XC800 Family

Guide to using the DALI LightNet tool

AP08104
## Trademarks

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Table of Contents

1 Overview ................................................................. 5
2 Getting started .......................................................... 7
   2.1 AP08104 Software Package ........................................... 7
   2.2 LightNet Installation ................................................ 8
   2.3 DALI Control Device Software ....................................... 13
   2.4 DALI Control Gear Software ........................................ 13
   2.5 Hardware Setup ................................................... 13
       2.5.1 Setting up the Control Device for LightNet ............... 13
       2.5.2 Setting up the Control Gear ................................. 15
       2.5.3 Connecting DALI Master and Slave to the DALI Bus .... 17
3 LightNet Tool ........................................................... 19
   3.1 Connecting the LightNet tool ...................................... 19
   3.2 Address Selection ................................................. 19
   3.3 General Control & Status Tab .................................... 20
   3.4 Detailed Configuration Command Tab ............................ 21
   3.5 Memory Access Control Tab ...................................... 23
4 Summary .................................................................. 24
5 References ............................................................... 24
   APPENDIX - DALI PHY Board ....................................... 25
   APPENDIX - DALI Control Gear Board ............................. 28
1 Overview

Digital Addressable Lighting Interface (DALI) is a communication protocol for lighting control in buildings. The interface was first described in the IEC60929 standard for fluorescent lamp ballast, Annex E. The standard was subsequently updated to include other lighting devices, such as LED, HID, etc., to become IEC-62386. The complete standard for control interface of electronic control gears was published in June 2009, while the standard for lighting control devices is scheduled to be published in 2012.

Only a pair of wires are required to form the bus for communication to all devices on a single DALI network. Each piece of operating equipment with a DALI interface can be communicated with individually. Using a bi-directional data exchange, a DALI controller can query and set the status of each connected lighting device. As a standalone system, DALI can be operated with a maximum of 64 devices. Alternatively, DALI can be used as a subsystem via DALI gateways for connection to building management systems.

Figure 1: DALI system types

**Grouped System**: Brightness control within large open-plan office, lecture halls or conference rooms. DALI can provide zoned or localised control of lighting. Control could be offered through infra-red remote control or a software control with GUI support, or used together as an easy configuration tool to group loads together. Offering flexibility in customised lighting.

**Complex System**: Multiple DALI systems can be connected together utilising gateways to building management systems. Software programs offer more sophisticated programming functionality for grouped systems, such as scenesetting, timeclock, and partition control.
Infineon has developed a solution for control gears based on the published IEC standard. The DALI Software Stack for Control Gear has been designed around the Infineon XC83x devices. ‘LightNet’ has been created to mimic the basic functions of a lighting control device and can therefore be used to evaluate the software. This document describes the setup of the LightNet tool.

The following items are required for use with this application note:

- 1x XC836 Easy Kit (to serve as a DALI Control Device; KIT_XC836_EK_V1)
- 1x DALI PHY (KIT_XC822_XC836_DALI)
- 1x XC836 DALI Slave (KIT_DALI_RGB_XC836_DKV1) including DALI Control Gear Software Stack (AP08102)
- Infineon DALI LightNet tool
2 Getting started

This section is a guide to installing LightNet.

2.1 AP08104 Software Package

This software package consists of the installation package for the LightNet software running on the computer and a DALI Software for Control Device developed to support the use of the LightNet tool.

The following figures step through the software installation on the user’s computer.

Figure 3 Copying ap08104

Figure 4 Selecting destination location
2.2 LightNet Installation

The LightNet software is designed to provide the control device the facility to send basic DALI commands to the connected control gear. Installation is only to be performed once, using the file: LightNet_setup_V1_3.exe.

The following figures step through the LightNet tool installation process.
Figure 7  LightNet tool installation window
Getting started

Figure 8  LightNet tool license agreement

Figure 9  LightNet tool destination location selection
Getting started

Figure 10  LightNet tool installation start

Figure 11  LightNet tool setup completed

Guide to using the DALI LightNet tool
AP08104
Figure 12 Screenshots of LightNet tool
2.3 DALI Control Device Software
The DALI Software for Control Device has been developed to support the use of the LightNet tool and can work on XC836 Easy Kit boards. This software must be downloaded to the XC836 Easy Kit board prior to calling the LightNet tool. (File: AP0810413_LightNet_XC800Master_code.exe) In addition to control via LightNet, touch pad control is available.

2.4 DALI Control Gear Software
The DALI Software for Control Gear has been developed on the XC83x devices to support the features specified in the International Standard IEC-62386 / Part 102 for control gears. This software includes application code for driving an LED module, supplied with the XC836 DALI Control Gear (KIT_DALI_RGB_XC836_DKV1). Through a control device, the LightNet software allows DALI commands to be issued to control the brightness of the LED module attached to the control gear. This software must be downloaded to the XC836 DALI Control Kit. For further details, please refer to AP08102 DALI Control Gear Software Stack.

2.5 Hardware Setup
The LightNet tool acts as the software for the DALI Control Device, used with the XC836 Easy Kit.

The following sections describe how to setup the LightNet tool to evaluate the DALI protocol.

Figure 13  Hardware Setup for Infineon Control Device and Control Gear

2.5.1 Setting up the Control Device for LightNet
The XC836 Easy Kit board can be used as the LightNet DALI Control Device, with the following steps:

1. Connect and download the generated hexfile (File:Lightnet_XC800Master.hex) from Section 2.3 into the XC836 Easy Kit board using XC800 FLOAD in DAVEBENCH™ or KEIL UVision4.
Note: To ensure the success of the following procedures, please ensure that the device is configured to User Mode Diagnostic and COM_SEL settings is set to USB.

**Figure 14** Overview for DALI Master (Control Device)

**Figure 15** DALI PHY connection for XC836 Easy Kit

DALI PHY is attached onto (H2 and H1) headers on the XC836 Easy Kit
METHOD 1: PC Control via LightNet

The LED display shows 8888 whenever LightNet is used. LightNet functions are described in this document.

METHOD 2: TOUCH PAD Control

Upon powering up, default control mode using touch pad control is entered.

Figure 16  DALI Control using PC and Touch Pad description

2. The DALI Control Device is now ready to be connected to the DALI bus.
3. User can control the DALI network using LightNet (via PC) and through the Touch Pad available on the XC836 Easy Kit.

2.5.2 Setting up the Control Gear

The DALI Control Gear can be setup with the following steps:

1. Connect the DAP MiniWiggler to the DALI Control Gear as shown in Figure 17. Download the hexfile (File:AP08102_v1_2_Slave.hex) from Section 2.4 into the DALI Slave Board using XC800 FLOAD in DAVEBENCH™ or KEIL UVision4.
2. The DALI Control Gear is now ready to be connected to the DALI bus.
Figure 17  Programming the Control Gear using DAP miniWiggler
2.5.3 Connecting DALI Master and Slave to the DALI Bus

The DALI network can be setup with the following steps:

1. To supply power for the DALI bus, connect 100Ω resistors in series to each terminal of a power supply unit supplying 15VDC. This supplies the DALI bus for the DALI network devices.
2. Connect the DALI Control Device (Master) and Control Gear (Slave) to the DALI bus. This completes the DALI setup to control the devices using LightNet!
Getting started

Figure 19  Adding 100Ω resistors to Power Supply

PC Connection via USB/UART
Control using:
- LightNET Software

Figure 20  DALI Network Hardware connection
3 LightNet Tool

This chapter describes how the LightNet software is organised.

3.1 Connecting the LightNet tool

Once the recommended hardware setup has been completed, LightNet can be used. Figure 21 shows how to connect to the LightNet tool.

*Note: The LightNet tool cannot be activated if the recommended setup has not been completed as described; i.e. the XC836 Easy Kit is not connected, or the BMI is incorrectly selected.*

![Figure 21 Connecting the Board](image1)

3.2 Address Selection

LightNet supports 3 types of DALI addressing:

- **Broadcast**
- **Short Address**
- **Group Address**

The user decides the type of addressing to be sent with each command by selecting from the available options. For Group Address, the user is required to add the group address to the detailed configuration settings tab, as shown in Chapter 3.4.

![Figure 22 Address Selection](image2)

**Figure 22 Address Selection**

---

**NOTE:**
1. Steps to adding group address and programming of short address can be found in Detailed Configuration tab.

2. This selection allows user commands to be addressed with the various supported address types listed.
3.3 General Control & Status Tab

This section describes the general device control and status functions.

**Send Direct ARC**
- Sends Direct ARC level command to device. User entry for desired ARC level to be sent.

**Steps to send direct ARC commands**
1. Enter user desired ARC level.
2. Click on “Send Direct ARC” to send command to device.

**Light Control**
- **OFF**: Turns off device.
- **ON & Step Up**: Turns on device if current state is OFF. Otherwise, set power level 1 step higher immediately without fading.
- **Step Down & OFF**: Turns off device if current state is minimum level. Otherwise, set power level 1 step lower immediately without fading.
- **Up**: Dim up 200ms using the selected Fade Rate. No change if power level is already at Maximum.
- **Step Up**: Set power level 1 step higher immediately without fading.
- **Down**: Dim down 200ms using the selected Fade Rate. No change if power level is already at Minimum.
- **Step Down**: Set power level 1 step lower immediately without fading.
- **Minimum**: Sets device to Minimum level without fading. Turns on device, if current state is OFF.
- **Maximum**: Sets device to Maximum level without fading. Turns on device, if current state is OFF.

**Control Gear**
- Indicates if connected control gear is functional.
  - Status: OK or NO

**Lamp Failure**
- Indicates if connected lamp has failure.
  - Status: YES or NO

**Lamp Arc Power**
- Indicates power status.
  - Status: ON or OFF

**Limit Error?**
- Indicates if last requested arc power level is between MIN and MAX LEVEL or OFF.
  - Status is YES or NO

**Actual Level**
- Indicates current power level of connected device.

**Device Type**
- Indicates which device is connected.
  - 0: Fluorescent lamps
  - 6: LED modules

**Fade Time**
- Range: 0 to 15

**Fade Rate**
- Range: 1 to 15

**Device Status**

**Get Status**
- Click on this to obtain current device status

**Fade Running?**
- Status: YES or NO

**Reset State?**
- Indicates if device is in reset state.
  - Status: YES or NO

**Missing Short Addr.?**
- Indicates if device has short address missing.
  - Status: YES or NO

**Power Failure?**
- Indicates if power failure has occurred. If no failure, it means that a "RESET" or an arc power control command has been received since last power-on.
  - Status is YES or NO

---

**Figure 23** Light Control

**Figure 24** Device Status
Figure 25  Go to scenes

3.4 Detailed Configuration Command Tab

This section describes the options in the configuration settings.

- **Go To Scene:**
  - Click button to jump to the selected Scene.

- **Scenes:**
  - Supports 16 scenes.
  - User to select desired scene to enter.

- **Program Short Addr**
  - Programs user selected short address to connected device.
  - Range: 0 to 63

- **Time / Rate**
  - Selects the device fade time / rate. 
  - Fade Time Range: 0 to 15
  - Fade Rate Range: 1 to 15

- **Power Control Settings**
  - Sets the desired power setting for selected device.
  - Supports following setting:
    - Maximum level
    - Minimum level
    - System Failure level
    - Power ON level.

- **Device Enable Type**
  - Set the device enable type.
  - Supported types: 0 and 6

**Steps to enable type settings**
1. Select from drop down list. 
2. Once setting, new setting takes effect.

**Steps to Join / Remove group**
1. Select the desired group from the drop down list provided.
2. Click on the radio button for the desired action.

**Steps to Set / Remove Scene info**
1. Select the desired scene from the drop down list provided.
2. Enter the desired level in the Level field. 
   - *Skip this step if intention is to remove scene.*
3. Click on the radio button for the desired action.

**Steps to Program Short Address**
1. Select from drop down list. Once setting, new setting takes effect.
2. Click on Program button. Once completed, new setting takes effect.

**Steps to select Fade Control Settings**
1. Select from drop down list. Once setting, new setting takes effect.

**Steps to Set power settings**
1. Select the type of power setting to be changed.
2. Enter the desired level in the Level field.
3. Click on the Set to activate setting.
4. The new settings will only be programmed to the flash upon “OFF” selection in the Lights Control tab.
<table>
<thead>
<tr>
<th>Scenes</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene 0 50</td>
<td>0.1.4.8.</td>
</tr>
<tr>
<td>Scene 1 255</td>
<td></td>
</tr>
<tr>
<td>Scene 2 255</td>
<td></td>
</tr>
<tr>
<td>Scene 3 255</td>
<td></td>
</tr>
<tr>
<td>Scene 4 255</td>
<td></td>
</tr>
<tr>
<td>Scene 5 255</td>
<td></td>
</tr>
<tr>
<td>Scene 6 33</td>
<td></td>
</tr>
<tr>
<td>Scene 7 255</td>
<td></td>
</tr>
</tbody>
</table>

- **Refresh!**: Click on this to refresh data in window.
- **Scenes**: Indicates the power level information from Scene 0 to 15.
- **Group**: Indicates the group(s) that selected device belongs to.

**Power Levels Status**

<table>
<thead>
<tr>
<th>Scenes</th>
<th>Physical Min. Level</th>
<th>Maximum Level</th>
<th>Minimum Level</th>
<th>Power ON Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene 0 50</td>
<td>12</td>
<td>160</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>Scene 1 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 2 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 3 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 4 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 5 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 6 33</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scene 7 255</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Versioning**: Indicates the version number.
- **System Failure Level**: Indicates the system failure level of the selected device.
- **Refresh**: Click on this to refresh data in window.

**Figure 27** Device Information
3.5 Memory Access Control Tab

This section describes the options for memory access feature.

**Figure 28 Memory Bank Window**

Memory Bank Window

*This shows the contents of the memory banks. Select the required memory contents for read or write. Clicking this window opens up the Memory Access Input Dialog.*

Retrieve Factory Settings

*This option retrieves the memory bank contents settings. Note: This operation takes a few seconds to complete.*

**Figure 29 Memory Input Dialog**

Address (Hex)

*Displays the address of the user selected memory cell from the Memory Bank Window.*

Memory bank Selection

*Selects Memory Bank 0 or 1.*

Read Button

*Executes the read command*

Write Button Selection

*Executes the write memory command*

Content (Hex)

*User entered content for the selected memory cell. This operation is supported for memory bank 1 when memory bank 1 lock byte is "55h" in accordance with IEC62386*
4 Summary

Infineon’s LightNet tool models the function of a lighting control device, controlling DALI control gears. This document demonstrates how easy the tool is to use, to evaluate a DALI system.

5 References

[1] IEC 62386 Digital addressable lighting interface; Part 101: General requirements - System (Edition 1.0, 2009-06)


[3] AP08102 DALI Control Gear Software Stack


APPENDIX - DALI PHY Board

Infineon DALI PHY circuit construction to support device evaluation within a typical DALI network, using the XC836 Easy Kit board. This following figure shows the schematic for a DALI PHY circuit construction that can be used with the XC822 Easy Kit board.

*Note: The DALI PHY board design supports a DALI bus level from 14.5V to 22.5V. The values of R1 and R4 can be adjusted to support a wider DALI bus voltage range if required.*

![Figure 30 DALI PHY Board Schematics](image)

**Note:**
IFX DALI PHY Board connectors ensure usage configurability.

Depending on DALI Control Gear Software stack settings, the DALI_TX/RX pins can be connected via jumpers to the corresponding pins on the Easy Kit connectors.
Table 1  Bill of Material for DALI PHY Circuit

<table>
<thead>
<tr>
<th>Item</th>
<th>Reference</th>
<th>Value</th>
<th>Device</th>
<th>Package</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B1</td>
<td>MB2S</td>
<td>MB2S</td>
<td>SOIC-4</td>
<td>Bridge Rectifier</td>
</tr>
<tr>
<td>2</td>
<td>C1</td>
<td>1u / 25V</td>
<td>C-EUC1210</td>
<td>C1210</td>
<td>Capacitor</td>
</tr>
<tr>
<td>3</td>
<td>D2</td>
<td>BAS16</td>
<td>DIODE-SOD323-R</td>
<td>SOD323-R</td>
<td>Diode</td>
</tr>
<tr>
<td>4</td>
<td>D3</td>
<td>BZX384-2V7</td>
<td>DIODE-SOD323-R</td>
<td>SOD323-R</td>
<td>Diode</td>
</tr>
<tr>
<td>5</td>
<td>IC1</td>
<td>SFH6156-2</td>
<td>SFH6156</td>
<td>SFH</td>
<td>5.3 kV TRIOS High Reliability Optocoupler</td>
</tr>
<tr>
<td>6</td>
<td>IC2</td>
<td>SFH6156-2</td>
<td>SFH6156</td>
<td>SFH</td>
<td>5.3 kV TRIOS High Reliability Optocoupler</td>
</tr>
<tr>
<td>7</td>
<td>Q1</td>
<td>BC817-25W</td>
<td>BC817-25WSMD323</td>
<td>SOT323</td>
<td>NPN Transistor</td>
</tr>
<tr>
<td>8</td>
<td>R1</td>
<td>10R</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>9</td>
<td>R2</td>
<td>0R</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>10</td>
<td>R3</td>
<td>0R</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>11</td>
<td>R4</td>
<td>11k</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>12</td>
<td>R5</td>
<td>324R</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>13</td>
<td>R6</td>
<td>4R7</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>14</td>
<td>R7</td>
<td>1k21</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>15</td>
<td>R8</td>
<td>3k16</td>
<td>R-EU-R0603</td>
<td>R0603</td>
<td>Resistor</td>
</tr>
<tr>
<td>16</td>
<td>X1A</td>
<td>MKDSN1,5/2-5,08</td>
<td>MKDSN1,5/2-5,08</td>
<td>MKDSN1,5/2-5,08</td>
<td>MKDSN 1,5/2-5,08 Printklemme</td>
</tr>
<tr>
<td>17</td>
<td>X1B</td>
<td>2x1</td>
<td>PINHD-1X2</td>
<td>1X02</td>
<td>Pin Header</td>
</tr>
<tr>
<td>18</td>
<td>X2</td>
<td>4x1</td>
<td>PINHD-1X4</td>
<td>1X04</td>
<td>Pin Header</td>
</tr>
</tbody>
</table>
Table 1  Bill of Material for DALI PHY Circuit

<table>
<thead>
<tr>
<th>Item</th>
<th>Reference</th>
<th>Value</th>
<th>Device</th>
<th>Package</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>H1</td>
<td>SAMTEC SSQ-1-14-03-S-S</td>
<td>PINHD-1X14</td>
<td>1X14</td>
<td>Pin Header</td>
</tr>
<tr>
<td>20</td>
<td>H2</td>
<td>SAMTEC SSQ-1-14-03-S-S</td>
<td>PINHD-1X14</td>
<td>1X14</td>
<td>Pin Header</td>
</tr>
</tbody>
</table>
APPENDIX - DALI Control Gear Board

Schematic for KIT_DALI_RGB_XC836_DKV1

Figure 32  Control Gear Board Schematics - Part 1
References

Figure 33  Control Gear Board Schematics - Part 2
Figure 34  Control Gear Board Layout