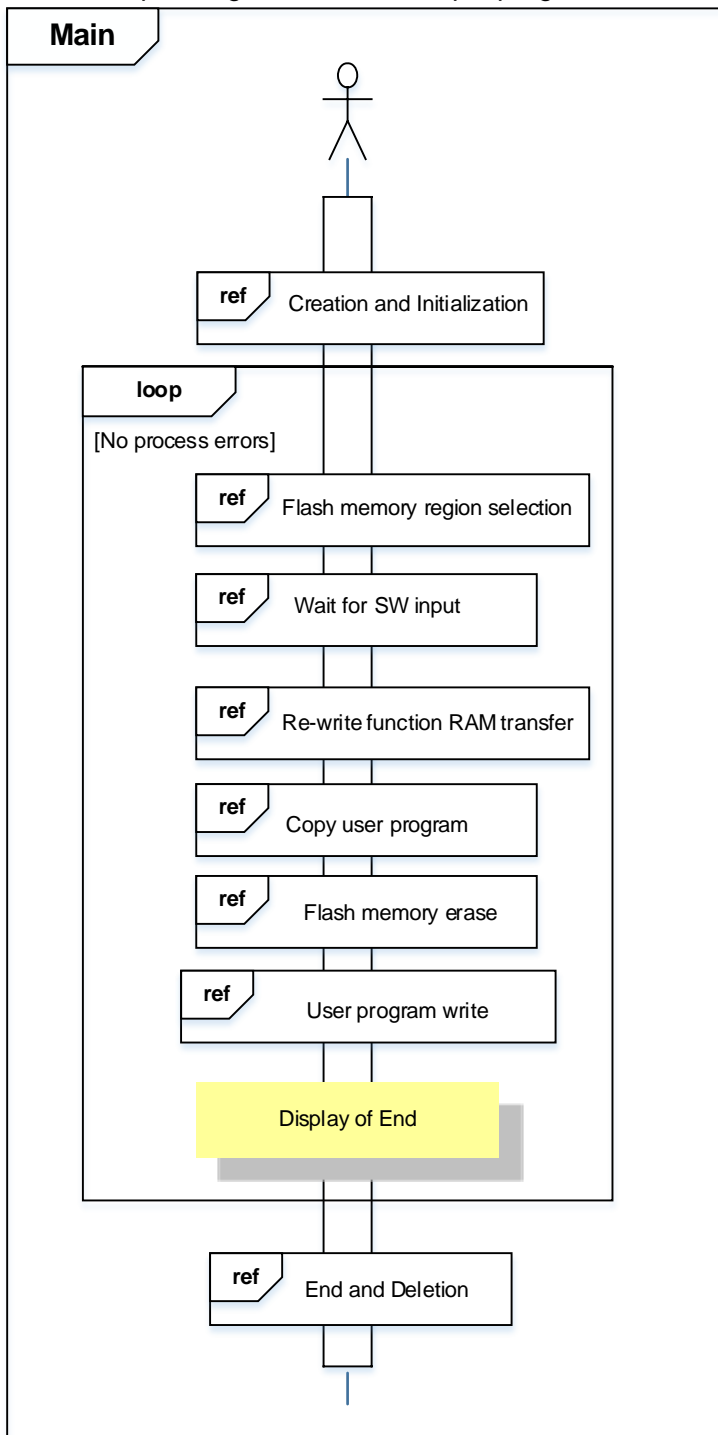
7.4.1. Setting Example of Terminal Software

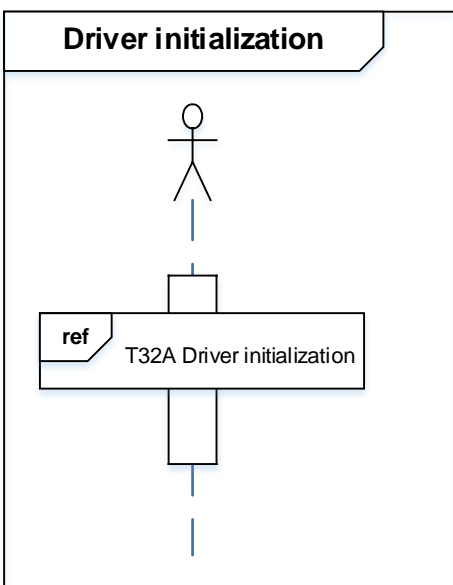
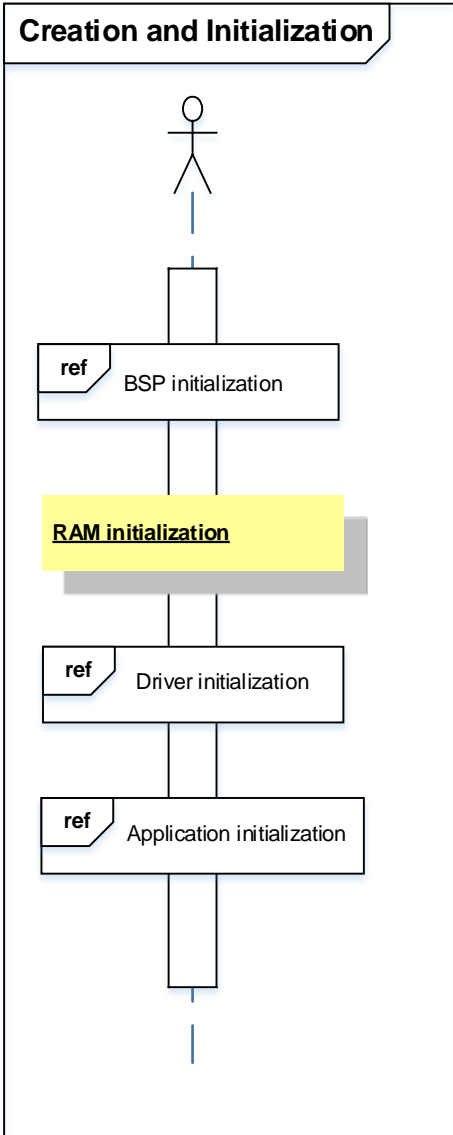
The operation of the terminal software (Tera Term) has been checked with the following settings.

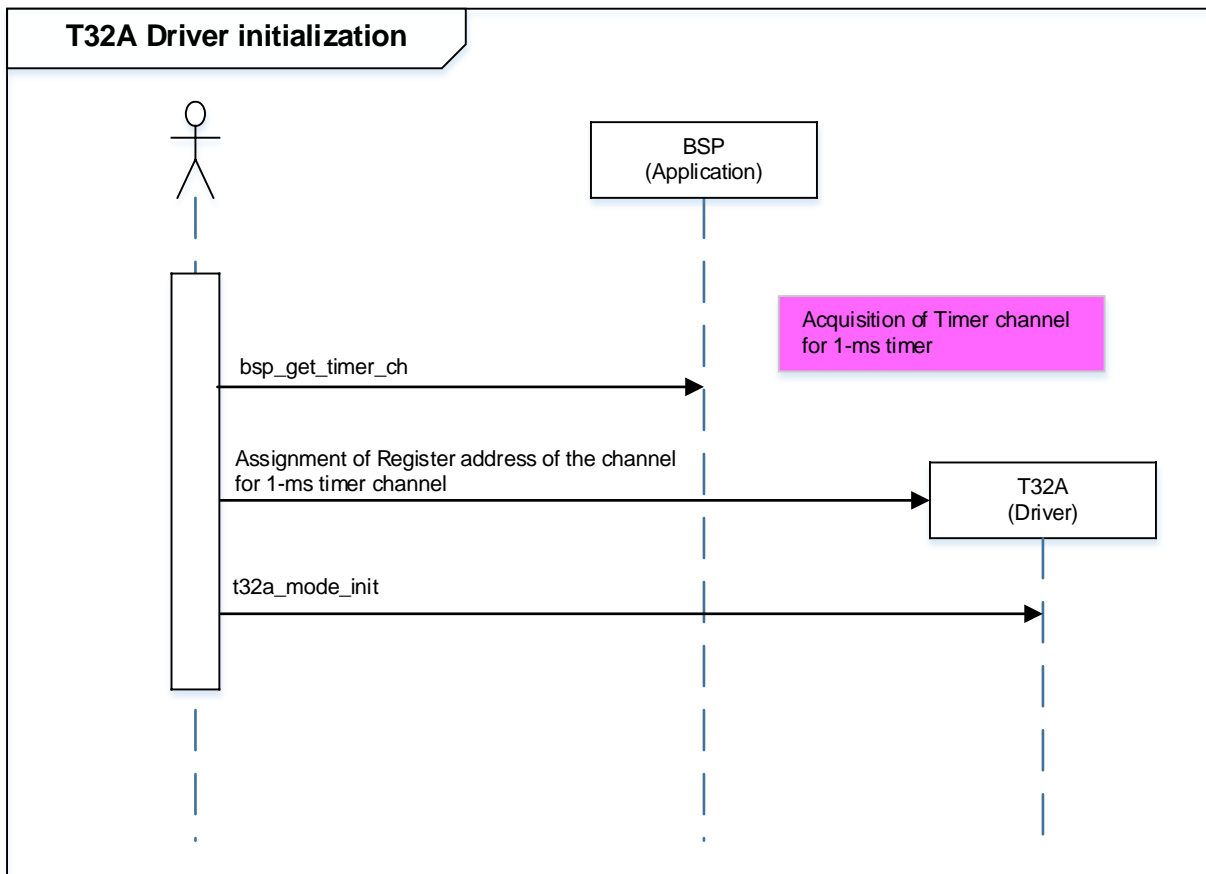


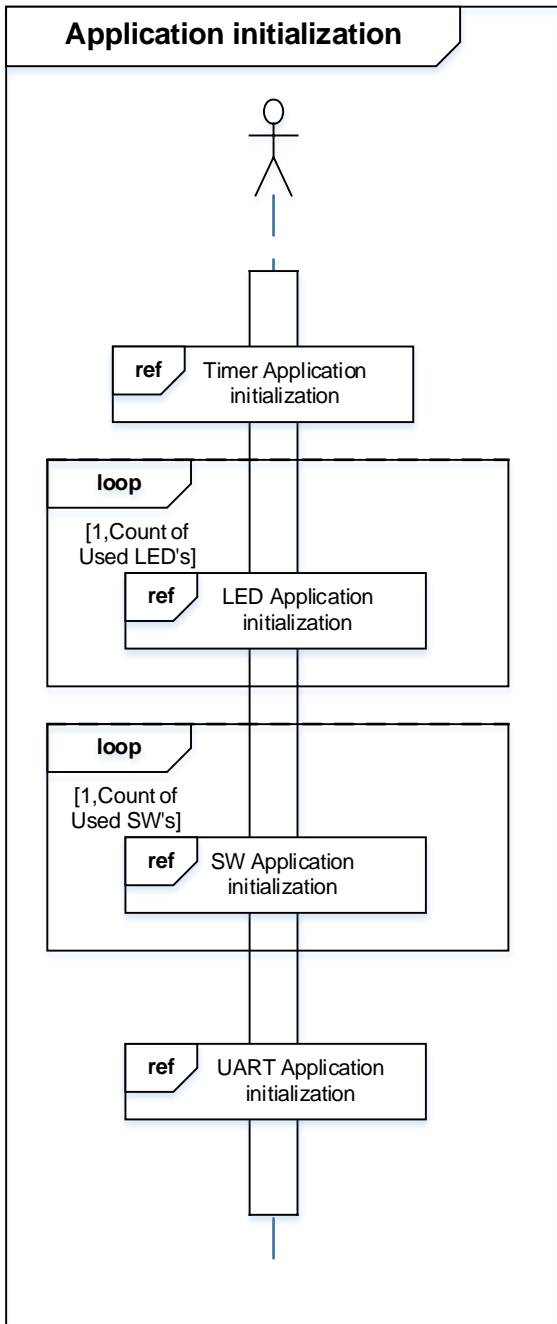
7.5. Operating Flow of Sample Program

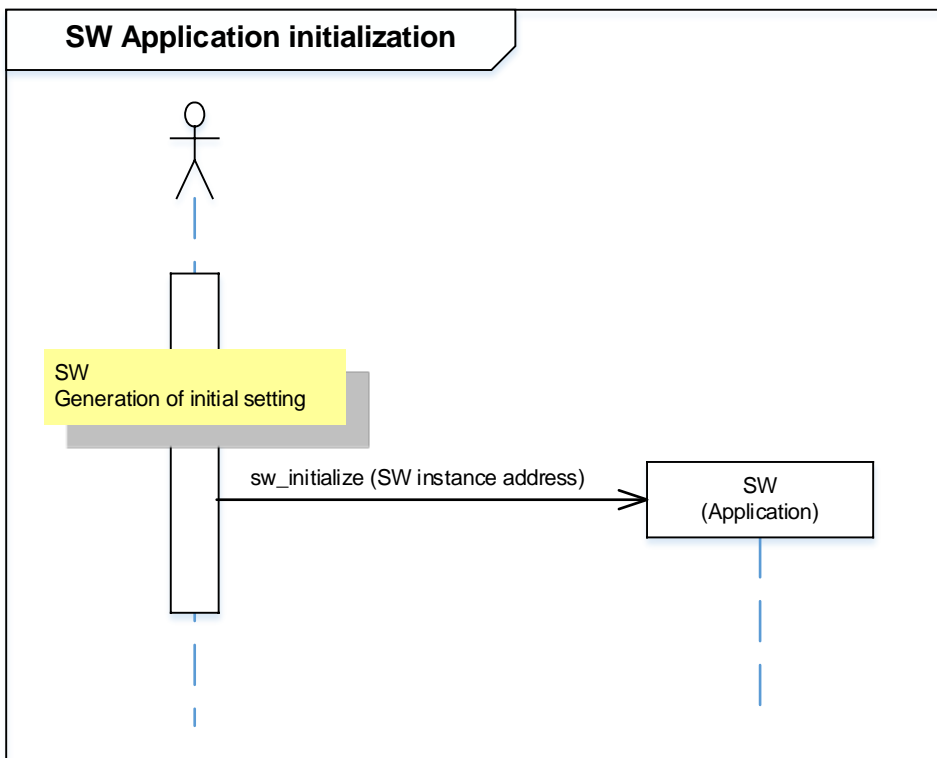
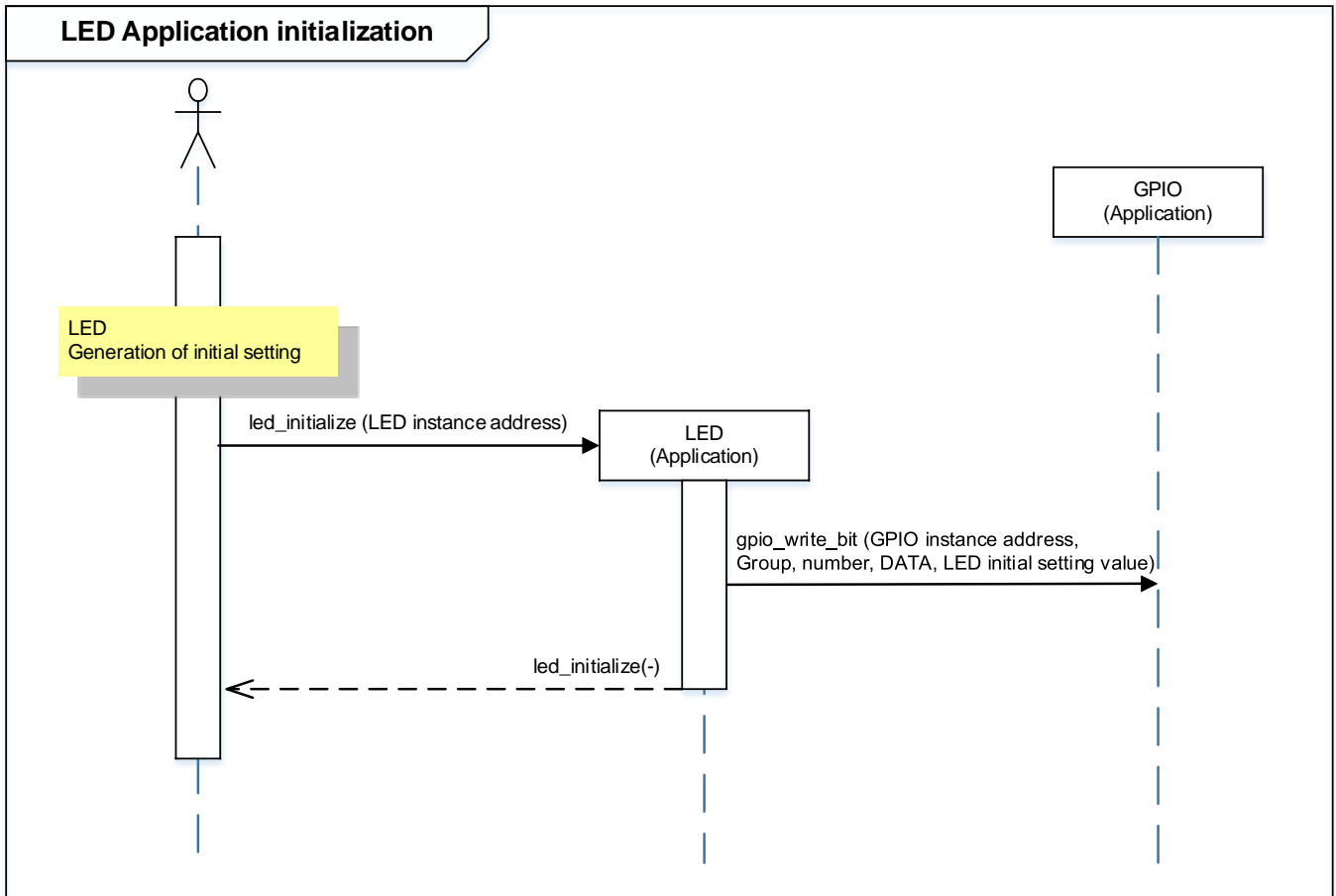
The basic operating flows of the sample program are shown in the following;

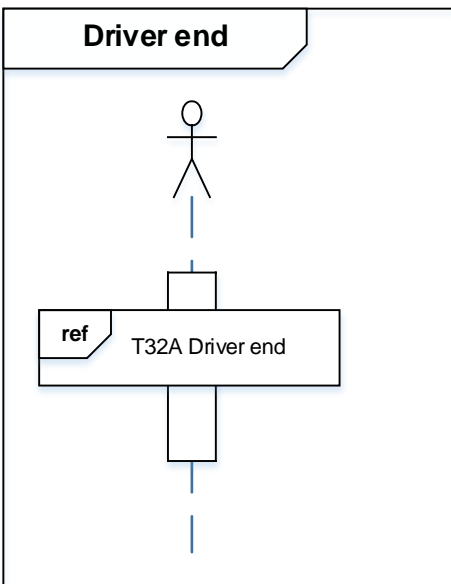
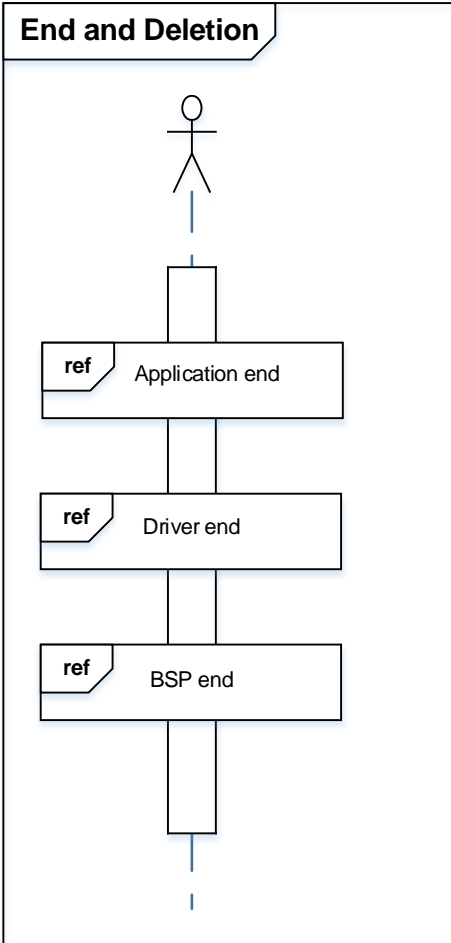


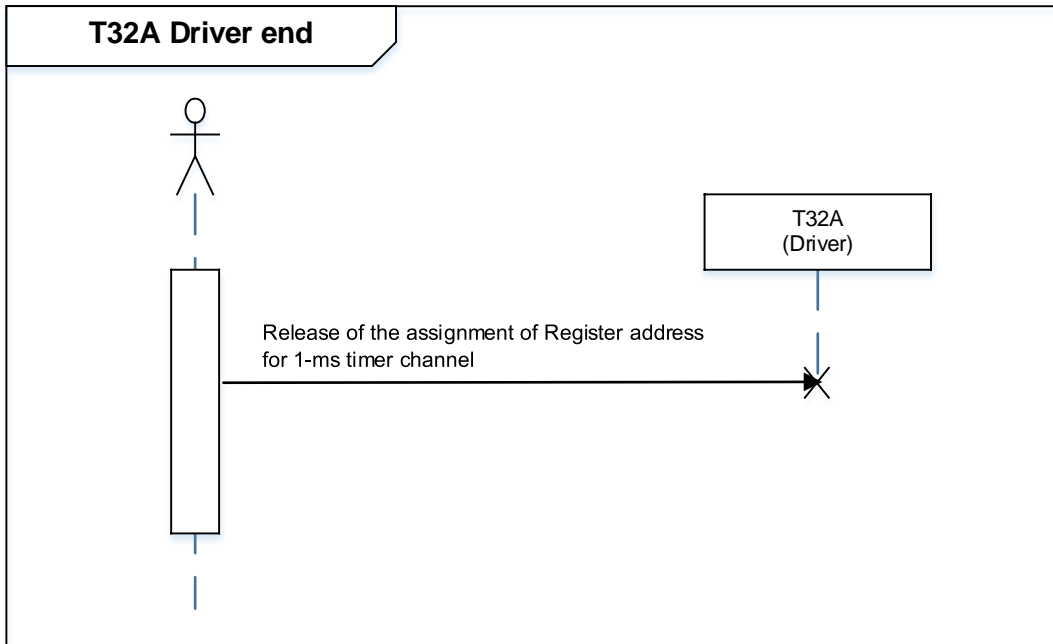


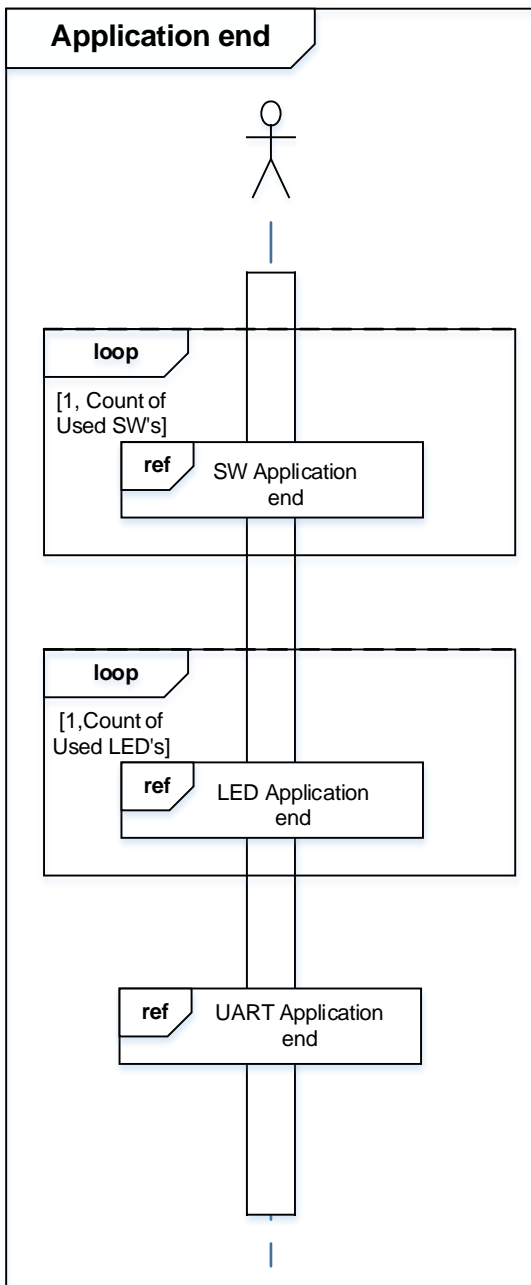


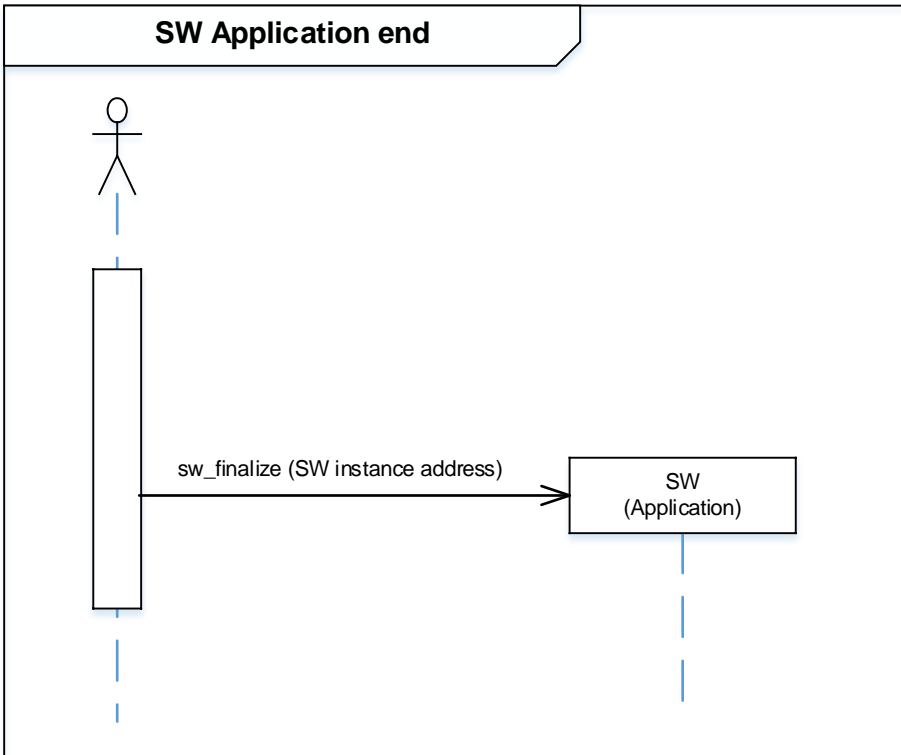
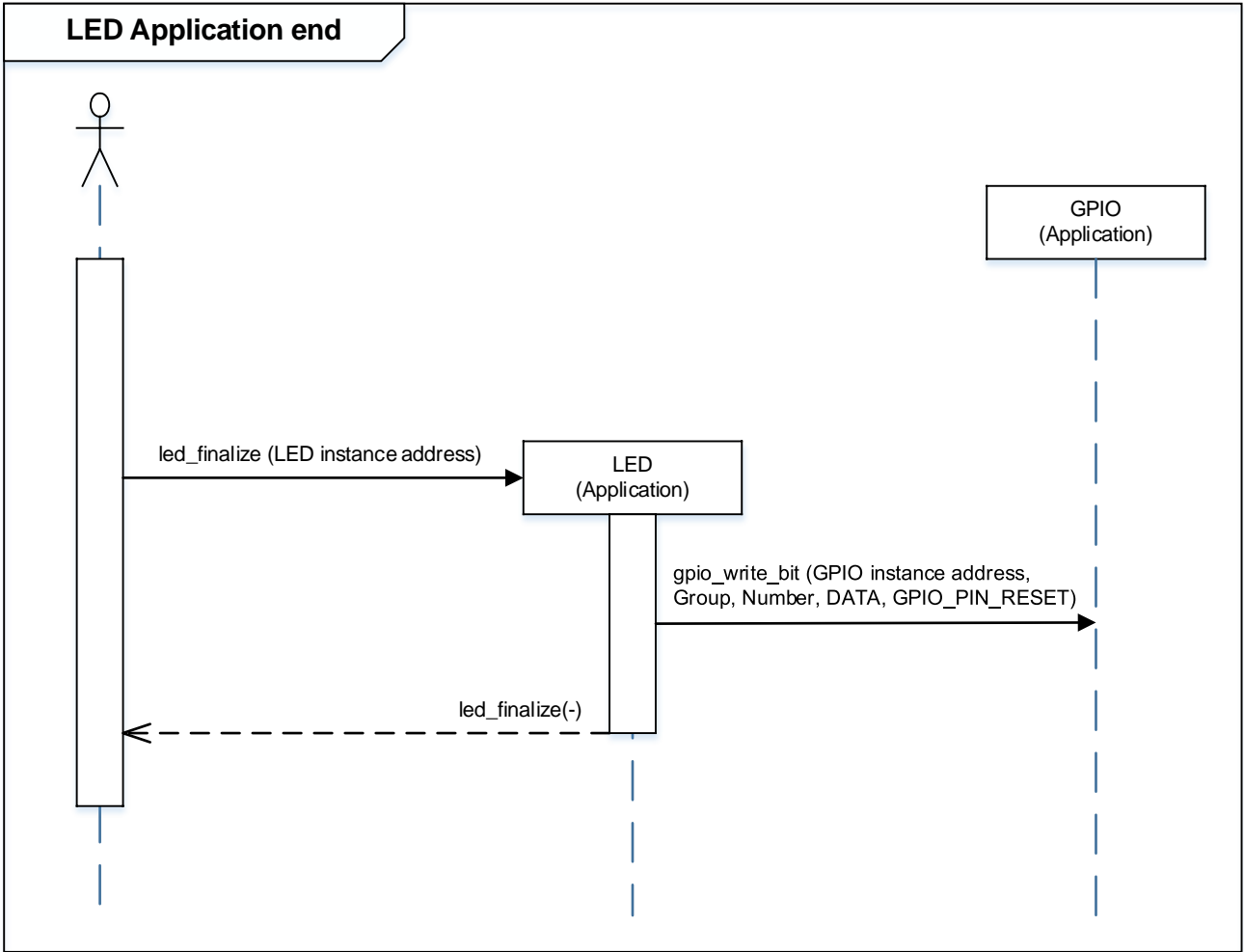


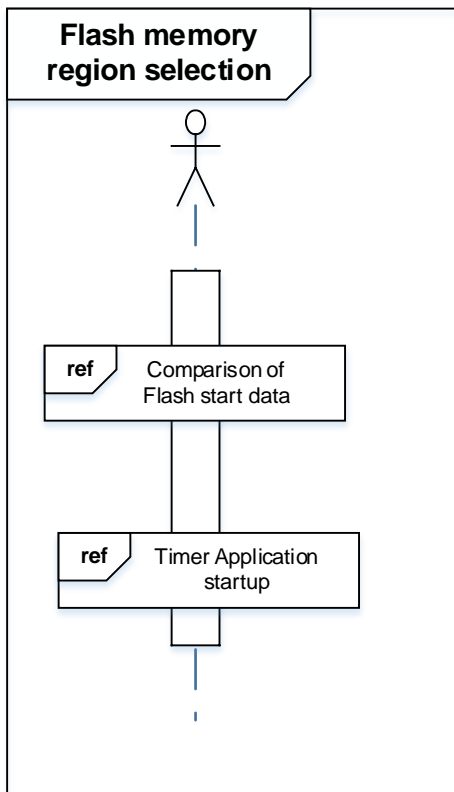


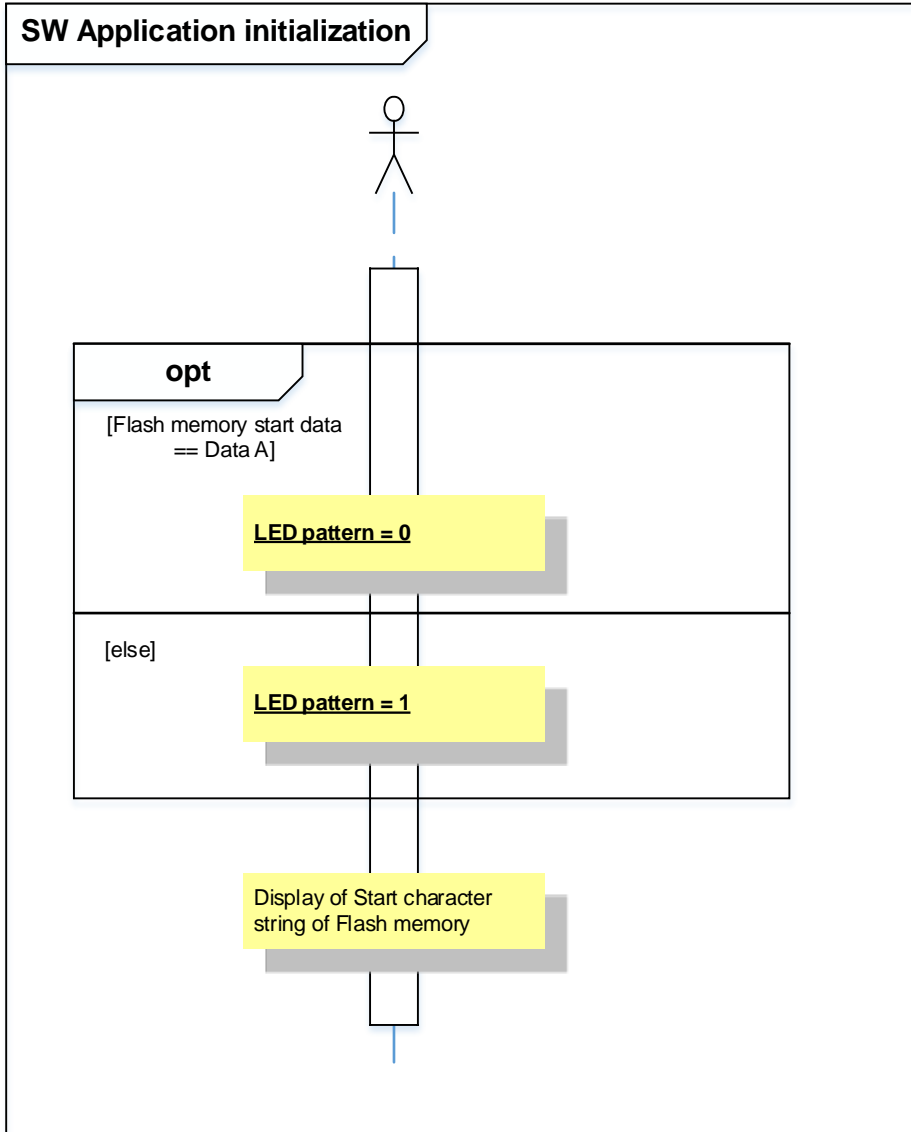


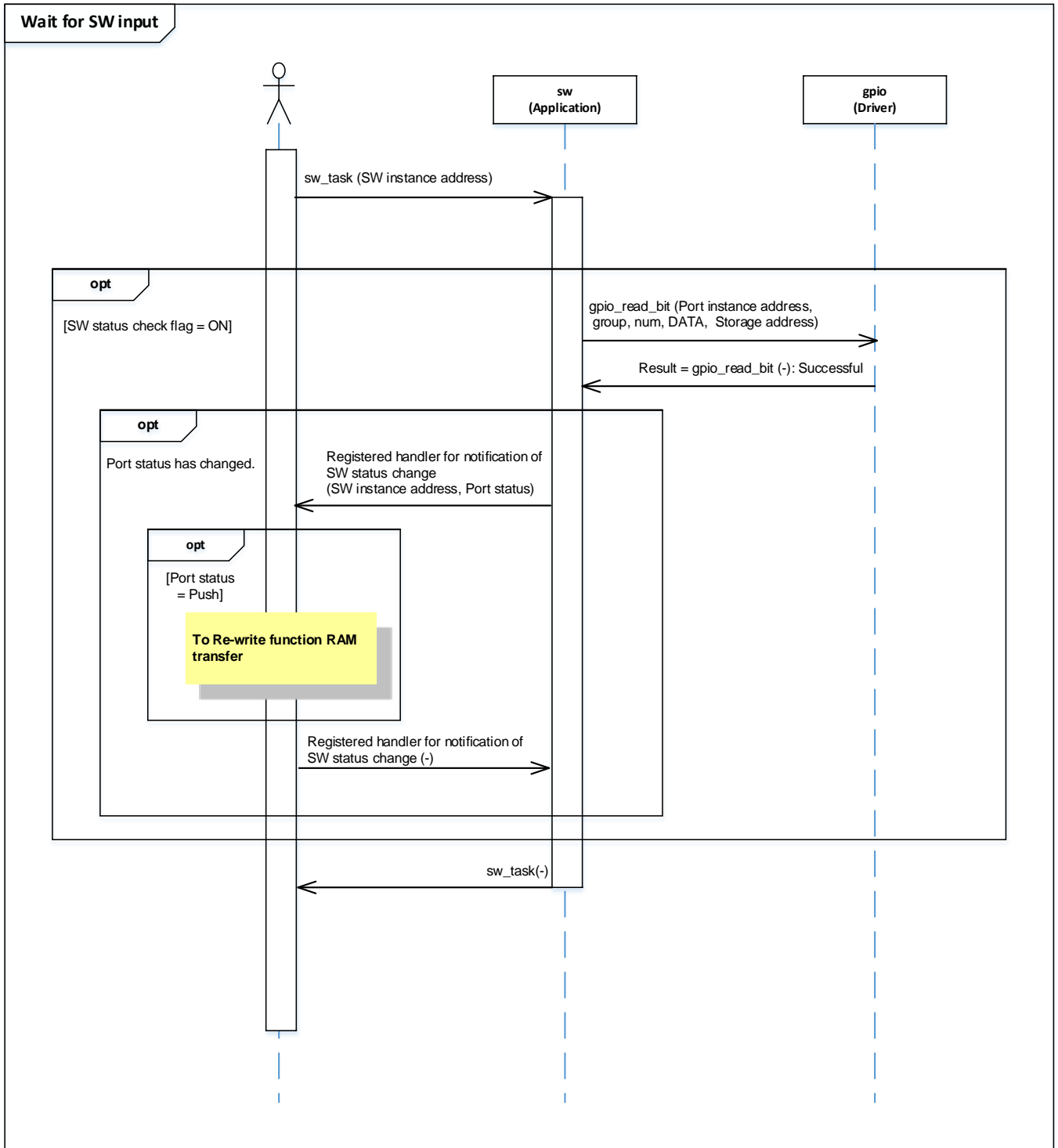


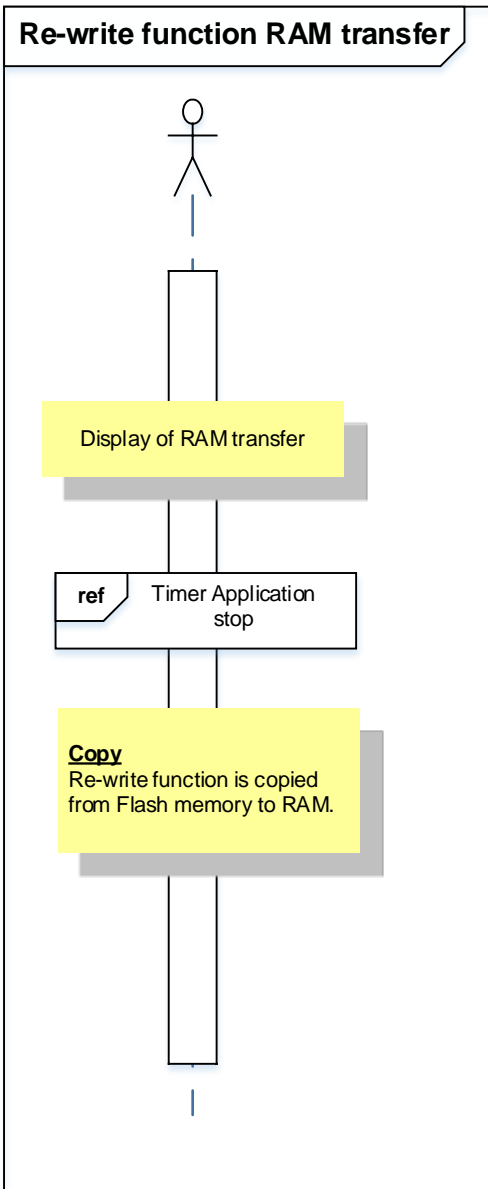


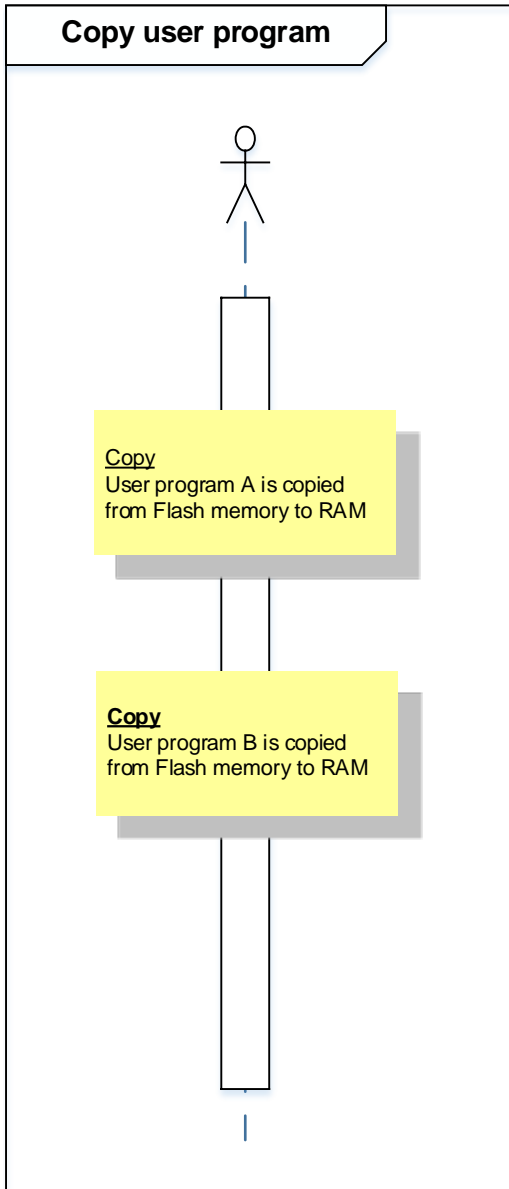


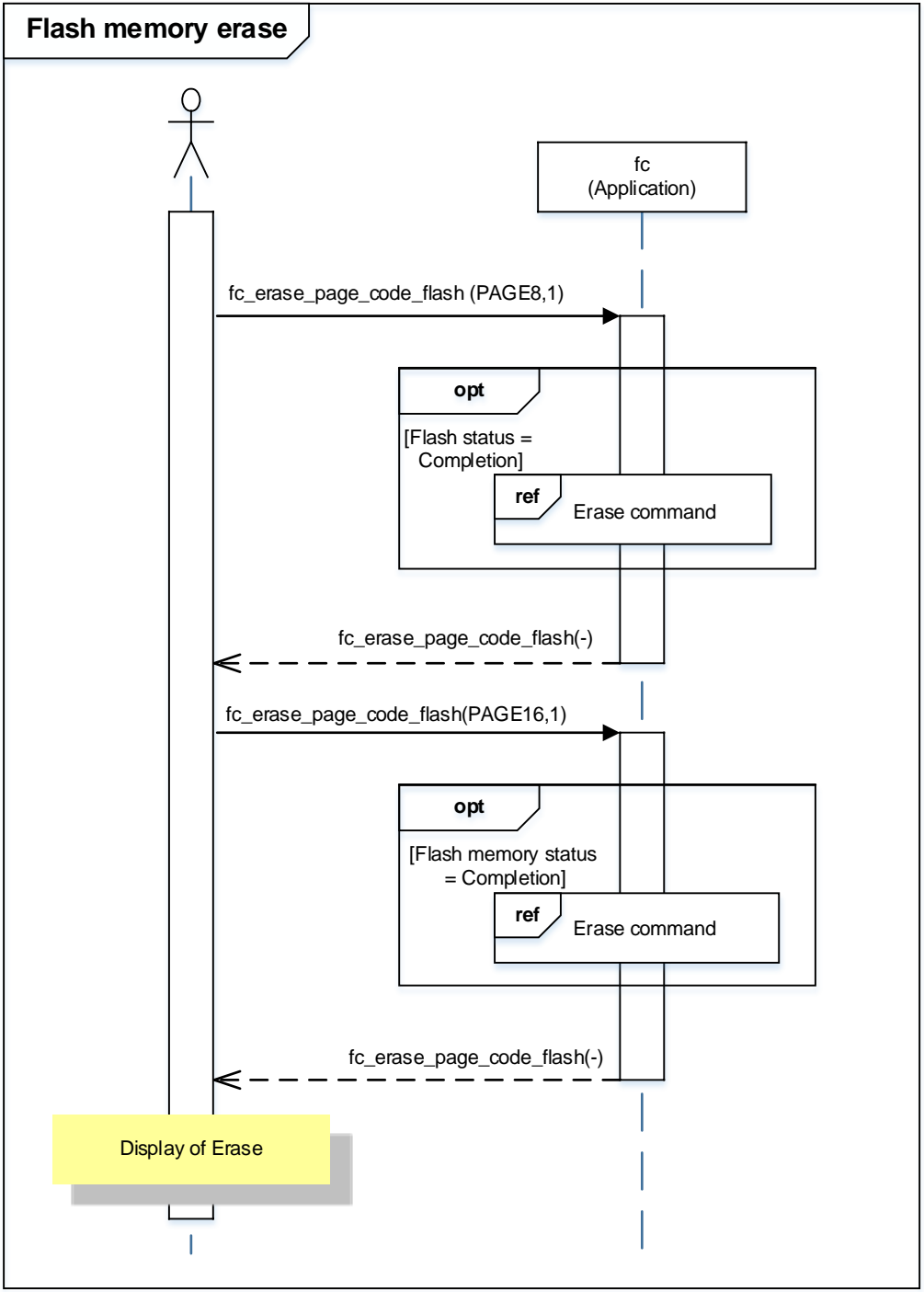


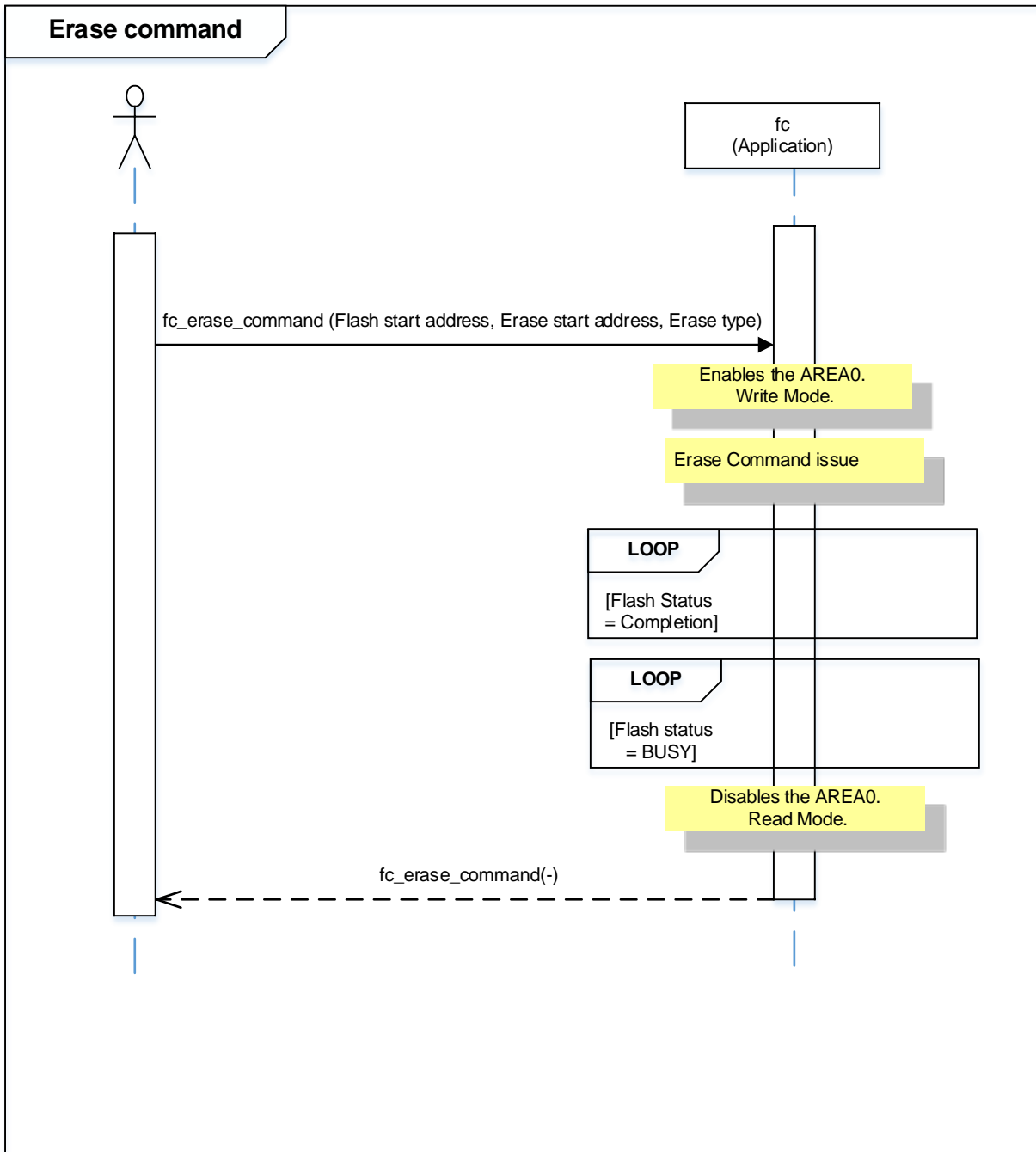


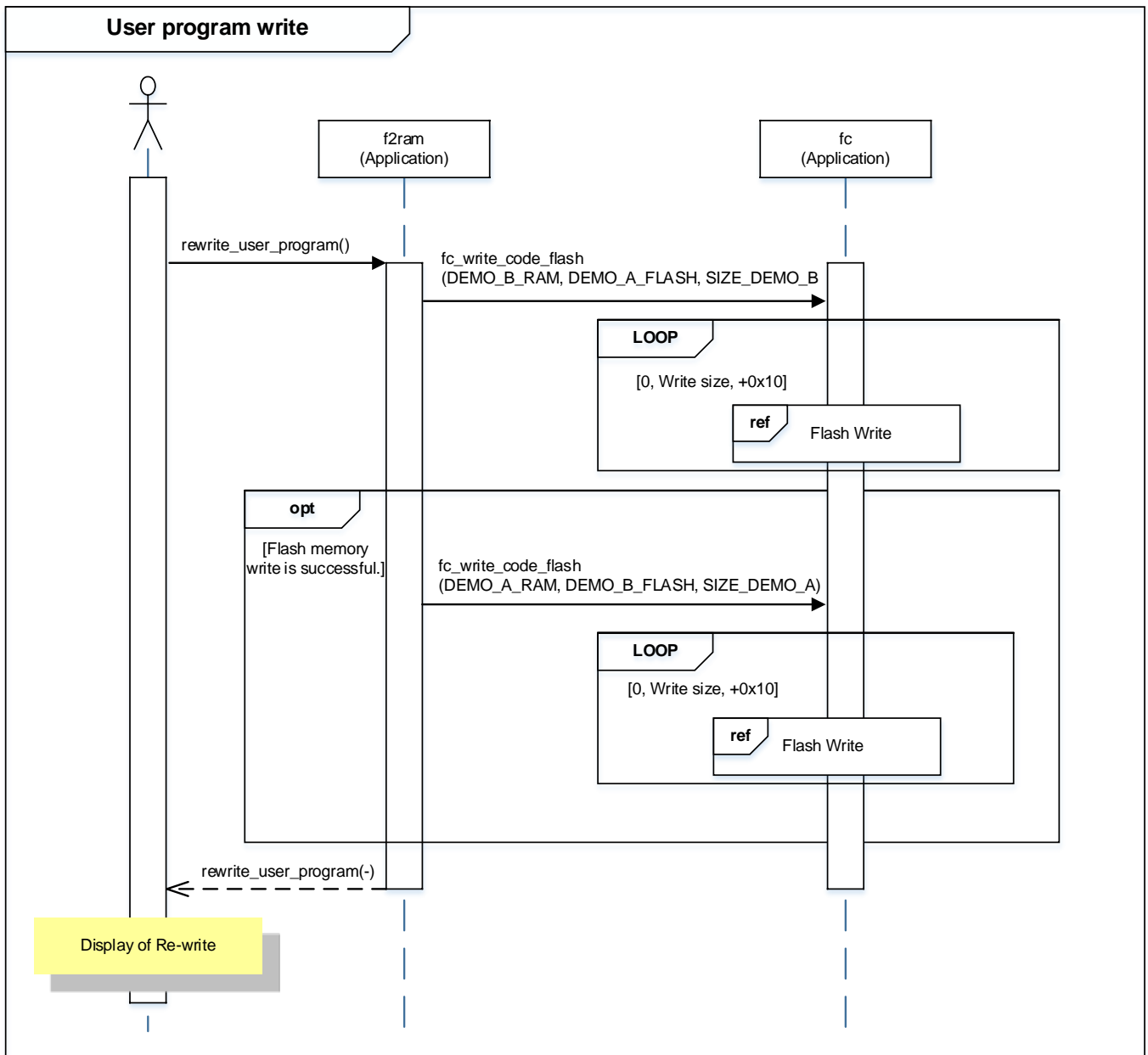


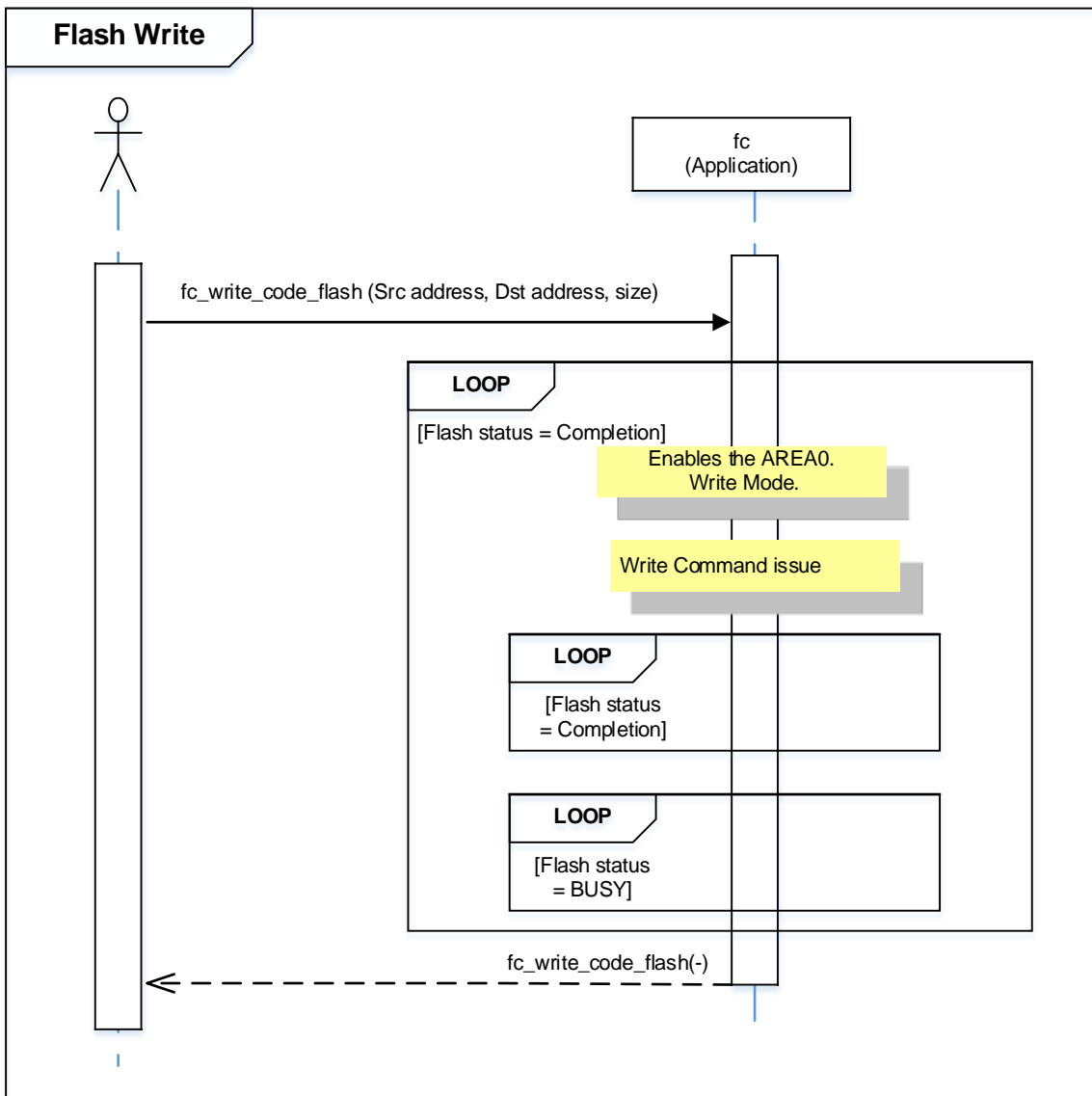


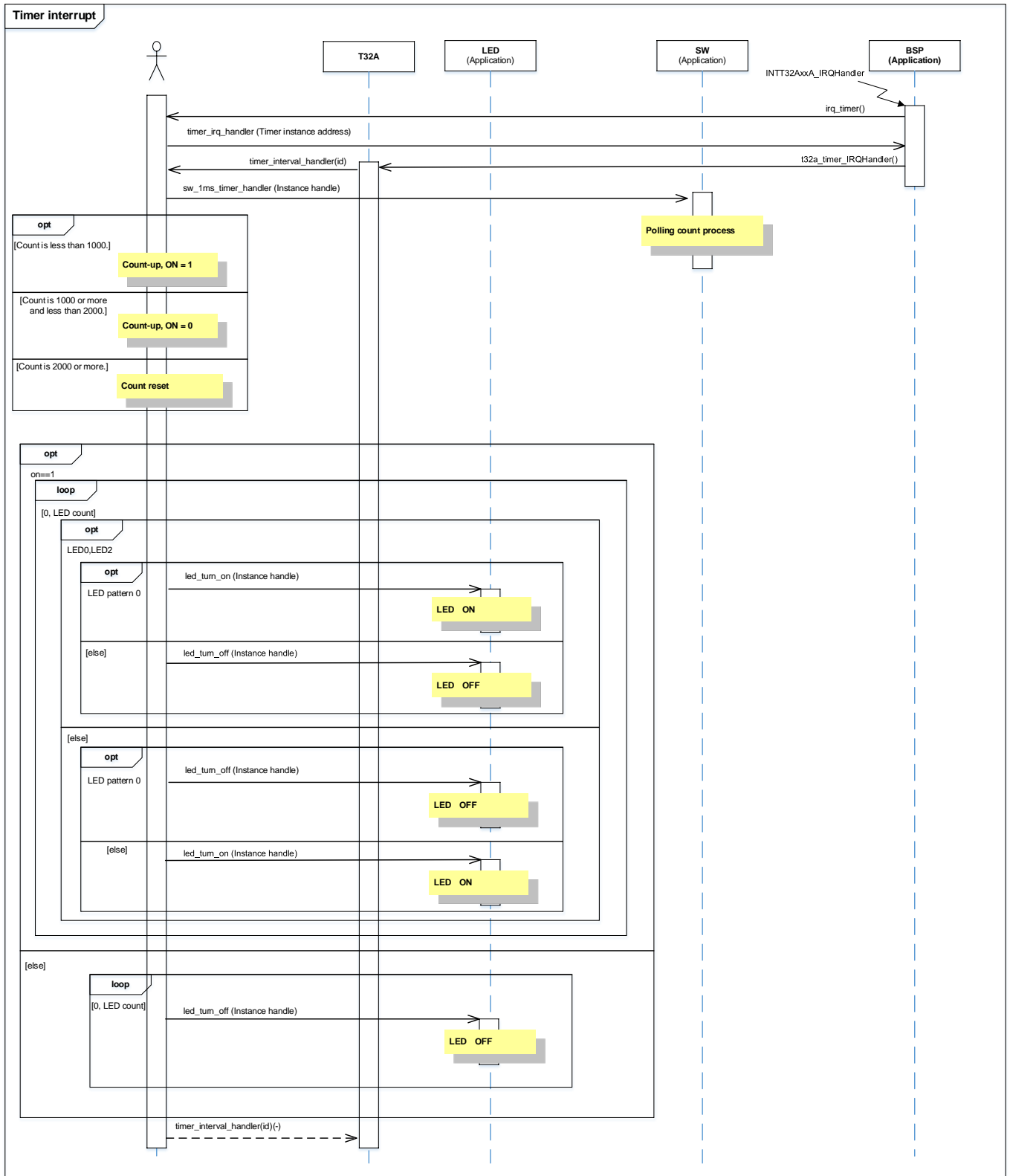












8. Points to Remember on Handling of Sample Programs

When using the sample program with other than “Operation Confirmation Condition”, please check the operation sufficiently.

9. Revision History

Revision	Date	Description
1.0	2019-10-09	First release

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