Outdoor

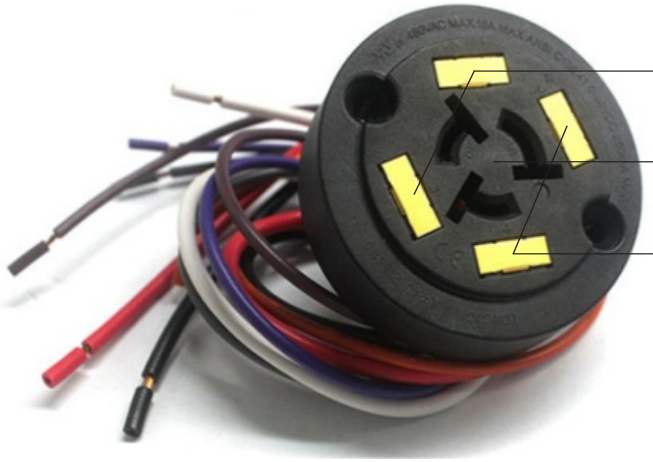
NEMA vs Zhaga-D4i

As more and more cities and utilities increasingly start to upgrade their lighting infrastructure to LED luminaires they face the key decision as to which lighting control socket they should use. The sockets enable new functions to be added to LED luminaires, such as controls and sensors, to make the lighting smart.

With standardised sockets it is possible to modify the control unit, without having to modify the entire LED luminaire. The two main global socket standards are the NEMA ANSI C136.41 socket (NEMA standard) and the Zhaga Book 18 socket (Zhaga standard) combined with the D4i intra-luminaire bus standard.

The following information should help you to understand the differences between the two standards.

NEMA ANSI 136.41



Pins 6/7: control/sensor

Pins 1/2/3 for mains power – on/off control

Pins 4/5: dimming control

Zhaga-D4i

Pin 3: Positive pole for DALI or DALI-based protocol

Pin 2: Negative pole for DALI or DALI-based protocol

Pin 1: +24 V power supply

Pin 4: Not connected
Reserved for future use

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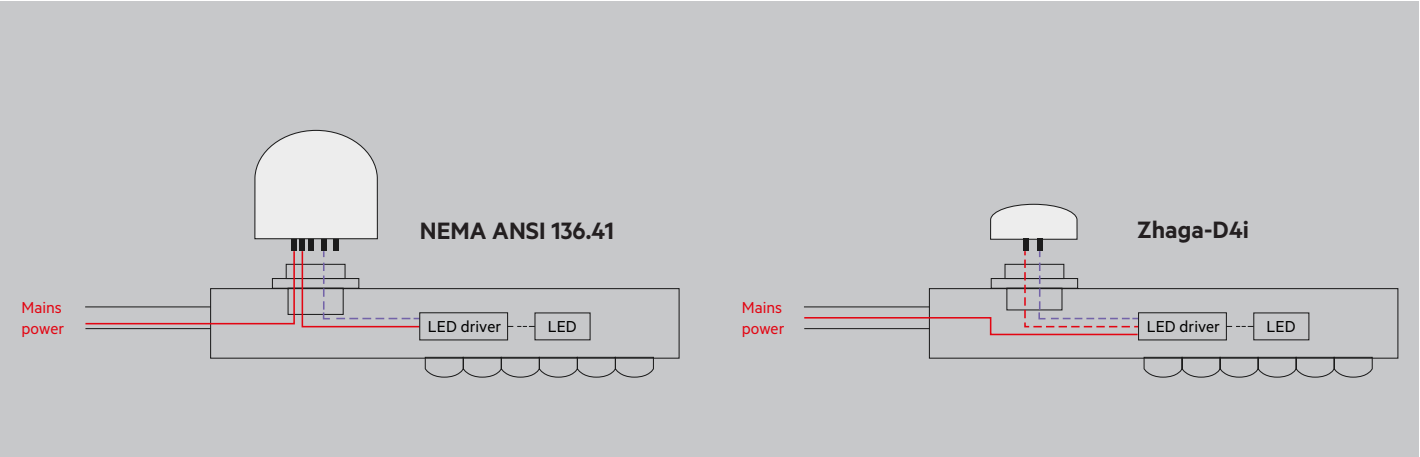
NEMA ANSI 136.41 & Zhaga-D4i



- Power goes to the socket which then supplies the driver
- 1–10 V or DALI dimming signal
- Compatible with any dimmable driver
- Surge protection by the node, mains switching of the driver, power supply, energy metering

- Mains power goes to the driver
- Driver powers the controller with 24 V
- DALI-2 dimming signal
- Compatible with D4i-compliant driver
- Surge protection, diagnostics, energy reporting by the driver, auxiliary 24 V supply

	NEMA ANSI C136.41	Zhaga-D4i
Size / mechanical attributes	Much larger than the Zhaga-D4i socket as mains is connected to the socket (safety clearance). Visible impact on luminaire design.	Small size thanks to low-power interface integration of up to 2 sockets in one luminaire (top/bottom) e.g. a combination of a control node (up) and sensor (down).
Maturity	Aged technology, but wide penetration in US, Middle East and UK.	Release 2018. Specifications for Zhaga plug & play ecosystem released in 3rd edition (Zhaga Book 18 Ed. 3) – 4th revision in the making. Street lighting tenders/projects in Europe increasingly specify Zhaga sockets thanks to their distinct advantages of cost, size and interoperability.

NEMA ANSI 136.41 & Zhaga-D4i

	NEMA ANSI C136.41	Zhaga-D4i
Safety	**High voltage:** 230 V: As the socket is directly powered by the mains, proper safety rules have to be considered.	**Low voltage:** Low-voltage 24 V power supply from the Zhaga socket enables plug & play installation of nodes and sensors.
Flexibility	Architectures with both 1–10 V and DALI-2 are possible today. For Zhaga-D4i certification of the luminaire a D4i driver is required. 2 extra pins (6 and 7) can be used for IoT sensors, opening the way for different Smart City use cases.	Uses a DALI-2 based dimming signal. D4i driver as go-to solution with integrated power supply, 24 V AUX and data generation. DALI-2 with external power supply is used in the market, but not recommended as prone to wiring errors and prohibitively expensive setup. Ideal for lighting control with motion sensors and nodes. Thanks to the DALI intra-luminaire bus, ideal for lighting use cases. Integrating non-lighting Smart City applications requires innovative solutions in how to tackle power limitation (cf. SensorX). DALI306 general-purpose sensor standard will give enough flexibility to integrate 'beyond lighting' sensors. Pin 4 reserved for functions to be specified in future editions of Zhaga Book 18.
Power considerations	No limitations on energy consumption, opening the door to high-power applications.	Control devices (Type A) limited to 3 W, input devices (Type B) limited to 1 W average power consumption.

NEMA ANSI 136.41 & Zhaga-D4i

	NEMA ANSI C136.41	Zhaga-D4i
Interoperability	The ANSI committee is working on standardising the interface and communication protocols supported on pins 6 and 7. However, manufacturers have implemented customised solutions. Interoperability is therefore not guaranteed. Since Zhaga Book 18 Ed.3, the 4-pin NEMA socket can be integrated in a ZD4i luminaire.	Right from the start, Zhaga has provided standards and rules for integrating drivers, controls and sensors. Zhaga-D4i combines mechanical, electrical and digital communication specifications. This facilitates the interchange and compatibility of products, leading to a guarantee of interoperability. A certification process, implemented by an independent testing agency, accompanies its standards in order to build trust in the interoperability.
Cost	The mains connection of the NEMA architecture comes at a cost – mains voltage has to be managed by the connector/controller, surge burst by the node. NEMA equipment usually ~50 % more expensive.	All sensors and controllers are powered by the LED driver in the low-voltage bus. Components are protected by the driver, which creates cost efficiency for the whole ZD4i architecture.

Conclusion

From Tridonic's point of view the Zhaga-D4i architecture will increase its penetration significantly:

- Uniform standards that guarantee interoperability and therefore upgradability ('future-proof') in the market
- Lower cost of architecture
- Popular support from a fast expanding landscape of sensors and controls

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