Technical Guide:

Zhaga-D4i control devices

This Technical Guide is a joint publication of the Zhaga Consortium and the DALI Alliance.

It describes the key considerations to achieve Zhaga-D4i certification of control devices.

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1.   Introduction

Zhaga-D4i is a joint certification program provided by the Zhaga Consortium and the DALI Alliance.

Zhaga-D4i luminaires can have one or two Zhaga interfaces (connectors), each of which accommodates a luminaire-mounted Zhaga-D4i control device, such as a sensor or a wireless communication device (also known as a network lighting controller or NLC).

Zhaga-D4i certification is designed to ensure plug-and-play interoperability between certified luminaires and certified control devices. Tenders and system specifications should request not only certified Zhaga-D4i luminaires but also appropriate certified Zhaga-D4i control devices. Certification indicates full compliance with the relevant specifications.

This document describes some of the key considerations to achieve Zhaga-D4i certification of control devices.

2.   Zhaga-D4i certification overview

Zhaga-D4i certification of luminaire-mounted control devices is a two-step process (Table 1). See www.dali-alliance.org/zhaga-d4i/ for more details of the certification procedure.

D4i certification (step 1) is required before proceeding to Zhaga-D4i certification (step 2).

Step	Name	Provider	Requirements	Main specification
1	D4i certification	DALI Alliance (DiiA)	DALI Alliance membership	DiiA Specification Part 351
2	Zhaga-D4i certification	Zhaga Consortium	Zhaga membership	Zhaga Book 18 or Zhaga Book 20

Table 1. Two-step procedure for Zhaga-D4i certification.

3.   D4i device types

D4i control devices comply with the DiiA Specification entitled "DALI Part 351 – Luminaire-mounted Control Devices".

Part 351 defines four device types A-D, which are aligned with the requirements of Zhaga Books 18 and 20.

Note that in these Zhaga Books, luminaire-mounted control devices are designated as Luminaire Extension Modules (LEX-M).

The Zhaga Books only allow certain D4i device types to be Zhaga-D4i certified, as shown in Table 2.

➔ **It is essential to design your product to have the correct D4i device type if you intend to apply for Zhaga-D4i certification.**

Zhaga Book	Principal use	D4i device type	Number of devices per luminaire	Options for Zhaga-D4i control devices
Book 18	Outdoor	A or B	Enables two-node (dual Zhaga interface) architecture	• 1 type A <u>and</u> 1 type B • 1 type A only • 1 type B only
Book 20	Indoor	C or D	Single Zhaga interface only	• 1 type C only • 1 type D only

Table 2. Allowed D4i device types for each Zhaga Book.

Any control device with a 4-pin Zhaga interface for outdoor lighting applications (as specified in Book 18) should be designed as a type A or type B device.

Book 20 defines a range of mechanical interfaces for indoor applications. Any control device with one of these interfaces should be designed as a type C or D device.

For example, if your D4i control device has a 4-pin Book 18 interface but has been designed as type D, then you cannot apply for Zhaga-D4i certification.

4.   Device type details

The two main categories of DALI control devices are:
1. application controllers (the "brain" of the system that receives data, makes decisions and sends commands)
2. input devices (such as sensors)

Some products may include both sensors and an application controller. Some may also include non-DALI functions such as wireless communication radios.

An application controller that can share the DALI bus with another application controller is termed "multi-master" while those that cannot share the DALI bus are designated as "single master".

5.   Zhaga Book 18

Zhaga Book 18 allows for up to two control devices on the bus, with up to one type A and one type B per luminaire.

Type A devices are powered by an AUX (24V auxiliary) supply, which is required in Zhaga Book 18 luminaires. Type A devices are typically used for communication between the luminaire and an external city-wide network via a wireless (non-DALI) protocol. Such devices are also known as network lighting controllers (NLCs).

Typical type B devices are sensors designed for outdoor use, and often consume less power compared with type A devices.

Type A devices must include a multi-master application controller. This ensures that it can share the bus with a type B device.

If a type B device includes an occupancy sensor, a daylight sensor or any other sensor that intends to control the light output of the luminaire directly, then it also needs to include a DALI multi-master application controller to be eligible for Zhaga-D4i Book 18 certification. This ensures it can share the bus with a type A device.

Other type B devices, for example sensors for pollution or noise, do not control the light output of the luminaire and therefore do not require an application controller.

If one of each device type A and B is connected (two-node architecture) then the type A device is dominant and controls the system, and the application controller in the type B device (if there is one) is automatically disabled. This arbitration method ensures that no conflicting commands are sent to the driver.

There is no arbitration function between either two type A devices or two type B devices, therefore these combinations are not permitted.

6.　　Zhaga Book 20

Book 20 allows only one Zhaga interface per DALI bus, accommodating either a type C or a type D device.

Type C and D devices must always include an application controller. Both types can optionally include either sensors or wireless transceivers (or both) in the same product.

A type C device must include a multi-master application controller, while type D devices are single master and are not intended to be used with other application controllers.

Type D may be the preferred choice for Zhaga Book 20 applications since it avoids the extra design effort to create a multi-master device. This limits applications to stand-alone luminaires, which is consistent with the requirements of Book 20.

Type D devices are not eligible for Zhaga-D4i Book 18 certification as they are single master devices, and this would cause interoperability issues in a two-node architecture.

Type C devices are bus-powered. Zhaga Book 18 doesn't allow the combination of type B and C as both devices can potentially be powered from the DALI bus and this could exceed the maximum power budget.

7.　　Summary

Zhaga-D4i certification of control devices is essential to ensure plug-and-play interoperability with Zhaga-D4i luminaires.

The specifications should be studied carefully to understand the D4i requirements and those in Zhaga Book 18 or 20. Care should be taken in choosing the correct device type (A-D). One common mistake is to design a single-master type D device with a Zhaga 4-pin Book 18 interface. Although such as device can obtain D4i certification, Zhaga-D4i certification is not available in this case!

Zhaga-D4i certification of control devices is a two-step process, with D4i certification by the DALI Alliance as the first step.

A D4i-certified control device featuring a Zhaga interface (connector) additionally must be Zhaga-D4i certified by Zhaga to ensure full compliance with all relevant specifications.

Without Zhaga-D4i certification, the interoperability promise of Zhaga-D4i is not guaranteed.

8.   Further information

The DALI Alliance (also known as the Digital Illumination Interface Alliance or DiiA) is an open, global consortium of lighting companies that drives the growth of lighting-control solutions based on internationally standardized Digital Addressable Lighting Interface (DALI) technology. The organization operates the DALI-2 and D4i certification programs to boost levels of cross-vendor interoperability. As lighting continues to evolve and converge with the IoT, the DALI Alliance is also driving the standardization of wireless and IP-based connectivity solutions.

- Visit www.dali-alliance.org
- Contact the DALI Alliance: www.dali-alliance.org/contact
- More details on Zhaga-D4i certification: www.dali-alliance.org/zhaga-d4i

Zhaga is a global association of lighting industry members. Zhaga standardizes interface specifications for LED luminaire components, including LED light engines, LED modules, LED arrays, holders, electronic control gear (LED drivers), connectors, sensor and/or wireless communication modules and associated devices. The Zhaga interface standards enable multi-vendor ecosystem of interoperable products. To create trust in the interoperability of products from multiple vendors Zhaga has a certification and logo-program executed by third party test houses. Through its focus on interoperability, Zhaga contributes to circularity lighting via smart, connected lighting and serviceable luminaires, supporting the UN Sustainable Development Goal 11 for sustainable cities and communities.

- Visit www.zhagastandard.org
- Contact the Zhaga Consortium: info@zhagastandard.org
- More details on Zhaga-D4i certification:
    - www.zhagastandard.org/certification/book-18-zhaga-d4i-certification.html
    - www.zhagastandard.org/certification/book-20-zhaga-d4i-certification.html