

euLINK DALI - Quick Guide for Integrators

Table of Contents

1. Where to start?.....	2
2. Physical connections.....	2
3. DALI system programmer	3
4. Initial addressing.....	5
5. Initial groups and scenes assignment.....	5
6. Testing a new DALI installation.....	6
7. Integrating euLINK with FIBARO.....	6
8. Identifying euLINK DALI Ports.....	6
9. Scanning the DALI bus for luminaires with euLINK	9
10. Selecting DALI luminaires, groups and scenes for import to FIBARO.....	10
11. Testing the luminaires from the euLINK.....	12
12. Importing the DALI device to FIBARO Home Center	14
13. Change of IP address of FIBARO HC Controllers and/or euLINK.....	17
14. DALI dimming switches and buttons	18
15. Communication with DALI and DALI-2 sensors	19
16. Support for advanced DALI functions (<i>Tunable White, Circadian Rhythm, etc.</i>)	20
17. Summary.....	21

Required skills:

- Installation practice in the field of electronic devices will be useful

1. Where to start?

If you are an experienced DALI installer, you may decide to skip the initial steps and go straight to section 7. (Integrating euLINK with FIBARO) on page 6.

However, if this is your first attempt to installing DALI technology, please review all of the sections of this Quick Guide step by step.

2. Physical connections

All DALI luminaires have to be properly powered. The construction of the different luminaires varies and the appropriate installation instructions should be provided by the luminaire manufacturer. Please check the parameters of every DALI luminaire and connect it to the mains supply in accordance with the manufacturer's instructions. This will provide source of energy for the luminaires.



Please remember that the supply voltage of DALI luminaires can be life-threatening!

Apart from the energy, the luminaires also need the information about dimming, and it is transmitted over a pair of wires, called the **DALI bus**. Almost all wire types are appropriate for DALI bus. The installers usually use 0.5mm² wires or thicker, up to a 1.5mm² popular in lighting cabling. The maximum number of luminaires on a single bus is 64. The maximum length of the bus is 300m with 1.5mm² cables. A voltage drop above 2V also means that the cable is too long. If there are more luminaires or the length of the bus exceeds the allowed limit, the bus has to be split to two or more bus segments.

The DALI specification is very flexible and the data connections between DALI controller and DALI luminaires can be arranged in different topologies, like bus, star, tree, or any mix of them. The only forbidden topology is **loop**. If the DALI bus forms a closed loop, the proper communication will be impossible and it will be extremely difficult to find the source of malfunction.

Every DALI bus segment requires its own, additional voltage source for transmission bias and for powering small accessories (like DALI motion sensors or light sensors). For this reason a specialized **DALI Bus Power Supply** (16V/240mA) is necessary for every DALI bus segment. Please do not confuse it with the luminaires power supplies, attached to the lamps - the DALI bus has its own low voltage source. If it is missing, the communication over the DALI bus will not work. Sometimes such specific power supply is built-in in some other device - a luminaire or even a DALI programmer. But the DALI Bus Power Supply must remain connected to the DALI bus forever - even when you disconnect your programmer and move it to another installation. A good example of such specific DALI Bus DC Power Supply is [DLP-04R](#) unit from MEAN WELL, shown in the photo on the right. It costs about €35.



Image: www.meanwell-web.com

All DALI devices (luminaires, bus power supplies, programmers, euLINK DALI ports) have a pair of terminals, marked DA - DA, which should be connected - thus forming the DALI bus. The bus is insensitive to polarity, so the installer does not have to pay attention to the positive and negative terminals 😊.



However, it makes sense to ensure that the DALI bus is not shorted or disconnected at any point. One of the faster methods is to measure voltage at the beginning and at the end of the bus - in both places the readout should be between 12V and 18V DC, usually around 16V DC. Please set your voltmeter to a DC voltage in range 20V – 60V and take a measurement. If the voltage measured is close to 0V, it may indicate that the bus is shorted or the DALI Bus Power Supply is not working. The only way to proceed then is to divide the bus to shorter segments and measure each of them separately until the fault is located. Also, please separate the DALI Bus Power Supply and make sure that it delivers 16-18V DC on its output terminals. And make sure that there is no loop in the DALI bus ;-)

3. DALI system programmer

You will need a DALI USB device to configure the DALI system. Please treat that DALI USB as your daily tool: a DALI System Programmer. You will use it in all your subsequent DALI installations in the future. You will use it once per every DALI bus, for initial addressing and testing only. After the successful initial programming the DALI USB is no longer necessary, unless you have to investigate some complex transmission problems. The DALI USB Programmer has also many test, diagnostics and DALI traffic monitoring functions, so it can be helpful in isolating problems and implementing the right solutions. But normally the DALI USB Programmer is disconnected just after the initial addressing and tests of the new DALI installation.

We recommend the [DALI USB from Tridonic](#) (about €150), shown in the photo on the right:

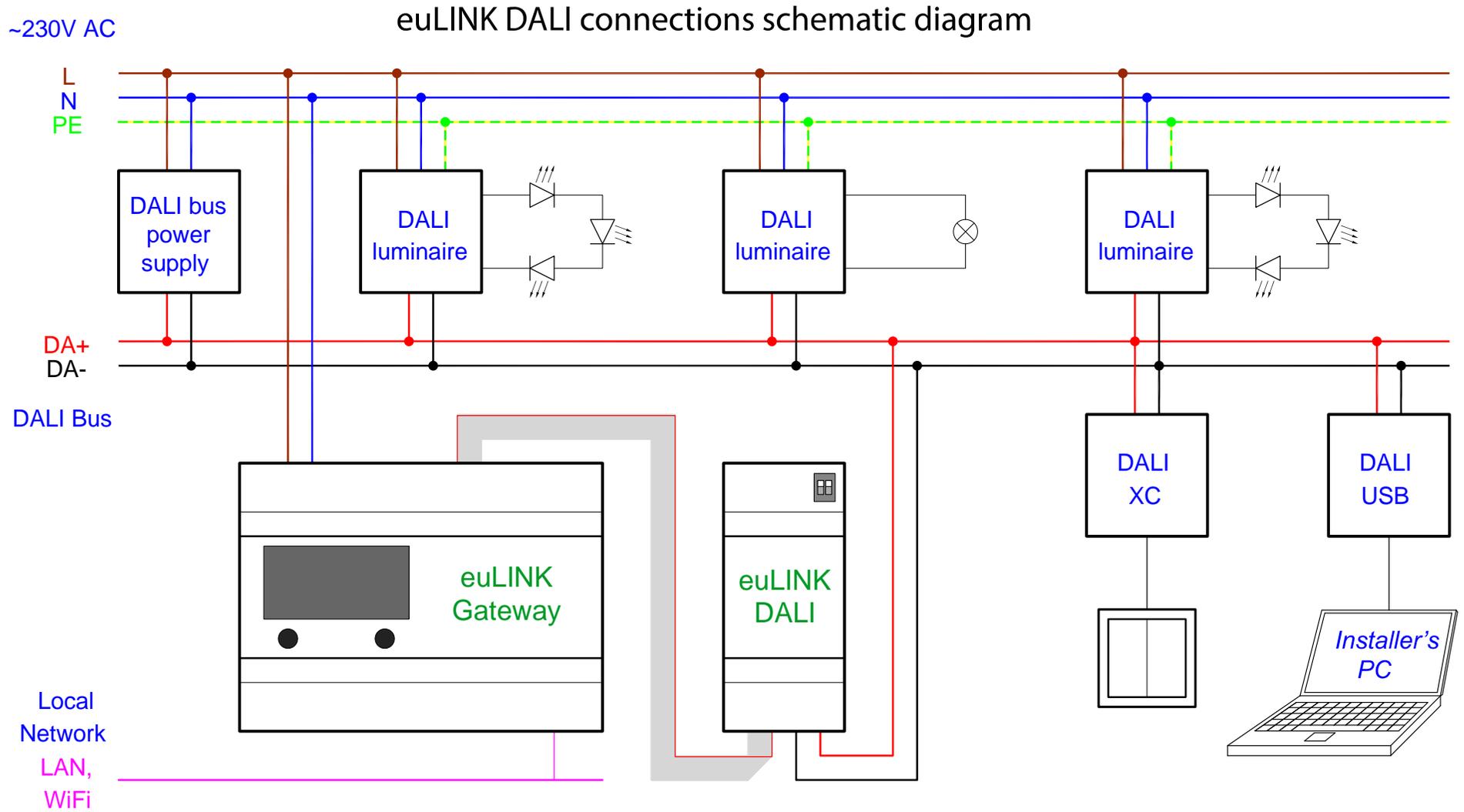
You can also choose Lunatone product or many others as well. In case of Lunatone you have a choice of 6 variants (standard, mini, with power supply, for DIN rail, and wireless). If you plan to use your notebook and the DALI USB as a mobile DALI Programmer, the best choice is the standard variant.



Image: www.tridonic.pl

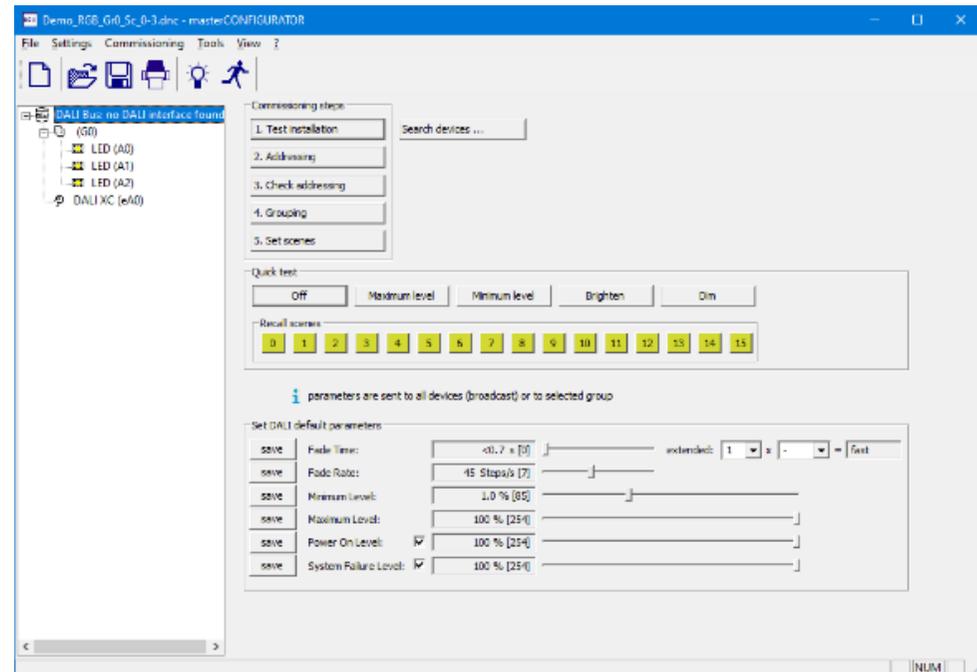
Of course, you will also need a computer software, usually provided by the DALI USB's manufacturer for free. In the case of Tridonic, it is the "[masterCONFIGURATOR](#)" software that can be downloaded from the manufacturer's website. If you bought the DALI USB from Lunatone, you have to download the programming software "[DALI Cockpit](#)" from Lunatone's website and install it on your notebook. It is easy to get familiar with this software because it is user-friendly and well documented.

I would advise building a small test DALI installation in your laboratory before going "live" on customer premises. You should learn how to build the smallest DALI network, how to test it, how to integrate it with euLINK and finally how to import it to the FIBARO Home Center. You will need at least 1 DALI luminaire with its Driver/Power_Supply, 1 DALI Bus Power Supply, a few insulated wires 1mm², 1 euLINK Lite Gateway, 1 euLINK DALI port, 1 FIBARO HC and a local LAN network to connect euLINK to the HC. An example of such a test installation is presented below:



4. Initial addressing

All DALI luminaires have a unique long address, assigned in the factory. It is a similar concept to a MAC address of the computer's network card. The DALI programmer software scans the DALI bus, reads the long addresses of all the luminaires found and assigns short addresses for all of them. This is similar to the IP addresses assigned to the network cards by DHCP server or router. The short address is selected from the range 0-63 and is unique within a particular DALI bus segment. The luminaires are made to remember their short DALI address, so the addressing operation has to be done once per every bus segment. It takes maximum 2-3 minutes, depending on the number of luminaires in that bus segment. The DALI programmer software allows for testing the newly added DALI luminaire by turning it on and off or by changing the dim level. It is a good habit to make a note linking the short DALI address with the room and a specific luminaire. A simple table in any spreadsheet is enough for this. Such notes will become very useful when importing luminaires to the FIBARO system, and can also be used to prepare the final documentation of the installation.



5. Initial groups and scenes assignment

Every DALI luminaire can be assigned to one or more (max. 16) groups by means of using the DALI USB Programmer software. Every luminaire remembers its group assignments forever, much like its short DALI address. When a DALI controller sends a command to the group, all luminaires assigned to that group have to execute that command. The "DALI Controller" can be any device able to send a command to the luminaires, e.g. a DALI programmer, a motion sensor, a push-button adapter, our euLINK or many other devices. The ability to control these groups of DALI luminaires is very important, especially from the point of view of the end-users' convenience. Let us consider the following example: there are 3 DALI bus segments in a room, and every bus contains 5 luminaires. Every luminaire has its individual DALI short address, so it is possible to control the dim level of every luminaire independently. But the end-users would be forced to deal with 15 luminaires one-by-one to get them equally bright. Instead, the installer usually assigns the luminaires to a few groups (for example: 3 groups) which significantly simplifies the end-users task. It is also important for the FIBARO integrators, because every DALI object (a luminaire or a group) uses one QuickApps in the FIBARO Home Center. As you will remember, FIBARO HC3 Lite has a limit of 10 QuickApps, so it would be able to support all 15 luminaires as 3 groups (thus 3 QuickApps) but it is unable to handle 15 independent luminaires due to a 10 QAs limit. A good DALI design assigns many

luminaires to a small number of groups, thus reducing complexity, decreasing the traffic (both on DALI and on LAN network) and improving the user experience, also on the FIBARO applications side. Similarly, the luminaires can be assigned to as many as 16 scenes per DALI bus, where every luminaire remembers its light level for every scene and can be quickly restored with a single command. It is a FIBARO integrator's decision, which independent luminaires, which groups and which scenes are imported to a FIBARO Home Center.

6. Testing a new DALI installation

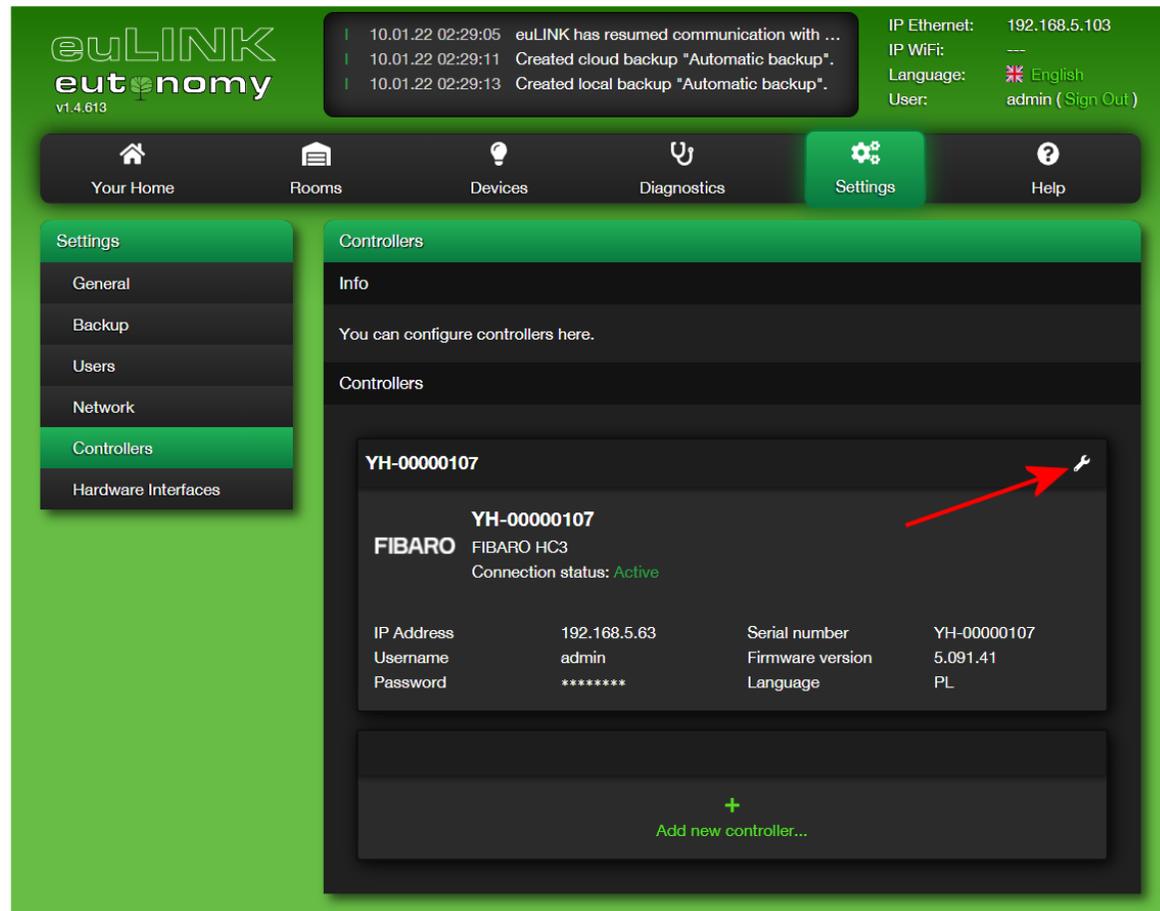
The DALI USB Programmer software can be used to test each individual luminaire, and it can also send a command to every group and invoke any scene. The installer can also assign accessories (such as DALI motion sensors, light sensors or push-buttons) to the particular groups and/or scenes. And again, the installer should make a note linking the short DALI addresses with particular groups and scenes. After the successful tests the DALI USB Programmer can be disconnected from the DALI bus and moved to another installation.

7. Integrating euLINK with FIBARO

To start, please make sure that you have entered your FIBARO Home Center's details into the euLINK configuration, by navigating to: euLINK Main Menu => Settings => Controllers (as you can see on the screenshot). When euLINK is properly linked to the Home Center, you can download the list of rooms defined within the Home Center's configuration. The list of rooms will be used to assign the DALI luminaires to the appropriate locations.

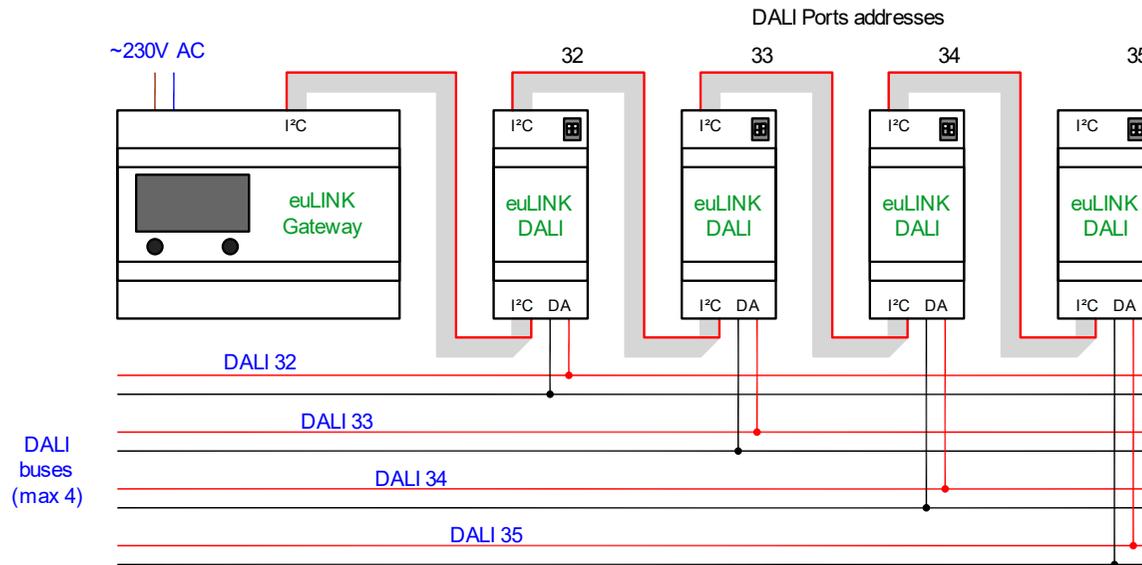
8. Identifying euLINK DALI Ports

When the DALI installation is up and running, it is time to login to euLINK, identify the DALI ports connected to the euLINK gateway and scan the DALI bus(es) in order to find all of the luminaires. If the bus is too long or the number of luminaires exceeds 64, the installer has to divide the bus into several smaller bus

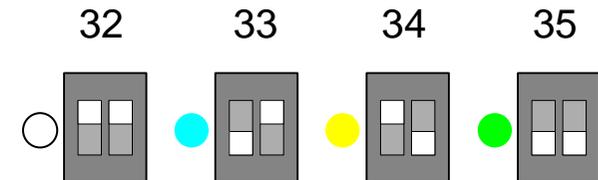


segments. Every DALI bus must be serviced by a single euLINK DALI Port. The method of cascading DALI Ports is illustrated in the following diagram. Up to 4 euLINK DALI Ports can be connected in a daisy chain to the euLINK gateway simultaneously. In the case of the euLINK **Lite** model, there should be no more than 2 DALI Ports.

euLINK DALI multiple buses connection



If there are more than one euLINK DALI Ports, the installer has to use the DIP switches on the DALI Ports to make the I²C addresses unique. Otherwise the euLINK gateway will not be able to recognize the particular DALI Ports. The address setting is done by moving 1 or 2 sliders on the DIP switch, visible at the top of the DALI Port board. Right next to the DIP switch is a multi-coloured LED that indicates the set address. The following 4 I²C addresses are possible: 32, 33, 34 and 35. The corresponding DIP switch settings are illustrated on the following image:



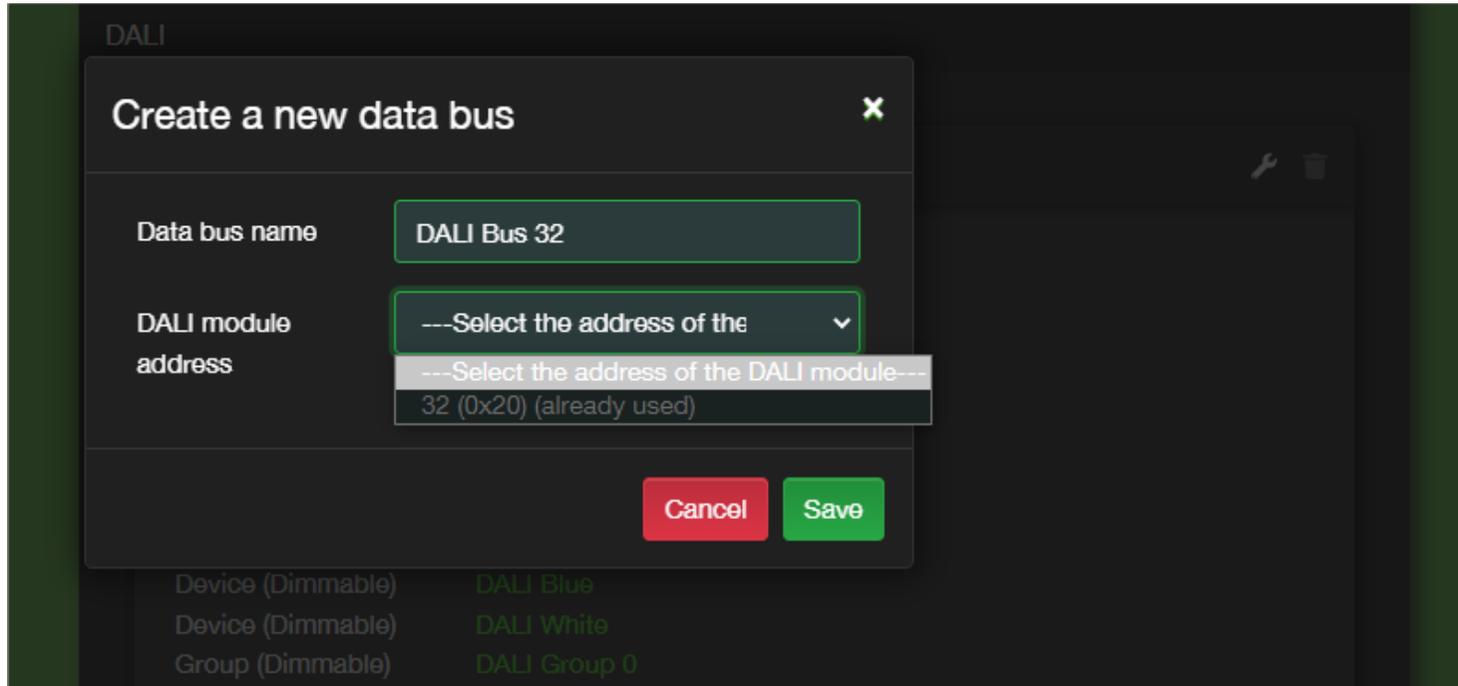
The DALI Ports with the same I²C address cannot be connected to one euLINK gateway, so each LED in the ports cascade should glow in a different colour. The state of the DIP switch is read only once upon powering up. Hence, it is best to set the I²C addresses before turning on the power - so that the change is 'noticed' by the device. There are two more diagnostic LEDs on the DALI port board: the red **Tx**, which flashes when transmitting, and the blue one, which is lit continuously as long as the DALI port is connected to a properly powered DALI bus. In addition, the blue **Rx** LED briefly dims when receiving data from the DALI bus.

The euLINK DALI Gateway can be installed in any point on the DALI bus - at the beginning, at the end or somewhere in the middle.

It does not matter to which of the two I²C DALI Port sockets the strip to the euLINK gateway is connected, because both sockets are internally connected in parallel. However, please pay attention to the descriptions on the enclosure, and to the fact that the red colour indicates the wire No. 1. As usually, the installer should make a note of the assignment of real DALI bus to the I²C address of the euLINK DALI Port.



Please navigate to Settings => Hardware interfaces => DALI => Add new DALI data bus... to add every DALI Port connected:

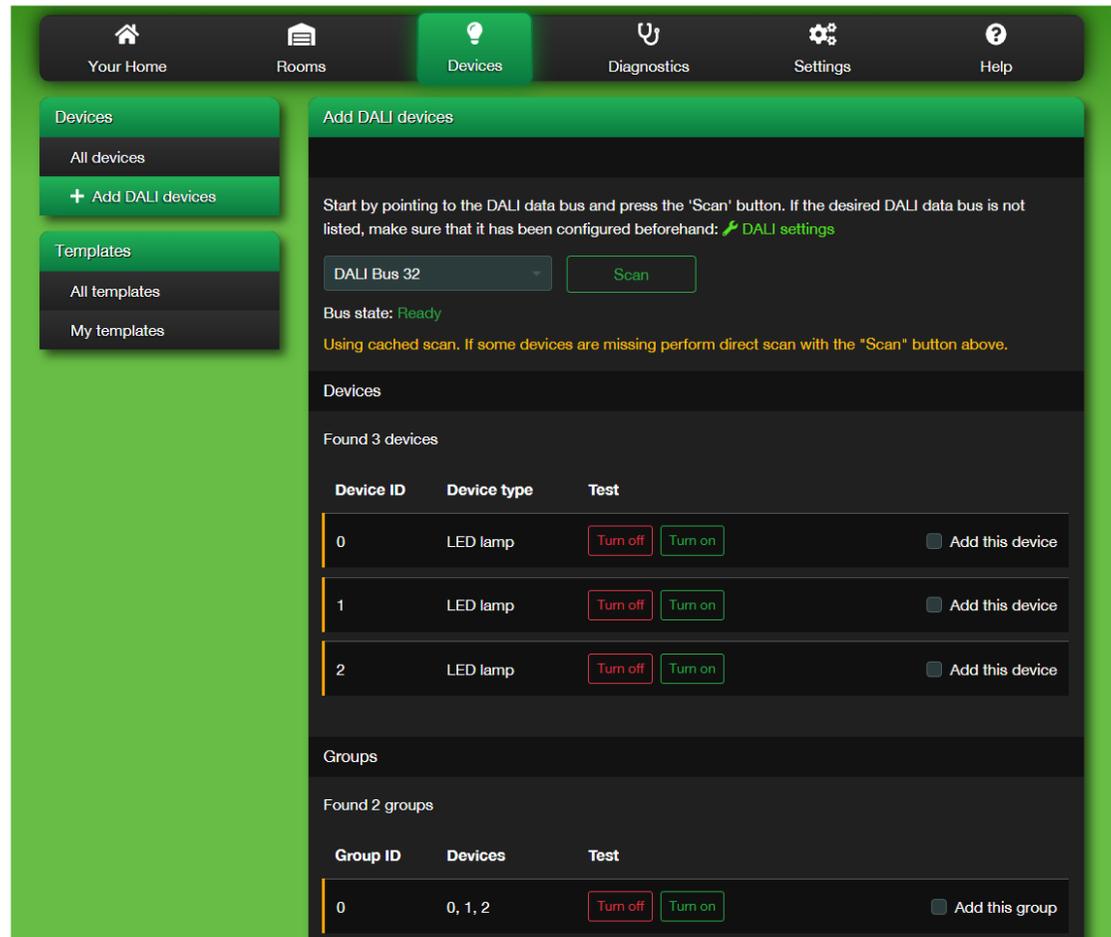


You can add new or modify the existing DALI buses by selecting their I²C addresses from the list of recognized DALI Ports. It makes sense to give an intuitive/familiar and location-related name to each bus. After successful installation, the euLINK DALI port performs a DALI bus diagnostics and should show the bus status as "Ready". However, if the message reads "DALI bus is disconnected", it may mean that it is physically disconnected or there is no properly working DALI power supply on this bus.

Note: If several DALI ports with the same I²C address are connected, none of them will be recognized. If a new DALI port with the same address as one of the previous ones is connected, the new DALI port will not be recognized, but the previous one will work without problems.

9. Scanning the DALI bus for luminaires with euLINK

Please navigate to the euLINK Main Menu => Devices => Add DALI Devices, then select the DALI bus assigned to the DALI Ports addresses and press the "Scan" button. The scanning should take no longer than 2-3 minutes, depending on the number of luminaires on the bus. However, usually there is no need to scan the bus manually because euLINK scans the bus automatically in the background, to save your time. The automatic scan occurs after adding a new DALI bus, and also after restarting the euLINK gateway. Therefore, you should immediately see the recognized luminaires, their groups and the DALI scenes without a manual scan, as it is shown in the following screenshot:

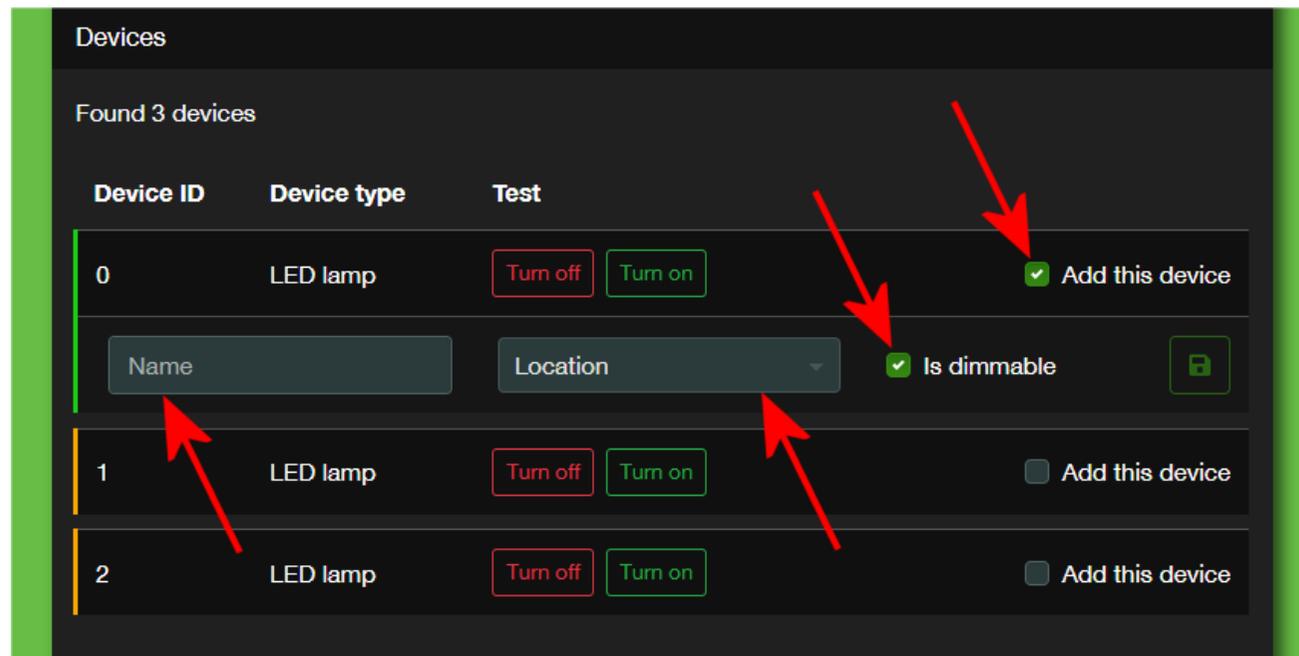


The only scenario where a new scan is required, is a recent change in the DALI bus configuration, e.g. adding new luminaires in the last few minutes. Please remember that **only one device can scan the DALI bus at one time**, so either euLINK or the DALI USB Programmer. Otherwise euLINK will report that the DALI bus is busy or inaccessible. Only a bus that is in the "Ready" state can be scanned. If the DALI bus is busy or disconnected, its status will be different.

The DALI devices other than the luminaires and their groups (like DALI motion sensors or buttons) are not imported during scanning, because euLINK is not a 'target' for them. You can observe the behaviour of the DALI light sensors, motion sensors or buttons in your FIBARO scenes by observing the state of the DALI luminaires linked to those sensors.

10. Selecting DALI luminaires, groups and scenes for import to FIBARO

Every DALI luminaire or group is shown in the scan result list with the "Turn Off" and "Turn On" buttons that help to test and identify the specific luminaires. There is also the "Add this device" checkbox with every DALI object. Please click that checkbox for every device to be imported, give it an intuitive name and assign it to the appropriate room, derived from the FIBARO Home Center earlier. If the luminaire is dimmable, please indicate this too:



When the particular luminaire is named and assigned, it can be saved by pressing the diskette icon.

The DALI Groups should also be assigned to the appropriate room(s) and saved in a similar way.

If there are any scenes defined for the particular DALI bus, euLINK should recognize and list them in the following form:

Scenes

Found 4 scenes

Scene ID	Devices	Test
0	0, 1, 2	Activate scene
1	0, 1, 2	Activate scene
2	0, 1, 2	Activate scene
3	0, 1, 2	Activate scene

Scene controllers

Create scene controller

Name

Location

The installer can test (activate) every scene and assign the scene controller panel to one of the Home Center's rooms.

11. Testing the luminaires from the euLINK

Please navigate to the euLINK Main Menu => Your Home, where you should see all of the luminaires previously selected for import. You can click on every light bulb icon to send a "Toggle" command to the lamp or group of lamps:



Clicking on the wrench symbol will open the detailed DALI device configuration, where you can test the luminaires or their group with the On/Off buttons and dim it with a slider:

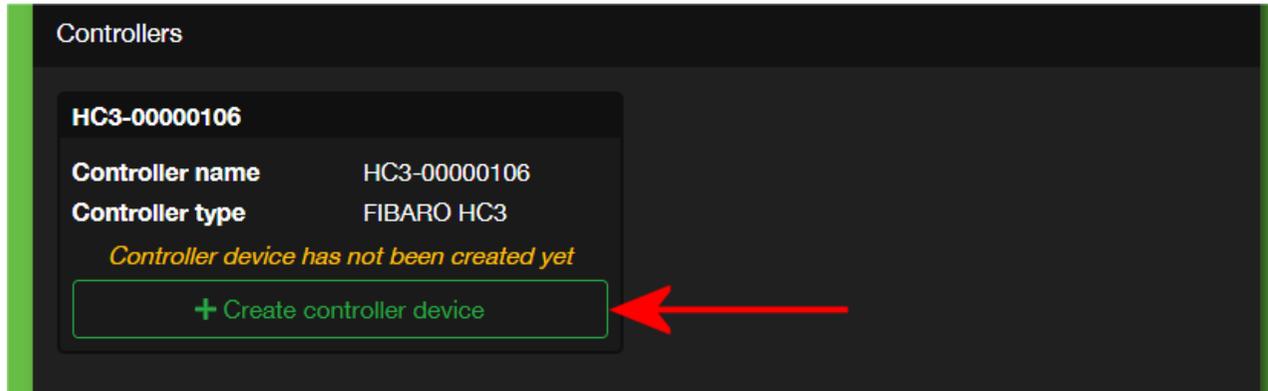
The screenshot displays the eutonomy web interface for configuring a DALI Red device. On the left, a sidebar contains navigation menus for 'Devices' (All devices, Add DALI devices, Details: DALI Red) and 'Templates' (All templates, My templates). The main content area is titled 'Details: DALI Red' and is divided into several sections:

- General:** A table of device metadata including Instance name (DALI Red), Location (Default Section | Default Room), Template name (DALI Dimmable Light (v1)), Device model (Eutonomy DALI-LIGHT-DIMMABLE), Categories (Dimmable Light), Description (DALI dimmable light), Comment (---), Documentation (https://www.eutonomy.com/docs/), and Tools (https://www.eutonomy.com/docs/). To the right of this table is a light bulb icon with a bar chart and a '1-24%' indicator, along with 'Edit general settings' and 'Remove device' buttons.
- Panel:** A control interface for the 'DALI Red' device, featuring a 'Toggle' button, 'Off' and 'On' buttons, and a 'Level' slider. Two red arrows point to the 'On' button and the 'Level' slider.
- Controllers:** A section at the bottom of the main area, currently empty.

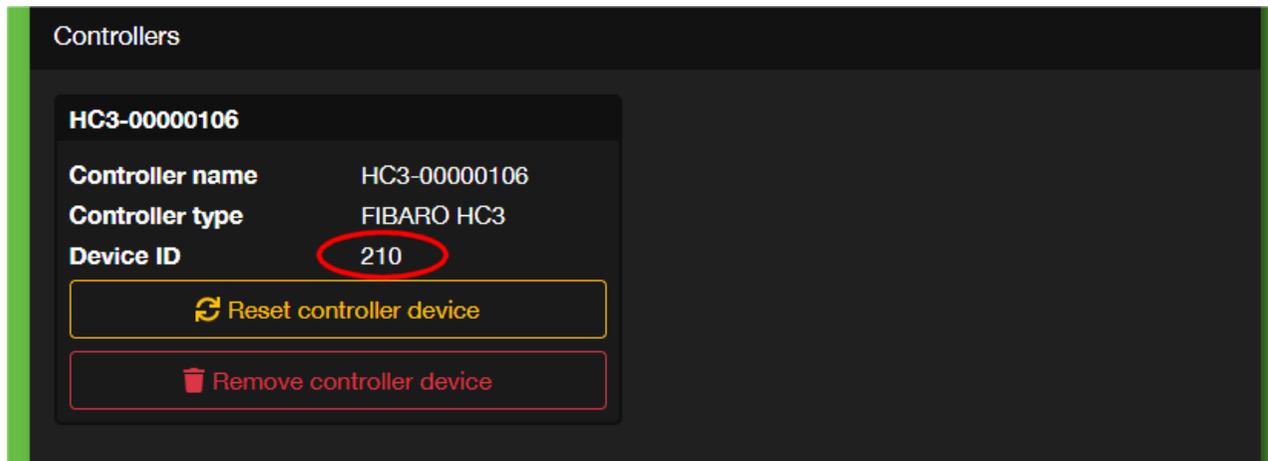
If everything works as expected, you are ready to import the luminaire or the group to the Home Center controller.

12. Importing the DALI device to FIBARO Home Center

Please scroll down on the same DALI device's window to the "Controllers" section and press "Create controller device" button:

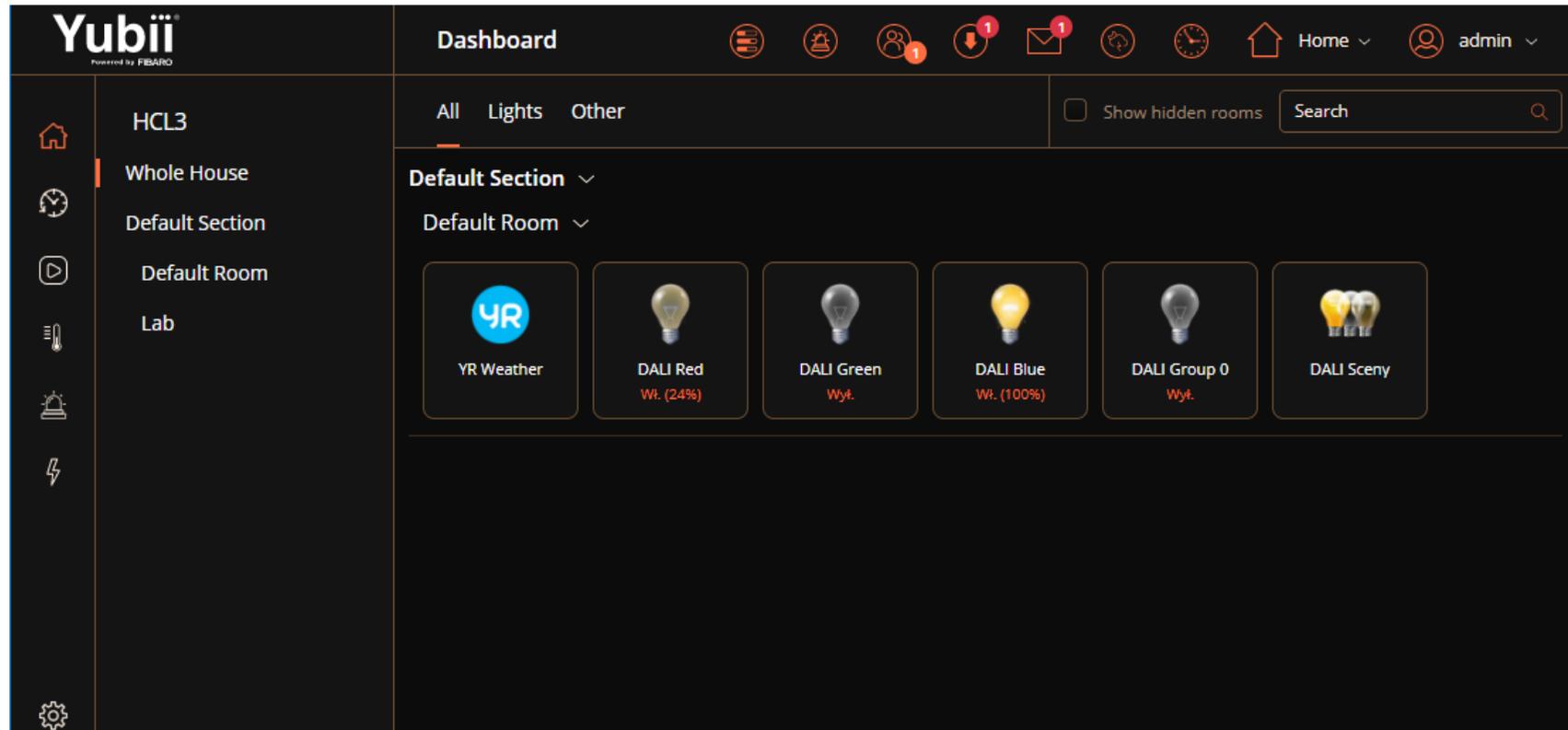


After a second the DALI device should be available in the FIBARO Home Center configuration webpage. But before you leave euLINK, please make a note of the circled number. It is the Device_ID, assigned by FIBARO Home Center to the newly created object:

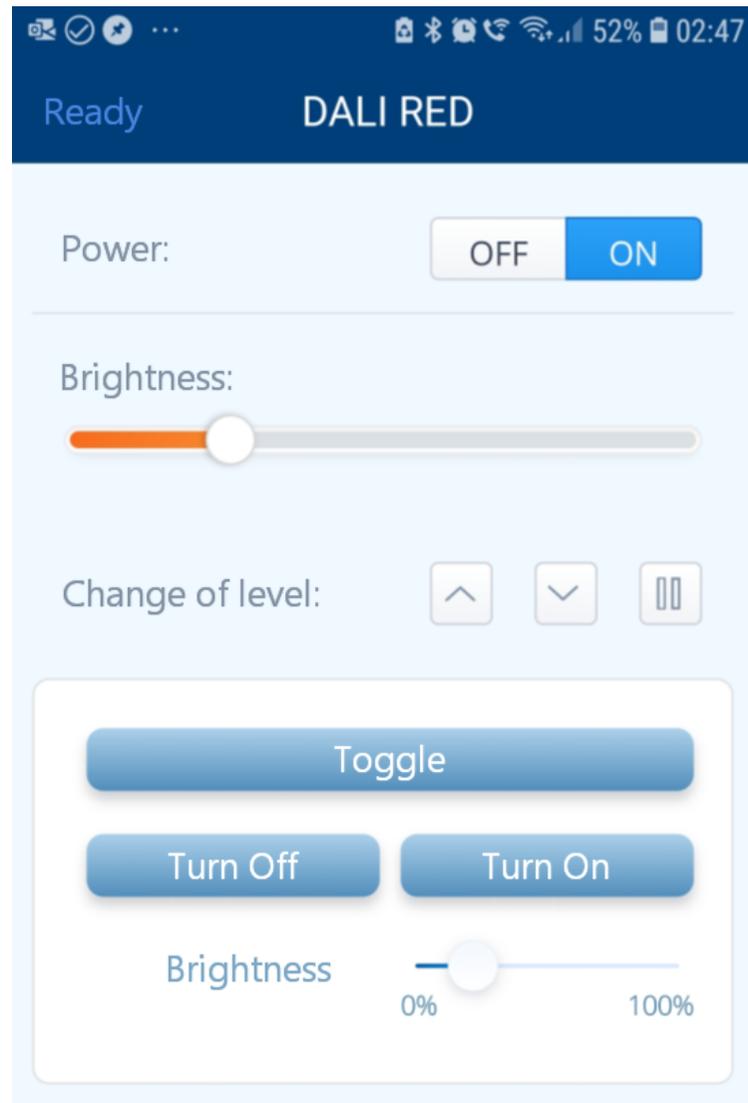


You can use that Device_ID (in our example it is equal to **210**) in your scenes, maintaining the DALI luminaires in the Home Center environment. You will also find the global variable named "eu_210_level_****" containing the DALI luminaire dim level, that can be used for some useful numerical calculations.

As the last step, you should test the ability to control the DALI devices, groups and scenes from the Home Center webpage:



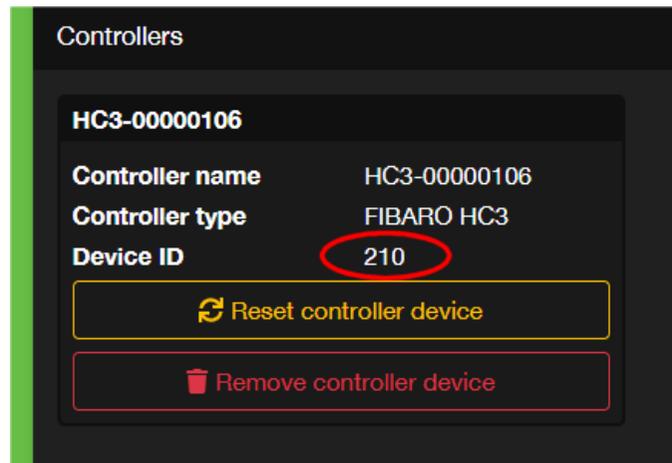
and from the FIBARO Smartphone application:



Should it become necessary in the future to assign the DALI luminaire to a different room, it will be easiest to do so entirely on the side of the euLINK gateway. In the DALI luminaire configuration, simply use the "Remove controller device" command, then change the room in the general settings of the luminaire and issue the "Create controller device" command again. In this way, the euLINK gateway will recreate and organize all information about a given luminaire (QA or VD objects, variables, etc.) on the side of the Home Center controller.

13. Change of IP address of FIBARO HC Controllers and/or euLINK

Please note that not only euLINK needs to know the IP address of the FIBARO HC controller. Each QuickApps or VirtualDevice object has a saved euLINK gateway IP address, because it is needed to send commands to euLINK and then to DALI or to MODBUS devices. If the IP address of the FIBARO HC controller changes, euLINK must learn its new address. But if the euLINK address has also changed, its new address must be entered in every QA or VD object on the FIBARO HC side. The easiest way to do it is with one button in euLINK in the configuration of the luminaire or DALI group. This is a yellow button that says "Reset Controller Device":



This button will refresh and update all parameters of the QuickApps or VirtualDevice object previously created by euLINK. Among other things, it will also update the IP address. In most cases, it is possible to do this without the need to change the DeviceID of the QuickApps object on the FIBARO HC side, so you do not need to change anything in the running FIBARO scenes. However, it is worth checking if the FIBARO scenes trigger the correct QuickApps objects, because it may happen that the FIBARO HC controller will create a new DeviceID for this object.

14. DALI dimming switches and buttons

There are two basic methods of connecting the DALI lighting control buttons:

- Within the DALI bus using DALI button sensors,
- Within the FIBARO System, using the scenes (block or LUA).

Each of these methods has advantages and disadvantages that should be kept in mind when designing an installation. Of course, mixed solutions are also possible, but it is necessary to ensure that it does not turn out that the mixed solution inherits all the disadvantages of both methods and few of their advantages.

The advantages of the first solution, based on DALI button sensors, are as follows:

- The delay in the reaction of the lighting to pressing the button is imperceptible for users,
- Lighting control is independent of the correct operation of the FIBARO integration,
- Hardware dimming control is easy and lag-free,

Disadvantages:

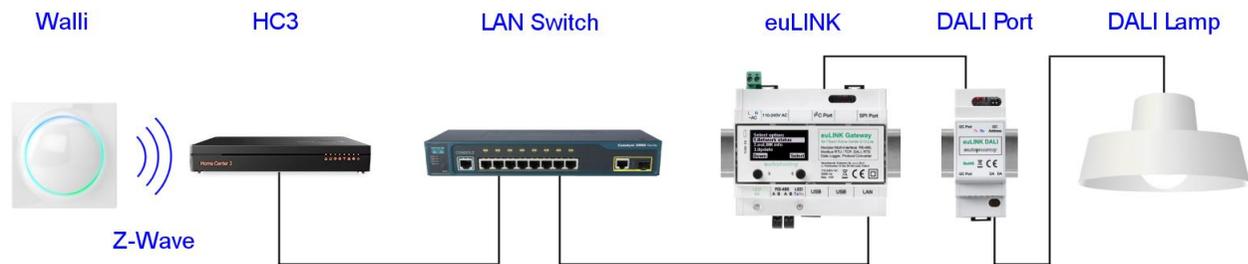
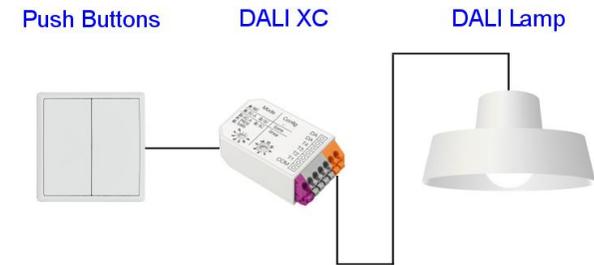
- Pressing a button can perform any action, but only within the DALI installation.

The advantages of the second solution (with FIBARO scenes) are as follows:

- Pressing a single button can trigger a scene that controls not only DALI luminaires, but also any other devices in the FIBARO system,
- Compared to the cost of a single button, the FIBARO scene triggering solution is slightly cheaper.

Disadvantages:

- Integration depends on the whole chain (FIBARO module => Z-Wave transmission => HC3 scene => LAN transmission => euLINK gateway => euLINK DALI port => DALI transmission => DALI luminaire). The failure of one link of the chain makes it impossible to control the lighting.



- LAN and DALI transmission delays are negligibly small, but Z-Wave transmission disruptions can extend the response time of the lighting to the button to several hundred milliseconds or sometimes more,
- Dimming by keeping the button pressed is much more difficult.

If the FIBARO System is to control DALI luminaires that are not dimmable, the matter is simple. Any binary switch is suitable for this task. It is also easy to create scenes that send simple commands to the DALI luminaires such as "TurnOn" or "TurnOff". The task is much more complex if the DALI luminaire is dimmable. Although almost every FIBARO module can be a scene trigger and recognizes both a short button press and a long press and release of the button, you need to create several scenes to handle such events. And if pressing a single button is to dim, and the next press is to brighten the light, then these will not be block scenes, but rather LUA code. In addition, the detection of the moment the button is released causes a delay, sometimes even exceeding 1 second.

For many of the above reasons, the best results are obtained with the first solution, using DALI button sensors. And even if you need to use a solution with FIBARO scenes, it is worth providing at least one DALI button sensor in the system for diagnostic purposes and for emergency control.

An example of a button sensor is the [DALI XC](#) product from Tridonic, shown in the photo on the right. The DALI XC sensor costs around €160. It supports 4 buttons, and each of them can be assigned to any DALI group or scene. It is best to define the function of each button right after addressing the DALI luminaires for the first time and after defining the DALI groups and scenes. The same software is used for that assignment that was previously used to address DALI luminaires. The DALI XC sensor is powered from the DALI bus, so it does not require a dedicated power supply.

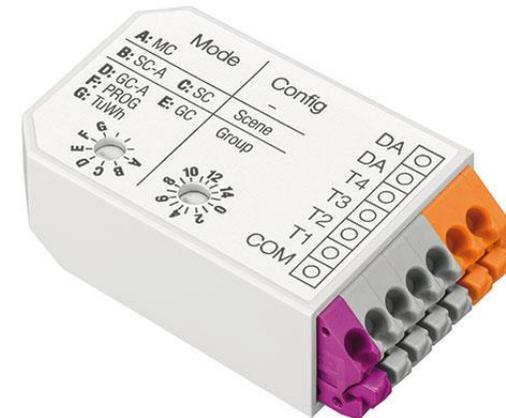


Image: www.tridonic.pl

15. Communication with DALI and DALI-2 sensors

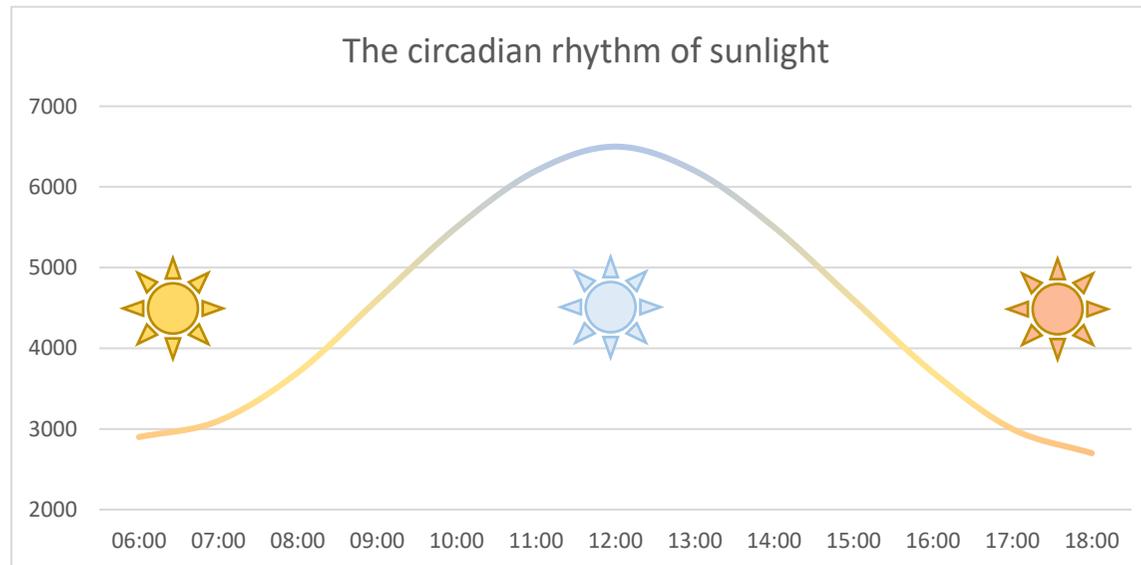
The installers frequently ask a question: does euLINK support DALI-2 sensors correctly? But euLINK gateway does not in any way deal with other controllers on the bus - whether DALI or DALI-2. All sensors, including occupancy sensors, are controllers and they issue commands to DALI luminaires or groups of luminaires, using standard command codes (e.g. turn on, turn off, set brightness level, etc.). The euLINK gateway only monitors the traffic on the DALI bus and if it detects that a fixture has received a command, it waits for 200ms and sends a question to it about its status. Thanks to this, euLINK knows whether the fixture's status has changed and what its new status is, so it then passes this information to Home Center, which changes the appearance of the fixture's icon. Therefore, regardless of who issued the command to the luminaire (a presence sensor, a DALI XC button converter, a DALI programmer, etc.), euLINK 'listens' only to these commands and checks their impact on a given luminaire. It does not interface with, scan, or otherwise check the sensors in any way. Interestingly,

euLINK queries the luminaire about its status (i.e. the current brightness level) even when it has sent a command to it. Although he should know what he ordered her to do, it is never certain whether the luminaire accepted and carried out this order. It is enough for the luminaire to detect a burned out bulb for its condition to be different than euLINK would expect. That's why euLINK always asks.

16. Support for advanced DALI functions (*Tunable White, Circadian Rhythm, etc.*)

Some modern DALI luminaires offer additional advanced functions. One example is Tunable White, which allows you to adjust not only the brightness of the light, but also its white colour temperature (from cool to warm white). Importantly, such an innovative DALI luminaire only needs one DALI address, not two.

Circadian Rhythm function uses the ability to adjust the white temperature to mimic natural sunlight at different times of the day. So in the morning the emitted light is warm, has a colour temperature below 3000K (like the rising sun), in the morning it is over 4000K, at noon it smoothly increases to 6500K (bright white, even cold) and in the afternoon it drops smoothly to 4000K and even below 3000K in the evening (like a setting sun). It is a very natural effect,



good for plants, animals and, of course, also for humans. It is well-received by users for whom it improves their well-being, increases the efficiency of their work and makes it easier to rest.

When euLINK is to import a DALI luminaire with the *Tunable White* function into FIBARO, it must create 2 dimmable lights, in which one slider is used to adjust the brightness and the other to adjust the white color temperature. In addition, this uses 2 DALI addresses instead of 1 for each *Tunable White* luminaire, so there cannot be 64 of them on the DALI bus, but only 32. This limitation may therefore affect the design of the arrangement of DT6 luminaires on DALI buses.

Work is underway to improve this control in the near future - so that on the Home Center side, the *Tunable White* luminaire is represented by a single QuickApps, and on the DALI bus side, it is a single address (thanks to the use of the DALI2 protocol in DT8 mode).

The Circadian Rhythm function can be programmatically implemented using FIBARO scenes, as long as the DALI installation includes luminaires that enable white temperature regulation.

17. Summary

Please note that the import of the DALI luminaire into the Home Center did not require any knowledge of LUA programming or the technique of building complex QuickApps objects. All necessary objects and variables are automatically created by the euLINK gateway and then quickly imported to the Home Center controller thanks to the FIBARO REST API mechanism.

If you encounter any problems, please post your question on our forum.eutonomy.com. There you can count on the help of a growing group of enthusiasts of our solution.

You can also always send an email to our Technical Department at support@eutonomy.com.

Good luck!



Maciej Skrzypczyński

CTO @ Eutonomy