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RENESAS

User's Manual

DALI Master Controller GUI

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PREFACE

Readers This manual describes the DALI Master Controller GUI.
This manual is intended for users who have general knowledge of Windows.
The descriptions in this manual are based on an example using the DALI Master Controller GUI in Windows XP.

Purpose This manual is intended to help users understand the basic specifications of the DALI Master Controller GUI, how to use it, and to be used as a reference for developing hardware and software of the system that uses the DALI Master Controller GUI.

Structure This manual consists of the following chapters:

- **CHAPTER 1 OVERVIEW**
- **CHAPTER 2 INSTALLING .NET Framework**
- **CHAPTER 3 INSTALLING THE DALI MASTER CONTROLLER GUI**
- **CHAPTER 4 STARTING AND CLOSING THE DALI MASTER CONTROLLER GUI**
- **CHAPTER 5 USING THE DALI MASTER CONTROLLER GUI**
- **CHAPTER 6 WINDOW AND DIALOG BOX REFERENCE**

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

To learn about the functions of DALI Master Controller GUI
→ Read this manual in the order of the **CONTENTS**.

Conventions The following signals are used in this manual.

Data significance:	Higher digits on the left and lower digits on the right
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
	Hexadecial... xxxxH

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

DALI Master Controller GUI User's Manual	(This Manual)
Lighting Communication Master Evaluation Board (EZ-0008) Quick Start Guide	(ZUD-CE-09-0018)

Remark The DALI standard is described based on the international standard IEC60929.
For details, see IEC60929.

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CHAPTER 1 OVERVIEW

1.1 Overview

The DALI Master Controller GUI (graphical user interface) controls the Lighting Communication Master Evaluation Board (EZ-0008) that enables communication conforming to the DALI standard.

The DALI Master Controller GUI has the following features:

- Short addresses can be displayed in a tree view for each group.
- The values specified for short addresses are always displayed.
- Easily checking operation

Remark DALI: Degital Addressable Lighting Interface

For details about the Lighting Communication Master Evaluation Board **(EZ-0008)**, see the **Lighting Communication Master Evaluation Board Quick Start Guide (ZUD-CE-09-0018)**.

1.1.1 Operating environment

(1) Host

OS: Windows Vista, Windows XP, Windows 2000
CPU: Intel Pentium 400 MHz or faster
Memory: At least 256 MB

(2) Additional components

When using the DALI Master Controller GUI, the following softwares must be installed in advance. It is recommended that the latest service pack be installed for any OS or component.

Windows XP, Windows Vista (Download each component from the Microsoft websites.)

- Microsoft .NET Framework 3.5 or later
- Microsoft .NET Framework 3.5 Language pack (language version other than English)

Windows 2000 (Download each component from the Microsoft websites.)

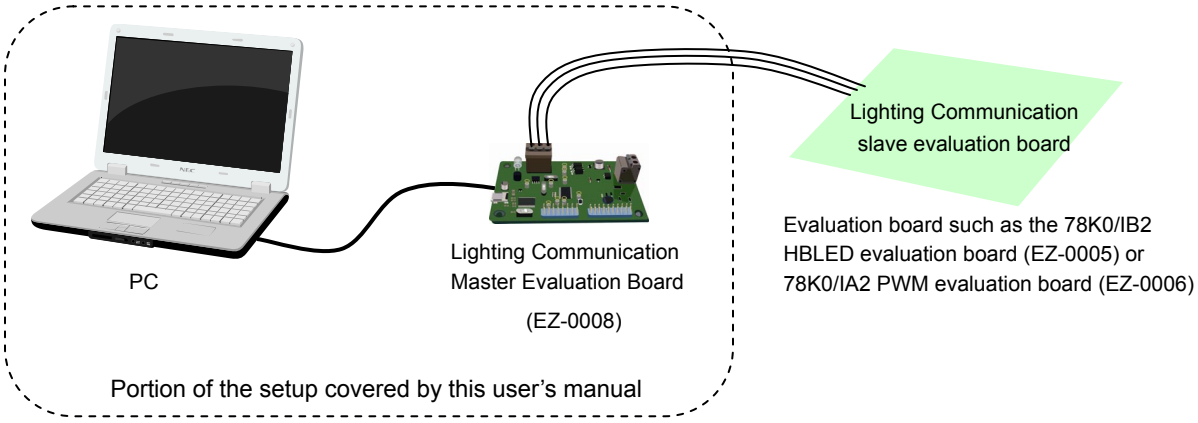
- Microsoft .NET Framework 2.0 or later
- Visual C++ 2008 Runtime Library

To use .NET Framework in language other than English of Windows, a language pack is required.
For details about how to install .NET Framework 3.5, see **CHAPTER 2 INSTALLING .NET Framework**.

1.1.2 System setup

The following shows an example of the system setup.

Figure 1-1. Example of System Setup



1.1.3 DALI communication

Serial communication between the PC and Lighting Communication Master Evaluation Board (EZ-0008) is performed by virtual COM-to-USB.

The Lighting Communication Master Evaluation Board (EZ-0008) can control a lighting communication slave evaluation board (such as the EZ-0005 or EZ-0006) using DALI communication.

1.2 Setup Procedure

The following shows the setup procedure.

<1> Install .NET Framework to the PC.
(See **CHAPTER 2 INSTALLING .NET Framework.**)

<2> Install the DALI Master Controller GUI to the PC.
(See **CHAPTER 3 INSTALLING THE DALI MASTER CONTROLLER GUI**)

<3> Install the driver.
Toggle the switch of the Lighting Communication Master Evaluation Board (EZ-0008) to **RUN**.
Connect the Lighting Communication Master Evaluation Board (EZ-0008) to the PC by using a USB cable.
Install the driver to the PC.
(For details, see **CHAPTER 3 INSTALLING THE DALI MASTER CONTROLLER GUI**)

<4> Specify a COM port.
Double click the [DALI Master Controller GUI] icon to display “DALI Controller”.
(For details, see **CHAPTER 4 STARTING AND CLOSING THE DALI MASTER CONTROLLER GUI**.)
The COM port is set to “COM4” and “250000” bps by default.
If other settings are specified, the message “Can’t open serialport” is displayed. Click [OK].

Specify a COM port in the Serial dialog box.
The port (COM1 to COM255) differs depending on the PC to connect.

<5> For details about how to use the GUI, see **CHAPTER 5 USING THE DALI MASTER CONTROLLER GUI.**
For details about the displayed windows and dialog boxes, see **CHAPTER 6 WINDOW AND DIALOG BOX REFERENCE**.

CHAPTER 2 INSTALLING .NET Framework

This chapter describes how to install .NET Framework in Windows XP.

2.1 Required Files

The following two files are required.
Download these files from the Microsoft website.

(1) .NET Framework 3.5 installer (Windows XP)
dotNetFx35setup.exe

(2) .NET Framework 3.5 Language pack installer (Windows XP)
dotnetfx35langpack_x86ja.exe
(A language pack is required for using the DALI Master Controller GUI in the language version other than English of Windows.)

2.2 Installing .NET Framework

Install .NET Framework, which is required for using the DALI Master Controller GUI.
This step is described by using Windows XP and .NET Framework 3.5 as an example.
The dialog boxes to be displayed and the components to be installed differ slightly for other OSs.
To use .NET Framework 3.5, a language pack corresponding to the language version other than English of Windows must be installed.

<1> When dotNetFx35setup.exe is double clicked, the Open File – Security Warning dialog box is displayed. Click [Run].

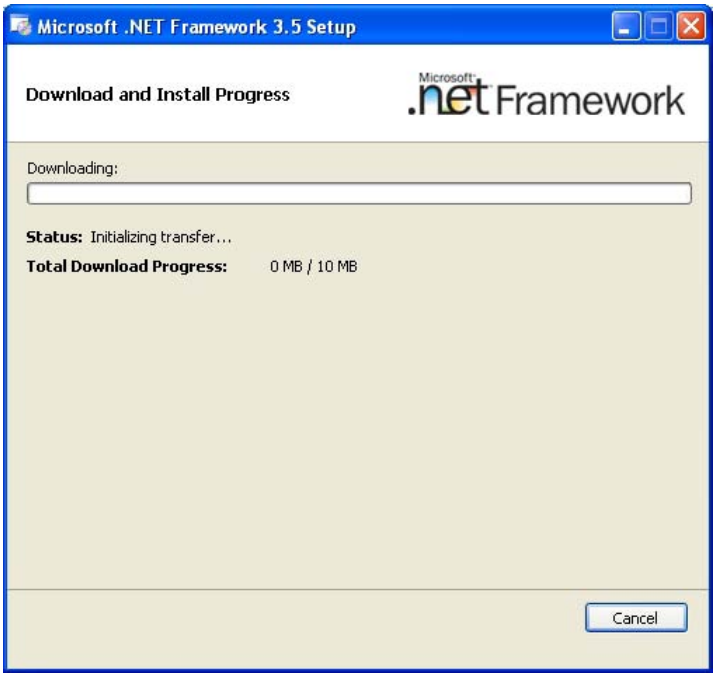
Figure 2-1. Open File – Security Warning

<2> The Microsoft .NET Framework 3.5 Setup dialog box is displayed.
Read the license agreement, select "I have read and ACCEPT the terms of the License Agreement" if you agree with the terms, and then click the [Install] button.

Figure 2-2. Microsoft .NET Framework 3.5 Setup (1)

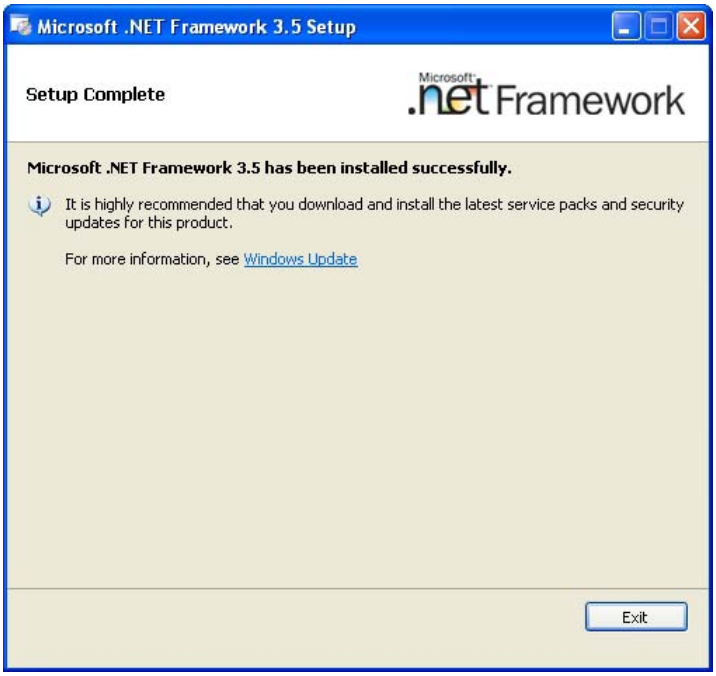
<3> Install .NET Framework according to the following procedure.

Figure 2-3. Microsoft .NET Framework 3.5 Setup (2)



<4> Click [Exit] when the installation is completed.

Figure 2-4. Microsoft .NET Framework 3.5 Setup (3)



<5> When using the language version other than English of Windows, install the Language Pack.

Caution If a new service pack is released, install that service pack by using Microsoft Update.

CHAPTER 3 INSTALLING THE DALI MASTER CONTROLLER GUI

This chapter describes how to install the DALI Master Controller GUI in Windows XP.

3.1 Installer

The DALI Master Controller GUI provides the following installer.
Double click the installer to install the DALI Master Controller GUI.

3.1.1 Installation procedure

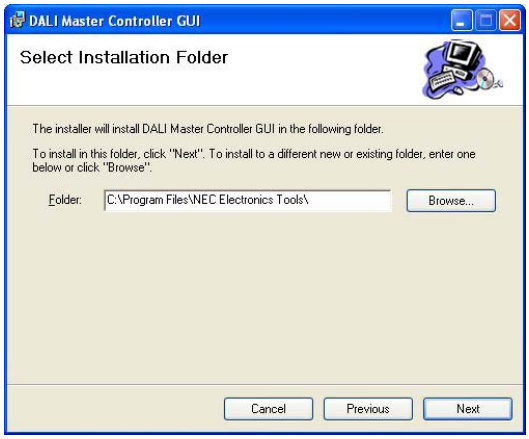
The following shows the installation procedure.

<1> When the installer is double clicked, the dialog box in Figure 3-1 is displayed.
Click [Next].

Figure 3-1. DALI Master Controller (Installer)

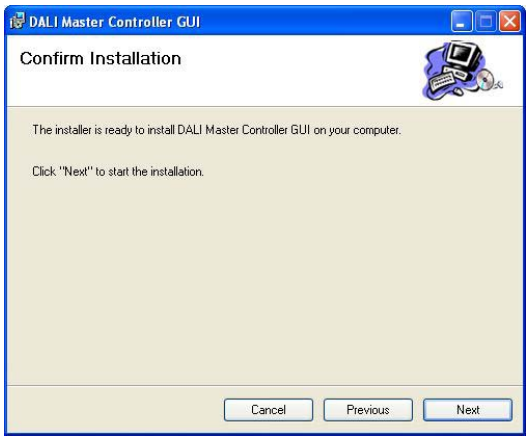
<2> Select the folder in the Select Installation Folder dialog box and then click [Next].

Figure 3-2. DALI Master Controller (Select Installation Folder)



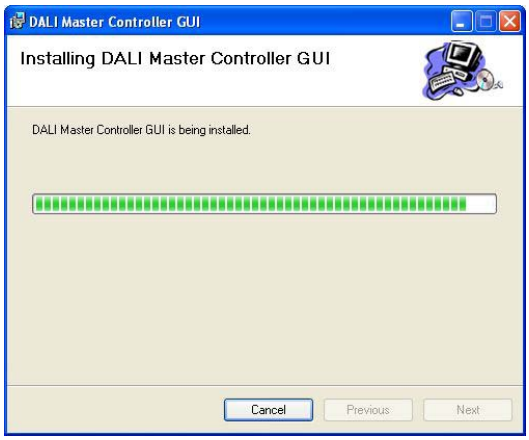
<3> The Confirm Installation dialog box is displayed.
Click [Next] to start the installation.

Figure 3-3. DALI Master Controller (Confirm Installation)



<4> Installation starts.

Figure 3-4. DALI Master Controller (Installing)



<5> Installation is complete.

Figure 3-5. DALI Master Controller (Installation Complete)

<6> The icon is added to the desktop.
When the icon is double clicked, the DALI Controller window is displayed.

3.1.2 Uninstallation procedure

The following shows the uninstallation procedure.

<1> Select [Start], [Control Panel], and then [Add or Remove Programs].

<2> Select “DALI Master Controller GUI” from the displayed programs and then click [Remove].

<3> The DALI Master Controller GUI is uninstalled.

3.2 Driver

Install the driver when connecting the Lighting Communication Master Evaluation Board (EZ-0008) to the PC by using a USB cable for the first time.

Save the following required files to any folder.

MQB2SALL.inf
MQB2SALL.sys
MQB2SVCP.sys

3.2.1 Installation procedure

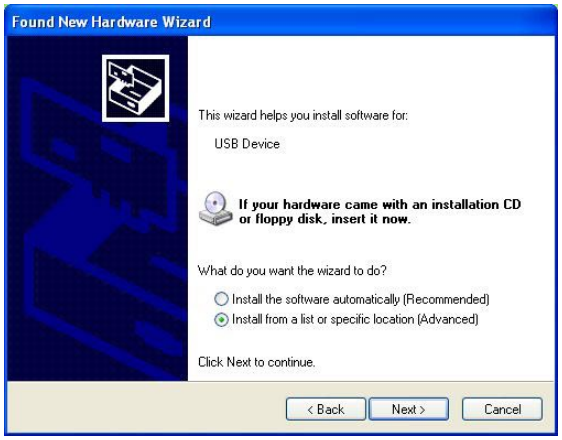
The following shows the installation procedure.

<1> When connecting the Lighting Communication Master Evaluation Board (EZ-0008) to the PC by using a USB cable, the following dialog box is displayed.
Select “Yes, now and every time I connect a device”.
Click [Next].

Figure 3-6. Found New Hardware Wizard (1)

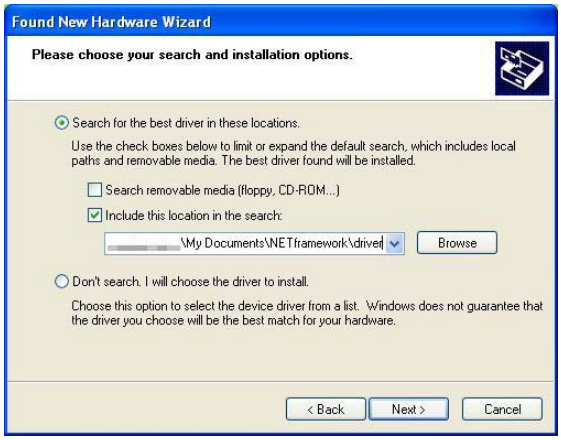
<2> Select “Install from a list or specific location (Advanced)”.
Click [Next].

Figure 3-7. Found New Hardware Wizard (2)



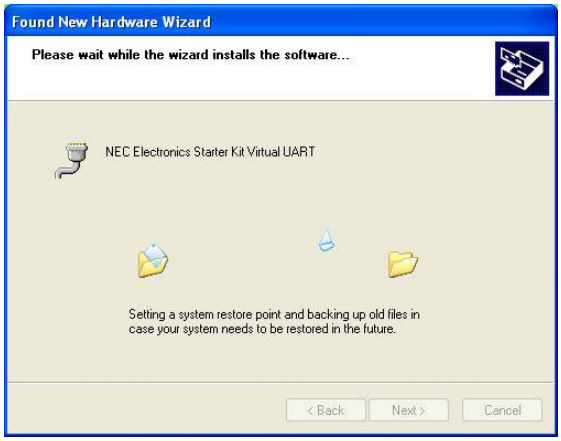
<3> Select “Include this location in the search:” and then click [Browse].
Specify the folder in which MQB2SALL.inf, MQB2SALL.sys, and MQB2SVCP.sys are saved.
Click [Next].

Figure 3-8. Found New Hardware Wizard (3)



<4> Installation starts.

Figure 3-9. Found New Hardware Wizard (4)

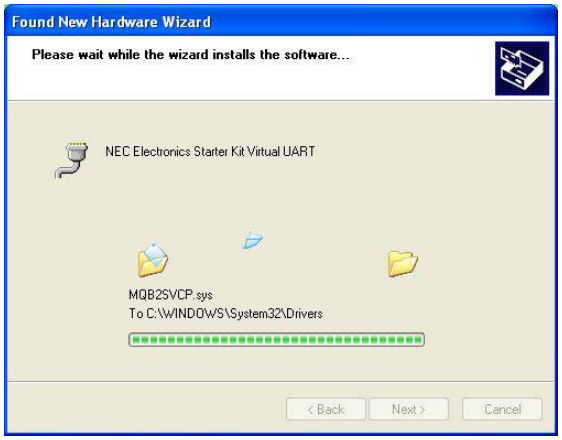


<5> Click [Continue Anyway].

Figure 3-10. Hardware Installation

<6> Continue the installation.

Figure 3-11. Found New Hardware Wizard (5)



<7> Click [Finish]. Installation is complete.

Figure 3-12. Found New Hardware Wizard (6)

CHAPTER 4 STARTING AND CLOSING THE DALI MASTER CONTROLLER GUI

After .NET Framework and the DALI Master Controller GUI have been installed, the DALI Master Controller GUI can be opened.

4.1 Starting

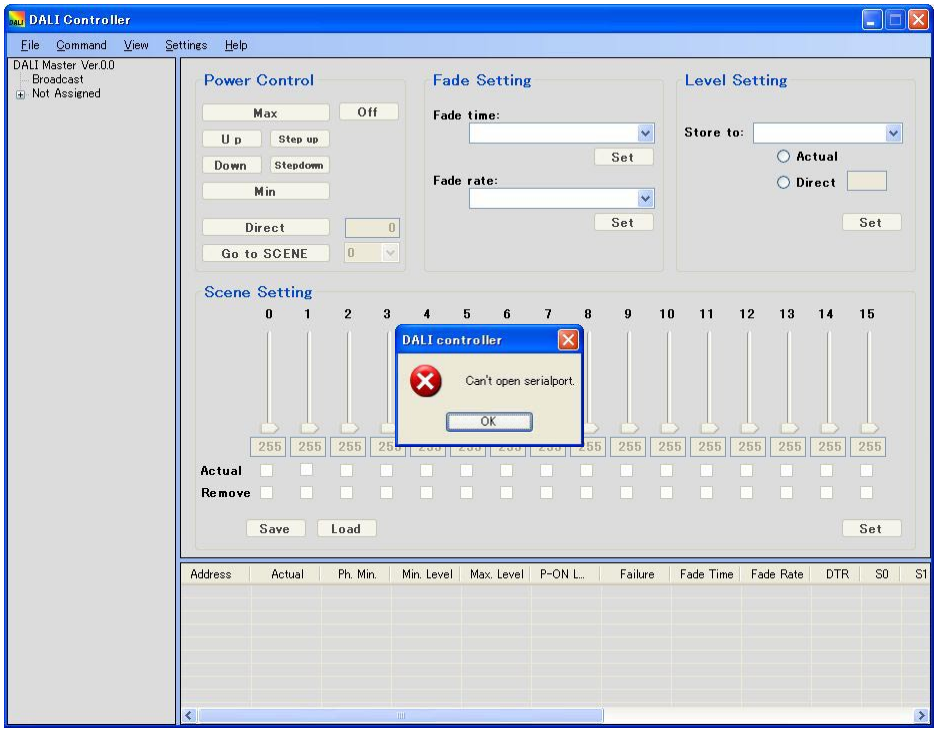
<1> Connect the Lighting Communication Master Evaluation Board (EZ-0008) to the host.

<2> Double click the [DALI Master Controller GUI] icon, or select [Start], [All Programs], [NEC Electronics Tools], [DALI Master Controller], and then [DALI Master Controller GUI].

<3> The DALI Controller window is displayed.

<4> The COM port is set to “COM4” and “250000” bps by default.
If the connection fails, the message “Can’t open serialport” renders, because the port (COM1 to COM255) differs depending on the PC to connect. If this error occurs, specify the COM port in the Serial dialog box.

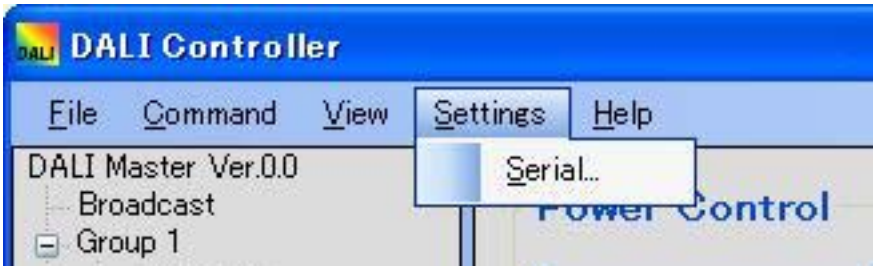
Figure 4-1. Window Displayed When the DALI Master Controller GUI Is Opened



<5> Click [OK].

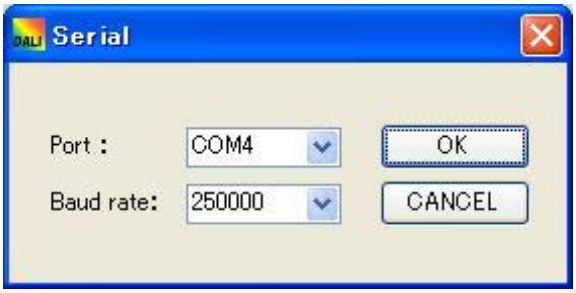
<6> In the menu, select [Settings] and then [Serial] to specify the COM port and communication speed.

Figure 4-2. DALI Controller Window



<7> Specify a COM port in the Serial dialog box, and then click [OK].
The port (COM1 to COM255) differs depending on the PC to connect.

Figure 4-3. Serial Dialog Box

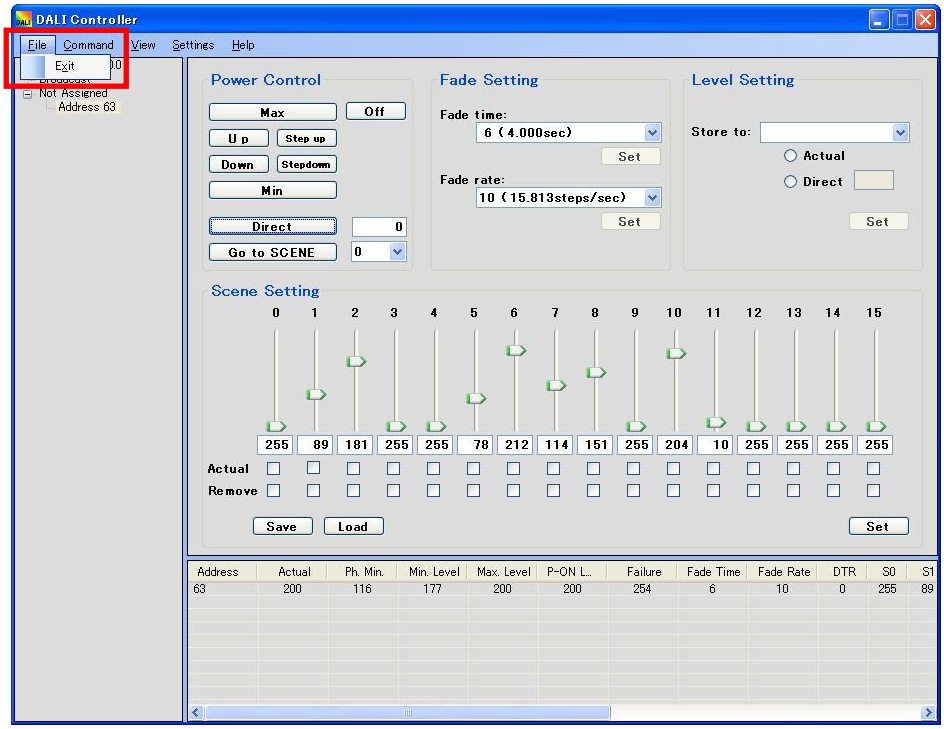


<8> If the Lighting Communication Master Evaluation Board (EZ-0008) is successfully connected to the PC, the settings are enabled.

4.2 Closing the DALI Master Controller GUI

<1> Select [File] and then [Exit].

Figure 4-4. Window Displayed When Closing the DALI Master Controller GUI

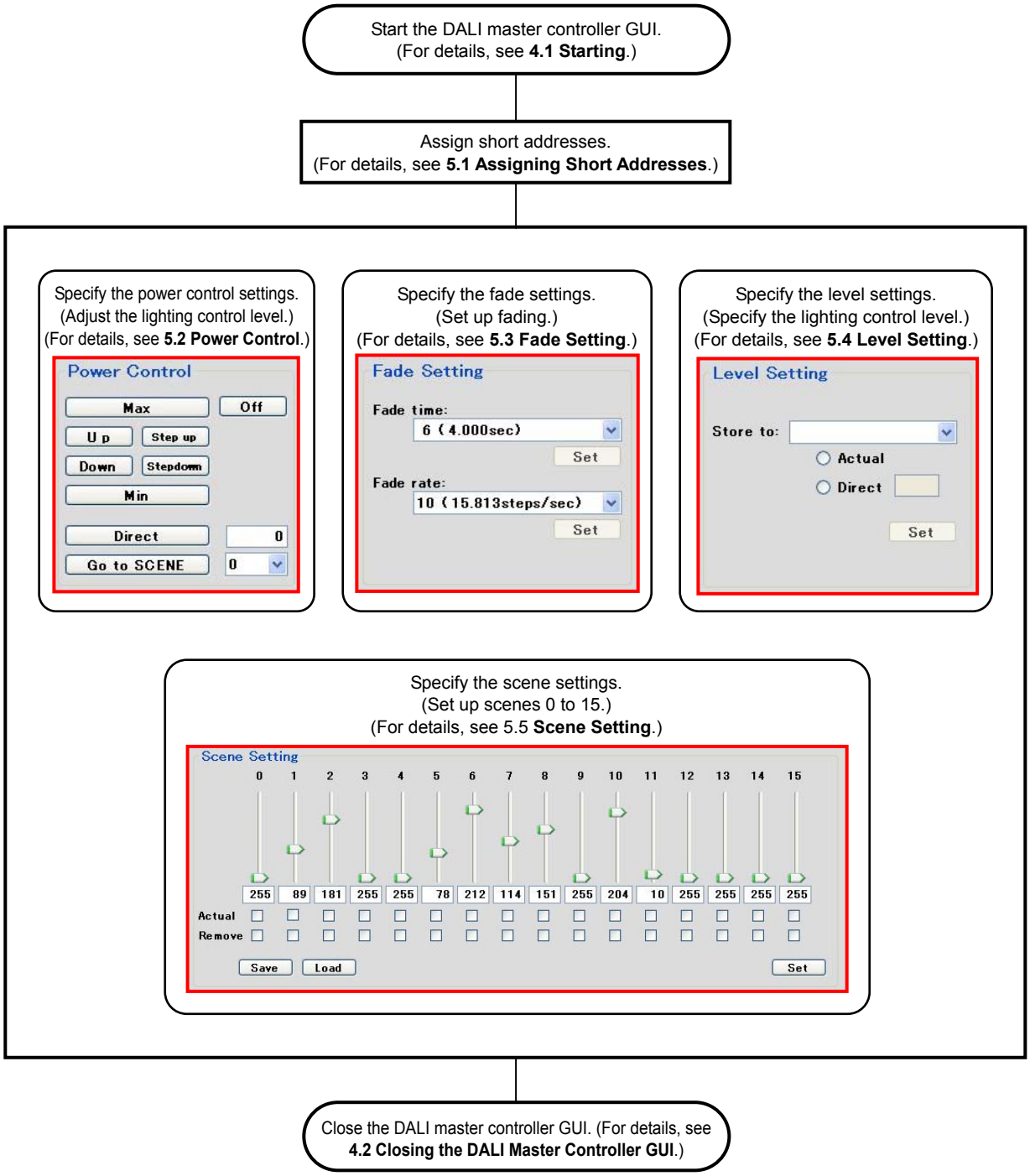


<2> Close the DALI Controller Window.

CHAPTER 5 USING THE DALI MASTER CONTROLLER GUI

This chapter presents some examples of using the DALI master controller GUI.

Figure 5-1. Operation Overview

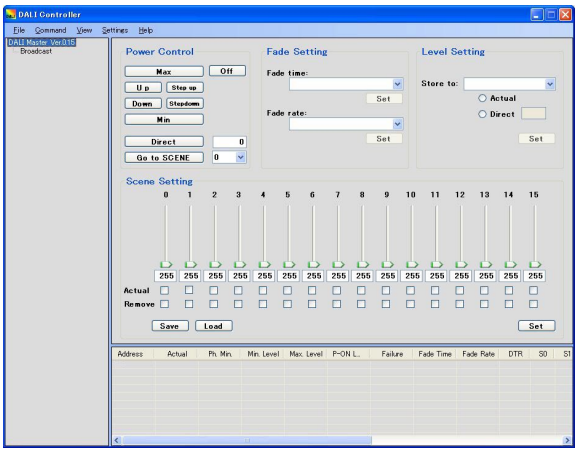


5.1 Assigning Short Addresses

An example of assigning a short address is described below.

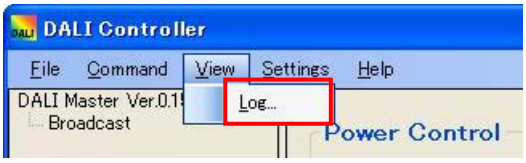
<1> Double-click the [DALI master controller GUI] icon to start the DALI master controller GUI.

Figure 5-2. Assigning a Short Address (1)



<2> In the main menu, select [View] and then [Log] to display the Command Log windows.
Transmitted commands and their responses can be displayed in text format in separate Command Log windows.

Figure 5-3. View (Menu)

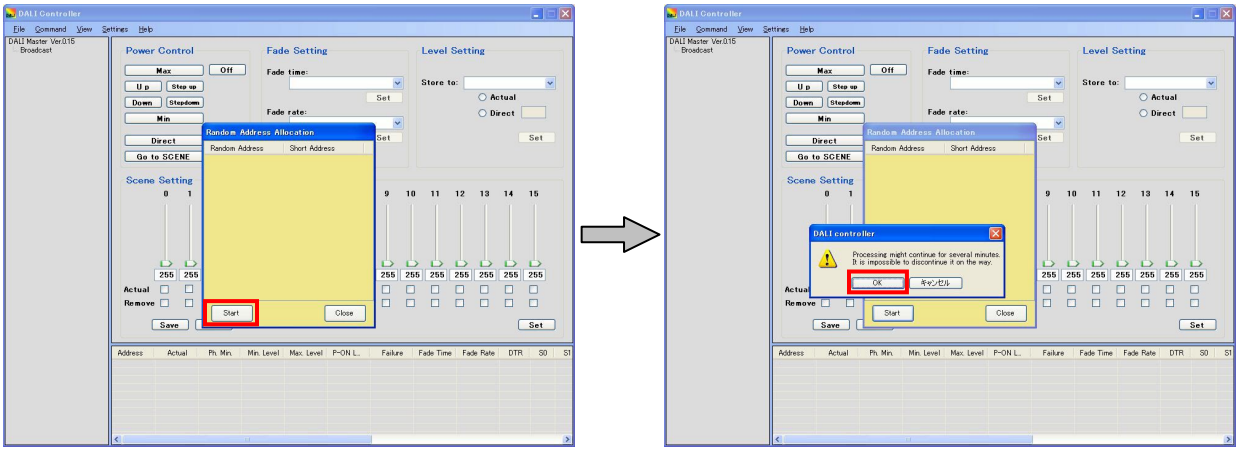


<3> In the main menu, select [Command] and then [Random Address Allocation].

Figure 5-4. Command (Menu)

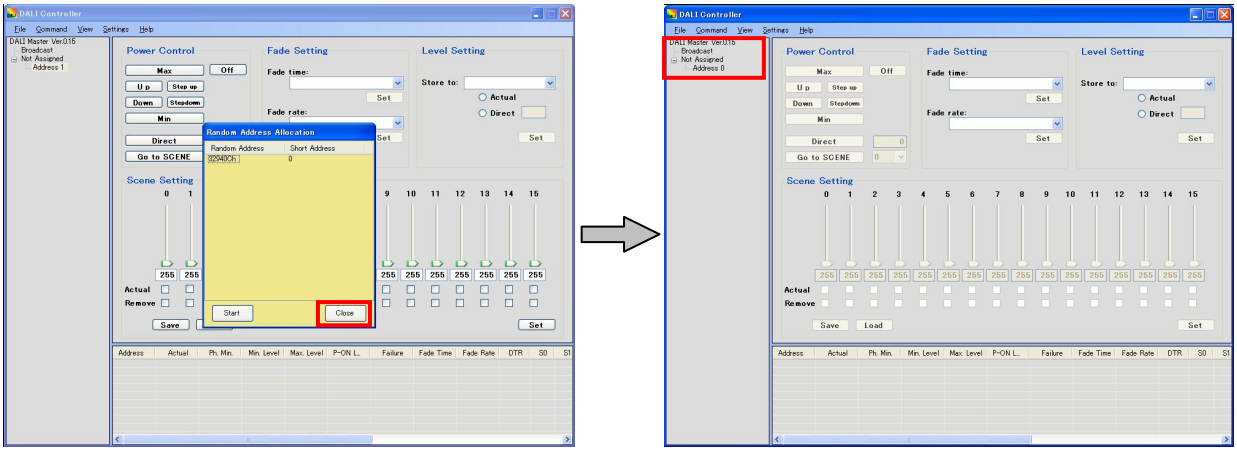
<4> The Random Address Allocation dialog box is displayed.
Click the [Start] button and then the [OK] button.

Figure 5-5. Random Address Allocation Dialog Box (1)



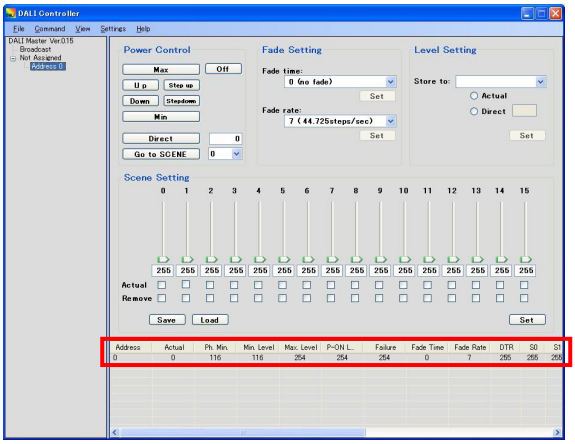
<5> 0 is assigned as a short address. Click the [Close] button to close the dialog box.
0 is assigned as a short address under [Not Assigned].

Figure 5-6. Random Address Allocation Dialog Box (3)



<6> Right-click [Address 0], and then select [Query] to change the display.

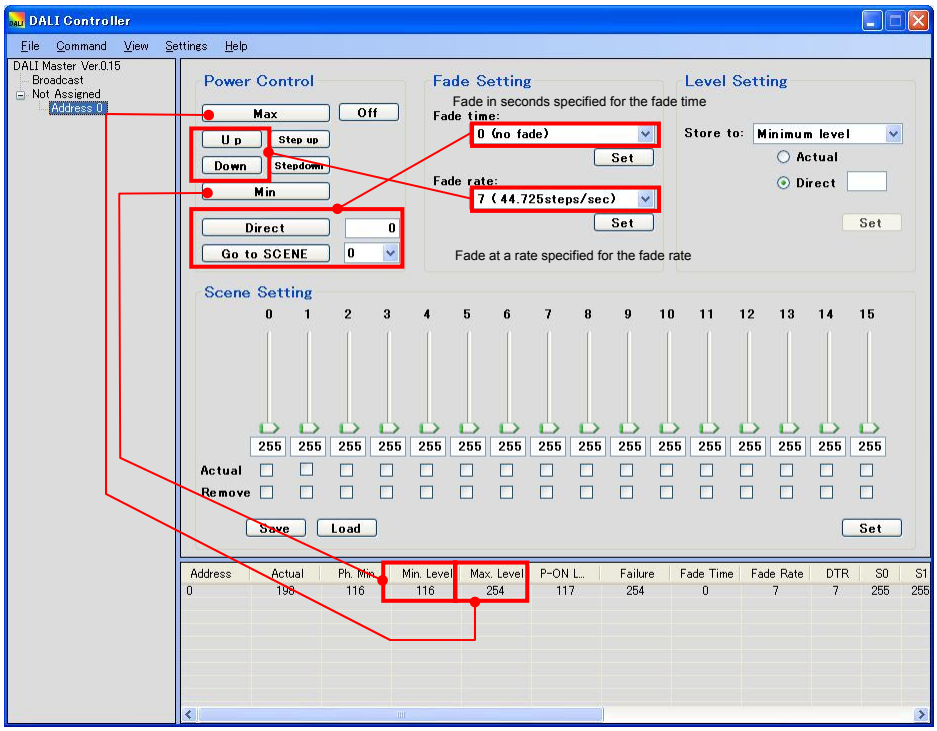
Figure 5-7. Assigning a Short Address (2)

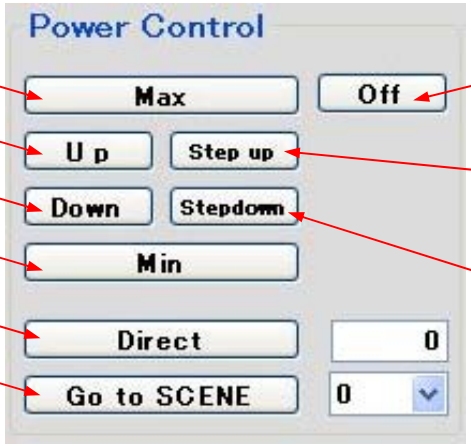


5.2 Power Control

This section describes how to control lighting for the selected address.

Figure 5-8. Power Control





Sets lighting to the maximum level.

Turns off lighting.

Increases the lighting control level according to the fade rate.

Increments the lighting control level.

Decreases the lighting control level according to the fade rate.

Sets lighting to the minimum level.

Decrements the lighting control level.

Sets the lighting control level to any level according to the fade time.

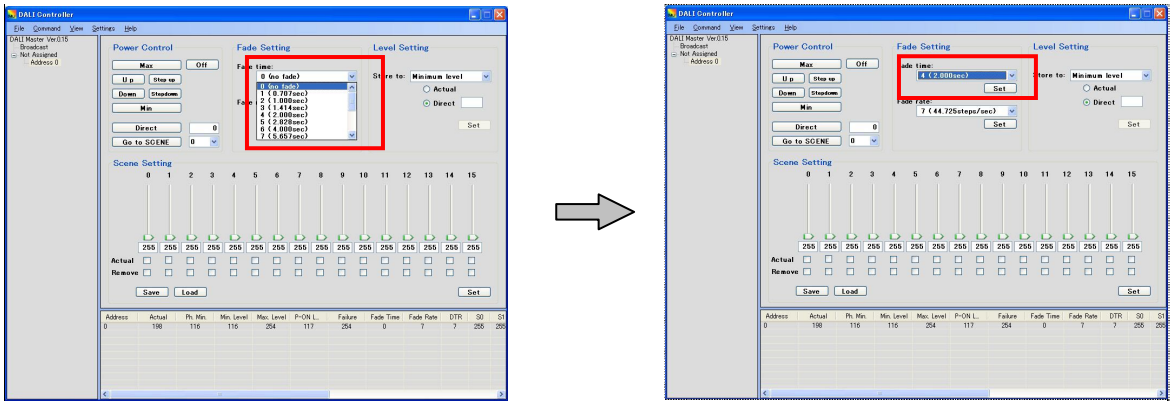
Sets the lighting control level to any scene according to the fade time.

5.3 Fade Setting

This section describes how to specify the fade time and fade rate.
An example of turning off lighting by fading address 0 at the maximum level (254) for two seconds is shown below.

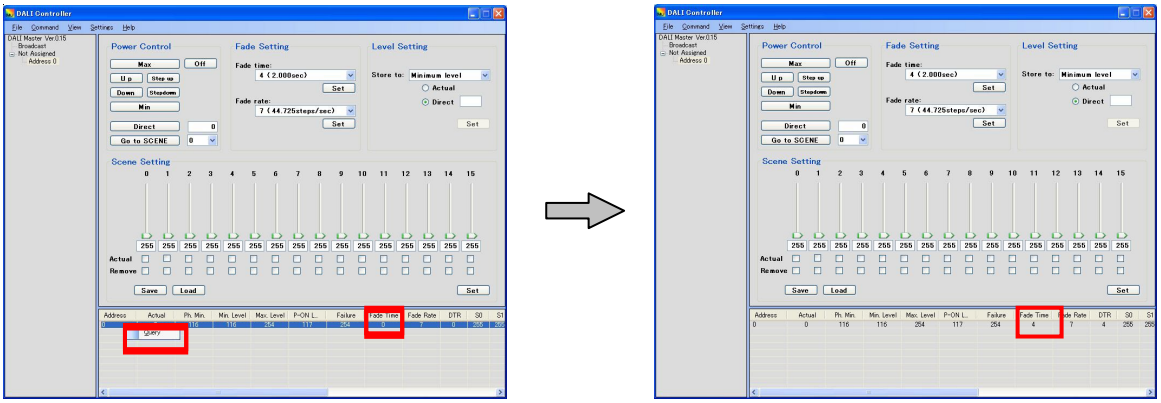
<1> Select address 0, select “4 (2.000sec)” for the fade time, and then click the [Set] button.

Figure 5-9. Fade Time Specification Example (1)



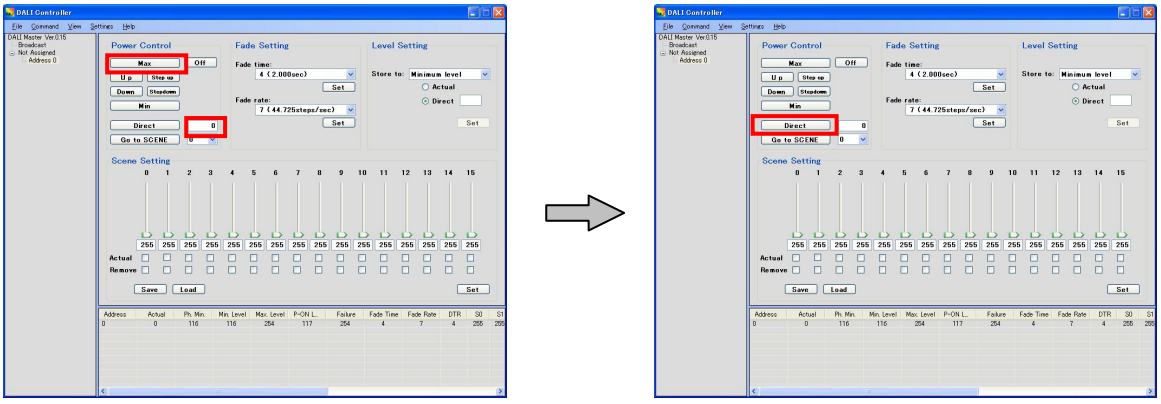
<2> Right-click [Address 0] and then select [Query] to display “4” under Fade time.

Figure 5-10. Fade Time Specification Example (2)



<3> Click the [Max] button to perform lighting at the maximum level. Enter “0” into the column next to the [Direct] button, and then click the [Direct] button to turn off the lighting by fading it for two seconds.

Figure 5-11. Fade Time Specification Example (3)



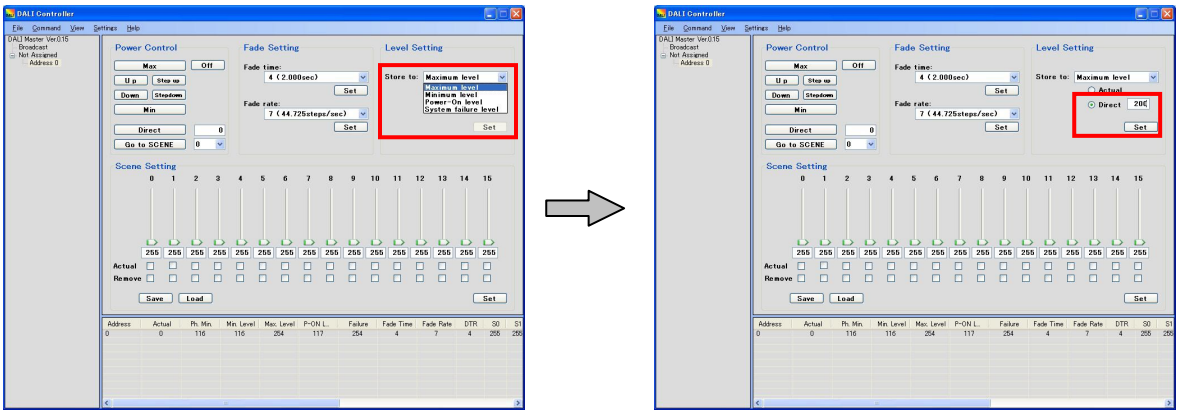
5.4 Level Setting

This section describes how to specify the maximum and minimum lighting control levels, the lighting control level when turning on the power, and the lighting control level when a failure occurs.

An example in which the maximum level (254) of address 0 is set to the maximum level (200) is shown below.

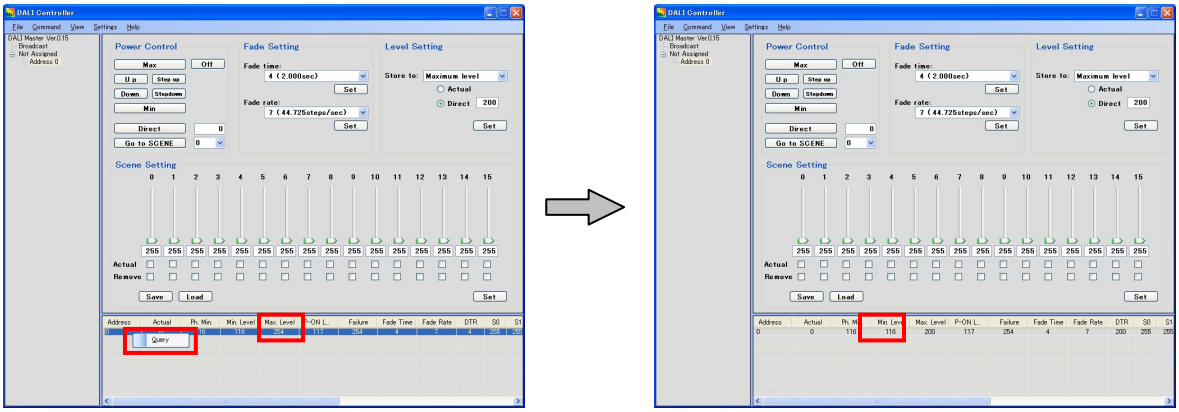
<1> Select address 0, and then “Maximum level" from the “Store to” drop-down list.
Select [Direct], enter “200” into the “Direct” field, and then click the [Set] button.

Figure 5-12. Level Setting Specification Example (1)



<2> Right-click [Address 0] and then select [Query] to display “200” in the Max. level column.

Figure 5-13. Level Setting Specification Example (2)



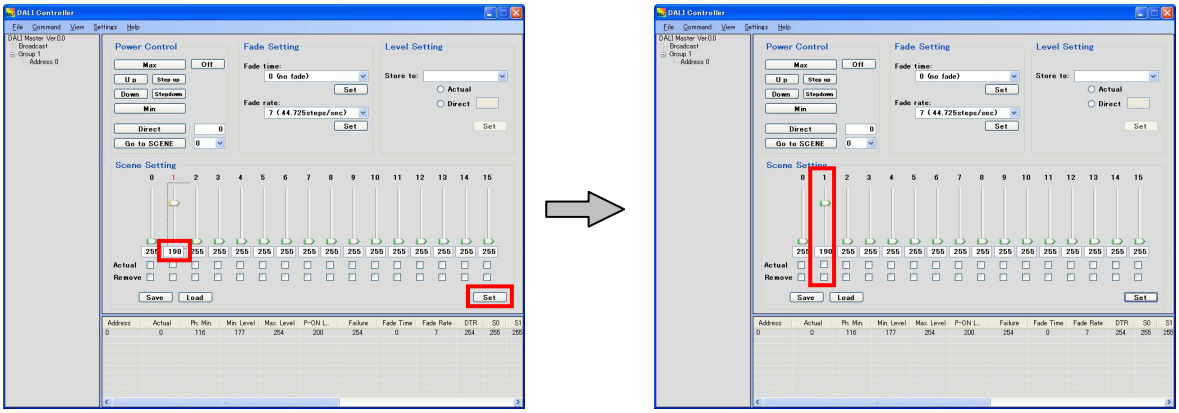
5.5 Scene Setting

This section describes how to specify the lighting control level separately for scenes 0 to 15.

An example of setting the lighting control level of scene 1 of address 0 to “190” by specifying “190” and then fading lighting for two seconds by clicking the [Go to SCENE] button is shown below.

<1> Select address 0, and then directly enter “190” for the lighting control level of scene 1. (The level can also be set to 190 using the slider.)
When the value is changed, the scene 1 number turns red.
Next, click the [Set] button. When scene 1 is set up, the scene 1 number turns black.

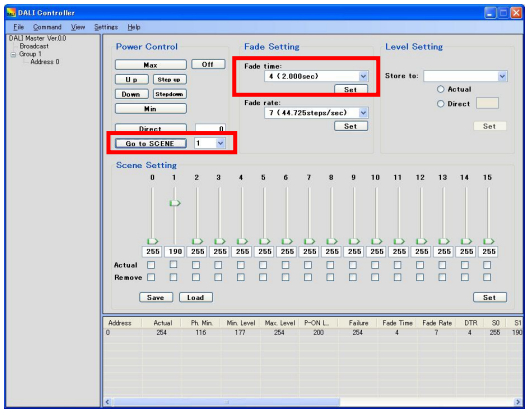
Figure 5-14. Scene Setting Specification Example (1)



<2> Set the fade time to “4 (2.000sec)”, and then click the [Set] button.

<3> Select “1” (the scene number) from the drop-down list next to the [Go to SCENE] button, and then click the [Go to SCENE] button. Lighting is faded for two seconds and the lighting control level is set to “190”.

Figure 5-15. Scene Setting Specification Example (2)



CHAPTER 6 WINDOW AND DIALOG BOX REFERENCE

6.1 Windows and Dialog Boxes

The windows and dialog boxes displayed during use are described below.

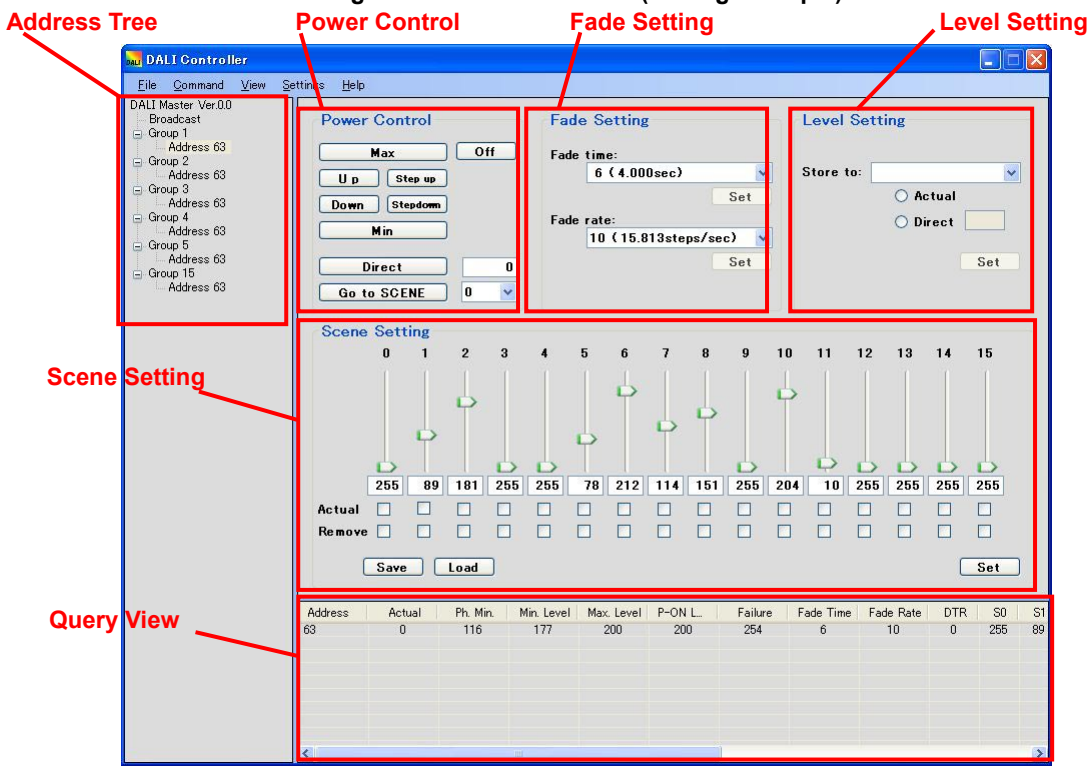
Table 6-1. Windows and Dialog Boxes

Window or Dialog Box	Description	See:
Main window	This window is displayed first when the DALI master controller GUI starts.	**6.2**
Manual Command dialog box	Use this dialog box to select a command to transmit from a drop-down list and transmit the code.	**6.3**
Manual Command (By Code) dialog box	Use this dialog box to directly enter the command to transmit and transmit the code.	**6.4**
Random Address Allocation dialog box	Assigned random addresses and short addresses are displayed in this dialog box.	**6.5**
Direct Address Allocation dialog box	Use this dialog box to directly assign short addresses.	**6.6**
Command Log windows	Transmitted commands and responses to those commands are displayed in text format in these windows.	**6.7**
Serial dialog box	Use this dialog box to specify the serial port.	**6.8**
Change Address dialog box	Use this dialog box to change short addresses.	**6.9**
Version dialog box	Use this dialog box to check the version.	**6.10**

6.2 Main Window

6.2.1 Main window

Figure 6-1. Main Window (Setting Example)



(1) Address tree

All addresses are displayed in a tree view under “Broadcast”.

Select the address to which to transmit the command in the right pane.

(2) Power control

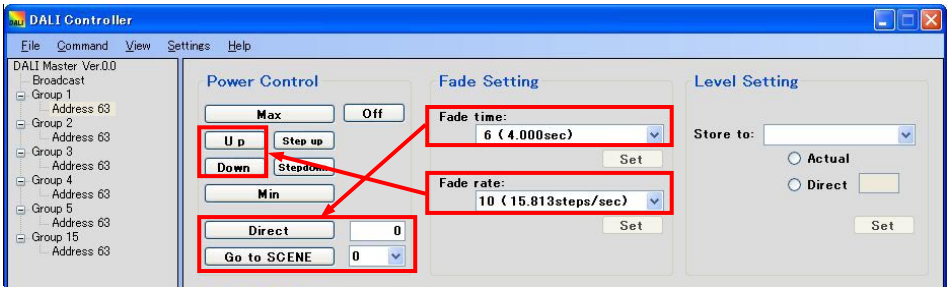
Adjust the lighting control level in this area.

(3) Fade Setting

Specify the fade time and fade rate in this area.

The fade time is related to the [Direct] and [Go to SCENE] buttons and the fade rate is related to the [Up] and [Down] buttons, as shown in Figure 6-2.

Figure 6-2. Main Window (Fade Time and Fade Rate)



(4) Level Setting

In this area, specify the maximum and minimum lighting control levels, the lighting control level when turning on the power, and the lighting control level when a failure occurs.

(5) Scene Setting

The lighting control levels of scenes 0 to 15 can be separately specified in this area.

(6) Query View

The values specified for each slave can be displayed in this area.

6.2.2 Address tree

"Broadcast", groups 0 to 15, and their short addresses are displayed under the root directory in a tree view.

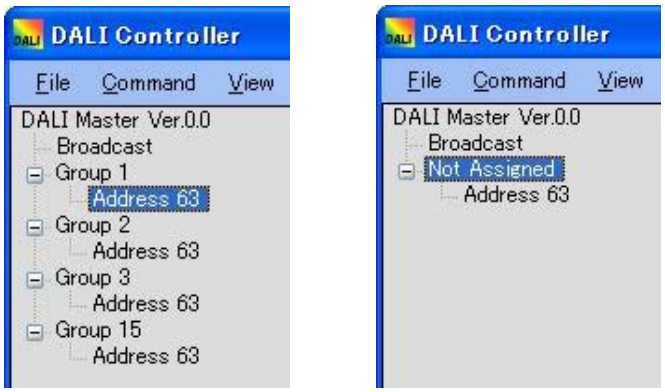
Short addresses that do not belong to a group are displayed under "Not Assigned".

Groups to which no short addresses belong are not displayed.

Short addresses are sorted in ascending order within each group.

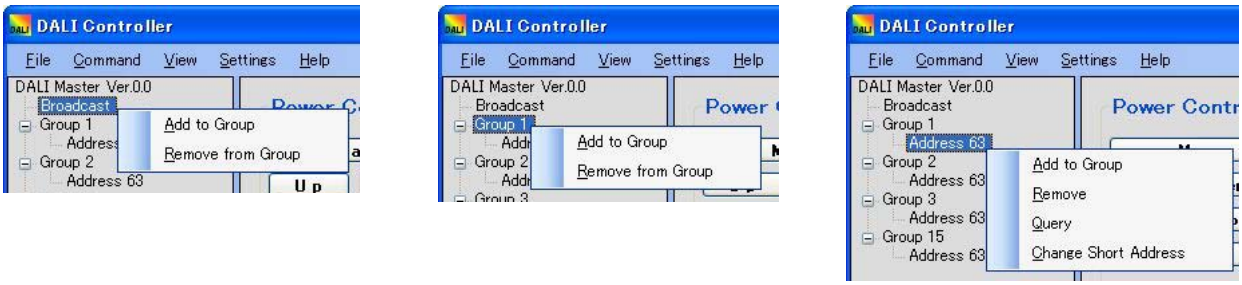
Multiple items cannot be selected all together.

Figure 6-3. Address Tree



"Broadcast", groups, and short addresses in the tree can be manipulated using the right-click menu.

Figure 6-4. Address Tree (Right-Click Menus)



(1) When "Broadcast" is selected

Add to Group: Adds all slaves to a specified group.

Remove From Group: Deletes all slaves from a specified group.

(2) When a group is selected

Add to Group: Adds the short addresses in the selected group to a specified group.

Remove From Group: Deletes the short addresses in the selected group from a specified group.

(3) When a short address is selected

Add to Group: Adds the selected short address to a specified group.

Remove: Deletes the selected short address from a specified group.

Query: Acquires the latest value specified for the selected short address and applies to the Query View area.

Change Short Address: Changes the selected short address.

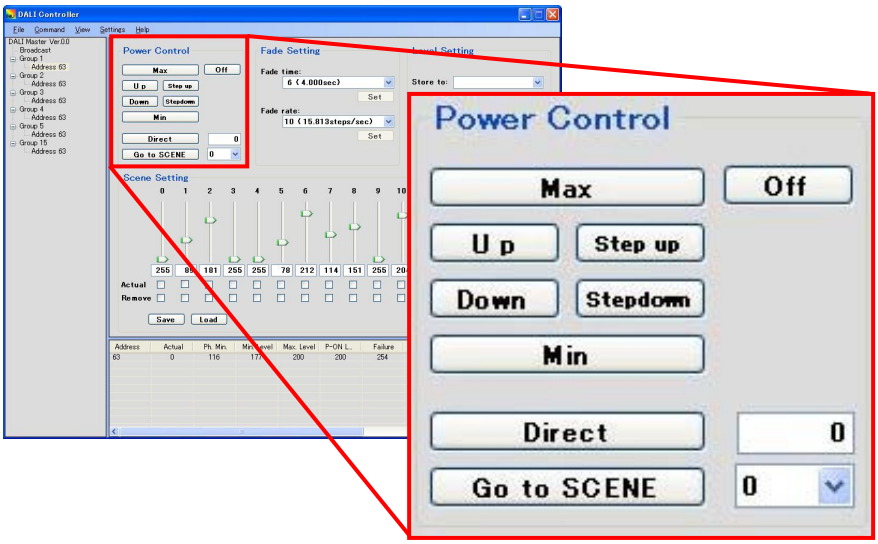
Caution The settings in the Power Control and Fade Setting areas cannot be specified if no valid broadcast, group, or short address is selected.

6.2.3 Power control

Buttons to use for adjusting the lighting control level are located in this area.

If one of these buttons is clicked, a command is transmitted to the selected address.

Figure 6-5. Power Control



(1) [Max] button

Transmits the RECALL MAX LEVEL command to the selected address.

(2) [Min] button

Transmits the RECALL MIN LEVEL command to the selected address.

(3) [Up] button

Transmits the UP command to the selected address.

(4) [Down] button

Transmits the DOWN command to the selected address.

(5) [Step up] button

Transmits the STEP UP command to the selected address.

(6) [Step down] button

Transmits the STEP DOWN command to the selected address.

(7) [Off] button

Transmits the OFF command to the selected address.

(8) [Direct] button

Transmits the value in the text box to the selected address by using the DIRECT ARC POWER CONTROL command. Any value from 0 to 255 can be entered (0 is the default).

If “255” is entered into the text box, the button label changes to [Stop Fading].

If an invalid value is entered into the text box, the [Direct] button is disabled.

(9) [Go to SCENE] button

Transmits the GO TO SCENE command to the selected address.

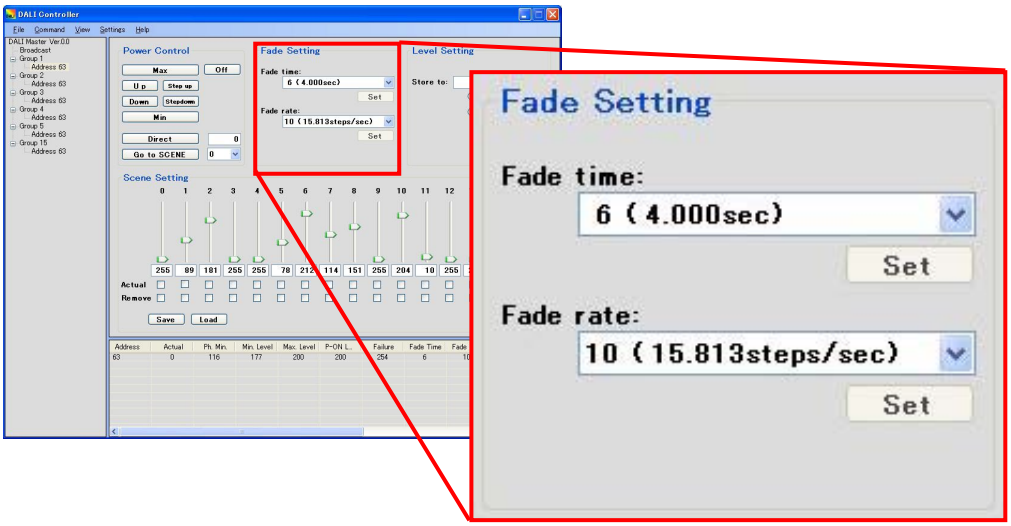
The settings of each scene (0 to 15) can be selected from the drop-down list (0 is the default).

6.2.4 Fade setting

Drop-down lists for selecting the fade time and fade rate are located in this area.

The selected values are not transmitted to a slave until the [Set] button is clicked. To apply the settings, be sure to click the [Set] button after selecting the values.

Figure 6-6. Fade Setting

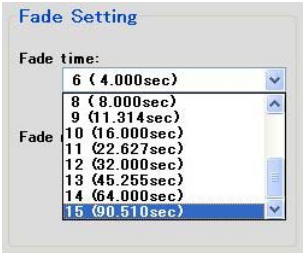


(1) Fade time

Select a value from “0 (no fade)” to “15 (90.510sec)” from the drop-down list (which is empty by default). If a short address is selected, the value set to it is displayed.

When the [Set] button is clicked, the DATA TRANSFER REGISTER(DTR) command and then the STORE THE DTR AS FADE TIME command are transmitted to the selected address. Transmitting the commands to the selected address has no effect when not changing the fade time.

Table 6-2. Fade Time

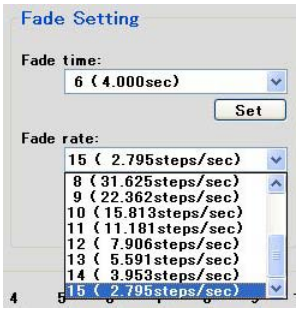
	Fade Time (Seconds)	Drop-Down List
0	no fade	
1	0.707	
2	1.000	
3	1.414	
4	2.000	
5	2.828	
6	4.000	
7	5.657	
8	8.000	
9	11.314	
10	16.000	
11	22.627	
12	32.000	
13	45.255	
14	64.000	
15	90.510	

(2) Fade rate

Select a value from “1 (357.796steps/sec)” to “15 (2.795steps/sec)” from the drop-down list (which is empty by default). If a short address is selected, the value set to it is displayed.

When the [Set] button is clicked, the DATA TRANSFER REGISTER(DTR) command and then the STORE THE DTR AS FADE RATE command are transmitted to the selected address. Transmitting the commands to the selected address has no effect when not changing the fade rate.

Table 6-3. Fade Rate

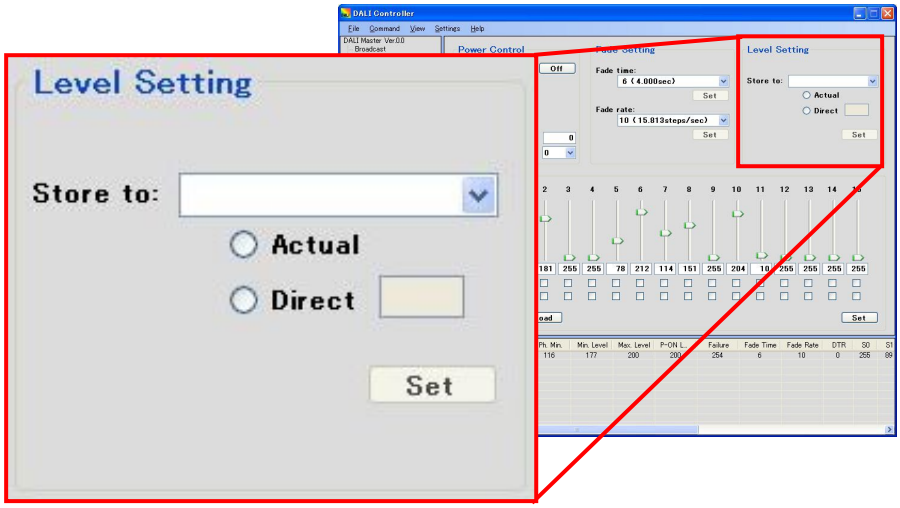
	Fade Rate (Steps/Seconds)	Drop-Down List
1	357.796	
2	253.000	
3	178.898	
4	126.500	
5	89.449	
6	63.250	
7	44.725	
8	31.625	
9	22.362	
10	15.813	
11	11.181	
12	7.906	
13	5.591	
14	3.953	
15	2.795	

6.2.5 Level setting

A drop-down list and button for specifying the maximum and minimum lighting control levels, the lighting control level when turning on the power, and the lighting control level when a failure occurs are located in this area.

The selected values are not transmitted to a slave until the [Set] button is clicked. To apply the settings, be sure to click the [Set] button after selecting the values.

Figure 6-7. Level Setting



(1) Store to

Select a value from the following drop-down list items.

Maximum Level:	Select this value to specify the maximum lighting control level.
Minimum Level:	Select this value to specify the minimum lighting control level.
Power-On Level:	Select this value to specify the lighting control level when turning on the power.
System Failure Level:	Select this value to specify the lighting control level when a failure occurs.

(2) Actual

Select this item to specify the actual level (the current lighting control level) as the value to be specified.

(3) Direct

Select this item to directly specify the lighting control level. (This item is not selected by default.)

(4) [Set] button

This button is disabled (cannot be clicked) if the settings are incomplete.

If the button is clicked, the DATA TRANSFER REGISTER(DTR) command and the following commands are transmitted to the selected address.

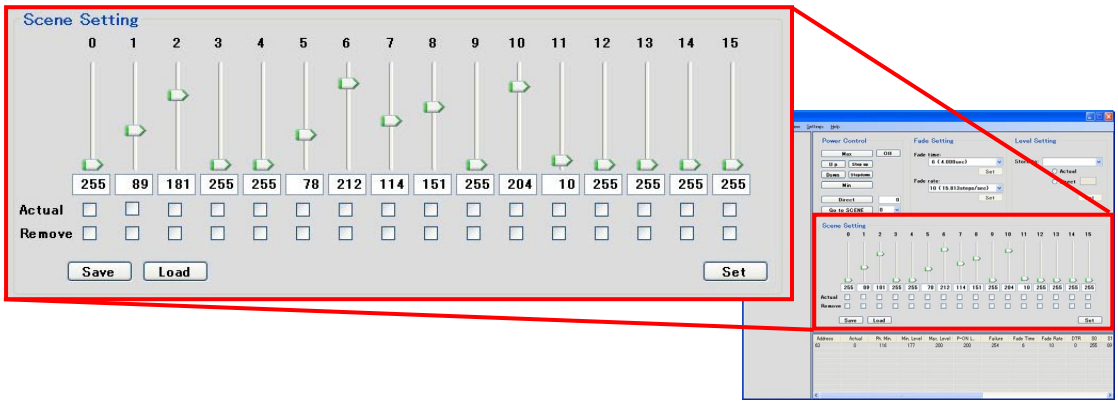
When the maximum level is selected:	STORE THE DTR AS MAX LEVEL command
When the minimum level is selected:	STORE THE DTR AS MIN LEVEL command
When the power-on level is selected:	STORE THE DTR AS POWER ON LEVEL command
When the system failure level is selected:	STORE THE DTR AS SYSTEM FAILURE LEVEL command

6.2.6 Scene setting

Sliders and buttons for separately specifying the lighting control level for scenes 0 to 15 are located in this area.

The selected values are not transmitted to a slave until the [Set] button is clicked. To apply the settings, be sure to click the [Set] button after selecting the values.

Figure 6-8. Scene Setting



(1) Scene number

If a setting for a scene is changed, the number of that scene turns red until the setting is applied.

If the [Set] button is clicked, the settings are transmitted to a slave and the scene number turns black.

(2) Slider

The position of a slider is 0 (default) if 255 (“MASK”) is entered into the corresponding text box.

If the value in a text box is changed, the position of the slider is automatically updated to reflect the value.

(3) Text box

Any value from 0 to 255 can be entered into a text box. (The default is 255.)

The value is updated according to the position of the corresponding slider.

If the corresponding Actual and Remove check boxes are selected, the text box is disabled.

(4) Actual

Select this item to specify the actual level (the current lighting control level) as the value to be specified.

(5) Remove

Select this item to remove the corresponding scene. (Selecting this item is equivalent to setting the value to 255.)

(6) [Set] button

If this button is clicked, the DATA TRANSFER REGISTER(DTR) command is transmitted, and then one of the following commands is transmitted to the selected address according to whether the check boxes are selected.

STORE THE DTR AS SCENE X command

STORE ACTUAL LEVEL IN THE DTR command

REMOVE FROM SCENE command

(7) [Save] button

If this button is clicked, the scene settings (0 to 15) are saved in a CSV file.

The CSV file can be saved in any location.

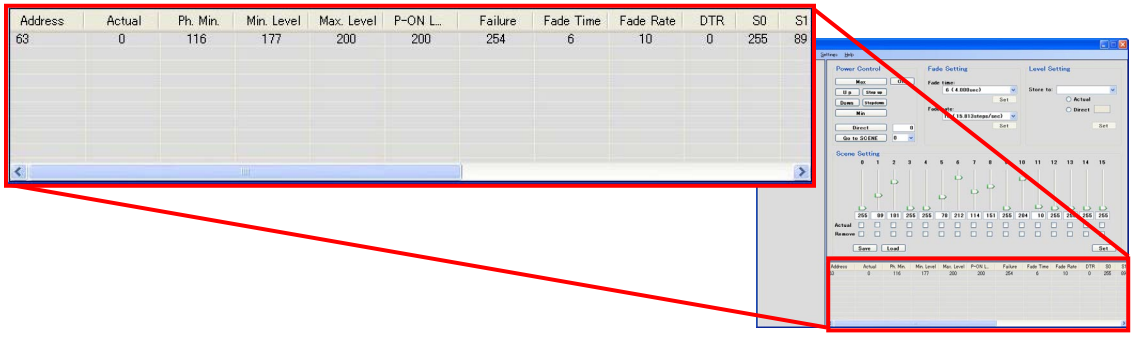
(8) [Load] button

If this button is clicked, the scene settings (0 to 15) are read from the CSV file.

6.2.7 Query view

The values specified for each slave are displayed in this area.

Figure 6-9. Query View



(1) Query

When “Broadcast” is selected, all short addresses are displayed.

When a group is selected, the short addresses in the group are displayed.

When a short address is selected, only that short address is displayed.

The values can be updated to the latest value by selecting "Query” in the right-click menu.

Caution The displayed values are those from when “Query” was last selected in the right-click menu. To update the status of a slave by transmitting a command, select “Query" again.

Table 6-4. Query View

Item	Meaning
Address	Short address
Actual	Current lighting control level
Ph. Min.	Minimum lighting control level in the hardware
Min. Level	Minimum lighting control level
Max. Level	Maximum lighting control level
P-ON Level	Lighting control level when the power is turned on
Failure	Lighting control level when a failure occurred
Fade Time	Fade time
Fade Rate	Fade rate
DTR	DTR (data transfer register) data
S0 to S15	Scene 0 to Scene 15

6.3 Manual Command Dialog Box

In this dialog box, select the command to transmit from the drop-down list, and then click the [Send] button to transmit the code. If the settings are incomplete, the [Send] button cannot be clicked.

Click the [Close] button to close this dialog box.

In the main menu, select [Command] and then [Manual Command] to display this dialog box.

Figure 6-10. Manual Command Dialog Box

(1) Command

Select the command to transmit from the drop-down list.

The display of “Address” and “Data” vary depending on the selected command.

For details about each command, see **APPENDIX A COMMANDS**.

(2) Address

Select one of the following radio buttons to specify “Broadcast”, a group, a short address, or that no short address is used.

Broadcast:	Select this item to specify “Broadcast”.
Group:	Select this item to specify a group. (0 to 15 can be selected.)
Short Address:	Select this item to specify a short address. (0 to 63 can be selected.)
Without Short Address:	Select this item to specify that no short address is used. (This item is only available for the INITIALIZE command.)

(3) Data

Data is displayed in decimal or hexadecimal format depending on the selected command.

In decimal format, a value from 0 to 255 can be selected. In hexadecimal format, a value from 00H to FFH can be selected.

(4) Code

The specified command code is displayed in hexadecimal and binary format. The code is not displayed until the settings are complete.

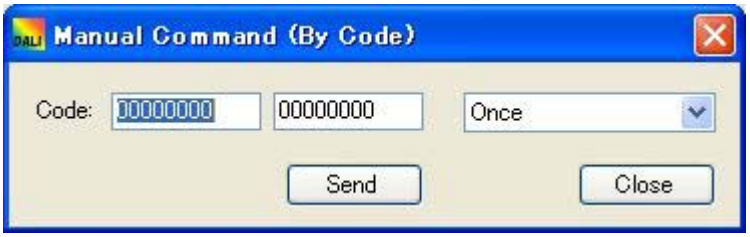
6.4 Manual Command (By Code) Dialog Box

In this dialog box, transmit the code by directly entering the command to transmit in binary format and then clicking the [Send] button. The [Send] button can be clicked after entering a binary number (16 bits). Whether the code is a valid DALI command is not checked.

Click the [Close] button to close this dialog box.

In the main menu, select [Command] and then [Send Code] to display this dialog box.

Figure 6-11. Manual Command (By Code) Dialog Box



(1) Command

Enter the command to transmit in binary or hexadecimal format.

Enter eight digits for the binary format or two digits (for example, 7f or 7F) for the hexadecimal format.

For details about each command, see **APPENDIX A COMMANDS**.

Code1: Enter the first byte of the code.

Code2: Enter the second byte of the code.

“Once”, “Twice”, “Query Yes/No”, or “Query 8-bit Info” can be optionally selected from the drop-down list.

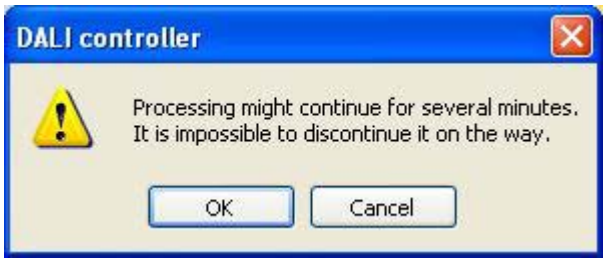
Once:	Transmits the code once.
Twice:	Transmits the code twice.
Query Yes/No:	Mode in which the response from a slave is displayed as “Yes” or “No”
Query 8-bit Info:	Mode in which the response from a slave is displayed using eight bits

6.5 Random Address Allocation Dialog Box

The random addresses of a slave and the short addresses assigned to those addresses are displayed in this dialog box. In the main menu, select [Command] and then [Random Address Allocation] to display this dialog box.

Figure 6-12. Random Address Allocation Dialog Box

Click the [Start] button to display the following dialog box.



Click the [OK] button to start random address allocation. (No other operation can be performed during allocation).
Click the [Close] button to close this dialog box.

Remark These operations might take a while depending on the connection status.

6.6 Direct Address Allocation Dialog Box

Directly assign a short address in this dialog box.
To use direct address allocation, use only one slave in the system.
In the main menu, select [Command] and then [Direct Address Allocation] to display this dialog box.

Figure 6-13. Direct Address Allocation Dialog Box

(1) Short Address

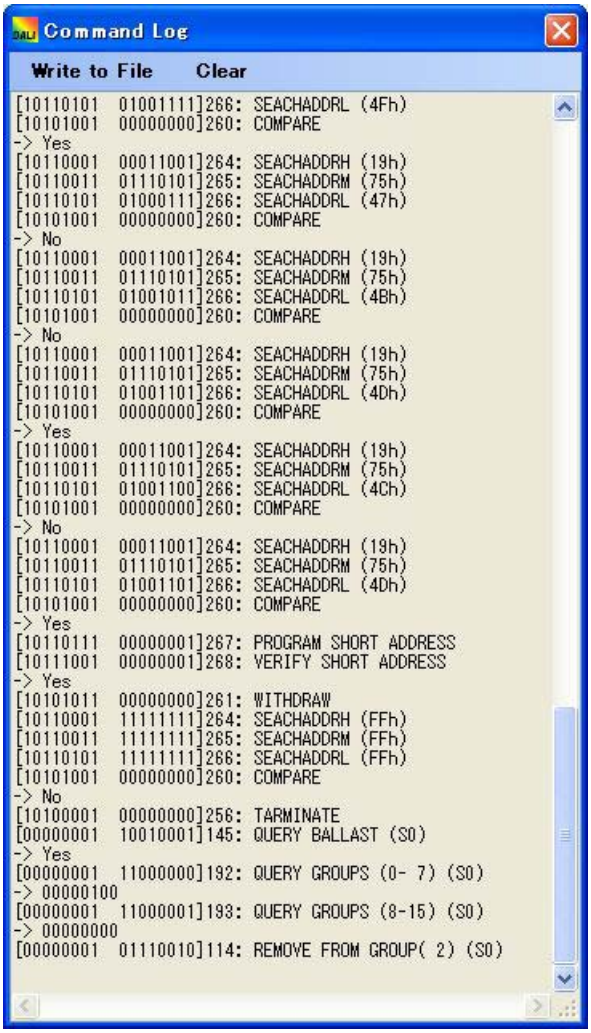
Assignable short addresses can be selected.
Select a short address, and then click the [Set] button to display the following dialog box.

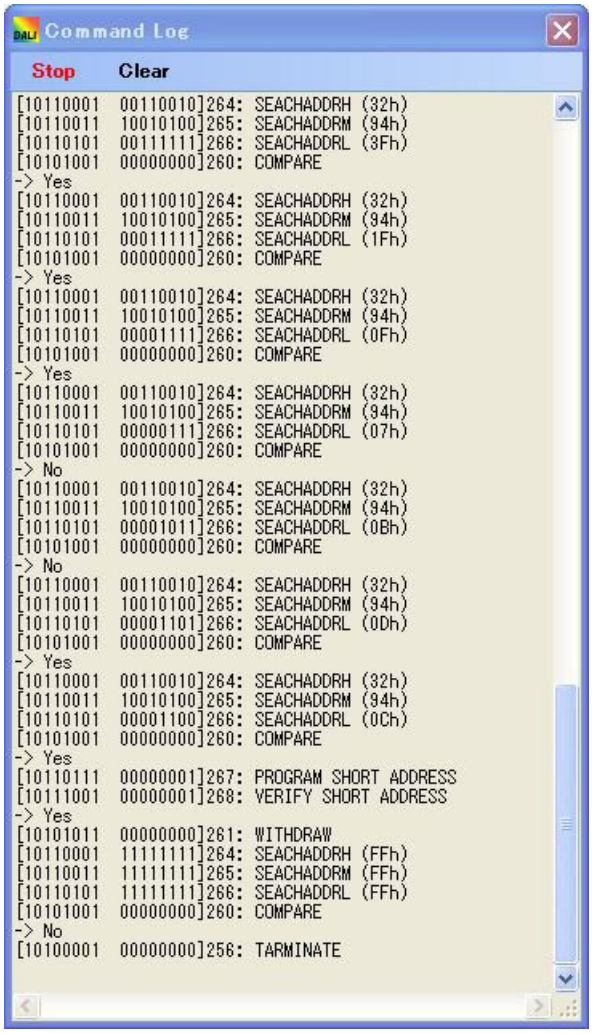
Click the [OK] button to start assigning the short address.
Click the [Close] button to close this dialog box.

6.7 Command Log Window

The transmitted commands and responses to those commands are displayed in text format in this window.
Click the button to close this window.
In the main menu, select [View] and then [Log] to display this window.

Figure 6-14. Command Log Window





(1) Write to File

Click [Write to File] to save the log data. [Write to File] changes to [Stop] while the log data is saved.
The log data is saved as a CSV file to the folder in which DALI.exe is installed.
Click [Stop] to stop saving the log data.

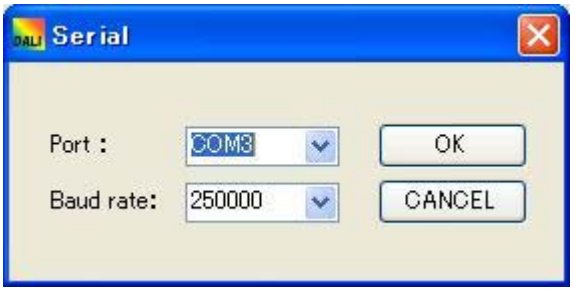
(2) Clear

Click [Clear] to clear the log data displayed in the windows.

6.8 Serial Dialog Box

Set up the serial port in this dialog box.
If the settings are not previously specified, “COM4” and “250000” are specified as the serial port using which to connect.
In the main menu, select [Setting] and then [Serial] to display this dialog box.

Figure 6-15. Serial Dialog Box



(1) Port

This drop-down box displays the port that was connected to previously by default.
The port (COM1 to COM255) varies depending on the connected PC.

(2) Baud rate

This drop-down box displays the baud rate that was used previously by default.
The baud rate can be selected from 9600, 14400, 19200, 38400, 115200, and 250000.

Remark To use the Lighting Communication Master Evaluation Board (EZ-0008), be sure to select 250000.

The following message is displayed if the serial port cannot be connected to.

6.9 Change Address Dialog Box

Change a short address in this dialog box.
To change an address, select the address from 0 to 63, and then click the [OK] button.
For details, see Figure 6-4 Address Tree (Right-Click Menus).

Figure 6-16. Change Address Dialog Box

6.10 Version Dialog Box

Check the DALI master controller GUI version in this dialog box.
In the main menu, select [Help] and then [Version] to display this dialog box.
Click the [OK] button to close this dialog box.

Figure 6-17. Version Dialog Box

6.11 Menu

(1) File

Figure 6-18. File (Menu)

Exit: Closes the DALI master controller GUI.

(2) Command

Figure 6-19. Command (Menu)

Manual Command: Displays the Manual Command dialog box.
(For details, see **6.3 Manual Command Dialog Box**.)

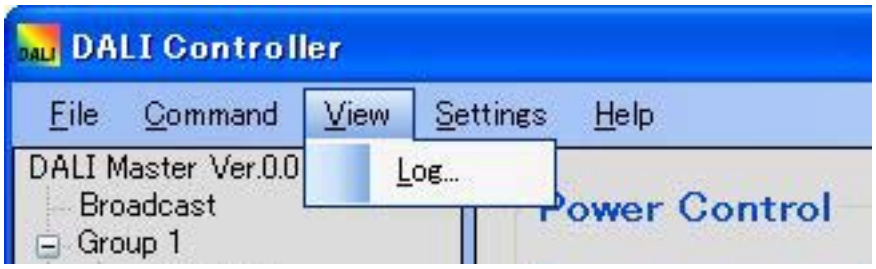
Send Code: Displays the Manual Command (By Code) dialog box.
(For details, see **6.4 Manual Command (By Code) Dialog Box**.)

Random Address Allocation: Displays the Random Address Allocation dialog box.
(For details, see **6.5 Random Address Allocation Dialog Box**.)

Direct Address Allocation: Displays the Direct Address Allocation dialog box.
(For details, see **6.6 Direct Address Allocation Dialog Box**.)

(3) View

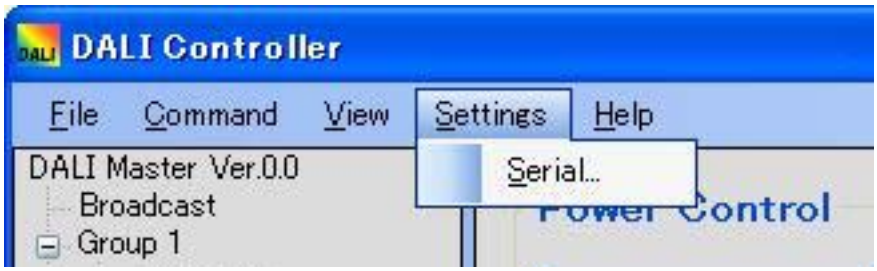
Figure 6-20. View (Menu)



Log: Displays the Command Log Window. (For details, see **6.7 Command Log Window**.)

(4) Settings

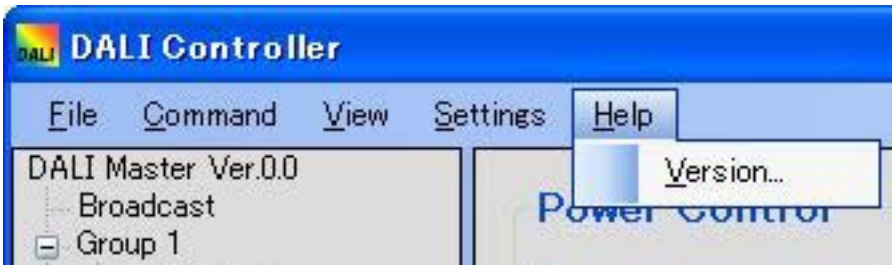
Figure 6-21. Settings (Menu)



Serial: Specifies the COM port and communication speed. (For details, see **6.8 Serial Dialog Box**.)

(5) Help

Figure 6-22. Help (Menu)



Version: Displays the DALI master controller GUI version. (For details, see **6.10 Version Dialog Box**.)

APPENDIX A COMMANDS

A.1 Arc Power Control Commands

These commands are used to adjust the lighting control level.

Table A-1. Arc Power Control Commands

Number	Code	Name	Description
–	YAAA AAA0 XXXX XXXX	DIRECT ARC POWER CONTROL	Adjusts the lighting control level to any level xxxx xxxx according to the fade time.
0	YAAA AAA1 0000 0000	OFF	Turns off lighting.
1	YAAA AAA1 0000 0001	UP	Increases the lighting control level for 200 ms according to the fade rate.
2	YAAA AAA1 0000 0010	DOWN	Decreases the lighting control level for 200 ms according to the fade rate.
3	YAAA AAA1 0000 0011	STEP UP	Increments the lighting control level.
4	YAAA AAA1 0000 0100	STEP DOWN	Decrements the lighting control level.
5	YAAA AAA1 0000 0101	RECALL MAX LEVEL	Maximizes the lighting control level.
6	YAAA AAA1 0000 0110	RECALL MIN LEVEL	Minimizes the lighting control level.
7	YAAA AAA1 0000 0111	STEP DOWN AND OFF	Decrements the lighting control level and turns off lighting if the level is at the minimum.
8	YAAA AAA1 0000 1000	ON AND STEP UP	Increments the lighting control level and turns on lighting if lighting is off.
9 to 15	YAAA AAA1 0000 1XXX	RESERVED	[Reserved]
16 to 31	YAAA AAA1 0001 XXXX	GO TO SCENE	Adjusts the lighting control level for scene xxxx according to the fade time.

Remark Y: Selection bit
A: Address bit
X: Data

A.2 Configuration Commands

These commands are used to change the slave settings.

Table A-2. Configuration Commands

Number	Code	Name	Description
32	YAAA AAA1 0010 0000	RESET	Changes the variables in the persistent memory to their reset values.
33	YAAA AAA1 0010 0001	STORE ACTUAL LEVEL IN THE DTR	Saves the current lighting control level to the DTR.
34 to 41	YAAA AAA1 0010 XXXX	RESERVED	[Reserved]
42	YAAA AAA1 0010 1010	STORE THE DTR AS MAX LEVEL	Specifies the DTR data as the maximum lighting control level.
43	YAAA AAA1 0010 1011	STORE THE DTR AS MIN LEVEL	Specifies the DTR data as the minimum lighting control level.
44	YAAA AAA1 0010 1100	STORE THE DTR AS SYSTEM FAILURE LEVEL	Specifies the DTR data as the FAILURE LEVEL.
45	YAAA AAA1 0010 1101	STORE THE DTR AS POWER ON LEVEL	Specifies the DTR data as the POWER ON LEVEL.
46	YAAA AAA1 0010 1110	STORE THE DTR AS FADE TIME	Specifies the DTR data as the fade time.
47	YAAA AAA1 0010 1111	STORE THE DTR AS FADE RATE	Specifies the DTR data as the fade rate.
48 to 63	YAAA AAA1 0011 XXXX	RESERVED	[Reserved]
64 to 79	YAAA AAA1 0100 XXXX	STORE THE DTR AS SCENE	Specifies the DTR data as scene xxxx.
80 to 95	YAAA AAA1 0101 XXXX	REMOVE FROM SCENE	Deletes the scene xxxx setting. (Specifies 1111 1111 for the scene register.)
96 to 111	YAAA AAA1 0110 XXXX	ADD TO GROUP	Adds the slave to group xxxx.
112 to 127	YAAA AAA1 0111 XXXX	REMOVE FROM GROUP	Deletes the slave from group xxxx.
128	YAAA AAA1 1000 0000	STORE DTR AS SHORT ADDRESS	Specifies the DTR data as a short address.
129 to 143	YAAA AAA1 1000 XXXX	RESERVED	[Reserved]

Remark Y: Selection bit
A: Address bit
X: Data
DTR: Data Transfer Register

A.3 Query Commands

These commands are used to query the status of a slave.
A response (backward) is returned for each query (forward).

Table A-3. Query Commands (1/2)

Number	Code	Name	Description
144	Fw: YAAA AAA1 1001 0000 Bw: STATUS INFORMATION	QUERY STATUS	Returns STATUS INFORMATION[Note].
145	Fw: YAAA AAA1 1001 0001 Bw: 'YES'/'NO'	QUERY BALLAST	Is there a slave that can communicate?
146	Fw: YAAA AAA1 1001 0010 Bw: 'YES'/'NO'	QUERY LAMP FAILURE	Is there a lamp problem?
147	Fw: YAAA AAA1 1001 0011 Bw: 'YES'/'NO'	QUERY LAMP POWER ON	Is a lamp on?
148	Fw: YAAA AAA1 1001 0100 Bw: 'YES'/'NO'	QUERY LIMIT ERROR	Is the specified lighting control level out of the range from the minimum to the maximum values?
149	Fw: YAAA AAA1 1001 0101 Bw: 'YES'/'NO'	QUERY RESET STATE	Is the slave in 'RESET STATE'?
150	Fw: YAAA AAA1 1001 0110 Bw: 'YES'/'NO'	QUERY MISSING SHORT ADDRESS	Does the slave not have a short address?
151	Fw: YAAA AAA1 1001 0111 Bw: (standard number)	QUERY VERSION NUMBER	What is the corresponding IEC standard number?
152	Fw: YAAA AAA1 1001 1000 Bw: DTR content	QUERY CONTENT DTR	What is the DTR content?
153	Fw: YAAA AAA1 1001 1001 Bw: (device type)	QUERY DEVICE TYPE	What is the device type? (fluorescent lamp: 0000 0000)
154	Fw: YAAA AAA1 1001 1010 Bw: (hardware minimum)	QUERY PHYSICAL MINIMUM LEVEL	What is the minimum lighting control level specified by the hardware?
155	Fw: YAAA AAA1 1001 1011 Bw: 'YES'/'NO'	QUERY POWER FAILURE	Has the slave operated without the execution of reset-command or the adjustment of the lighting control level?
156 to 159	YAAA AAA1 1001 11XX	RESERVED	[Reserved]
160	Fw: YAAA AAA1 1010 0000 Bw: (ACTUAL LEVEL)	QUERY ACTUAL LEVEL	What is the ACTUAL LEVEL (the current lighting control level)?
161	Fw: YAAA AAA1 1010 0001 Bw: (maximum lighting control level)	QUERY MAX LEVEL	What is the maximum lighting control level?
162	Fw: YAAA AAA1 1010 0010 Bw: (minimum lighting control level)	QUERY MIN LEVEL	What is the minimum lighting control level?
163	Fw: YAAA AAA1 1010 0011 Bw: (POWER ON LEVEL)	QUERY POWER ON LEVEL	What is the POWER ON LEVEL (the lighting control level when the power is turned on)?
164	Fw: YAAA AAA1 1010 0100 Bw: (FAILURE LEVEL)	QUERY SYSTEM FAILURE LEVEL	What is the SYSTEM FAILURE LEVEL (the lighting control level when a failure occurs)?
165	Fw: YAAA AAA1 1010 0101 Bw: < higher >Time < lower >Rate	QUERY FADE TIME / FADE RATE	What are the fade time and fade rate?
166 to 175	YAAA AAA1 1010 XXXX	RESERVED	[Reserved]

Table A-3. Query Commands (2/2)

Number	Code	Name	Description
176 to 191	Fw: YAAA AAA1 1011 XXXX Bw: (lighting control level)	QUERY SCENE LEVEL (SCENES 0-15)	What is the lighting control level for scene xxxx?
192	Fw: YAAA AAA1 1100 0000 Bw: <0> No or <1> Yes for each bit	QUERY GROUPS 0-7	Does the slave belong to a group among groups 0 to 7? (Each bit corresponds to a group.)
193	Fw: YAAA AAA1 1100 0001 Bw: <0> No or <1> Yes for each bit	QUERY GROUPS 8-15	Does the slave belong to a group among groups 8 to 15? (Each bit corresponds to a group.)
194	Fw: YAAA AAA1 1100 0010 Bw: random address (high)	QUERY RANDOM ADDRESS (H)	What are the higher 8 bits of the random address?
195	Fw: YAAA AAA1 1100 0011 Bw: random address (middle)	QUERY RANDOM ADDRESS (M)	What are the middle 8 bits of the random address?
196	Fw: YAAA AAA1 1100 0100 Bw: random address (low)	QUERY RANDOM ADDRESS (L)	What are the lower 8 bits of the random address?
197 to 223	YAAA AAA1 110X XXXX	RESERVED	[Reserved]

Note STATUS INFORMATION: 8-bit data indicating the status of a slave. The meanings of the bits are as follows:

bit 0 Status of ballast :<0>=OK
bit 1 Lamp failure :<0>=OK
bit 2 Lamp arc power on :<0>=OFF
bit 3 Query Limit Error :<0>=No
bit 4 Fade ready: <0>=fade is ready, <1>=fade is running
bit 5 Query RESET STATE :<0>=No
bit 6 Query Missing short address :<0>=No
bit 7 Query POWER FAILURE :<0>=No

Remark Y: Selection bit
A: Address bit
X: Data
DTR: Data Transfer Register
'YES': 1111 1111
'NO: Without Backward
Fw: Forward
Bw: Backward

A.4 Special Commands

These commands are used to specify addresses.

Table A-4. Special Commands

Number	Code	Name	Description
256	1010 0001 0000 0000	TERMINATE	All special mode processes shall be terminated.
257	1010 0011 XXXX XXXX	DATA TRANSFER REGISTER(DTR)	Stores the data xxxx xxxx to the DTR.
258	1010 0101 XXXX XXXX	INITIALISE	Sets the slave[Note 1] to the INITIALISE status for 15 minutes. Commands 259 to 270 are enabled only for a slave in this status.
259	1010 0111 0000 0000	RANDOMISE	Generates a random address.
260	Fw: 1010 1001 0000 0000 Bw: 'YES'/'NO'	COMPARE	Is the random address smaller or equal to the search address?
261	1010 1011 0000 0000	WITHDRAW	Excludes slaves for which the random address and search address match from the compare process.
262	1010 1101 0000 0000	RESERVED	[Reserved]
263	1010 1111 0000 0000	RESERVED	[Reserved]
264	1011 0001 HHHH HHHH	SEARCHADDRH	Specifies the higher 8 bits of the search address.
265	1011 0011 MMMM MMMM	SEARCHADDRM	Specifies the middle 8 bits of the search address.
266	1011 0101 LLLL LLLL	SEARCHADDRL	Specifies the lower 8 bits of the search address.
267	1011 0111 0AAA AAA1	PROGRAM SHORT ADDRESS	The slave shall store the received 6-bit address as a short address if it is selected..
268	Fw: 1011 1001 0AAA AAA1 Bw: 'YES'/'NO'	VERIFY SHORT ADDRESS	Is the short address AAA AAA?
269	Fw: 1011 1011 0000 0000 Bw: 0AAA AAA1	QUERY SHORT ADDRESS	What is the short address of the slave[Note 2] being selected?
270	1011 1101 0000 0000	PHYSICAL SELECTION	Sets the slave to physical selection mode and excludes the slave from the compare process.
271	1011 1111 XXXX XXXX	RESERVED	[Reserved]

Notes 1. Specifications of slaves subject to the INITIALISE status (xxxx xxxx)

0000 0000: All slaves are subject to the status.

0AAA AAA1: Slaves with the address AAAAAA are subject to the status.

1111 1111: Slaves without a short address are subject to the status.

2. This slave has a random address that is identical to the search address or is in physical selection mode.

Remark

Y:	Selection bit	'YES':	1111 1111
A:	Address bit	'NO':	Without Backward
X:	Data	Fw:	Forward
H, M, L:	Search addresses	Bw:	Backward

A.5 Extending Special Commands

These commands are used for function expansion.

Table A-5. Extending Special Commands

Number	Code	Name	Description
224 to 255	YAAA AAA1 11XX XXXX	APPLICATION EXTEND COMMANDS	Expansion area for special devices.
272	1100 0001 XXXX XXXX	ENABLE DEVICE TYPE X	Adds the device xxxx xxxx (a special device).
273 to 287	110X XXX1 XXXX XXXX	RESERVED	[Reserved]

Remark Y: Selection bit
A: Address bit
X: Data

APPENDIX B FUNCTIONS

The following table shows the specifiable values.

Table B-1. Functions (Initial Values and Specification Range)

Name	Description	Reset Value	Specification Range	Memory Area
ACTUAL DIM LEVEL	Current lighting control level	254	0 and minimum to maximum	- (1 byte RAM)
MIN LEVEL	Minimum lighting control level	PHYSICAL MIN LEVEL	Minimum to maximum physical level	1 byte
MAX LEVEL	Maximum lighting control level	254	Minimum to 254	1 byte
POWER ON LEVEL	Lighting control level when turning on the power	254	1 to 254[Note 1]	1 byte
SYSTEM FAILURE LEVEL	Lighting control level when a failure occurs	254	0 to 255[Note 1]	1 byte
FADE RATE	Fade rate	7 (=45steps/sec)	1 to 15	1 byte
FADE TIME	Fade time	0 (=no fading)	0 to15	1 byte
SHORT ADDRESS	Short Address	Does not change.	0 to 63, 255	1 byte
SEARCH ADDRESS	Search address	FF FF FF	00 00 00 to FF FF FF	- (3 bytes RAM)
RANDOM ADDRESS	Random address	FF FF FF	00 00 00 to FF FF FF	3 bytes
GROUP 0 to 7[Note2]	Whether a short address belongs to a group among groups 0 to 7	0000 0000 (=does not belong to any group)	0 to 255	1 byte
GROUP 8 to 15[Note2]	Whether a short address belongs to a group among groups 8 to 15	0000 0000 (=does not belong to any group)	0 to 255	1 byte
SCENE 0 to 15	Scene	255 (“MASK”) (= no scene)	0 to 255[Note1]	16 bytes
STATUS INFORMATION[Note3]	Status information	0?10 0???	0 to 255	- (1 byte RAM)
VERSION NUMBER (See top of this document)	Version information	Factory burn-in	0 to 255	- (1 byte ROM)
PHYSICAL MIN LEVEL	Minimum lighting control level in the hardware	Factory burn-in	1 to 254	- (1 byte ROM)

Notes 1. Only the lighting control level within the range from the minimum to the maximum values can be specified.

2. These differ from the group addresses used for transmitting commands.
(Each bit corresponds to a group. A short address either <0> does not belong or <1> belongs to a group.)

3. For details, see the QUERY STATUS command in **A.3 Query Commands**.

APPENDIX C LOGARITHMIC DIMMING CURVE

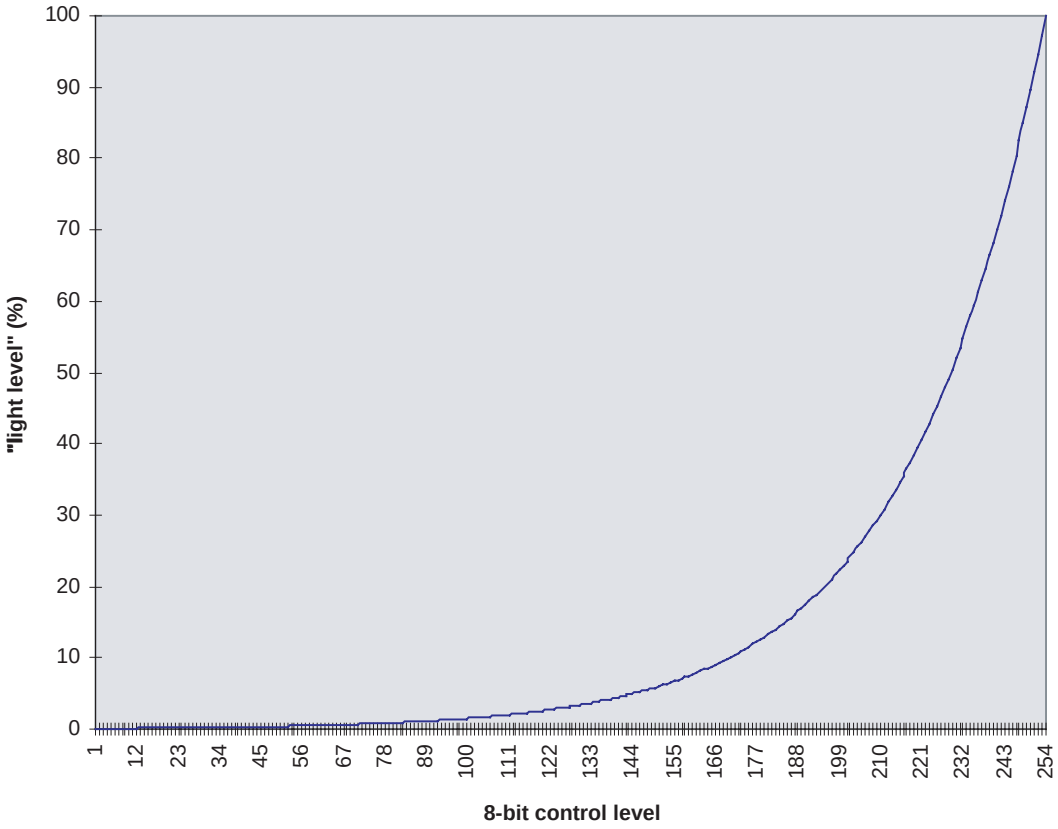
$$X(n) = 10^{\frac{n-1}{253/3}-1}$$

$$\left| \frac{X(n) - X(n+1)}{X(n)} \right| = \text{const.} = 2.8\ \%$$

Table C-1. Logarithmic Dimming Curve with a Minimum Arc Power Level of 0.1%

n	X	n	X	n	X	n	X	n	X
1	0.100	52	0.402	103	1.620	154	6.520	205	26.241
2	0.103	53	0.414	104	1.665	155	6.700	206	26.967
3	0.106	54	0.425	105	1.711	156	6.886	207	27.713
4	0.109	55	0.437	106	1.758	157	7.076	208	28.480
5	0.112	56	0.449	107	1.807	158	7.272	209	29.269
6	0.115	57	0.461	108	1.857	159	7.473	210	30.079
7	0.118	58	0.474	109	1.908	160	7.680	211	30.911
8	0.121	59	0.487	110	1.961	161	7.893	212	31.767
9	0.124	60	0.501	111	2.015	162	8.111	213	32.646
10	0.128	61	0.515	112	2.071	163	8.336	214	33.550
11	0.131	62	0.529	113	2.128	164	8.567	215	34.479
12	0.135	63	0.543	114	2.187	165	8.804	216	35.433
13	0.139	64	0.559	115	2.248	166	9.047	217	36.414
14	0.143	65	0.574	116	2.310	167	9.298	218	37.422
15	0.147	66	0.590	117	2.374	168	9.555	219	38.457
16	0.151	67	0.606	118	2.440	169	9.820	220	39.522
17	0.155	68	0.623	119	2.507	170	10.091	221	40.616
18	0.159	69	0.640	120	2.577	171	10.371	222	41.740
19	0.163	70	0.658	121	2.648	172	10.658	223	42.895
20	0.168	71	0.676	122	2.721	173	10.953	224	44.083
21	0.173	72	0.695	123	2.797	174	11.256	225	45.303
22	0.177	73	0.714	124	2.874	175	11.568	226	46.557
23	0.182	74	0.734	125	2.954	176	11.888	227	47.846
24	0.187	75	0.754	126	3.035	177	12.217	228	49.170
25	0.193	76	0.775	127	3.119	178	12.555	229	50.531
26	0.198	77	0.796	128	3.206	179	12.902	230	51.930
27	0.203	78	0.819	129	3.294	180	13.260	231	53.367
28	0.209	79	0.841	130	3.386	181	13.627	232	54.844
29	0.215	80	0.864	131	3.479	182	14.004	233	56.362
30	0.221	81	0.888	132	3.576	183	14.391	234	57.922
31	0.227	82	0.913	133	3.675	184	14.790	235	59.526
32	0.233	83	0.938	134	3.776	185	15.199	236	61.173
33	0.240	84	0.964	135	3.881	186	15.620	237	62.866
34	0.246	85	0.991	136	3.988	187	16.052	238	64.607
35	0.253	86	1.018	137	4.099	188	16.496	239	66.395
36	0.260	87	1.047	138	4.212	189	16.953	240	68.233
37	0.267	88	1.076	139	4.329	190	17.422	241	70.121
38	0.275	89	1.105	140	4.449	191	17.905	242	72.062
39	0.282	90	1.136	141	4.572	192	18.400	243	74.057
40	0.290	91	1.167	142	4.698	193	18.909	244	76.107
41	0.298	92	1.200	143	4.828	194	19.433	245	78.213
42	0.306	93	1.233	144	4.962	195	19.971	246	80.378
43	0.315	94	1.267	145	5.099	196	20.524	247	82.603
44	0.324	95	1.302	146	5.240	197	21.092	248	84.889
45	0.332	96	1.338	147	5.385	198	21.675	249	87.239
46	0.342	97	1.375	148	5.535	199	22.275	250	89.654
47	0.351	98	1.413	149	5.688	200	22.892	251	92.135
48	0.361	99	1.452	150	5.845	201	23.526	252	94.686
49	0.371	100	1.492	151	6.007	202	24.177	253	97.307
50	0.381	101	1.534	152	6.173	203	24.846	254	100.000
51	0.392	102	1.576	153	6.344	204	25.534		

Figure C-1. Logarithmic Dimming Curve with a Minimum Arc Power Level of 0.1%



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