# M4K Group (1)
# Application Note
# RAM Parity
# (RAMP-A)

## Outlines

This application note is a reference material for developing products using the RAM parity (RAMP-A) function of M4K Group (1).
This document helps the user check operation of the product and develop its program.

Target sample program: RAMParity

# Table of Contents

# 1. Preface

This sample program is used to check the operation of the RAM parity function.
The character string which is input from the terminal software is stored to the RAM with its parity data.
The “read” command checks the parity of the data which is stored in the RAM and the data is output to the terminal software.
The maximum count of the input characters is 10.

# 2. Reference Document

1. Datasheet
   TMPM4K Group (1) datasheet Rev2.0 (Japanese edition)
2. Reference manual
   RAM PARITY (RAMP-A) Rev1.0 (Japanese edition)
   Asynchronous Serial Communication Circuit (UART-C) Rev3.0 (Japanese edition)
3. Application note
   M4K Group (1) Application Note Startup (CMSIS System & Clock Configuration) Rev1.0
4. Other reference document
   TMPM4KxA Group Peripheral Driver User Manual (Doxygen) V1.0.4.0

# 3. Function to Use

| IP | Channel | Port | Function/Operation mode |
|---|---|---|---|
| RAM PARITY | - | - | RAM parity control |
| Asynchronous Serial Communication Circuit | ch0 | PK0 (UT0TXDA)<br>PK1 (UT0RXD) | UART mode |

# 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 |

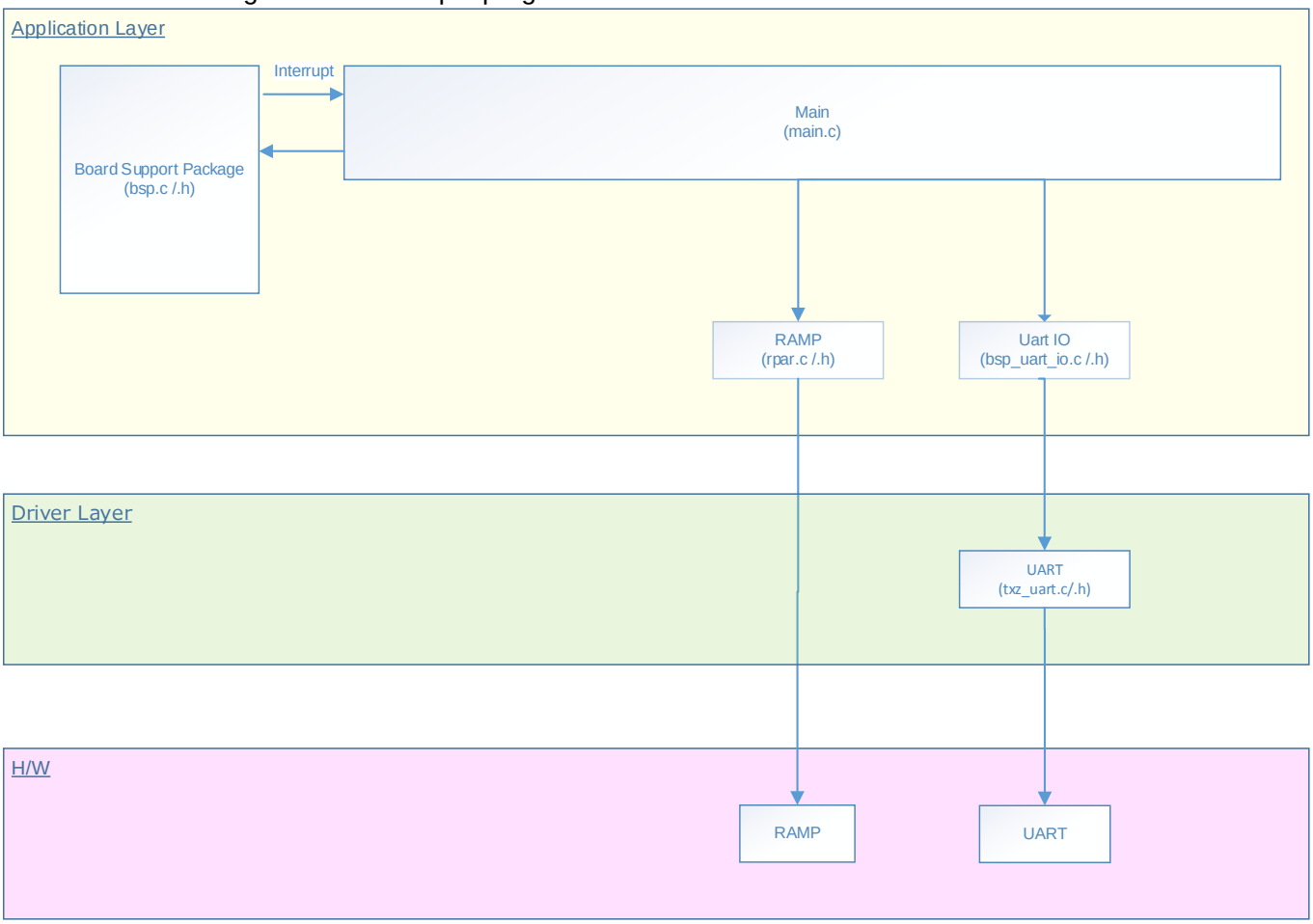
## 6. Evaluation Board Operation

The USB_UART pin on the evaluation board should be connected to a PC with a USB cable.
The terminal software should be started up.
For the details of the setting, refer to the setting example of the terminal software.
The reset button should be pushed down on the evaluation board.
The communication starts according to the command input.
For the details of the command operation, refer to “Main Operation”.

# 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 should be done.
The initialization of the USB_UART should be done as the initialization of the application software.
The RAM clear should be done and the Parity error interrupt is enabled.
After the process above is done, the following operation should be done on the terminal software (Tera Term) on the PC.
“command >” is displayed on the Tera Term screen. Commands should be input according to the following command format.

When the “write” command is input, the written data after “write” is stored to the RAM with its parity data.
When the “read” command is input, the data in the RAM is read and the parity data is checked.
The “write” command and the “read” command output the written data and the read data, respectively, to the terminal software.
Then the sample software waits for the input of the next command.
The process above repeats.

- Command format:
  write command
  write X  X: Arbitrary characters

read command
read

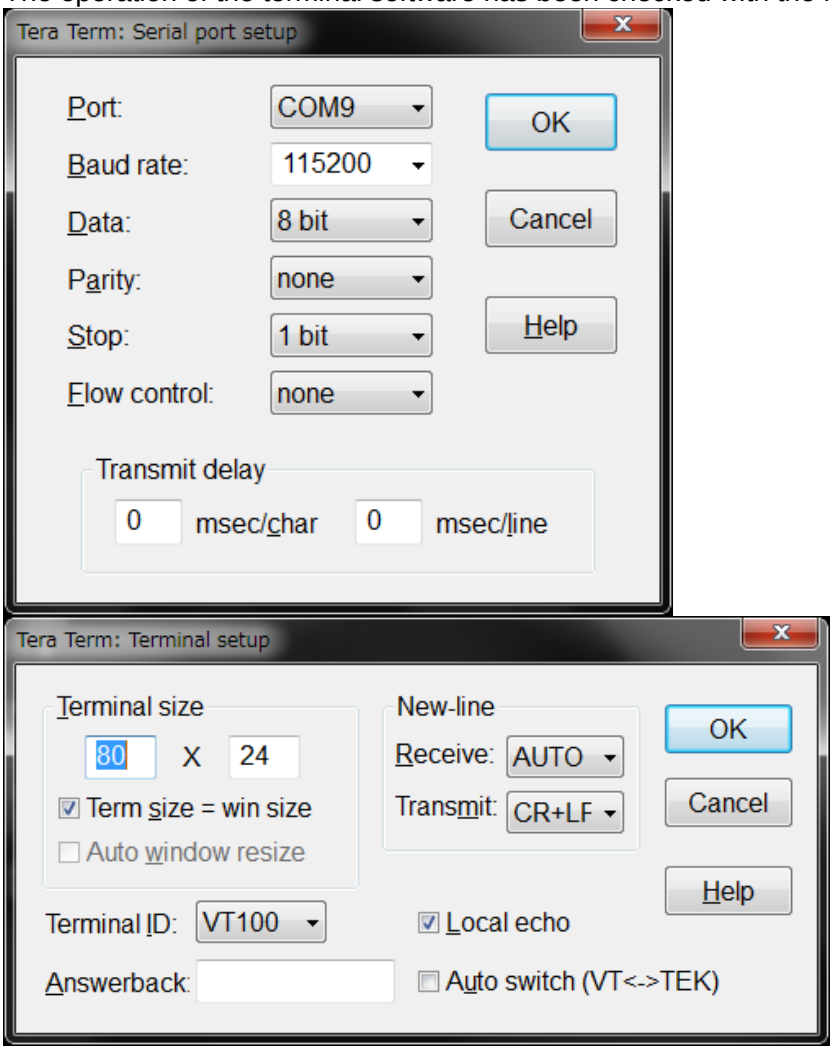
### 7.4. Output Example of Terminal Software

When the sample program is executed, the command result is displayed as follows;

```
command > write abc

write data > abc

command > read

read data > abc

command >
```

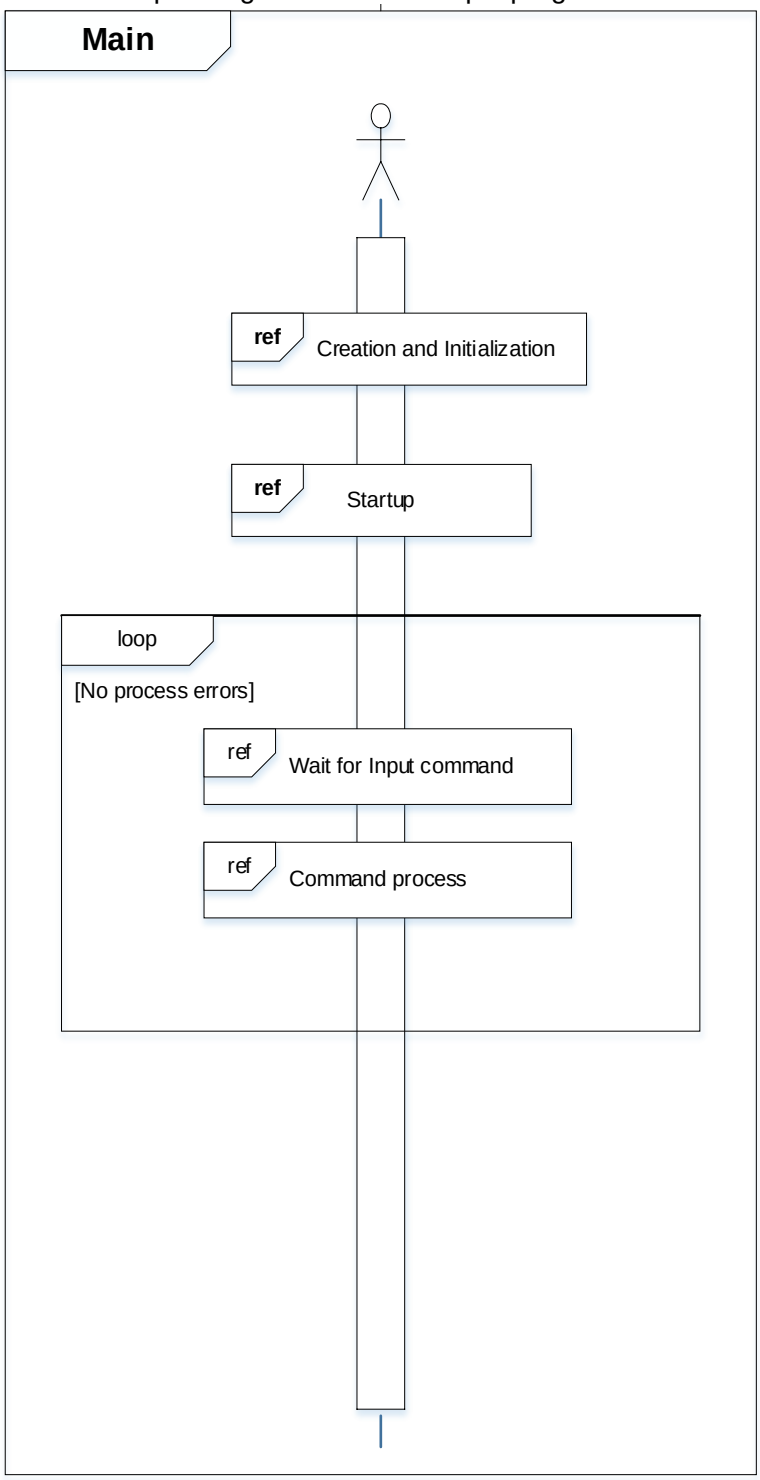
#### 7.4.1. Setting Example of Terminal Software

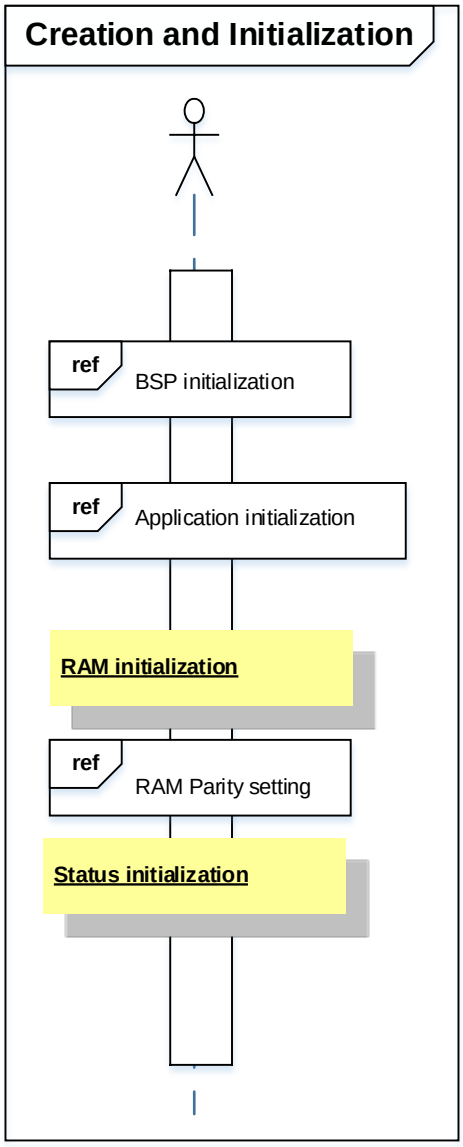
The operation of the terminal software has been checked with the following settings.

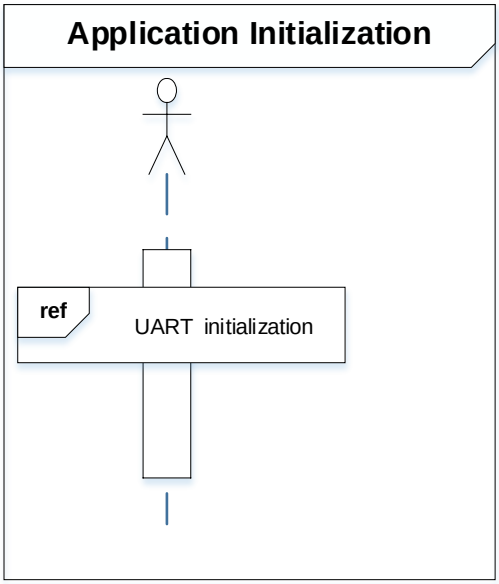


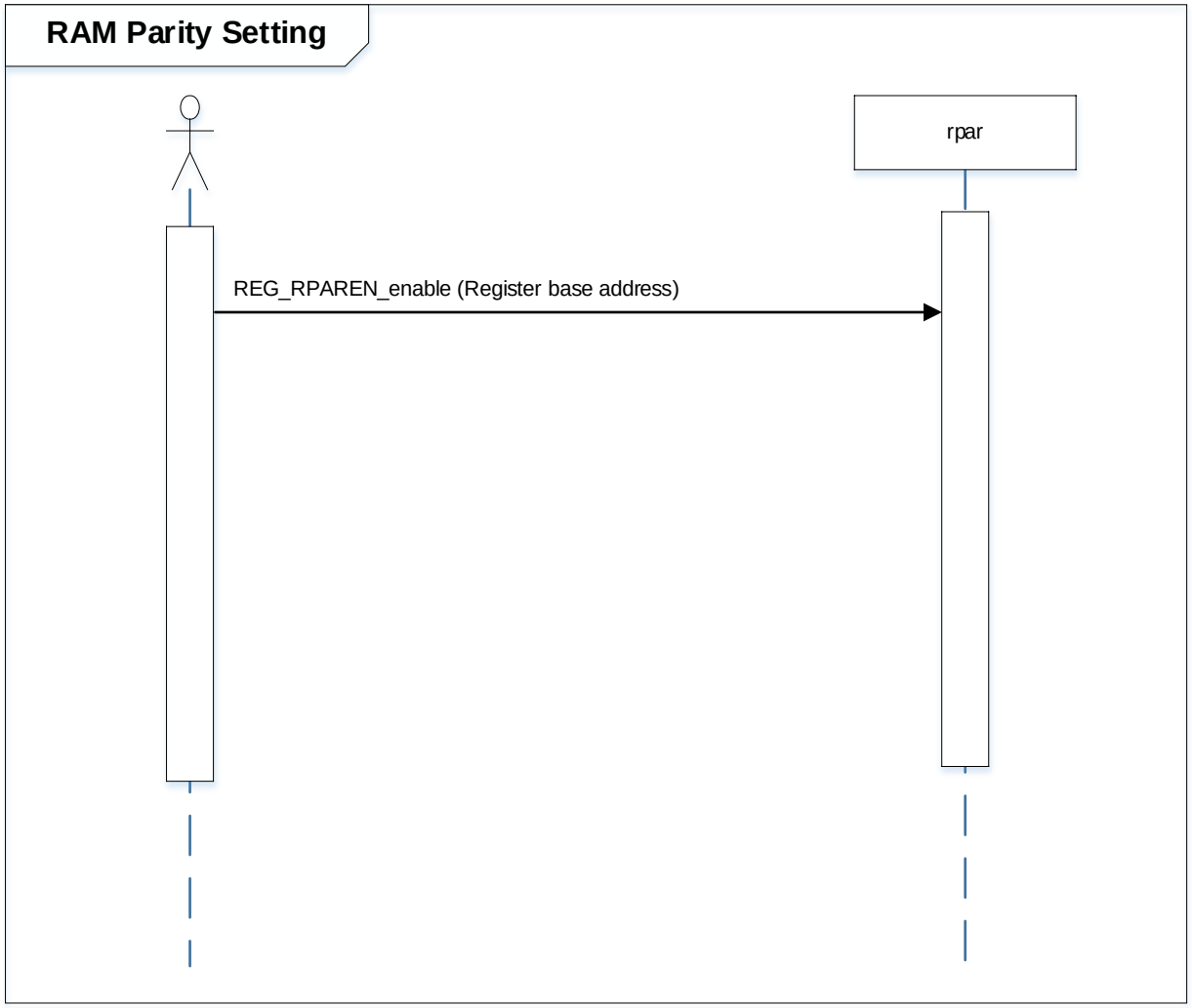
## 7.5. Operating Flow of Sample Program

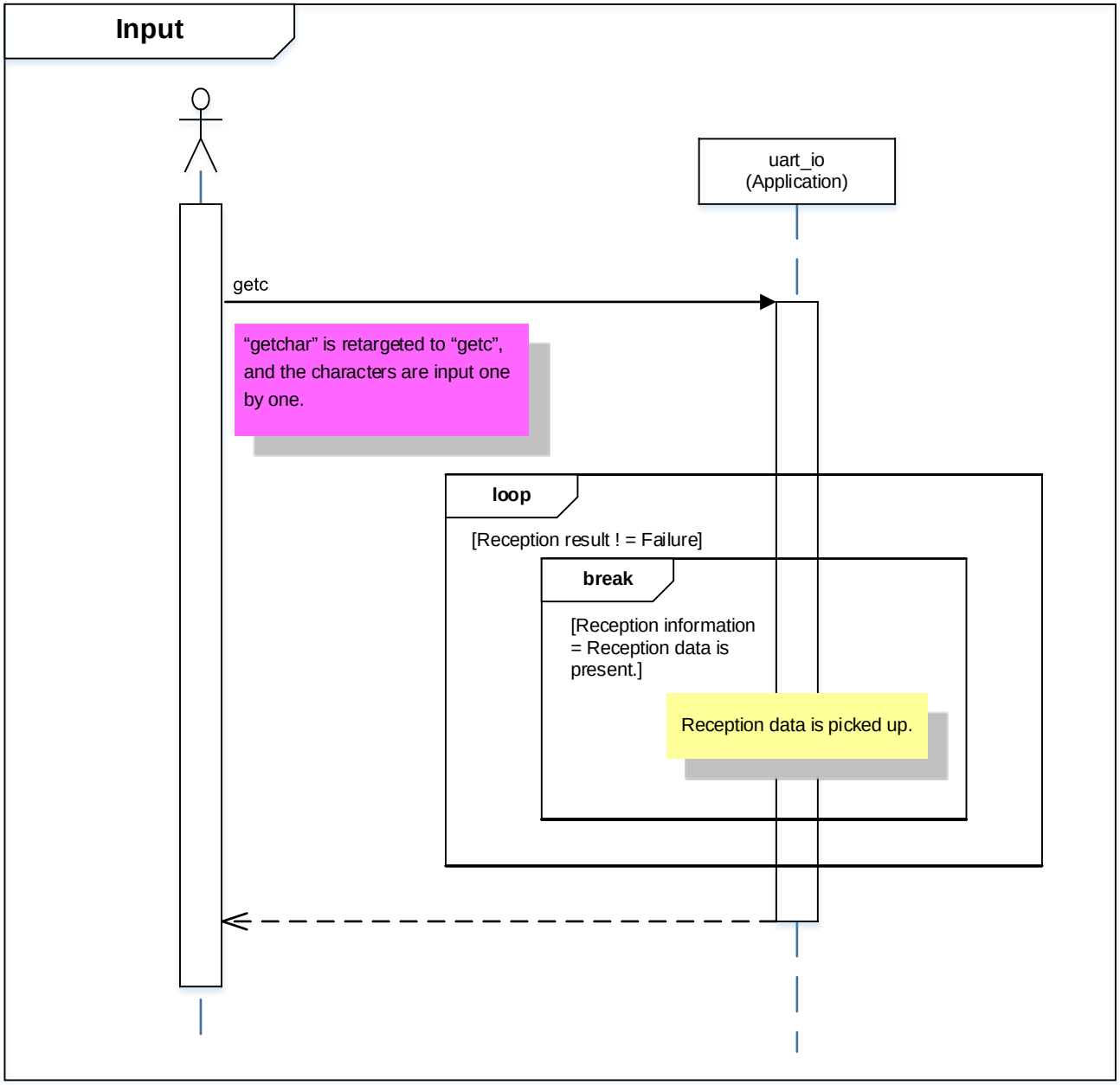
The basic operating flows of the sample program are shown in the following;

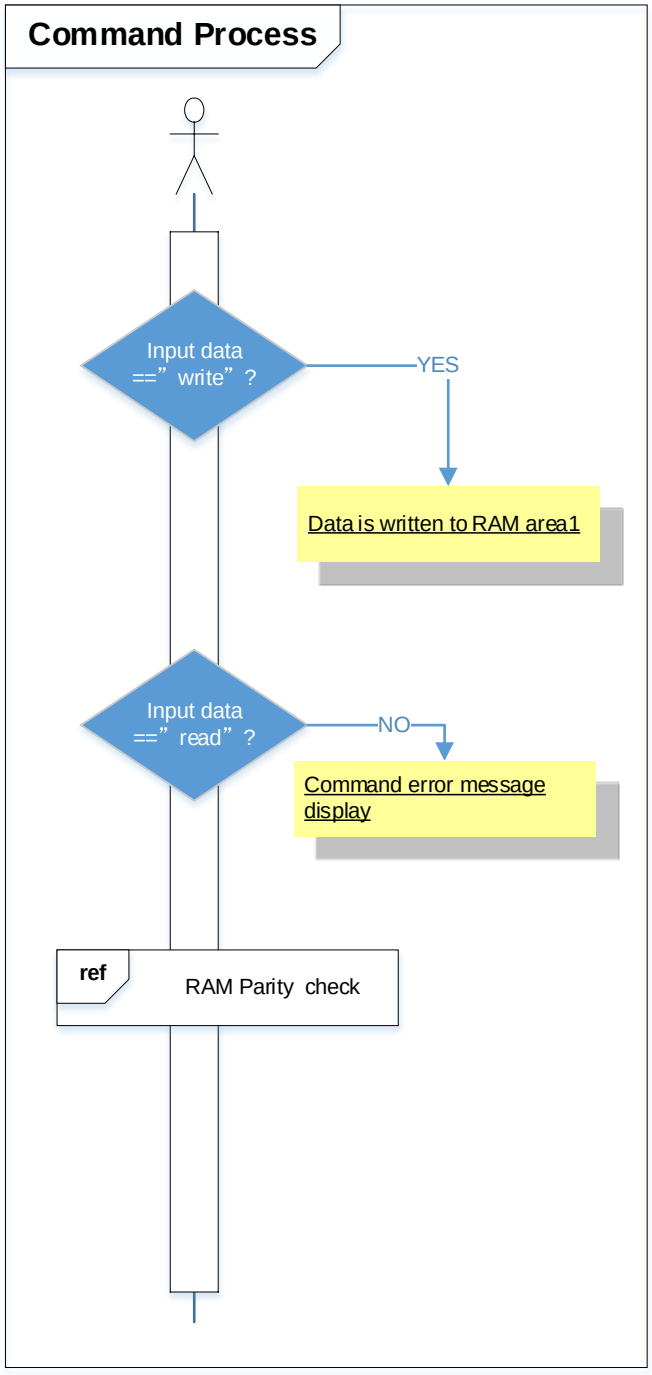


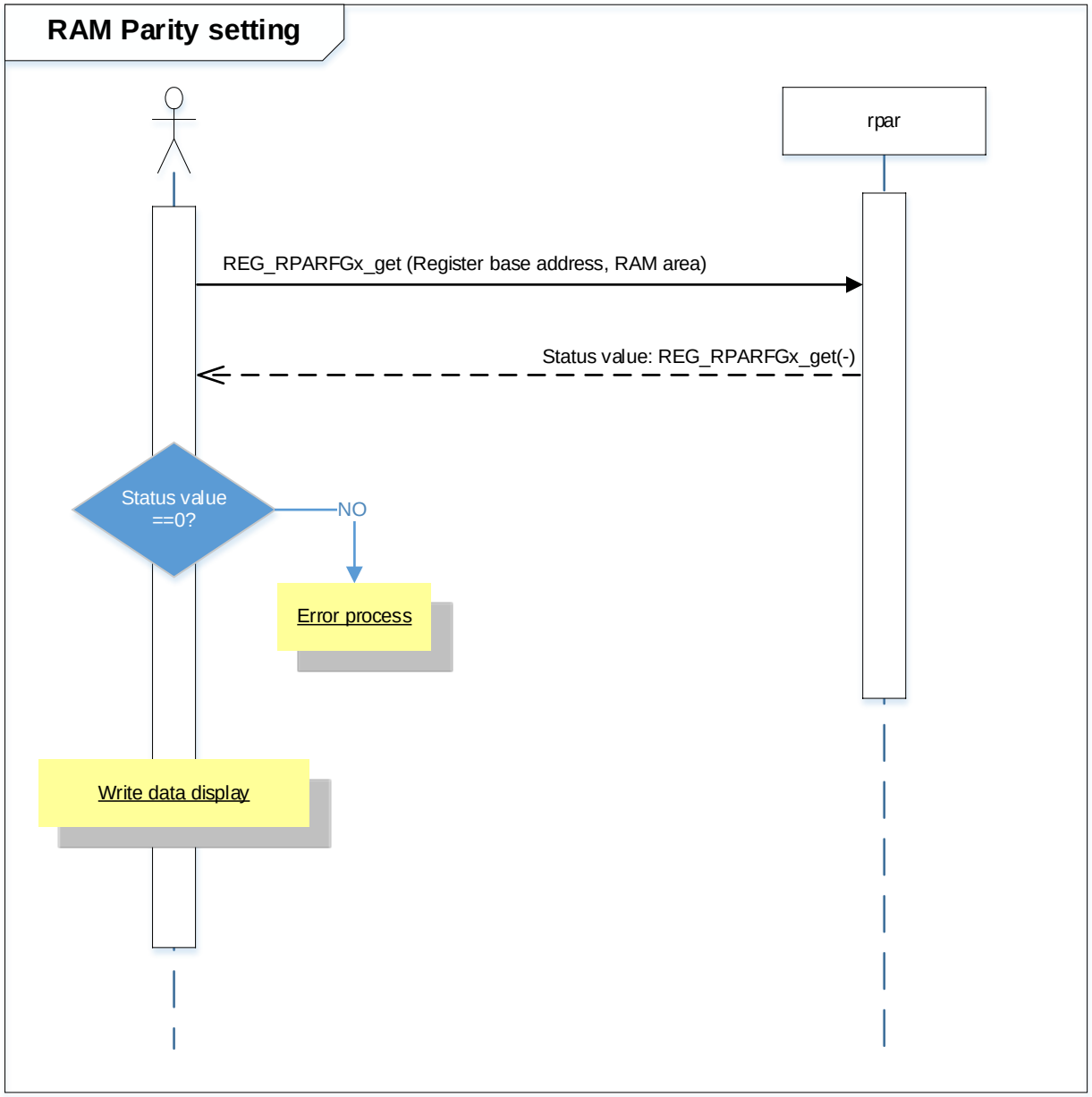

Creation and Initialization
ref
BSP initialization
ref
Application initialization
RAM initialization
ref
RAM Parity setting
Status initialization


Application Initialization
ref
UART initialization


RAM Parity Setting
rpar
REG_RPAREN_enable (Register base address)


Input
uart_io
(Application)
getc
“getchar” is retargeted to “getc”, and the characters are input one by one.
loop
[Reception result ! = Failure]
break
[Reception information = Reception data is present.]
Reception data is picked up.


Command Process
Input data
==" write" ?
YES
Data is written to RAM area1
Input data
==" read" ?
NO
Command error message
display
ref
RAM Parity check


RAM Parity setting
rpar
REG_RPARFGx_get (Register base address, RAM area)
Status value: REG_RPARFGx_get(-)
Status value ==0?
NO
Error process
Write data display

## 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 | 2019-10-16 | First release |

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