Application Note

TRM
(TRM-B)

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1. Preface

This application note describes sample software for the monitoring function of the built-in oscillator (fIHOSC) using the TRM driver.
This document helps the user check operation of a product under development and develop its program.

2. Technical Term

Term/Abbreviation	Definition
CG	Clock Control and Operation Mode
Timer	T32A:32-bit Timer Event Counter
TRM	Trimming circuit
UART	Universal Asynchronous Receiver Transmitter

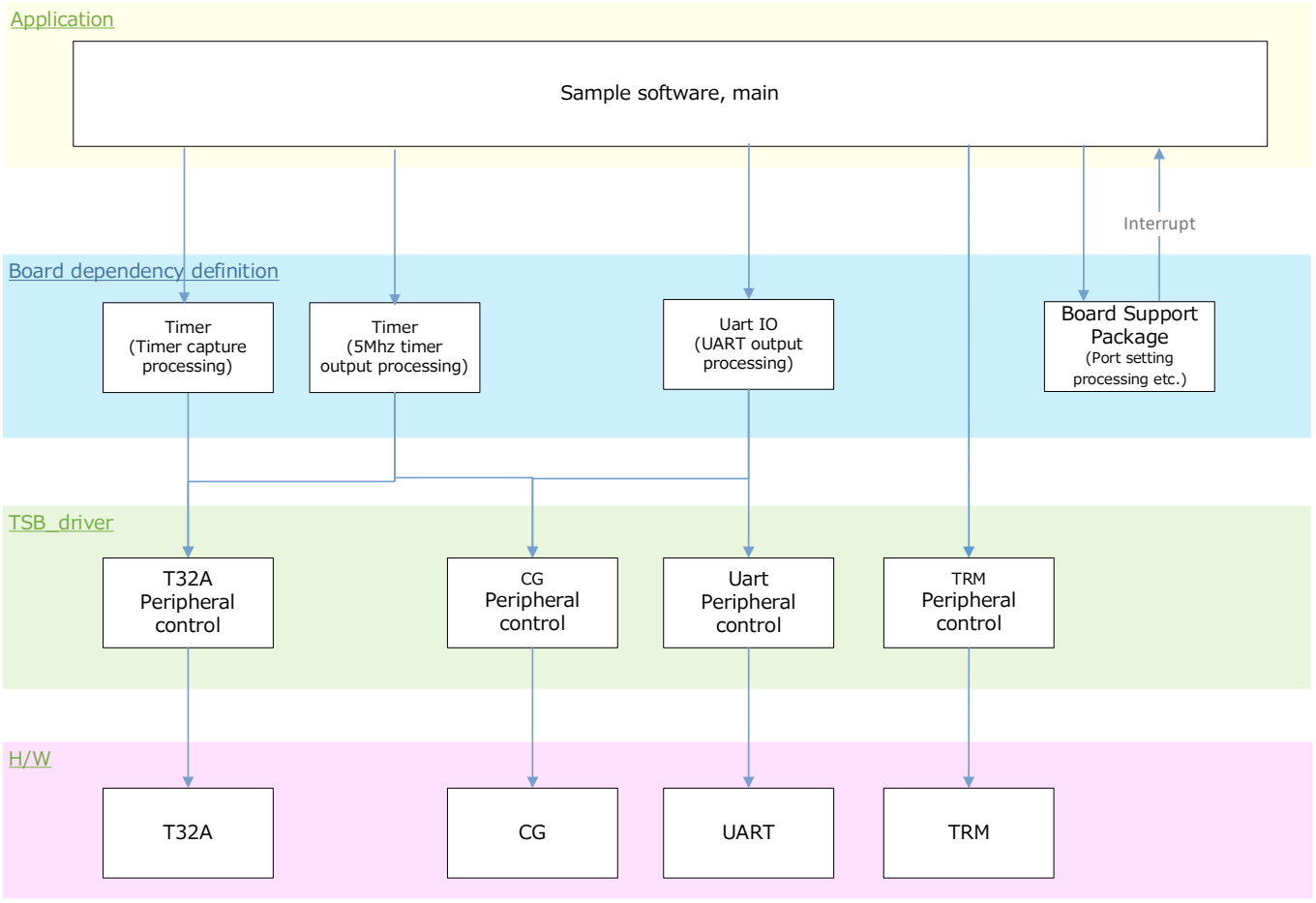
3. Reference Document

Document	Notes
Data sheet	Refer to the data sheet of MCU to be used.
Reference manual	Refer to the reference manual of each IP to be used.
Application note MCU User Guide	Refer to the MCU user guide to be used.

4. Target Sample Program

Sample Program	Outline
TRM	Sample program of TRM function

5. Configuration Diagram



6. Sample Program:TRM

This is sample software that trims the built-in oscillation (fIHOSC) using the reference clock (low-speed oscillator (fs) or external reference clock (BSP_T32A_CAPT_1)).
The compile options to switch the reference clock.

6.1. Outlines of Operation

Pulse B is output from BSP_T32A_PPG_2. After that, set the trimming initial setting value.
Error measurement (waveform measurement) is performed until the number of trimmings is reached.

6.2. Function to Use

The functions to use are as follows:
For the Port assignment of each BSP channel, refer to the MCU user guide.

IP	Channel	Objective
T32A	BSP_T32A_CAPT_1	For pulse measurement. Used to measure the external reference clock
	*1 BSP_T32A_TRM_fs	*1 For pulse measurement. Used for measuring fs
	BSP_T32A_PPG_2	For pulse output. Used to check the error correction result
UART	BSP_UART_1	For terminal emulator communication (Outputs log)

*1 SBK-M4KN has no fs and is not used.

6.3. Interrupt to Use

Interrupt	Outlines
INTT32A01ACCAP1	T32A ch0 Timer_A Capture 1 For pulse measurement. Used for measuring external reference clock
INTT32A06A	T32A ch6 Timer_A For pulse measurement. Used for fs measurement
INTT32A03B	T32A ch3 Timer_B For pulse output. Used to check error correction results
INTUART0RX	UART ch0 Receive interrupt for terminal emulator
INTUART0TX	UART ch0 Transmission interrupt for terminal emulator
INTUART0ERR	UART ch0 Error interrupt for terminal emulator

6.4. Configuration

“main.c” configuration setting.

Configuration	Current Value	Description
Reference clock	PPG	Switch between slow oscillator (fs) and external reference clock
Pulse_A Cycle_A Duty_A	 240Hz 50%	This is the input waveform of the external reference clock. It will be a low width specification * Specifications assuming a waveform created by transmitting UART2400bps characters and 0xF0 (1byte).
Pulse_B Cycle_B Duty_B	 5MHz 50%	Output waveform for checking trimming result
Trimming times	10	-
Trimming default value	Minus maximum	The adjustment value will be shifted once for the trimming demo.

6.5. Example of Terminal Emulator Output

6.5.1. Normal Operation

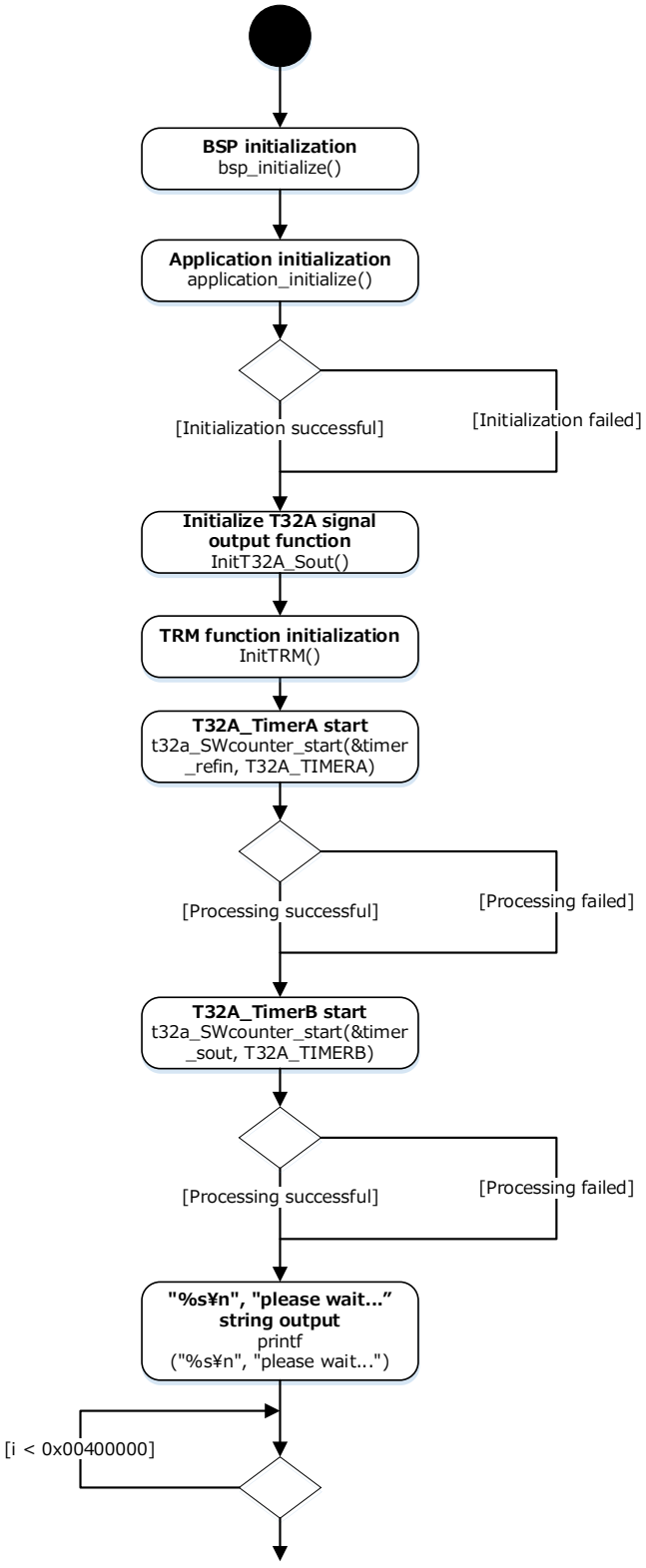
```
please wait...
----------------
|      start      |
----------------
TRMOSC_RUN
<TRIMSET>:D
TRMOSC_RUN
<TRIMSET>:F
TRMOSC_DONE
<TRIMSET>:F
```

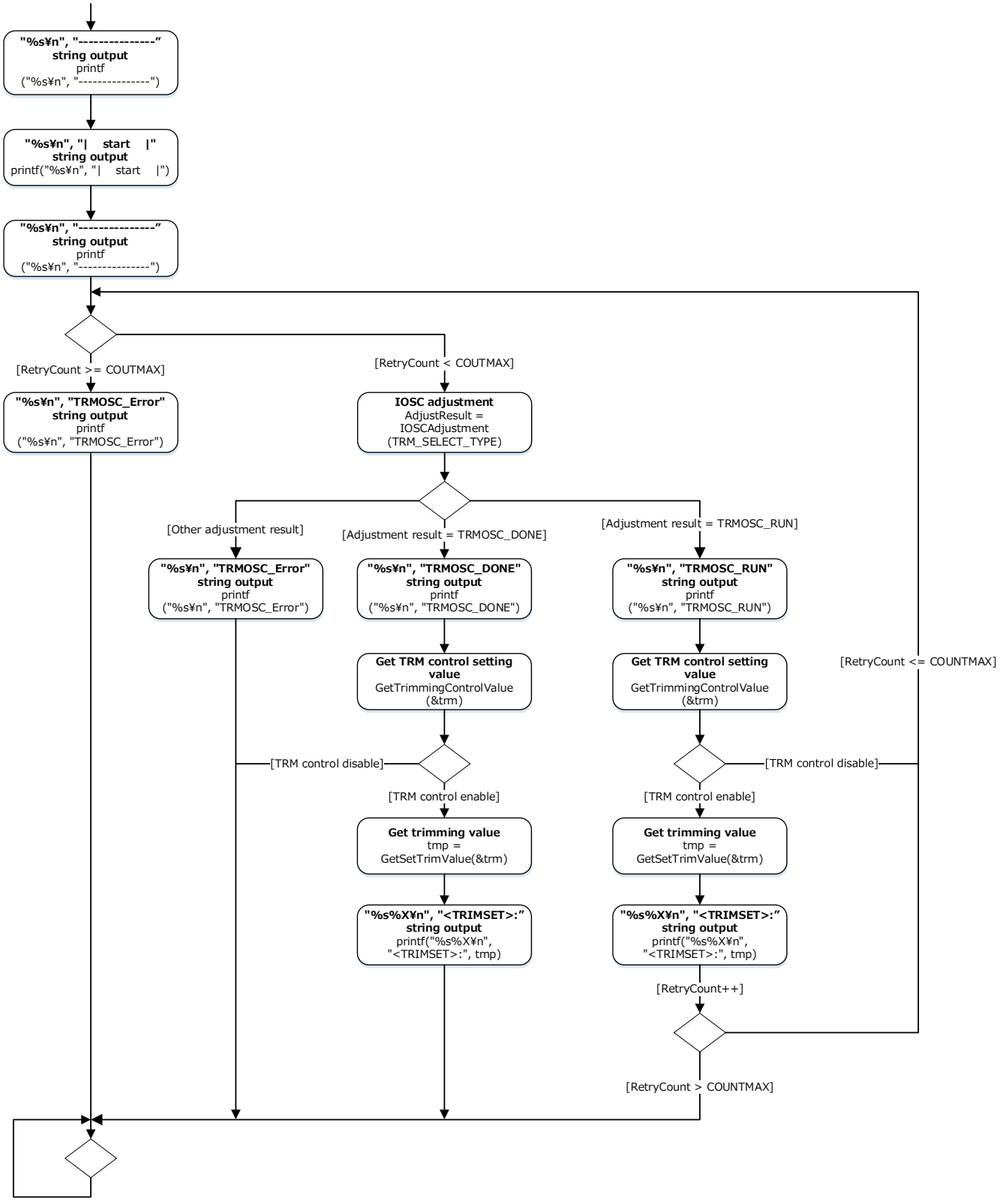
6.5.2. Case of Error Occurrence

Nothing.

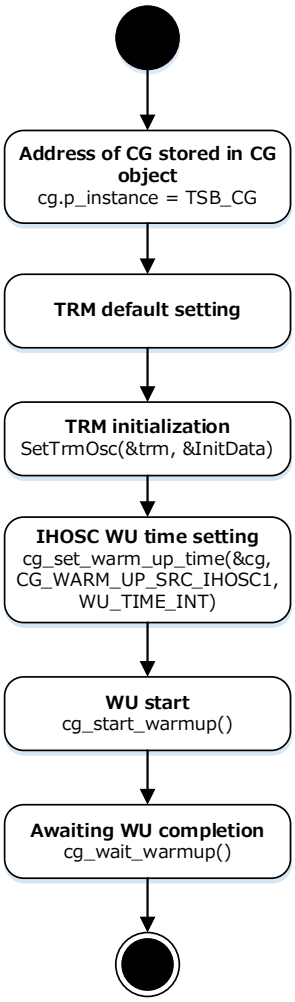
7. Activity diagram

7.1. main

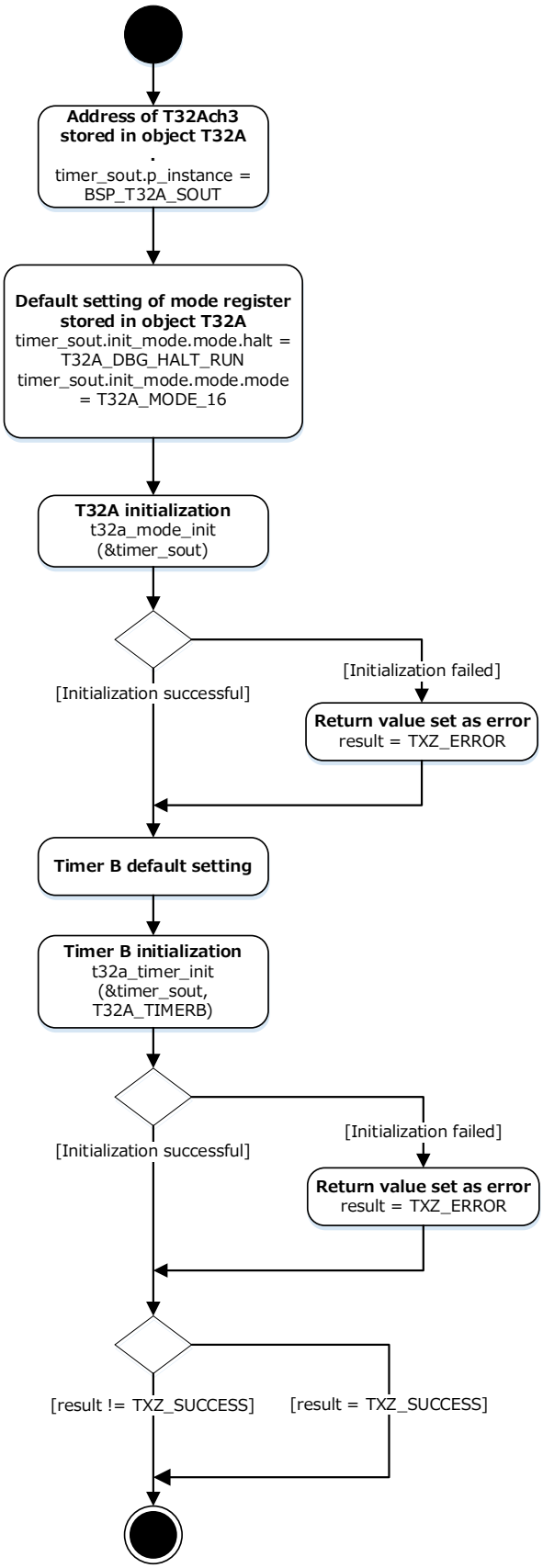




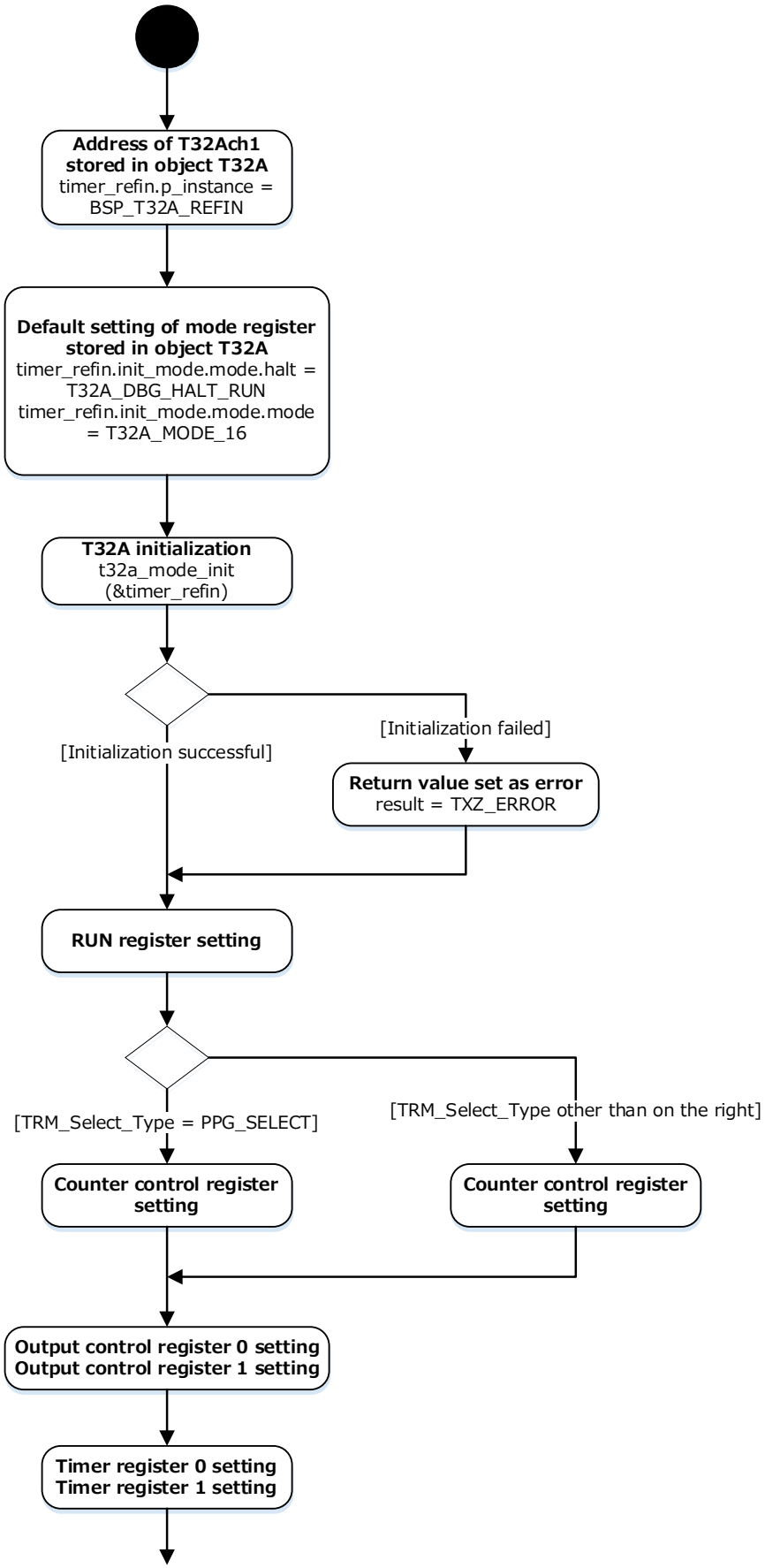
7.2. InitTRM

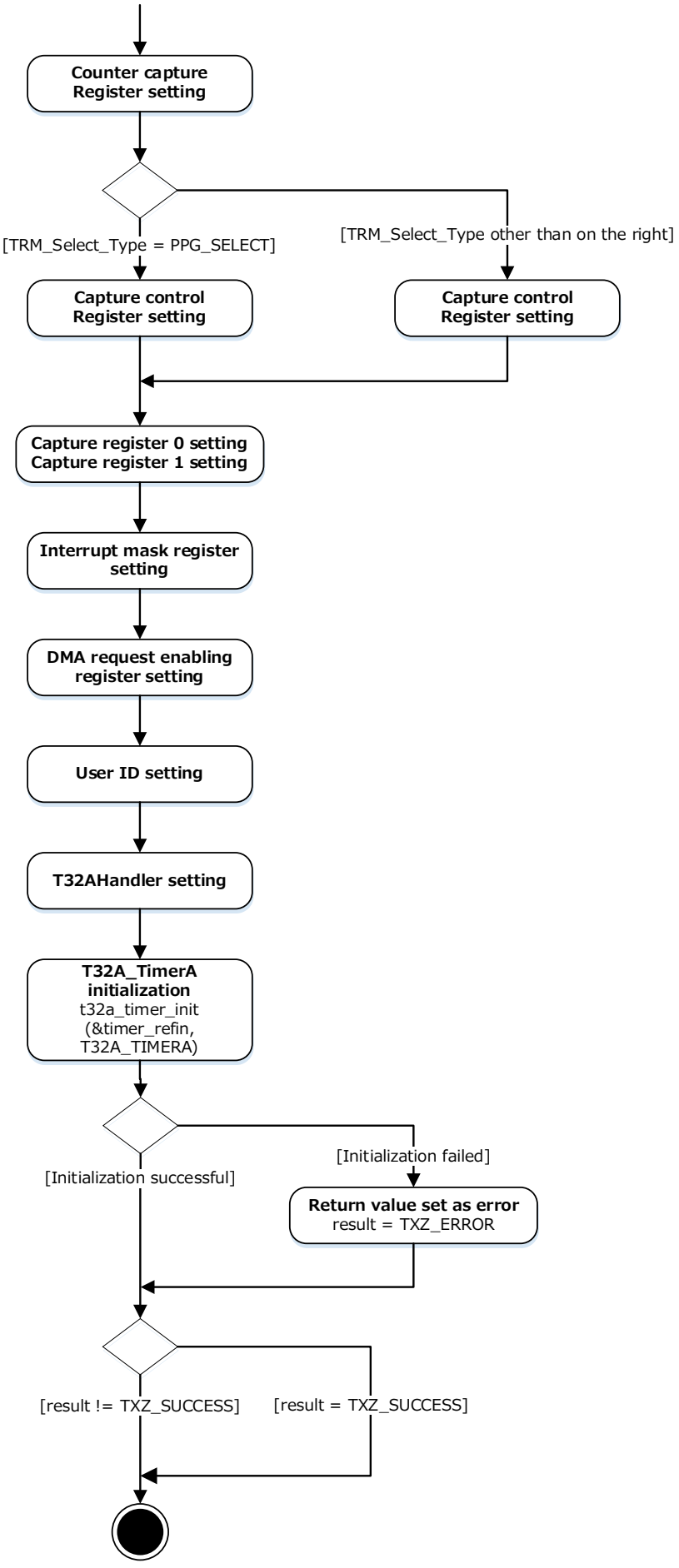


7.3. InitT32A_Sout

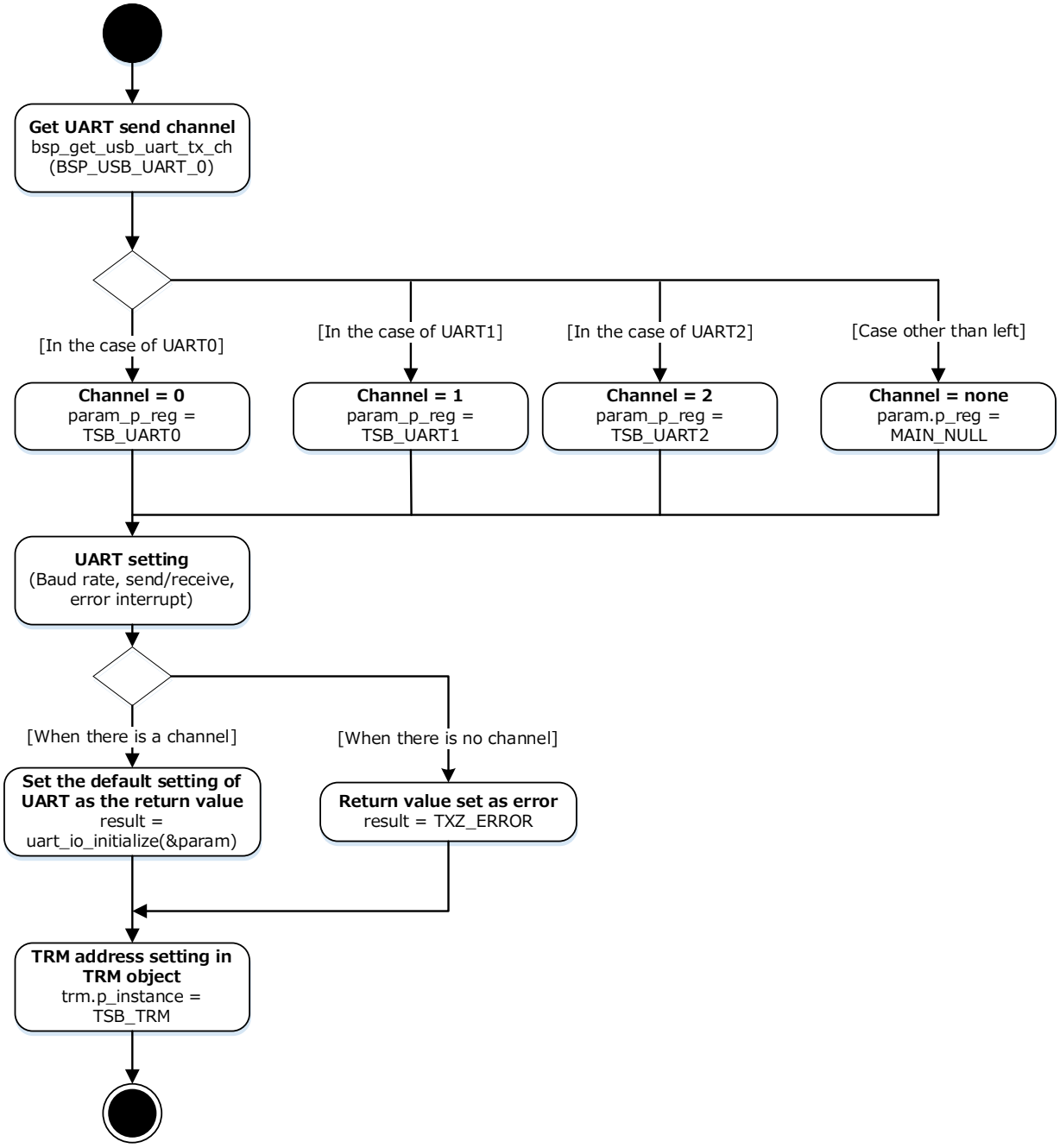


7.4. InitT32A_RefIn

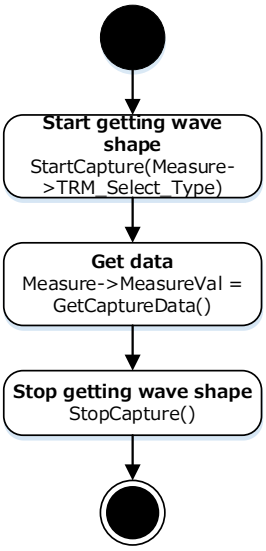




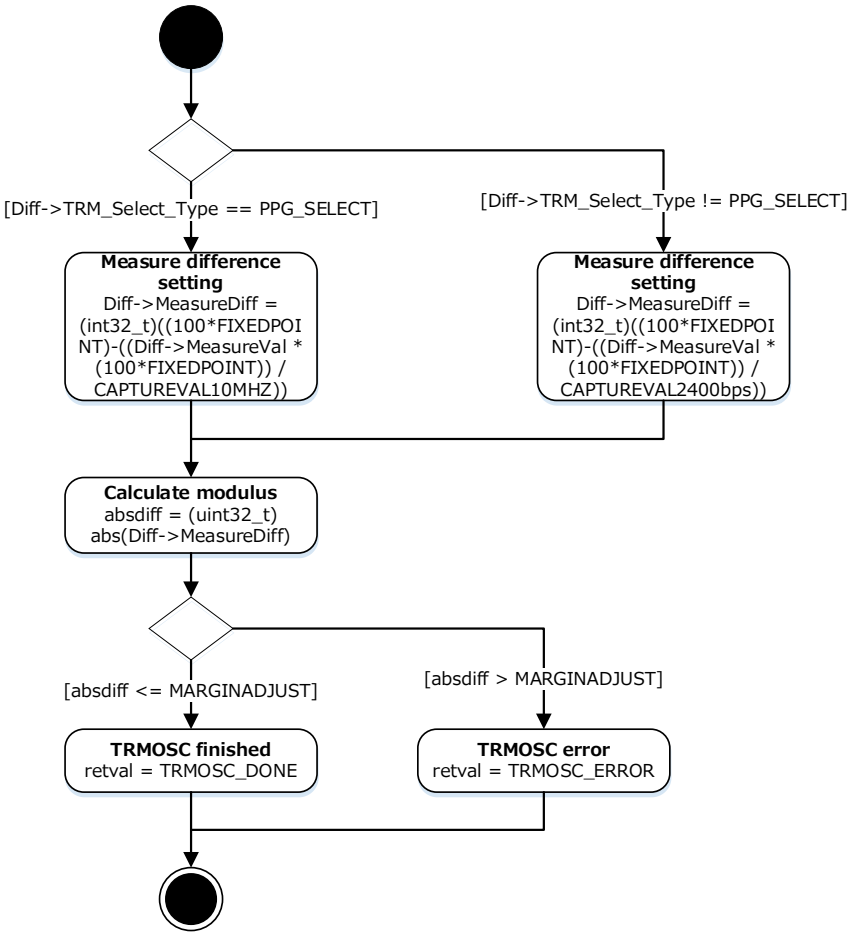
7.5. application_initialize



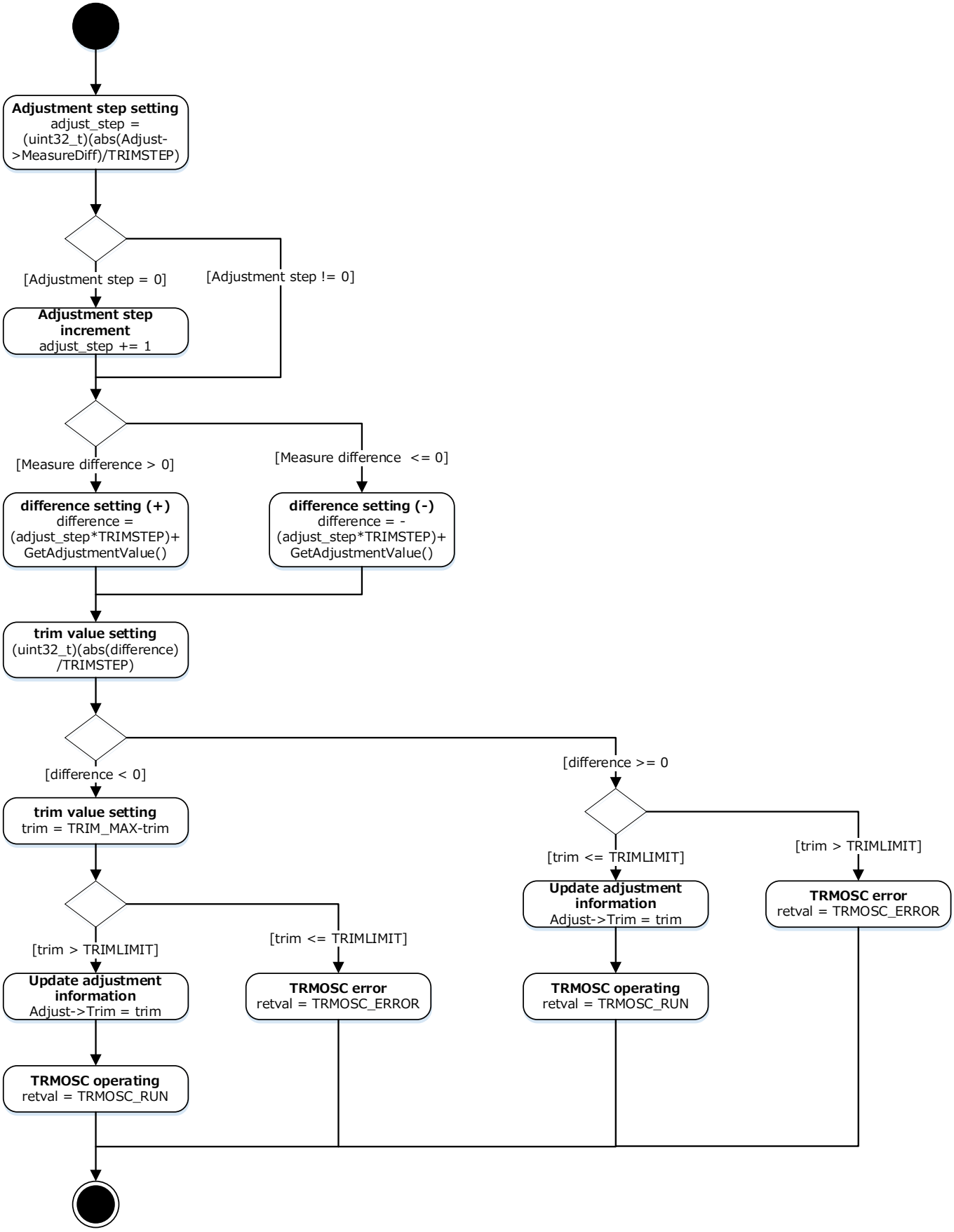
7.6. MeasureWave



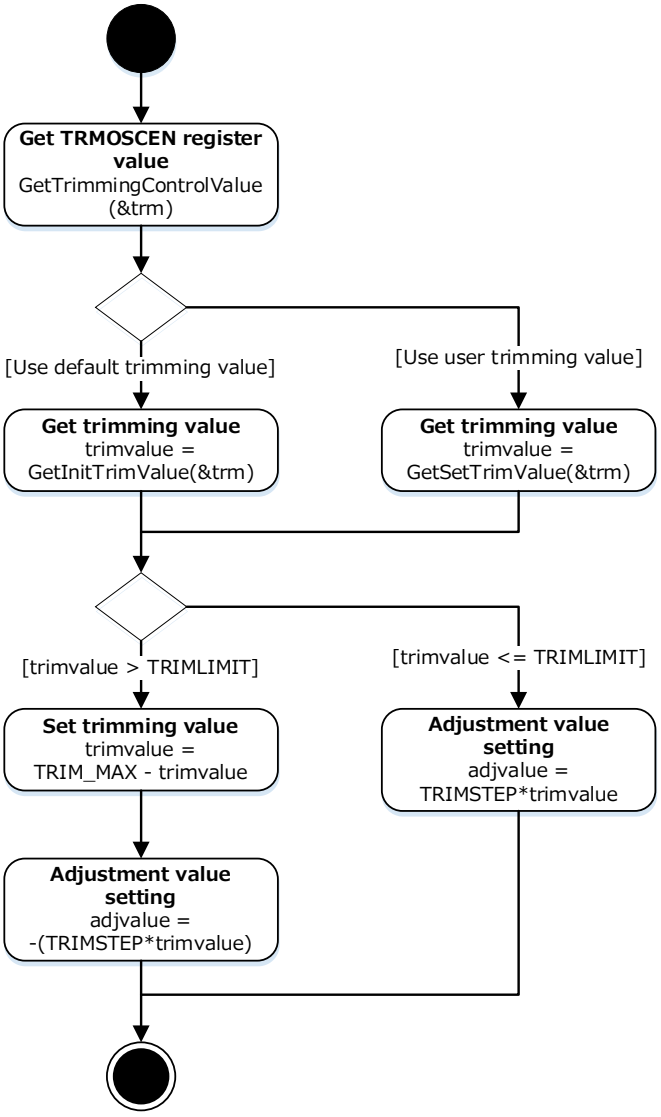
7.7. CalcDiff



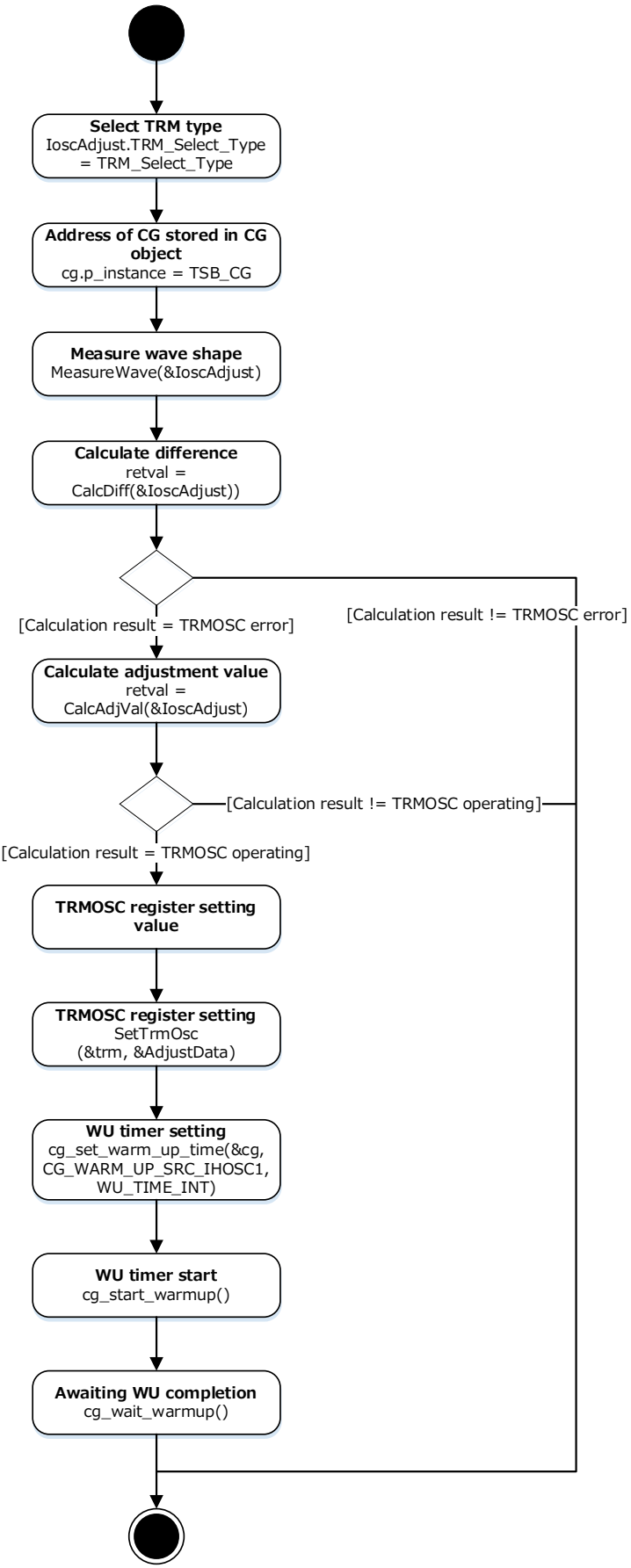
7.8. CalcAdjVal



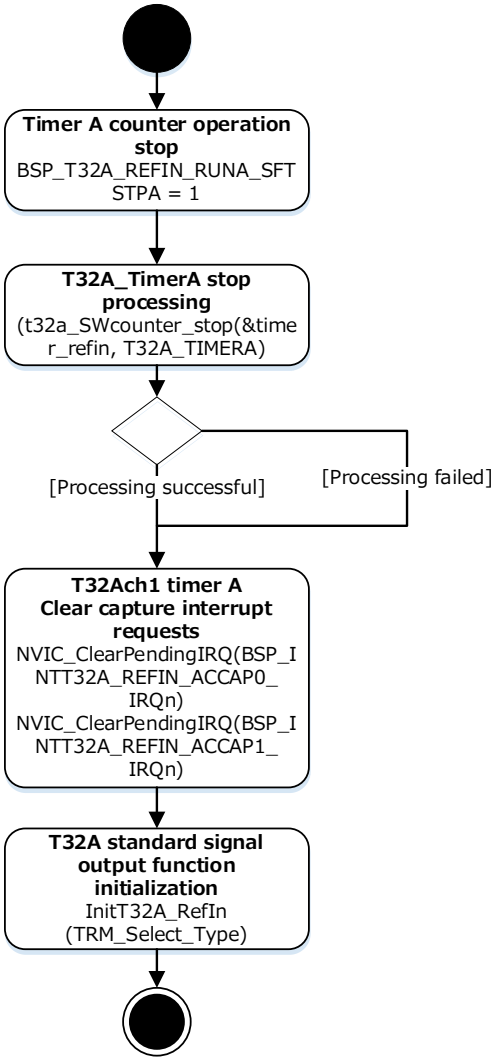
7.9. GetAdjustmentValue



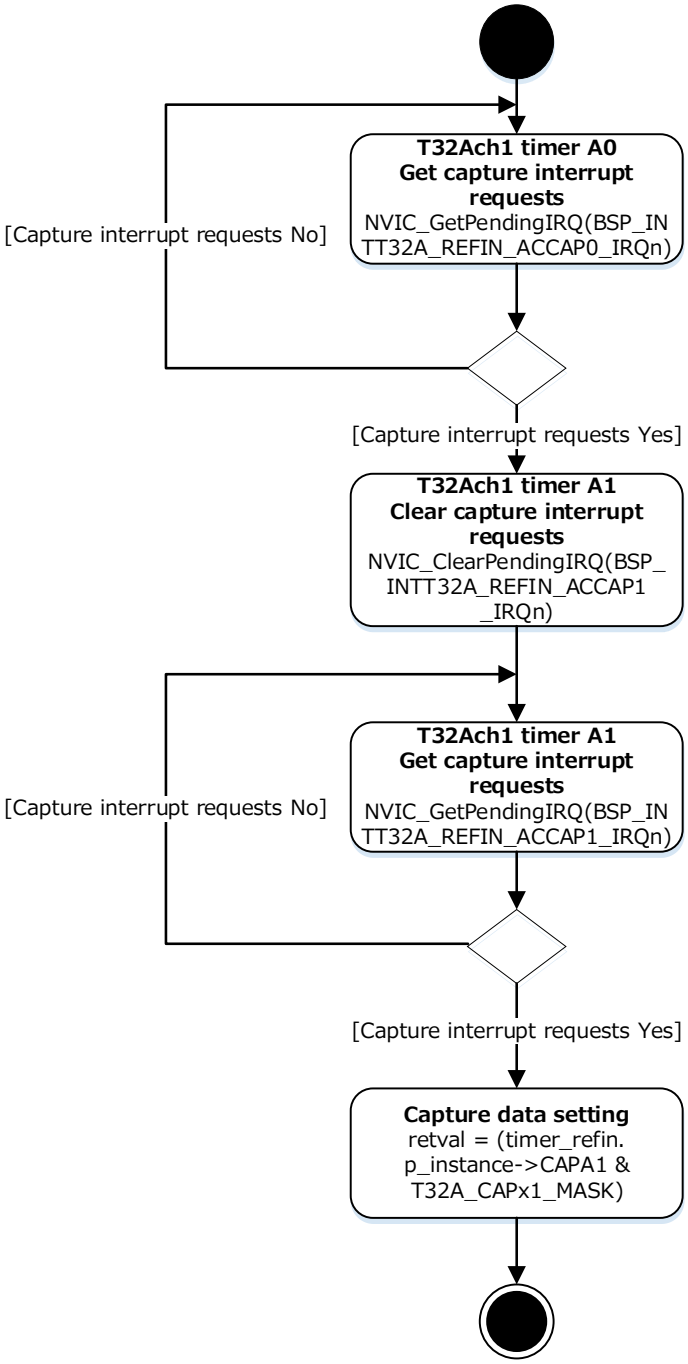
7.10. IOSCAdjustment



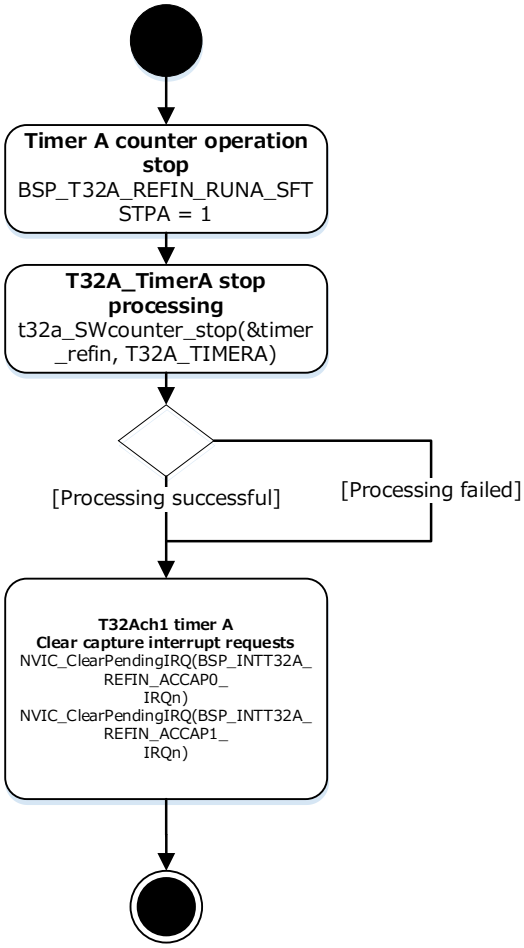
7.11. StartCapture



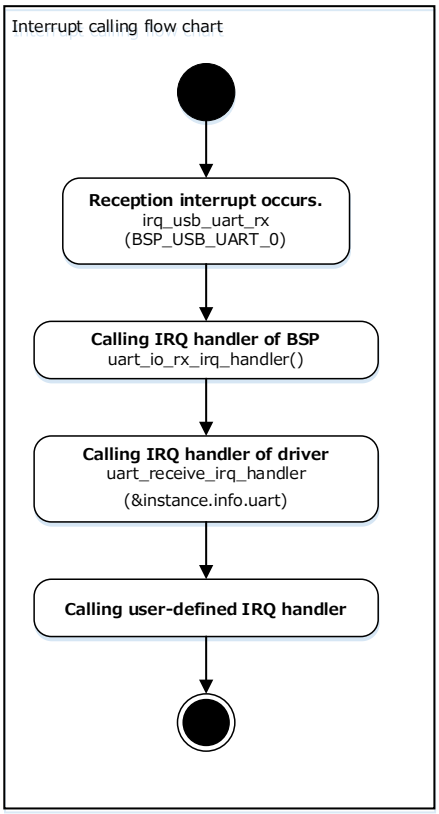
7.12. GetCaptureData

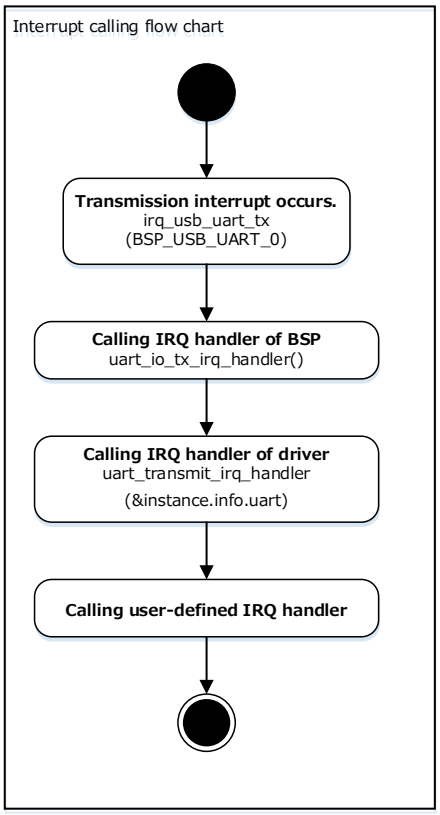


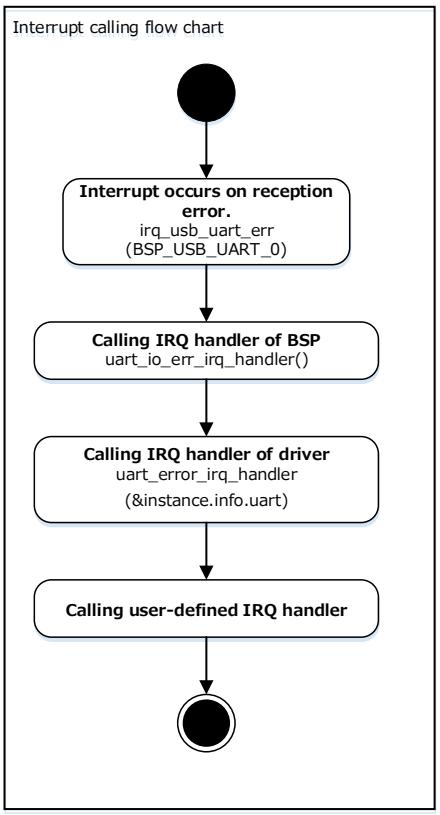
7.13. StopCapture



7.14. Interrupt







8. Revision History

Revision	Date	Description
1.0	2023-10-16	First release

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