

DALI BASIC THEORY

INTRODUCTION TO DALI



COURSE PURPOSE

An introduction to DALI.

This will help you to understand:

- What is DALI;
- DALI standards compliance;
- Types of DALI products;
- How the electrical wiring is done;
- Understanding about safety and electrical isolation;
- How communication works.

WHAT IS DALI?

- DALI = **D**igital **A**dressable **L**ighting **I**nterface.
- Published as IEC Standards: IEC 62386-10x and IEC 62386-2xx.
- DALI is: ***A wiring and software system to allow control of lighting devices.***

- DALI is an Open System.
- Certification managed by Digital Illumination Interface Association (DiiA).
 - www.digitalilluminationinterface.org
 - Product database is available.

COMPLIANT PRODUCTS

- Devices that comply with the standard are marked.
 - Use products from reputable manufacturers.
 - Some non-compliant products are marked also.
 - Be careful of cheap DALI products.

- Some new DALI 2 products appearing also.

- Avoid ***DALI Compatible*** products.
 - These might not work the same way.
 - Can waste a lot of time checking.



TYPES OF DALI PRODUCT



TYPES OF DALI PRODUCTS

- DALI products are in 4 general categories:

- **Infrastructure Devices**

- Power Supplies, accessories, wiring, connectors – things needed to make it all work;
Devices used for commissioning.*

- **Control Gear** (Ballasts, Lamp Drivers, Relays, Dimmers)

- Control Gear allows an electrical load to be controlled.*

- **Control Devices** (Switches, Sensors)

- An input to system, from a person or sensor.*

- **Application Controllers**

- Link Control Devices to Control Gear.
Can be simple or complex.
Can be integral to another product.*

TYPES OF DALI PRODUCTS: EXAMPLE (1)

- Lamp Driver



Type: **Control Gear**

- Motion Sensor



Type: **Control Device**

(often with built-in **Application Controller**)

TYPES OF DALI PRODUCTS: EXAMPLE (2)

- Commissioning Interface



Type: **Infrastructure Device**

- Zone Controller



Type: **Application Controller**

CONTROL GEAR

- Can be up to 64 Control Gear products on a DALI line.
- Each has its own address (0 .. 63).
- The address allows each Control Gear to be separately controlled.

- Control Gear also allows membership of up to 16 Group Addresses.
- Control Gear also can be addressed as a broadcast (everything on the line).

- We recommend no more than 50 Control Gear products per DALI line.
 - Electrical installations always change through a building lifetime.
 - 50 units allows spare capacity in case it will be needed later.

ELECTRICAL WIRING

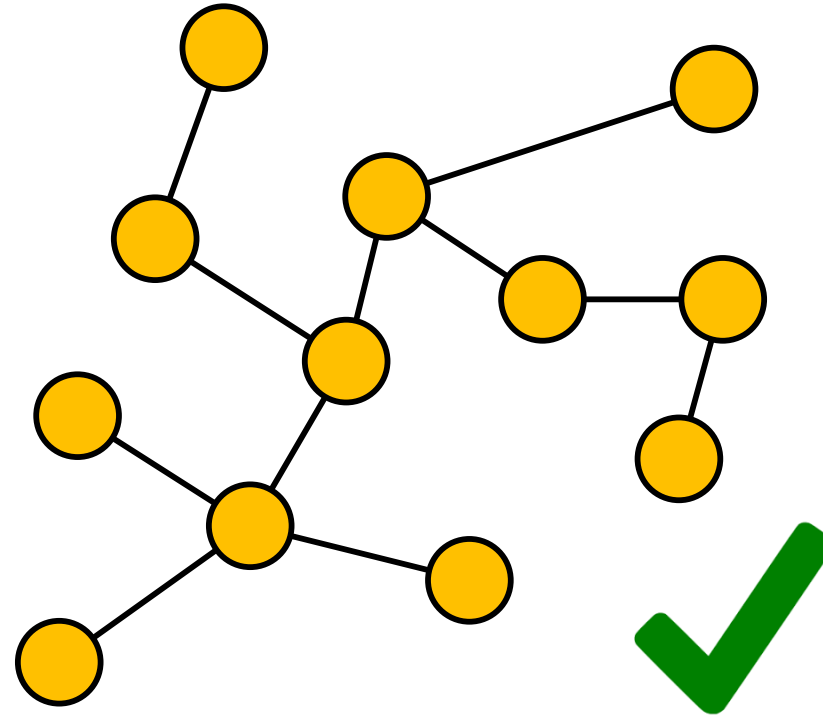


ELECTRICAL WIRING: CABLE TYPE

- DALI is wired using normal mains power cable.
- DALI wiring is called:
 - DALI LINE**
 - *Sometimes you will see DALI LOOP. Try to avoid using this name.*
- **No segregation needed from mains wiring.**
- Cable cross section ***must be*** $\geq 1.5 \text{ mm}^2$.
- No more than 300 m cable per DALI line.
 - ***To get really technical: sometimes, with some topologies, and some cable types, it is possible to do more. Better to have a simple rule: limit = 300 m.***

ELECTRICAL WIRING: TOPOLOGY

- Wiring can be any topology:
 - Star
 - Daisy chain (Bus)
 - Combination
 - Ring is discouraged.
 - *Don't wire in a ring topology.*
 - *Sometimes it will be OK, and sometimes not.*



ELECTRICAL WIRING: DALI POWER SUPPLIES

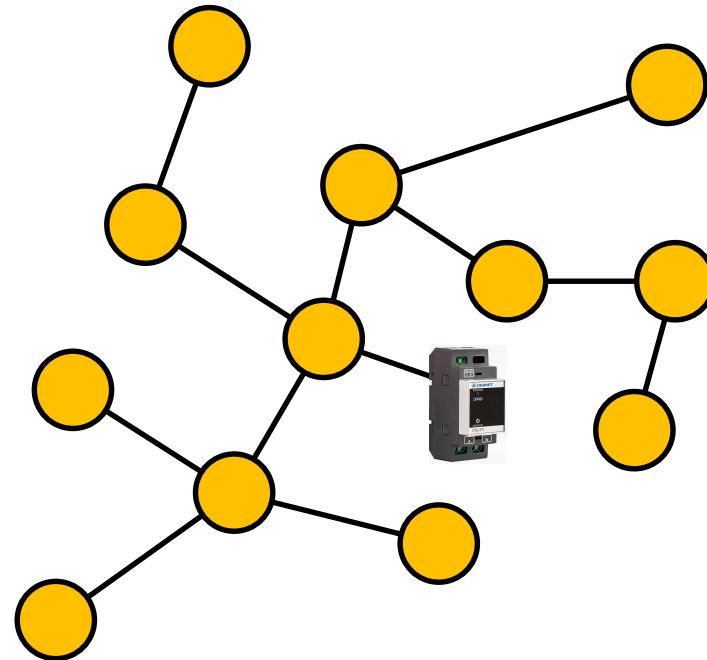
- Every DALI line needs a DALI power supply.
 - Can be a separate device.
 - Can be built into an equipment item.
 - Be careful adding power supplies in parallel:
 - Check polarity
 - Check the power supplies allow parallel wiring.

- **Never exceed 250 mA power supply capacity on a DALI line.**
 - Tolerances mean that power capacity > 240 mA should be avoided.



ELECTRICAL WIRING: POWER SUPPLIES LOCATION

- If possible: locate DALI power supplies in the middle of a DALI line:



- Compared to a power supply at one end of a line: lower voltage drop to the ends.

ELECTRICAL WIRING: DEVICE CURRENT DRAW

- **Control Gear** may draw up to 2 mA from DALI.
 - Careful: Some Control Gear draws more! Check your products!
 - (This means those devices do not comply with the standard!)
- All other device types may draw any current from DALI.
 - Check device markings and user / install guides.
 - Add these up manually.
- A DALI line must have spare power supply capacity.
 - We recommended ≥ 20 mA spare capacity

ELECTRICAL WIRING: MAINS TOLERANCE

- Mistakes happen.
 - Sometimes mains power gets wired to a DALI line.
- DALI devices should tolerate mains power applied to DALI terminals.
 - Good quality devices are OK. Poor quality devices may be damaged.
 - ***Use care when wiring. Try to avoid accidentally connecting mains to a DALI line.***
 - ***Devices that **do not** tolerate mains on DALI terminals are **not** marked to show this!***
 - ***Finding products that do not tolerate mains power: Can be expensive!***

ELECTRICAL WIRING: POLARITY

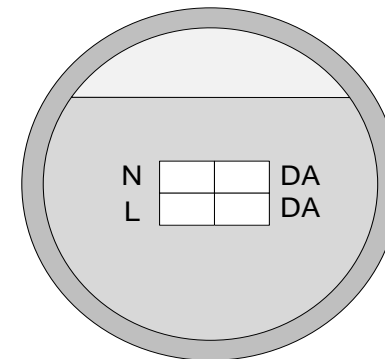
- Most DALI products do not care about polarity.
- On some DALI products, polarity is important.
 - For those DALI products, terminals should be marked + and –
- Very occasionally:
 - Product may not respond properly to control operations.
 - If this happens, try reversing the DALI connection to the product.

SAFETY AND ISOLATION



SAFETY AND ISOLATION

- DALI can be used in a 5 core cable.
- DALI has BASIC isolation (Single insulation) from mains.
- In most applications DALI should be handled the same as mains power.
- Most terminals and cables do not have safety isolation between mains and DALI.



Common arrangement for terminals.

Often seen on products like movement sensors.

No barriers or special mains – DALI separation.

- **TREAT DALI AS IF IT WAS MAINS POWER.**

COMMUNICATION



COMMUNICATION: LINE VOLTAGES

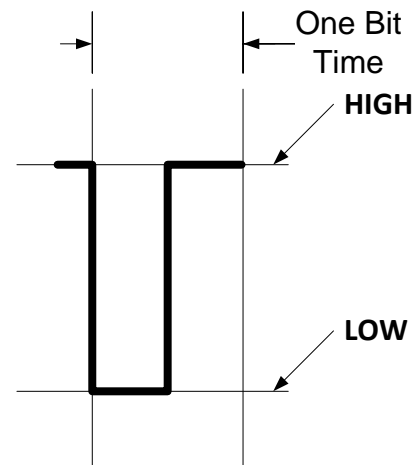
- DALI line idle voltage: 9.5V to 22.5V
 - Typical: 15V or 16V
- Communication pulls line voltage low:
 - Short circuit; or
 - Line voltage < 4.5 V
- The power supply must limit the delivered current:
 - This allows communication by simply applying a short circuit.

COMMUNICATION: SIGNALLING

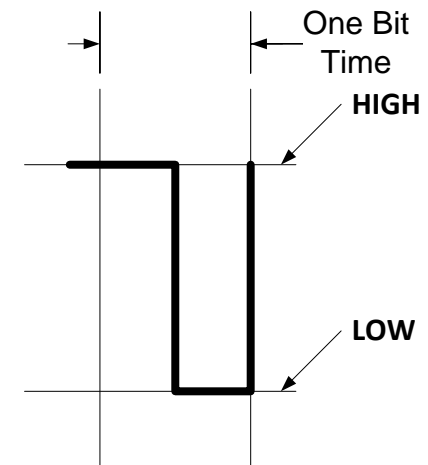
- Data communication uses Manchester Coding.
 - Also called Bi-phase coding.

- Speed 1200 bits / second.
 - A bit is 833.3 μ s.
 - A half-bit is 416.67 μ s.

ONE BIT



ZERO BIT



SUMMARY

DALI:

- Simple lighting control wiring system.
- 1.5 mm² Mains cable (or larger), any topology (but avoid loops).
- 250 mA maximum DALI power supply.
- 300 m maximum cable.
- Maximum 64 Control Gear products per line (we suggest limit to 50).
- DALI line idle state is normally 15 – 16 V dc (but can be 9.5V to 22.5V)
- Low speed, 1200 bits / second.
- Communication by pulling the DALI line low, relies on the power supply to limit current.
- Treat DALI the same as mains power.