

SPMD Usecase – Lighting control

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Lighting control – overview

- “Old” method was to use analogue control: **1-10V** or **0-10V**
 - This allows dimming (without switch-off) of all devices connected to the same 2 wires.
- This has been replaced in most regions by a digital protocol: **DALI**
- Notably, the U.S. still uses a large proportion of 0-10V, but this is changing to DALI – more quickly in outdoor than indoor applications.
- Entertainment lighting is predominantly DMX-512
- DALI is most popular for commercial/professional applications, architectural and high-end residential – for indoor and outdoor lighting.
- Main use-cases include energy saving, emergency lighting, comfort, human-centric lighting, colour control.
- The international standard IEC 62386 provides the requirements.
- DiiA has published further specifications to extend the DALI standard for new applications.

Lighting control

– DALI (Digital Addressable Lighting Interface)

- A protocol for communications between lighting control devices, developed from late 90's.
- 2-wire bus for communications and low-voltage power
- Flexible wiring topology: daisy-chain, star, spurs or combinations
- Up to 250mA, 10-22.5V available to power devices such as sensors, push-buttons, wireless transceivers...
- Can be bundled with the mains cables (check local wiring regulations)
- Can use standard mains cable for the bus wire – 1.5mm² (AWG 15-16) copper recommended
- Up to **300m** between furthest-apart nodes.
- **Low-cost transceiver.** At least basic insulation between DALI and mains.
- Device connection, disconnection, or powering on/off does not affect the bus communication
- No connector requirements. Can be wired by an electrical installer.

Lighting control

– DALI (continued)

- For **control gear** (example: LED drivers, used in luminaires)
- For **control devices** (example: occupancy/light sensors, buttons)
- 64+64 devices per bus (control gear + control devices)
- **Addressing**: individual, group and broadcast
- Allows: control, configuration and querying of devices
- Robust communication: low data rate (1200 bps)
- Efficient command set: a single 16-bit frame can simultaneously affect all lights on the bus, for example commanding them to recall a scene.
- Test software and certification provided by industry body: DiiA (a members' organization within IEEE-ISTO). Over 2000 listed products (Dec'2019).
- Why is DiiA interested in SPMD?
 - Case 1: Higher data throughput would be desirable for extending the use of sensor and luminaire data.
 - Case 2: Supplying higher-power wireless transceivers (e.g. long-range).
 - Case 3: Supplying a small number of luminaires (e.g. office luminaires).

Usecase: Lighting control – DiiA input

Item	Min Value	Desired value	Extra information
Supported nodes on one mixing segment	Case 1: 128 Case 2: 6 Case 3: 10	512 50 30	MIN: Luminaires in a grid layout, so 3x3 luminaires plus 1 sensor.
Minimum supported cable length	30m	300m	MIN: 10 nodes, 2-3m between Desired: Same as DALI, making it suitable for larger offices.
Acceptable cable gauges	Sufficient to carry the power over the required distance.		
Required power for a node	Case 1: 0.3W (+ PHY) Case 2: 5W Case 3: 25W		Most nodes require 0.1W or less. Some outdoor wireless transceivers can may require up to 2W average, 5W peak. Office luminaires typically require 20-30W.
Required initial power allocation	0.1W + PHY		
60V voltage OK ?	Yes		Lighting control (0-10V and DALI) already require insulation rated above this.
Interoperability level for the application	Plug & play		Lighting must give basic operation “out-of-box” without configuration. This means “broadcast” on/off from sensors/buttons to the luminaires.
Pass through or T connection	-		Needs to be a low-cost solution for control gear (drivers)
Hotpluggability	Y		
Possible market (in #nodes/year)	250M		Based on expected regulatory push towards connected lighting for energy saving. Sales: EU: 100M pieces in 2030 + rest of world 1,5* EU Based on EU report (http://ecodesign-lightingsystems.eu/documents) Assumption that cost is equal or lower to DALI system.
Presentation: <URL>			

Item	Description
Supported nodes on one mixing segment	Indicate the numbers of nodes on a single mixing segment. The minimum reflects the number of nodes needed for the usecase to make sense. The desired value represents a natural fit for the application. Both numbers could be the same.
Minimum supported cable length	Is the length you need between the two furthest nodes on the mixing segment.
Acceptable cable gauges	What cable gauges can be accepted for the application (consider cost, size, bend radius, ...)
Required power for a node	How much power is needed in the node to run the application. This is the power level as measured at the connector of the device. Note that there may be a rectifier or other elements that cause some loss (2% to 5% typical).
60V voltage OK ?	Is it acceptable for the input voltage to be up to 60V ? If not, what is the reason ?
Required initial power allocation	Because this is a bus powered system, a node needs to be permitted to draw some amount of power after being plugged in. This power is used to communicate with the PSE about the power requirements. The system should be able to operate it's PHY with this power. How much power do you foresee to need for this. This is different from the "Required power for a node" which is about the complete power need of the device.
Interoperability level for the application	Choose between "plug&play" or "engineered" system. Plug & play means that a compliant device works when connected to a network of other compliant devices. There is no need for configuration or to verify if devices will be compatible or not. Engineered system means that you will use the standard within your own products or that the end user can determine which devices will work in the system.
Pass through or T connection	See slide 4-6 of http://grouper.ieee.org/groups/802/3/SPMD/public/sep19/spmd_cjones_01_0919.pdf If the application cannot be equipped with two connectors, select T connection. If it must be possible to live connect a new node without disconnecting other nodes, also select T connection.
Hotpluggability	Should it be supported to connect new devices while the bus is powered and guaranteed that this does not cause devices to be interrupted (eg. Reboot, lose long stretches of data). If not required, select no.
Possible market size	Potential market expressed in number of nodes. Do not express this in currency of any kind due to IEEE SA rules.

Thank You