

A corridor of linear luminaires, each one holding a level that reached it as a number on a bus.

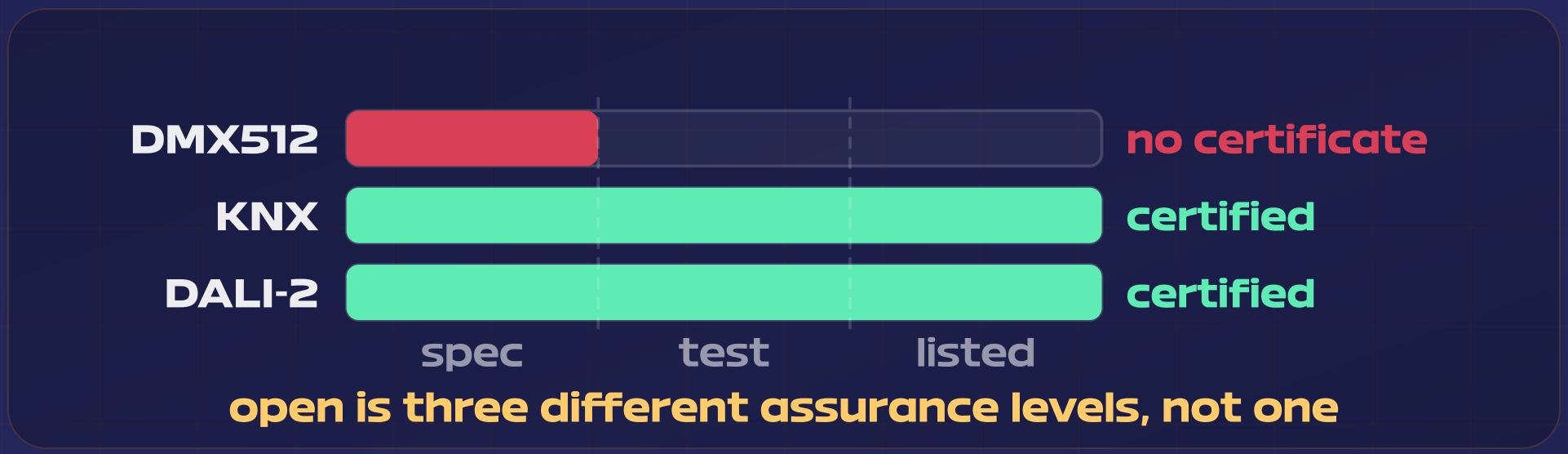
NLC ACADEMY · EPISODE 24

Halfway is not half the light.

DALI, KNX, DMX, 0-10 V and wireless, compared on the numbers that decide what a Gulf project can commission. Starting with this: DALI level 127 is 3.1% light.

A NAME WE DID NOT CHOOSE

The Bluetooth lighting standard is called NLC



open is three different assurance levels, not one

1. The Bluetooth SIG's lighting profiles are literally called **NLC**: Networked Lighting Control. Seven profiles, one of them for HVAC integration. [1]
2. "Open" covers three assurance levels. DMX512 compliance is voluntary, with no certification programme or product database; KNX and DALI-2 certify products in public databases. [2][3]

Ask what "open" buys you, and whether the exact product is in a database anyone can search.

SEVEN PROTOCOLS, ONE TABLE

What each protocol can actually do

	speed	capacity	talks back	listing
0-10 V	analogue	no addresses	no	none
DALI-2	1200 bit/s	64 + 64	yes	database
DMX512	250 kbit/s	512 slots	with RDM	none
KNX TP	9600 bit/s	64 or 256	yes	database
Bluetooth mesh	1 Mbit/s radio	32,767 addresses	yes	SIG database
Zigbee	250 kbit/s	n/a	yes	CSA database
Casambi	n/a	up to 250 units	yes	vendor only

n/a: no published figure, so none is printed

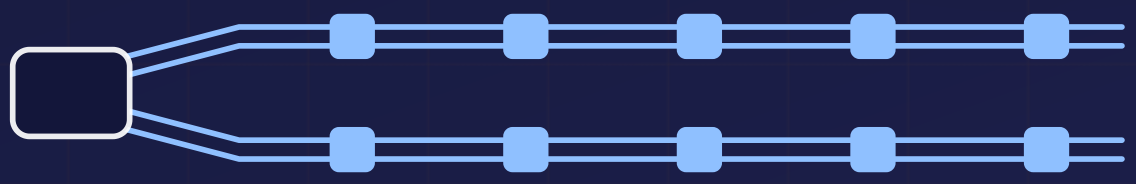
Four of the seven have a public product listing; **DMX512 and 0-10 V have none**. Casambi runs its own mesh, not the SIG's. [1][11]

Ceilings, not design figures: KNX is 64 per segment with TP1-64, 256 with TP1-256, within supply current and device mix. [11]

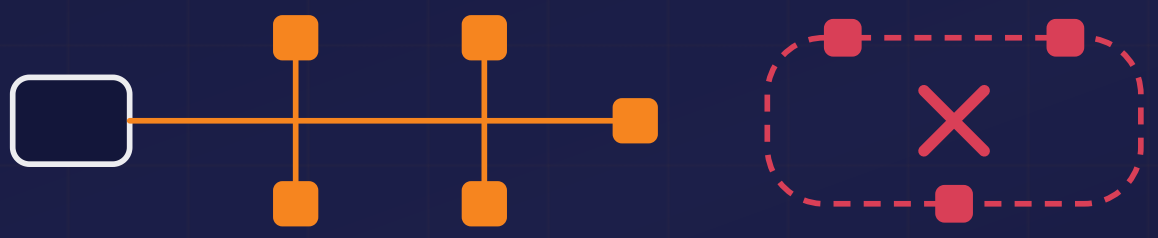
WHAT IT LOOKS LIKE ON THE DRAWINGS

Four wiring rules, and only one is a chain

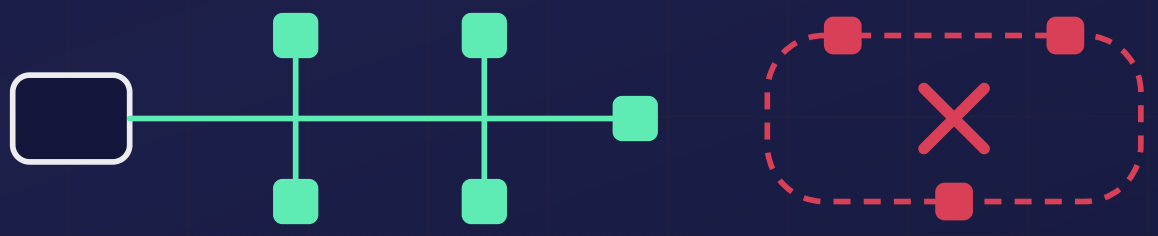
0-10 V
one pair per zone, no addresses



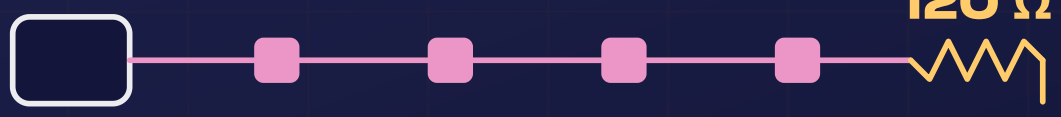
DALI-2
line, star or tree, never a loop



KNX TP
no ring; 64 or 256 per segment



DMX512
terminated line, 32 unit loads



1. DALI-2 and KNX TP are free topology with no closed loop. KNX: 64 devices per segment with TP1-64, 256 with TP1-256, within the supply current. [3][11]
2. DMX512 is a line terminated with 120 Ω, 32 unit loads per link, and no cable length in ANSI E1.11-2024. [2]

Only DMX512 is a chain; 0-10 V is a pair per zone.

GET THE NAME RIGHT FIRST

DALI-2 is a certification, not a version

the certificate is a row keyed on all four fields

brand	GTIN	firmware	hardware
matches	matches	updated	matches

this build is not certified
a company is not DALI-2, a specific build is

The standard is IEC 62386

Parts 101 system, 102 control gear, 103 control devices, 207 LED modules, 209 colour. International, not European. [3]

IEC 62386

"DALI-8 does not exist"

The DALI Alliance's own correction: it is device type 8, colour control. The versions are DALI version-1 and DALI-2. [3]

DT8

The database is the certificate

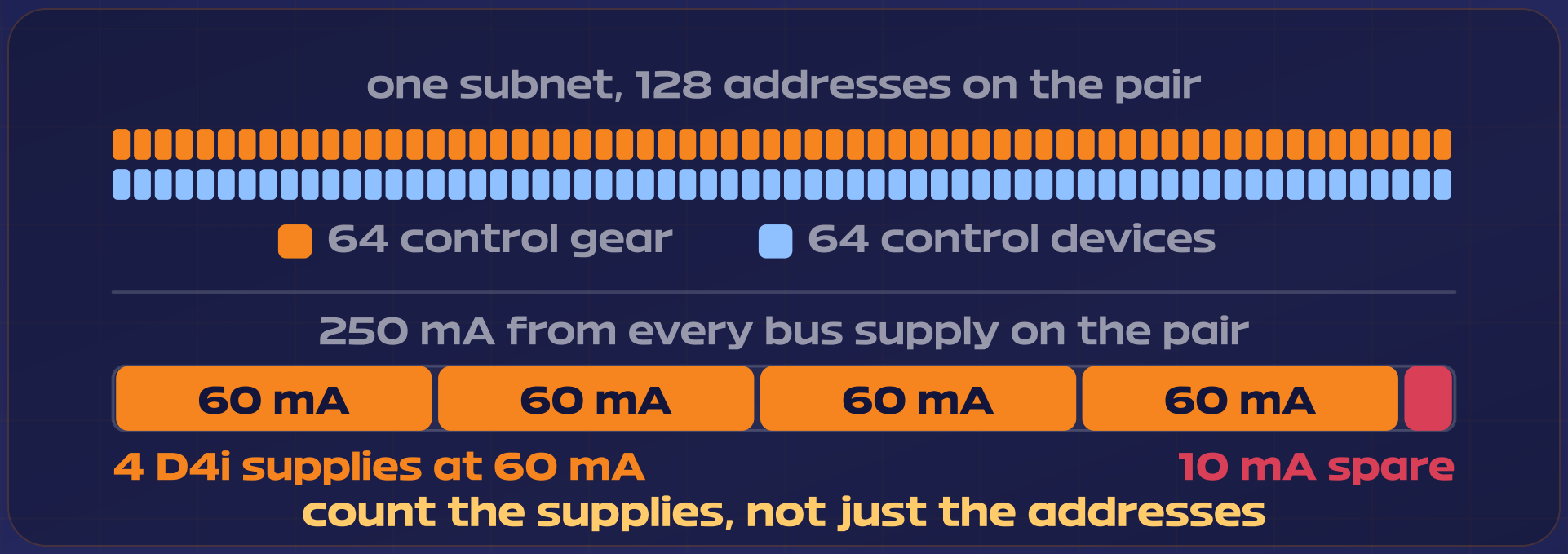
"DiiA does not issue test reports or product certification documents." Brand, GTIN, firmware and hardware must match the entry. [3]

database

So SASO 2927 saying "DALI" does not require DALI-2. A company cannot be DALI-2; a product build can.

THE NUMBERS THAT SIZE A SUBNET

64 is the most misquoted number in lighting control



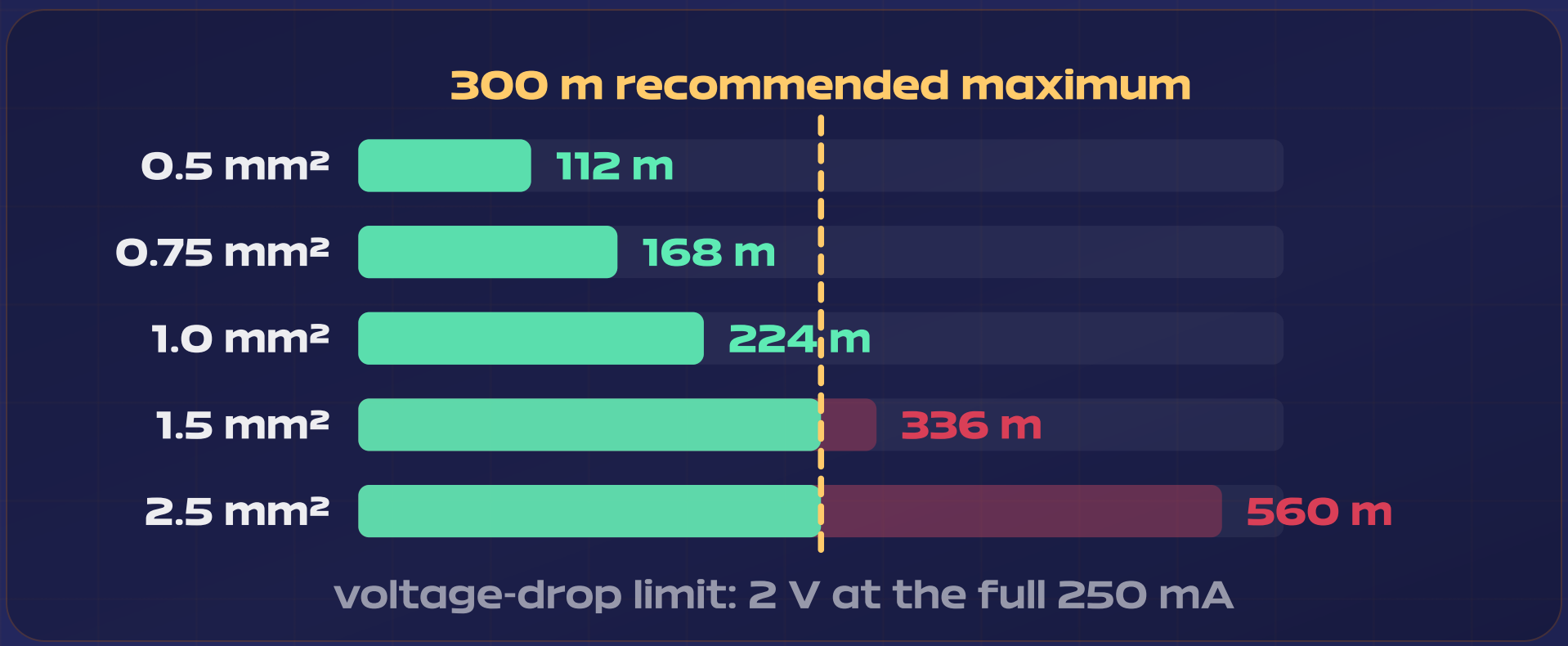
A DALI-2 subnet carries **64 control gear AND 64 control devices**, 128 addresses on the same pair. The old "64 devices" figure is DALI version-1, when control devices were not on the bus. [3]

64	64	16	16	250
gear	devices	groups	scenes	mA

16 groups for gear, 32 for devices, 16 scenes stored in the gear. On a D4i run, count supplies too: each driver's supply is on by default, and 4 at 60 mA reach the 250 mA ceiling. [3]

THE 300 METRE FIGURE

300 m is the ceiling, not a promise

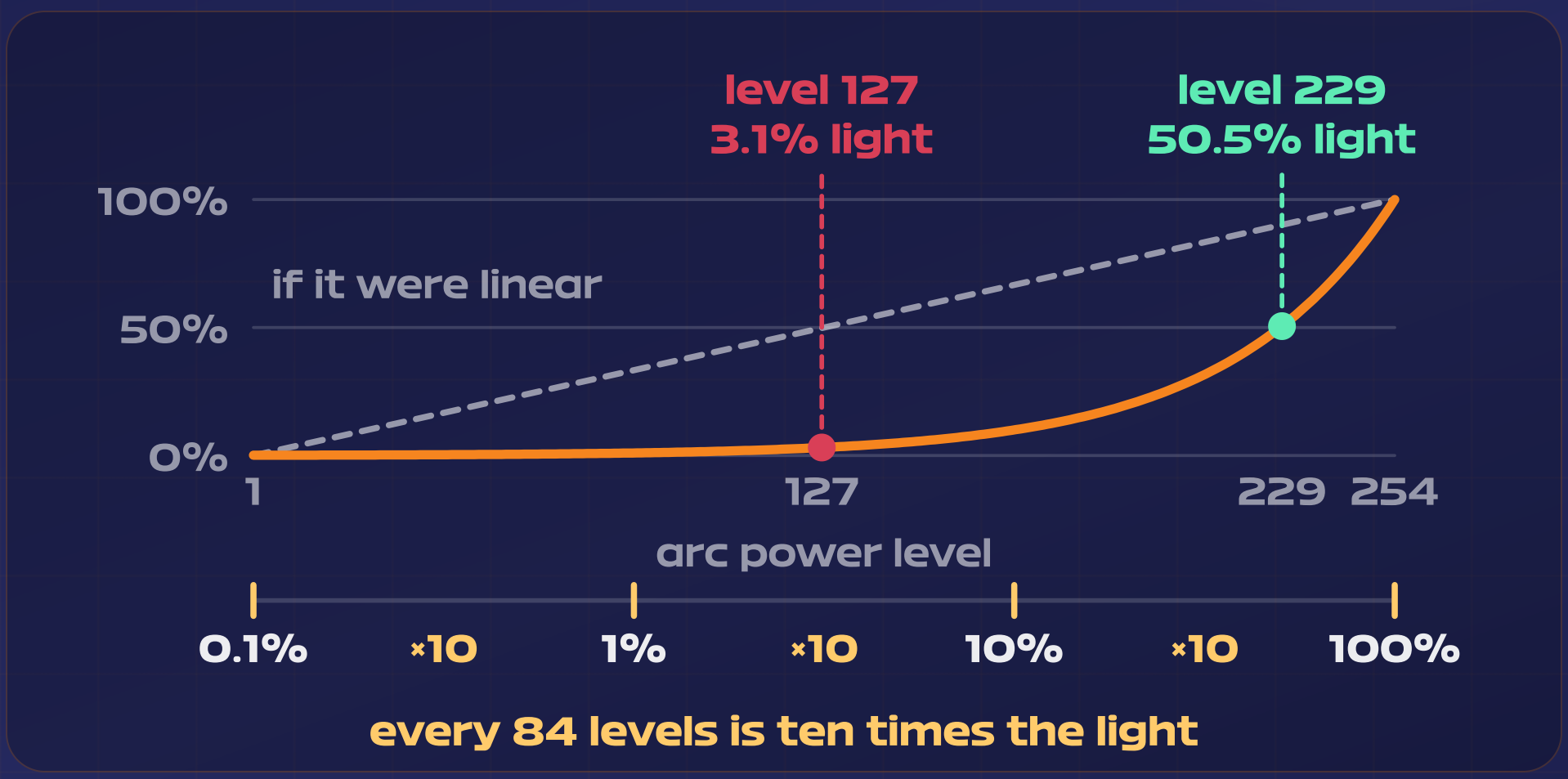


1. The DALI Alliance gives 300 m as the recommended maximum between any two devices, on 1.5 mm² cable at 250 mA. [3]
2. Lunatone and Tridonic give the reason: at most 2 V drop on the line. Thinner cable reaches it sooner; worst case, 0.5 mm² runs out at 112 m. [12]

Size the run from the voltage drop first, then check it against 300 m. On thin cable, the drop decides.

WHY THE CURVE MATTERS

The dimming curve is the real argument against 0-10 V



DALI's curve is logarithmic and exact: level 1 is 0.1%, level 254 is 100%, and every step is a constant 2.77% larger than the last. So level 127, dead centre, is 3.1% light, and half the light is level 229. [3]

Every 84 levels is ten times the light, and the curve is defined in IEC 62386, so it repeats across makers. No 0-10 V standard fixes one curve: IEC 60929 sets the end points; ANSI C137.1-2022 allows linear or logarithmic. [4]

SPEED TELLS YOU WHAT IT IS FOR

DALI is a building bus, and the timing proves it



one message, start to finish

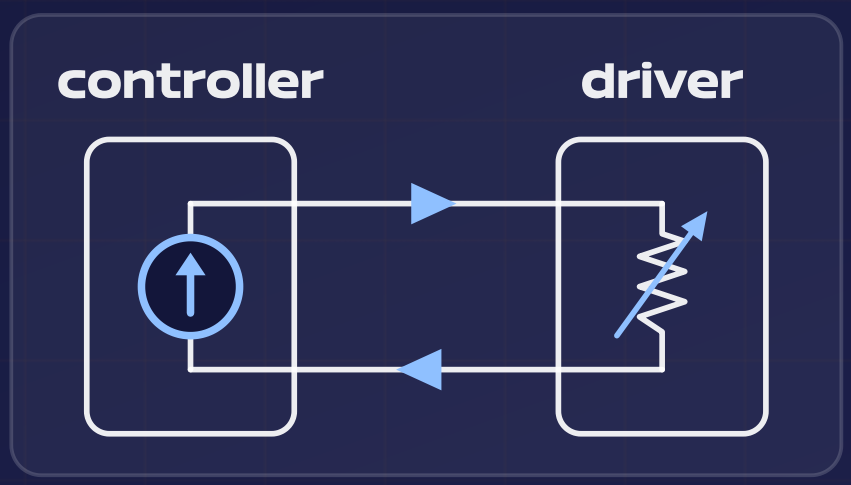
1. DALI runs at 1200 bit/s: a 16-bit command takes 15.83 ms and an 8-bit reply 9.17 ms. DALI-2 devices add 24-bit frames. [3]

2. DMX512 runs at 250 kbit/s, yet a full 513-slot universe takes at least 22.7 ms: 44 updates per second, per ANSI E1.11-2024 Table 6. [2]

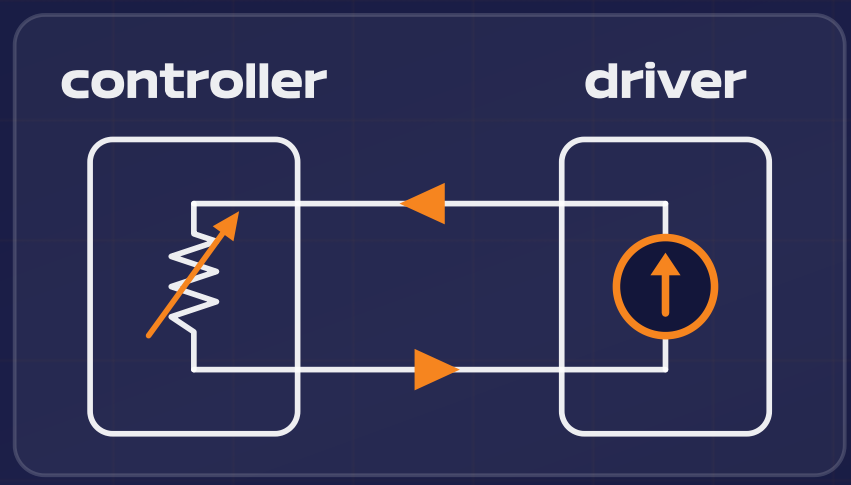
The "1 ms DMX refresh" figure is wrong. Cite ANSI E1.11-2024 and ANSI E1.20-2025, not the 2008 and 2010 editions.

TWO PROTOCOLS, ONE NAME

0-10 V is not one interface



controller sources
ANSI E1.3



driver sources
IEC 60929 Annex E
ANSI C137.1

1. ANSI E1.3: the **controller sources** the current. IEC 60929 Annex E and ANSI C137.1: the **driver sources it and the controller sinks it**. Same two wires, opposite direction. [4]

2. PNNL fed 23 LED streetlights the same control voltages; relative power differed by about 53 percentage points on average, 32 to 75 by voltage. [5]

IEC 60929 Annex E specifies no off state; ANSI C137.1 defines standby at or below 0.5 V. Check which one the driver follows. [4]

CITE THE RIGHT DOCUMENT

Three citation traps in one subject

ISO/IEC 14543-3, the family people cite from

3-6	3-7	3-10, 3-11
KNX twisted pair	KNX radio	energy harvesting
the one you cite	not twisted pair	not KNX at all

Edition 1.0 · 2006 and 2007 · never revised

cite the part, not the family

KNX twisted pair is 14543-3-6

3-7 is KNX radio. 3-10 and 3-11 are other protocols, not KNX. [6]

14543-3-6

Every KNX ISO part is still Edition 1.0

Dated 2006 and 2007, so KNX Secure is not in the ISO/IEC text. [6]

Ed 1.0

ANSI/ASHRAE 135 is BACnet

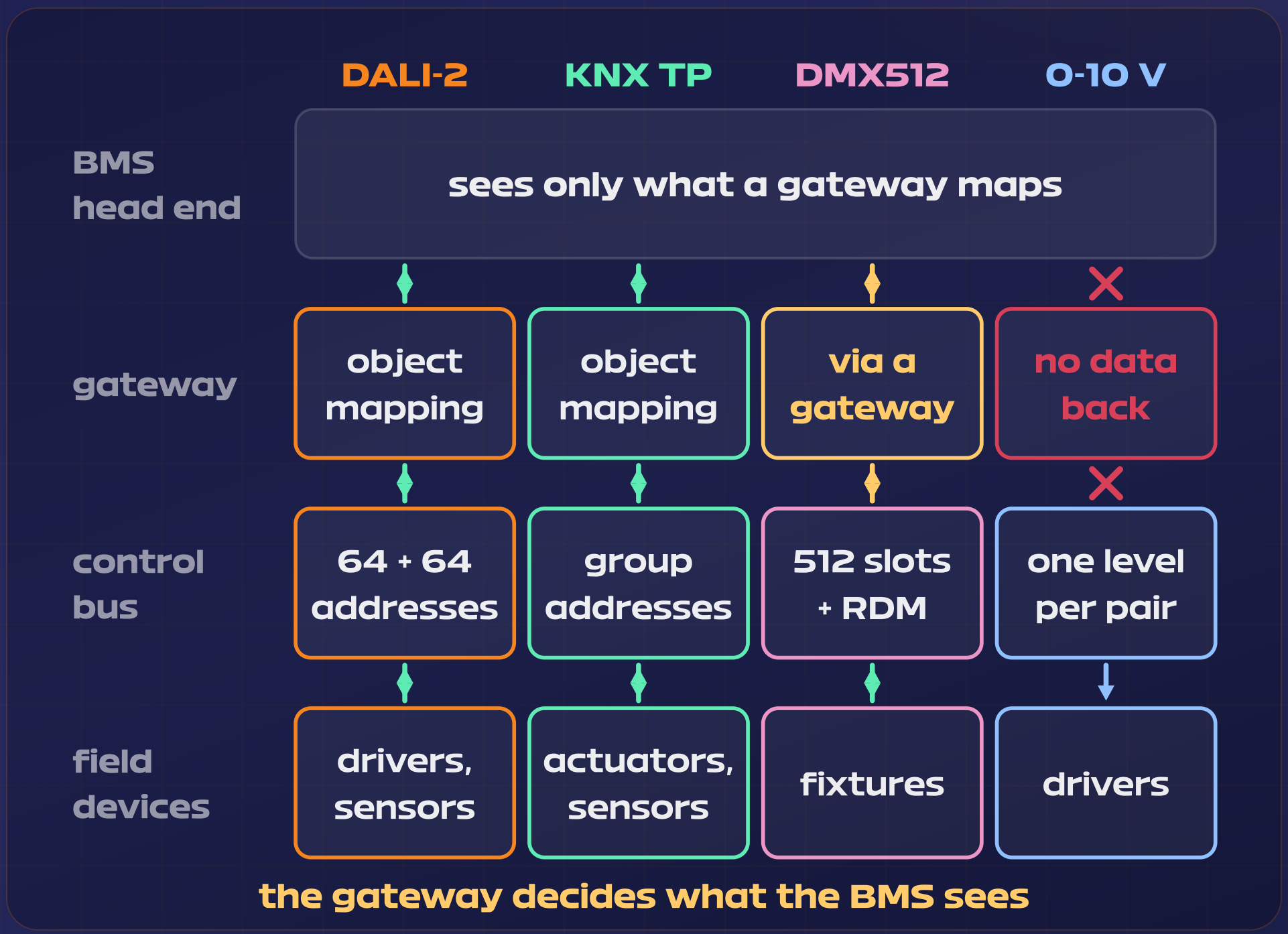
Older KNX material called it a KNX standard; the 2016 edition only maps KNX, in Annex H.5. Cite it for BACnet. [6]

BACnet

IEC 62386-202:2009 (emergency) was withdrawn on 15 December 2022. Cite Edition 2.0. [3]

FROM DRIVER TO HEAD END

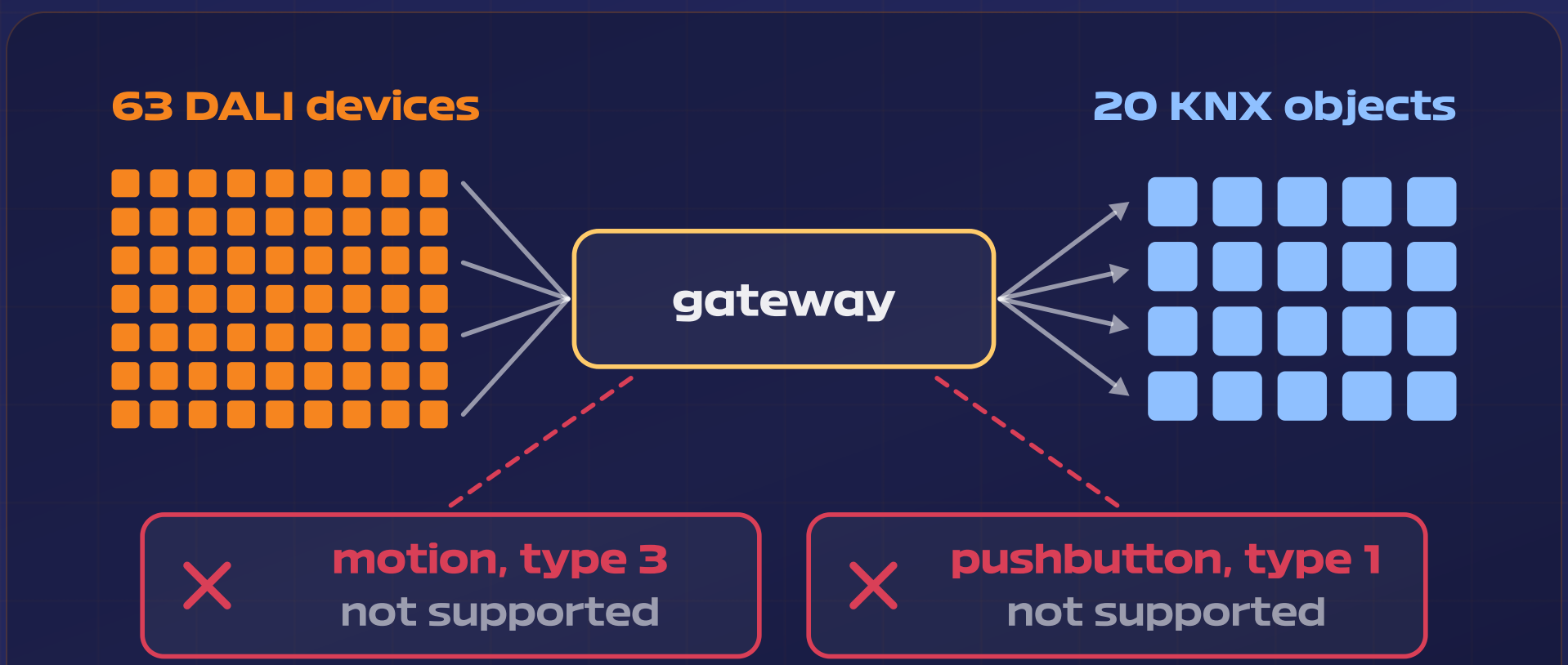
The gateway decides what the BMS sees



DALI-2 and KNX report back. With RDM, DMX512 can too: status, sensor readings, faults. But the BMS sees only what a gateway maps, often levels or programmed points, not fixture health. 0-10 V returns no data. [2][7][13]

WHAT ONE GATEWAY COSTS

Sixty-three fixtures in, twenty objects out



The Lunatone KNX-DALI Gateway (89453899), DALI-2 and KNX certified, handles up to 63 DALI devices but offers **20 KNX gates**; motion (type 3) and push-button (type 1) events do not cross. [7]

Ask for the supported instance types before the sensor schedule is fixed. [7]

THE SAUDI POSITION

SASO 2927 permits DALI or 0-10 V on road luminaires

SASO 2927	Mostadam
DALI (preferable) 0-10V dimmable	0 hits across 7 protocol names
names the driver programme	names no protocol at all

SASO's 2020 workshop on SASO 2927:2019 lists the road-luminaire driver programme as "DALI (preferable) or 0-10V dimmable", with a 7-pin NEMA socket capped. That is a permitted option, not an installed share. [8]

1. Mostadam's Commercial and Residential manuals name no control protocol: zero hits for DALI, KNX, DMX, 0-10 V, BACnet, Zigbee or Casambi. [9]
2. The 2.4 GHz regulator has been CST, formerly CITC, since November 2022. [9]

THE GULF CHECK

Check the rated ambient, product by product



Datasheet examples: the Lunatone DALI-2 PS bus supply is rated -20 to +55 °C, the MDT STC-0640.01 KNX supply 0 to +45 °C, and the Casambi CBU-ASD-LR node -20 to +50 °C, derating from +40. Product ratings, not protocol limits. [10]

Check the mains rating too: the CBU-ASD-LR input is rated 50 Hz only, and Saudi mains is 60 Hz. The Lunatone DALI-2 CS Corridor PIR quotes its range above an 8 °C body-to-background difference. [10]

WHAT TO ASK FOR

Five questions, all answerable from published documents

PUT THESE IN THE TENDER

1. Is the exact product build in the DALI Alliance or KNX database? 2. How many head-end objects does the gateway expose, for how many fixtures? 3. Which sensor instance types cross it? 4. What is each device's rated ambient where it will be installed? 5. Who holds the commissioning software licence and the project file at handover, in writing?

Question 5 is the lock-in question: an ETS licence and project file on KNX, a configuration backup on DALI, a vendor account on a proprietary mesh.



All five questions are questions about a panel like this one.

SOURCES

Where every number comes from

[1] Bluetooth SIG NLC Profiles (7 adopted); Mesh Protocol v1.1
bluetooth.com/specifications/specs
[2] ANSI E1.11-2024 (DMX512-A); ANSI E1.20-2025 (RDM)
tsp.esta.org/tsp/documents/published_docs.php
[3] IEC 62386-101/102/103/202:2022; DALI Alliance FAQ, Quick Start
dali-alliance.org/about-us/faqs.html
[4] ANSI E1.3-2001 (R2021); IEC 60929:2011 Annex E; ANSI C137.1-2022
webstore.ansi.org/standards/nema/ansic1372022
[5] PNNL-32949 (Dec 2023), 0-10 V control of LED streetlights
www.pnnl.gov, search PNNL-32949
[6] ISO/IEC 14543-3-6:2007 (KNX TP); ANSI/ASHRAE 135-2024 (BACnet)
iso.org/standard/43842.html
[7] Lunatone KNX-DALI Gateway 89453899; Helvar 436 Gateway
lunatone.com/en/product/knx-dali-2-gateway-en
[8] SEEP/SASO workshop on SASO 2927:2019, 28 Jan 2020, slide 24
saso.gov.sa, media centre: Lighting part 3 workshop
[9] Mostadam manuals (2024); CST cabinet decree 235, Nov 2022
cst.gov.sa/en/about/who-we-are
[10] Lunatone DALI-2 PS, DALI-2 CS Corridor; MDT STC-0640.01
casambi.com/ecosystem/cbu-asd-lr (Casambi CBU-ASD-LR)
[11] KNX TP1-256 (knx.org, 2020); CSA products; Casambi Overview V5
knx.org/news/tomorrows-world-power-knx-tp1-256
[12] Lunatone DALI factsheet; Tridonic DALI at a glance v1.5
lunatone.com/en/dali-factsheet
[13] Pharos BACnet Server module; Cristal Controls CC-DMX2BACnet
pharoscontrols.com cristalcontrols.com

Curve, bus length and frame times are computed from the clauses.

PRACTICAL LIGHTING ENGINEERING

Save this. Send it to a colleague.

Read the full episode article

https://nlc.com.sa/academy/lighting-control-protocols.html

Next episode
The BAS Backbone