

**M3H Group(1)**  
**Application Note**  
**Real Time Clock**  
**(RTC-A)**

**Outlines**

This application note is a reference material for developing products using the real-time clock (RTC) function of M3H Group(1).

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

Target sample program: RTC\_UART

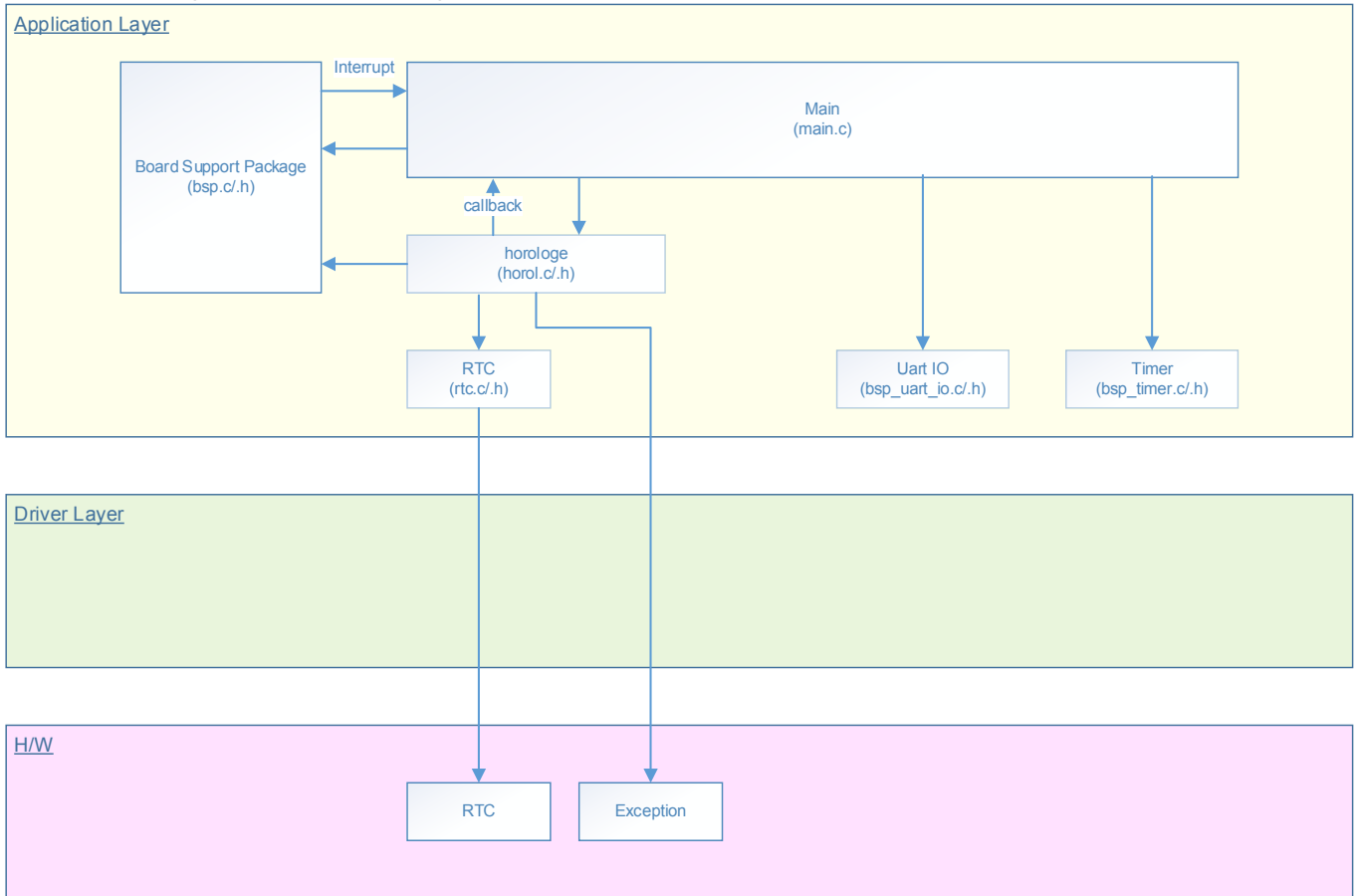
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### 1. Preface

This sample program is a sample program for checking the operation of the RTC's clock function. The time values is displayed on the 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  
Real time clock (RTC-A) Rev2.1 (Japanese edition)
- Other reference document  
TMPM3H(1) Group Peripheral Driver User Manual (Doxygen)

### 3. Function to Use

IP	channel	port	Function / operation mode
Real time clock	-	-	Clock function
Asynchronous serial communication	ch0	PA1 (UT0TXDA) PA2 (UT0RXD)	Asynchronous communication with PC

## 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

\* This sample program operates on the evaluation board of TMPM3H6FWFG.

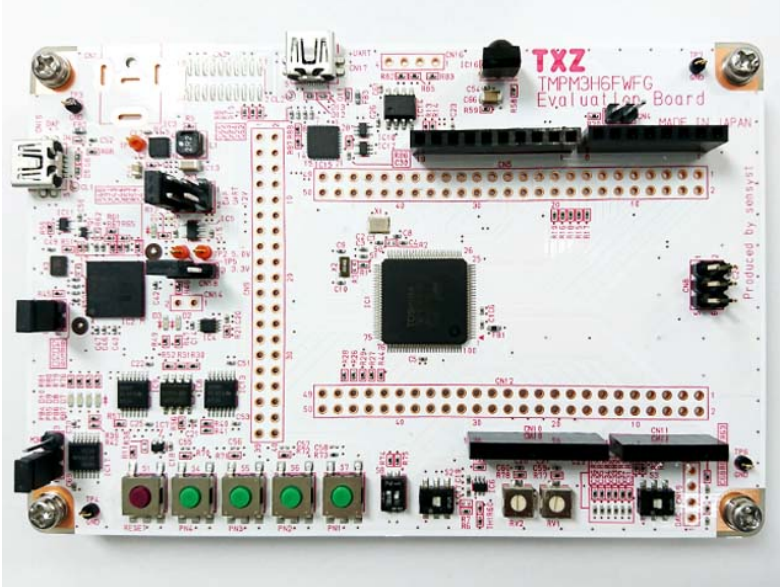
If other function than the TMPM3H6 one is checked, it is necessary that CMSIS Core related files (C startup file and IO header file) should be changed properly.

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. Operation confirmation condition

Used microcontroller    TPM3H6FWFG  
Used board                TPM3H6FWFG Evaluation Board (Product of Sensyset)  
Unified development environment    IAR Embedded Workbench for ARM 8.11.2.13606  
Unified development environment     $\mu$ Vision MDK Version 5.24.2.0  
Terminal software        Tera Term V4.96  
Sample program         V1100

Evaluation board (TPM3H6FWFG Evaluation Board) (Top view)

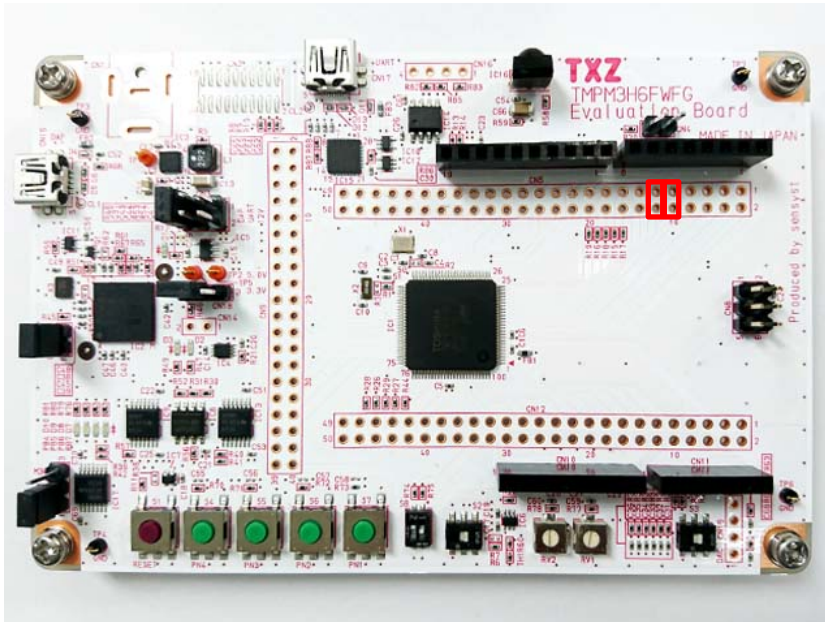


For purchasing the board, refer to the following homepage. (<http://www.chip1stop.com/>)

## 6. Evaluation Board Setting

The following pin connections should be done on the evaluation board.

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



## 7. Outline of RTC function

RTC function is the clock function which can count a leap year in the calendar.

It operates with 1Hz clock which is generated by counting the low speed clock (fs).

A clock correction function corrects the gaining or losing of the time caused by the frequency error of the low speed oscillator.

The alarm function issues an interrupt request or outputs a pulse on ALARM\_N pin when the preset time values match the clock time values.

The main RTC function is as follows:

- Clock function

- Alarm function

This sample program can check the operation of the clock function.

## 8. Sample Program

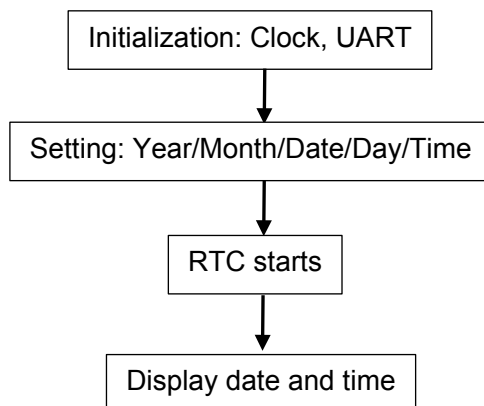
The sample program displays year / month / date / time and day of the week in terminal software.  
RTC uses 1Hz interrupt and the clock function.  
Time information is displayed on the terminal software via USB-UART.

### 8.1. 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.

### 8.2. Sample program main operation

It initializes UART, System Clock, the UART SW reset, and others.  
The time setting is done by this sample program.  
Year/Month/Date/Day/Time/ are set (initialized).  
After the settings complete, this program starts the clock.  
The date and time are acquired from the clock register at the timing of the 1Hz periodic interrupt.  
The time values are transferred via UART ch0 to PA1/2 pins (UTOTXDA/UTORXD) and displayed by the terminal software.  
For the details of the register setting, refer to an appropriate reference manual.



### 8.3. Output Example of Sample Program

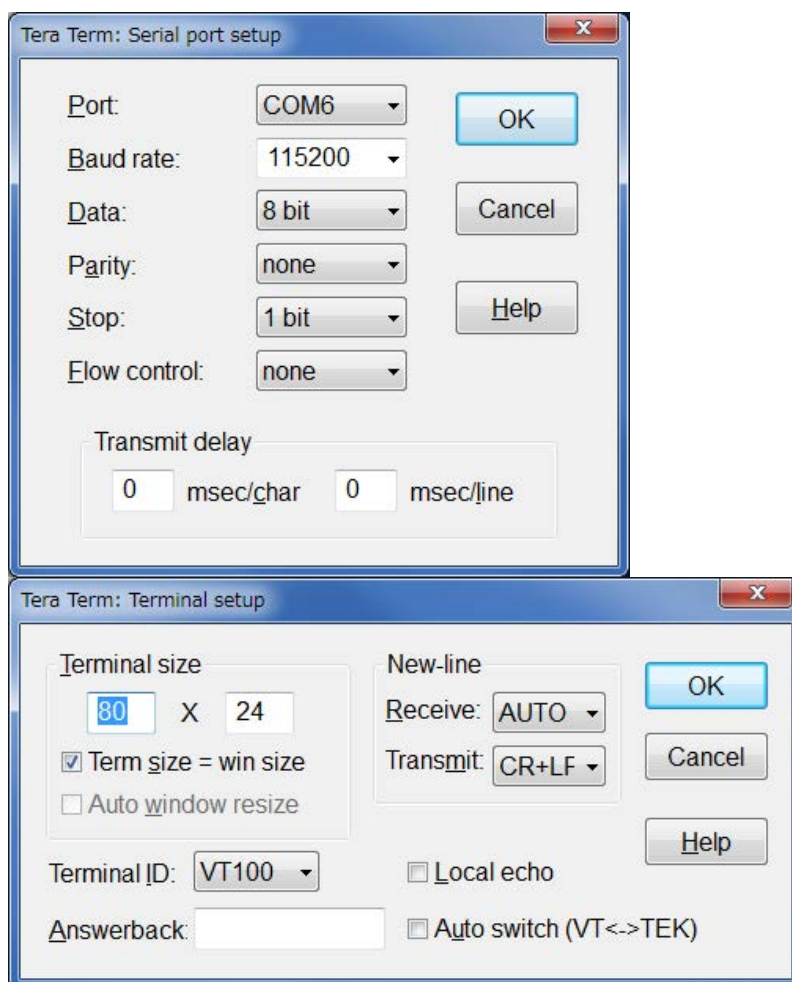
When this sample program operates, the content in the clock register is displayed, as shown in the following figure.

The followings are the output of the default value of the sample program.

```
2016-01-01 00:00:00
2016-01-01 00:00:01
2016-01-01 00:00:02
2016-01-01 00:00:03
2016-01-01 00:00:04
2016-01-01 00:00:05
```

#### 8.3.1. Setting Example of Terminal Software

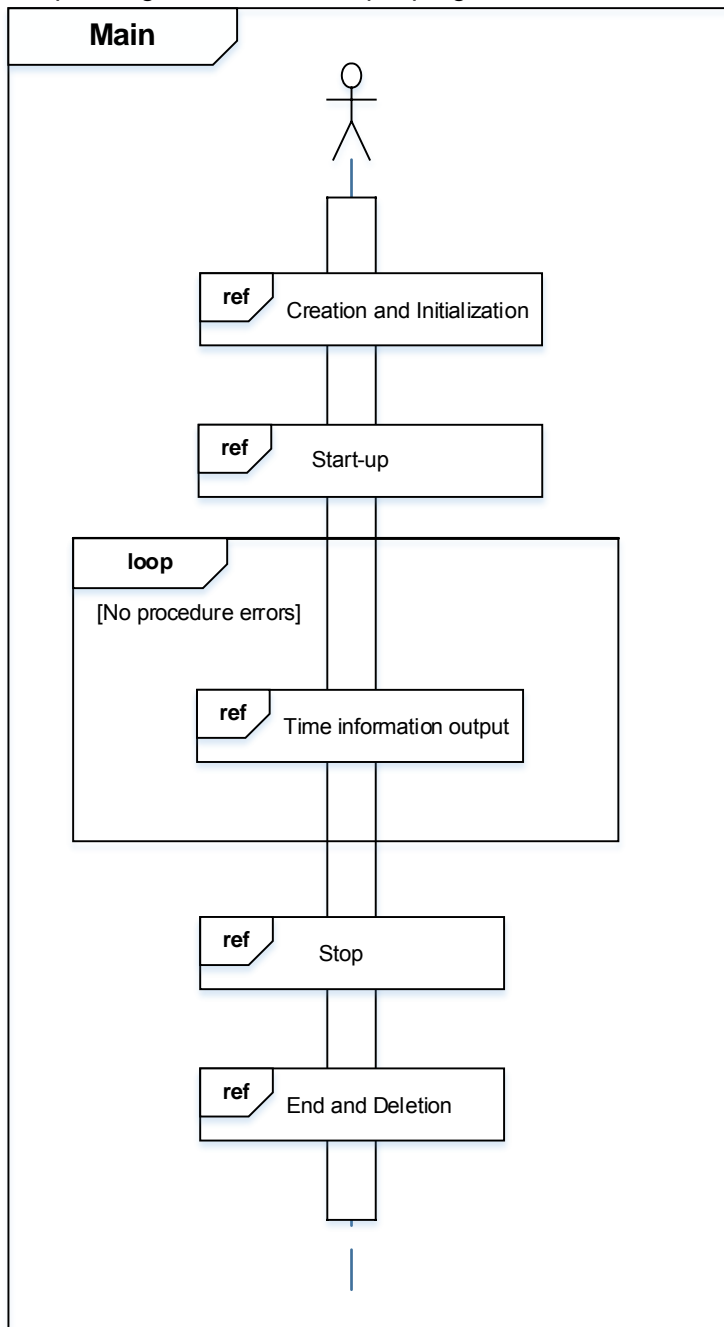
The operation of the terminal software (Tera Term) has been checked with the following settings.



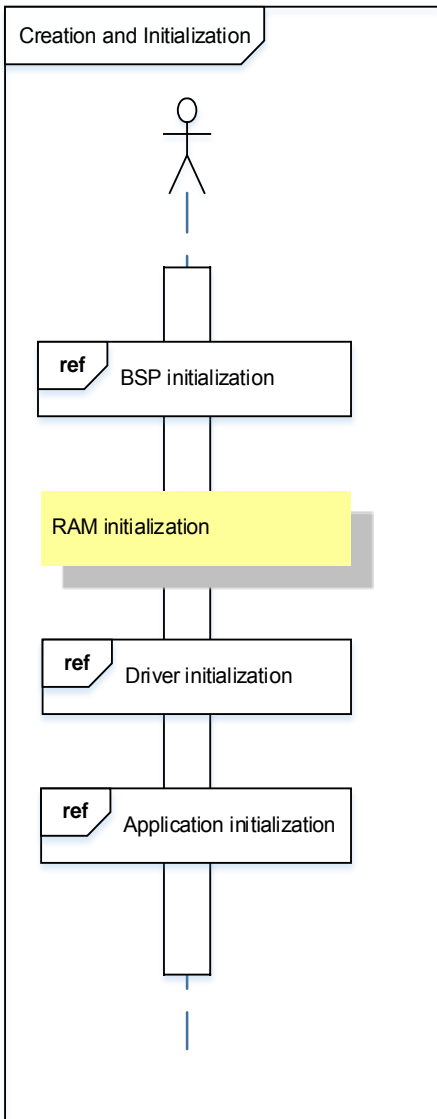


### 8.4. Operating Flow of Sample Program

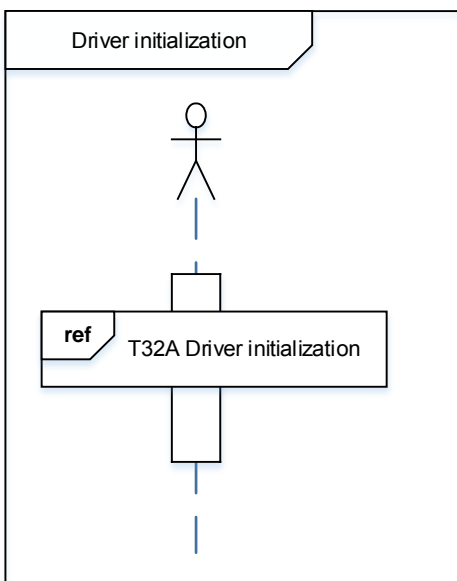
The operating flows of the sample program are shown as follows.



### Creation and Initialization flow

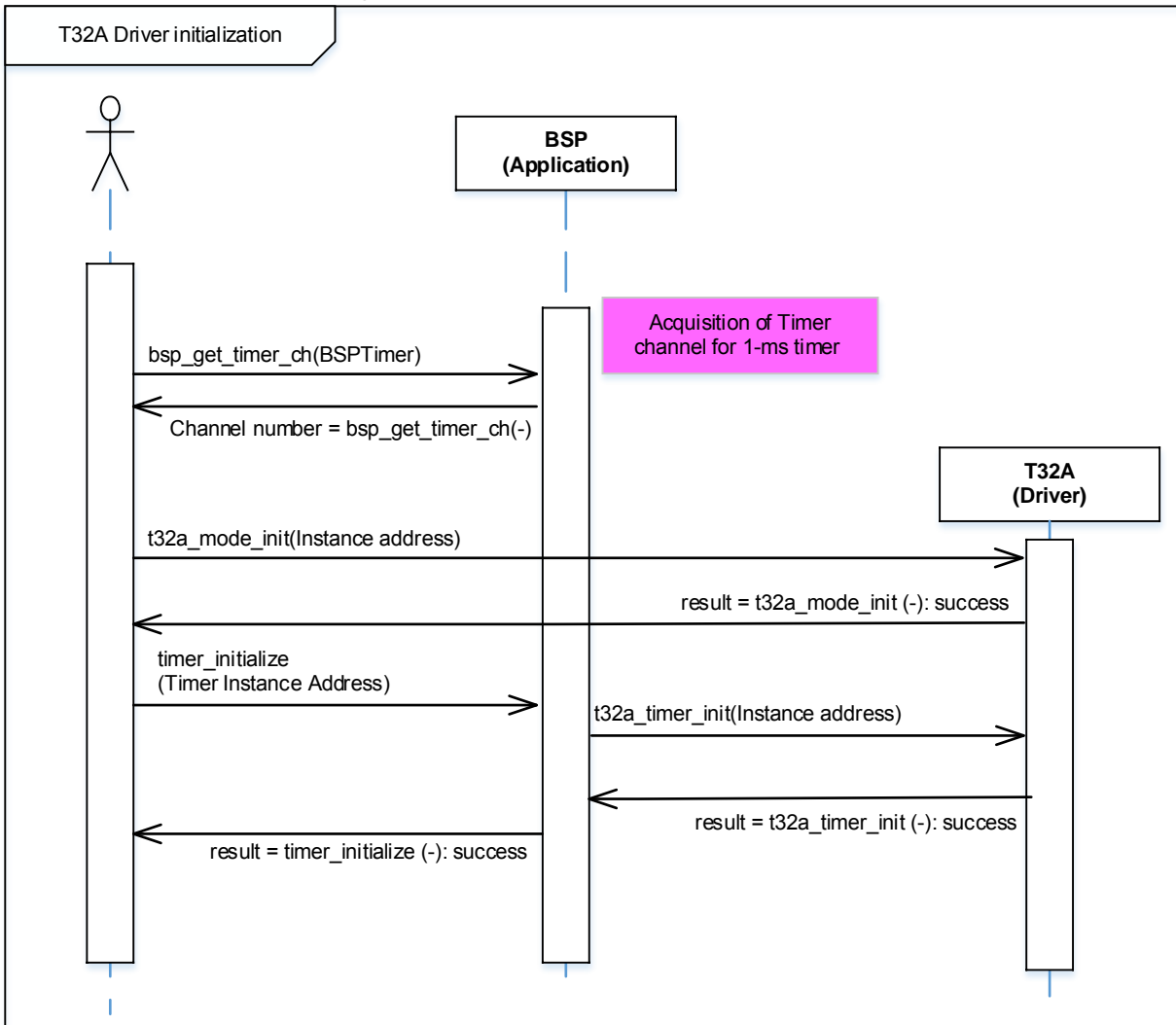


### Driver initialization

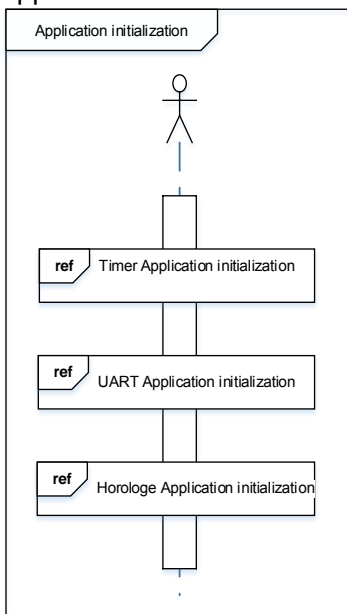


### T32A (Timer) Driver initialization

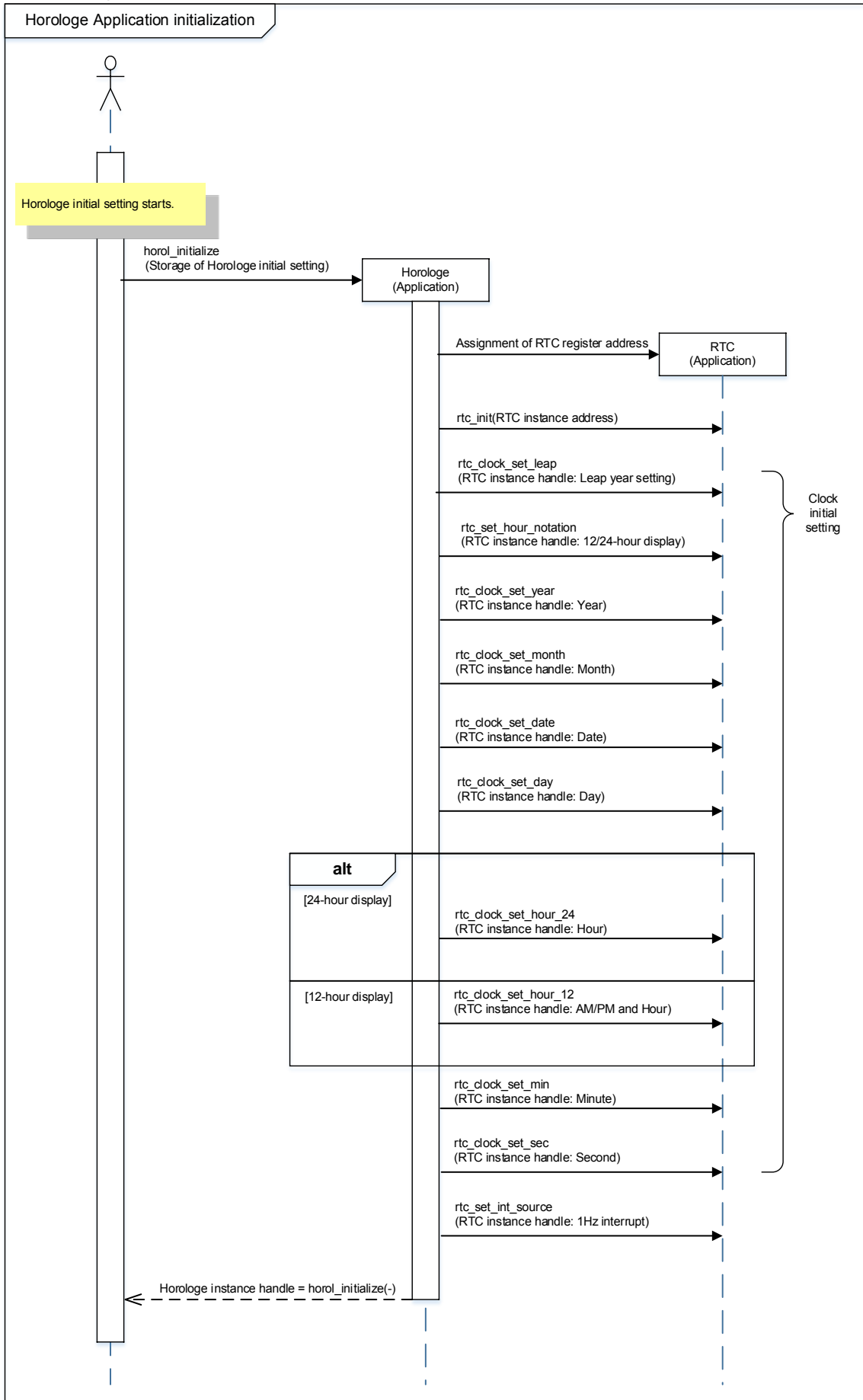
Although initialization setting of 32-bit timer event counter of TMPM3H is done, it is not used in actual operation of this sample program.



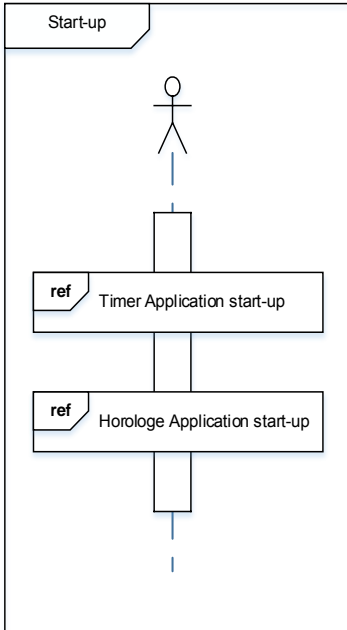
### Application initialization



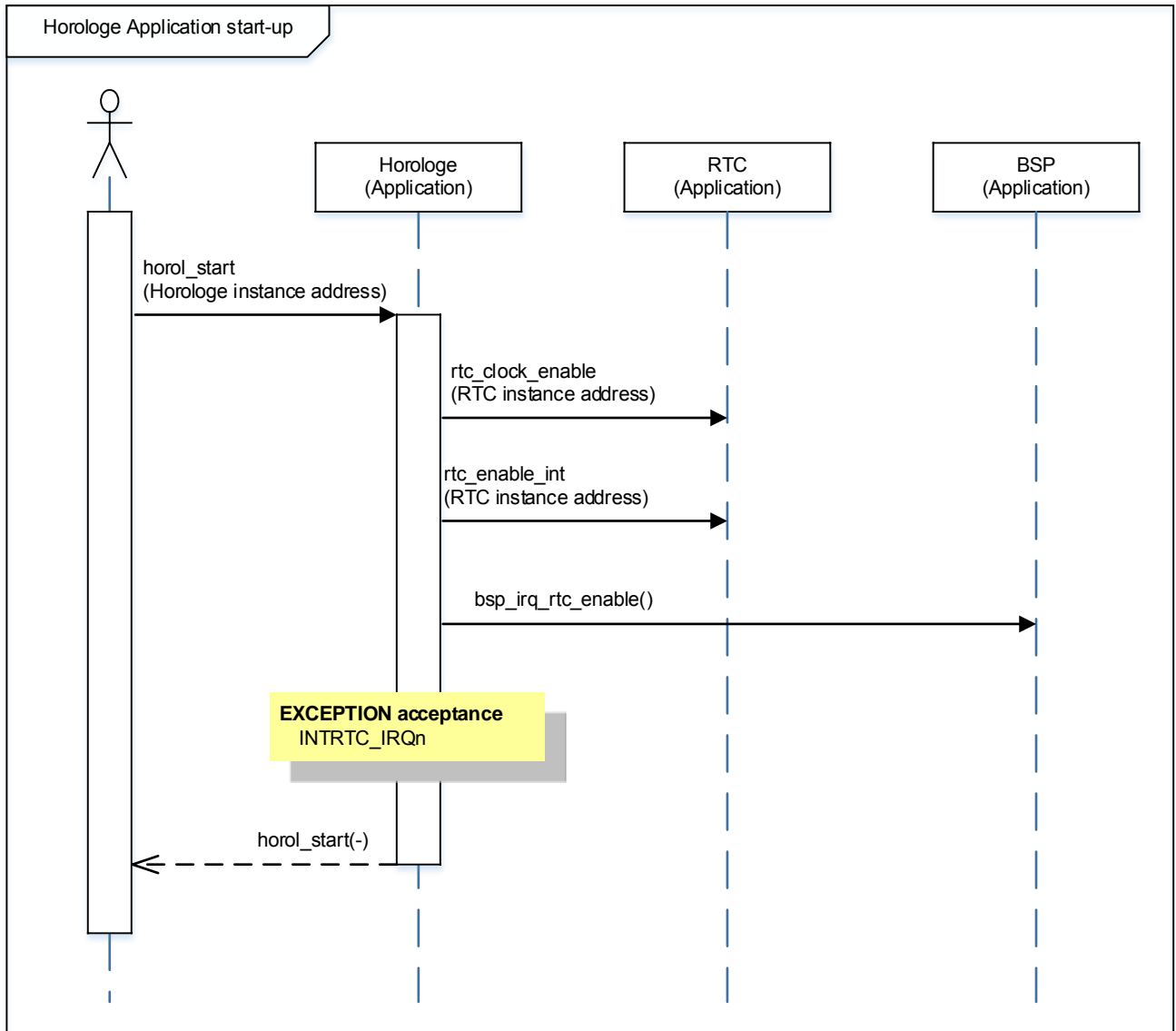
### Time setting initialization



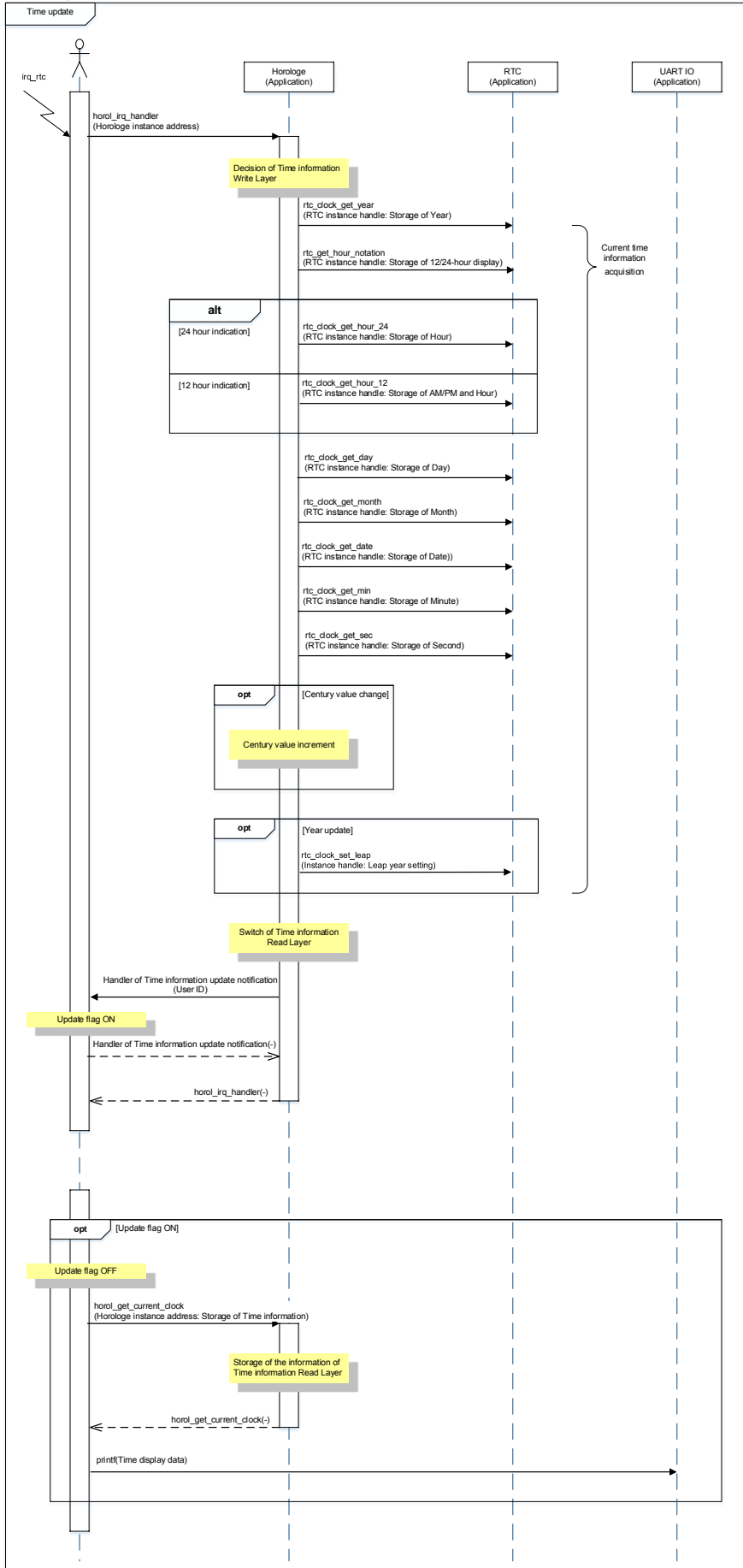
### start-up



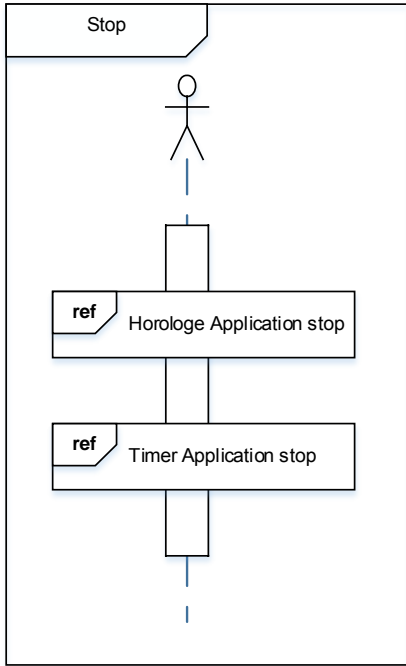
### Time Application start-up



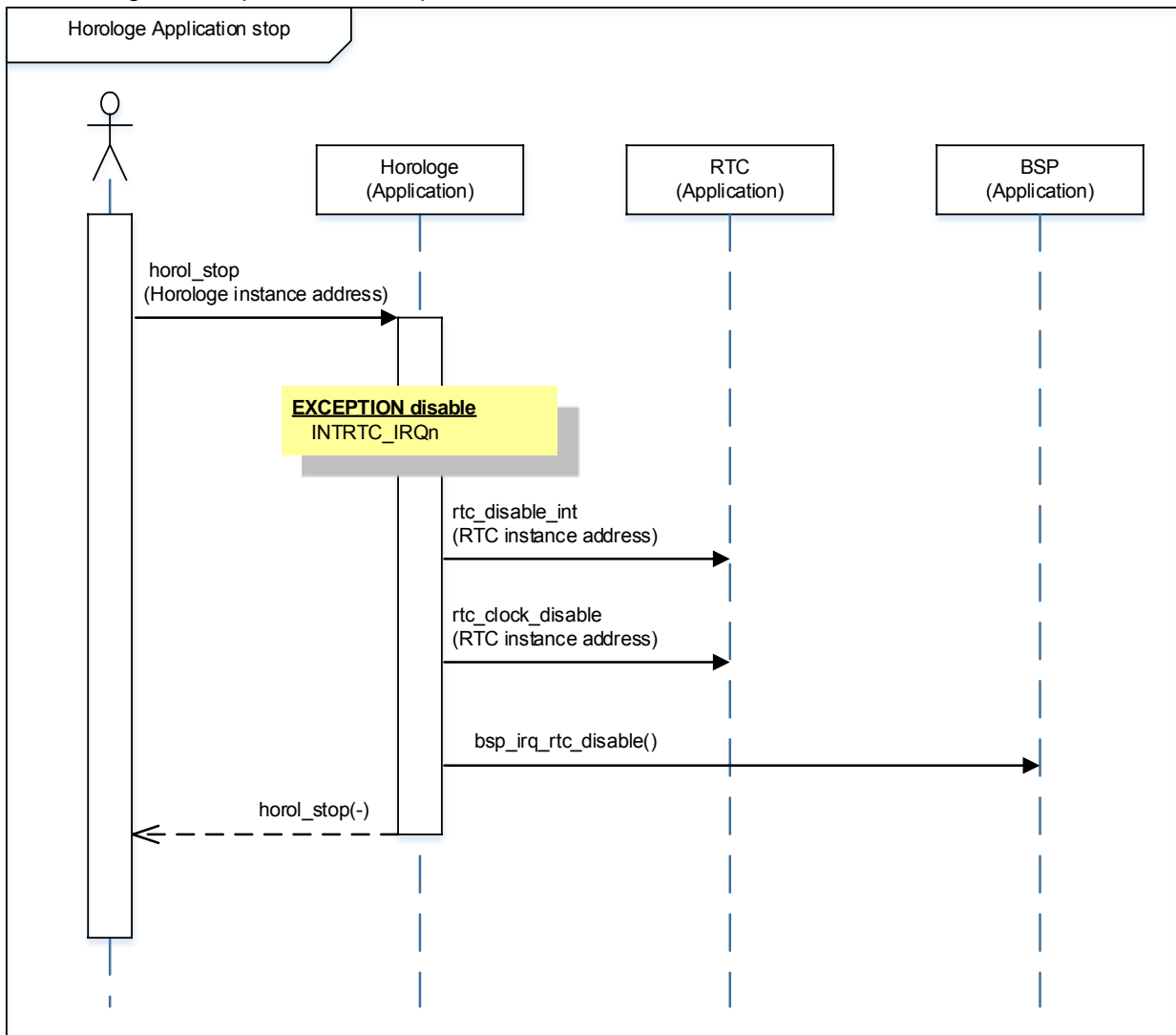
## Setting and output of Time information



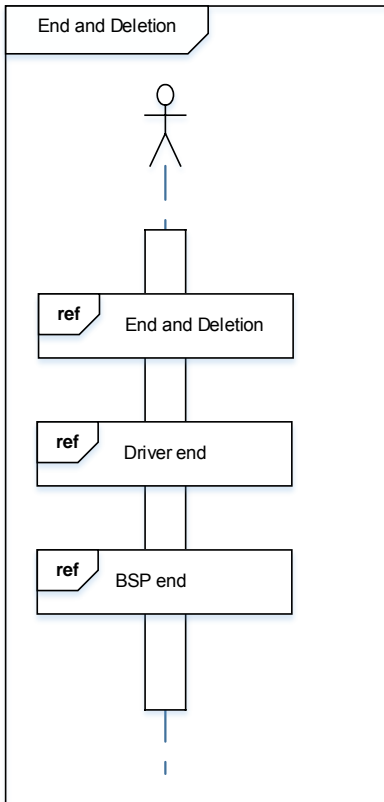
## Application stop procedure



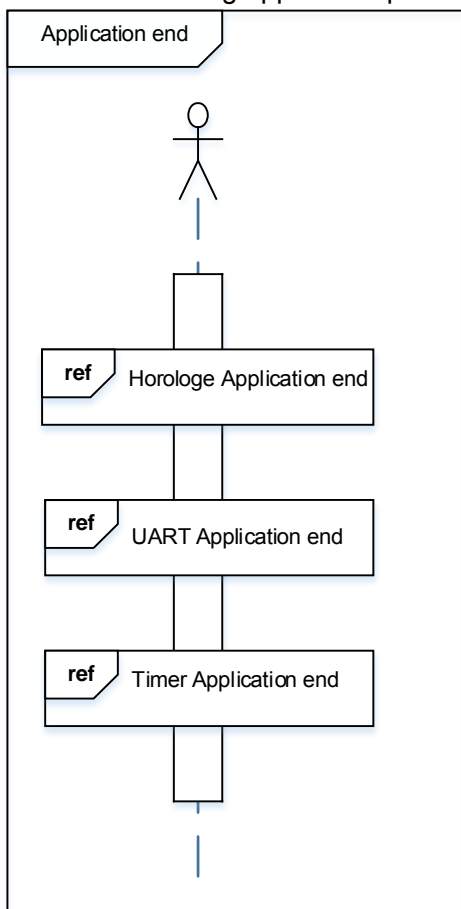
## Time setting and Stop of the timer operation



### RTC end procedure

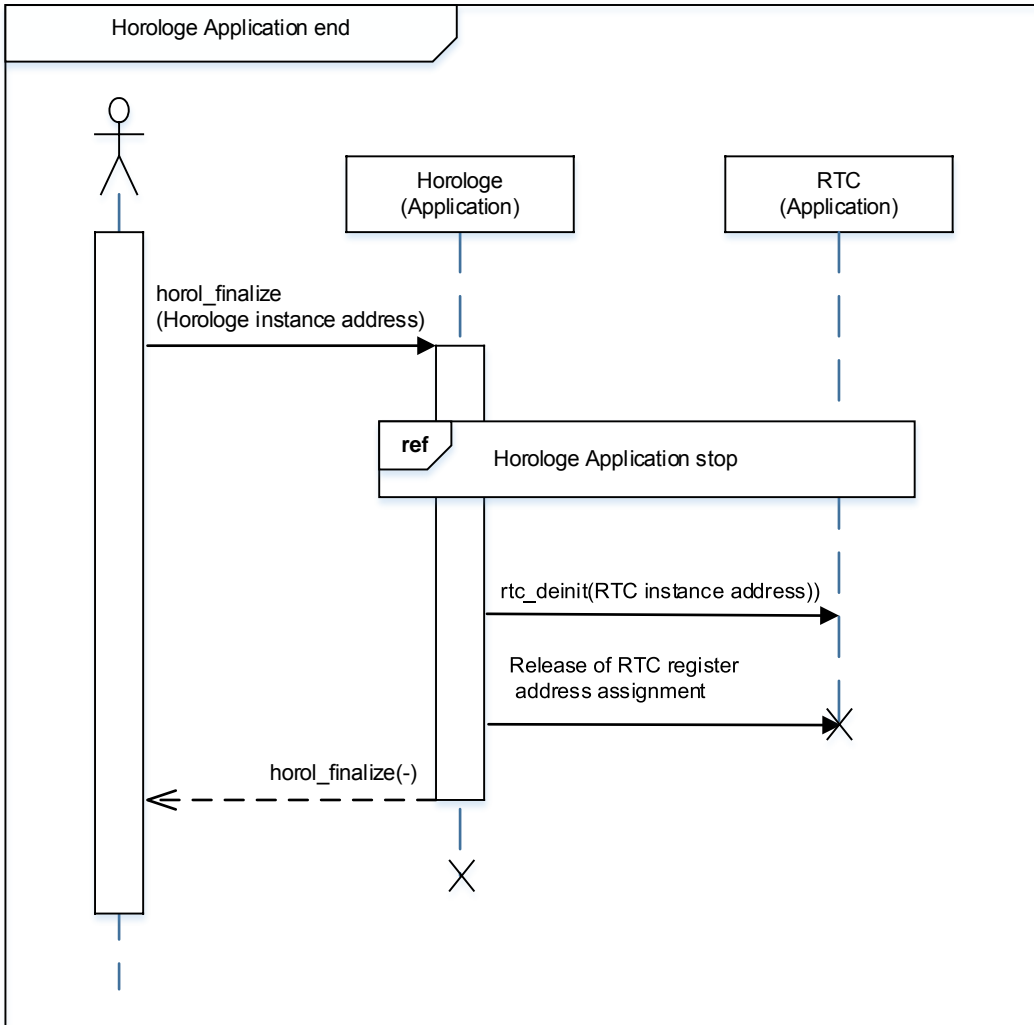


### End of Time setting application procedure

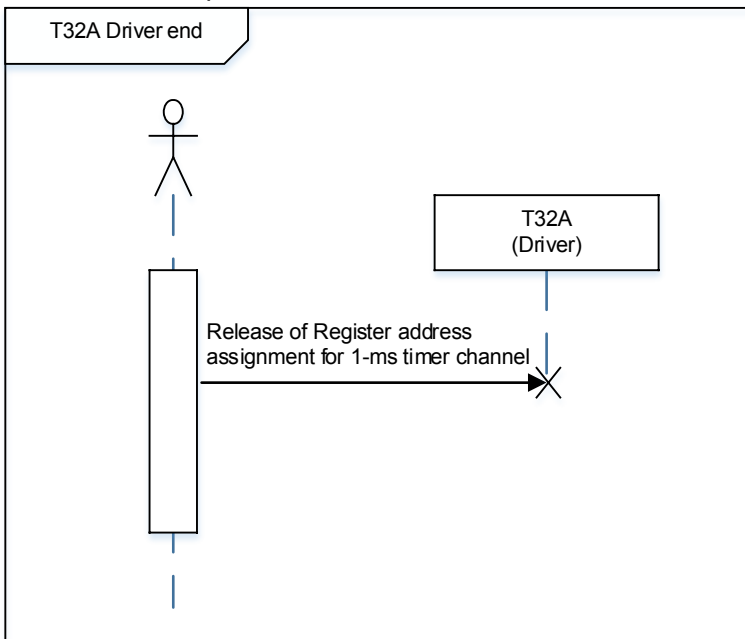




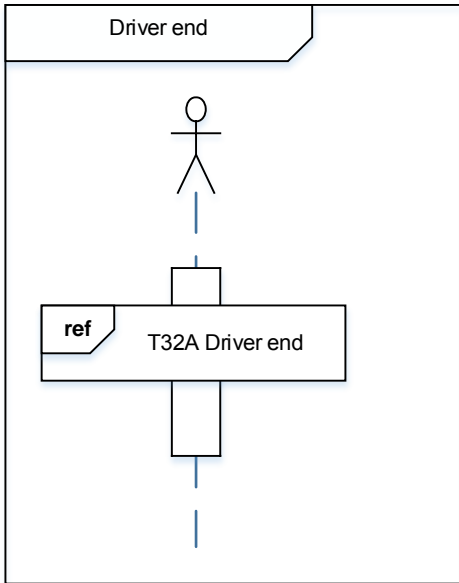
End of Time setting application procedure



Timer driver end procedure



## Driver end procedure



## 8.5. Setting Modification of Displayed Time Information

When the time information is changed, change the setting value in RTC: main.c

Item	Modified location	Note
CFG_HOROL_HOUR_NOTATION	(RTC_HOUR_NOTATION_24)	24-hour display setting
CFG_HOROL_CENTURY	((uint8_t)21)	Year setting
CFG_HOROL_YEAR	((uint8_t)17)	Setting of 2 least significant digits of the year
CFG_HOROL_MONTH	(RTC_MONTH_JAN)	Month setting
CFG_HOROL_DATE	((uint8_t)1)	Date setting
CFG_HOROL_DAY	(RTC_DAY_SUNDAY)	Day setting
CFG_HOROL_MERIDIEM	(RTC_MERIDIEM_AM)	AM/PM setting
CFG_HOROL_HOUR	((uint8_t)0)	Hour setting
CFG_HOROL_MIN	((uint8_t)0)	Minute setting
CFG_HOROL_SEC	((uint8_t)0)	Second setting

The initial values of the time has been set to “Sunday, January 01, 2017 00:00:00” in this sample program. Any time values can be set by modifying each item value.

For the modification conditions and the range of each item value, refer to “rtd.h file” in ¥Project¥Examples¥utilities¥rtc. The modification range of each item is set there.

## 9. Precaution

When using the sample program with CPU other than TPM3H6, please check operation sufficiently.

## 10. Revision History

Rev	Date	Page	Description
1.0	2018-03-07	-	First release

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