



# Using DALI Ballasts in HomeWorks QS

Revision A—10/2013

## Overview

Lighting fixtures that utilize DALI digitally addressable dimming ballasts can be controlled in a HomeWorks QS system by using DIN-rail Power Modules w/ DALI (LQSE-2DAL-D), Wallbox Power Modules (WPM) w/ DALI (LQRx-WPM-yD), or GRAFIK Eye QS w/ DALI main units (QSGRx-yD). DIN-rail Power Modules w/ DALI are capable of controlling up to 128 DALI ballasts (64 max. per DALI loop) and GRAFIK Eye QS or WPM w/ DALI main units are capable of controlling up to 64 DALI ballasts. Ballasts can then be grouped together into zones either in the HWQS software (for DIN-rail Power Modules) or locally at the main unit (for GRAFIK Eye QS or WPM units). The DIN-rail Power Modules support up to 16 zones per DALI loop (2 loops per module) and the GRAFIK Eye QS and WPM units support up to 16 zones per unit. The DALI ballasts all communicate over a 2-wire, non-polarized, topology-free, digital communication bus.

The purpose of this document is to explain how to design, program, activate, and troubleshoot a HWQS system that utilizes DALI ballasts. This document is split into 2 sections, with one section focused on the DIN-rail Power Module w/ DALI solution, and the other section focused on the GRAFIK Eye QS and WPM w/ DALI solution. Please refer to the appropriate section based on the control hardware being used on the specific project.

**NOTE: HomeWorks QS versions 3.1.0 and later support the use of DIN-rail Power Modules w/ DALI. Only HomeWorks QS versions 6.0.0 and later support the use of GRAFIK Eye QS or WPM w/ DALI main units.**

## Lutron Qualified DALI Ballasts

All DALI ballasts connected to Lutron DALI controllers must be tested to meet the DALI standard (IEC Standard 62386). Although many devices claim compliance with the DALI standard, many fail when tested using a DALI standard device tester.

Lutron has qualified many DALI devices from a variety of DALI device vendors with all Lutron DALI controllers. Lutron tests these devices using a DALI standard device tester provided by ProbitLab, LVI Technologies, and by connecting all DALI devices to all Lutron DALI controllers for functional testing.

Our testing qualifies that the DALI device is compliant with the DALI standard and can be used with our Lutron DALI controllers. However, we do not guarantee the performance of these individual devices as they are not Lutron products.

If you have a device with a similar model number as one listed but a different revision number it will need to be sent to Lutron for testing. We have only qualified the revisions listed and do not guarantee performance of different revisions or models.

Below is a link to the Lutron qualified DALI ballast list. If there is a device you would like to use on a project that is not on the “Lutron Qualified DALI Ballasts” list, contact your Lutron sales representative or Lutron Technical Support for details on how to get these devices tested by Lutron.

[Lutron Qualified DALI Ballasts List](#)

## DIN-rail Power Module (DPM) w/ DALI

The DIN-rail Power Module w/ DALI is a QS wired device that resides on the QS link and counts as 1 of the available 99 devices on the link. Each module has 2 DALI loops on it and each DALI loop can have a maximum of 64 DALI ballasts that can be grouped together in up to 16 zones (32 max. per module).

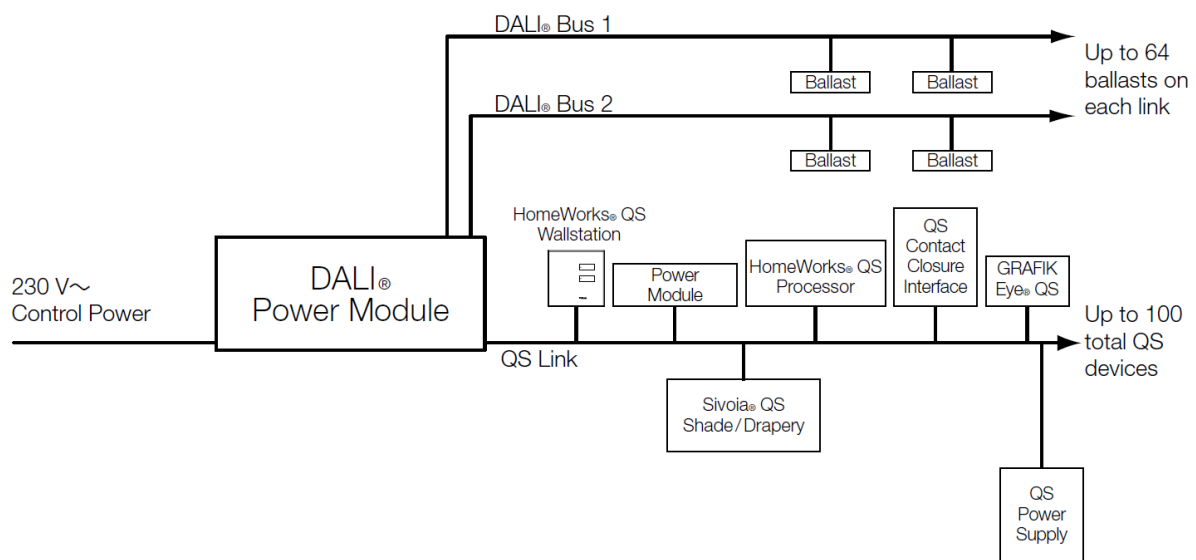
Below is a list of important technical documents pertaining to the DIN-rail Power Module w/ DALI. Please review the information contained within these documents as they will be referred to throughout this document:

[DIN-rail Power Module w/ DALI Specification Submittal](#)

[DIN-rail Power Module w/ DALI Installation Guide](#)

### Installation & Wiring:

Refer to the DIN-rail Power Module w/ DALI Specification Submittal and Installation Guide (above) for information regarding the installation and wiring of modules. See below for a one-line system example wiring diagram:



### Wiring Tips:

In addition to what is already called out in the DALI Specification Submittal and Installation Guide documents, below are some DALI wiring tips:

1. **DO NOT** connect line voltage to the 2-wire DALI wiring

2. **DO NOT** connect the 2-wire DALI wiring to earth ground (doing this will typically result in fixtures flickering or being stuck at low end)
3. DALI wiring can be run in the same conduit as line voltage since it is treated as Class 1 wiring. Please follow all Class 1 safety rules for DALI wiring.
4. DALI wiring is topology-free (daisy-chain, star, homerun, t-tap), however, for ease of troubleshooting Lutron recommends using a daisy-chain wiring topology
5. If using a daisy-chain wiring topology, it is recommended to run a “loop back” wire for the DALI loop from the last ballast on the loop back to the DPM but not physically connected to the unit. This “loop back” wire would only be connected to the DPM in the event of a wiring issue somewhere in the middle of the DALI loop.

Additional Notes:

1. Each DPM is 9 DIN modules wide
2. Each DPM counts as 1 device on the QS Link (PDU count = 0)
3. Each DPM has 2 DALI loops and each DALI loop can control a maximum of 64 DALI ballasts
4. DALI ballasts can be grouped together into lighting zones in the HWQS software (see “HWQS Software – Design Tab” section). A zone is a group of independently addressed ballasts which will operate and be controlled as a single unit, the same as a traditional incandescent switch leg with multiple blubs or fixtures on it.
  - a. NOTE: Lutron recommends not exceeding more than 8 lighting zones in an area per DALI loop for optimum performance and minimal delay. If more than 8 lighting zones are needed in an area you should split the zones up across multiple DALI loops.
5. Upon completion of DALI ballast wiring, it is recommended to verify your wiring by using the “Test” button on the DPM. Refer to the [DIN-rail Power Module w/ DALI Installation Guide](#) for information on how to verify wiring using the “Test” button.

## HWQS Software – Design Tab:

### Creating DALI Loads:

1. Navigate to the “Design > Loads” screen and verify that at a minimum the following columns are visible. If they are not, click on “Customize Columns” and add them in.
  - a. Zone #
  - b. Zone Name
  - c. Load #
  - d. Fixture (required if using a Fixture Schedule)
  - e. Load Type (required if not using a Fixture Schedule)
  - f. Fixture Wattage
  - g. Fixture Qty
  - h. Emergency
  
2. Add in the appropriate number of DALI ballasts in a selected area by following the steps below:
  - a. Enter a Zone Number and Zone Name in the “Zone #” and “Zone Name” fields (i.e. Zone # = 1 and Zone Name = Downlights). To zone multiple ballasts together, modify the zone number of the selected ballast to match the ballasts you wish to zone it with.
  - b. In the “Load #” field, enter the load number of each DALI ballast in the following format **[DPM (Panel #)-(DPM # in panel)-(DALI Loop #)-(DALI Address #)]**. For example, if the ballast is connected to a DPM in Panel #1, DPM #1 in that panel, DALI Loop #1, and you want it to be Address #1, the Load # would be **DPM 1-1-1-1**. Using this naming convention for the Load # will ease in the assignment, addressing and troubleshooting process (covered later in this document).
    - i. **NOTE 1:** For the DALI address number, you will start with #1 and increment by 1 for each additional ballast wired on the same DALI loop. Best practice is to lay out your job so that the addresses appear in a particular pattern (i.e. left to right, front to back in a room). By taking this approach, it will be much easier to verify proper ballast addressing when using the ‘Verify’ feature in the software (mentioned later in this document).
    - ii. **NOTE 2:** You will want to note on your reflected ceiling plans the Load # of each DALI fixture in the project to aid in the ballast addressing/activation process (covered later in this document). Failure to do this will make ballast addressing and troubleshooting very difficult.
  - c. If you created a Fixture Schedule in your project, assign the appropriate DALI fixture to the load in the “Fixture” field, otherwise set the “Load Type” column to a *DALI* load type.
  - d. Enter the appropriate fixture wattage in the “Fixture Wattage” field and set the “Fixture Qty” field to **1** since each DALI ballast needs its own unique address.
  - e. In the “Emergency” field, enter the emergency level for the fixture. The emergency level will trigger when the ballast is still receiving line voltage power, but the DALI loop is disconnected or de-energized. DALI ballasts will go to their emergency level when one of the DALI loop wires is removed or the DPM is powered down, thus de-energizing the DALI loops.
  
3. Repeat step 2 for each additional DALI ballast. See Figure 1 below for an example of an area that contains 11 DALI ballasts and 3 lighting zones (Downlights, Sconces, Pendant).

Loads		3rd Party HVAC						
2a		2b		2c		2d		2e
Zone #	Zone Name	Load #	Fixture	Load Type	Fixture Wattage	Fixture Qty	Emergency	
1	Downlights	DPM 1-1-1-1	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
1	Downlights	DPM 1-1-1-2	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
1	Downlights	DPM 1-1-1-3	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
1	Downlights	DPM 1-1-1-4	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
1	Downlights	DPM 1-1-1-5	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
1	Downlights	DPM 1-1-1-6	Downlight - DALI Ballast	Fluorescent DALI	25	1	100%	
2	Sconces	DPM 1-1-1-7	Sconce - DALI Ballast	Fluorescent DALI	15	1	100%	
2	Sconces	DPM 1-1-1-8	Sconce - DALI Ballast	Fluorescent DALI	15	1	100%	
2	Sconces	DPM 1-1-1-9	Sconce - DALI Ballast	Fluorescent DALI	15	1	100%	
2	Sconces	DPM 1-1-1-10	Sconce - DALI Ballast	Fluorescent DALI	15	1	100%	
3	Pendant	DPM 1-1-1-11	Pendant - DALI Ballast	Fluorescent DALI	40	1	100%	

**Figure 1**

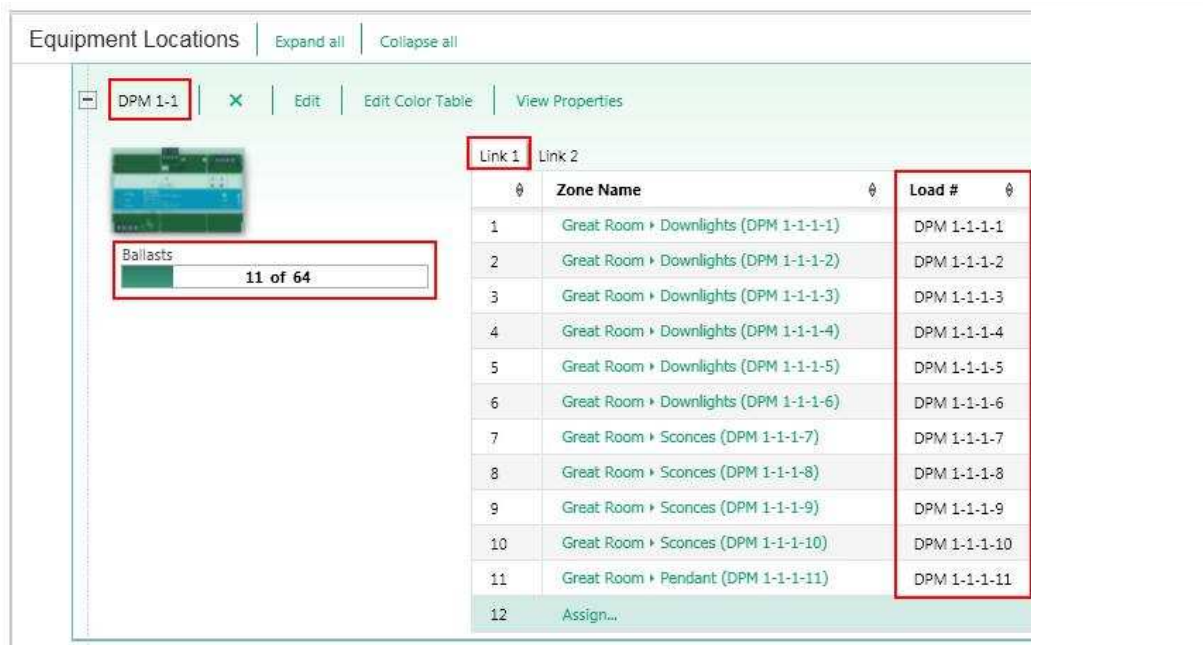
**Adding DIN-rail Power Modules and Assigning Loads to DALI Loops:**

1. Navigate to the “Design > Equipment” screen and add a “DIN-rail Power Module DALI” to your Toolbox.
2. Add the appropriate number of DPM’s into your project and name them using the following format, **[DPM (Panel #)-(DPM #)]**. For example, if you are mounting 2 DPM’s in the same DIN-rail panel, you would name the first module **DPM 1-1**, and the second module **DPM 1-2**. See Figure 2 below.



**Figure 2**

3. Click on the “Assign” link in the Zone Name field for the DPM that you want to assign ballasts to and assign each ballast to the appropriate DALI loop and address slot (1 – 64). See Figure 3 below for an example of ballasts assigned to DALI loop 1. Notice how the Load # of each ballast clearly defines the DPM Panel #, DPM #, DALI loop #, and Address #.



**Figure 3**

4. After assigning all DALI ballasts to the appropriate DALI loops, you must assign all DPM's to the QS Link of the processor(s) on the "Design > Link Assignment" screen. Remember that each DPM counts as 1 of the available 99 devices on the QS link, and each DALI group/zone counts as 1 of the available 512 zones on the QS link.

## HWQS Software – Activate Tab:

### Activate DIN-rail Power Module Devices:

1. Navigate to the "Activate > Devices" screen and select the QS link(s) of the processor that the DPM(s) are assigned to.



**Figure 4**

2. Activate the DPM(s) on the QS link(s) by pressing and holding a button on each DPM, or manually entering in each DPM's serial number, or barcode scanning in each DPM's serial number. The DPM(s) must be activated before activating/addressing any DALI ballasts.



**Figure 5**



Activate DALI Ballasts:

1. Navigate to the “Activate > Ballasts” screen and select the DALI loop of ballasts to be activated from the “Selected device loop” drop-down menu. See Figure 6 below.

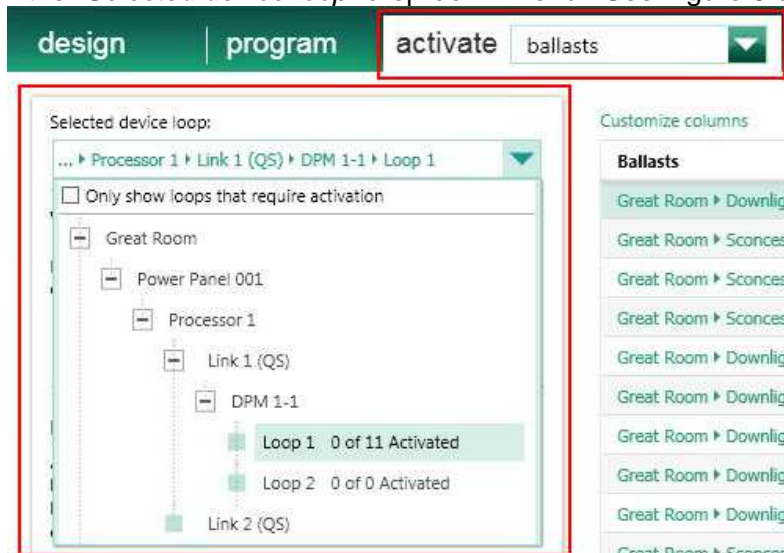


Figure 6

2. After selecting the DALI loop to be activated, you can verify the wiring of all ballasts on the loop by setting all fixtures to High End, Low End, and Off via the buttons in the software. See Figure 7 below. If you notice any ballasts which fail to respond as expected, please correct the issue before proceeding to addressing. Note that you can also test the DALI loop wiring at the DPM itself by using the “Test” button on the unit (see “Installation & Wiring” section).

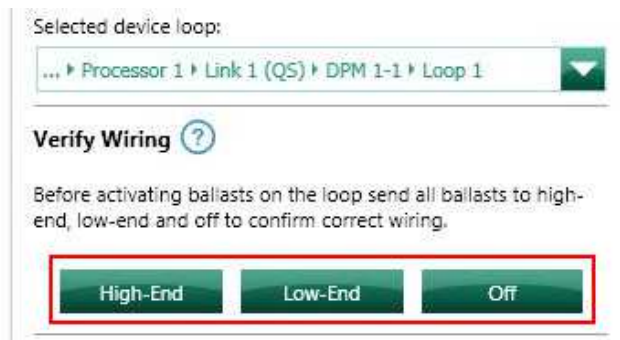


Figure 7

3. After verifying the loop wiring, the next step is to activate all new ballasts on the loop. If you are activating a loop of ballasts for the first time you will want to choose the second option in the list to “Activate all ballasts”. If you have already addressed some ballasts on the loop and are replacing or adding ballasts, you will want to choose the first option in the list to “Activate only new/unaddressed ballasts” so that the ballasts that are already addressed do not get unaddressed.

After choosing the appropriate option, click on “Start Activation”.



**Figure 8**

4. Verify that the number of ballasts detected on the loop matches the number of ballasts assigned to that loop in the database. See Figure 9 below.



**Figure 9**

5. Click on “Customize Columns” above the list of ballasts in the grid and check the box to show “Address On Link”. See Figure 10 below. Notice how the last number of the load number in parentheses of each ballast correlates to the matching “Address On Link” number. This will help to aid in the addressing and troubleshooting process.

Customize columns  Show only unactivated ballasts

Ballasts	Address On Link	Status	Action
Great Room ▶ Downlights (DPM 1-1-1-1)	1	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-2)	2	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-3)	3	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-4)	4	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-5)	5	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-6)	6	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-7)	7	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-8)	8	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-9)	9	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-10)	10	-	Activate
Great Room ▶ Pendant (DPM 1-1-1-11)	11	-	Activate

**Figure 10**

- At this point, 1 random fixture on the loop will begin to flash in order to identify itself. If you have multiple areas on the same DALI loop (which is likely), it is easiest to address ballasts on an area by area basis rather than walking throughout the residence trying to find the fixture that is flashing. To aid in this process, click on the “Flash Next Ballast” link until a fixture in the area that you are trying to activate ballasts in begins to flash. For example, if you are trying to activate ballasts in the Great Room, click on “Flash Next Ballast” until a fixture begins to flash in the Great Room. Using your reflected ceiling plan with the load numbers of each DALI fixture noted on it, identify the fixture that is flashing and click on “Activate” in the Action column for that fixture (i.e. DPM 1-1-1-2 in the Great Room). See Figure 11 below.

Ballasts	Address On Link	Status	Action
Great Room ▶ Downlights (DPM 1-1-1-1)	1	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-2)	2	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-3)	3	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-4)	4	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-5)	5	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-6)	6	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-7)	7	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-8)	8	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-9)	9	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-10)	10	-	Activate
Great Room ▶ Pendant (DPM 1-1-1-11)	11	-	Activate

**Figure 11**

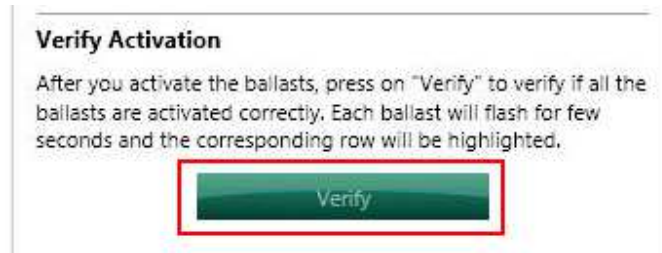
**NOTE:** If you accidentally skipped a fixture that was flashing before activating it, you can click on the “Flash Previous Ballast” link to go back to that fixture.

- After successfully activating a ballast, the Status column will display “Good ✓” and the Action column will display the word “Deactivate”. See Figure 12 below.

Ballasts	Address On Link	Status	Action
Great Room ▶ Downlights (DPM 1-1-1-1)	1	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-2)	2	Good ✓	Deactivate
Great Room ▶ Downlights (DPM 1-1-1-3)	3	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-4)	4	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-5)	5	-	Activate
Great Room ▶ Downlights (DPM 1-1-1-6)	6	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-7)	7	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-8)	8	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-9)	9	-	Activate
Great Room ▶ Sconces (DPM 1-1-1-10)	10	-	Activate
Great Room ▶ Pendant (DPM 1-1-1-11)	11	-	Activate

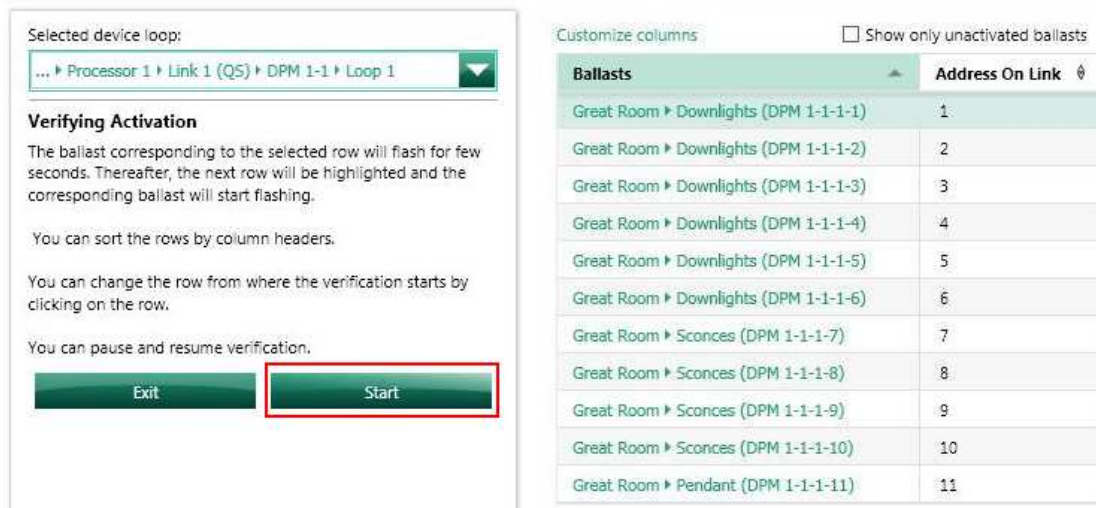
**Figure 12**

8. Repeat step 6 until all ballasts on the loop have been successfully addressed/activated.
9. Upon completion of addressing/activating all ballasts on a loop, click on “Exit Activation” to go back to the main ballast activation screen.
10. The final step in the ballast activation process is to verify that all ballasts were activated in the correct areas using the correct addresses. To begin this process, click on the “Verify” button. See Figure 13 below.



**Figure 13**

11. Click on “Start” to begin the verification process. Once the verification process begins, the ballasts will flash one at a time in the order that they are listed on the screen. The ballast that is flashing will be highlighted in the grid. You can reorder the grid by clicking in the column headers. You can also pause and resume the verification process at any time. See Figure 14 below.



**Figure 14**

12. Once all ballasts have been verified click on the “Exit” button to exit the verification process.
13. Repeat steps 1 – 12 for all other DALI loops in the project.

## HWQS Software – Program Tab:

1. DALI zones can be programmed to any system triggers (keypad buttons, contact closures, timeclocks, etc.) or 3<sup>rd</sup> party control the same as any other lighting zone.

NOTE: The HWQS software allows for a maximum fade time of 4 hours (14,400 seconds), however, DALI ballasts support a maximum fade time of 42 seconds. Any additional fade time programmed beyond 42 seconds for DALI load types will be ignored and the load(s) will fade over the course of 42 seconds.

## GRAFIK Eye QS or WPM w/ DALI

GRAFIK Eye QS or WPM w/ DALI units are available in a 6, 8, or 16 zone variety. They can be used as either QS wired devices in the system or as RF devices in the system.

Each GRAFIK Eye QS or WPM w/ DALI unit can have a maximum of 64 DALI ballasts connected to it using the 2-wire DALI digital communication bus. DALI ballasts can then be grouped together into zones locally at the GRAFIK Eye QS or WPM main unit.

Below is a list of important technical documents pertaining to the GRAFIK Eye QS w/ DALI and the WPM w/ DALI main units. Please review the information contained within these documents as they will be referred to throughout this document:

[GRAFIK Eye QS w/ DALI Specification Submittal](#)

[GRAFIK Eye QS with DALI Installation and Operation Guide](#)

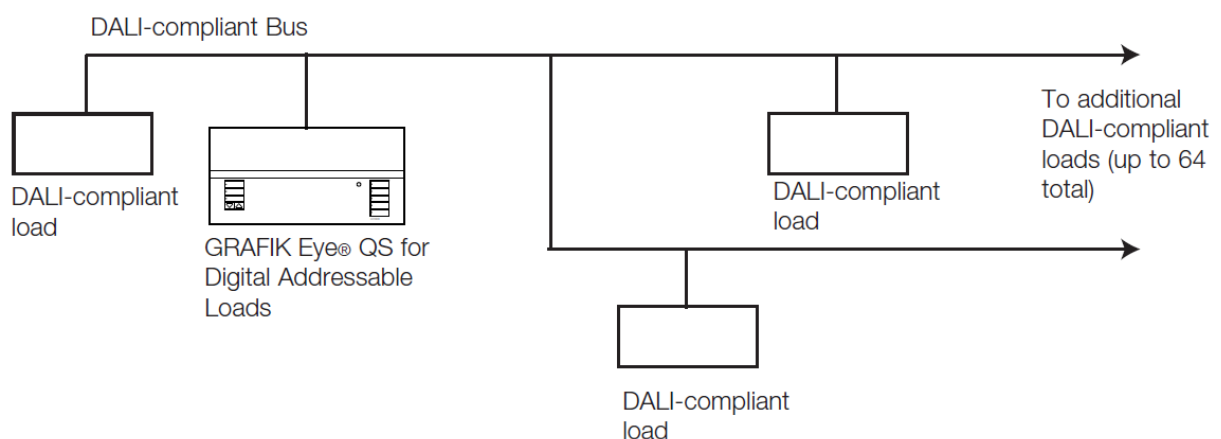
[WPM w/ DALI Specification Submittal](#)

[WPM with DALI Installation and Operation Guide](#)

### Installation & Wiring:

Refer to the GRAFIK Eye QS or WPM w/ DALI Specification Submittal and Installation and Operation Guide (above) for information regarding the wiring and local addressing/zone configuration of DALI ballasts connected to GRAFIK Eye QS or WPM w/ DALI units. See below for a one-line DALI wiring example:

#### DALI-Compliant Bus Wiring Example



### Wiring Tips:

In addition to what is already called out in the DALI Specification Submittal and Installation Guide documents, below are some DALI wiring tips;

1. **DO NOT** connect line voltage to the 2-wire DALI wiring
2. **DO NOT** connect the 2-wire DALI wiring to earth ground (doing this will typically result in fixtures flickering or being stuck at low end)
3. DALI wiring can be run in the same conduit as line voltage since it is treated as Class 1 wiring. Please follow all Class 1 safety rules for DALI wiring.
4. DALI wiring is topology-free (daisy-chain, star, homerun, t-tap), however, for ease of troubleshooting Lutron recommends using a daisy-chain wiring topology
5. If using a daisy-chain wiring topology, it is recommended to run a “loop back” wire for the DALI loop from the last ballast on the link back to the GRAFIK Eye QS or WPM unit but not physically connected to the unit. This “loop back” wire would only be connected to the main control unit in the event of a wiring issue somewhere in the middle of the DALI loop.

### Additional Notes:

1. Each GRAFIK Eye QS or WPM w/ DALI unit counts as 1 device on the QS or RF Link (PDU count = 0)
2. Each GRAFIK Eye QS or WPM w/ DALI unit has 1 DALI loop that can control a maximum of 64 DALI ballasts
3. DALI ballasts can be grouped together into lighting zones at the GRAFIK Eye QS unit itself (refer to the “DALI Setup” section in the [GRAFIK Eye QS with DALI Installation and Operation Guide](#) or [WPM with DALI Installation and Operation Guide](#) for more details)

### HWQS Software—Design Tab:

1. Navigate to the “Design > Controls” screen and add either a GRAFIK Eye QS w/ DALI or WPM w/ DALI unit to the Toolbox. See Figure 1 below.



**Figure 1**

2. Navigate to the “Design > Loads” screen and add the appropriate number of DALI loads in each area. Each GRAFIK Eye QS or WPM with DALI unit can have a maximum of 64 DALI ballasts connected to it and can control a maximum of up to 16 zones, however, you are unable to change the “Fixture Qty” to anything other than 1 for a DALI load type in the software. For DALI zones that contain *multiple* ballasts you will need to leave the fixture quantity set to 1 and enter the **TOTAL** fixture wattage in the “Fixture Wattage” field.

For example, if you have **4** DALI Sconce fixtures that are 25 W each and are all in the same zone, you would enter in a “Fixture Wattage” of **100 W** and leave the “Fixture Qty” set to **1**. See Figure 2 below.

Loads		3rd Party HVAC				
Zone #	Zone Name	Voltage	Load Type	Fixture Wattage	Fixture Qty	Total Watts
1	Pendant	230V CE	Fluorescent DALI	75	1	75
2	Sconces	230V CE	Fluorescent DALI	100	1	100
3	Cove	230V CE	LED DALI	25	1	25

**Figure 2**

*NOTE: Even though the software will make it look like only 6, 8, or 16 ballasts are connected to the GRAFIK Eye QS or WPM w/ DALI main unit, you need to remember if you have multiple ballasts grouped into zones that **you cannot physically exceed 64 ballasts per main unit.***



3. Add the appropriate number of GRAFIK Eye QS or WPM w/ DALI units to each area on the “Design > Controls” screen and assign each DALI zone to its corresponding unit. See Figure 3.

Device Locations |  Auto-Create Loads | Expand all | Collapse all

Family Room Entry

Number Of Zones: 6 | Number of Shade Groups: 0 | Model: QSGRK-6D

	Output	Input	Model	Name	Interface
1			QSGRK-6D	Pendant	
2			QSGRK-6D	Sconces	
3			QSGRK-6D	Cove	
4			QSGRK-6D	Assign...	
5			QSGRK-6D	Assign...	
6			QSGRK-6D	Assign...	

**Figure 3**

## HWQS Software—Program and Activation Tabs:

1. The DALI ballasts can be programmed to any system triggers (keypad buttons, contact closures, timeclocks, etc.) or 3<sup>rd</sup> party control, just like other load types.
2. Device activation of GRAFIK Eye QS units can occur either before or after the EcoSystem ballasts/drivers have been addressed and grouped together into zones locally at the main unit.

*NOTE: All ballast/driver addressing and zoning is done locally at the main unit, not in the HWQS software. Refer to the [“GRAFIK Eye QS with DALI Installation and Operation Guide”](#) or the [“WPM with DALI Installation and Operation Guide”](#) for more information on the wiring and local addressing/zone configuration of the DALI ballasts connected to each unit*

## Contact Lutron:

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