RL78 Family

DALI-2 Control Gear Library
User's Manual: Colour control (209Tc)

16-bit single chip microprocessor

Renesas Electronics
www.renesas.com

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General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Precaution against Electrostatic Discharge (ESD)

    A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

2. Processing at power-on

    The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

3. Input of signal during power-off state

    Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

4. Handling of unused pins

    Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

5. Clock signals

    After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

6. Voltage application waveform at input pin

    Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (Max.) and V_{IH} (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (Max.) and V_{IH} (Min.).

7. Prohibition of access to reserved addresses

    Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

8. Differences between products

    Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

How to Use This Manual

1. Purpose and Target Readers

This manual is intended for users who want to develop Control Gear for DALI systems with RL78 microcontrollers.

Basic knowledge of electrical circuits, logic circuits, and microcomputers is required to use this manual.

This manual is broadly categorized and consists of product overview, specifications, and usage instructions.

> Particular attention should be paid to the precautionary notes when using the manual. These notes occur within the body of the text, at the end of each section, and in the Usage Notes section.

> The revision history summarizes the locations of revisions and additions. It does not list all revisions. Refer to the text of the manual for details.

The following documents apply to the DALI Library. Make sure to refer to the latest versions of these documents. The newest versions of the documents listed may be obtained from the Renesas Electronics Web site.

Document Type	Description	Document Title	Document No.
User's Manual Hardware	Hardware specifications (pin layout, memory map, peripheral function specifications, electrical characteristics, timing) and operation description	RL78/I1A User's Manual Hardware	R01UH0169EJ0320
User's Manual Software	Description of CPU instruction set	RL78/I1A User's Manual Software	R01US0015EJ0220
Application note	How to use peripheral functions, application examples Reference programs How to create programs in C language	The information is available on the Renesas Electronics website.	
Renesas Technical Update	Breaking news on product specifications, documents, etc.		

2. Explanation of abbreviations

Abbreviation	English name	Remarks
DALI	Digital Addressable Lighing Interface	International Standard for Lighting Control
NVM	Non-Volatile Memory	Non-volatile memory

Table of Contents

1. DALI209 Library Overview

1.1 Overview of library features

This library is an extension library dedicated to the DALI102 library, which realizes processing of the hardware-independent part of the DALI102 standard as a library for the slave (Control Gear) in DALI communication.

For the specifications of the DALI102 library, refer to the DALI102 Library User's Manual.

This library provides the hardware-independent part of the specifications specified in IEC62386-209ed1.0 (hereinafter referred to as DALI209). It supports some of the colour control methods called " colour type" defined in the standard. The colour types supported by this library are listed below.

Table 1.1 Supported colour type

colour type	Supported by this library
xy-coordinate (hereafter, XY)	-
colour temperature Tc (hereafter, Tc)	✓
RGBWAF	-

colour type: Use this option if you want to use Tc to extend the colour control feature.

Table 1.2 Processing range

User creation processing	Library processing
・Colour control (Tc)	・Received 16-bit forward frame processing (partial) ・Transmitted backward frame issuance (partial) ・Timing control ・DALI variable manipulation

This library provides extensions to each logical unit defined using the DALI102 library. The extended logical units will automatically process DALI209 commands with the receive command processing functions provided by the DALI102 library.

There are various commands that can be specified in the 16-bit forward frame, such as DALI variable setting commands and DALI variable setting value acquisition commands. If it is necessary to change the settings on the application side, the application will be notified as necessary.

1.2 Software configuration

The Control Gear software configuration when using this library is shown below.
The part surrounded by the red line is this library. This library is assumed to be extended to the DALI102 library.
In addition, this library can be extended to the DALI207 library, which is released separately for the DALI102 library.
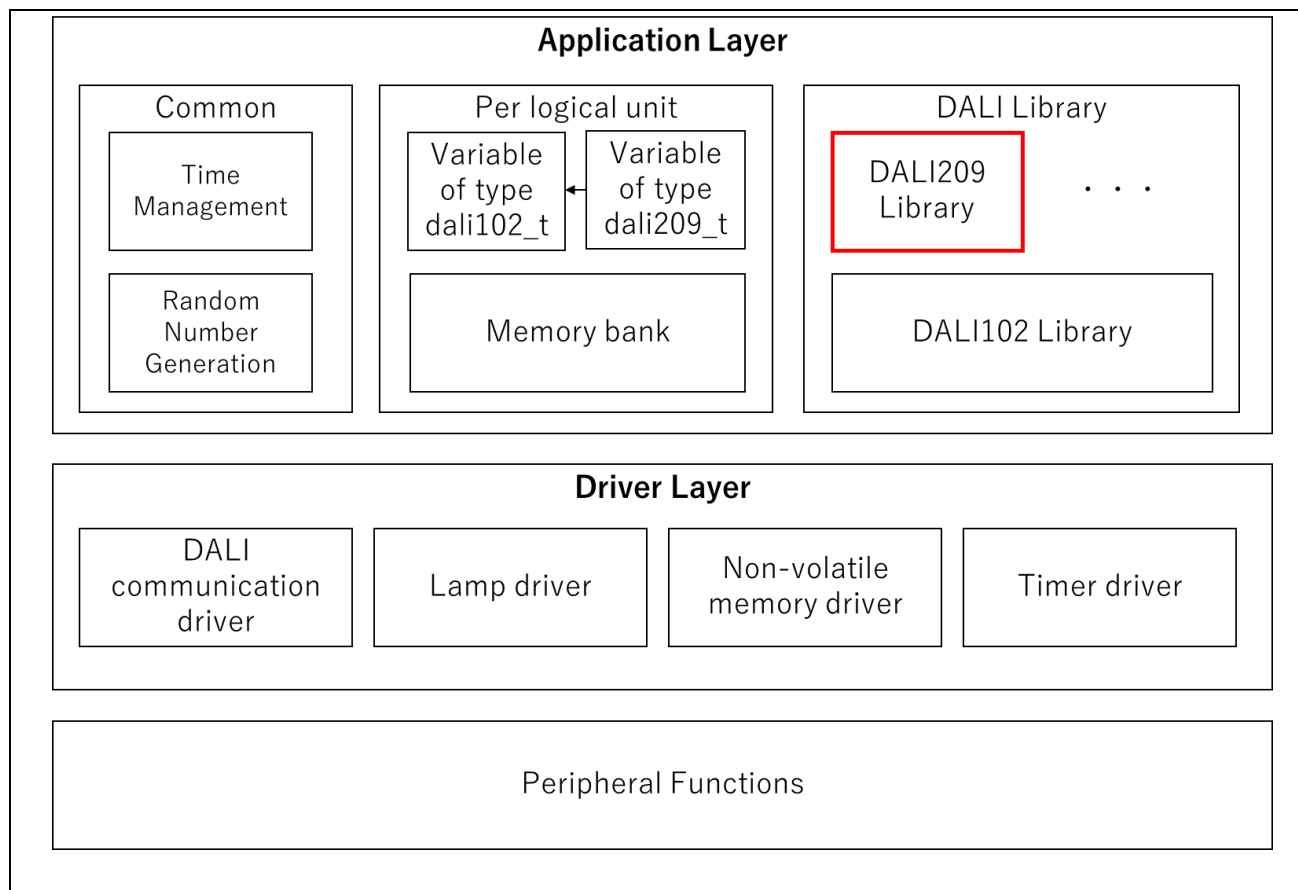
Figure 1.1 Control Gear software configuration diagram

1.3 Supported standard

The standards supported by this library are as follows.

Table 1.3 Supported standard and library name

Supported standard	Compiler	Library name
IEC62386-209Edition 1.0	Renesas CC-RL V1.10.00	r_dali_209_cc_gen2_v1_00.lib
	IAR C/C++ Compiler for Renesas RL78 V4.21.2.2420	r_dali_209_iar_gen2_v1_00.a

1.4 File list

The list of files provided by this library is described below.

Table 1.4 File list

File name	Description
r_dali_209_cc_gen2_v1_00.lib	CC-RL version library file
r_dali_209_iar_gen2_v1_00.a	IAR version library file
r_dali209_api.h	Library header file
r_dali209_common.h	Definition header file used in multiple modules
r_dali209_fade.h	Definition header file for fade module
r_dali209_var.h	Definition header file for variable modules

1.5 Resource

The library resources (ROM/RAM size and maximum stack size) required by this library are shown below. Table 1.5 Library resource(fixed)lists resources that do not depend on Control Gear implementation content, and Table 1.6 Library resource(variable) lists resources that do not depend on Control Gear implementation content.

Table 1.5 Library resource(fixed)

Compiler	Item		Size
CC-RL	Library resource	ROM size	11,235 [bytes]
		RAM size	0 [byte]
	Maximum stack size		128 [bytes] (R_DALI209_Fading function)
IAR	Library resource	ROM size	14,259 [bytes]
		RAM size	0 [byte]
	Maximum stack size		148 [bytes] (R_DALI209_Fading function)

Table 1.6 Library resource(variable)

Compiler	Item	Size
CC-RL	dali209_t	266 [bytes / logical unit]
IAR	dali209_t	266 [bytes / logical unit]

1.6 Development environment

The environment when developing this library is described below.

Table 1.7 Library development environment

Compiler	Item	Description
CC-RL	Integrated development environment	e2studio V2021-04
	C compiler	Renesas CC-RL V1.10.00
	CPU core	RL78-S2 core
	Optimization level	Code size precedence
	Language standard	GNU ISO C99
IAR	Integrated development environment	IAR Embedded Workbench for Renesas RL78 V8.5.2.7561
	C compiler	IAR C/C++ Compiler For Renesas RL78 V4.21.3.2447
	CPU core	RL78-S2 core
	Optimization level	Code size precedence
	Language standard	GNU ISO C99

1.7 Notes

1. The API functions in this library are prohibited from being called by the interrupt handler in the user application.
2. The loop processing of programs containing this library should be able to run for less than 1 ms at maximum. An environment in which loop processing runs for more than 1 ms will not meet the DALI standard specifications.
   3. The dali209_t type structure is a reference-only structure.

2. **Programming environment**

The hardware and software environments required for users to perform Control Gear operations using this library are described in this section.

Only the requirements that are required in addition to those in the DALI102 library are described.

2.1 Hardware requirement

2.1.1 Dimming/colour control circuit

As a dimming/colour control circuit, a control circuit is required that can dim the lamp and control the colour by Tc.

2.2 Software requirement

2.2.1 DALI209 Module Definition

A unit of a logical Bus unit (corresponding to Control Gear in this document) defined in one piece of hardware is called a logical unit. This library provides a structure (dali209_t) that summarizes the parameters necessary to extend the DALI209 standard for the DALI102 module provided by the DALI102 library. A dali209_t type variable is called a DALI209 module.

Please define DALI209 modules for the number of logical units that need to be extended by DALI209.

2.2.2 Dimming/Colour control processing

Reflect the colour obtained by the R_DALI209_GetActualColourValueTc function to the lamps with the dimming rate indicated by the actual level obtained by the R_DALI102_GetActualLevel function of the DALI102 library.

3. DALI209 library feature

The features of this library are described below.

3.1 Definition of data types and return values

The data types provided by this library are described below.

Table 3.1 List of data types

Type	Description
dali209_t	DALI209 module type

The definition macros provided by this library are described below.

Table 3.2 List of colour type

Macro name	Macro value	Description
DALI209_COLOUR_TYPE_XY	0x10	colour type : XY
DALI209_COLOUR_TYPE_TC	0x20	colour type : Tc
DALI209_COLOUR_TYPE_RGBWAF	0x80	colour type : RGBWAF

Table 3.3 List of active colour space

Macro name	Macro value	Description
DALI209_ACTIVE_COLOUR_SPACE_XY	0x10	active colour type: XY
DALI209_ACTIVE_COLOUR_SPACE_TC	0x20	active colour type: Tc
DALI209_ACTIVE_COLOUR_SPACE_RGBWAF	0x80	active colour type: RGBWAF

Table 3.4 List of colour type features

Macro name	Macro value	Description
DALI209_COLOUR_TYPE_FEATURES _XY_CAPABLE	0x01	colour type: XY capable
DALI209_COLOUR_TYPE_FEATURES _TC_CAPABLE	0x02	colour type: Tc capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_1CH	0x20	colour type: RGBWAF (1ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_2CH	0x40	colour type: RGBWAF (2ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_3CH	0x60	colour type: RGBWAF (3ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_4CH	0x80	colour type: RGBWAF (4ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_5CH	0xA0	colour type: RGBWAF (5ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_6CH	0xC0	colour type: RGBWAF (6ch) is capable

The return values provided by this library are described below.

Table 3.5 List of return value(dali209_return_t)

Definition	Return value	Description
DALI209_RETURN_OK	0	Normal end
DALI209_RETURN_ERR	1	Error end

3.2 List of structures

The structures provided by this library are described below.

Definition of the colour value type structure (dali209_default_t)

```
typdef struct
{
      uint16_t tc;
      uint16_t xy[DALI209_CHANNEL_NUMBER_XY];
      uint8_t rgbwaf[DALI209_CHANNEL_NUMBER_RGBWAF];
} dali209_colour_value_t;
```

Definition of the default value type structure (dali209_default_t)

```
typdef struct
{
    uint8_t colour_type_features;
    uint8_t power_on_colour_type;
    dali209_colour_value_t power_on_colour_value;
    uint8_t system_failure_colour_type;
    dali209_colour_value_t system_failure_colour_value;
    uint8_t rgbwaf_channels_present;
    uint8_t power_ratio;
    uint16_t colour_temperature_tc_physical_coolest;
    uint16_t colour_temperature_tc_physical_warmest;
    bool tc_physical_limits_read_only : 1;
} dali209_default_t;
```

Definition of the NVM variable type structure (dali209_nvm_t)

```
typdef struct
{
    uint8_t last_active_colour_type;
    dali209_colour_value_t last_active_colour_value;
    uint8_t scene_colour_type[SCENE_SIZE];
    dali209_colour_value_t scene_colour_value[SCENE_SIZE];
    uint8_t power_on_colour_type;
    dali209_colour_value_t power_on_colour_value;
    uint8_t system_failure_colour_type;
    dali209_colour_value_t system_failure_colour_value;
    uint16_t colour_temperature_tc_coolest;
    uint16_t colour_temperature_tc_warmest;
    uint16_t colour_temperature_tc_physical_coolest;
    uint16_t colour_temperature_tc_physical_warmest;
    uint8_t colour_temperature_tc_step_increment;
    uint8_t enabled_channels;
} dali209_nvm_t;
```

3.3 List of API Functions

The API functions of this library are described below.

Table 3.6 List of API functions

Function name	Description
R_DALI209_InitLibrary	Initialize the DALI209 library
R_DALI209_InitLogicalUnit	Initialize the logical unit
R_DALI209_NvmIsValid	Check NVM variable values within valid range
R_DALI209_SetNvm	Set the NVM variable value
R_DALI209_GetNvm	Get the NVM variable value
R_DALI209_NvmIsChanged	Check for NVM variable value change
R_DALI209_GetActiveColourSpace	Get active colour space
R_DALI209_GetActualColourValueTc	Get actual colour value (Tc)
R_DALI209_GetLibraryVersion	Get library version

3.4 Schematic flowchart

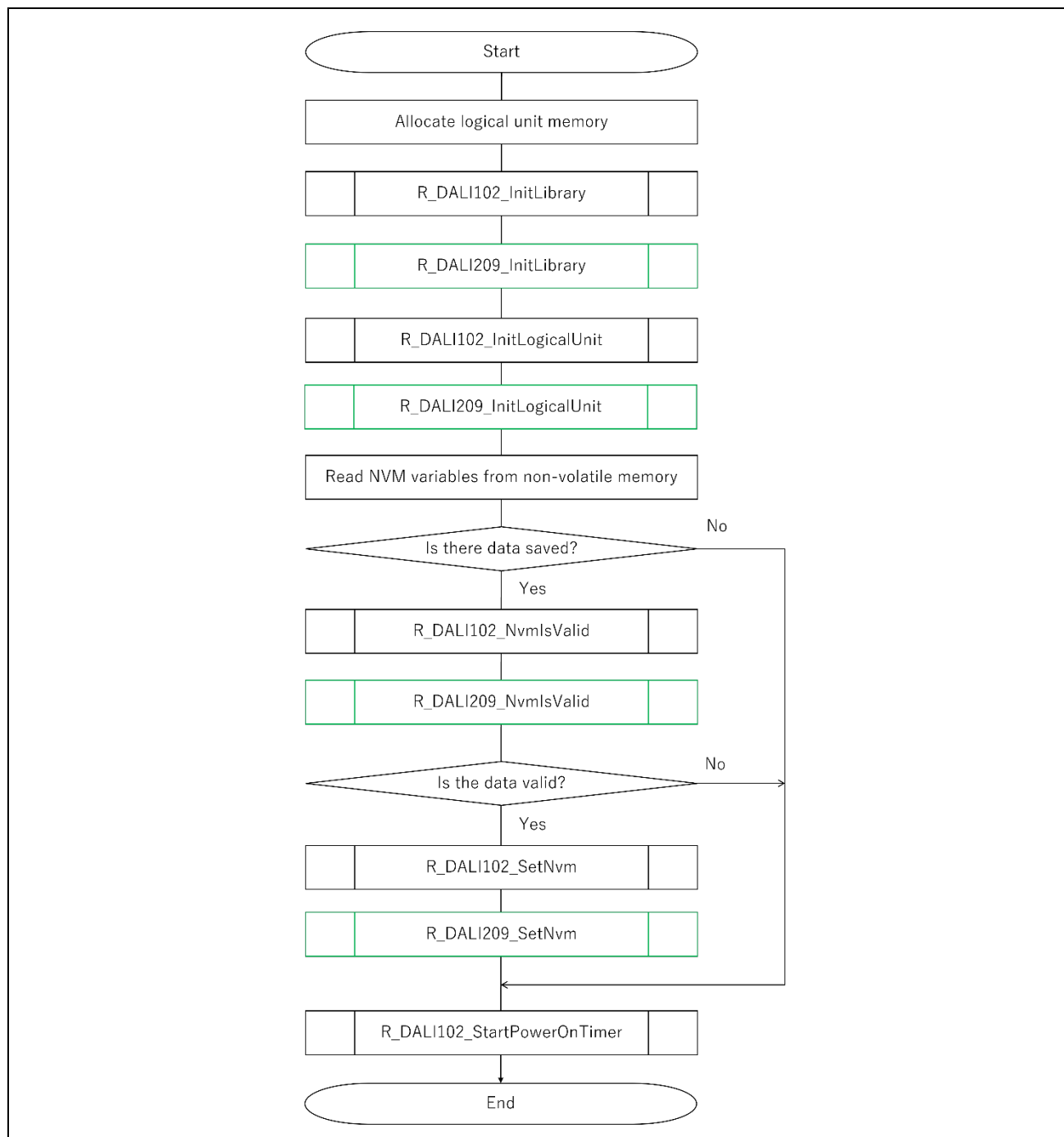In addition to the environment for using the DALI102 library, the flow chart for using this library is described below.
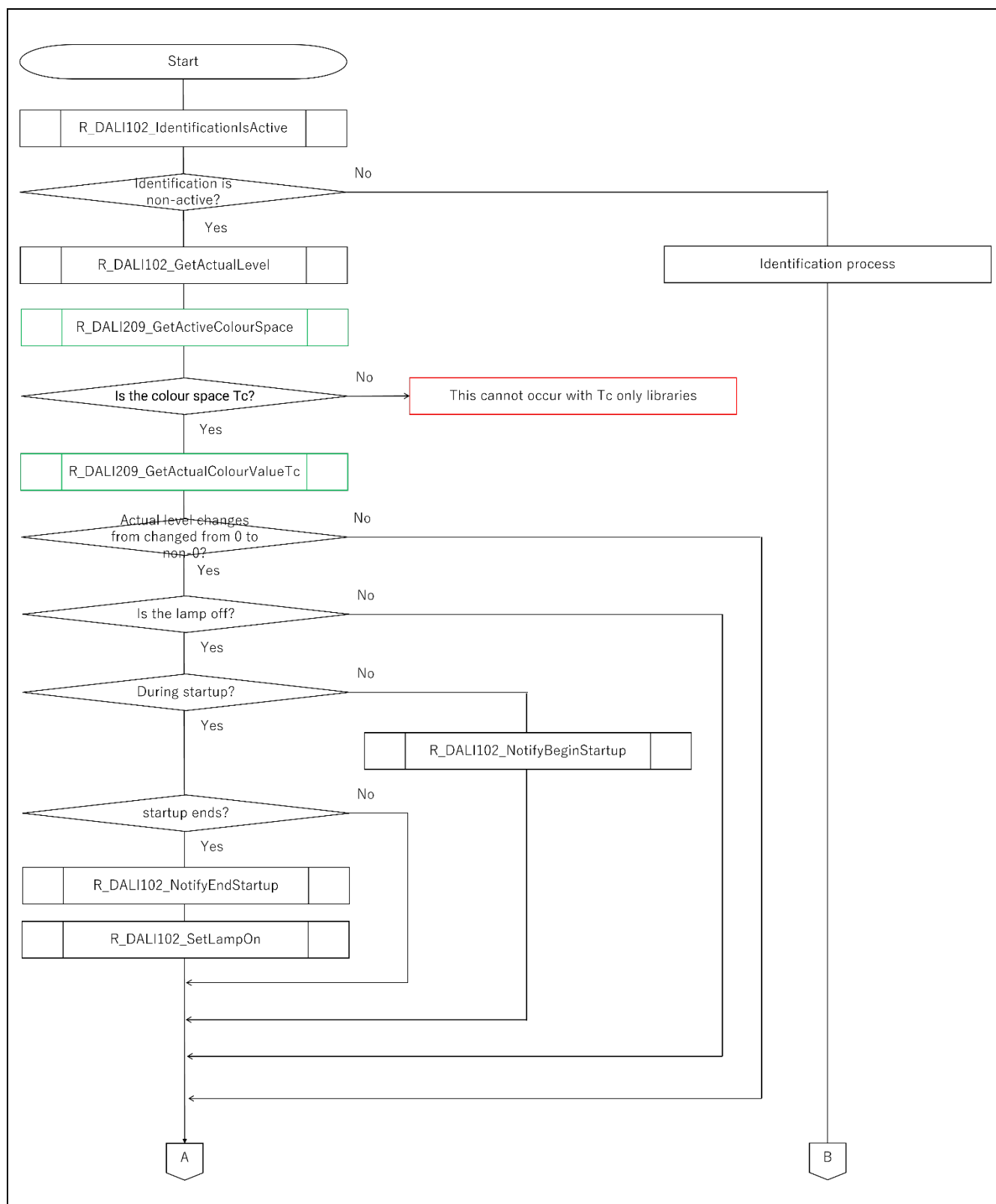The functions in the green boxes on the flowchart indicate the API functions of this library.
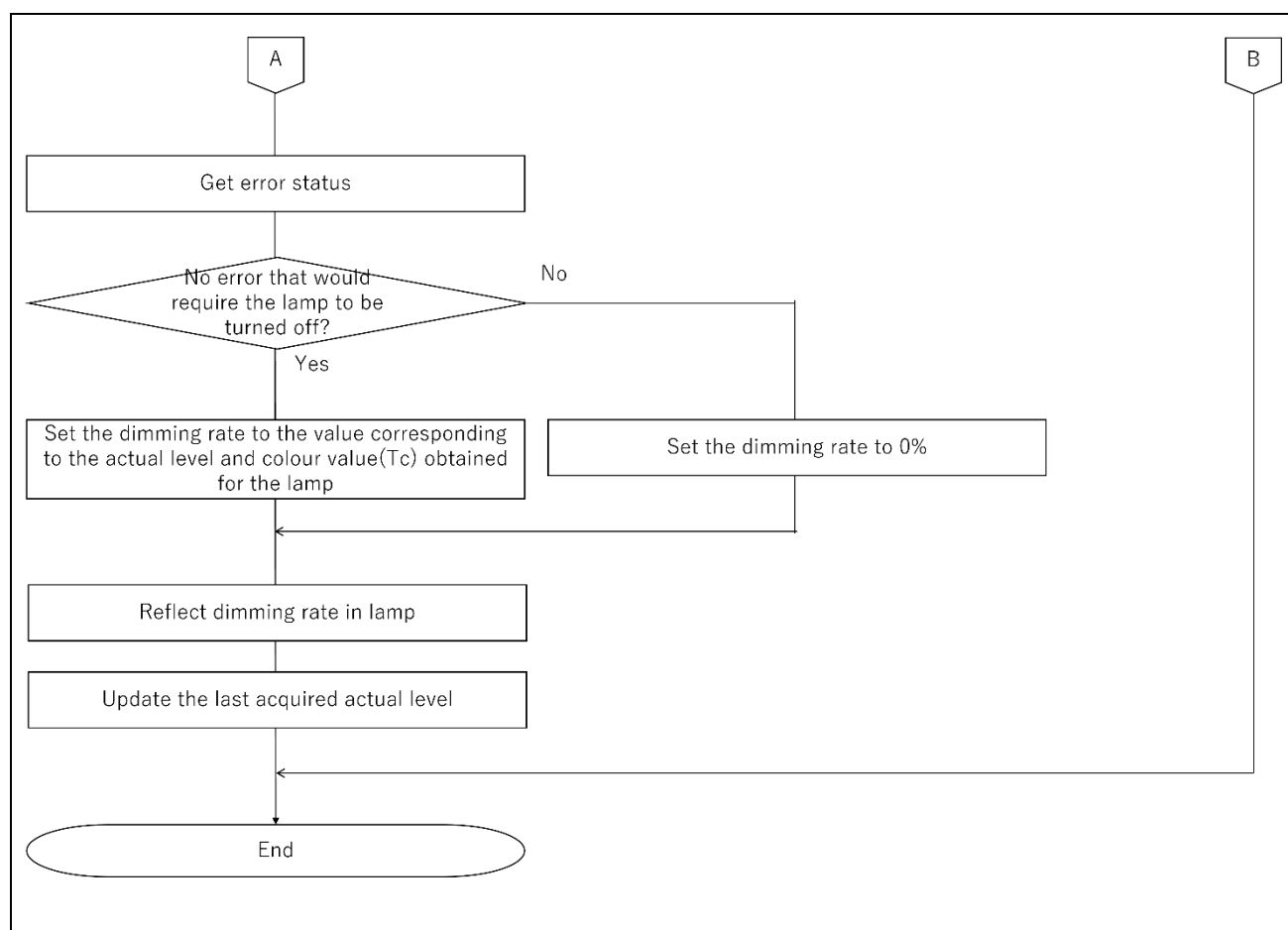
3.4.1 Initialization

The initialization flow is described below.

3.4.2 Dimming processing

This section describes the flow of the dimming process. Perform the process periodically.

```
                    ┌─────┐                    RENESAS                              ┌─────┐
                    │  A  │                                                         │  B  │
                    └──┬──┘                                                         └──┬──┘
                       │                                                               │
          ┌────────────┴────────────┐                                                  │
          │      Get error status   │                                                  │
          └────────────┬────────────┘                                                  │
                       │                                                               │
                  ╱────┴────╲                                                          │
                 ╱ No error   ╲          No                                            │
                ╱  that would   ╲──────────────────┐                                   │
                ╲ require the lamp╱                 │                                   │
                 ╲ to be turned off?╱               │                                   │
                  ╲────┬────╱                       │                                   │
                       │ Yes                        │                                   │
   ┌───────────────────┴──────────────┐   ┌─────────┴──────────────────────┐           │
   │ Set the dimming rate to the value│   │  Set the dimming rate to 0%    │           │
   │ corresponding to the actual level│   │                                │           │
   │ and colour value(Tc) obtained    │   │                                │           │
   │ for the lamp                     │   │                                │           │
   └───────────────────┬──────────────┘   └─────────┬──────────────────────┘           │
                       │◄─────────────────────────────┘                                 │
   ┌───────────────────┴──────────────┐                                                │
   │   Reflect dimming rate in lamp   │                                                │
   └───────────────────┬──────────────┘                                                │
   ┌───────────────────┴──────────────┐                                                │
   │ Update the last acquired actual  │                                                │
   │           level                  │                                                │
   └───────────────────┬──────────────┘                                                │
                       │◄───────────────────────────────────────────────────────────────┘
                  ╭────┴────╮
                  │   End   │
                  ╰─────────╯
```

3.4.3 Non-volatile Data Processing

This section describes the flow of non-volatile data processing.
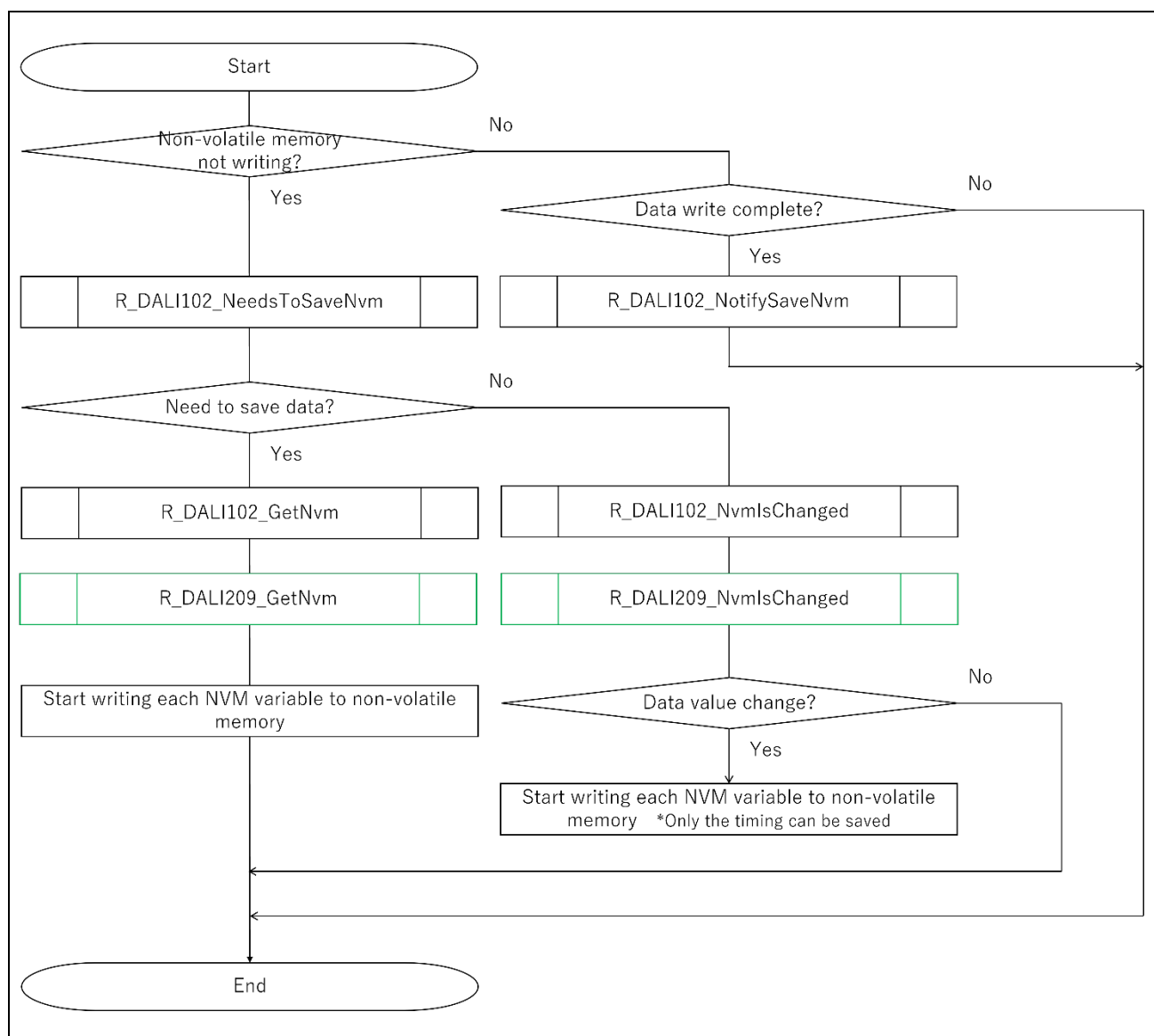
3.5 API Function Specifications

The API function specifications for this library are listed below.

3.5.1.1 R_DALI209_InitLibrary

[Overview]

Initializes the DALI209 library.

[Format]

void R_DALI209_InitLibrary (void)

[Prerequisite]

1. R_DALI102_InitLibrary function must have ended normally.

[Arguments]

None

[Return values]

None

3.5.1.2 R_DALI209_InitLogicalUnit

[Overview]

Initializes the specified logical unit.

Specify and call the Dali102 module of the logical unit to be extended by DALI209.

[Format]

dali209_return_t R_DALI209_InitLogicalUnit (dali209_t * p_this,
          dali102_t * p_dali102,
          const dali209_default_t * p_default_value)

[Prerequisite]

1. R_DALI102_InitLibrary function must have ended normally.
2. R_DALI209_InitLibrary function must have ended normally.
3. R_DALI102_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
dali209_t * p_this	Pointer to DALI209 module
dali102_t * p_dali102	Pointer to DALI102 module

const dali209_default_t *
   p_default_value
	factory burn-in default value
	   Refer to the next section for the valid range.

[Return values]

Value	Description
DALI209_RETURN_OK	Normal end
DALI209_RETURN_ERR	Parameter error - Review the argument settings.

(1) **Set the colour_type_features parameter**

Set the colour type that is met by this library with the following parameters.

If multiple types are supported, the parameter can be a logical OR of the ones that meet the requirement.

* Note that the only coluor type supported by this library is Tc, and the valid range is only

DALI209_COLOUR_TYPE_FEATURES_TC_CAPABLE.

Parameter	Content
DALI209_COLOUR_TYPE_FEATURES_XY_CAPABLE	colour type: XY capable
DALI209_COLOUR_TYPE_FEATURES_TC_CAPABLE	colour type: Tc capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_1CH	colour type: RGBWAF (1ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_2CH	colour type: RGBWAF (2ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_3CH	colour type: RGBWAF (3ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_4CH	colour type: RGBWAF (4ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_5CH	colour type: RGBWAF (5ch) is capable
DALI209_COLOUR_TYPE_FEATURES _RGBWAF_CAPABLE_6CH	colour type: RGBWAF (6ch) is capable

(2) **Set the power on colour type / power on colour value**

Specify the colour type and colour value at power-on. The valid range of each variable is as follows.

・power on colour type: DALI209_COLOUR_TYPE_TC

・power_on_colour_value.tc: 0x0000 to 0xFFFF

* Do not set any value to the xy member or the rgbwaf member.

(3) **Set the system failure colour type / system failure colour value**

Specify the colour type and colour value when system failure is detected. The valid range of each variable is as follows.

・system_failure_colour type: DALI209_COLOUR_TYPE_TC

・system_failure_colour_value.tc: 0x0000 to 0xFFFF

* Do not set any value to the xy member or the rgbwaf member.

(4) **Set the rgbwaf_channels_presents**

This variable is used to set the channel that is valid when colour type is RGBWAF.

This library does not support colour type: RGBWAF, so set it to 0.

(5) **Set the power_ratiio**

This variable is used to set the light output when colour type: RGBWAF is used.
This library does not support colour type: RGBWAF, so set it to 0xFF.

(6) **Set the colour_temperature_tc_physical_coolest**

When colour type: Tc, set the physical minimum value of the colour temperature [mirek].
The valid range is from 1 to colour _temperature_tc_physical_warmest, or 0xFFFF.
If the value of this variable is 0xFFFF, it indicates that the physical minimum value of the colour temperature
has not been calibrated. To ensure normal operation, set the tc_physical_limits_read_only parameter
described below to false, and set the calibrated value using the appropriate DALI command from the
Application Controller before operation.

(7) **Set the colour_temperature_tc_physical_warmest**

When colour type: Tc, set the physical maximum value of colour temperature [mirek].
The valid range is colour_temperature_tc_physical_coolest to 0xFFFE or 0xFFFF.
If the value of this variable is 0xFFFF, it indicates that the physical minimum value of the colour temperature
has not been calibrated. To ensure normal operation, set the tc_physical_limits_read_only parameter
described below to false, and set the calibrated value using the appropriate DALI command from the
Application Controller before operation.

(8) **Set the tc_physical_limits_read_only**

Set whether the variable values of colour_temperature_tc_physical_coolest and
colour_temperature_tc_physical_warmest should be read-only or not. Valid ranges are true and false.
If the setting value of at least colour_temperature_tc_physical_coolest or
colour_temperature_tc_physical_warmest is 0xFFFF, it indicates that it is not calibrated. Set this parameter
to false, and then set the calibrated value using the appropriate DALI command from the Application
Controller before operation.

3.5.1.3 R_DALI209_NvmIsValid

[Overview]

Returns whether or not all the values set in the members of the dali209_nvm_t type variable are within the valid range.

Be sure to call the aforementioned R_DALI209_SetNvm function to check before setting the values.

[Format]

```
bool R_DALI209_NvmIsValid ( const dali209_t * p_this,
                            const dali209_nvm_t * p_nvm )
```

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
const dali209_t * p_this	Pointer to DALI209 module

const dali209_nvm_t * p_nvm	Pointer to NVM variable for DALI209 module
	Valid range:
	  - last_active_colour_type : 0x10, 0x20, 0x40, 0xFF
	  - last_active_colour_value.tc : 0x0000 to 0xFFFF
	  - power_on_colour_type : 0x10, 0x20, 0x40
	  - power_on_colour_value.tc : 0x0000 to 0xFFFF
	  - system_failure_colour_type : 0x10, 0x20, 0x40
	  - system_failure_colour_value.tc : 0x0000 to 0xFFFF
	  - scene_colour_type : 0x10, 0x20, 0x40, 0xFF
	  - scene_colour_value.tc : 0x0000 to 0xFFFF
	  - colour_temperature_tc_coolest :
	    colour_temperature_tc_physical_coolest to
	    colour_temperature_tc_warmest, 0xFFFF
	  - colour_tempearture_tc_warmest :
	    colour_temperature_tc_coolest to
	    colour_temperature_tc_physical_warmest, 0xFFFF
	  - colour_temperature_tc_physical_coolest :
	    0x0001 to colour_temperature_tc_physical_warmest, 0xFFFF
	  - colour_tempearture_tc_physical_warmest :
	    colour_temperature_tc_physical_coolest to 0xFFFE, 0xFFFF
	  - colour_temperature_tc_step_increment : 0x01 to 0x64
	  - enabled_channels : 0x01 to 0x3F

[Return values]

Value	Description
true	All variables are within the valid range
false	At least one variable is outside the valid range

3.5.1.4 R_DALI209_SetNvm

[Overview]

Sets the NVM variable value in the DALI209 module.

Use this function to set the read data when the NVM variable data is stored in the non-volatile memory at power-on.

[Format]

```
void R_DALI209_SetNvm ( dali209_t * p_this,
                        const dali209_nvm_t * p_nvm )
```

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.
3. Make sure that the NVM variable is within the valid range in the R_DALI209_NvmIsValid function.

[Arguments]

Argument	Description
dali209_t * p_this	Pointer to DALI209 module
const dali209_nvm_t * p_nvm	Pointer to NVM variable for DALI209 module

[Return values]

None

3.5.1.5 R_DALI209_GetNvm

[Overview]

Gets the value of the NVM variable setting from the DALI209 module.

Use this function to store the latest NVM variable values in non-volatile memory.

[Format]

```
void R_DALI209_GetNvm (const dali209_t * p_this,
                        dali209_nvm_t * p_nvm )
```

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
const dali209_t * p_this	Pointer to DALI209 module
dali209_nvm_t * p_nvm	Pointer to NVM variable for DALI209 module

[Return values]

None

3.5.1.6 R_DALI209_NvmIsChanged

[Overview]

Gets whether there has been a change in at least one NVM variable value.

If the return value of this function is true, save the NVM variable to the non-volatile memory according to the hardware status.

The state that can be acquired by this function is the target from the time when this function was called last time (when it was called for the first time, when it was started).

[Format]

bool R_DALI209_NvmIsChanged (dali209_t * p_this)

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
dali209_t * p_this	Pointer to DALI209 module

[Return values]

Value	Description
true	Value change
false	No value change

3.5.1.7 **R_DALI209_GetActiveColourSpace**

[Overview]

Gets the colour space in which a valid colour value exists.

Call the function to get the actual colour value corresponding to the colour space gotten by this function and use it as the colour tone value.

[Format]

uint8_t R_DALI209_GetActiveColourSpace (const dali209_t * p_this)

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
const dali209_t * p_this	Pointer to DALI209 module

[Return values]

Value	Description
DALI209_ACTIVE_COLOUR_SPACE_TC	A valid coluor exists on colour space: Tc
DALI209_ACTIVE_COLOUR_SPACE_XY	A valid coluor exists on colour space: XY
DALI209_ACTIVE_COLOUR_SPACE_RGBWAF	A valid coluor exists on colour space: RGBWAF

3.5.1.8 R_DALI209_GetActualColourValueTc

[Overview]

Gets the active colour value on the colour space: Tc.

Call this function when the return value of R_DALI209_GetActiveColourSpace function is
DALI209_ACTIVE_COLOUR_SPACE_TC.

[Format]

> uint16_t R_DALI209_GetActualColourValueTc (const dali209_t * p_this)

[Prerequisite]

1. R_DALI209_InitLibrary function must have ended normally.
2. R_DALI209_InitLogicalUnit function must have ended normally.

[Arguments]

Argument	Description
const dali209_t * p_this	Pointer to DALI209 module

[Return values]

Value	Description
0x0001 to 0xFFFE	colour type: Tc colour value [Unit: Mirek] $$Mirek = \frac{1,000,000}{T[K]}$$

3.5.1.9 R_DALI209_GetLibraryVersion

[Overview]

Gets the version number of this library.

[Format]

uint16_t R_DALI209_GetLibraryVersion (void)

[Prerequisite]

None

[Arguments]

None

[Return values]

Value	Description

uint16_t	Version number (format: 0xXXYY)
	  XX: Major version
	  YY: Minor version

Revision History	RL78 Family Control Gear Library User's Manual: Colour control (209Tc)

Rev.	Date	Description	
		Page	**Summary**
1.00	15th, Jun., 22	—	First Edition issued
1.01	1st, Nov., 22	—	Correct wrong description, Changed resource expression.

RL78 Family