User's Manual

Applilet® EZ for HCD Controller

For Ver.9.00

User's Manual

Renesas Electronics
www.renesas.com

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(2012.4)

How to Use This Manual

Readers

This manual is intended for user engineers who want to understand the features of the RL78/I1A in order to design and develop its application systems and programs.

Purpose

This manual is intended to give users an understanding how to use Applilet EZ for HCD Controller and of the features described in the Organization below.

Organization

This manual is broadly divided into the following parts.

- Overview
- Installation
- Starting and Ending
- Applilet EZ for HCD Controller operation
- Windows reference

How to Use This Manual

It is assumed that the readers of this manual have general knowledge of electrical engineering, logic circuits, and microcontrollers.

To understand the overall features of Applilet EZ for HCD Controller

→Read this manual in the order of the CONTENTS. The mark "<R>" shows major revised points. The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

To learn the details of the hardware features of the RL78/I1A

→Refer to RL78/I1A User's Manual (R01UH0169E).

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Active low representation:	$\overline{xxx}$ (overscore over pin or signal name)
Note:	Footnote for item marked with Note in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numerical representation:	Binary ... xxxx or xxxxB
	Decimal ... xxxx
	Hexadecimal ... xxxxH

Related Documents

The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to Devices

Document Name	Document No.	
	Japanese	English
RL78/I1A User's Manual; Hardware	R01UH0169J	R01UH0169E

Documents Related to Development Hardware Tools

Document Name	Document No.	
	Japanese	English
RL78/I1A DC/DC LED Control Evaluation Board User's Manual	R01UH0363J	R01UH0363E

Documents Related to Development Software Tools

Document Name		Document No.	
		Japanese	English
CubeSuite+ V.2.02.00 User's Manual	Start	R20UT2865J	R20UT2865E
	Analysis	R20UT2868J	R20UT2868E
	Message	R20UT2871J	R20UT2871E
	RL78 Design	R20UT2684J	R20UT2684E
	RL78, 78K0R Coding	R20UT2774J	R20UT2774E
	RL78, 78K0R Build	R20UT2623J	R20UT2623E
	RL78 Debug	R20UT2867J	R20UT2867E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document for designing.

CONTENTS

CHAPTER 1 OVERVIEW

1. 1 Overview

Applilet EZ for HCD Controller is a tool used to automatically generate software for microcontrollers for LED lamps and illumination and to write programs.

By specifying dimming and the communication mode on the GUI, Applilet EZ for HCD Controller can be used to easily generate the programs that control the software for microcontrollers that control LEDs at a constant current. It can also be used to automatically write the generated software to the flash memory in microcontrollers via a USB cable and to check operation by using an evaluation board.

By using Applilet EZ for HCD Controller, the labor hours for controlling LEDs, developing communication software, and checking operation can be significantly reduced. In addition, application systems for LED lamps and illumination that use microcontrollers can be evaluated without microcontroller expertise.

<Configuration example>

<R> **Caution** For DALI communication, it's possible to output source files at the time of IEC62386-102 ed1.0 standard selection.
The hex files are output at the time of IEC62386-102+207 ed1.0 and the IEC62386-102 ed2.0 standard selection.
For IEC62386-102+ 207 ed1.0 and IEC62386-102 ed2.0, a library is prepared separately.
For details, contact your local Renesas Electronics sales.

1. 2 Host Machine, Software, and Hardware Configurations

<R>

The host machine, software, and hardware configurations for using Applilet EZ for HCD Controller are shown below.

(1) Host machine

- OS: Windows 7 (32-/64-bit mode)
- CPU, Memory: Must satisfy the recommended requirements for each OS
- USB: USB 1.1 interface or later

(2) Software

- Applilet EZ for HCD Controller (this software)
- Software that can edit CSV files, such as Microsoft Excel®
- Assembler/compiler/integrated development environment/device file[Note 1]

<Renesas Electronics[Note 2]>

Integrated Development Environment: CubeSuite+ CA78K0R

<IAR Systems>

Integrated development environment: IAR Embedded Workbench

Compiler[Note 4]: IAR C/C++ Compiler for Renesas RL78

Assembler[Note 4]: IAR Assembler for Renesas RL78

Device file[Note 4]: DF-RL78I1A-EE_xxxxx[Note3]

<KPIT (GCC)>

Tool package: GNURL78[Note5]

- Renesas Flash Programmer

…… Software for flash memory programming

- Board driver

…… Driver used to make the host PC recognize the evaluation board (RL78/I1A AC/DC Full digital 3ch LED control unit, etc.)

(3) Hardware

- Evaluation board

RL78/I1A DCDC LED Control Evaluation Board

…… This is an evaluation board for LEDs that uses the RL78/I1A. Red, green, and blue LEDs are mounted on the board. The LEDs can be controlled by using the internal features of the L78/I1A and an FET without the constant-current driver IC.

RL78/I1A AC/DC Full digital 3ch LED control unit

…… This is an evaluation unit for the LED power source with the RL78/I1A implemented manufactured by Tessera Technology Inc. It can control the power factor correction circuit (PFC) and up to three channels of LED. Writing to the microcomputer and debugging are handled by using the on-board USB interface or E1.

RL78/I1A AC/DC 1 converter LED evaluation unit

…… This is an evaluation board for LED control by non-isolated 1 converter system that uses the RL78/I1A. Writing to the microcomputer and debugging are handled by using the on-board USB interface or E1.

RL78/I1A AC/DC 2 converter LED evaluation unit

…… This is an evaluation board for LED control by non-isolated 2 converter system that uses the RL78/I1A. Writing to the microcomputer and debugging are handled by using the on-board USB interface or E1.

RL78/I1A Lighting Communication Master Evaluation Board

…… It is possible to use as a communication master board for controlling various lighting evaluation board. Each interface of DALI protocol communication, DMX512 protocol communication and infrared remote control are supported. In addition, the communication only by the switch operation on the master board is also possible.

Notes1. The supported development environment differs depending on the OS used.

2. When using a software tool manufactured by Renesas Electronics, software can be automatically generated using Applilet EZ for HCD Controller without installing a device file.
3. "xxxx" indicates the version.
4. Applilet EZ for HCD may not operate depending on the versions of the complier, assembler, and device file.
5. Use e2studio manufactured by Renesas as the integrated development environment for GNURL78.

Cautions1. It is recommended that the latest service pack be installed for any OS.

2. Applilet EZ for HCD Controller requires the compiler, assembler, or integrated development environment and device file of an Renesas Electronics or IAR Systems product.

Remarks1. For details about how to obtain compilers, assemblers, integrated development environments, and device files, contact your local Renesas Electronics sales representative.

2. For details of the evaluation boards, refer to each user's manual.

CHAPTER 2 INSTALLATION

2. 1 Installing Application

<R>

The following applications must be installed to use Applilet EZ for HCD Controller.

- Microsoft .NET Framework 4.5 or later
- Microsoft Visual Studio 2013 Visual C++ Redistributable Package
- Applilet EZ for HCD Controller
- Compiler, assembler, or integrated development environment and device file[Note 1]

Notes1. Install one of the following as the compiler, assembler, integrated development environment and device file. Install the device file according to the chip mounted on the evaluation board.

<Renesas Electronics>

Integrated development environment: CubeSuite CA78K0R

<IAR Systems>

Integrated development environment: IAR Embedded Workbench

Compiler: IAR C/C++ Compiler for Renesas RL78

Assembler: IAR Assembler for Renesas RL78

Device file: DF-RL78I1A-EE_xxxxx

<KPIT (GCC)>

Tool package: GNURL78

Remark For details about how to obtain compilers, assemblers, integrated development environments, and device files, contact your local Renesas Electronics sales representative.

<R>2. 1. 1 Installing .NET Framework

Install .NET Framework 4.5, which is required for using the Applilet EZ for HCD Controller.

(a) Download the required files

Download following files required for installation from the Microsoft website.

(1) .NET Framework 4.5Web installer

NDP452-KB2901954-Web.exe: Web installer

(When a web access is possible, use a Web installer. Using a web installer, Language Pack which matches the language of the OS is also installed.)

(2) .NET Framework 4.5 offline installer & Language pack installer

NDP452-KB2901907-x86-x64-ALLOS-ENU.exe: Offline installer

(When a web access is not possible, use an offline installer. Using an offline installer, Language Pack is not installed. For using in language other than English of Windows, install Language Pack after installing.NET Framework 4.5 by an offline installer.)

(b) Install .NET Framework

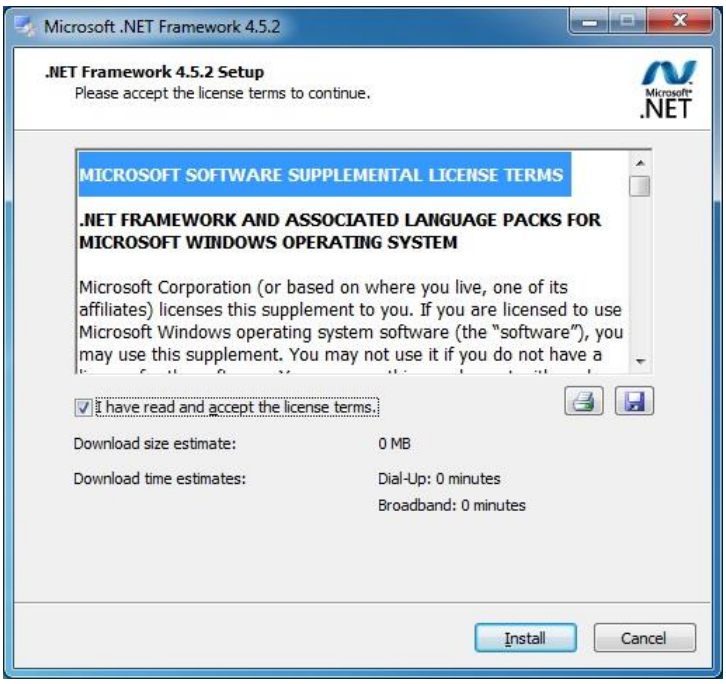
This step is described offline installation of .NET Framework 4.5.

It is necessary to install Language Pack separately from the .NET Framework 4.5 by the offline installation.

When "NDP452-KB2901907-x86-x64-ALLOS-ENU.exe" is double-clicked, "User Account Control" dialog box is displayed.

Click [Yes].

"Microsoft .NET Framework 4.5 Setup" dialog box is displayed.



After confirming the license terms, when agreeing, check "I have read and accept the license terms" and click [Install].

Proceed with the installation by following the instructions that will be displayed in the wizard window.

(c) Install Language pack

When using the language other than English of Windows, install the Language Pack.

<R> 2. 1. 2 Installing Visual C++ Redistributable Package

Install Visual C++ Redistributable Package, which is required for using the Applilet EZ for HCD Controller.

(a) Download the required files

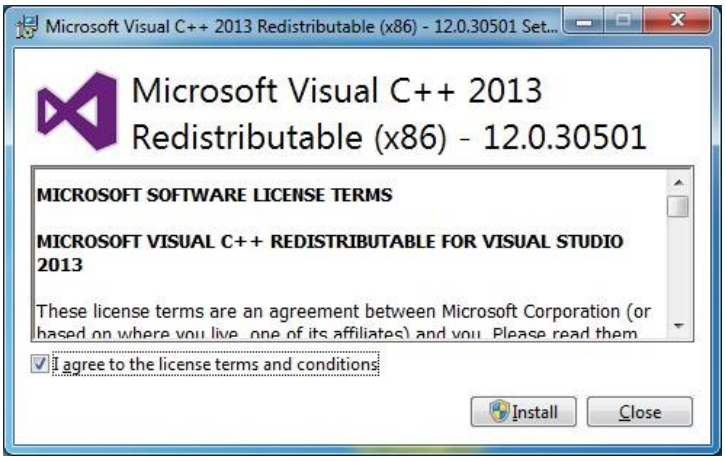
Download following files required for installation from the Microsoft website.

(1) Visual Studio 2013 Visual C++ Redistributable Package installer

Vcredist_x86.exe

(b) Install Visual C++ Redistributable Package

When "Vcredist_x86.exe" is double-clicked, "Visual C++ redistributable package Setup" dialog box is displayed.



After confirming the license terms, when agreeing, check "I agree to the license terms and conditions" and click [Install].

Proceed with the installation by following the instructions that will be displayed in the wizard window.

2. 1. 3 Installing Applilit EZ for HCD Controller

Double-click the AppEZHCD_V90J.msi file to start the installation wizard of Applilet EZ for HCD Controller.

Click the [Next] and proceed with the installation by following the instructions that will be displayed in the wizard window.

2. 1. 4 Installing compiler, assembler, or integrated development environment and device file

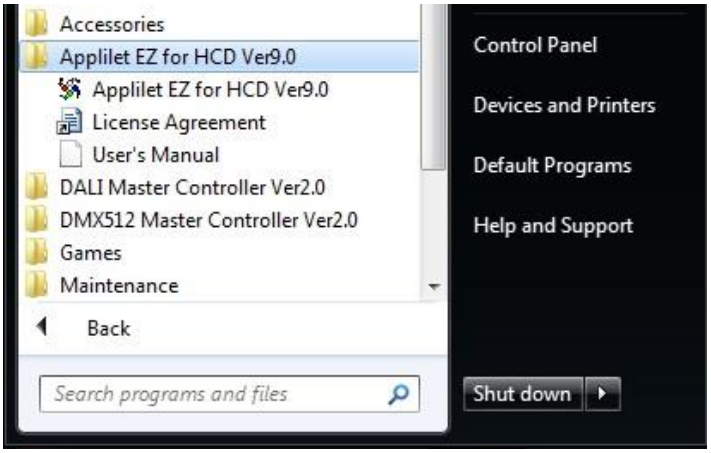
Install the compiler, assembler, or integrated development environment and device file according to each product manual.

Caution After installation, the compiler to be used must be selected. For details, refer to 3.1.1 (a)Setting up at the first startup and (B)Compiler setting.

2. 1. 5 Windows [start] menu and shortcut icon

When installing of the application has been completed normally, the following folder will be copied into the specified installation folder.

Figure2-1 Windows [start] Menu



The following shortcut icon is displayed on the Windows desktop.

Figure2-2 Shortcut Icon

2. 2 Installing USB Driver

USB driver is required when using an evaluation board. The USB driver for evaluation board is stated in the disk media provided or in an e-mail message.

The first time that the host machine is connected to the evaluation board via the bundled USB cable, Windows' [Found New Hardware Wizard] appears, prompting for installation of the USB driver.

Proceed with the installation by following the windows that will be displayed.

2. 3 Uninstall

To uninstall Applilet EZ for HCD Controller, C compiler, and assembler, go to the Windows Control Panel and select [Programs and Features] (in Windows 7).

CHAPTER 3 STARTING AND ENDING

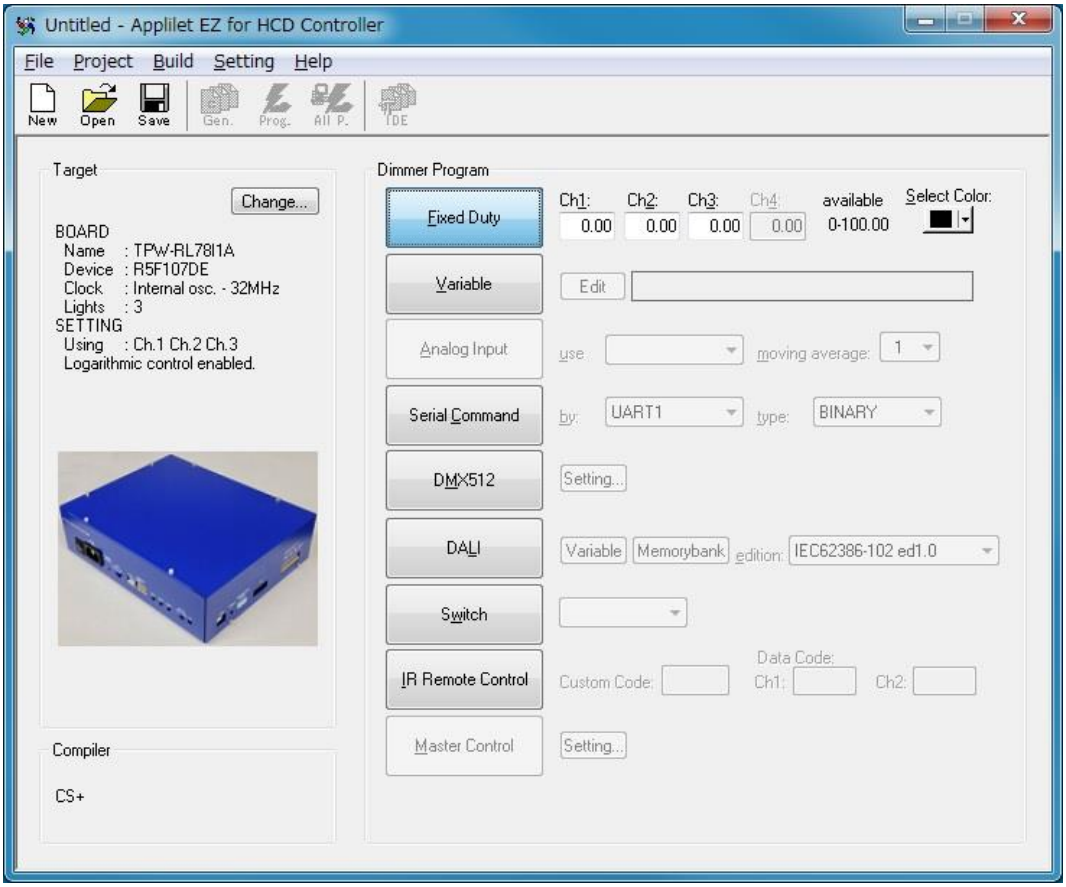
3. 1 Starting

<R>

To start Applilet EZ for HCD Controller, go to the Windows [start] Menu and select [All Programs] →[Programs] → [Applilet EZ for HCD Ver9.0] → [Applilet EZ for HCD Ver9.0] (refer to Figure2-2 Windows [start] Menu), or double click the shortcut icon on the Windows Desktop (refer to Figure2-3 Shortcut Icon).

Once Applilet EZ for HCD Controller is started, the following Main window opens.

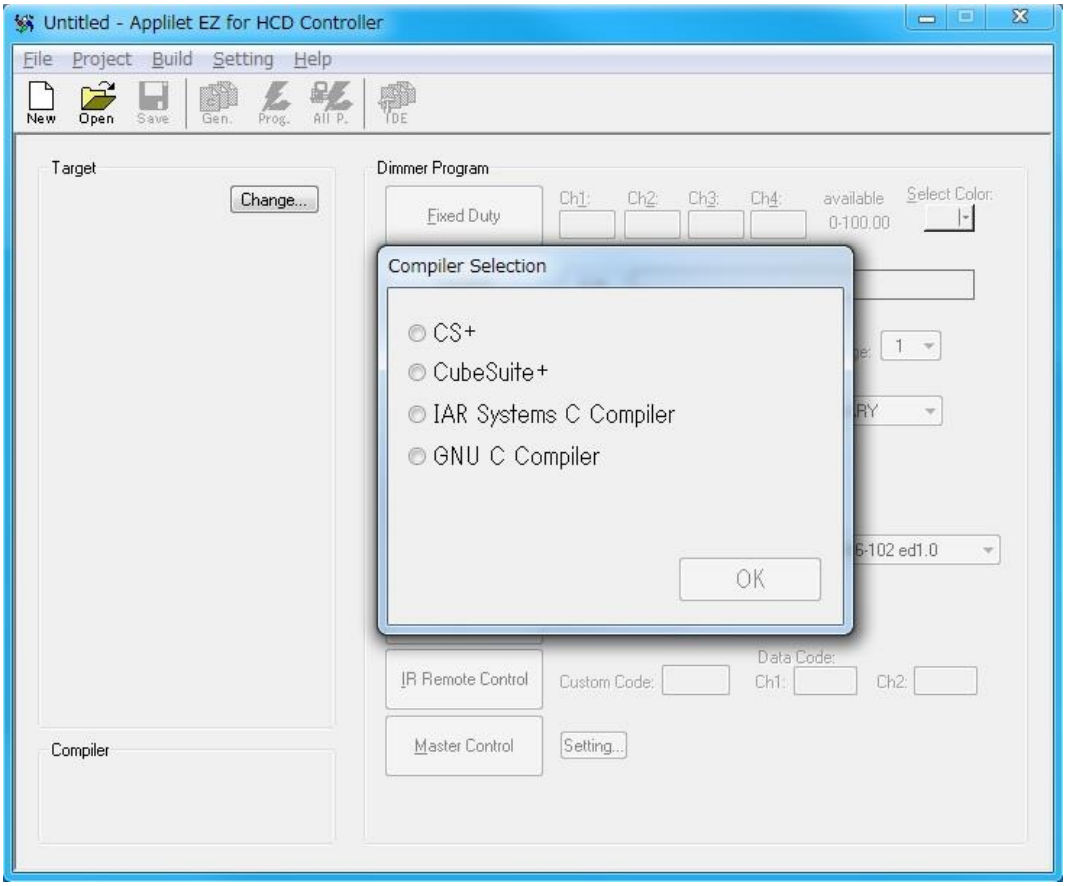
Figure3-1 Main Window When Starting



3. 1. 1 Setting up at the first startup

(a) Setting up at the first startup

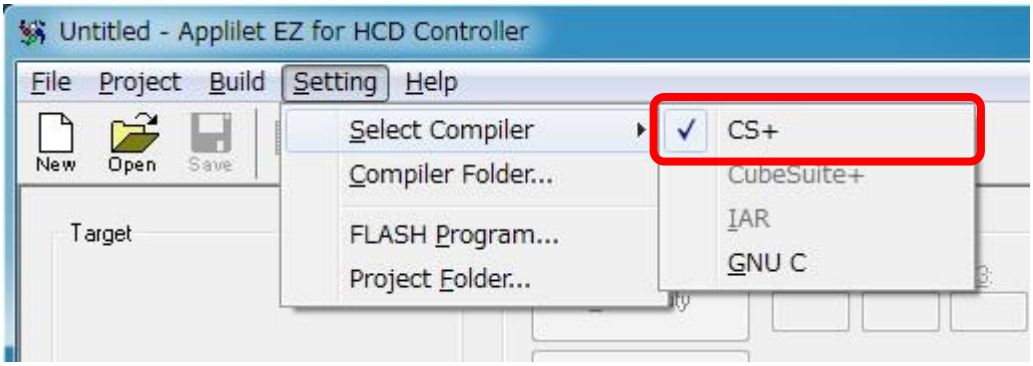
If starting Applilet EZ for HCD Controller for the first time after installation, the following window is displayed. Select the compiler to use from the compiler name that is displayed in the "Compiler Selection" window, click [OK].



(b) Compiler setting

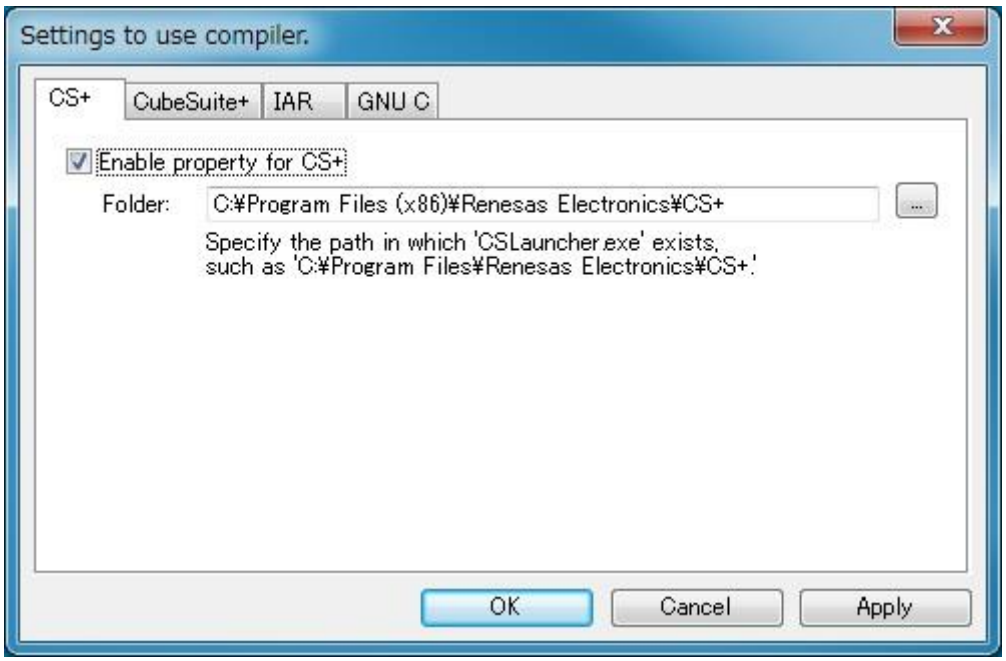
When changing the compiler, perform it as follows.

On [Setting] menu, select [Select Compiler], and then select the compiler name to be used.



(c) Compiler folder setting

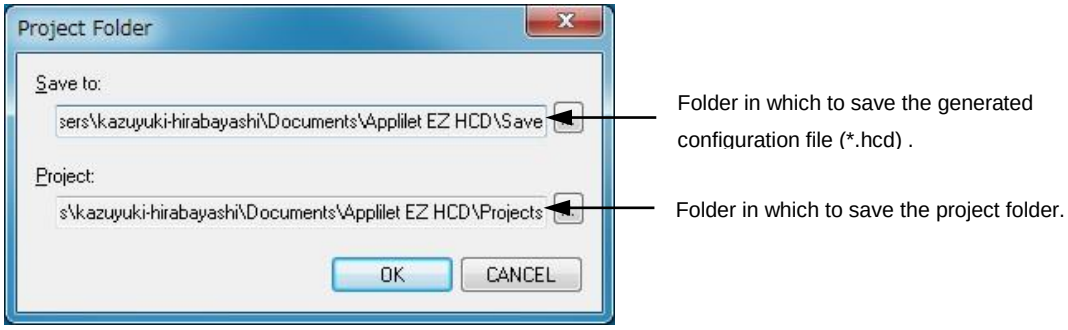
On the [Setting] menu, select [Compiler Folder] to specify the folder in which the compiler to be used is installed. Inputting the path is not usually required because the path is automatically retrieved. If the path is not automatically entered, enter it manually.



(d) Project folder setting

Specifying the folder in which to save the generated configuration file (*.hcd) and the project folder to create.

On the [Setting] menu, select [Project Folder]. The following dialog box will then be displayed.

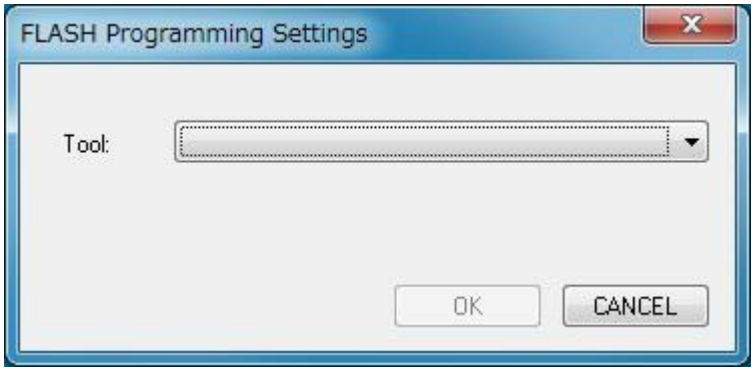


Change the location where the *. hcd and the project folder are saved as required.

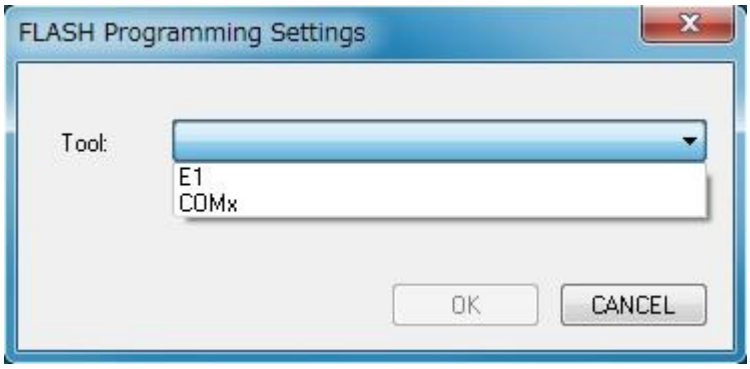
(e) Flash programming setting

The COM Port connected to the flash memory programmer or the board is specified here.

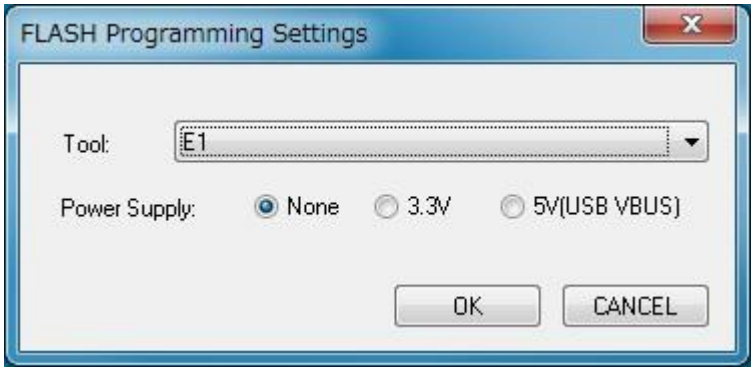
On the [Setting] menu, select [Flash Program…] .The following dialog box will be displayed.



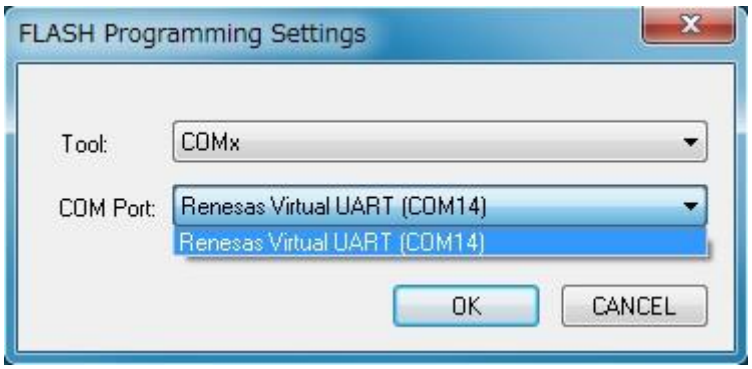
Select the connection method from the list box [Tool:].



When selecting [E1], the [Power supply:] item is displayed.



If not supplying power from the E1, sets the [None], and if supplying, set according to the input voltage of the board to be used.

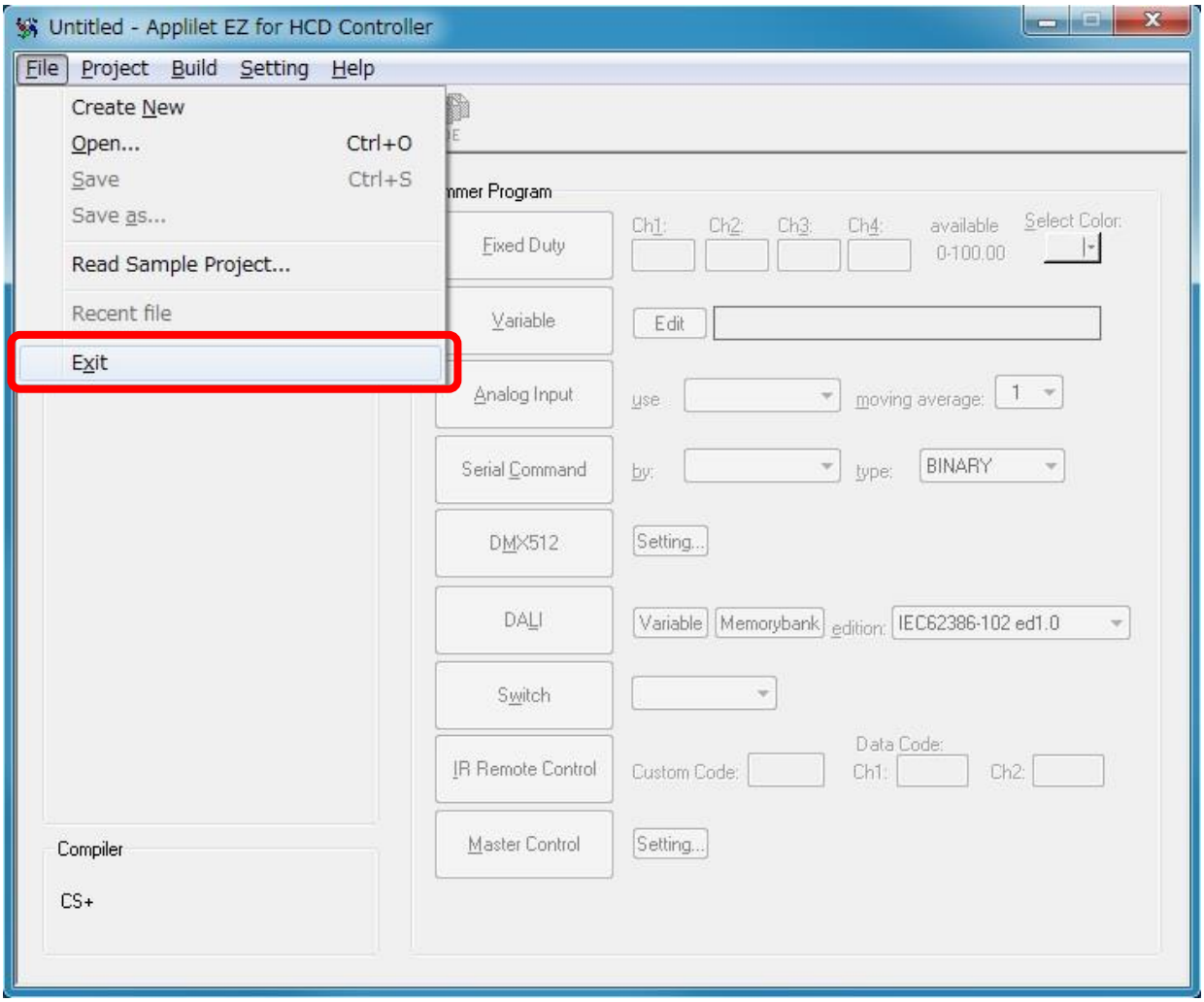


If selecting [COMx], [COM Port:] item is displayed.
COM port that is currently connected to the PC is displayed in the [COM Port] list. Select the COM port to be used.

If setting ends, click [OK].

3. 2 Ending

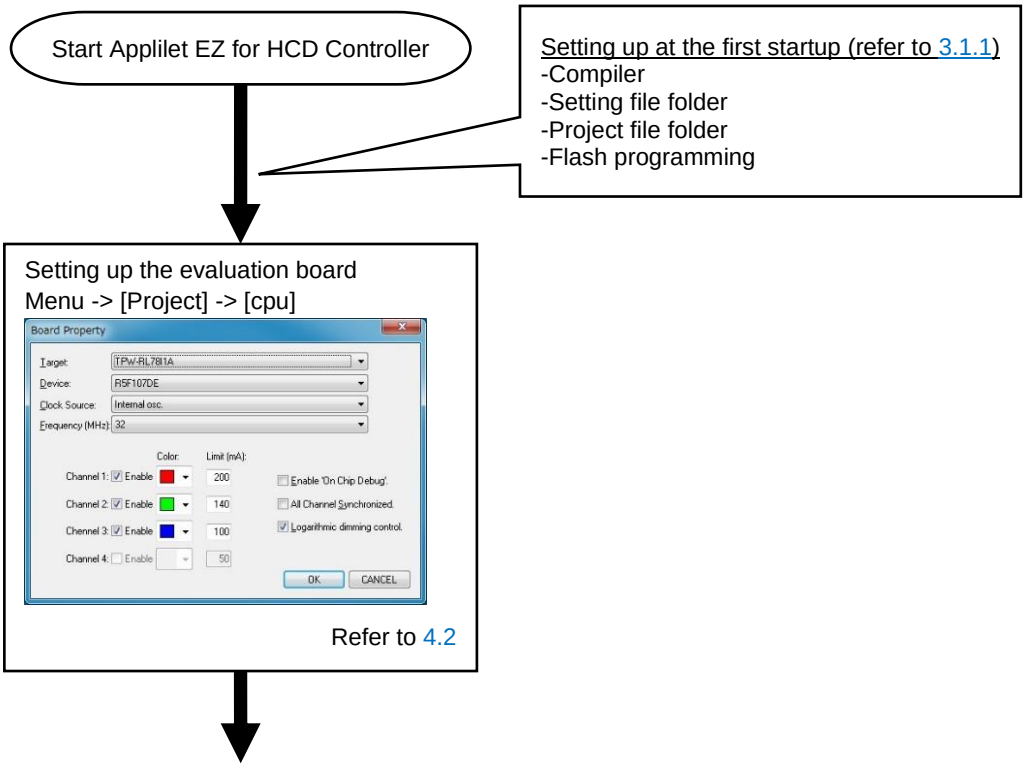
To exit from Applilet EZ for HCD Controller, go to the Main window's [File] menu and select [Exit].



CHAPTER 4 APPLILET EZ FOR HCD CONTROLLER OPERATION

This chapter describes the operation flow, from automatically generating object codes (*.hex) by using Applilet EZ for HCD Controller and writing to the flash memory, up to checking operation by using the evaluation board.

4. 1 Operation Flow



Setting up the evaluation board (from the previous

Mode setting

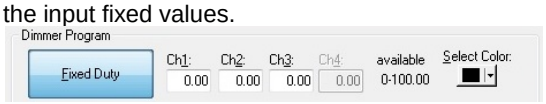
Switch mode

In this mode, the dimming levels are changed by the switch connected to the board.

Refer to 4.3.7

Fix mode

In this mode, the LEDs are dimmed according to the input fixed values.



Refer to 4.3.1

DMX512 mode

In this mode, the LEDs are dimmed using the DMX512 protocol.

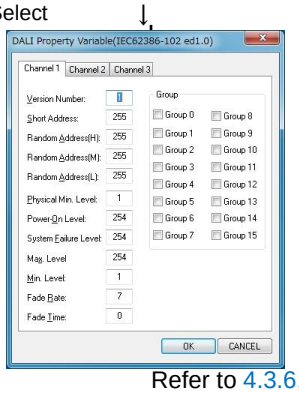
Select

Refer to 4.3.5,Chapter 5

DALI mode

In this mode, the LEDs are dimmed using the DALI protocol.

Select



Refer to 4.3.6,Chapter 5

IR remote control mode

In this mode, the LEDs are dimmed using the remote control signal reception function on the board.

Refer to 4.3.8

Variable mode

In this mode, LED dimming can be continuously changed. The output pattern can be specified as in art software.

Select Click the [Edit] button

Refer to 4.3.2

Analog Input mode

In this mode, the LEDs are dimmed according to the A/D converted values.

Refer to 4.3.3

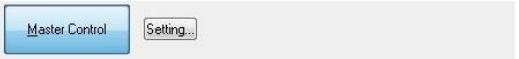
Serial Command mode

In this mode, the LEDs are dimmed by using commands depending on the type of communication.
Specify the communication format, communication command type, and channels to use for serial communication.

Refer to 4.3.4

Master Control mode

It is the mode for exclusive use of the lighting communication master evaluation board.
set the transmission command of the DALI / IR to nine switch on the evaluation board.



Refer to 4.3.9

Caution Some modes may be unavailable, depending on the board specifications. For details, see the each board's manual.

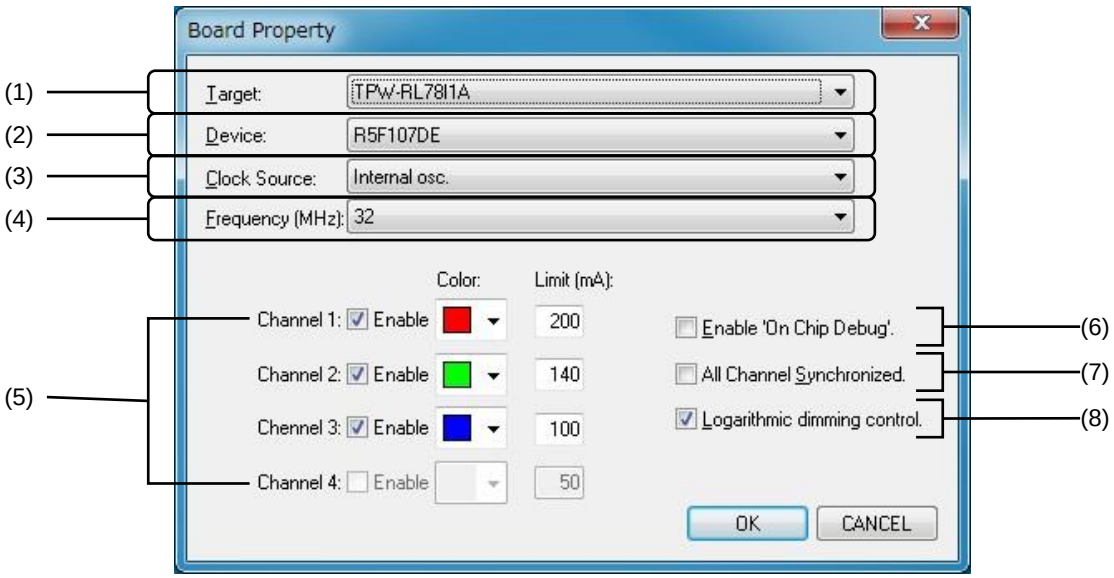
Save the project

Generation, writing, and evaluation (refer to 4.4)

4. 2 Setting Up the Evaluation Board

In the menu, select [Project] and then [CPU] to set up the evaluation board in the dialog box below.

Performing this setup updates the specified mode displayed in the main window.



(1) Target:

Select the evaluation board to use.

(2) Device:

If an evaluation board is selected, the mounted microcontroller is displayed. (This setting cannot be changed.)

(3) Clock Source:

Select the clock to use. This setting might be fixed depending on the setting of (1).

(4) Frequency (MHz):

Select the frequency. This setting might be fixed depending on the setting of (1) and (3).

(5) Channel X:

Specify the channels to enable by selecting their [Enable] checkboxes.

Specify the color of the lighting of each channel by using the [Color] buttons.

These settings might not be selectable or changeable depending on the setting of (1).

Enter the max current level of each channel in [Limit].

* This setting may be unavailable, depending on the board.

(6) Enable 'On Chip Debug'.:

If this checkbox is selected, a program that enables on-chip debugging is generated.

(7) All Channel Synchronized.:

If this checkbox is selected, the brightness of all selected channels will be the same.

If only one channel is selected, this checkbox is disabled.

(8) Logarithmic dimming control.:

Select this checkbox to logarithmically change the dimming of the LEDs.

If this checkbox is not selected, dimming values are handled as direct values. If the checkbox is selected, the specified value is converted to logarithmic value.

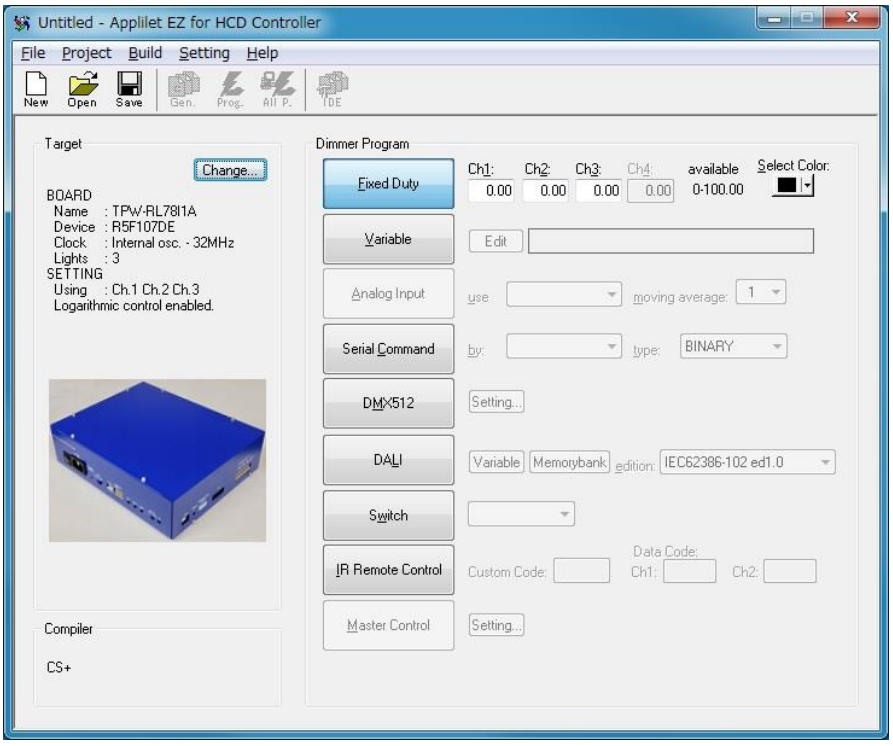
4. 3 Mode Setting

Select a mode to use from Dimmer Program on the main window and set the details.

4. 3. 1 Fix mode

In this mode, the LEDs are dimmed according to the input fixed values.

If multiple channels are set to synchronization mode (refer to 4.2 (7)), dimming values can be specified only for channels that have lower numbers. (The dimming value cannot be entered for the other channels, but the same dimming value applies.) The corresponding [Chx.] (where x is the channel number) turns black for the other channels to synchronize.



(1) Select the [Fixed Duty] button in Dimmer Program (This button is selected by default.).

(2) Enter a value into the [Ch1] to [Ch4] boxes[Note] or select a color from the [Select Color] drop-down list.

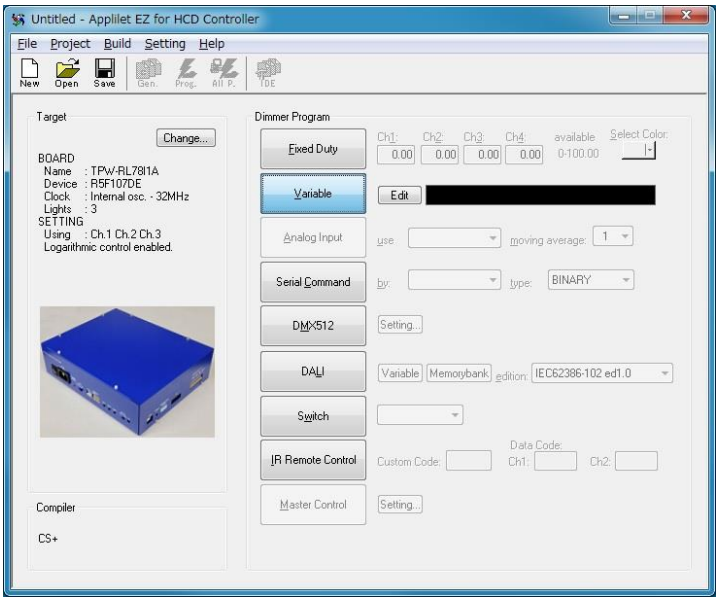
(3) Click  icon or select Menu → [File] → [Save] to save the project.

Note The values that can be entered vary depending on the evaluation board.

4. 3. 2 Variable mode

In this mode, LED dimming can be continuously changed.

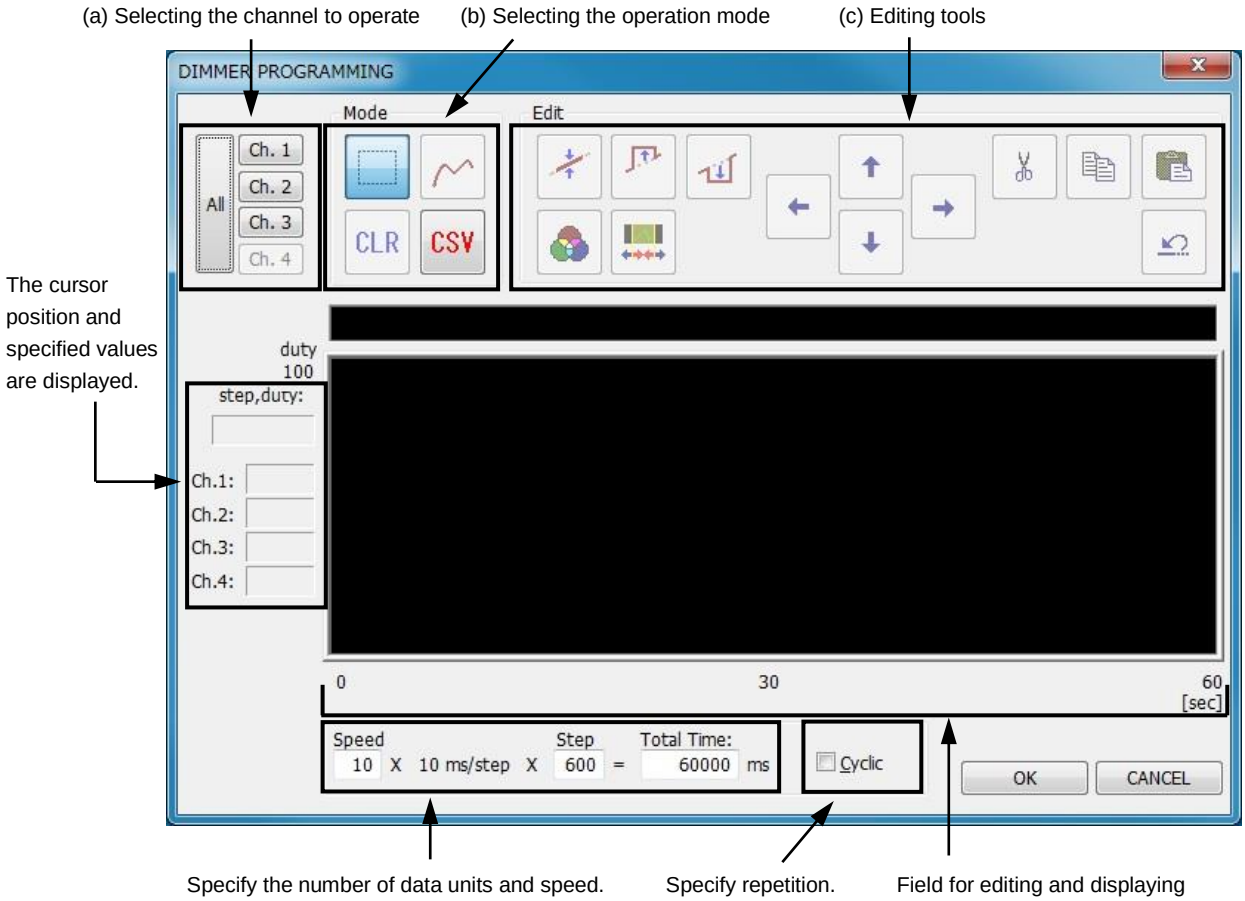
The output pattern can be specified as in art software.



(1) Select the [Variable] button in Dimmer Program.

(2) Click the [Edit] button to open a separate window, shown below.

Edit the output pattern in this window.



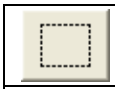
(a) Selecting the channel to operate

Select the channel to edit. Only channels that can be edited can be selected.

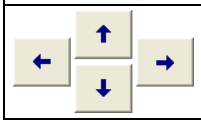
Select all channels or individual channels.

The brightness curve of a selected channel is displayed as a bold line.

(b) Selecting the operation mode

 Range selection mode	A range can be selected by left-clicking and then dragging the mouse in the brightness curve editing field. Editing tools are used for the selected range.
 Freehand line mode	A freehand line can be drawn by left-clicking and then dragging the mouse in the brightness curve editing field. This mode is enabled only if one operation channel is selected.
 Clear mode	All data of the selected channel is cleared.
 CSV editing mode	The brightness values are output to a CSV file and an editing application (the application associated with the extension .csv) starts. Control does not return to Applilet EZ for HCD Controller until the application is closed.

(c) Editing tools

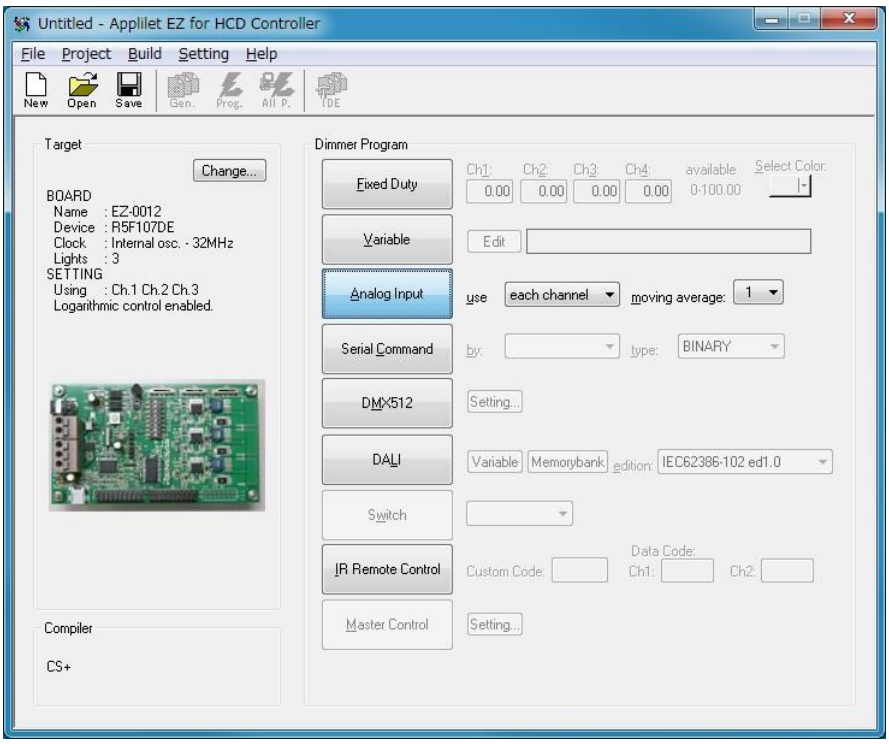
 Straight line	Turns changes in the values of a selected channel or selected range into a straight line. The straight line connects the values of the start and end positions in the selected range.
 Maximization	Sets the values in the selected range to their maximum specifiable values.
 Minimization	Sets the values in the selected range to their minimum value (0).
 Color specification	Specifies the color of a value in the selected range from the color specification window. This tool is enabled only if all operation channels (All) and a range are selected.
 Shifting	Shifts the values in the selected range to the left, right, up, or down by one point. If these buttons are clicked while holding down the [Ctrl] key, the values shift in 10-point units.
 Cutting	Cuts the values in the selected range and temporarily retains them in a buffer. The cut values can be pasted to any position by using the paste button. This tool is enabled only if one operation channel is selected.
 Copying	Temporarily copies the values in the selected range to a buffer. The copied values can be pasted to any position by using the paste button. This tool is enabled only if one operation channel is selected.
 Pasting	Pastes the data temporarily retained in a buffer. The position to which to paste the data must be selected as a range. Multiple channels can be selected for pasting. Values that were cut or copied when one channel was selected are applied to the values of the selected channels.
 Undo	Undoes the previous operation. This can be used to undo only the most recent operation.

(3) When editing has been completed, click [OK].

(4) Click  icon or select Menu → [File] → [Save] to save the project.

4. 3. 3 Analog Input mode

In this mode, the LEDs are dimmed according to the A/D converted values.



(1) Select the [Analog Input] button in Dimmer Program and specify from the [use] drop-down list the A/D conversion port to be used for the dimming value.

(For RL78/I1A DCDC LED Control Evaluation Board)

- [each channel]

  The conversion value of each A/D conversion port is applied to the dimming values of the corresponding effective channel.

  <Example> When Channels 1 and 2 are effective

  ANI0 → Channel 1

  ANI1 → Channel 2

- [ANIx only]

  The conversion value of the selected A/D conversion port is applied to the dimming value of all effective channels.

  <Example> When ANI3 is selected and Channels 1 and 2 are effective

  ANI3 → Channel 1, 2

Caution ANIx varies depending on the evaluation board.

(2) Set the number of samples to be used in moving average processing.

Caution When the number of samples is set to 1, the moving average processing is not performed.

(3) Click  icon or select Menu → [File] → [Save] to save the project.

Remarks1. To use this mode, an analog signal source must be connected to the analog input port (ANI) of the microcontroller. For details, refer to the user's manuals of the microcontroller and evaluation board.

2. The moving average interval is 5 ms.

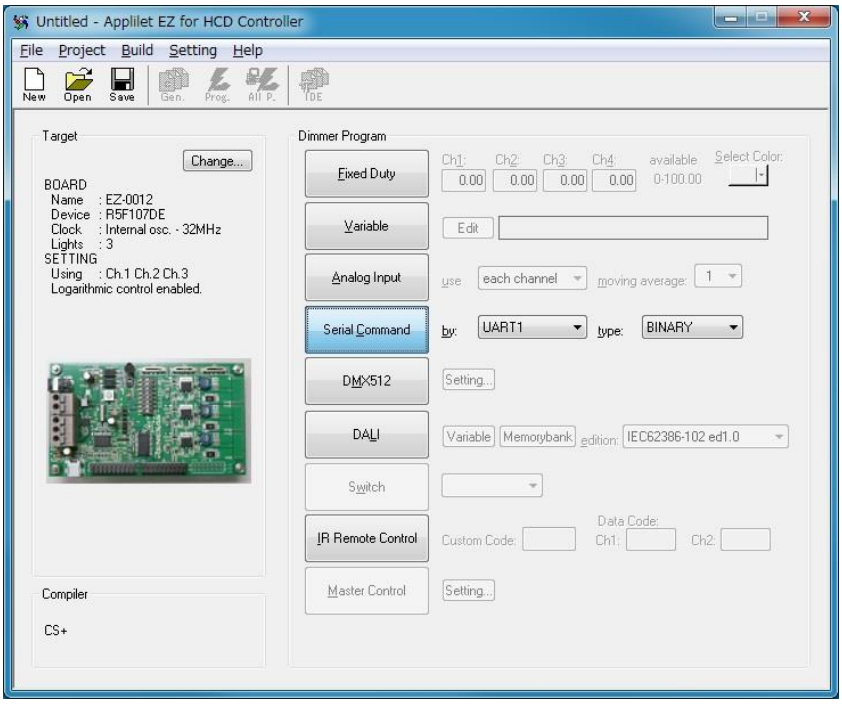
4. 3. 4 Serial Command mode

In this mode, the LEDs are dimmed by using commands depending on the type of communication.

Specify the communication format, communication command type, and channels to use for serial communication.

To use this mode, a host controller for serial communication must be connected to the serial communication port of the evaluation board. For details, refer to the user's manuals of the microcontroller and evaluation board.

For the command of Serial Command mode, refer to APPENDIX B SERIAL COMMAND MODE COMMUNICATION COMMANDS.



(1) Select the [Serial Command] button in Dimmer Program and specify from the [by] and [type] drop-down lists the communication mode and communication command system to be used, respectively.

- [by]

  Select from UART1[Note 1],

UART1	Serial communication is performed in this mode by using UART (Universal Asynchronous Receiver Transmitter) with the TxD1 or RxD1 pin of the device.

- [type][Note 2]

  Select from ASCII and BINARY.

ASCII	Communication by using ASCII codes is performed.
BINARY	Communication by using binary data is performed.

(2) Click 

icon or select Menu → [File] → [Save] to save the project.

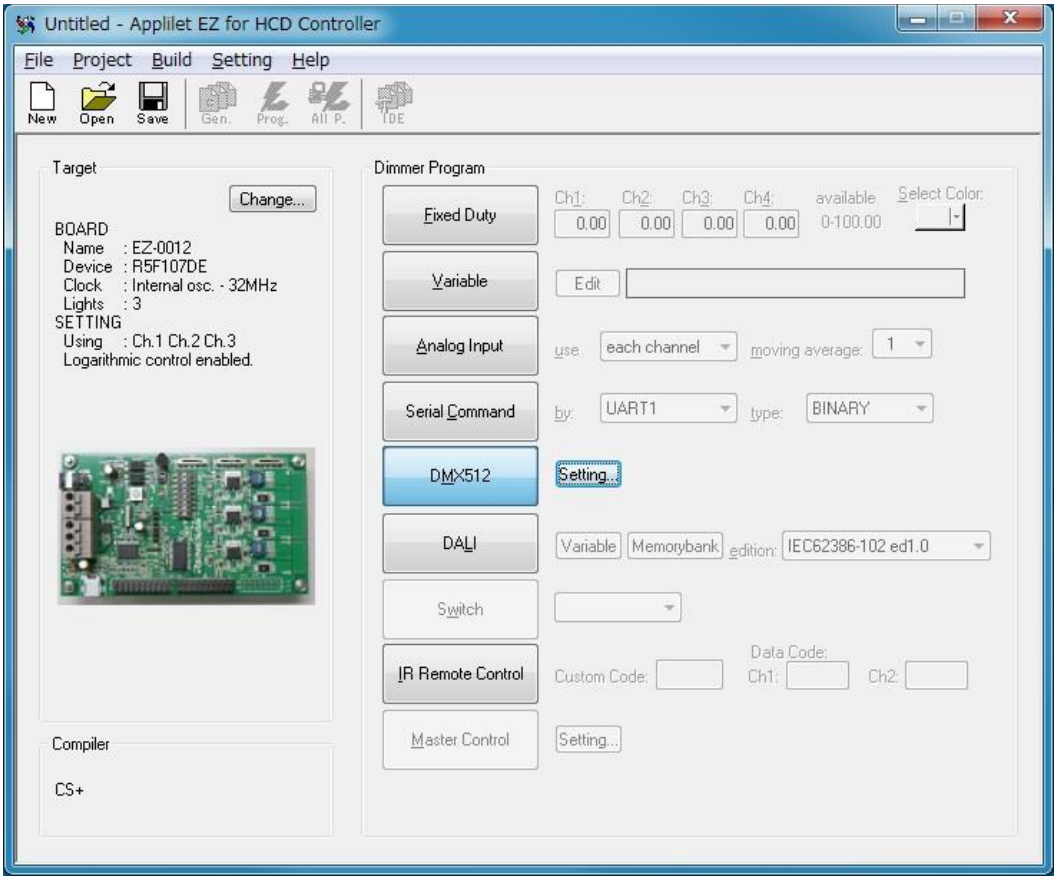
Notes1. The communication system which can be specified now is only UART1.

2. [type] can be set only if UART is selected.

4. 3. 5 DMX512 mode

In this mode, the LEDs are dimmed by using the DMX512 protocol.

For the communication command of DMX512, refer to APPENDIX C DMX512 MODE COMMUNICATION DATA.



(1) Select the [DMX512] button in Dimmer Program.

(2) Push the [Setting] button and then [DMX512 Property] in the menu, and then specify the channel number. For details about this setting, see the [DMX512 Property] dialog box described in CHAPTER 5 WINDOW REFERENCE.

(3) Click 

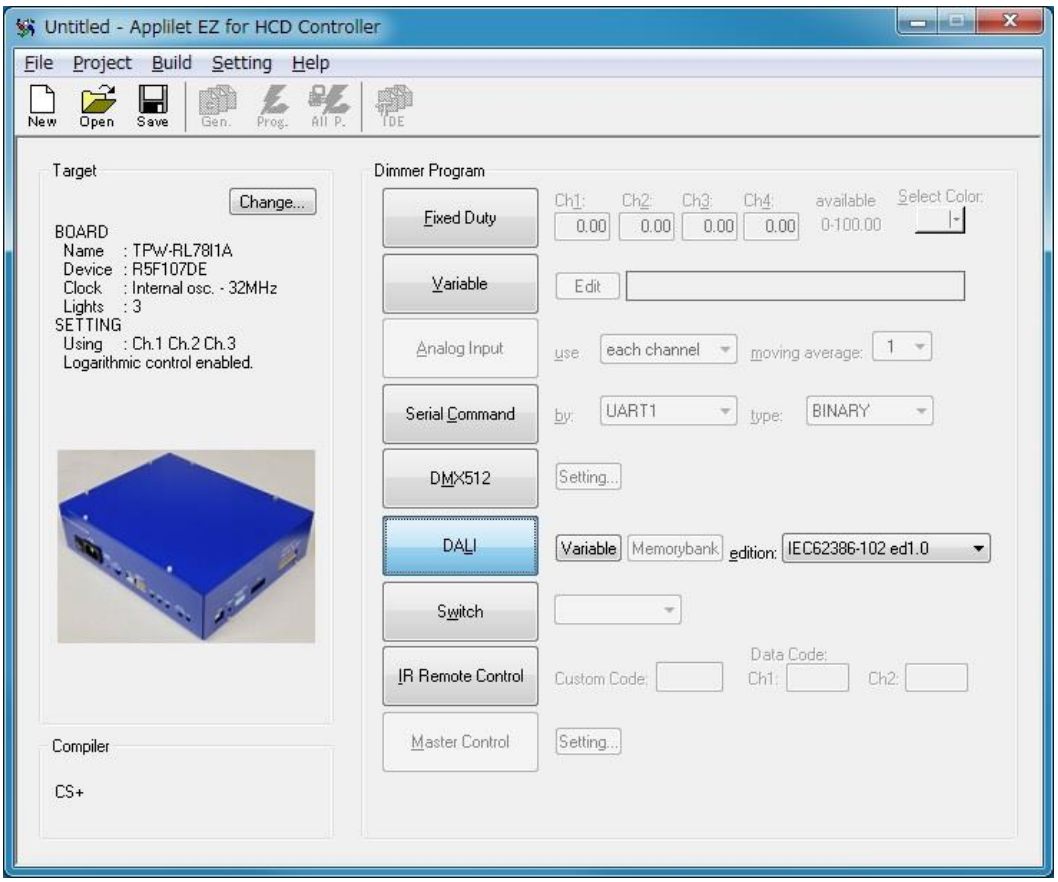
icon or select Menu → [File] → [Save] to save the project.

<R> 4. 3. 6 DALI mode

In this mode, the LEDs are dimmed by using the DALI protocol.

DALI (Digital Addressable Lighting Interface) is an international open standard lighting control communication protocol, mainly used for light control of multiple fluorescent lamps or LED lights.

For the communication command of DALI, refer to APPENDIX D DALI MODE COMMUNICATION DATA.



(1) Select the [DALI] button in Dimmer Program.

(2) Open the [DALI Property] dialog box by clicking the [Variable] button, and then specify the parameter. For details about this setting, see the [DALI Property] dialog box described in CHAPTER 5 WINDOW REFERENCE.

(3) IEC62386-102+207 ed1.0 and IEC62386-102 ed2.0 is available for the setting of the memory bank. Open the [DALI Property Memorybank] dialog box by clicking the [Memorybank] button, and then specify the parameter. For details about this setting, see the [DALI Property Memorybank] dialog box described in CHAPTER 5 WINDOW REFERENCE.

(4) Click Save icon or select Menu → [File] → [Save] to save the project.

Caution For DALI communication, it's possible to output source files at the time of IEC62386-102 ed1.0 standard selection.

The hex files are output at the time of IEC62386-102+207 ed1.0 and the IEC62386-102 ed2.0 standard selection, and you cannot call the integrated development environment.

For IEC62386-102+ 207 ed1.0 and IEC62386-102 ed2.0, a library is prepared separately.

For details, contact your local Renesas Electronics sales.

4. 3. 7 Switch mode

In this mode, light is controlled depending on the switches connected to the board.

Switch mode has 2 modes.

Mode1: Fade mode

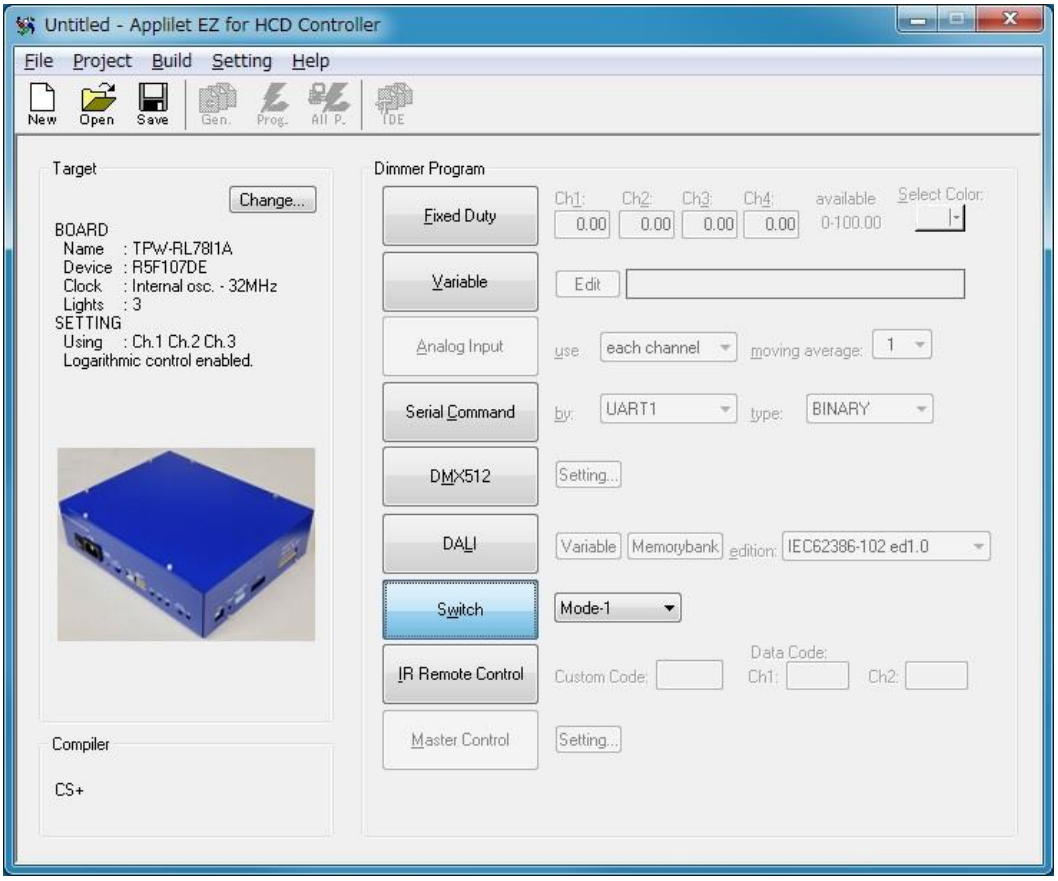
You can press and hold the switch to gradually raise or lower (fade) the dimming level.

Press and release the switch to turn the light ON or OFF.

Direction of the dimming level of the raise/lower by pressing and holding switches every time you press and hold.

Mode 2: Level dimming mode

Go to 15→20→30→50→100→50→30→20→15 [%] by pressing down the switch to change the dimming level in steps.

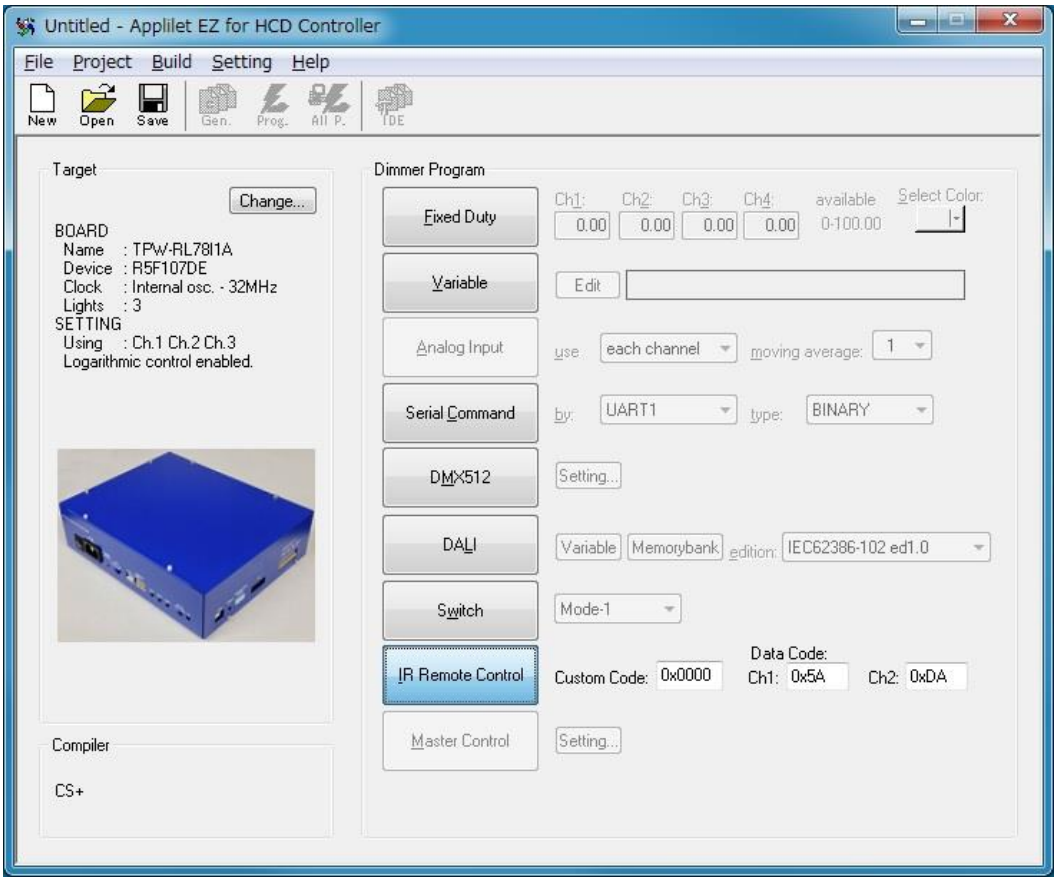


4. 3. 8 IR Remote controller control mode

In this mode, lights are dimmed by using the on-board function for receiving remote control signals. Remote control signals in the NEC format can be received.

In this mode, the custom code and data code can be specified as a four-digit and a two-digit hexadecimal respectively. The dimming level is changed as OFF --> 100% --> 50% --> 10% --> OFF every time the remote control code is received.

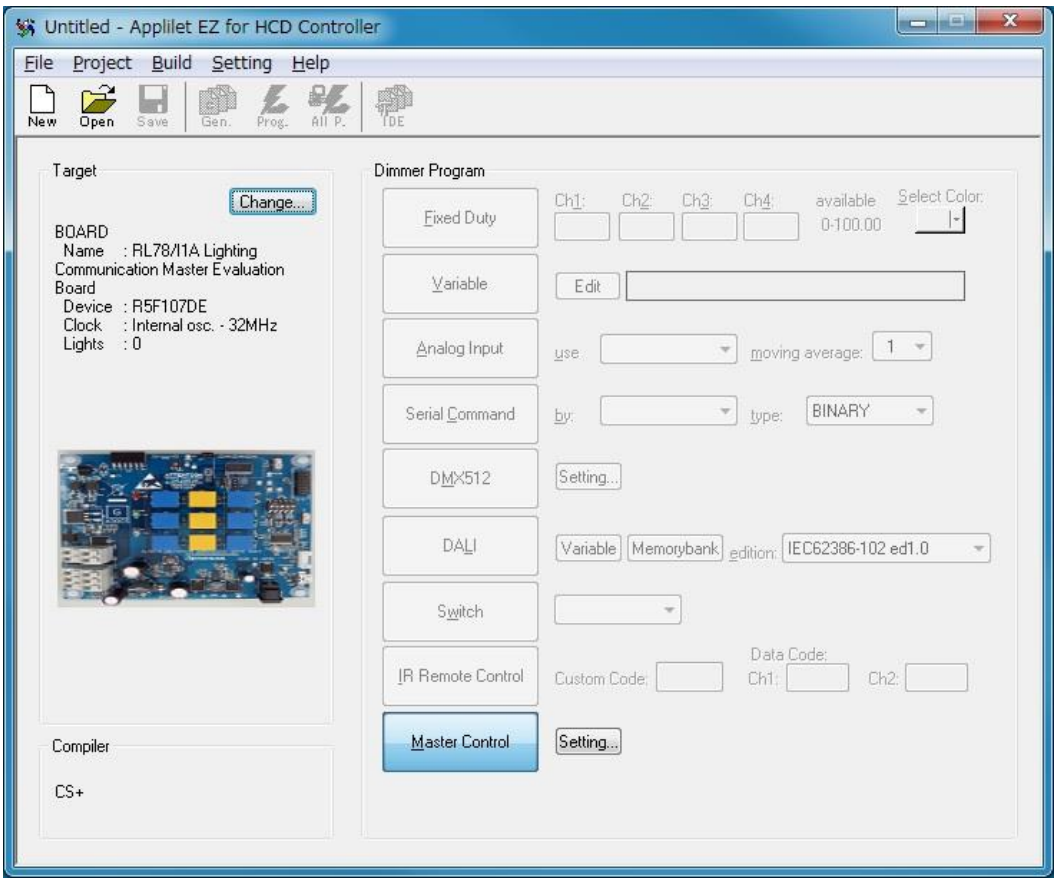
When an evaluation is performed using the infrared remote control function of the Lighting Communication Master Evaluation Board, which is optionally available, set the following values based on the channel settings on the master evaluation board.



<R> 4. 3. 9 Master Control mode

This mode is only for RL78/I1A Lighting Communication Master Evaluation Board.

It is possible not only to control the slave connected to the DALI Master Control GUI and DMX512 Master Control GUI, but also to transmit the DALI and IR commands by the implemented 9 switches without Master Control GUI.



(1) Select the [RL78/I1A Lighting Communication Master Evalution Board] in the [Board Property] dialog box.

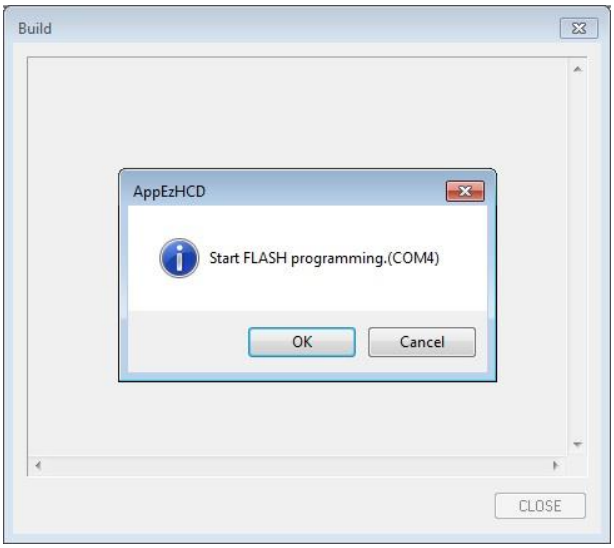
(2) Other than the [Master Control] button in Dimmer Program cannot be selected.

(3) Open the [Master Control Setting] dialog box by clicking the [Setting] button, and then specify the operation of 9 switches. For details about this setting, see the [Master Control Setting] dialog box described in CHAPTER 5 WINDOW REFERENCE.

4. 4 Generation, Writing, and Evaluation

Object codes (*.hex) are automatically generated and software is written to a microcontroller.
After writing has been completed, the operation can be checked by using the evaluation board.
The writing procedure differs depending on the board used.

(1) Click  icon to open the Build window. Preparation for generating object codes (*.hex) and writing will be performed.



Remark If an abnormality occurs during object code generation (*.hex) or flash writing, an error code may be displayed.

Example: "code = xx"

Take the following countermeasures according to the code number (xx) displayed.

Code No.	Countermeasures
2	Applilet EZ for HCD Controller may not be correctly installed. Reinstall it.
3	Data cannot be written because the folder that should be set via the [Folders...] setting on the [Setting] menu does not exist. Re-set an appropriate folder.
4	The compiler or assembler selected via the [Compiler] setting on the [Setting] menu cannot be found. Check whether the compiler or assembler is correctly selected and installed. If it still cannot be found, reinstall the compiler or assembler.
5	The compiler or assembler selected via the [Compiler] setting on the [Setting] menu is not correctly installed. Reinstall the compiler or assembler.
9	The folder set via the [Folders...] setting on the [Setting] menu or the BASEPROJECT folder in the installation folder of Applilet EZ for HCD Controller is set as a read-only folder. Cancel the read-only setting for the whole folder.
23	This is a system error of the compiler or assembler selected via the [Compiler] setting on the [Setting] menu or the main body of Applilet EZ for HCD Controller. Handle this error by checking the following points. If a read-only folder or file exists under the folder set via the [Folders...] setting on the [Setting] menu, cancel all read-only settings. If the error still cannot be fixed, reinstall the compiler or assembler and the main body of Applilet EZ for HCD Controller.
26	Illegal value of DALI propaty. Details of the error are displayed by text as below. If two or more errors exist, only the first detected error is displayed. "Power-On Level" < "Min. Level", "Power-On Level" > "Max. Level", "System Failure Level" < "Min. Level", "System Failure Level" > "Max. Level" "Min. Level" < "Physical Min. Level", "Min. Level" > "Max. Level", "Min. Level" < 1 "Min. Level" > 254, "Max. Level" < "Min. Level", "Max. Level" > 254, "Max. Level" < 1, "Fade Rate" < 1, "Fade Rate" > 15, "Fade Time" < 1 "Fade Time" >15, "Random Address" < 0x000000, "Random Address" > 0xFFFFFF

(2) Writing preparation

<R> If the board has a USB interface

Check that the PC and the evaluation board are correctly connected with a USB cable.

Depending on the evaluation board, there are those that require switching the features of "write / normal operation" by the DipSW. After checking the manual of each evaluation board, when needing setting change, turn on the power in the state of writing.

<R> If the board is using E1

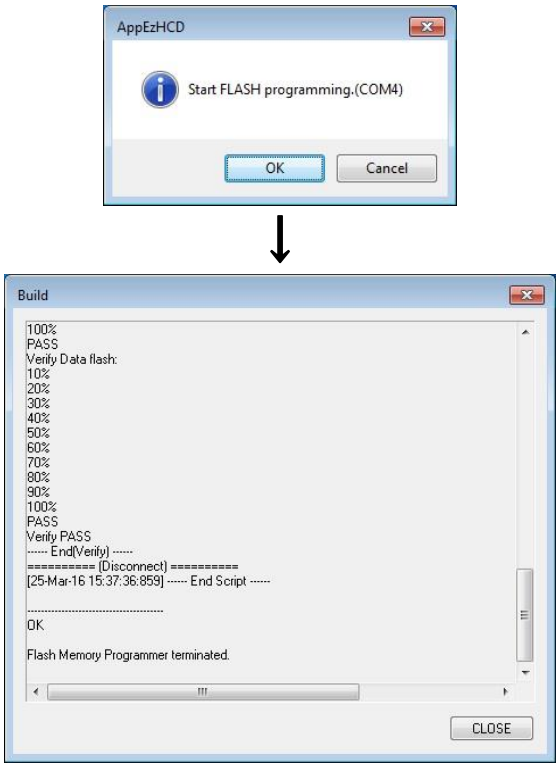
Connect the PC, E1 and the evaluation board to each other correctly.

Depending on the evaluation board, there are those that require switching the features of "write / normal operation" by the DipSW. After checking the manual of each evaluation board, when needing setting change, turn on the power in the state of writing.

(3) Writing

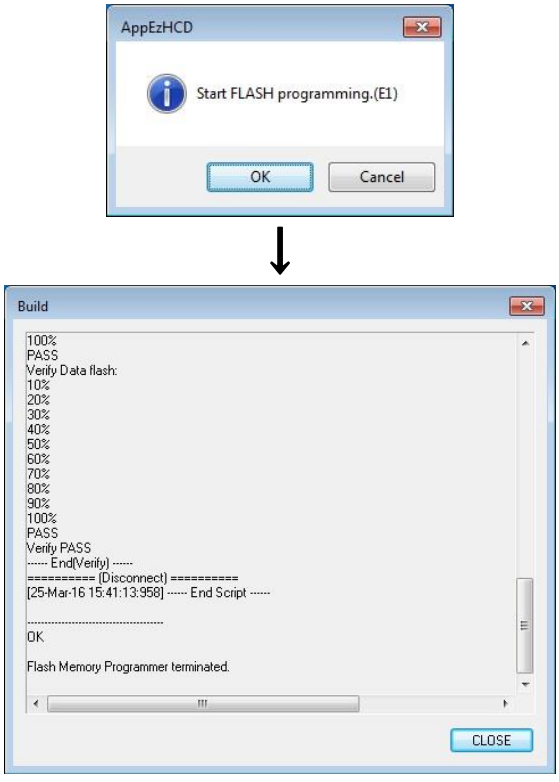
<R> If the board has a USB interface

Click [OK] and flash programming is started.



<R> If the board is using E1

Click [OK] and flash programming is started.



(4) Operating preparation

<R> If the board has a USB interface

When the program has been written normally, turn the evaluation board off.

If it is necessary to switch features of "write / normal operation", turn on the power of an evaluation board again after switching to "normal operation ".

<R> If the board is using E1

After the writing of the program is completed successfully, turn off the power to the board, and then remove the E1.

If it is necessary to switch features of "write / normal operation", turn on the power of an evaluation board again after switching to "normal operation ".

(5) Operating

<R> For RL78/I1A AC/DC Full digital 3ch LED control unit and RL78/I1A AC/DC 2 converter LED evaluation unit

Perform the auto tuning operation (lights all the LEDs of the connected channels) first to check the characteristics of the connected LEDs. Start the auto tuning by pushing the switch[Note1] after power ON. The operation of auto selected program starts after the auto tuning.

If an illegal condition (such as internal overvoltage) occurs, the LEDs are automatically turned off and the operation backs before auto tuning. In that case, push the switch[Note1] again to start again from the auto tuning.[Note]

<R> For boards other than the above

The operation will start immediately when the power is turned ON.

Note 1 Use the switch 1 (SW1) on RL78/I1A AC/DC Full digital 3ch LED control unit, and use switch 5 (SW5) on RL78/I1A AC/DC 2 converter LED evaluation unit.

2 When protection against the circuit by the comparator is actuated on RL78/I1A AC/DC Full digital 3ch LED control unit, the status lamp will be turned on and off. In such cases, push a reset switch to start again.

Caution Since the "write / normal operation" procedure differs depending on the board used, refer to the board's manual for details.

Remark When only generating object codes (*.hex), click 

icon.

CHAPTER 5 WINDOW REFERENCE

5. 1 Overview of Windows and Dialog Boxes

The following windows and dialog boxes are provided with Applilet EZ for HCD Controller.

<R> Table 5-1 List of Windows and Dialog Boxes in Applilet EZ for HCD Controller

Window/Dialog Box Name	Description
Main window	This window is opened automatically when Applilet EZ for HCD Controller is started. This window is used to select and set all functions to be included in the automatically generated object codes.
[UARTx Settings] dialog box	This dialog box is used to set UARTx.
[DALI Property] dialog box	This dialog box is used to save variable settings of DALI.
[DALI Property Memorybank] dialog box	This dialog box is used to set memory bank configuration of DALI. It's effective only at the time of selection of IEC62386-102+207 ed1.0 and IEC62386-102 ed2.0.
[DMX512 Property] dialog box	This dialog box is used to set DMX512.
[Master control setting] dialog box	This dialog box is used to set SW2 to 10 of Lighting Communication Master Evaluation Board.
[SW X Setting] dialog box	This dialog box is used to set SW X of Lighting Communication Master Evaluation Board.
[Board Property] dialog box	This dialog box is used to set the evaluation board. For details, refer to 4.2.
[Setting to use Compiler]	Set the installed folder of the compiler to use. For details, refer to 3.1.1.
[FLASH Programming Settings] dialog box	This dialog box is used to set flash programming. For details, refer to 3.1.1.
[Project Folder] dialog box	This dialog box is used to set a folder into which the generated file is to be saved. For details, refer to 3.1.1.

5. 2 Description of Windows and Dialog Boxes

The following format is mainly used to describe Applilet EZ for HCD Controller's windows and dialog boxes.

Window/dialog box name

The name of the window or dialog box is indicated in this text frame.
Next, the window or dialog box's functions are described briefly and an illustration of the window or dialog box is shown.

Menu bar

The options that appear in pull-down menus under each item in the window's menu bar are enumerated and described briefly.

Tool bar

The functions corresponding to the buttons in the window's tool bar are described.

Description of function-related areas

The areas corresponding to functions set via the dialog box are described below.

Function buttons

The various function buttons in the dialog box are described.

Other

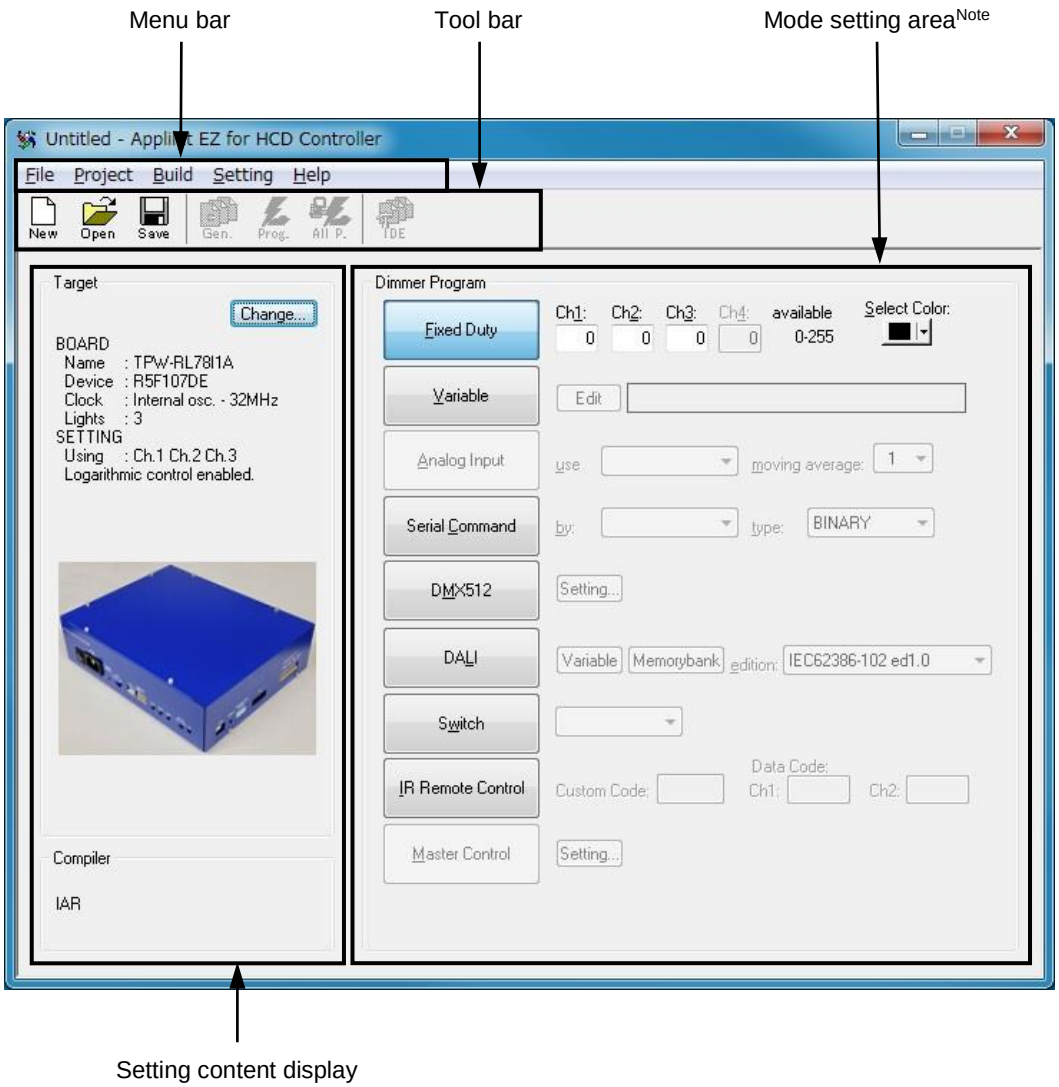
Operation methods, functions, and other noteworthy items or caution points are described.

Main window

This window is opened automatically when Applilet EZ for HCD Controller is started.

Setting items (Setting up the evaluation board, mode setting (refer to 4.2 and 4.3), etc.) are sequentially selected in this window to automatically generate object codes (*.hex) that can be directly written to the flash memory of a microcontroller.

Figure5-1 Main Window



The following parts of this window are described below.

- Menu bar
- Tool bar

Note For the mode setting area, refer to 4.3 Mode Setting.

Menu bar

(1) [File] menu

[Create New]	This option is used to create a new setting. Clicking the  button selects the same function.
[Open...]	This option is used to open an existing setting file. Use the dialog box that opens for this option to select the existing setting file (*.xml). Clicking the  selects the same function.
[Save]	This option is used to save the current settings. Clicking the  button selects the same function.
[Save as...]	This option is used to save the current settings with a newly named.
[Exit]	This option is used to close Applilet EZ for HCD Controller.
[Read Sample Project…]	This option is used to read a setting file created as a sample. The dialogue box specified the folder that the sample setting file is saved is displayed. Please select the sample setting file to use.

(2) [Project] menu

[Cpu...]	This option is used to open the [Board Property] dialog box which sets an evaluation board.
[UARTx...]	This option is used to open the [UARTx Settings] dialog box which sets UARTx.
[DALI...]	This option is used to open the [DALI Property Variable] dialog box which sets DALI.
[DMX512...]	This option is used to open the [DMX512 Property] dialog box which sets DMX512.

(3) [Build] menu

[Generate and Build]	Executes automatic generation of object codes (*.hex). Clicking the  button selects the same function.
[FLASH Programming]	Writes an already generated object codes (*.hex). Clicking the  button selects the same function.
[All procedure]	Executes automatic generation and writing of object codes (*.hex). For the procedures from generation to writing, refer to 4.4 Generation, Writing, and Evaluation. Clicking the  button selects the same function.

(4) [Setting] menu

[Select Compiler]	Select the compiler to be used.
[Compiler Folder...]	This option is used to open the [Setting to use compiler] dialog box which sets Compiler installed folder to use.
[FLASH Program...]	This option is used to open the [FLASH Programming Settings] dialog box which sets flash programming.
[Project Folder...]	This option is used to open the [FLASH Programming Settings] dialog box which sets folder to save the generated files.

(5) [Help] menu

[Version...]	This option is used to display version information about Applilet EZ for HCD Controller.

Tool bar

The icons on the Tool bar are provided to enable one-click selection of frequently used menu items.

	This selects the same function as when [Create New] is selected in the [File] menu.
	This selects the same function as when [Open...] is selected in the [File] menu.
	This selects the same function as when [Save] is selected in the [File] menu.
	This selects the same function as when [Generate and Build] is selected in the [Build] menu.
	This selects the same function as when [FLASH Programming] is selected in the [Build] menu.
	This selects the same function as when [All procedure] is selected in the [Build] menu.

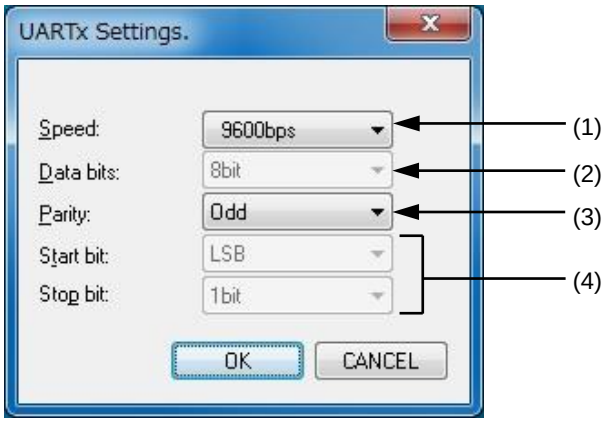
[UARTx Settings] dialog box

This dialog box can be opened by clicking [UARTx...] in the [Project] menu.

Set UARTx in this dialog box.

The setting items are identical in both dialog boxes. The [UARTx Settings] dialog box is used below as an example.

Figure5-2 [UARTx Settings] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Speed:

This can be selected from 9,600, 19,200, and 115,200 bps.

(2) Data bits:

This is fixed to 8 bits and cannot be changed.

(3) Parity:

This can be selected from None, Odd, and Even.

(4) Start bit:, Stop bit:

These are fixed to LSB and 1 bit respectively, and cannot be changed.

Function buttons

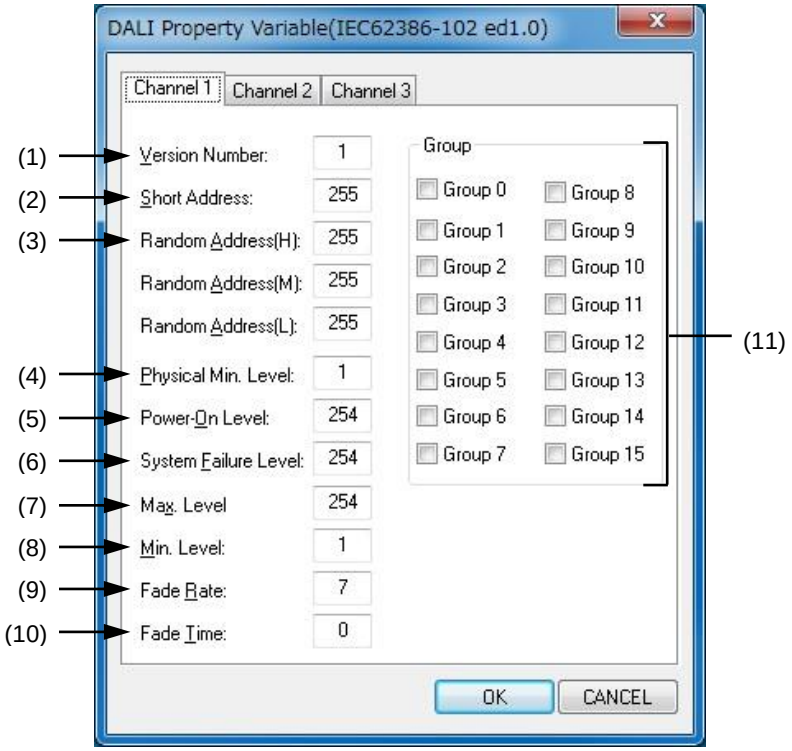
Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

[DALI Property] dialog box (IEC62386-102 ed1.0)

This dialog box can be opened by clicking [DALI...] in the [Project] menu or clicking [Variable] after selecting the edition to [IEC62386-102 ed1.0].

Set parameter of DALI in this dialog box.

Figure5-3 [DALI Property] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Version Number:

Specify the version number of the evaluation board (as a value from 0 to 255).

(2) Short Address:

Specify the default address of the evaluation board (as a value from 0 to 63 and 255)

Caution When the short address is assigned to the same address of the mounted LED channels, a right result may not be acquired in command replies such as Query.

(3) Random Address:

Specify a value when assigning a random address to the evaluation board.

Set random address value (0 to 255) to Random Address(H),(M),(L).

Caution When the Random Address(H),(M),(L) are assigned to the same address of the mounted LED channels, a short address cannot be set definitely in Random Address Allocation.

(4) Physical Min. Level:

Specify physical minimum dimming level (as a value from 1 to 254) of the connected lamp on the evaluation board or the evaluation board.

(5) Power-On Level:

Specify the dimming level for when turning on power (as a value from 1 to 255).

(6) System Failure Level:

Specify the dimming level for when a failure occurs (as a value from 0 to 255).

(7) Max. Level:

Specify the maximum dimming level (as a value from the minimum level to 254).

(8) Min. Level:

Specify the minimum dimming level (as a value from the physical minimum level to the maximum level).

(9) Fade Rate:

Specify the amount by which the dimming level is changed by fading (as a value from 1 to 15).

(10) Fade Time:

Specify the time required for the dimming level to be changed by fading (as a value from 0 to 15).

(11) Group

Specify the group the evaluation board belongs to. Multiple groups can be specified.

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

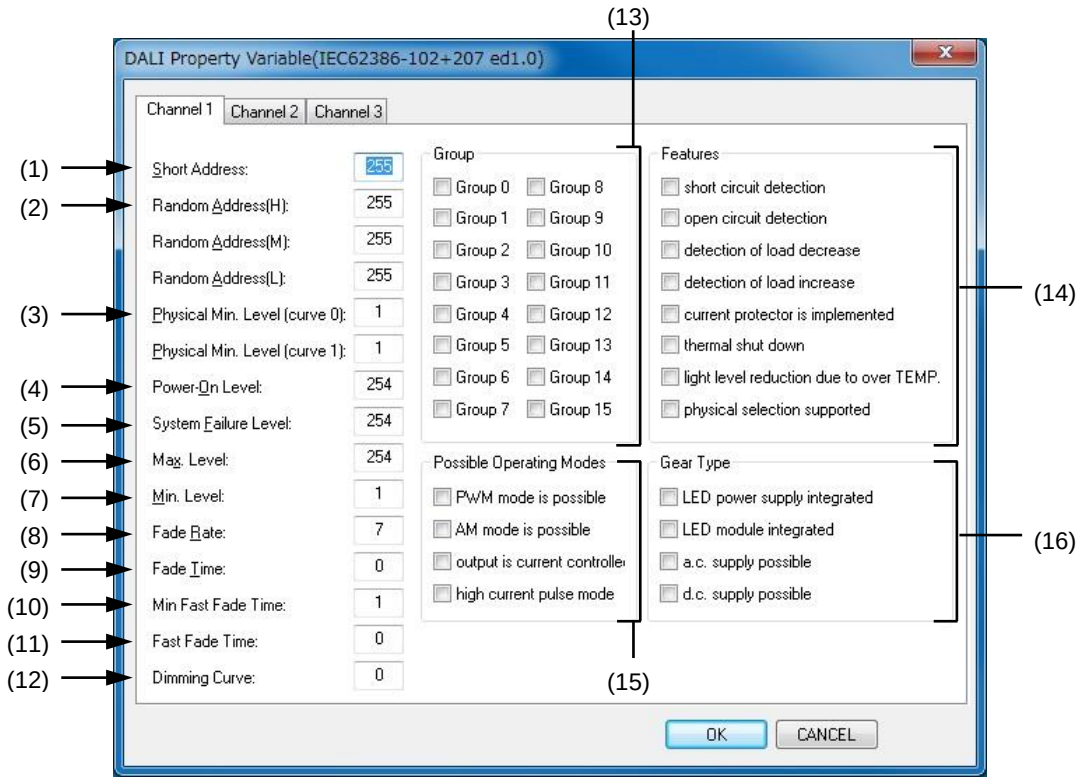
[DALI Property Variable] dialog box (IEC62386-102+207 ed1.0)

<R>

This dialog box can be opened by clicking [DALI...] in the [Project] menu or clicking [Variable] after selecting the edition to [IEC62386-102+207 ed1.0].

Set parameter of DALI in this dialog box.

Figure5-4 [DALI Property] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Short Address:

Specify the default address of the evaluation board (as a value from 0 to 63 and 255)

Caution When the short address is assigned to the same address of the mounted LED channels, a right result may not be acquired in command replies such as Query.

(2) Random Address:

Specify a value when assigning a random address to the evaluation board.

Set random address value (0 to 255) to Random Address(H),(M),(L).

Caution When the Random Address(H),(M),(L) are assigned to the same address of the mounted LED channels, a short address cannot be set definitely in Random Address Allocation.

(3) Physical Min. Level:

Specify physical minimum dimming level (as a value from 1 to 254) of the connected lamp on the evaluation board or the evaluation board.

For non-linear (curve 0) and linear (curve 1), because it is different for the physical minimum dimming level, it is necessary to set in each.

(4) Power-On Level:

Specify the dimming level for when turning on power (as a value from 1 to 255).

(5) System Failure Level:

Specify the dimming level for when a failure occurs (as a value from 0 to 255).

(6) Max. Level:

Specify the maximum dimming level (as a value from the minimum level to 254).

(7) Min. Level:

Specify the minimum dimming level (as a value from the physical minimum level to the maximum level).

(8) Fade Rate:

Specify the amount by which the dimming level is changed by fading (as a value from 1 to 15).

(9) Fade Time:

Specify the time required for the dimming level to be changed by fading (as a value from 0 to 15).

(10) Min Fast Fade Time:

Specify the minimum set value of the high-speed fade time (as a value from 1 to 27).

(11) Fast Fade Time:

Specify the time required for the dimming level to be changed by fast fading (as a value from 0 and from Min Fast Fade Time to 27).

(12) Dimming Curve

Specify a dimming curve (0: logarithm curve 1: a fault logarithm curve) to use.

(13) Group

Specify the group the evaluation board belongs to. Multiple groups can be specified.

(14) Features

Specify the hardware features of the evaluation board. It is possible to select multiple.

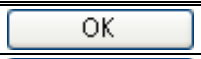
(15) Possible Operating Modes

Specify the operational mode on the evaluation board. It is possible to select multiple.

(16) Gear Type

Specify the type of the evaluation board. It is possible to select multiple.

Function buttons

Button	Description
	Click this button to save the current settings and close the open dialog box.
	Click this button to close the open dialog box without saving the current settings.

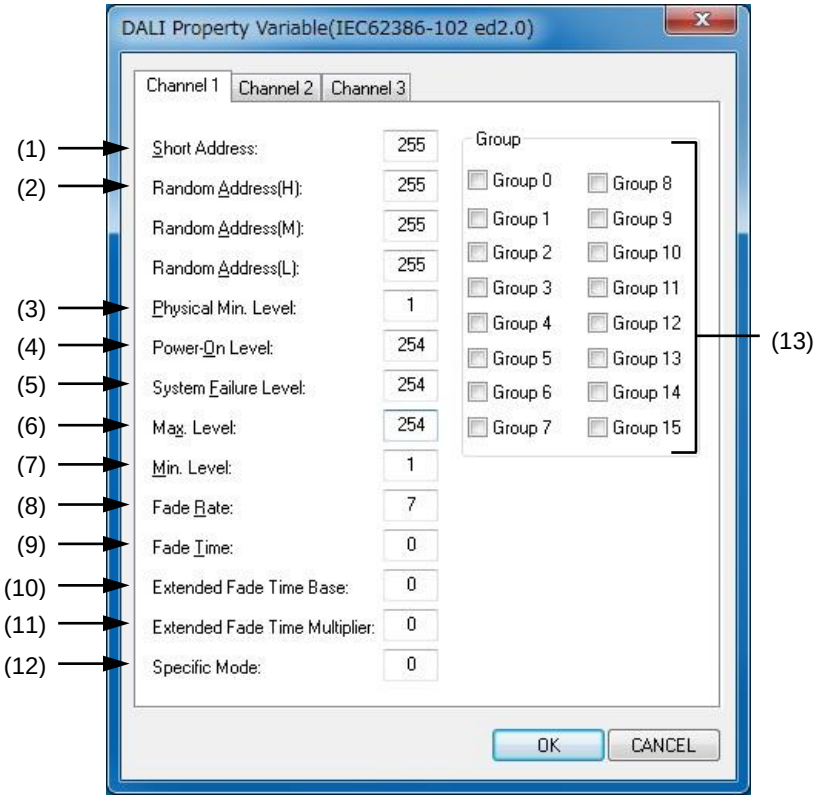
[DALI Property Variable] dialog box (IEC62386-102 ed2.0)

<R>

This dialog box can be opened by clicking [DALI...] in the [Project] menu or clicking [Variable] after selecting the edition to [IEC62386-102 ed2.0].

Set parameter of DALI in this dialog box.

Figure5-5 [DALI Property] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Short Address:

Specify the default address of the evaluation board (as a value from 0 to 63 and 255).

Caution When the short address is assigned to the same address of the mounted LED channels, a right result may not be acquired in command replies such as Query.

(2) Random Address:

Specify a value when assigning a random address to the evaluation board.

Set random address value (0 to 255) to Random Address(H),(M),(L).

Caution When the Random Address(H),(M),(L) are assigned to the same address of the mounted LED channels, a short address cannot be set definitely in Random Address Allocation.

(3) Physical Min. Level:

Specify physical minimum dimming level (as a value from 1 to 254) of the connected lamp on the evaluation board or the evaluation board.

(4) Power-On Level:

Specify the dimming level for when turning on power (as a value from 1 to 255).

(5) System Failure Level:

Specify the dimming level for when a failure occurs (as a value from 0 to 255).

(6) Max. Level:

Specify the maximum dimming level (as a value from the minimum level to 254).

(7) Min. Level:

Specify the minimum dimming level (as a value from the physical minimum level to the maximum level).

(8) Fade Rate:

Specify the amount by which the dimming level is changed by fading (as a value from 1 to 15).

(9) Fade Time:

Specify the time required for the dimming level to be changed by fading (as a value from 0 to 15).

(10) Extended Fade Time Base:

Specify base value of the extended fade time of dimming (as a value from 0 to 15).

(11) Extended Fade Time Multiplier:

Specify multiplier value of the extended fade time of dimming (as a value from 0 to 4).

(12) Specific Mode:

Specify the time (0 and as a value from 128 to 255) required for the dimming level to be changed.

(13) Group

Specify the group the evaluation board belongs to. Multiple groups can be specified.

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

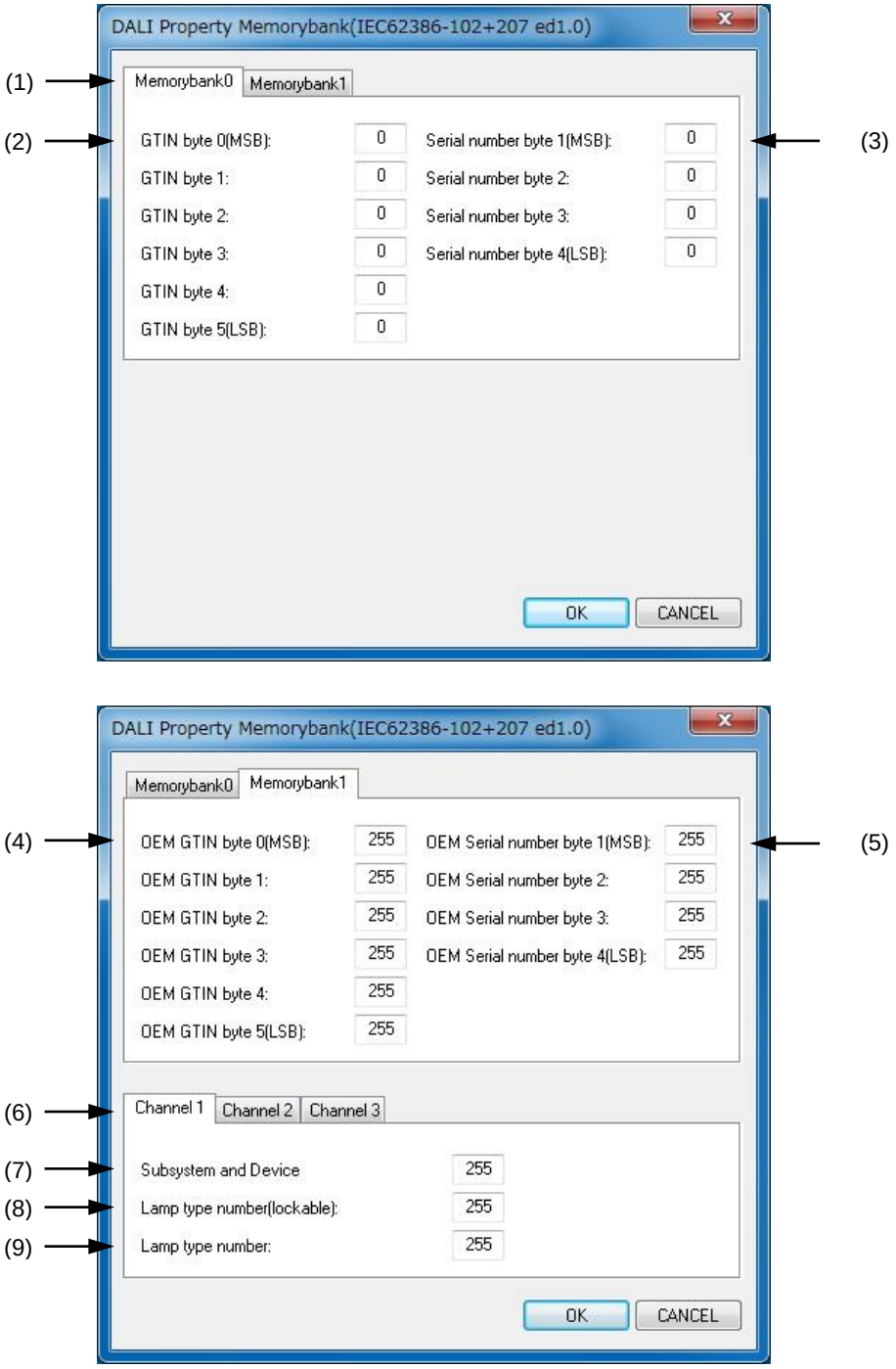
[DALI Property Memorybank] dialog box (IEC62386-102+207 ed1.0)

<R>

This dialog box can be opened by clicking [Memorybank] after selecting the edition to [IEC62386-102+207 ed1.0].

Set Memorybank parameter of DALI in this dialog box.

Figure5-6 [DALI Property Memorybank] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Selection Memorybank TAB

Select the Memorybank to be set.

(2) GTIN byte:

Set GTIN: Global Trade Item Number (international standard for product identification code) of evaluation board.

(3) Serial number byte:

Set the serial number of the evaluation board.

(4) OEM GTIN byte:

Set the GTIN (the international standard for product identification code) that OEM of the evaluation board sets.

(5) OEM Serial number byte:

Set the serial number that OEM of the evaluation board sets.

(6) channel TAB:

Select the logical device of the evaluation board.

(7) Subsystem and Device:

Set the subsystem number (bit7-4) and device number (bit3-0) including Control gear.

(8)Lamp type number(lockable):

Set the lamp type. It is protected by the Lock byte.

(9) Lamp type number:

Set the lamp type.

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

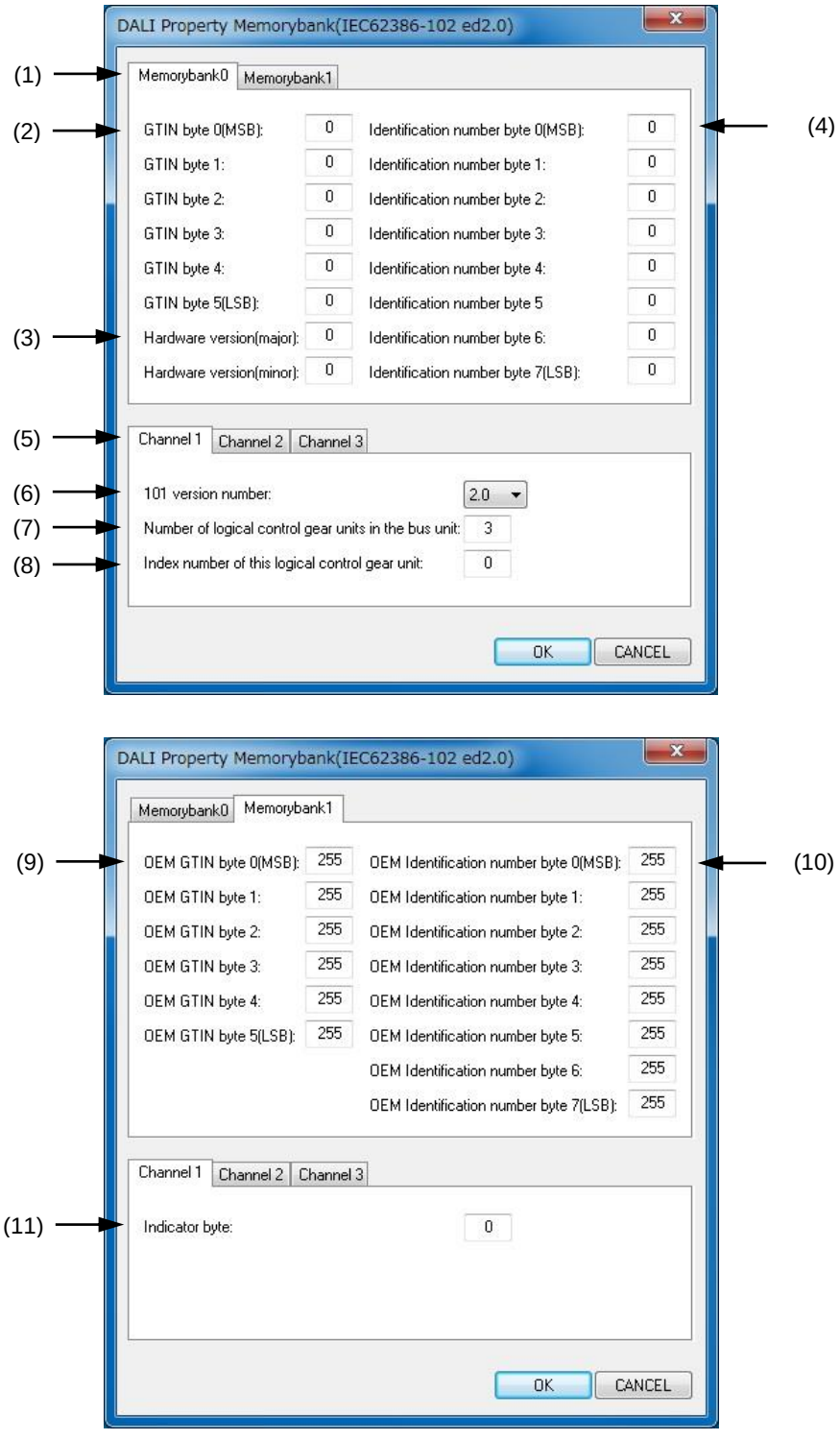
[DALI Property Memorybank] dialog box (IEC62386-102 ed2.0)

<R>

This dialog box can be opened by clicking [Memorybank] after selecting the edition to [IEC62386-102 ed2.0].

Set Memorybank parameter of DALI in this dialog box.

Figure5-7 [DALI Property Memorybank] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Selection Memorybank TAB

Select the Memorybank to be set.

(2) GTIN byte:

Set GTIN: Global Trade Item Number (international standard for product identification code) of evaluation board.

(3) Hardware Version:

Set Hardware Version [major] [minor] of evaluation board.

(4) Identification number byte:

Set the Identification number of evaluation board.

(5) channel TAB :

Select the logical device of the evaluation board.

(6) 101 version number:

Select the IEC62386-101 version number to be used on the evaluation board.

Caution This item is common to all channels. This can be set only on youngest TAB of channel number.

(7) Number of logical control gear unit in the bus unit:

Set the number of connected Control gear on the same BUS unit.

Caution This item is common to all channels. This can be set only on youngest TAB of channel number.

(8) Index number of this logical control gear unit:

Set the index number of Control gear connected on the same BUS unit (as a value from 1 to Number of logical control gear unit in the bus unit - 1).

This number is used as Short Address Number in Random Address Allocation.

Caution As for this number, the overlap on the same BUN unit is not forgiven. When overlapping, it becomes the overlap error in Random Address Allocation and cannot set Short Address Number.

(9) OEM GTIN byte:

Set the GTIN (the international standard for product identification code) that OEM of the evaluation board sets.

(10) OEM Identification number byte:

Set the Identification number that OEM of evaluation board sets.

(11) Indicator byte:

Purpose and the set value of this byte are left to the manufacturer. Set the value the manufacturer has decided (as a value from 0 to 255).

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

[DMX512 Property] dialog box

This dialog box can be opened by clicking [DMX512...] in the [Project] menu.

Set channel numbers of DMX512 in this dialog box.

Figure5-8 [DMX512 Property] dialog box

The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Channel X

Enter a number from 1 to 512 in order to assign each channel to a slot (channel) of the DMX512 protocol.

If an existing setting file is open, the value in that file is displayed.

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

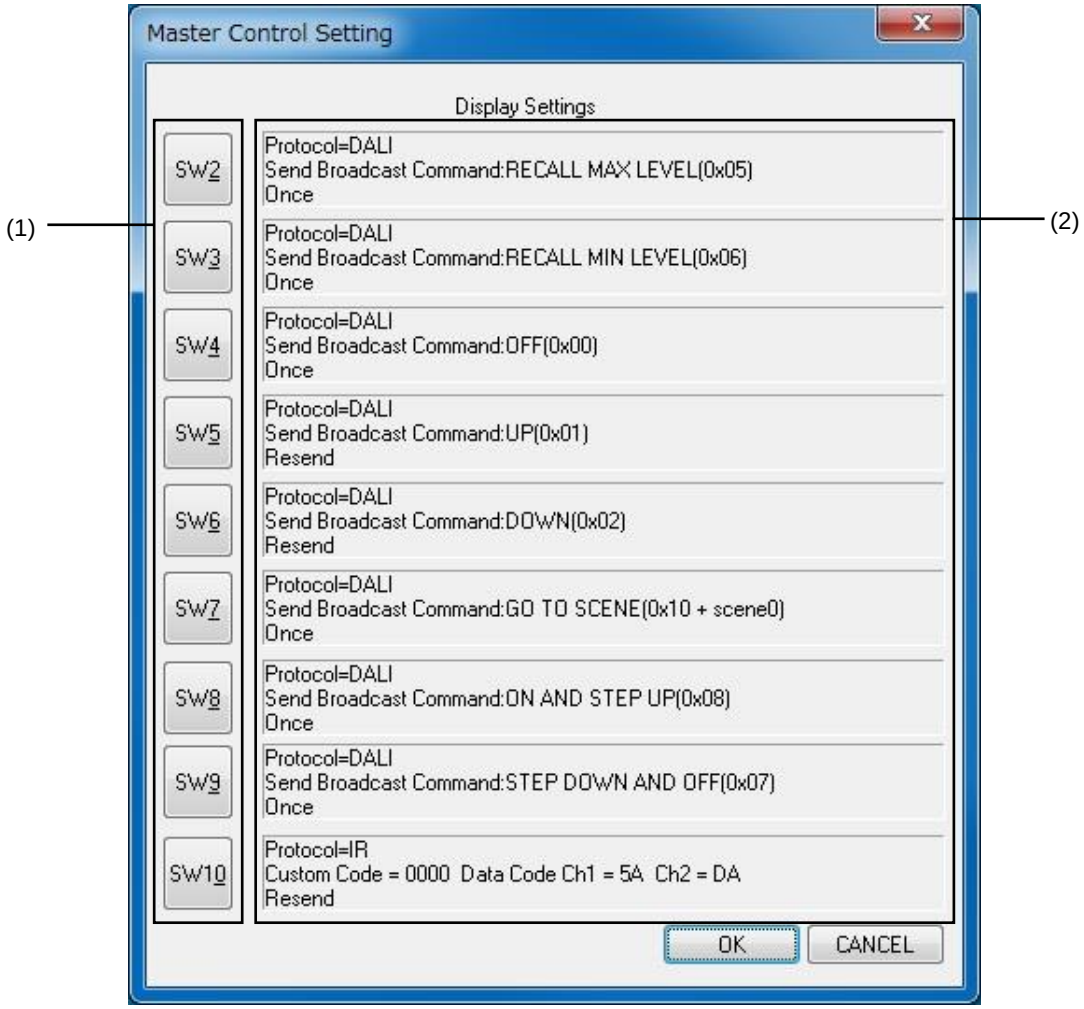
[Master Control Setting] dialog box

<R>

This dialog box can be opened by clicking [Setting..] button on the [Master control].

Set transmission contents setting of SW 2 to 10 on Lighting Communication Master Evaluation Board in this dialog box.

FIgure5-9 [Master Control Setting] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

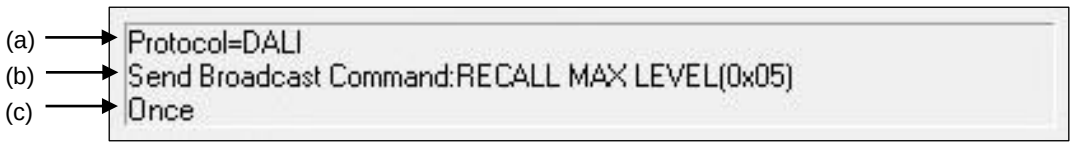
(1) SW X settings dialog box display button

Display the settings dialog box for each SW.

In the dialog box, the value that set currently is displayed.

(2) SW X setting display

Display the contents set currently for each SW.



(a) Setting Protocol Display

Protocol set for each SW is displayed.

Displayed protocol

- DALI: DALI protocol
- IR : IR protocol

(b) Setting Command Display

Command set for each SW is displayed.

- DALI: Setting address + Command
- IR: Custom Code + Data Code + Setting Ch1 + Setting Ch2

(c) Setting Operation mode Display

Operation mode setting when you hold down the SW X is displayed.

- Once: Single transmission (command only transmit once)
- Resend: Continuous transmission (command transmitted every 150msec)
- Repeat: Continuous transmission (Repeat command transmitted every 108msec, when the IR only)

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

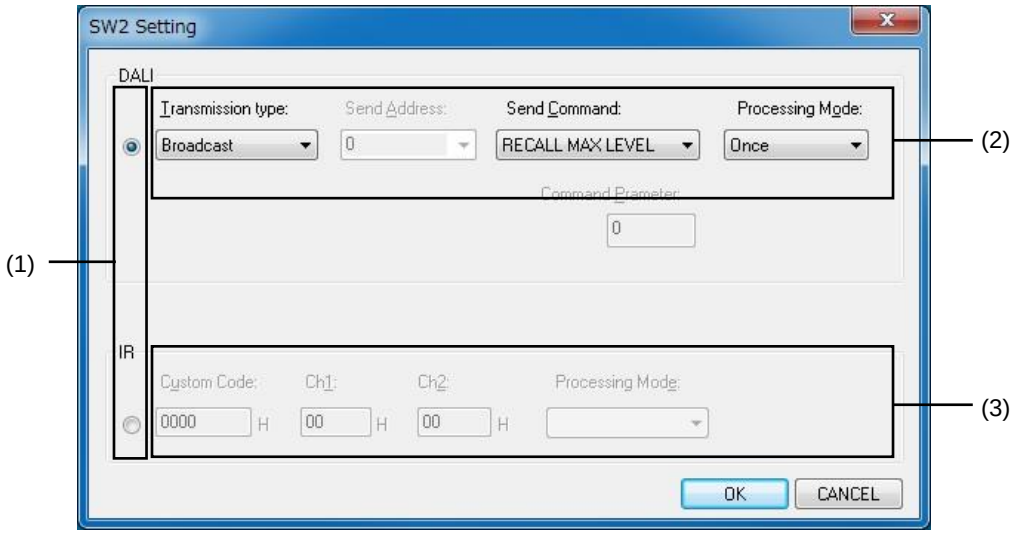
[SW X Setting] dialog box

<R>

This dialog box can be opened by clicking [SW X] button on the [Master control Setting] dialog box.

Set transmission of SW X in this dialog box.

FIgure5-10 [Master Control Setting] dialog box



The following parts of this window are described below.

- Description of function-related areas
- Function buttons

Description of function-related areas

(1) Mode selection radio button

Set a mode (DALI or IR protocol) to set in SW.

(2) Setting of DALI command

Set a transmission command in DALI.

(a) Setting of address type

Set an address type of DALI protocol.

Setable address type

- Broadcast: Broadcast (all devices) transmission
- Group Address: Group address (group setting device) transmission
- Short Address: Short address (individual devices) transmission

(b) Setting of address

Set an address number at the time of the group address of the DALI protocol or the short address setting.

Setable range

- Group Address: 0 to 15
- Short Address: 0 to 63

(c) Setting of command

Set a command of DALI protocol

Setable command

- DAPC: Dimming the specified dimming level according to the Fade time
- OFF: Turn off
- UP: UP the 200msec dimming level according to the Fade rate.
- DOWN: DOWN the 200msec dimming level according to the Fade rate.
- STEP UP: Dimming level +1 (impossible to OFF)
- STEP DOWN: Dimming level -1 (impossible from OFF)
- RECALL MAX LEVEL: Maximize dimming level
- RECALL MIN LEVEL: Minimize dimming level
- STEP DOWN AND OFF: Dimming level -1 (possible to OFF)
- ON AND STEP UP: Dimming level +1 (possible from OFF)
- GO TO SCENE: Dimming to Scene value that is set according to Fade time.

(d) Setting of operation mode

Set the operating mode when SW that is set to DALI protocol is continued to be pushed.

Setable operation mode

- Once: Single transmission (command only transmit once)
- Resend: Continuous transmission (command transmitted every 150msec)

(d) Setting of command parameter

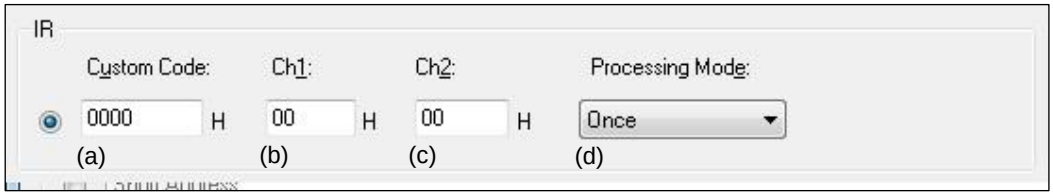
Set the parameters (data) to be set in the DALI protocol command.

Setable parameter

- DAPC: 0 to 255
- GO TO SCENE: 0 to 15
- Other: Setting disable

(3)Setting of IR command

Set the transmission command in the IR mode.



(a) Customer code

Set the manufacturer identification code.

- Setting range: 0000h－FFFFh

(b) Channel 1 code

Set control data at the time of the Channel 1 setting.

- Setting range: 00h－FFh

(c) Channel 2 code

Set control data at the time of the Channel 2 setting.

- Setting range: 00h－FFh

(d) Setting of operation mode

Set the operating mode when SW that is set to DALI protocol is continued to be pushed.

Setable operation mode

- Once: Single transmission (command only transmit once)
- Resend: Continuous transmission (command transmitted every 150msec)
- Repeat: Continuous transmission (Repeat command transmitted every 108msec, when the IR only)

Function buttons

Button	Description
OK	Click this button to save the current settings and close the open dialog box.
CANCEL	Click this button to close the open dialog box without saving the current settings.

APPENDIX A SAMPLE FILE

This chapter introduces sample files for specific colors.

These sample files are stored in the following folder.

-C:¥Program Files(x86)¥Renesas Electronics¥ Applilet EZ for HCD Ver9.0¥Sample¥Board name¥

Sample File Name	Description	Operation Mode
Flash_xxxxx.xml	Flash	Variable mode
Rainbow_xxxxx.xml	Rainbow	
Random_xxxxx.xml	Random color	

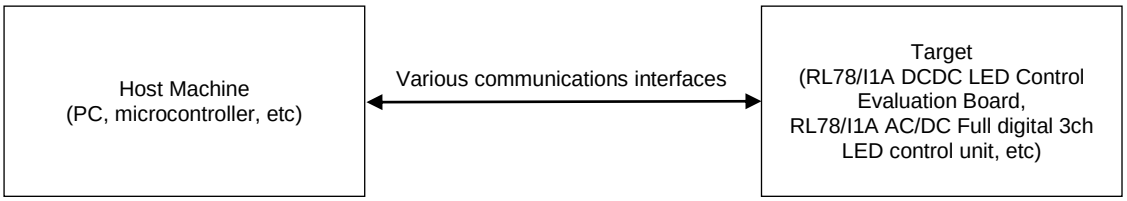
Remarks 1. In the sample file names, "xxxxx" represents the name of an evaluation board.

2. Depending on the board, these files may not exist.

3. If the LED being beforehand mounted on a board is changed, the color may be changed.

<R> APPENDIX B SERIAL COMMAND MODE COMMUNICATION COMMANDS

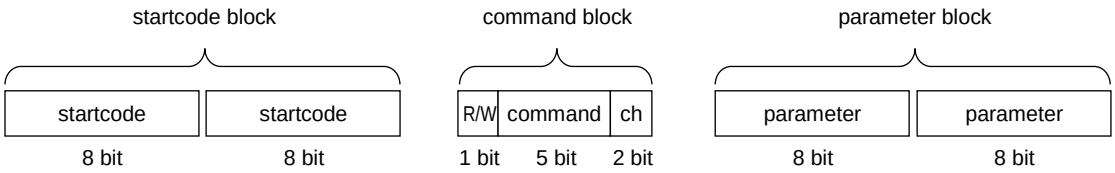
This chapter describes the communication commands used between a host device (such as a PC or a microcontroller) and a target device (evaluation board). An application software that uses the communication commands can be generated by selecting [Serial Command] on the Applilet EZ for HCD Controller and determining the communication method. Refer to 4.3.4 for operation details.



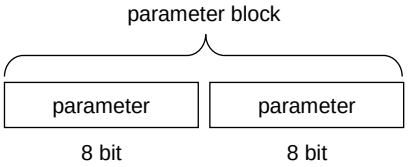
The communication methods that can be selected with the Serial Command mode are UART1.
About type of data, binary types and ASCII types of these communication methods can be selected.
Refer to B.1 Overview of Binary Type, B.2 Overview of ASCII Type for details of each type.
Refer to B.3 for the timings of each communication method.

B.1 Overview of Binary Type

Basic format 1 (host →target)



Basic format 2 (target → host)



Basic formats 1 and 2 are binary type communication formats. Basic format 1 is used to transmit data from a host device to a target device and consists of a startcode block, a command block, and a parameter block. Basic format 2 is used to transmit data from a target device to a host device and consists of only a parameter block.
Details of each block are described below.

B. 1. 1 Details of basic format 1 (host → target)

-startcode block

2 [byte] data, each byte consisting of 8 bits fixed to 0. It is required when transmitting data from a host device to a target device.

-command block

1 [byte] data consisting of 8 bits. The meaning of each bit is as follows.

R/W (1 bit): This bit specifies the flow of information. Whether status acquisition is requested to the target device or an operation status is set to the target device changes, depending on this bit.

1 (READ): This specifies status acquisition (during reception).

0 (WRITE): This specifies setting (during transmission).

Command (5 bit): These bits specify the items whose status is to be acquired (during reception) or that is to be set (during transmission). The following one item type exist and their meanings vary, depending on whether they are set to status acquisition (during reception) or setting (during transmission).

01000 (Dimming value): This item represents the dimming value

Status acquisition (during reception) =When this command is selected, the target device returns as 2 [byte] data the dimming value setting value of the channel instructed with "Ch". Refer to B.1.2 for details.

Setting (during transmission) = When this command is selected, the dimming value of the channel instructed with "Ch" is set by using the value specified by "parameter".

Ch (2 bit): These bits specify the target channel.

00 Channel1

01 Channel2

10 Channel3

11 Channel4

-parameter block

2 [byte] data consisting of 8 bits.

This block has no meaning when set to status acquisition (during reception: R/W = 1)[Note 1]. Specify 0x00 for status acquisition (during reception).

When it is set to setting (during transmission: R/W = 0), it has the following meaning according to "Command (5 bits)"of the Command block.

01000 (Dimming value): During dimming value setting

This specifies the dimming value of the channel instructed with "Ch". A value within the range of 0 to 0x2710 (10000:100.00%) [Note 2] can be specified.

Notes 1. This has no meaning but it cannot be omitted.

Notes 2. Setting range for future expansion is a 0-10000 (0.00 to 100.00). Since the setting value that specifies the same dimming level has a width by the board specifications, even if you set a different value, it may be the same dimming level.

B. 1. 2 Details of basic format 2 (target → host)

-parameter block

2 [byte] data consisting of 8 bits.

It is not transmitted when the host device has selected setting (during transmission: R/W = 0).

When status acquisition (during reception: R/W = 1) has been selected, it has the following meaning according to "Command (5 bits)".

01000 (Dimming value): During dimming value setting

This returns as 2 [byte] data the dimming value setting value of the channel instructed with "Ch".

The dimming value holds a value within the range of 0 to 0x2710 (10000: 100.00%).

B. 1. 3 Binary type execution example

1. Setting the dimming value of channel 1 of the target device to 10.00%

- Transmission from the host device

Hexadecimal:	00	00	20	03	E8
Binary:	0000 0000	0000 0000	0010 0000	0000 0011	1110 1000

- Reception from the target device

None

2. Acquiring the dimming value of channel 3 of the target device

- Transmission from the host device

Hexadecimal:	00	00	A2	00	00
Binary:	0000 0000	0000 0000	1010 0010	0000 0000	0000 0000

- Reception from the target device (dimming value = 50.00%)

Hexadecimal:	13	88
Binary:	0001 0011	1000 1000

B. 2 Overview of ASCII Type

Basic format 3 (host → target)

ch	Comma(0x2C)	cmd	Comma(0x2C)	data	LineFeed(0x0D)	CarriageReturn(0x0A)
1byte	1byte	2byte	1byte	5byte	1byte	1byte

Basic format 4 (target → host)

data	LineFeed(0x0D)	CarriageReturn(0x0A)
5byte	1byte	1byte

The ASCII-type communication format uses ASCII characters for transmission and reception. Similarly with the binary type, there are two communication formats of the ASCII type. Basic format 3 is used to transmit data from a host device to a target device, consists of a ch block, a cmd block, and a data block, and is delimited by commas. Basic format 4 is used to transmit data from a target device to a host device and consists of only a data block. Furthermore, LineFeed (0x0D) and CarriageReturn (0x0A) are added to each format.

B. 2. 1 Details of basic format 3 (host → target)

- ch block

  1 [byte] data. It specifies the channel to be controlled.

  Specifiable values: "1", "2", "3", "4"

- cmd block

  2 [byte] data. It can be used to specify for the dimming value of each channel of the target device, status acquisition (during reception) or setting (during transmission). The following four items can be specified.

  Specifiable items: "wd" Set Duty…… This sets the dimming value of the channel specified with the "ch" block.

  "rd" Read Duty…… This requests the setting of dimming value of the channel specified with the "ch" block.

  When requesting to the target device has been specified, the target device returns the current status. Refer to B.2.2 for details.

- data block

  5 [byte] data. It has the following meanings according to the items specified with the cmd block.

  cmd ="wd": This specifies as 5 digits in decimal format the value of the dimming value to be set. ("00000" to "10000") Note 1

  cmd ="rd": This specifies "00000" with a dimming value request to the target device Note 2.

Notes 1. Setting range for future expansion is a 0-10000 (0.00 to 100.00). Since the setting value that specifies the same dimming level has a width by the board specifications, even if you set a different value, it may be the same dimming level.

Notes 2. When cmd is "rd" and "rs", the data block has no meaning, but it cannot be omitted.

B. 2. 2 Details of basic format 4 (target → host)

- data block

5 [byte] data. The data is transmitted from the target device only when cmd is "rd", among the items specified for basic format 3.

cmd ="rd": This return as 5 digits in decimal format the dimming value of the specified channel. ("00000" to "10000")

B. 2. 3 ASCII type execution example

Remark LineFeed (0x0D) and CarriageReturn (0x0A) are expressed as ¥r and ¥n, respectively, in this section.

1. Setting the dimming value of channel 1 of the target device to 10.00%
   - Transmission from the host device

     "1,wd,01000¥r¥n"
   - Reception from the target device

     None
2. Acquiring the dimming value of channel 3 of the target device
   - Transmission from the host device

     "3,rd,00000¥r¥n"
   - Reception from the target device (dimming value = 50.00%)

     "05000¥r¥n"

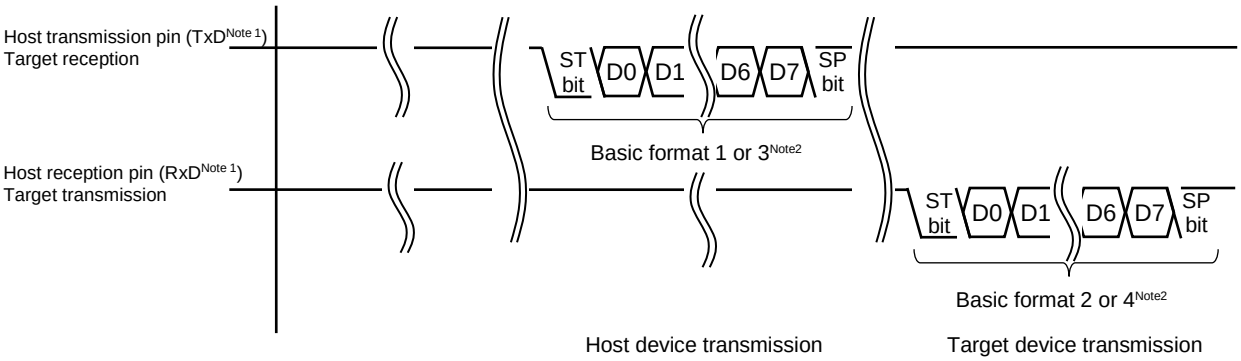
B. 3 Transmission/Reception Timing According to Communication Method

The method and timing of transmission and reception differ according to the communication method. The differences of each communication method are as follows.

<UARTx (ASCII/BINARY)>

In communication using a UART, transmission and reception are performed completely asynchronously. A transmission operation of the target device uses basic format 1 or 3, and occurs only when the host device has requested information acquisition (during reception) to the target device.

UART communication example

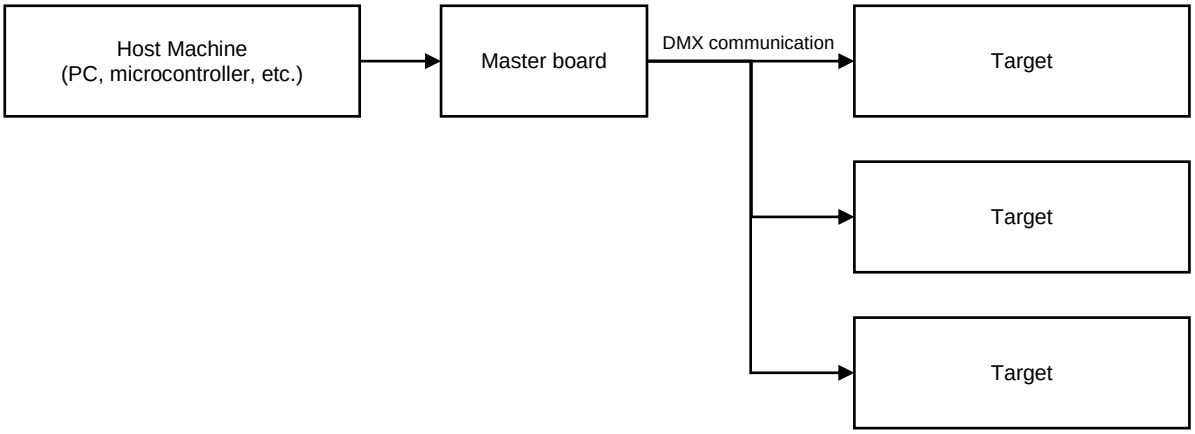


Notes 1. Name of the signal line on the host side

2. This is a waveform of when parity has been set to "None".

APPENDIX C DMX512 MODE COMMUNICATION DATA

The communication data by DMX512 mode is described below.



<R> **Remark** RL78/I1A AC/DC 1 converter LED evaluation unit and RL78/I1A AC/DC 2 converter LED evaluation unit are not supported DMX.

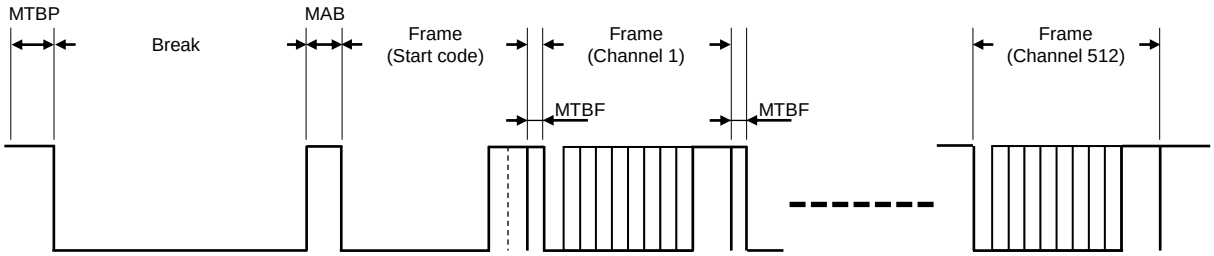
DMX512 performs communication using the following protocol.

C. 1 Protocol Specifications

<1> Packet

One packet is configured of one MTBP, one BREAK, one MAB, 513 frames, and 512 MTBFs.

The first frame is a start code and data is fixed to 0.

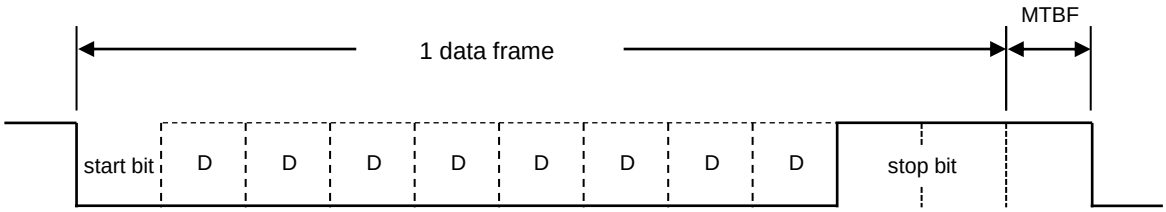


Name	Data width			Level
	MIN.	TYP.	MAX.	
BREAK	88 μs	88 μs	176 μs	Low-level
MAB	8 μs	8 μs	1 s	High-level
FRAME	44 μs	44 μs	44 μs	Low-level/High-level
MTBF	0 μs	–	1 s	High-level
MTBP	0 μs	–	1 s	High-level

<2> Frame

One frame is configured of one start bit, eight data bits, and two stop bits.

One frame is equivalent to one UART communication data byte with a baud rate of 250 kbps, no parity, and two stop bits.

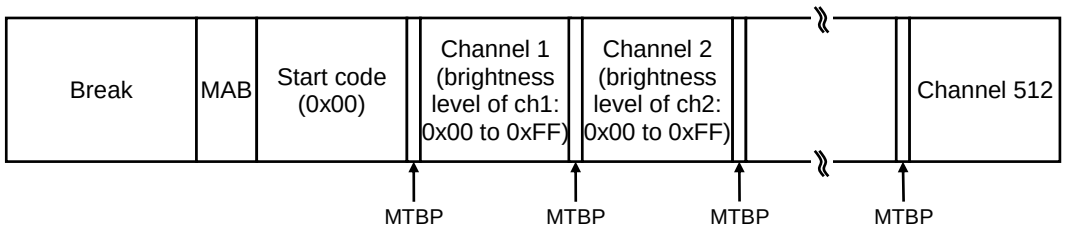


Name	Data width	Level
Start bit	4 μs	Low-level
Data bits	4 μs × 8 bits	Low-level/High-level
Stop bits	4 μs × 2 bits	High-level

C. 2 Communication Data Specification

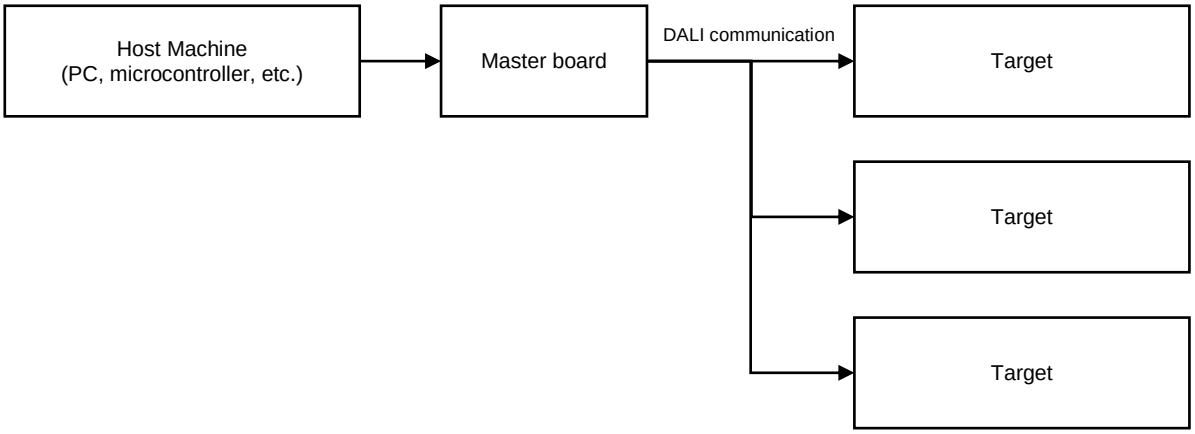
- The frame data bits are LSB first.
- The start code is fixed to 0x00. Packets with a start code other than 0x00 are invalid.
- Brightness data corresponding to channels 1 to 4 on the board are set to each frame (0 ≤ brightness data ≤ 255).

Example of communication data



APPENDIX D DALI MODE COMMUNICATION DATA

The communication data by DALI (Digital Addressable Lighting Interface) mode is described below.



Remark RL78/I1A AC/DC 1 converter LED evaluation unit is not supported DALI communication.

DALI performs communication using the following protocol.

D. 1 Protocol Specifications

DALI is a network consisting of up to 64 short addresses and 16 group addresses, and performs half-duplex command communication between one master and one slave or multiple slaves.

DALI commands are used for purposes such as setting the dimming level with 8-bit accuracy and saving or switching among up to 16 arbitrary dimming levels.

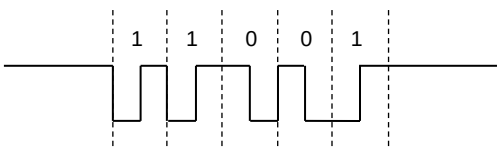
The communication speed is 1,200 Hz ±10%.

<1> Bit definition

A falling edge is bit-defined as "0" and a rising edge as "1", because DALI communication uses Manchester code.

If no communication is performed, DALI communication is fixed to the high level.

FigureD-1 Bit Definition

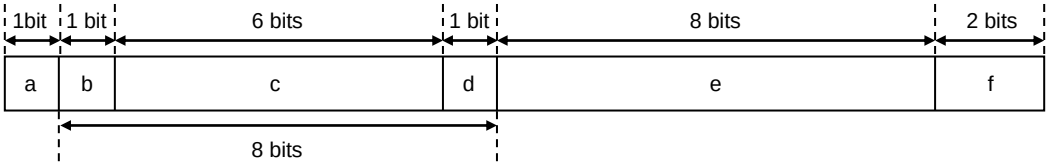


<2> Frame

- Forward frame

  This is a frame used when transmitting from the master to a slave. A frame consists of 19 bits.

Figure D-2 Forward-Frame Structure



a: Start bit

This indicates the start of the frame. It is always the same waveform as "1".

b-d: Address byte

This specifies the transmission destination of the frame.

e: Data byte

This specifies a command.

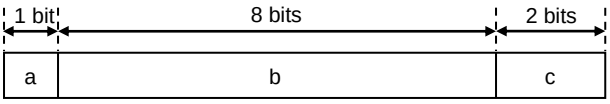
f: Stop bits

These indicate the end of the frame. These are fixed to the high level.

- Backward frame

  This is a frame used when transmitting from the slave to a master. A frame consists of 11 bits.

FigureD-3 Backward-Frame Structure



a: Start bit

This indicates the start of the frame. It is always the same waveform as "1".

b: Data byte

This replies to the master.

c: Stop bits

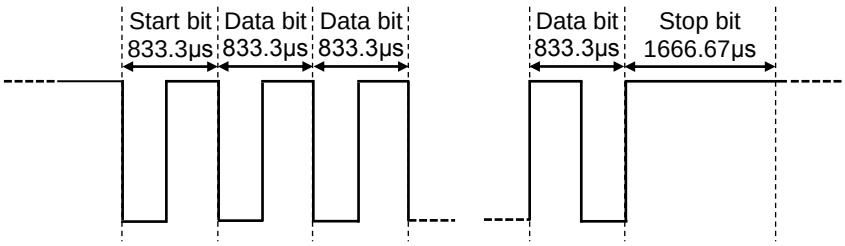
These indicate the end of the frame. These are fixed to the high level.

D. 2 Transmission/Reception Timing Rules

<1> Timing in the frame (101ed1.0)

1 bit width in DALI is 833.3 µs ±10% for both Forward and Backward frames.

FigureD-4 Timing in the Frame



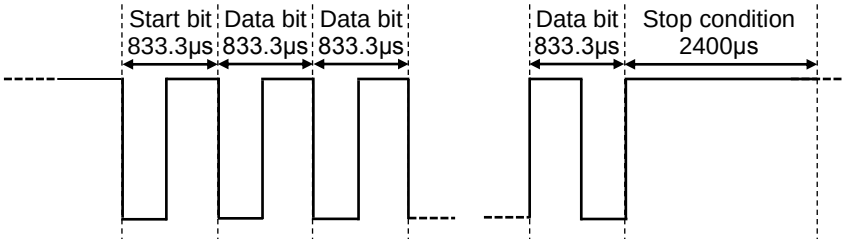
Note Because there are two stop bits, their timing is 1666.67 µs.

<R> <2> Timing in the frame (101ed2.0)

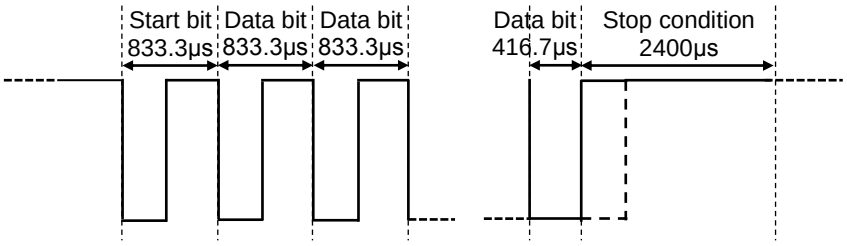
1 bit width in DALI is 833.3 µs for both Forward and Backward frames.

The allowable range of the bit width is 1 bit = 666.7 µs ≤ 1000 µs.

FigureD-5 Timing in the Frame (The last bit= 0)



FigureD-6 Timing in the Frame (The last bit= 1)



Note The start of the Stop condition starts from the end of the rising edge.

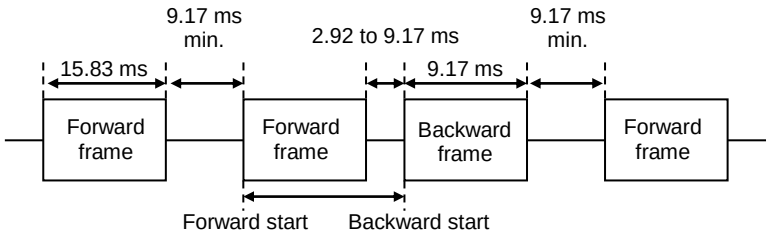
Starting timing of Stop condition changes whether the last bit is 0 or 1.

<3> Timing among frames (101ed1.0)

With DALI, the following timing must be controlled in frame units.

- Forward frame width: 15.83 ms±10 %
- Backward frame width: 9.17 ms±10 %
- Communication interval between one Forward frame and the Backward frame: 2.92 to 9.17 ms
- Communication interval between one Forward frame and the next Forward frame: 9.17 ms min.
- Communication interval between one Backward frame and the next Forward frame: 9.17 ms min.

FigureD-7 Timing among frames

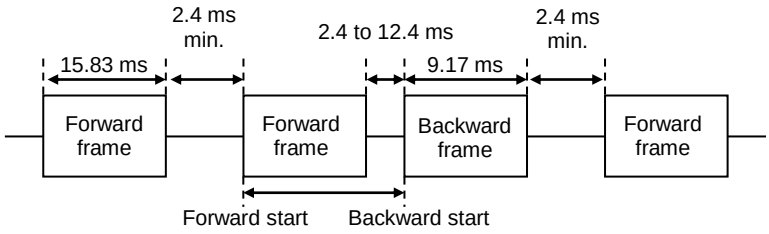


<R> <4> Timing among frames (101ed2.0)

With DALI, the following timing must be controlled in frame units.

- Forward frame width: 15.83 ms (12.66 to 19.00ms)
- Backward frame width: 9.17 ms (7.33ms to 11.00ms)
- Communication interval between one Forward frame and the Backward frame: 2.4～12.4 ms (Settling time)
- Communication interval between one Forward frame and the next Forward frame: 2.4 ms min. (Settling time)
- Communication interval between one Backward frame and the next Forward frame: 2.4 ms min. (Settling time)

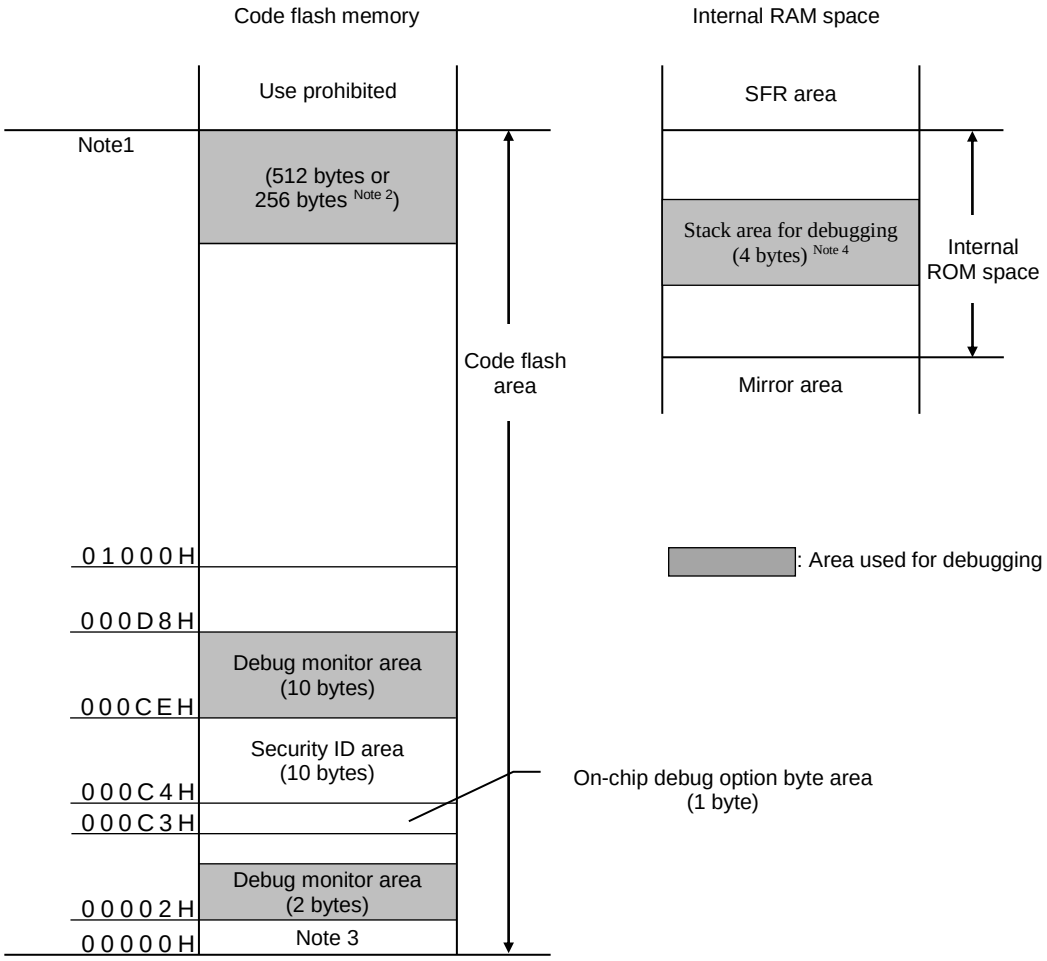
FigureD-8 Timing among frames



<R> APPENDIX E RESERVED AREAS USED IN ON-CHIP DEBUGGING

The reserved areas shaded in gray in Figures F-1 are used during on-chip debugging.

FigureF-1 Reserved Areas Used in On-chip Debugging (RL78/I1A)



Notes 1. Address differs depending on products as follows.

Products	Address of Note 1
R5F1076C, R5F107AC, R5F107BC	07FFFH
R5F107AE, R5F107DE	0FFFFH

2. When real-time RAM monitor (RRM) function and Dynamic Memory Modification (DMM) function are not used, it is 256 bytes.
3. In debugging, reset vector is rewritten to address allocated to a monitor program.
4. Since this area is allocated immediately before the stack area, the address of this area varies depending on the stack increase and decrease. That is, 4 extra bytes are consumed for the stack area used.
   When using self-programming, 12 extra bytes are consumed for the stack area used.

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