Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Building Academy Smart Buildings

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Document ID.: Rev.:

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Agenda

Introduction and DALI technology

Overview of ABB i-bus® KNX DALI Gateways and Light Controller

Functions of KNX DALI Gateways, e.g.

      Individual and group control

      Color control RGB(W) / HSV(W) and color temperature Tc tunable white

      Self-contained emergency converter

      Sequencer, Scenes, Load shedding, Operating duration, …

ABB i-bus® Tool for diagnostics, DALI addressing, group assignment and more

DALI communication and diagnostic

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Introduction and DALI technology

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology

- The DALI protocol is standardized (IEC 62 386) and transmits at 1,200 bit per second
- DALI allows up to 16 groups and 16 scenes
- DALI-1: Single-Master-Slave System without collision control, max. 64 devices (slaves) per DALI line
- DALI-2: Single/Multi-Master-Slave System with collision control, max. 64 devices (slaves) and max. 64 controllers (masters) per DALI line
- Installation is easy due to the free wiring topology up to 300 m and non-polarity sensitive 2 wire cable (1.5 mm²)
- No SELV – no specific cable required
  The DALI control line can be installed together with mains cable (e.g. by using a 5 wires standard cable)
- Interface voltage U_N 16 V (12 V to 20.5 V)
- DALI Power supply: Max current of 250 mA
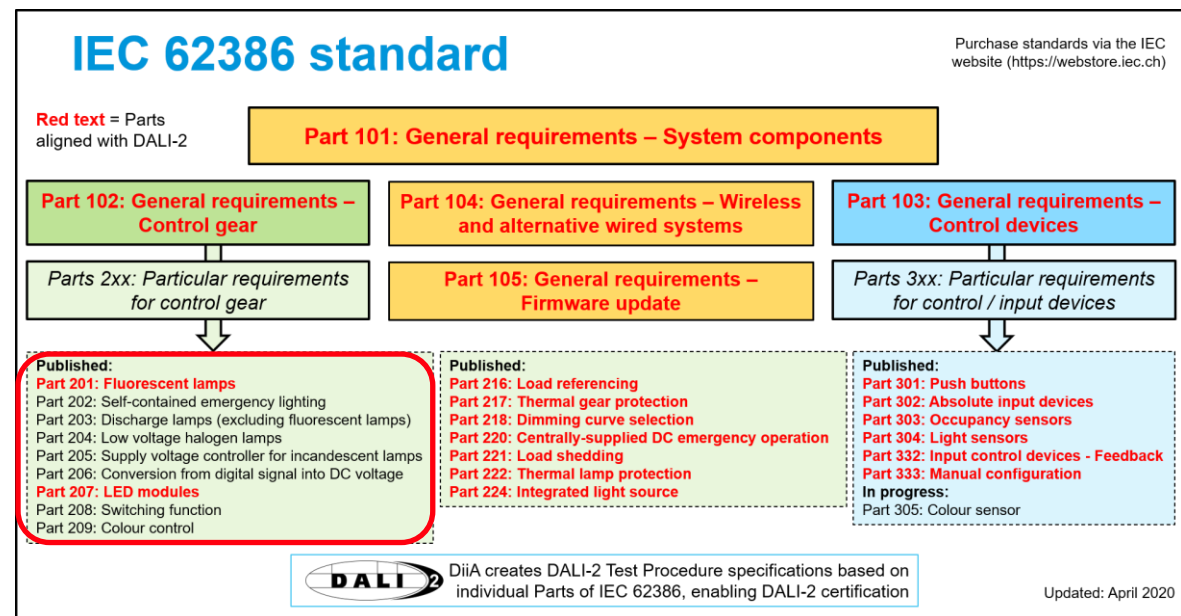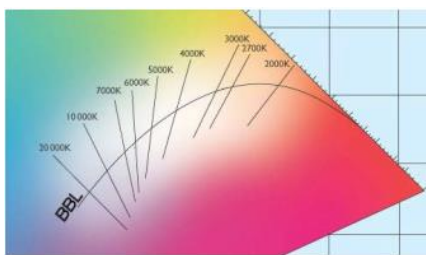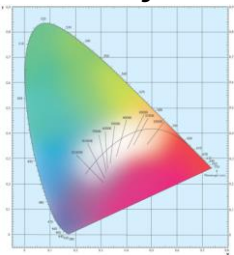- A device may consume a maximum of 2 mA

www.dali-alliance.org

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology

Main important DALI Device Types

– DT0 (part 201): Fluorescent lamps

– DT1 (part 202): Self-contained emergency lighting

– DT6 (part 207): LED-Module (single color)

– DT8 (part 209): Colour control/Colour temperature control

- Colour temperature T_C (tunable white)

- Colour control RGBWAF → RGB(W) and HSV(W)

- XY-Coordinate

- Primary N

IEC 62386 standard

Purchase standards via the IEC website (https://webstore.iec.ch)

Red text = Parts aligned with DALI-2

Part 101: General requirements – System components

Part 102: General requirements – Control gear

Part 104: General requirements – Wireless and alternative wired systems

Part 103: General requirements – Control devices

Parts 2xx: Particular requirements for control gear

Part 105: General requirements – Firmware update

Parts 3xx: Particular requirements for control / input devices

Published:
Part 201: Fluorescent lamps
Part 202: Self-contained emergency lighting
Part 203: Discharge lamps (excluding fluorescent lamps)
Part 204: Low voltage halogen lamps
Part 205: Supply voltage controller for incandescent lamps
Part 206: Conversion from digital signal into DC voltage
Part 207: LED modules
Part 208: Switching function
Part 209: Colour control

Published:
Part 216: Load referencing
Part 217: Thermal gear protection
Part 218: Dimming curve selection
Part 220: Centrally-supplied DC emergency operation
Part 221: Load shedding
Part 222: Thermal lamp protection
Part 224: Integrated light source

Published:
Part 301: Push buttons
Part 302: Absolute input devices
Part 303: Occupancy sensors
Part 304: Light sensors
Part 332: Input control devices - Feedback
Part 333: Manual configuration
In progress:
Part 305: Colour sensor

DiiA creates DALI-2 Test Procedure specifications based on individual Parts of IEC 62386, enabling DALI-2 certification

Updated: April 2020

IEC 62386 - the international standard for DALI technology
Source: Digital Illumination Interface Alliance
www.dali-alliance.org

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# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI-2

What is DALI?

– DALI stands for Digital Addressable Lighting Interface and is a protocol set out in the technical standard IEC 62 386

– DALI was developed as an international industry standard for intelligent and easy management of lighting equipment

Changes from DALI to DALI-2?

– Extension for control devices

– New commands / features
  • Extended fade-time
  • DALI Multi-Master

– Higher quality standards, increased testing procedures and thus higher compatibility

– Backwards compatibility
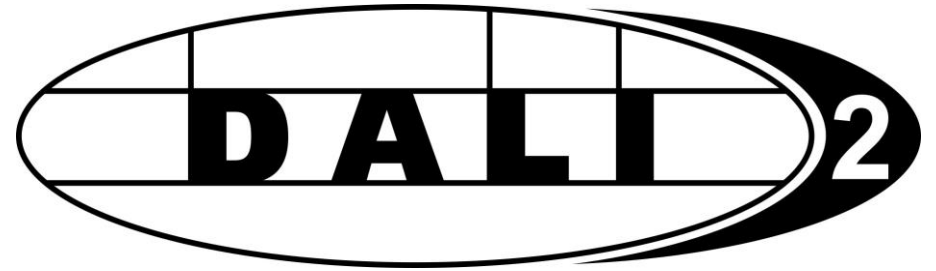
To achieve DALI-2 certification, a product must be tested by a given test equipment and show compliance with each specification (Part) that is implemented
→ DALI-2 guarantees improved compatibility of DALI components

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI-2 – Certified ABB Products

ABB DALI Gateways DG/S x.64.x.1 have successfully completed the DALI-2 certification process and are certified

www.dali-alliance.org

Digital Illumination Interface Alliance

→ Products → Product Database

Brand Name	Product Name	DALI Parts	Initial registration	DALI 2 Certified
ABB	DG/S 1.64.5.1 DALI Gateway, Premium 1-fold	101, 103	Feb 20, 2020	Yes
ABB	DG/S 2.64.5.1 DALI Gateway, Premium 2-fold	101, 103	Feb 20, 2020	Yes
ABB	DG/S 1.64.1.1 DALI Gateway, Basic 1-fold	101, 103	Sep 4, 2019	Yes
ABB	DG/S 2.64.1.1 DALI Gateway, Basic 2-fold	101, 103	Sep 4, 2019	Yes

Digital Illumination Interface Alliance

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About >   DALI >   DALI-2 certification >   D4i >   Products ∨   Members >   News & Events >

Home > Products > Product Database > DG/S 1.64.5.1

DG/S 1.64.5.1

General information

Product ID	3014
Product Name	DG/S 1.64.5.1
Brand Name	ABB
Status	Certified: DALI 2
Part number	2CDG110273R0011
GTIN	04016779067201

Testing

Test conditions	- ProbitLab2 - Voltcraft ME-42 Digital-Multimeter - Tektronix TDS2014 100MHz 1Gs - KNX Spannungsversorgung ABB SV/S 30.320.5; GHQ 631 0038 R0111; 195...255V AC; 50...60Hz; 29V DC; 320mA; -5°C...45°C
Test type	Full

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DALI technology and KNX DALI Gateways

– DALI was very successful and established itself as a standalone lighting control system

– The functions and advantages of the DALI standard (e.g. status feedback of lamp/ballast failure, light effects, color control RGB/tunable white, controlling of individual ballast/groups, emergency tests,…) can be integrated into KNX intelligent building systems via Gateways

– A DALI KNX Gateway serves as translator and connects both "worlds"

– DALI works as multiple subsystems with ballasts and emergency converters

– Use of KNX control elements, presence detectors, sensors, touch panels, BMS, etc.

→ **Perfect connection of modern lighting with building automation**
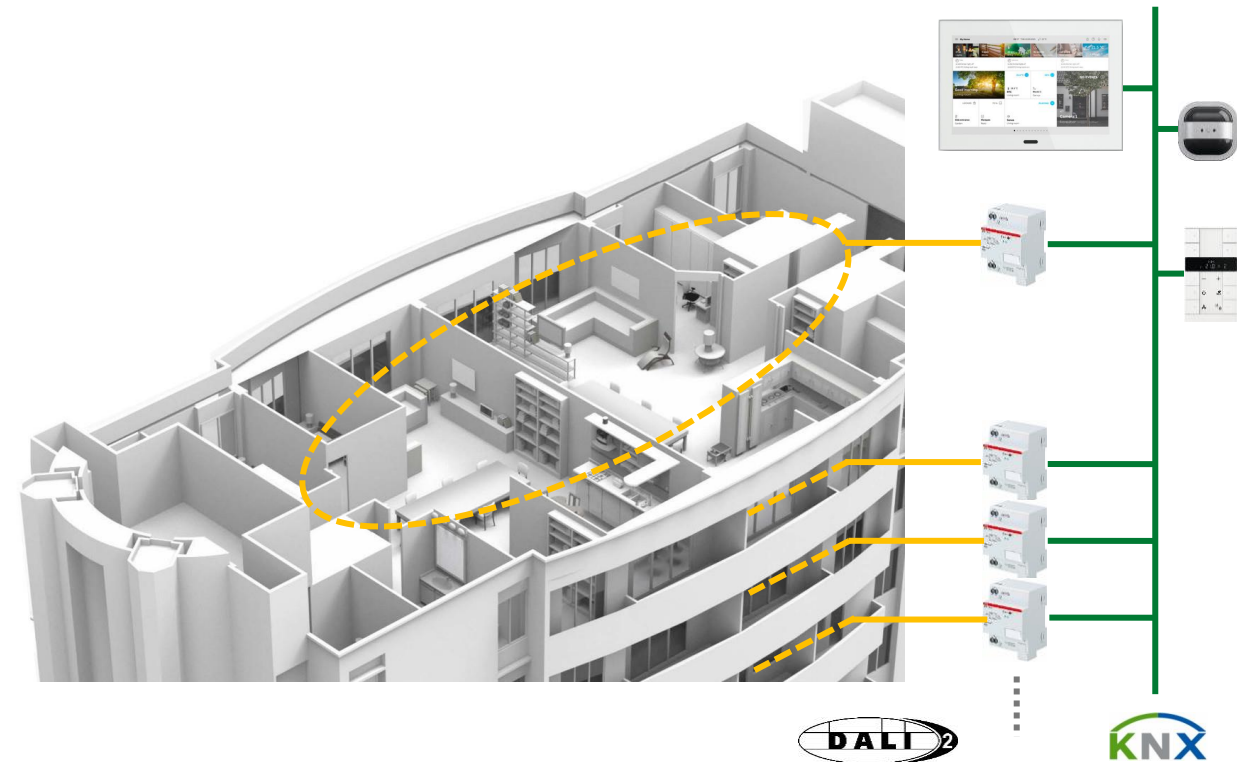
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DALI technology and KNX DALI Gateways

The DALI Gateway as the Master

– Transfers <u>commands</u> from KNX to DALI and sends back status messages to KNX

– Sends cyclical <u>queries</u> to all DALI devices (slaves)
  - Status
  - Actual level

  • Only the addressed device replies with information

  • This is a continuous process (24/7)

<u>Note</u>:

– All ABB i-bus® KNX DALI Gateways are DALI single master with integrated DALI power supply and up to 64 DALI devices (slaves) can be connected per output

– Other DALI masters, DALI power supplies or functional devices must not be connected to the DALI output.
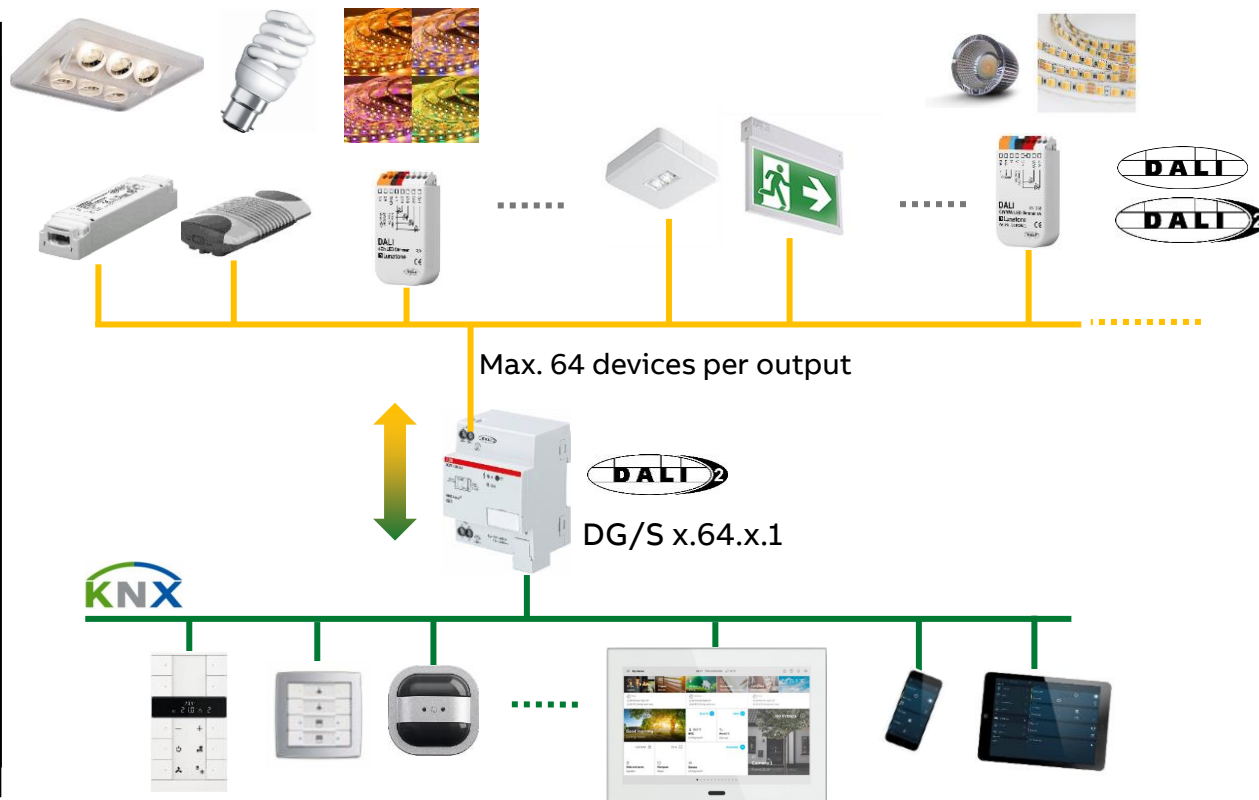
Max. 64 devices per output

DG/S x.64.x.1

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways
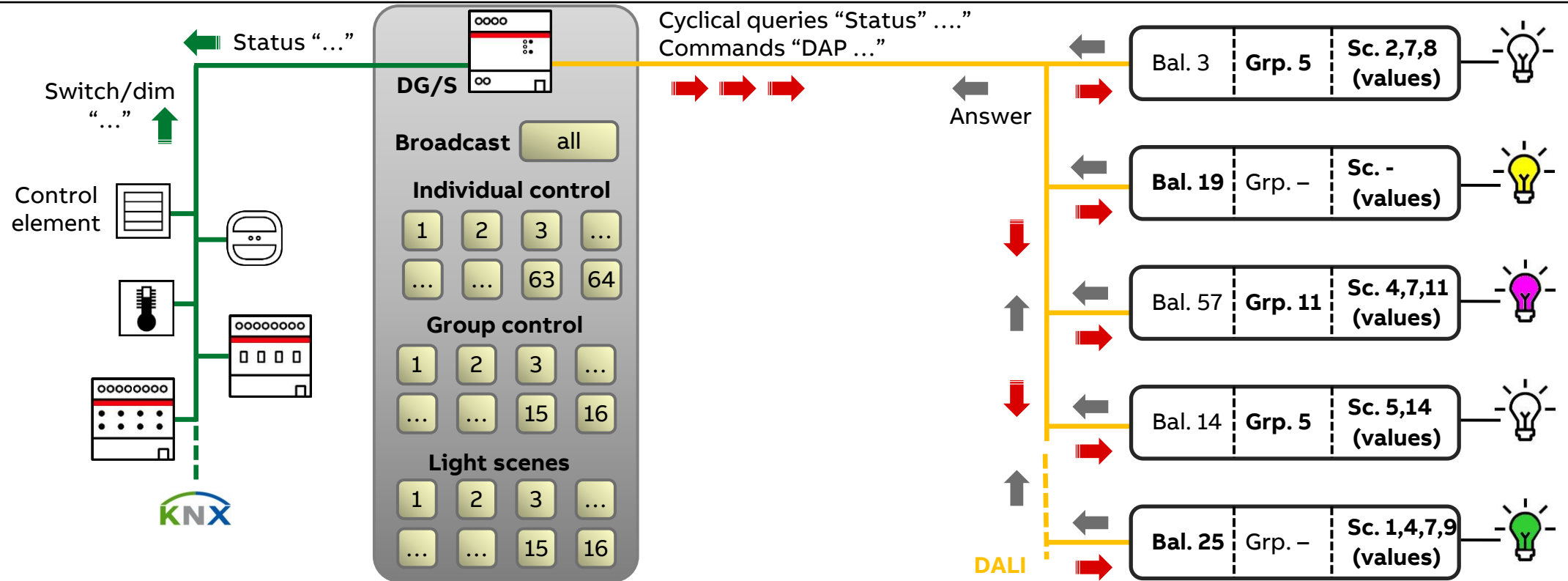
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways: Switch Output ON → Command "Broadcast (all) - ON"
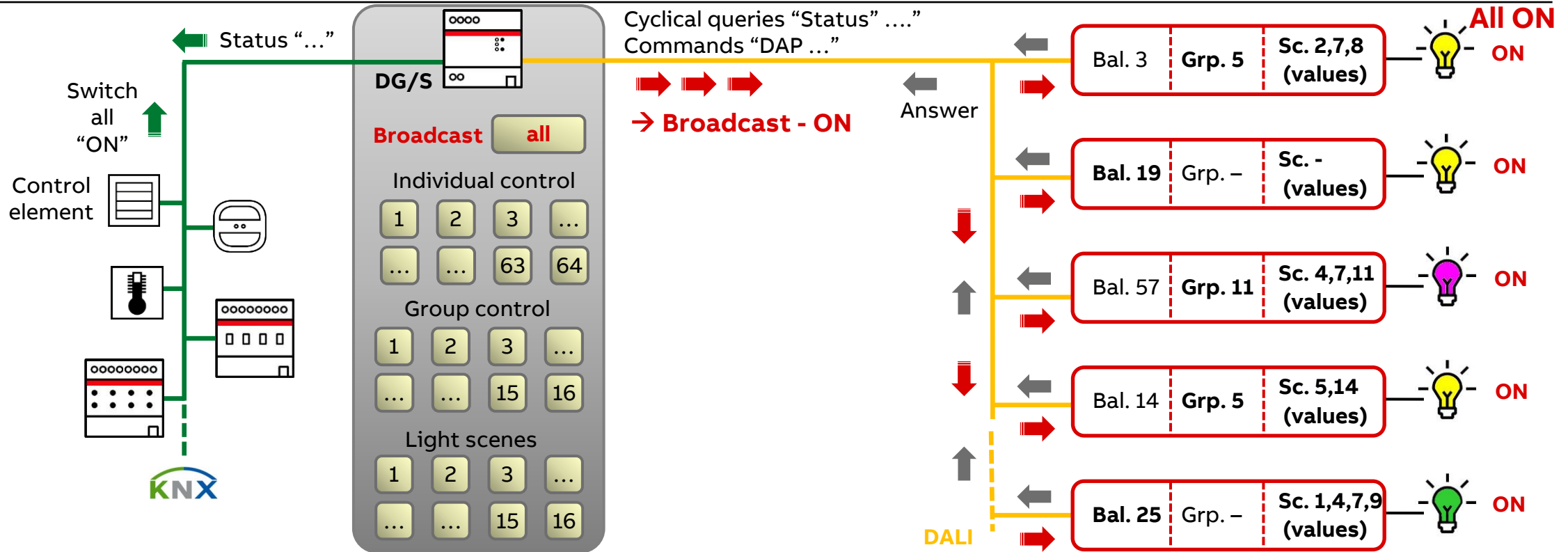
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways: Switch Ballast 19 (individual controlled) ON → Command "Ballast 19 - ON"
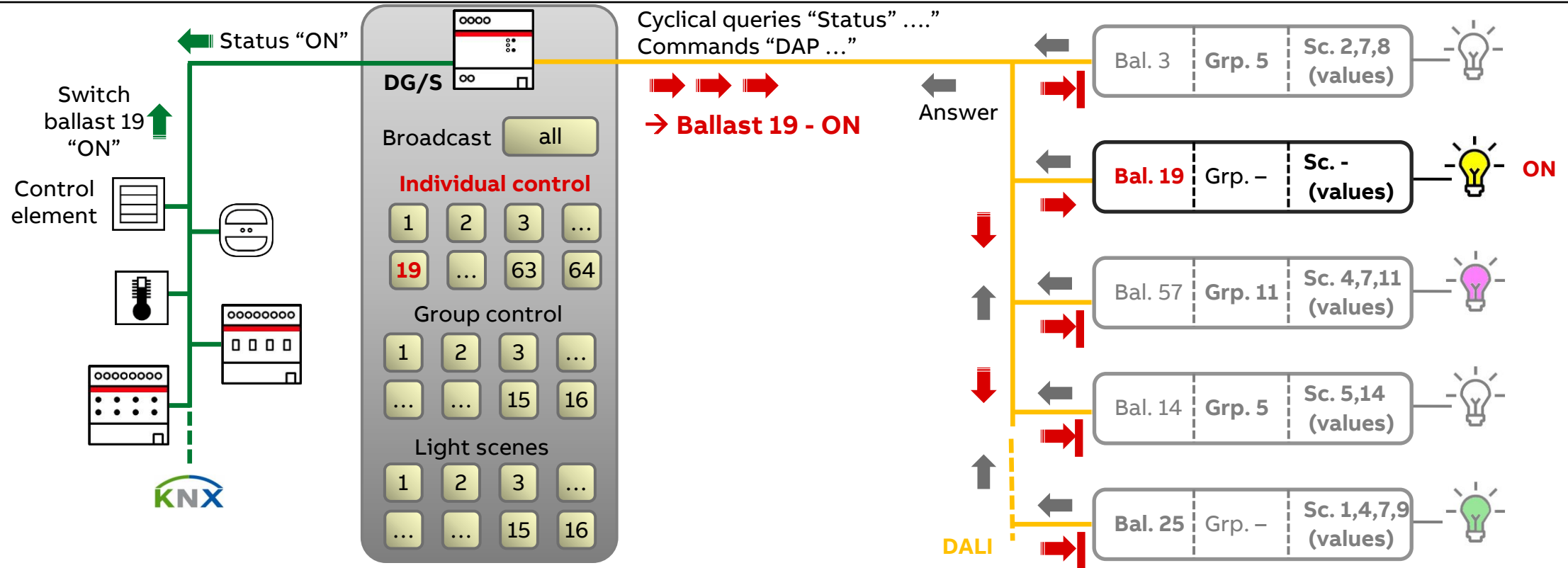
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways: Set Value Ballast 25 (individual controlled) 70% → Command "Ballast 25 - 70%"
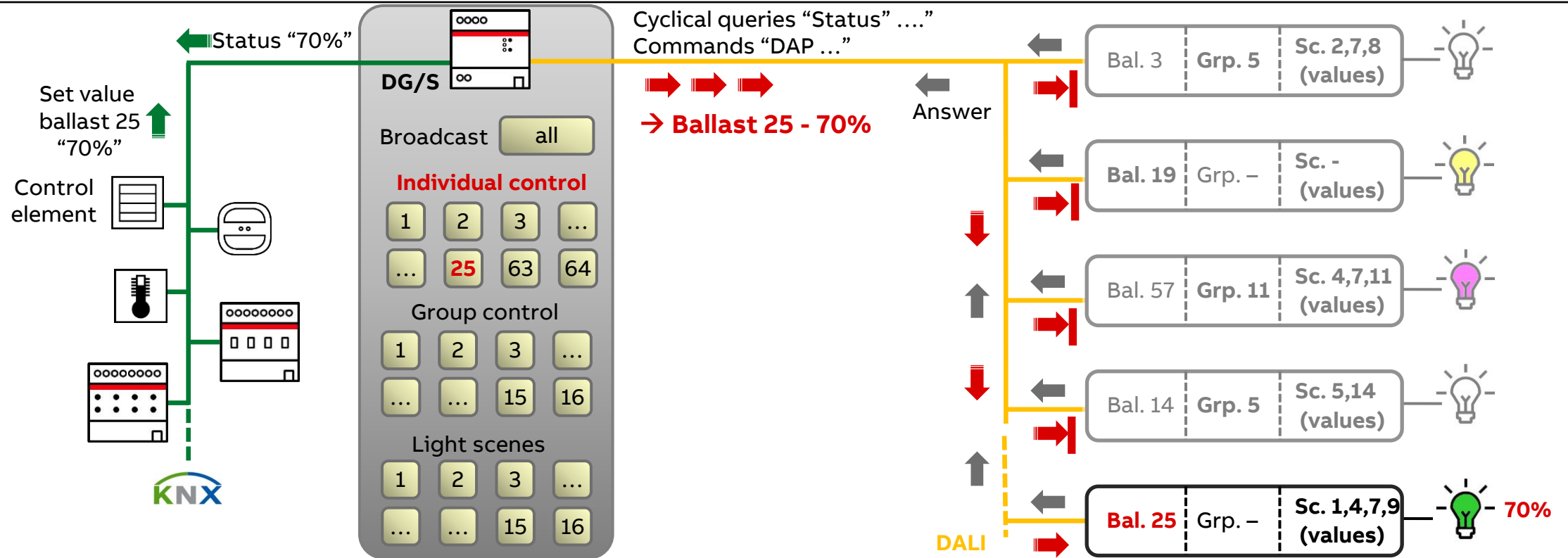
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways: Switch Group 5 (group controlled) OFF → Command "Group 5 - OFF"
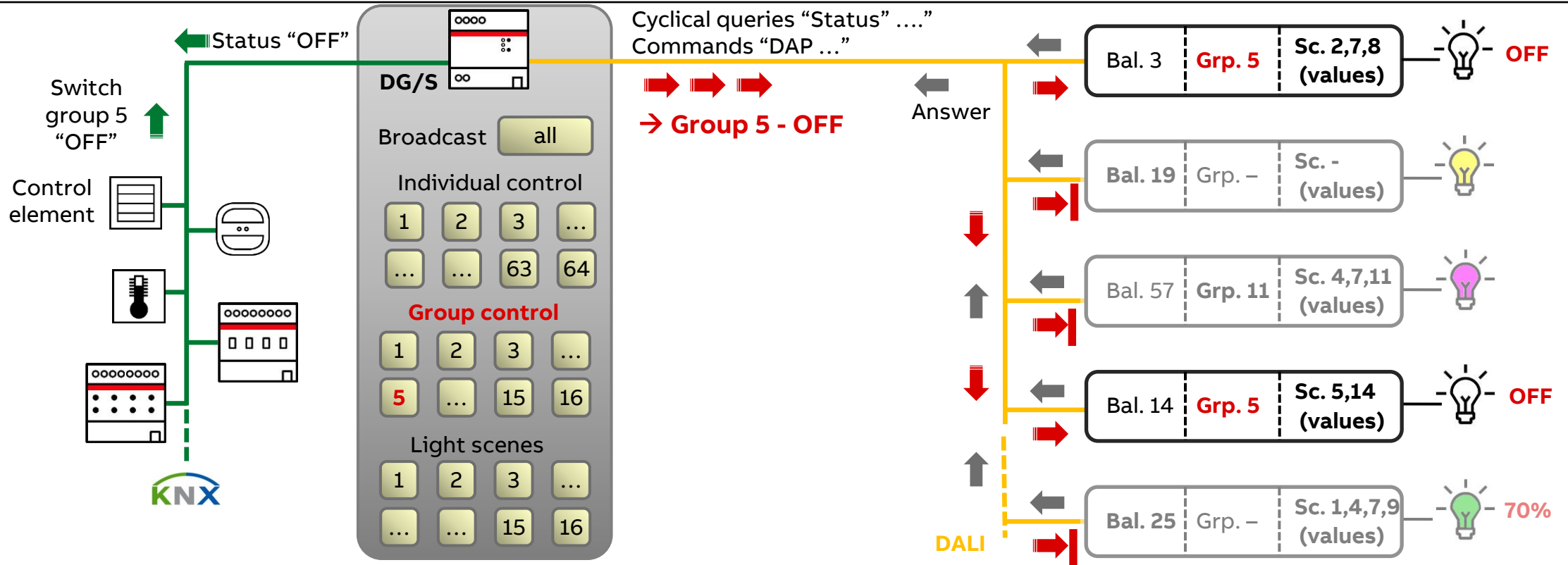
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI technology and KNX DALI Gateways: Call Scene 7 → Command "Call Scene 7"
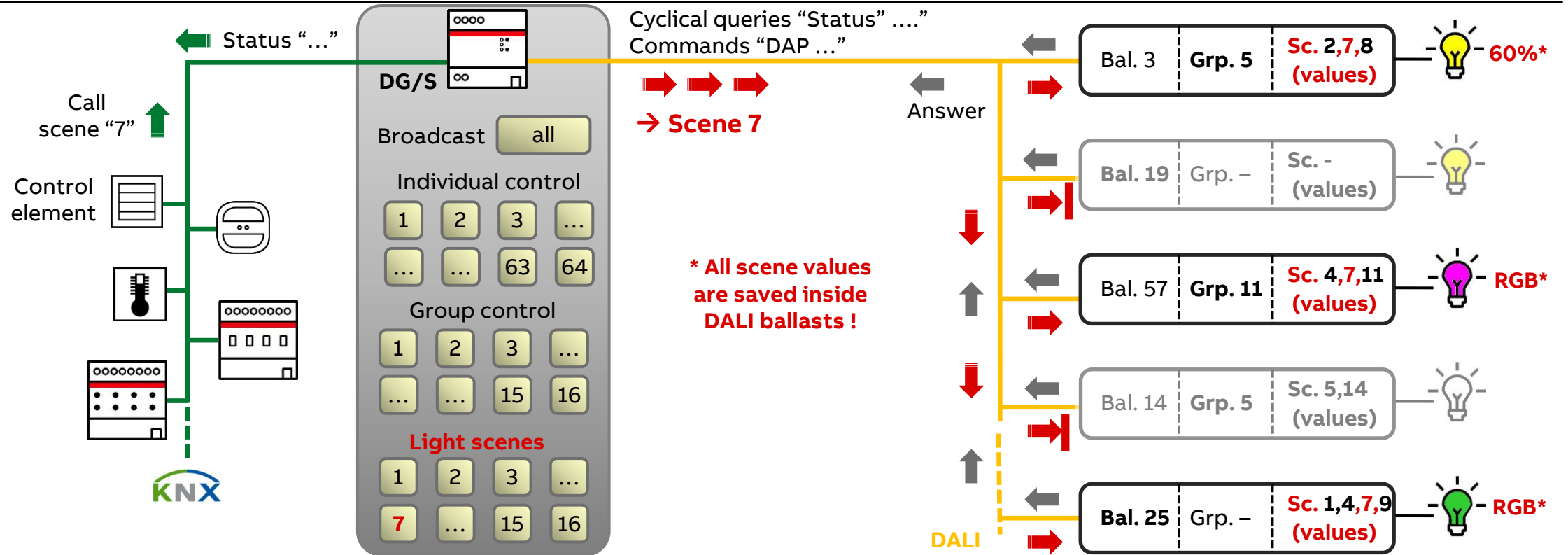
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® KNX – Product Range Overview
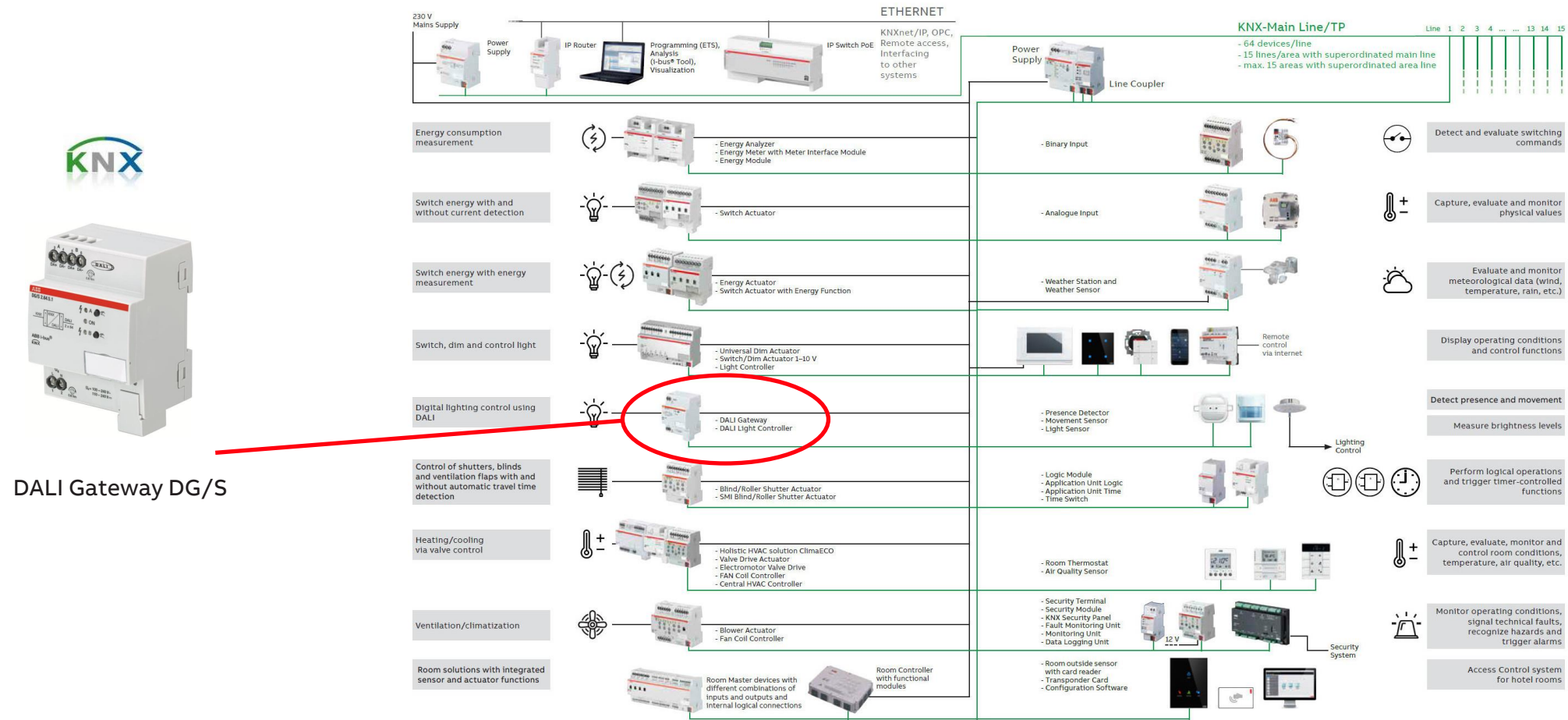
DALI Gateway DG/S

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

History of DALI Gateways and DALI Light Controller

– 2006: DG/S 1.1
  - A main channel A (individual operation) and an additional channel B (broadcast operation) with max. 64 DALI participants
  - <u>Individual</u> control of DALI devices
– 2009: DG/S 1.16.1
  - A main channel with max. 64 DALI participants
  - Control of 16 lighting <u>groups</u> (group-oriented)
– 2012: DGN/S 1.16.1
  - Based on DALI Gateway DG/S 1.16.1
  - Control of DALI participants <u>including</u> DALI emergency ballasts acc. IEC 62386-202
  - The different mandatory emergency lighting tests are controlled by KNX
  - Normal DALI participants are controlled via 16 lighting groups

DG/S 1.1   DG/S 1.16.1   DGN/S 1.16.1

Today DG/S x.64.x.1: Functions of DG/S 1.1, DG/S 1.16.1, DGN/S 1.16.1 and many more ….

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

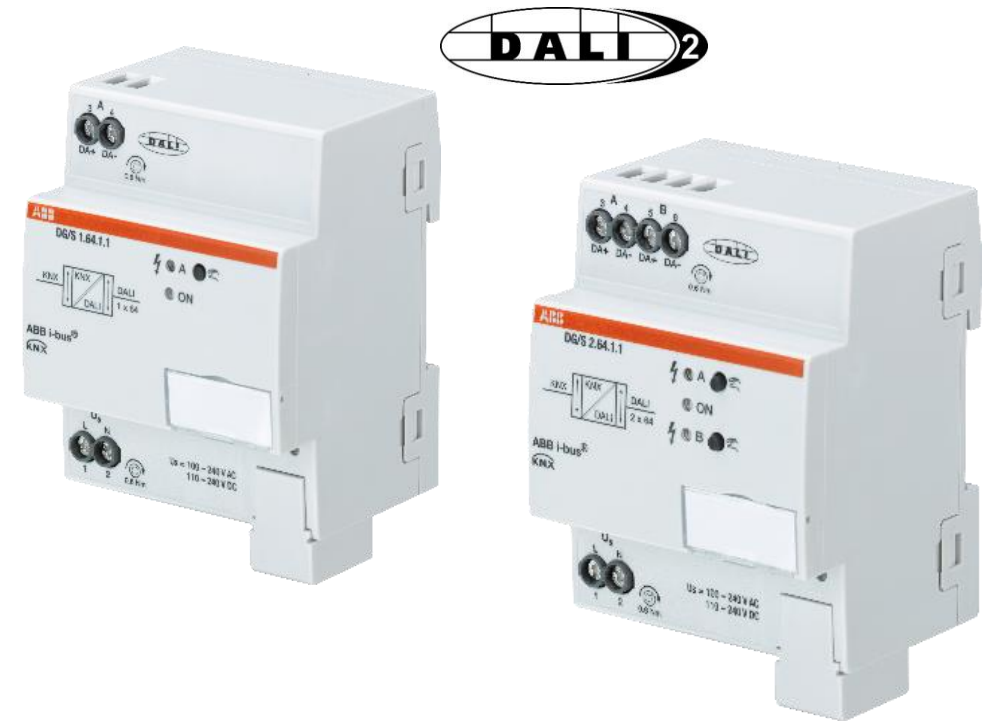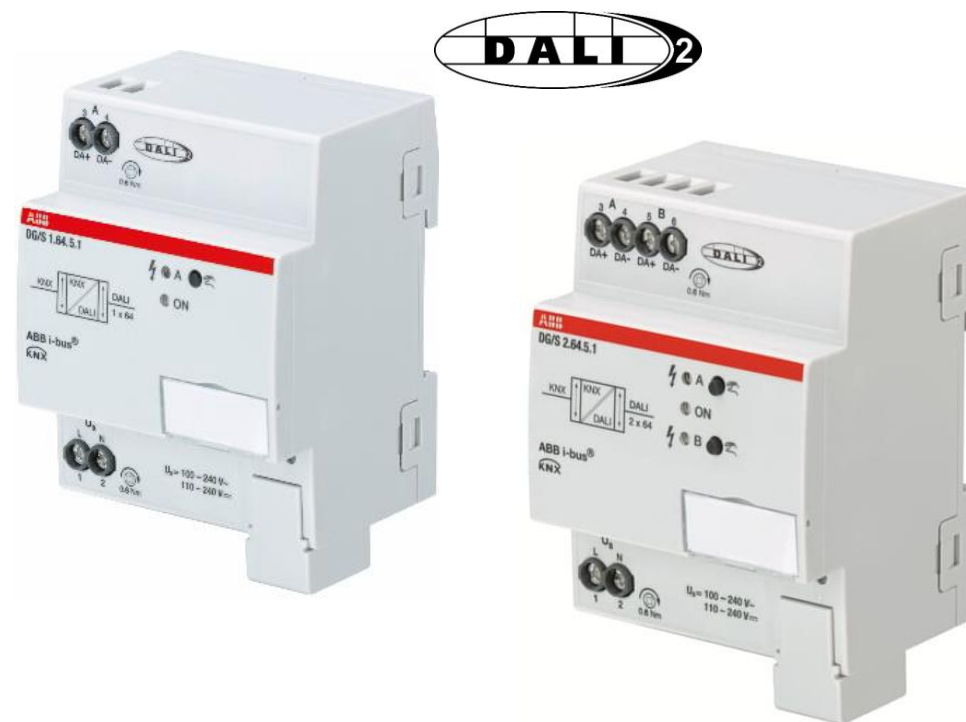Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

DALI Gateways and DALI Light Controller

– DG/S 8.1 (2005 to present)
  • 8 DALI channels, max. 16 DALI devices per channel
  • Broadcast control per channel
  • No addressing required
– DLR/S 8.16.1M (2010 to present)
  • 1 DALI channel controls 16 DALI groups (max. 64 DALI devices)
  • 8 light sensors (LF/U2.1) can be integrated → 8 groups adjustable
– DLR/A 4.8.1.1 (2013 to present)
  • Surface-mounted unit for decentralized DALI solution with integrated constant light control
  • 1 DALI channel controls 16 DALI groups (max. 64 DALI devices)
  • 4 light sensors (LF/U2.1) can be integrated →4 groups adjustable
  • Housing IP54
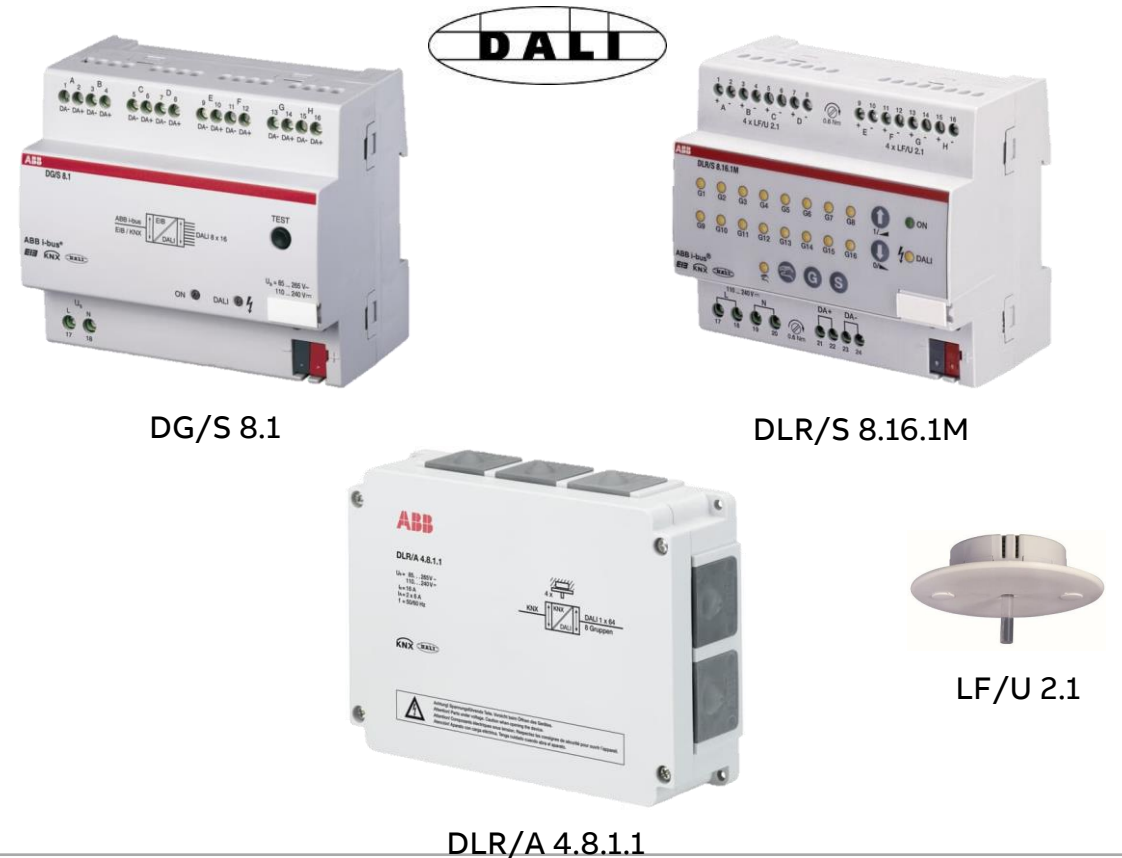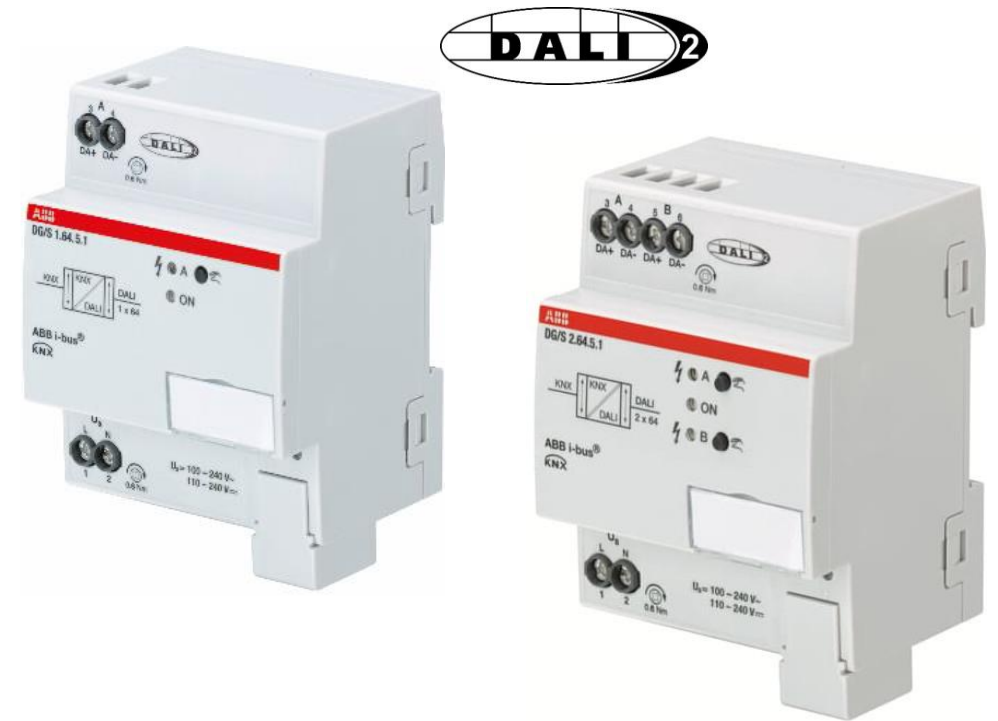
DG/S 8.1

DLR/S 8.16.1M

DLR/A 4.8.1.1

LF/U 2.1

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

KNX DALI Gateway Basic DG/S x.64.1.1

Hardware

– DG/S 1.64.1.1 (one channel, 64 ballasts)

– DG/S 2.64.1.1 (two independent channels, 2 x 64 ballasts)

The following ballast can be operated on the gateway

– Normal DALI ballasts (device type 0 and 6)

– DALI single battery emergency lighting converter (device type 1)

– Functions

  • Flexible combination of DALI groups or individual control

  • ABB i-bus® tool support

  • Templates

  • Turn off brightness, basic brightness, partial failure, scenes

  • …

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

KNX DALI Gateway Premium DG/S x.64.5.1

Hardware

– DG/S 1.64.5.1 (one channel, 64 ballasts)

– DG/S 2.64.5.1 (two independent channels, 2 x 64 ballasts)

The following ballast can be operated on the gateway

– Normal DALI ballasts (device type 0 and 6)

– DALI single battery emergency lighting converter (device type 1)

– Colour-controlled DALI ballast (device type 8)

– Additional functions to the KNX DALI Gateway Basic DG/S

  • Color temperature Tc (tunable white) and Color control RGBW

  • Dim2Warm and Human Centric Lighting

  • Standby switch-off

  • Operating duration and load shedding

  • Sequencer …

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

## Hardware KNX DALI Gateway Premium/Basic

– Supply voltage 100 - 240V AC/DC, 50/60Hz
  → Suitable for worldwide use

– Integrated DALI power supply
  → No additional power supply required

– DALI Outputs 230V secure
  → Incorrect connection with mains voltage does not destroy the device

– Manual operation with broadcast function
  → Test of installation and lighting

– 2 LEDs for device ON and DALI fault
  → Quick and easy diagnostics

– DALI commissioning via ABB i-bus® tool
  → Unique support during commissioning and fault detection

– Fast application download via IPS/S 3.1.1 or IPR/S 3.1.1 and USB Interface USB/S 1.2 (support long frames)
  → Time saving

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller
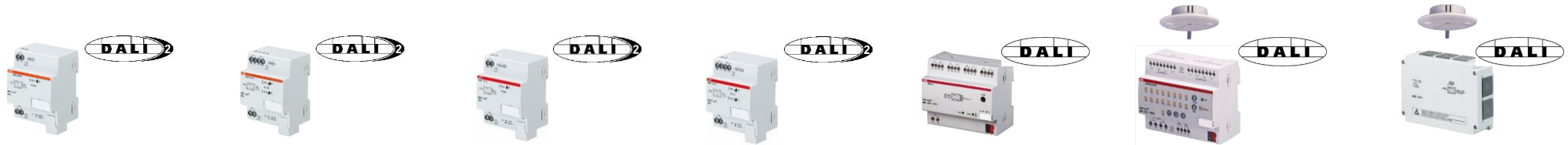
	Gateway DG/S 1.64.1.1 Basic	Gateway DG/S 2.64.1.1 Basic	Gateway DG/S 1.64.5.1 Premium	Gateway DG/S 2.64.5.1 Premium	Gateway DG/S 8.1	Light Controller DLR/S 8.16.1M	Light Controller DLR/A 4.8.1.1
Controlled	Individual/Group control	Individual/Group control	Individual/Group control	Individual/Group control	Broadcast	Group control	Group control
DALI outputs	1	2	1	2	8 (A…H)	1	1
DALI ballast	64 (ballasts and EMC)	2 x 64 (ballasts and EMC)	64 (ballasts and EMC)	2 x 64 (ballasts and EMC)	128 (max. 16 per output)	64	64
DALI addressing	64 individual	A: 64 individual B: 64 individual	64 individual	A: 64 individual B: 64 individual	not necessary	64 individual	64 individual
Lighting groups	16 DALI	2 x 16 DALI	16 DALI	2 x 16 DALI	cable installation	16 DALI	8 DALI
Emerg. light conv.	Yes	Yes	Yes	Yes	-	-	-
DT8 Color temp. Tunable White T_C	-	-	Yes	Yes	-	-	-
New application V2.0, e.g. DT8 RGB(W), load shedding, sequencer, …	-	-	Yes	Yes	-	-	-

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Overview of all ABB i-bus® KNX DALI Gateways and DALI Light Controller

Commissioning steps

– Pressing manual operation button → "Manual Operation" mode

  • Testing the wiring, installation, lighting and supply voltage of the ballasts and lamps → all lamps switch on and off

– ETS

  • Set the DG/S parameters (template or individual settings), enable functions, link group addresses, …

  • Download individual address and application

– ABB i-bus® Tool

  • Needed to parametrize the DALI part of DALI Gateways

  • Trigger DALI addressing, assign ballasts to the groups, test the DALI devices, check set parameters and functions, trigger ballast monitoring, …

– If necessary, the parameters in the ETS must be adjusted and reloaded into the DALI Gateway
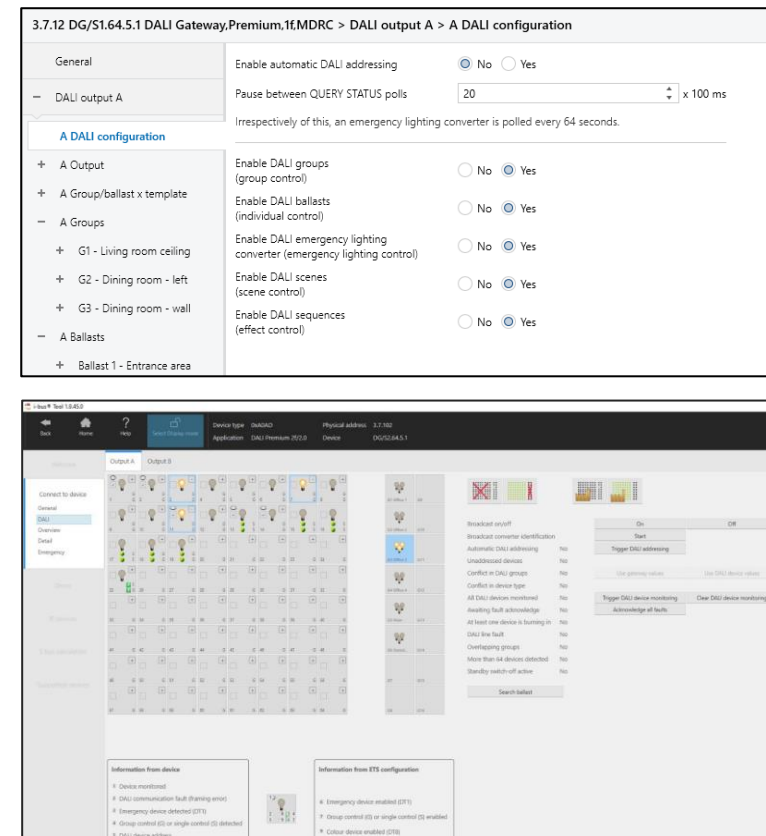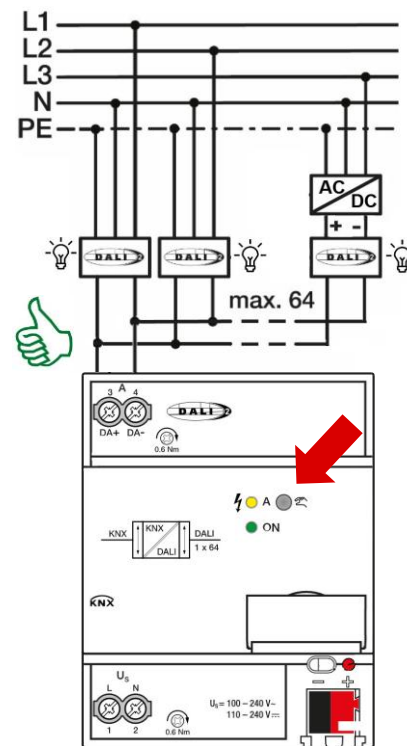
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Further information

– www.abb.com/KNX

- Products and Downloads → Lighting Control → DALI Gateways
- Product information (manual, software, …)

– Training & Qualification Database
The database contains extensive training content

- Webinar, Learning Sessions, … slides and videos
- Presentations
- Video tutorials
- and more …
- https://go.abb/ba-training

– YouTube

- Channel "ABB Home and Building Automation"
https://www.youtube.com/user/ABBibusKNX

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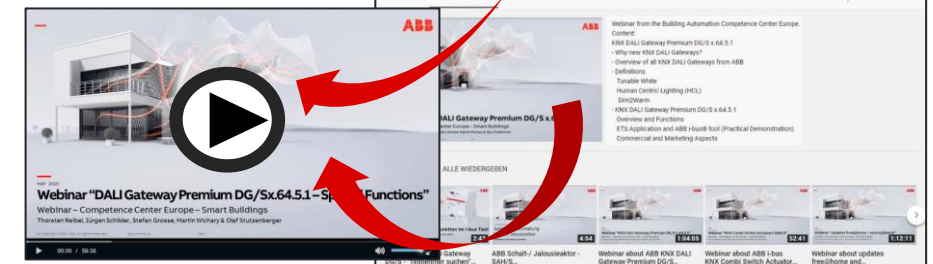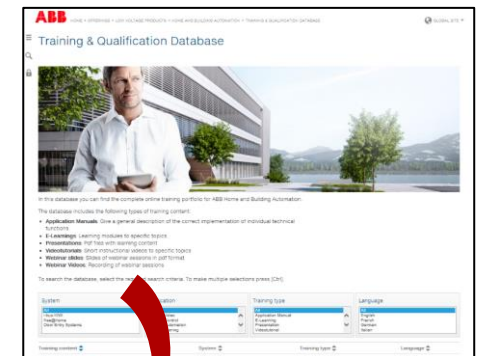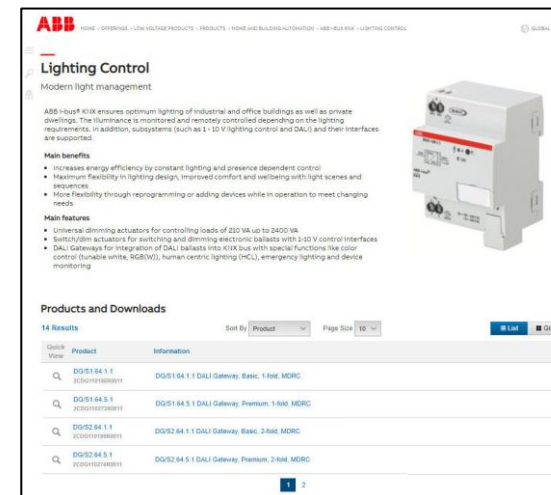
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

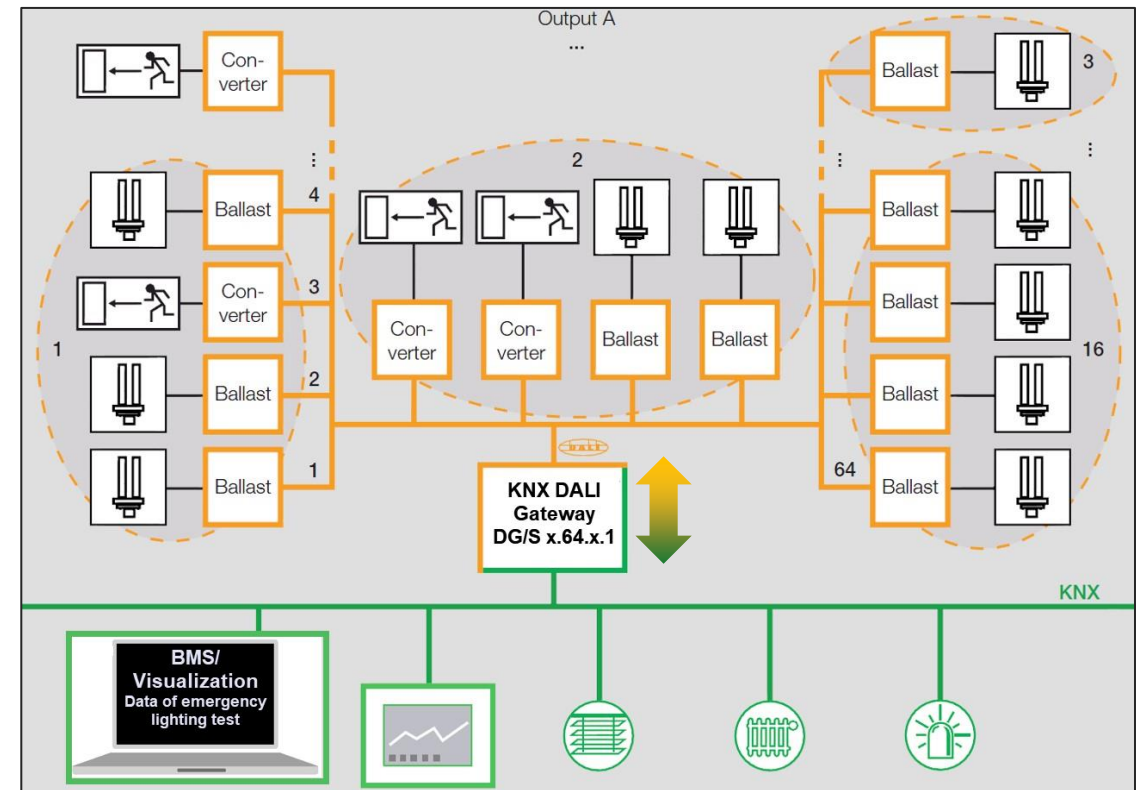# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

DALI Emergency Lighting

– DALI emergency converter according to IEC 62 386 device type 1 (self-contained emergency lighting) are supported

– It controls and monitors an emergency lighting system and provides the information (test results) on standardized DALI telegrams according to IEC 62 386-202

– The DALI Gateway evaluates this information and transfer the test results on the KNX according to KNX standards (DPTs)

→ General and emergency lighting in one system with more functions and less investment

→ Great flexibility and easy commissioning from planning to completion

→ In any commercial project with KNX, DALI and emergency lighting it's a must to discuss this solution
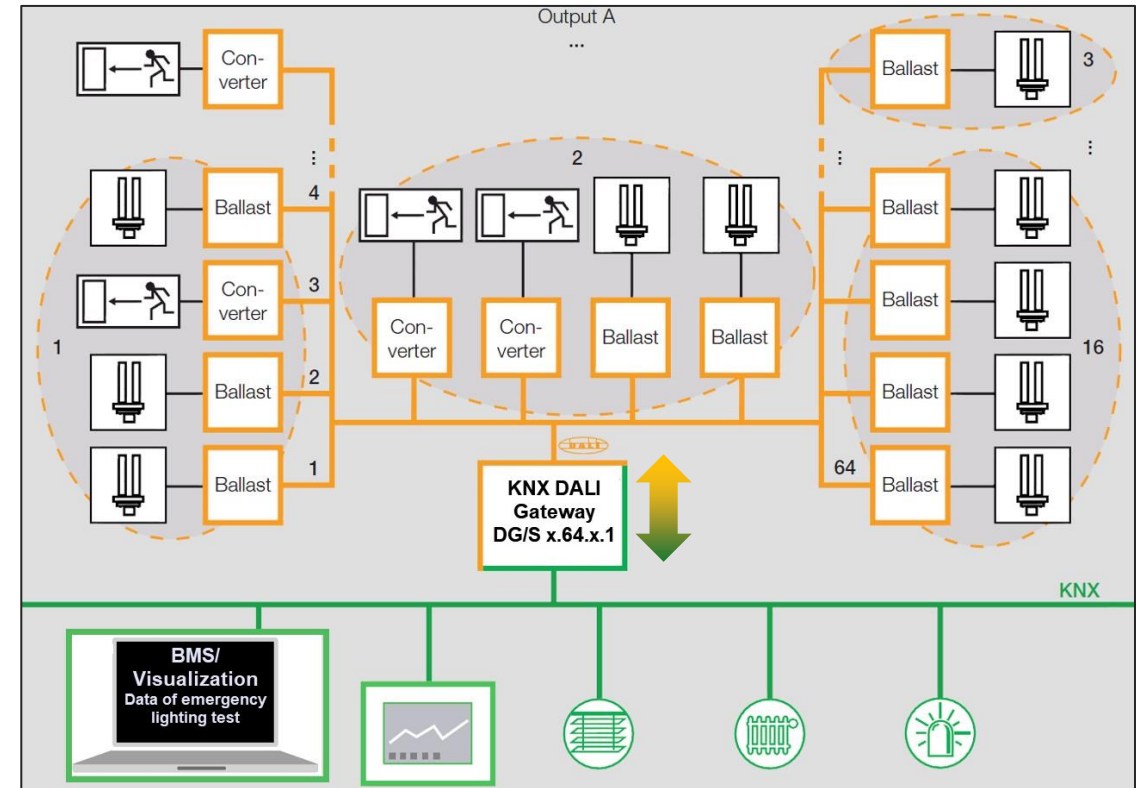
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

DALI Emergency Lighting

– Provides no functionality in terms of the emergency lighting regulations, e.g. logging functions or other associated stipulated functions

– Serves as an intelligent mediator between KNX and DALI

– The various mandatory emergency lighting tests, e.g. function or duration tests, can be triggered via KNX using group objects, and the result provided in the same way

– This information can then be used for higher-level management (BMS or visualisation) of the emergency lighting, which triggers at prescribed times and captures, saves or logs the result provided on KNX via the DALI Gateway

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting
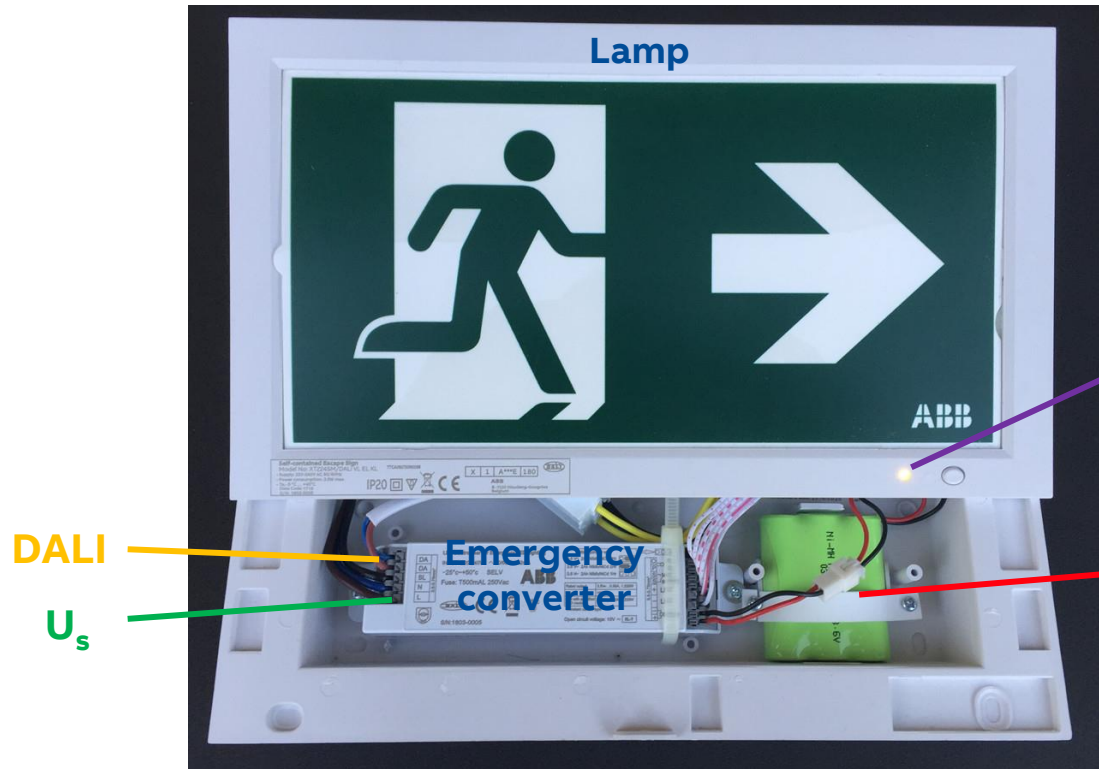
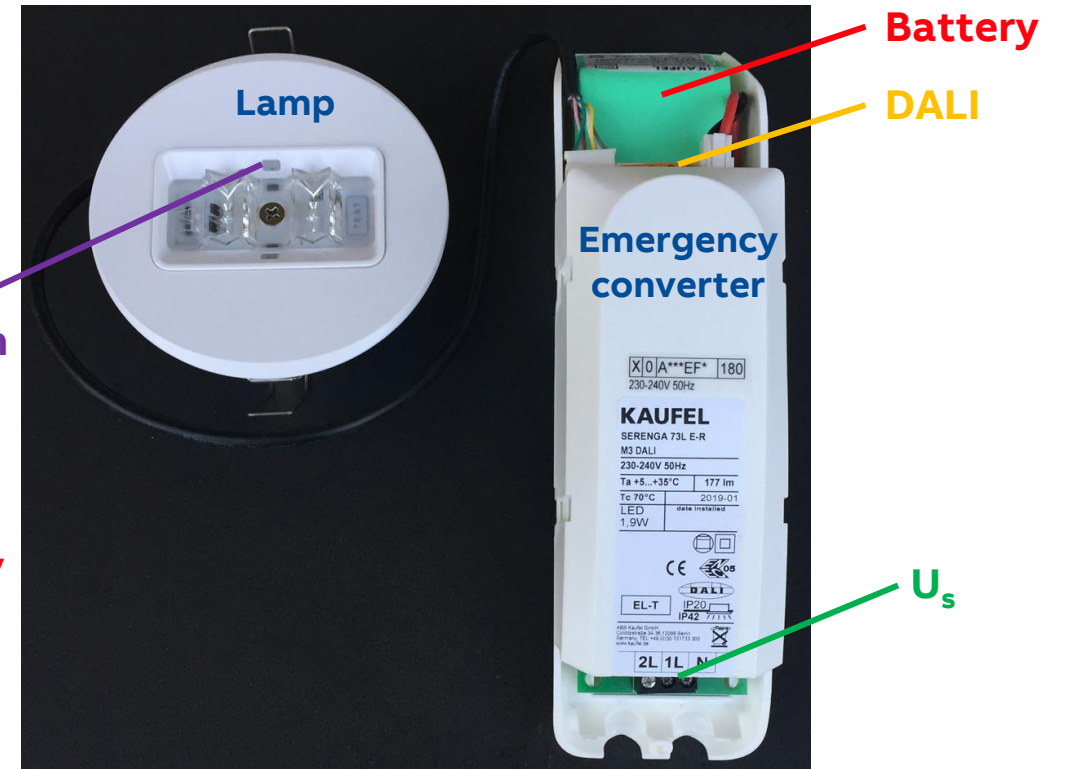ABB Kaufel route escape signs "Ovano"

ABB Kaufel LED downlights "Serenga"

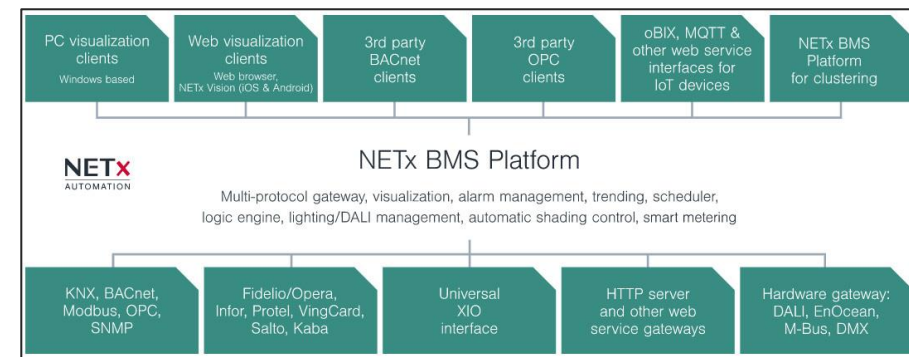# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

Higher-level management systems

– Building management system
– Visualisation software

For example:
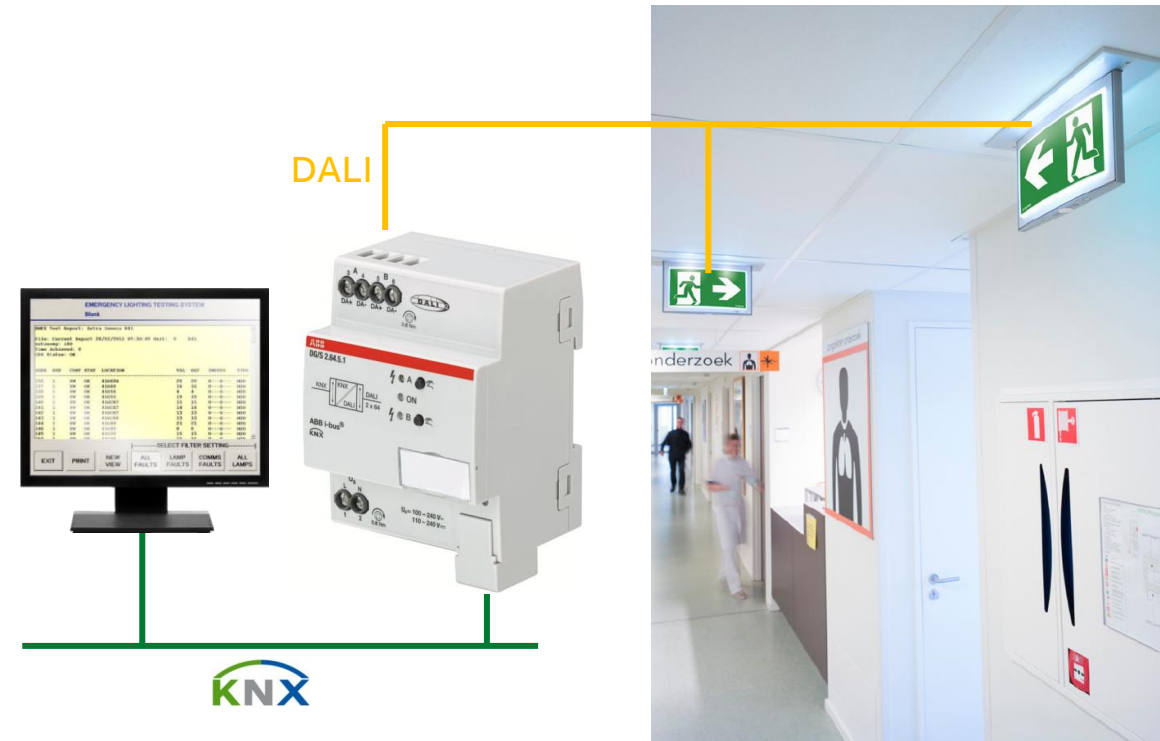
– NETxAutomation
  • www.netxautomation.com

– EisBaer
  • https://www.busbaer.de/en

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

Emergency lighting tests

– The various mandatory tests for emergency lighting are controlled by KNX group objects and the results are sent on KNX by further group objects

– The DALI Gateway sends a command to start a test (=request)

– This command is now pending in the emergency lighting converter and it decides when the test is carried out (running), e.g. the battery will still be charged after an emergency lighting event

– A further option for emergency lighting tests is the use of an automated test interval controlled by the DALI emergency lighting converter itself

  • The interval duration is defined by KNX parameters

  • KNX group objects send the results on KNX

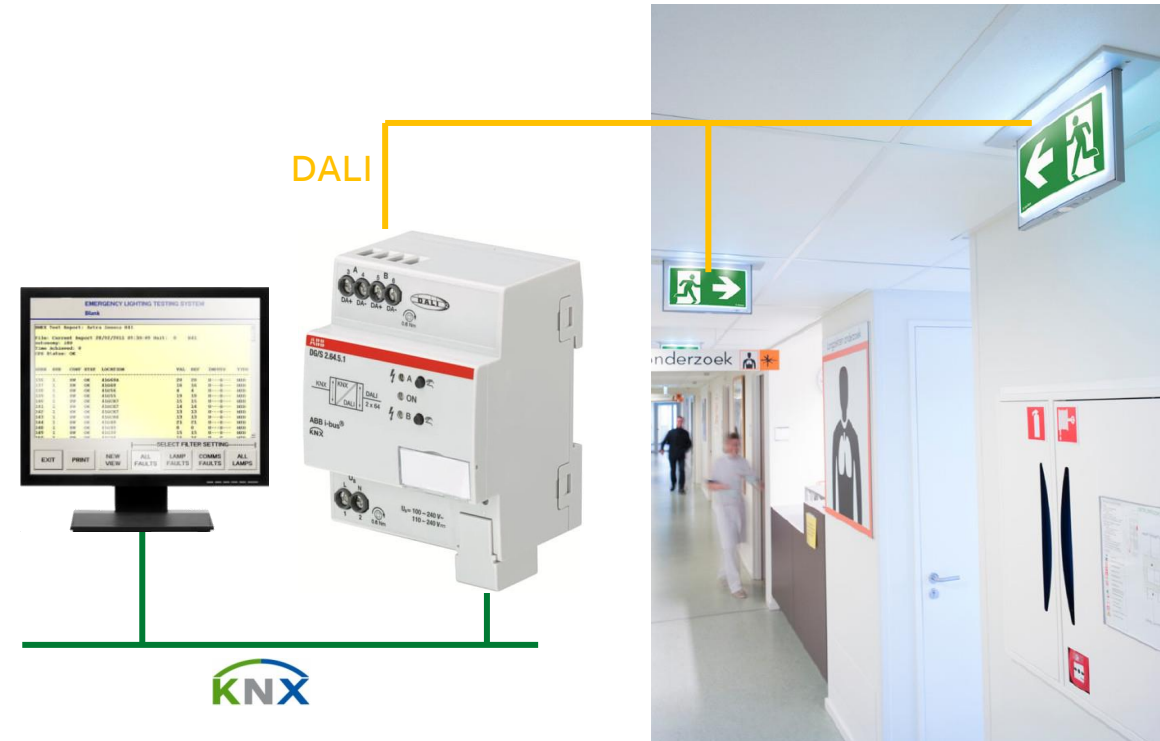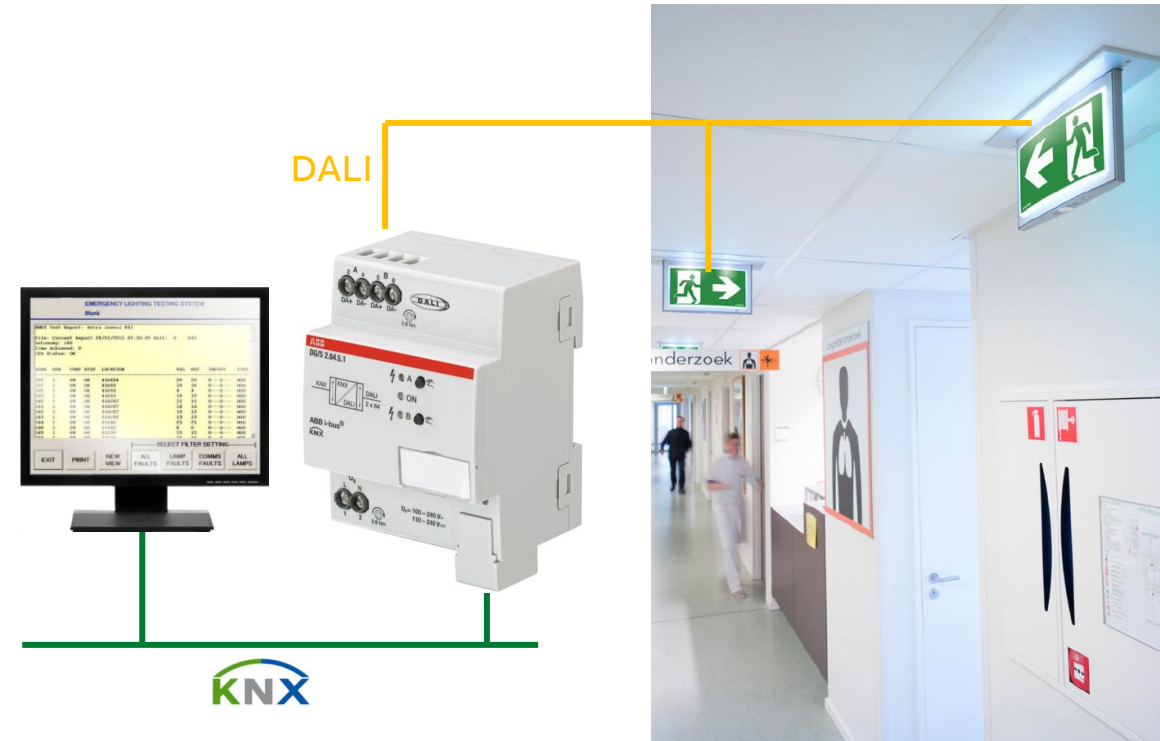– Emergency lighting test results are not stored in the DALI Gateway

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

Emergency lighting tests: Function test

- The test is implemented on the basis of IEC 62 386-202 and covers the

  - Functional security of the emergency lighting converter electronics

  - Correct operation of a lamp

  - Check the switch-over device for an individual battery

- The test is requested at a parametrizable interval in the emergency lighting converter or by a KNX group object

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

Emergency lighting tests: Duration test

- The duration test is implemented on the basis of IEC 62 386-202 and is used to determine whether the individual battery supplies the system within the limits of the rated operating duration in emergency lighting operation

- The test is requested at a parametrizable interval in the emergency lighting converter or by a KNX group object

DALI

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Emergency lighting

Emergency lighting tests: Partial duration test

- It is just an additional option to improve the operation readiness of emergency lighting simply and quickly without fully discharging the battery

- The DALI Gateway controls the partial duration test with the aid of the DALI device duration test

- The partial duration test is a duration test that is stopped by the DALI Gateway after a set time

- This is possible because a partial duration test is not stipulated or described by the standards

- The test is requested at a parametrizable interval in the emergency lighting converter or by a KNX group object
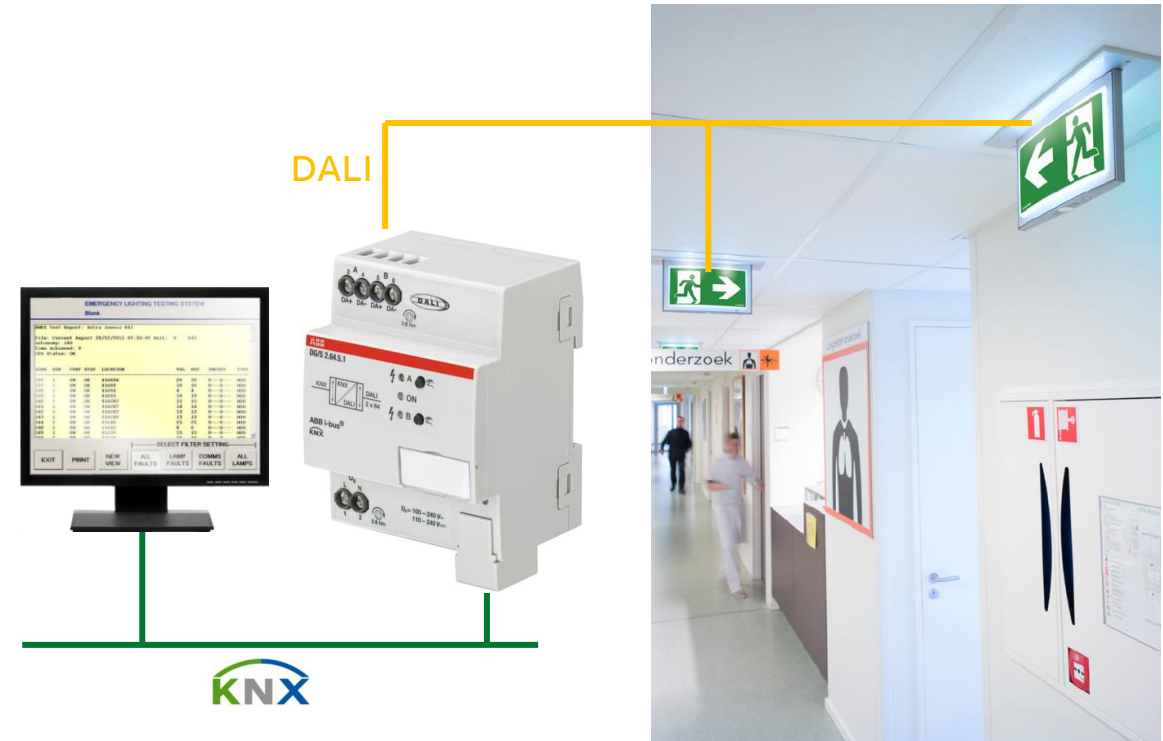
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways
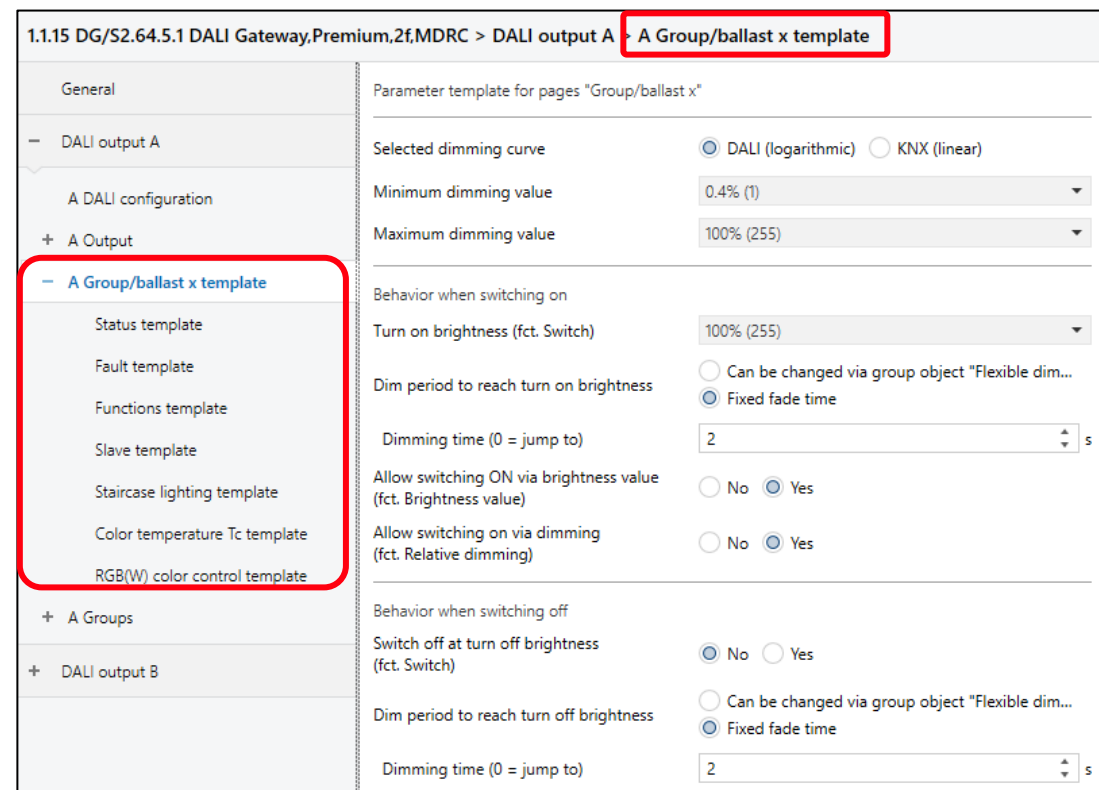
Functions of KNX DALI Gateways

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Parameter templates

Parameter templates for ballasts, groups and emerg. light.

- In the ETS application of the gateways, up to 64 individual ballasts or up to 16 DALI groups can be parameterized per channel with different parameter (e.g. status, burn-in, partial failure)

- Normally not necessary to make individual parameter settings for each ballast or group

- This is very time-intensive so that simplify-cation is useful for identical or slightly different settings

- The template is used in the ETS application of the KNX DALI-Gateways divided into the seven parameter menus mentioned plus general parameter

- For the individual ballasts, DALI groups and for output A or B (Broadcast) you have the choice between using the template or individual parameter settings

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Parameter templates

ETS Parameter settings of the groups and ballasts

Group 1

Status template	←	Status	→	Status: Individual parameter settings
Fault template	←	Fault	→	Fault: Individual parameter settings
… template	←	…	→	…: Individual parameter settings
Colour temperature template	←	Colour temp.	→	Colour temp.: Individual parameter settings

Parameter settings in the template

Group x/ballast x

| | ← | Status | → | Status: Individual parameter settings |

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Scenes"

Scenes

– 16 scenes, can be assigned to 64 possible scene numbers used in KNX for 8-bit scenes

– For each member of the scene (DALI group or ballast) brightness level can be adjusted
- For tunable white ballasts also color temperature parametrizable
- For color control ballasts also RGBW color parametrizable

– Recall of each scene with 1 bit object available

– Better overview for selecting scene members, only enabled groups or ballasts are visible and can be chosen

1.1.15 DG/S2.64.5.1 DALI Gateway,Premium,2f,MDRC > DALI output A > A Scenes > Scene 1

General	Transition time for scene	2.0 s	
– DALI output A	Overwrite saved scene val. on download	☑	

A DALI configuration
+ A Output
+ A Group/ballast x template
+ A Groups
+ A Ballasts
+ A Emergency lighting converter
– A Scenes
  Scene 1
  Scene 2
  Scene 3
  Scene 4

Group/ballast	Device	Change brightness	Brightness	Change color	Color	White value
G1:	☑	☑	94% (240)	☑	3000 K	
G2:	☑	☑	100% (255)	☑	#E61F1F	255
G3:	☑		69% (176)			
G4:	☑	☑	100% (255)	☑	#E69919	255
G5:	☐					
G6:	☐					
G7:	☐					
Ballast 5:	☑	☑	100% (255)	☑	3000 K	
Ballast 6:	☑	☑	78% (199)	☑	#12BF79	255
Ballast 7:	☑		46% (117)			
Ballast 8:	☐					

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Turn Off Brightness"
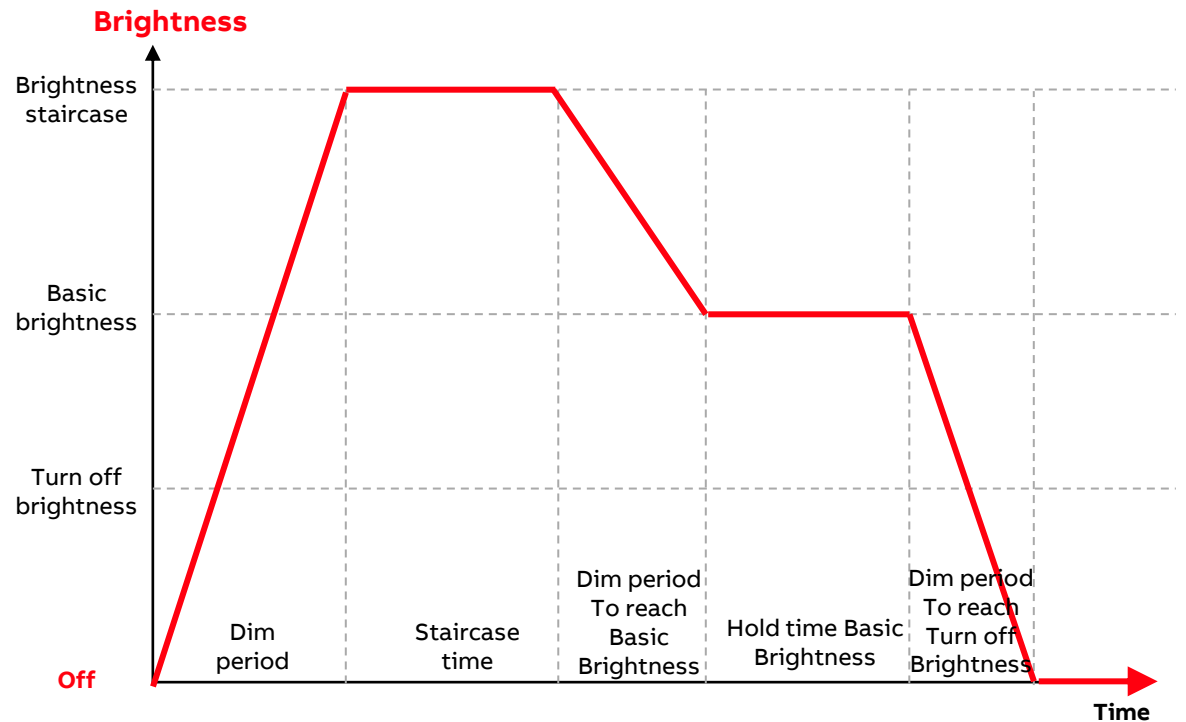
Turn Off Brightness

- Turn off brightness means that, when sending a **switch-off** telegram, the lighting does not switch off completely, but is set to a parameterizable turn off brightness value between 0.4 …100%

- Application:
  For security reasons darkness in corridors of hospitals or homes for elderly people is not accepted during the night
  → Basic lighting

- The function can be used with

  - "Normal" switching off (1-bit switch object)

  - "Automatic switching off" (staircase lighting function)

- The switch-off brightness has no influence on the disable, forced operation, slave or scene functions

- The switch-off brightness is neither used for dimming and setting brightness value commands
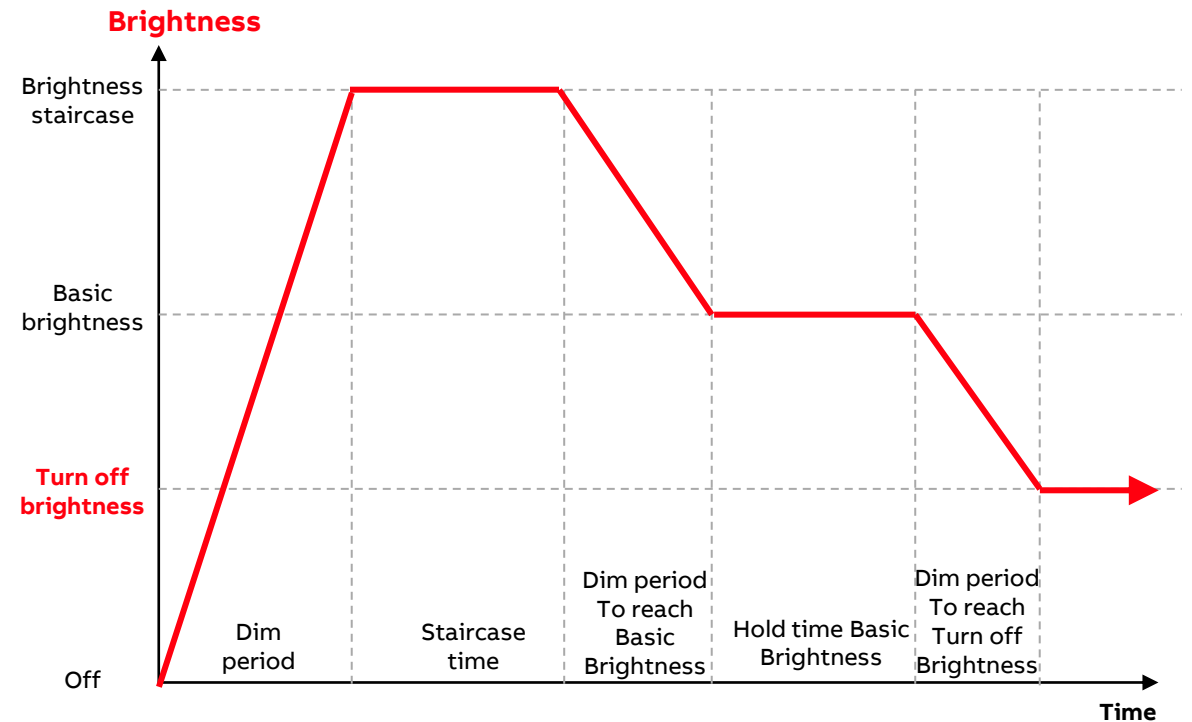
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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Turn Off Brightness"

Turn Off Brightness with staircase lighting function (automatic switching off)

During the day: Turn off brightness function is deactivated → Light OFF

At night: Turn off brightness function is activated → Basic lighting

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Partial Failure"

Partial Failure

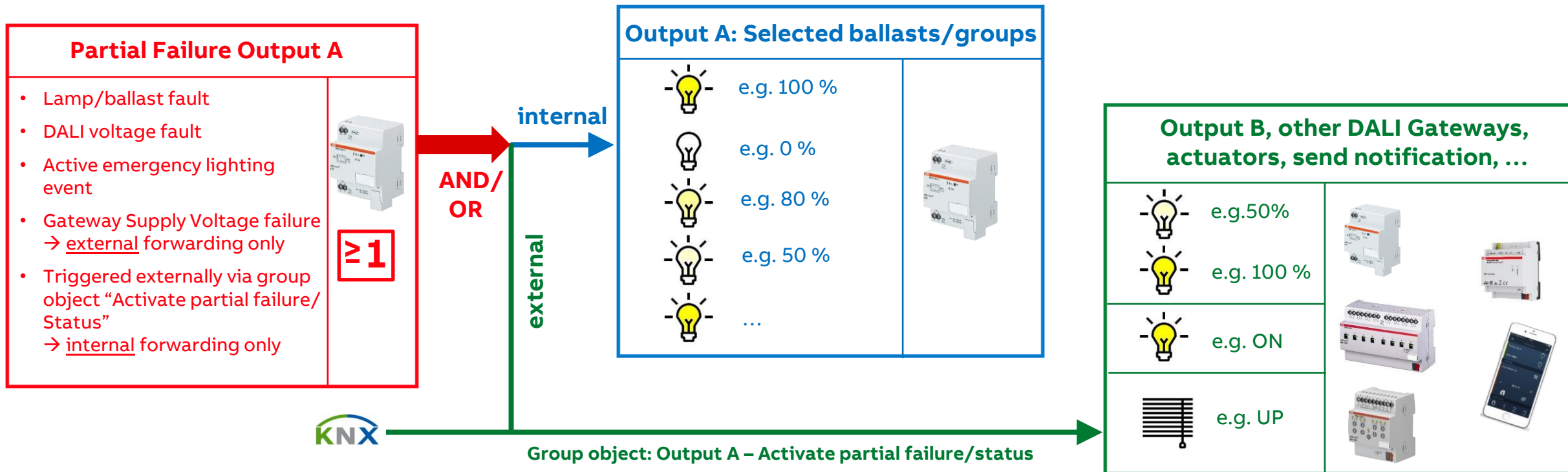**Target**: In the event of a failure or malfunction, other devices are switched with a higher priority

– Switch on other devices to compensate for brightness loss, e.g. in a hall when a certain number of lamps or ballasts fails

– In the event of emergency lighting, turn on with maximum brightness the additional lighting for the escape and rescue routes, e.g. all corridor and staircase lighting in an office building

– Switching off the lighting in areas that should not be entered

– Usage for a further priority operation below "Forced Operation" and "Disable" function

– Forwarding to KNX

  • Integration of further KNX devices (other DALI Gateways, Switch Actuators, Shutter Actuators, send alarm messages, …)

  • Failure of the supply voltage on the DALI Gateway, e.g. Phase failure

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Partial Failure"

Partial Failure – Overview

Partial Failure Output A

- Lamp/ballast fault
- DALI voltage fault
- Active emergency lighting event
- Gateway Supply Voltage failure → external forwarding only
- Triggered externally via group object "Activate partial failure/ Status" → internal forwarding only

≥1

AND/ OR

internal

external

Output A: Selected ballasts/groups

- e.g. 100 %
- e.g. 0 %
- e.g. 80 %
- e.g. 50 %
- …

Output B, other DALI Gateways, actuators, send notification, …

- e.g.50%
- e.g. 100 %
- e.g. ON
- e.g. UP

Group object: Output A – Activate partial failure/status

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Basic and Premium – Function "Forced Operation"

Forced Operation

Target: High priority function – no overwriting from subordinated KNX commands, e.g. local control element, time switch

– Emergency and dangerous situations (intrusion alarm, evacuation, fire alarm, …)
  • Panic lighting (some areas on and other areas off)
  • Guided lighting for leaving the building

– Energy saving
  • Switch off during work breaks
  • Hotel room: Remove the card from the card reader

– Define a brightness
  • Required brightness, e.g. for the cleaning crew

– Disable local operation (control elements, presence detectors)
  • Schoolchildren play with the light buttons
  • Museum
  • Presentation, no accidental changes to the lighting possible

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways
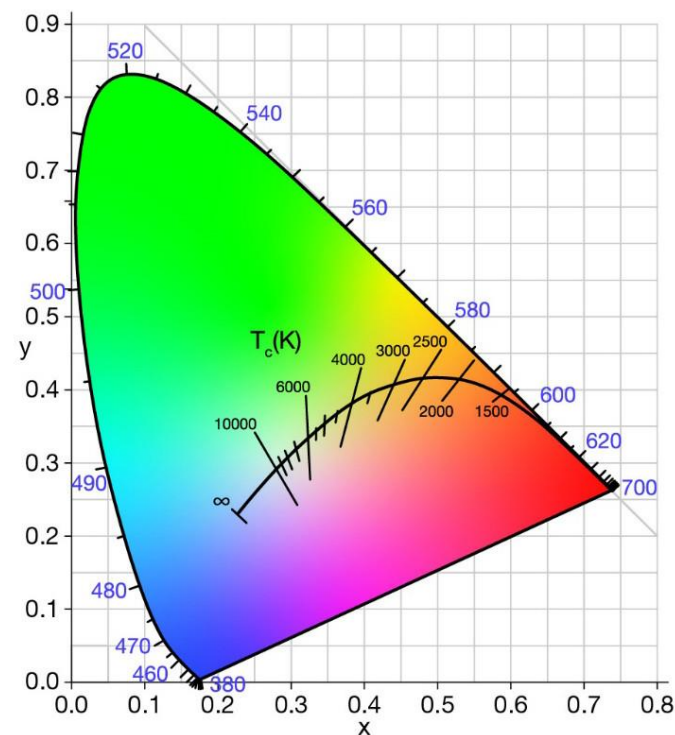
Functions of KNX DALI Gateways Premium

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

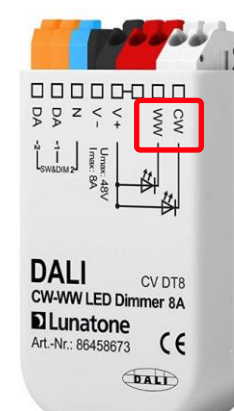DALI Gateways Premium – Color control

DT8 Color control

Color types

– The DALI Gateway Premium supports color control switching devices (ballast) of Device Type 8 to EN 62386-209

– These ballasts have multichannel color control (RGB) capability, which allows you to mix a lamp color or a color temperature via DALI

- T_C Tunable White – ETS application program V1.0

- RGB(W) – ETS application program V2.0 and higher

- HSV(W) – ETS application program V2.0 and higher
  Based on RGBW → RGBW ballast is required

Device Type 8
RGBW
one DALI
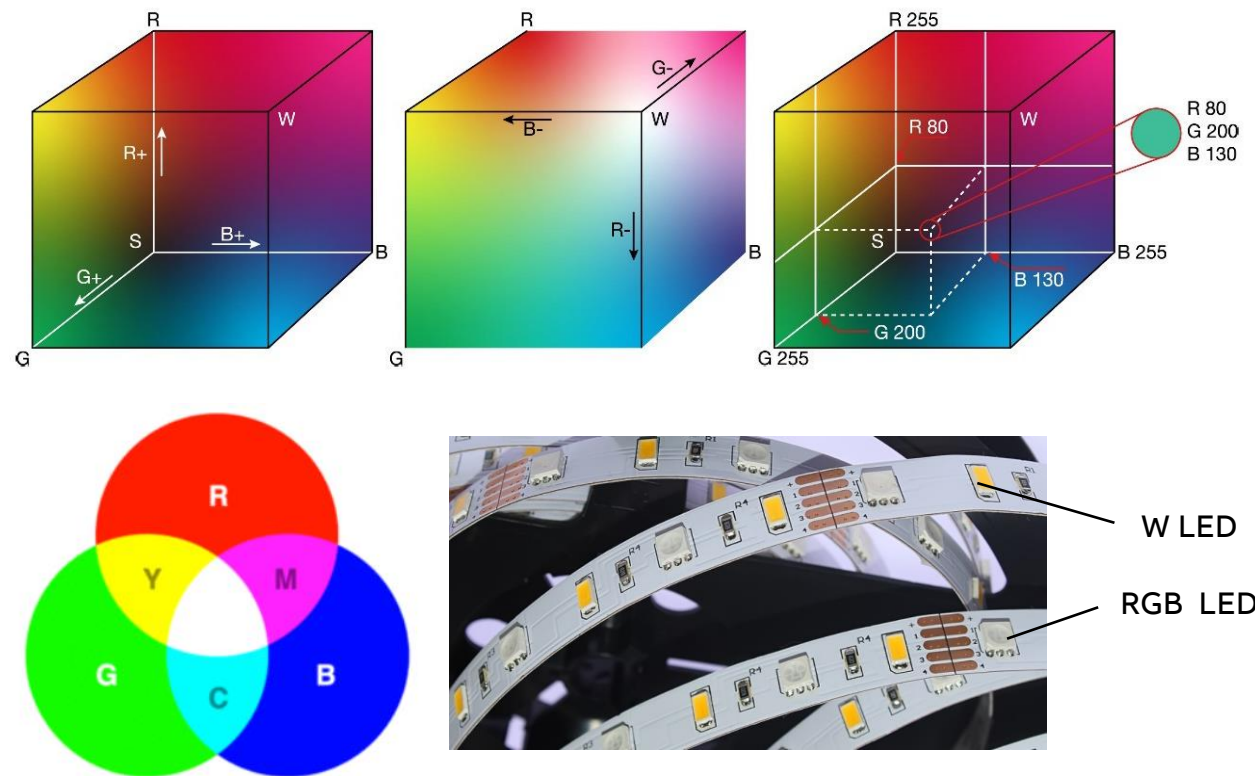address

Device Type 8
T_C
one DALI
address

Source: Lunatone

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – RGB(W) and HSV(W)

DT8 Color control – What is RGB(W)?

– Colors are made of the primary colors **RED**, **GREEN** and **BLUE**

– The **RGB** color space is based on exactly this model

– So a color is always defined in terms of the primary colors, expressed as the ratio between the color channels

- • Mixing of three primary colors

- • e.g. 100% red, 100% green and 0% blue produces yellow

– If these three colors are added together, the result is theoretically white

– Nowadays there is also the option to add a white component by mixing in an additional channel → RGB(W)

– This white component helps produce a lighter light, which brightens the color and only a LED is used (energy saving)

– There are still special variants, RGBWAF lights:
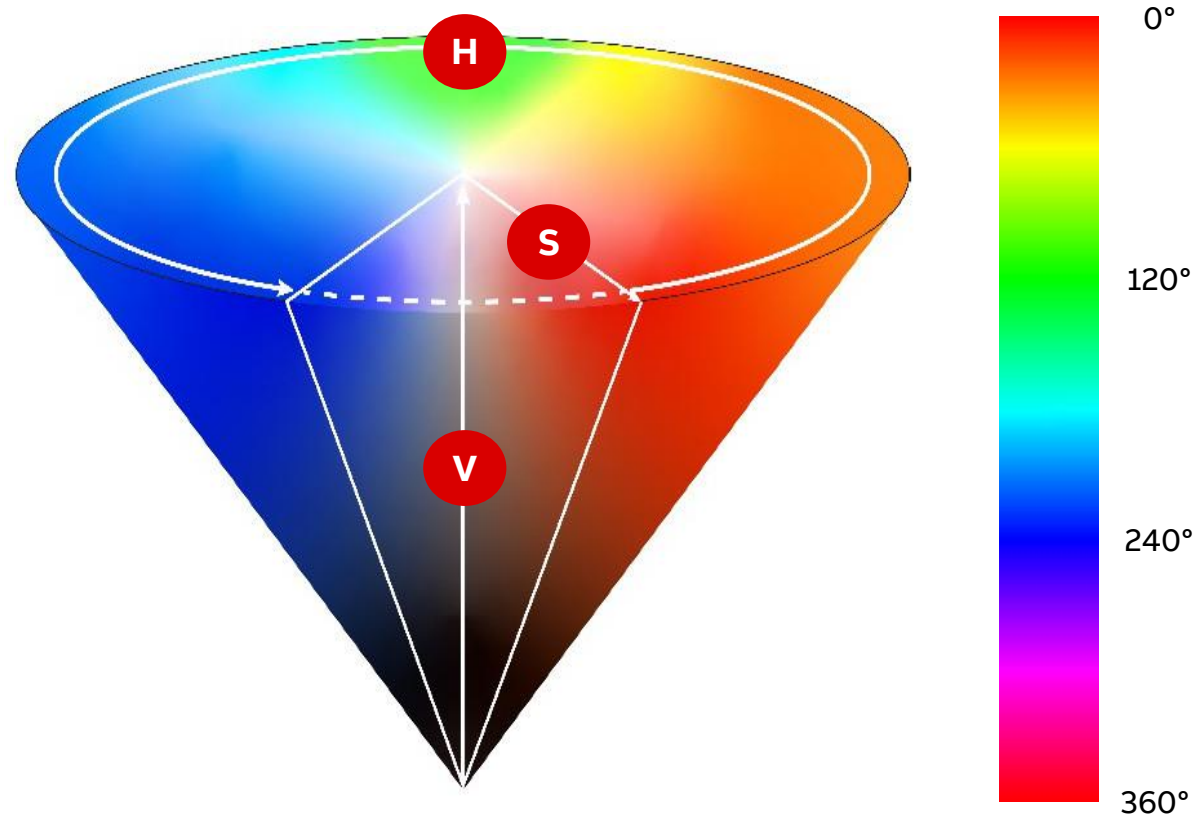A = Amber, F = other color

W LED

RGB LED

Source: Internet

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – RGB(W) and HSV(W)

DT8 Color control – What is HSV?

– The **HSV** color space defines color perception in terms of 3 coordinates:

- **Hue:** This value determines the color shade and is shown on a 0°... 360° wheel.
0° correspond approximately to the color red, 120° to the color green and 240° to the color blue

- **Saturation**: This value sets the saturation of the color shade. At 100% saturation, the color is fully saturated - this is the pure color. If white is added to the color, the result becomes more pastel - the color is less saturated.

- **Value**: This value sets the brightness of the color shade. If the brightness is high, the color appears bright and if the brightness is low, the color appears dark. If the brightness is 0% this corresponds to black and at 100% to full brightness
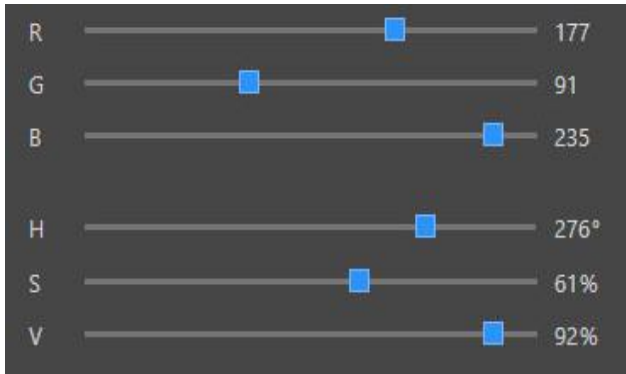
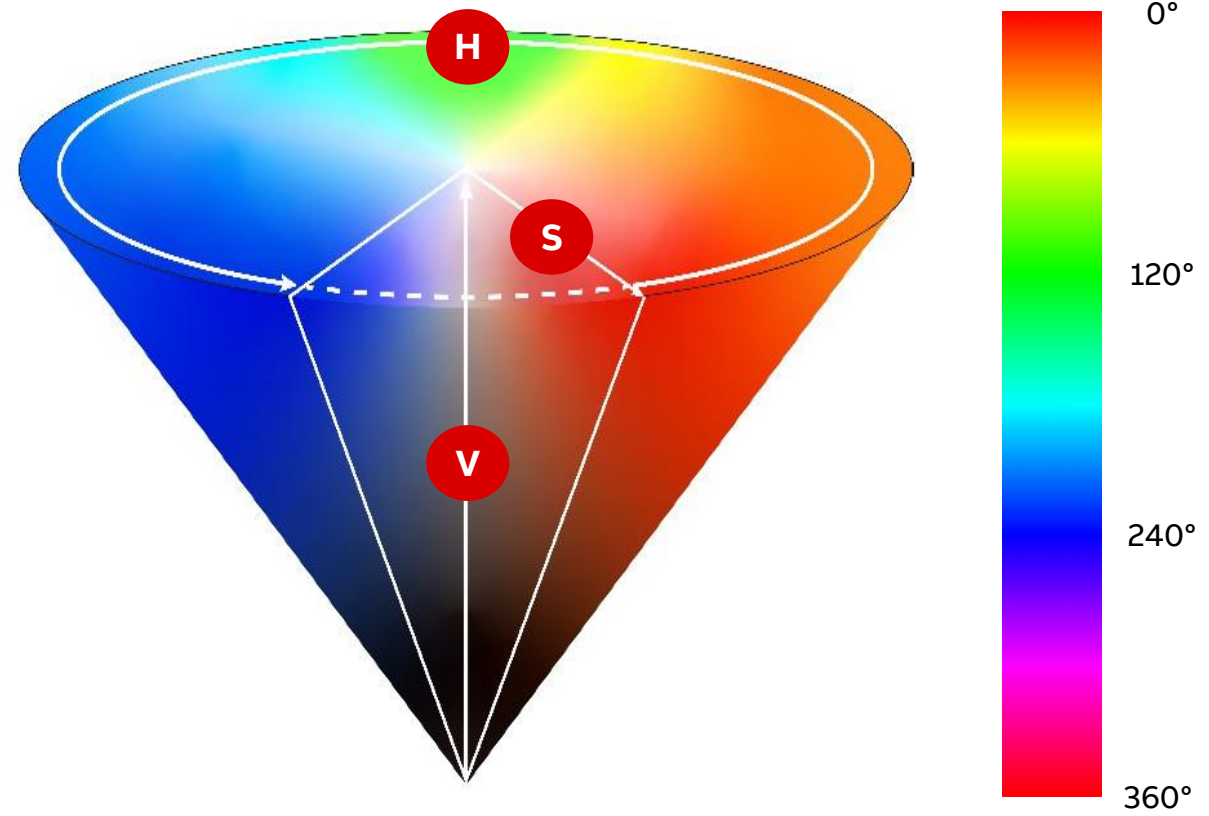# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – RGB(W) and HSV(W)

DT8 Color control – What is HSV?

- In color matching, the HSV color space is preferred over the RGB color space because it mimics human color perception

- When mixing colors you can simply select the required shade and then decide how saturated and how light (or dark) you want it to be, or whether a different shade would be more suitable

- The RGB and HSV color spaces can be transformed into each other by means of calculations

R		177
G		91
B		235
H		276°
S		61%
V		92%

Current color level:
RGBW in hex: B1 5B EB 00
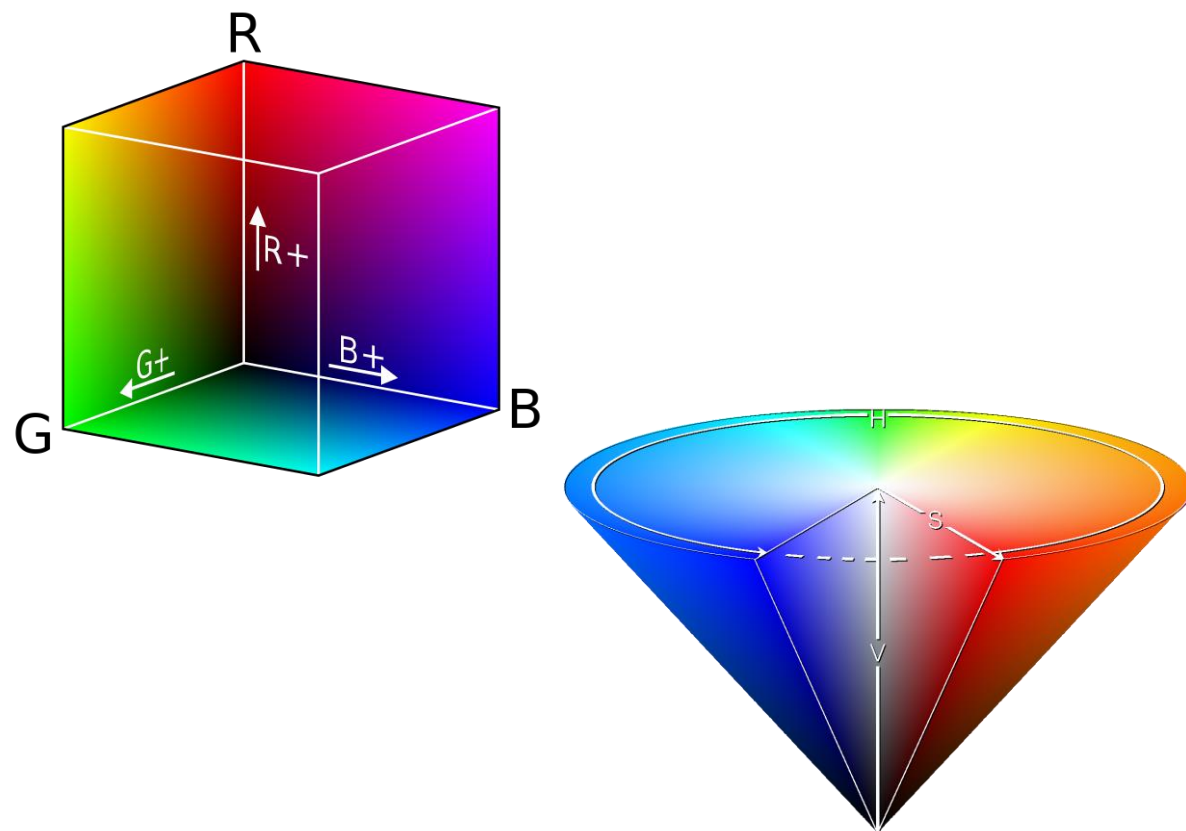RED: 177 / 276°
Green: 91 / 61%
BLUE: 235 / 92%

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – RGB(W) and HSV(W)

DT8 Color control – RGB(W) and HSV(W)

Maximum flexibility in lighting design

- Color control for each group and ballast

- Dim color value and set value

- Color control is also possible using scenes and sequencer

- Color control is performed using

  - RGB(W)

  - HSV(W) – Based on RGBW → RGBW ballast is required

- The following options are available for color control:

  - Single group objects for each color channel (4 x 1-byte)

  - Combined 3-byte group object RGB/HSV
    DPT_Color_RGB 232.600

  - Combined 6-byte group object RGBW/HSVW
    DPT Color_RGBW 251.600

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – RGB(W) and HSV(W)

DT8 Color control – RGB(W) and HSV(W)

ABB SmartTouch® KNX

ABB IP touch

App "Busch-ControlTouch®"

ABB RoomTouch® KNX

6-byte RGBW value (DPT 251.600)

3-byte RGB value (DPT 232.600)

4 x 1-byte RGBW value (DPT 5.001)

4 x 1-byte value (DPT 5.001)

4 x 4-bit dim (DPT 3.007)

Power adapter

DALI

DALI Gateway Premium DG/S x.64.5.1

Device Type 8 RGBW → one DALI address
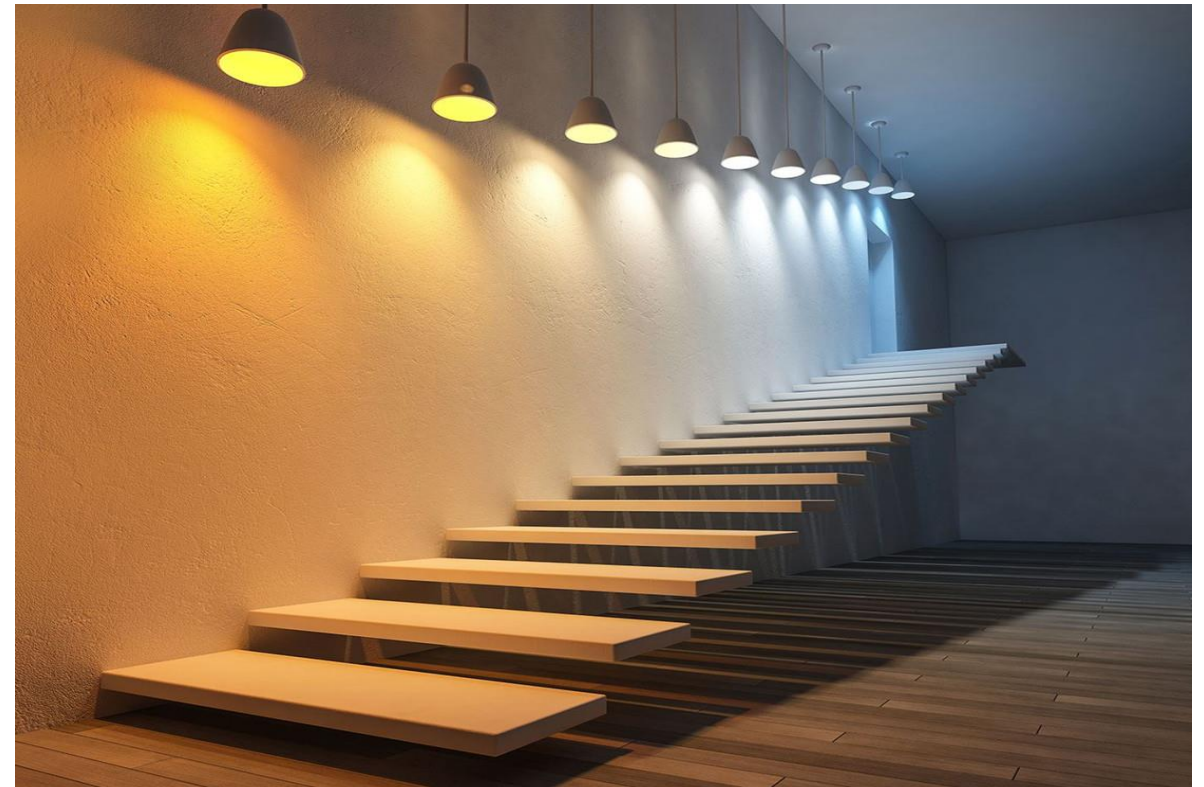
V+ R G B W

Source: Internet

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – DT8 Color temperature Tc (tunable white)

Tunable white – Color temperature control DT8

Change of color temperature T_C (warm and cold white) with dimming/setting of color temperature and brightness for lamps according to device type 8

– Typical range between 2,000K (Kelvin) and 6,000K depending on ballast and lamp

– Quality feature of light is not only brightness level, distribution in the room, no glare effects but also color temperature T_C

– Optimization of biological and emotional effects (performance and well-being) of light for human beings both in private environment and working activities

– Warm white → relaxation
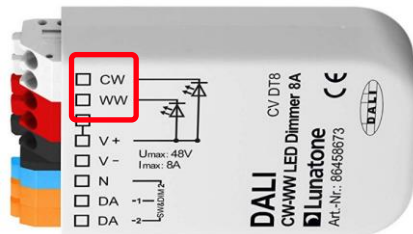 Cold white → activity

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – DT8 Color temperature Tc (tunable white)

Tunable white – Color temperature control DT8

– There is a distinction between warm and cool color temperature ranges, as follows

- Warm light (up to 3,300 Kelvin) is homely and comfortable This color of this light is rather like a sunset
- Neutral light (3,300–5,300 Kelvin) is stimulating and inviting, making it suitable primarily for working
- Cold light (5,300 Kelvin or more) is similar to daylight and promotes concentration

Ballast device type 8 T_C
→ one DALI address

3,000 Kelvin (warm white)   6,500 Kelvin (cold white)

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"

Dim2Warm

The following consideration is behind "Dim2Warm"

– The good old light bulb was never economical, but it could be dimmed so wonderfully: When we turned the dimmer down, the light became weaker and warmer at the same time

– A strongly dimmed light bulb no longer appears warm white, but already clearly orange

– When dimming LEDs, however, the colour temperature usually does not change

– No matter how far down a warm white LED strip is dimmed, it always remains constant - depending on which LED strip is used

– This is where Colour function "Dim2Warm" comes in, which simulate exactly this behavior

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"

What is "Dim2Warm"?

→ A change in colour temperature during dimming

Applications

– Quite a few people associate the change in colour temperature when dimming in the direction of warmer colours with cosiness and comfort

  • At home in the bedroom or in the living room like in the glow of candles or by the cozy fireplace

– To give the feeling of the warm and welcoming atmosphere

  • Hotel bar, restaurant, … in the evening

  • In the morning at breakfast

– …

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"

Brightness value 30%
3,000 Kelvin
(warm white)

Brightness value 90%
6,500 Kelvin
(cold white)
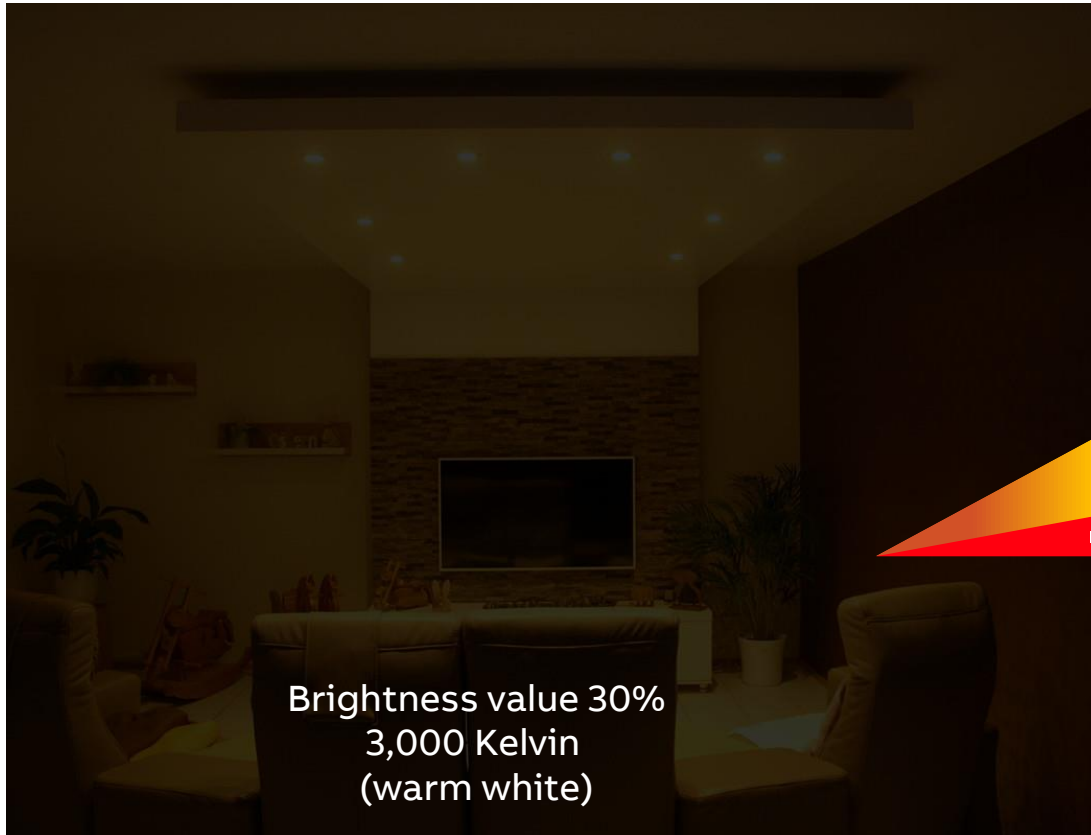
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"

What is "Dim2Warm"?

The DALI Gateway has an additional function called "Dim2Warm", which changes the colour temperature based on the brightness

The colour temperature changes proportionally to brightness

– Dimming up: Increasing of colour temperature
 → cold white

– Dimming down: Decreasing of colour temperature
 → warm white

Dim2Warm can be activated on a group or a ballast

This dependency is similar to the dimming behavior of a light bulb (light bulb effect)
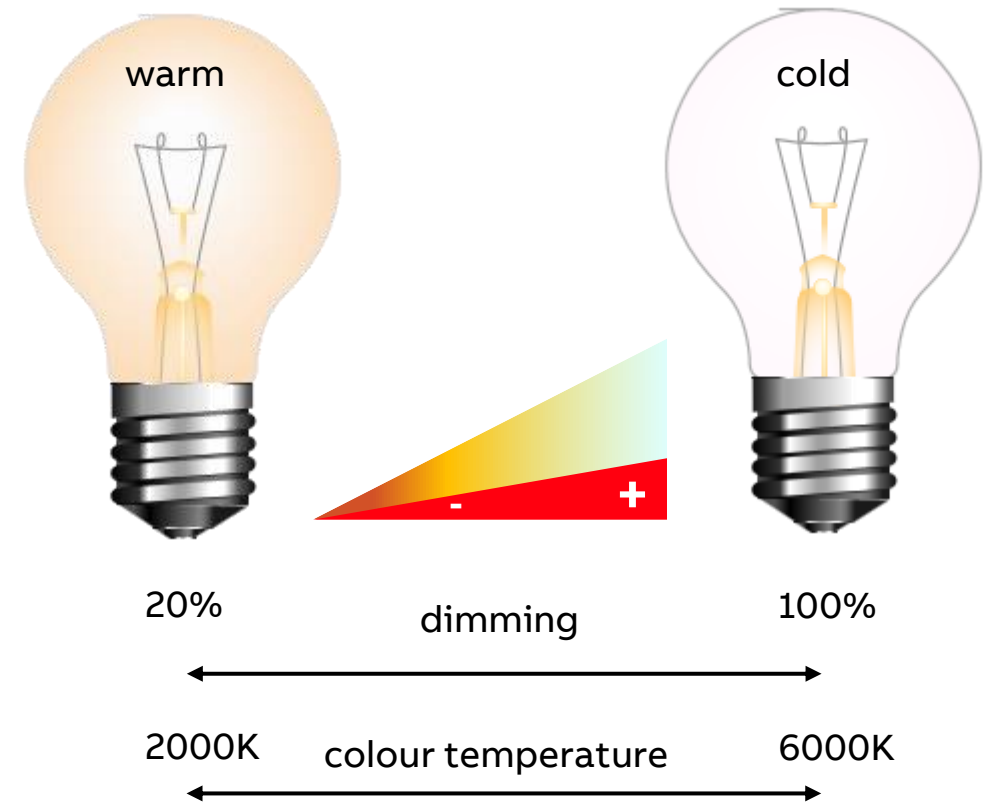
warm

cold

20%

dimming

100%

2000K

colour temperature

6000K

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"

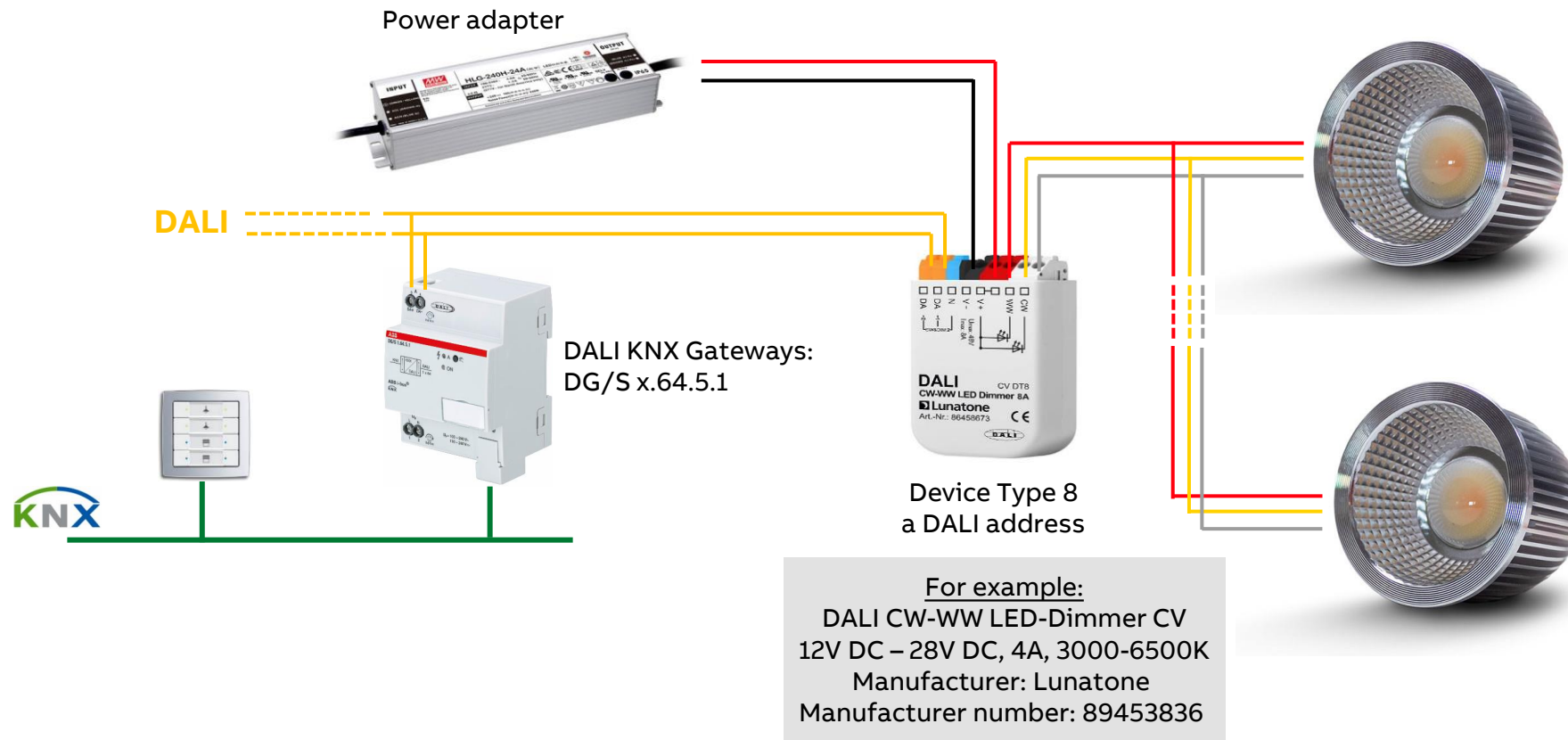**Commissioning of the Colour function Dim2Warm**

– Set ETS parameter: DALI Output A → <u>Group X or ballast X</u> → Colour functions … (template or individual)

- Enable colour function "The Dim2Warm" for the group/ballast

- "State after KNX recovery and download"

- Reaction on "Set colour temperature, "Dim colour temperature" and "Colour change by scene" when Colour function is active

– Set ETS parameter: DALI Output A → <u>Output</u> → Colour functions

- Enable the group object "*Output – Activate Dim2Warm colour function*" (if necessary)

- Limitation of the proportional and Colour temperature range (if necessary)

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Dim2Warm"
Example: Hardware for Tunable White with DALI and KNX

Power adapter

DALI

DALI KNX Gateways:
DG/S x.64.5.1

KNX

Device Type 8
a DALI address

For example:
DALI CW-WW LED-Dimmer CV
12V DC – 28V DC, 4A, 3000-6500K
Manufacturer: Lunatone
Manufacturer number: 89453836

For example:
Spot Deep Tunable white CV
8 W, 750 lm, 2200-6500 K
Manufacturer: ConstaLED
Manufacturer number: 31362

Source: Internet

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

What is Human Centric Lighting ?

The light of the sun is crucial for our health and well-being

Every artificial light source should therefore match the properties of sunlight as closely as possible

Light affects our mood and level of activity

Human Centric Lighting can adapt people's daily rhythms to one another and increase their motivation, well-being and productivity

Because our physiological response to light depends on the properties of light such as colour spectrum, intensity and timing, the properties of artificial light in our environment are of great importance when we spend a long time in closed rooms

Solutions with Human Centric Lighting can promote the circadian rhythm, improve the ability to concentrate, prevent sleep disorders and increase our general well-being
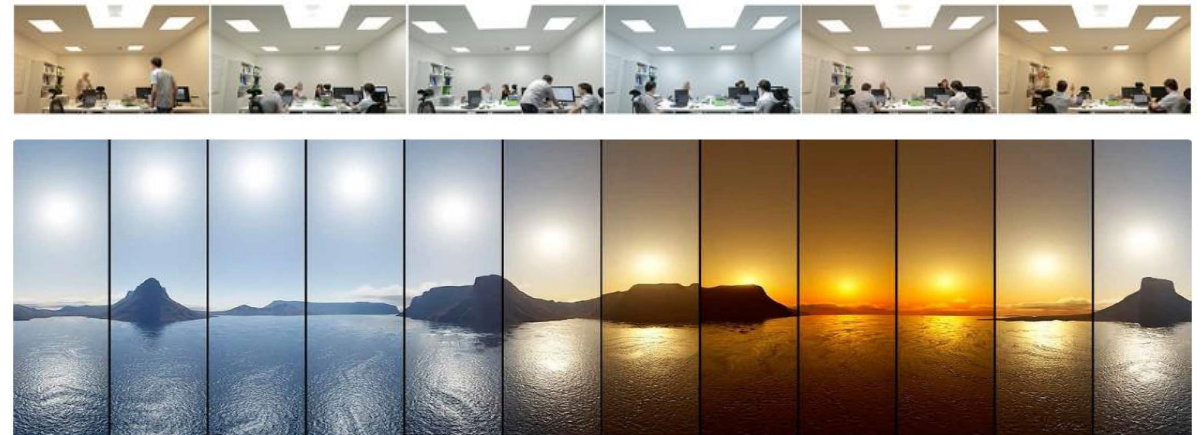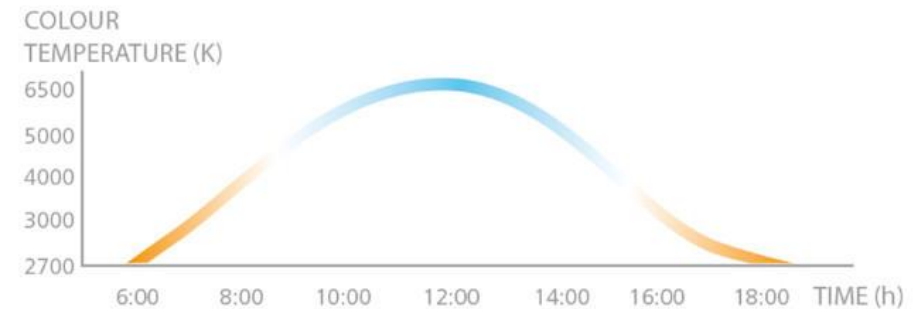
Source: Internet

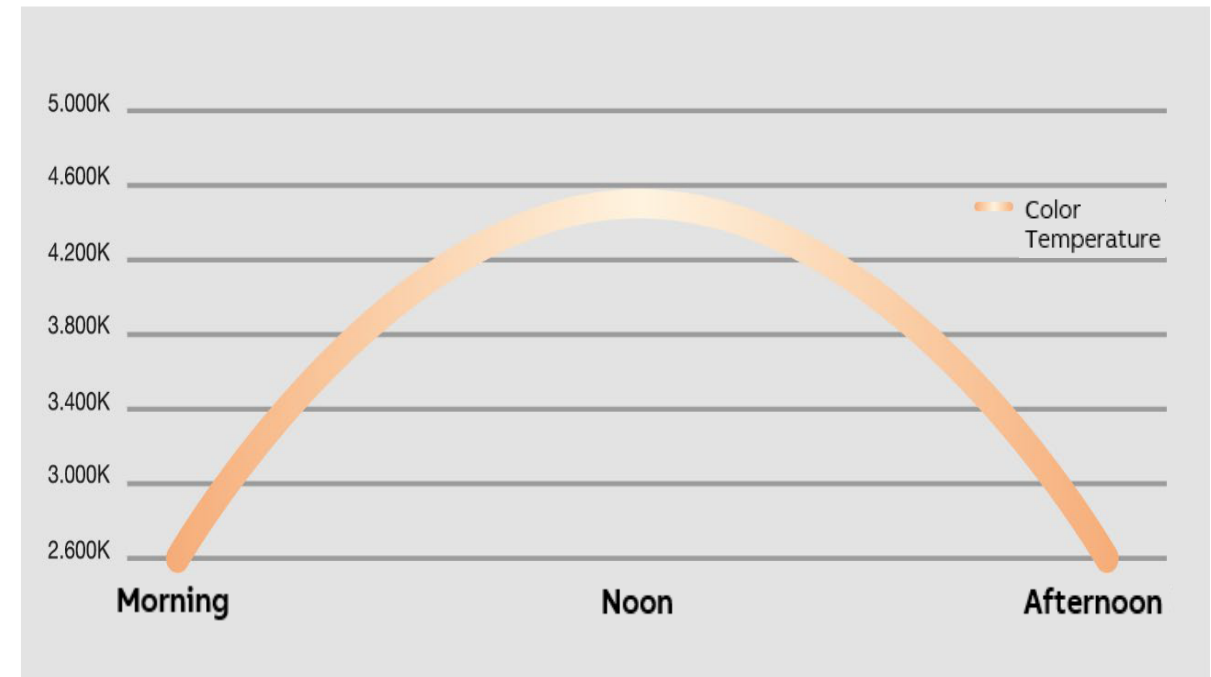# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

Principle

With Human Centric Lighting (HCL), the daylight is simulated in the building, means the colour temperature of the outside light is reproduced by colour temperature controllable lights in the room

Actually it is the function tunable white, automized for a dynamic and suitable light situation with change of colour temperature over the day and with all positive aspects mentioned before

In complex HCL lighting systems, brightness, light distribution, direction of light and colour temperature are varied. The dynamic of the daylight, the seasons and the location of the building are considered. Furthermore special light situation can be created, e.g. scene with cold light for focused working at a machine.

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

HCL solutions in educational institutions

A classroom is equipped with tunable white lights, which are partly controlled by an automatic sequence and partly via a control element/panel

The automatic sequence is parameterized in the DALI gateway (rising and falling ramp plus transition times)

The teacher can set a focus light with a short-term alertness-promoting effect for concentration tasks and a relaxation light during relaxation phases

- Energy light in the morning or focus light for class examinations: High illuminance, 6500 K

- Automatic light for normal activities: Normal illuminance and HCL active

- Relaxation light for relaxation phases and for storytelling: Normal illuminance, 2700 K

Source: Internet

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

HCL in offices

People spend most of their time awake in closed rooms

For this reason, office space is an excellent place for introducing Human Centric Lighting solutions

Such solutions can improve the energy and motivation of employees

– Exposure to more intense light can increase the feeling of alertness and vitality of the employee during the day and at night

– Intense, blue-enriched light can affect the individual's ability to maintain constant attention and cognitive performance during the day and at night

– Exposure to light during the day that affects the circadian rhythm can have a positive effect on the sleep of the worker the following night

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

HCL in healthcare facilities

In hospitals and nursing homes, residents often suffer from a lack of daylight due to their illness or restricted mobility

The long stay in closed rooms can interrupt the sleep patterns

Patients with dementia or other cognitive disorders in particular are sensitive to the loss of daylight

– Avoid mood swings and depression

– The emotional and physical well-being improves due to the more relaxing nights

– Reduce the need for sedatives

– The lack of daylight is compensated, which counteracts insomnia

– Improved employee well-being

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

HCL in industry

Lighting Installations with high illuminance and "tunable white" can have a positive effect on production output and reduce fatigue, errors and accidents

These effects are even greater with repetitive work tasks

Higher illuminance in combination with the correct light colour spectrum and careful timing of the different light settings can lead to increased alertness and attention among industrial workers

The result is less fatigue, which in turn reduces the risk of mistakes

For shift workers, the light can be used to shift the phases of the daily rhythm and to adapt more easily to the night work

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

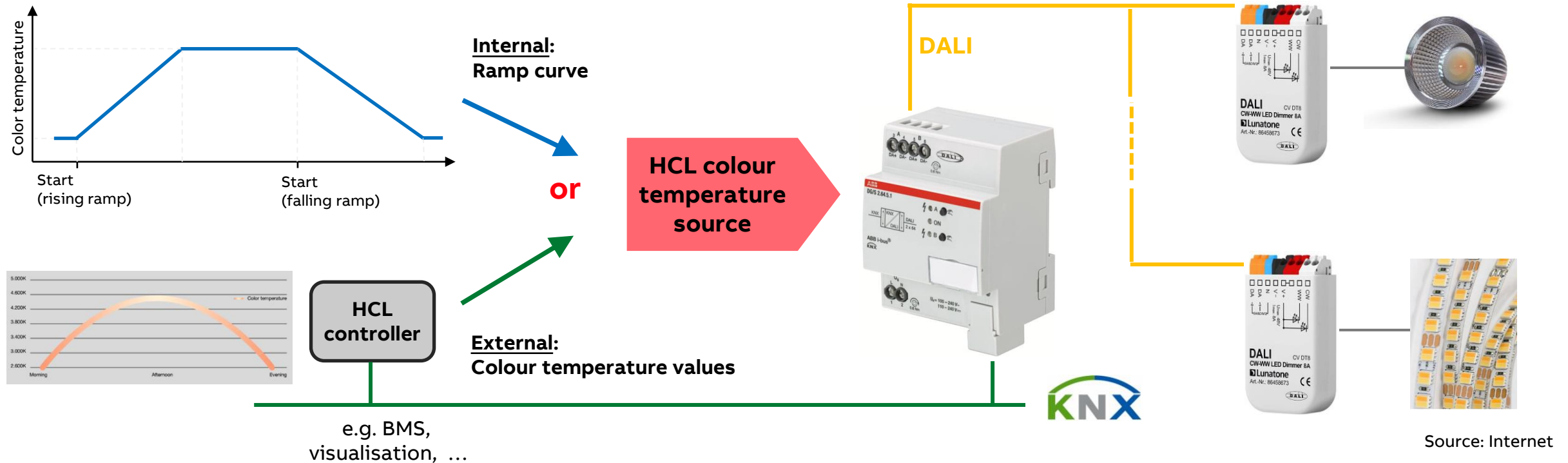DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

Commissioning of the Colour function HCL

– Set ETS parameter: DALI Output A → Group X or ballast X →
  Colour functions … (template or individual)

  • Enable the colour function "Central Colour temperature (HCL)"
    for the group/ballast

  • "State after KNX recovery and download"

  • Reaction on "Set colour temperature, "Dim colour
    temperature" and "Colour change by scene" when Colour
    function is active

– Set ETS parameter: DALI Output A → Output → Colour functions

  • HCL colour temperature source (16-bit group object *"Colour
    temperature"* or 1-bit group object *"Ramp curve"*)

  • Enable the group object "*Output – Activate automatic HCL
    colour function colour function*" (if necessary)

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Colour function "Human Centric Lighting HCL"

Internal:
Ramp curve

or

HCL colour temperature source

DALI

KNX

External:
Colour temperature values

HCL controller

e.g. BMS, visualisation, …

Source: Internet

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "DALI Sequences" (effect control)

Sequences

– A sequence is a series of brightness values or color gradients
 → Lighting effects made easy

- Shop

- Restaurant

- Hotel, e.g. outer facade, lobby

- Sauna, swimming pool, wellness areas

- Entertainment

- Medical applications (relaxation, color light therapy, mood enhancer, …)

- Human Centric Lighting HCL simulates the daylight in a building

- Different day and night sequence

- …

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "DALI Sequences" (effect control)

Sequences

– A sequence is used to call up other

  • Color values RGB(W) and HSV(W)

  • Color temperatures T_C

  • Brightness values

  one after the other

– 4 sequences per DALI output

– Each sequence consists of up to 11 individual steps (10+1)

– Each step can apply to a ballast, group, scene or output

– Defined stop behavior with end step

– A sequence can be started and stopped with the "Sequence x start-stop/Status" group object
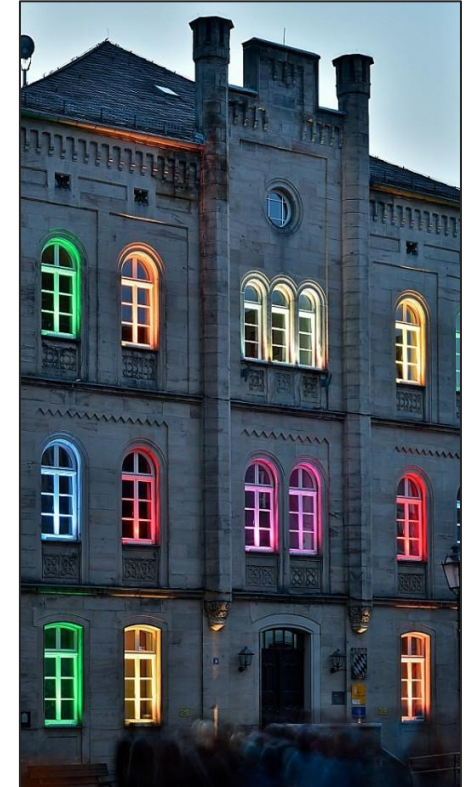
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "DALI Sequences" (effect control)

Sequences

Applications

- HCL – "Human Centric Lighting" to simulate the daylight in a building

- RGB(W) Color Control and color gradients

  - A Sequencer is used to call a different color every minute

  - The Sequencer runs endlessly

  - When stopping, the end step has been executed and the lighting is switched off
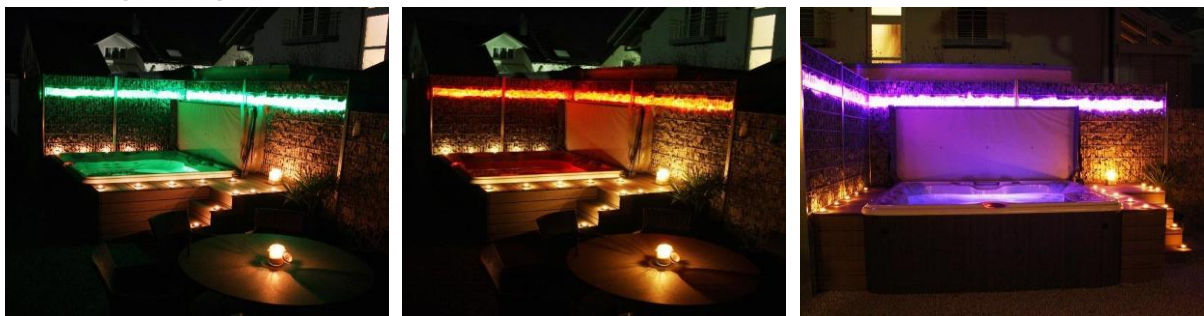
3.7.101 DG/S1.64.5.1 DALI Gateway,Premium,1f,MDRC > DALI output A > A Sequences > Sequence 3

General		

Number of steps: 10
Number of cycles (0...255, 0 = not limited): 0
Reaction on stop via KNX: ● End step ○ Co
Perform end step: ○ No ● Yes

Scenes, groups and ballasts used must be enabled.
Colors must be supported by output/groups/ballasts.
Dimming time and step duration start simultaneously.

Step	DALI	No.	Brightness	Color type	Color value	White value	Dimming time [s]	Step duration [s]
1	Group	5	100% (255)	RGBW	#FF0000	255	2	60
2	Group	5	100% (255)	RGBW	#FF9400	255	2	60
3	Group	5	100% (255)	RGBW	#CBFF00	255	2	60
4	Group	5	100% (255)	RGBW	#37FF00	255	2	60
5	Group	5	100% (255)	RGBW	#00FF6A	255	2	60
6	Group	5	100% (255)	RGBW	#00FFFF	255	2	60
7	Group	5	100% (255)	RGBW	#0065FF	255	2	60
8	Group	5	100% (255)	RGBW	#3700FF	255	2	60
9	Group	5	100% (255)	RGBW	#D000FF	255	2	60
10	Group	5	100% (255)	RGBW	#FF009D	255	2	60
End	Group	5	0% (OFF)	RGBW	#FFFFFF	255	2	60

Sidebar tree: General, DALI output A, A DALI configuration, A Output, A Group/ballast x template, A Groups, A Ballasts, A Emergency lighting converter, A Scenes, A Sequences (Sequence 1, Sequence 2, Sequence 3, Sequence 4)

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Load shedding"

Load shedding

Optimization of operating costs by avoiding load peaks

- With the "Load shedding" function, a load control master (e.g. KNX Energy Analyzer QA/S, Energy Actuator SE/S) can manage an electrical installation energy efficiently

- If a defined load limit is exceeded, the load control master sends commands in the form of load shedding stages on KNX and the actuators (e.g. Switch Actuator) react according to the parameterization

- <u>New</u>: Integration of the DALI Gateway into a load control system

- Every group or ballast can use the load shedding function

- The group/ballast receive the load shedding stages and react according to the parameterization
  → Limitation by setting the maximum brightness value

KNX Energy Analyzer QA/S 1.16.1

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Load shedding"

Load shedding

Target: Prevention of electrical load peaks due to limited power and installation availability or significant costs

– The master "KNX Energy Analyzer QA/S" sums up all received power values and manages depending on adjusted load limit the connected loads (turn on/off, dim) with priority

– Loads not able to send any direct energy consumption values can also be integrated into load shedding via an energy meter (Meter interface ZS/S or KNX Energy Module EM/S)

– Loads on each output can listen to load shedding stages from the QA/S to be turned off/on or dimmed depending on load threshold

– Beside the 1-byte object load shedding stage (DPT 236.001) the QA/S can send also for each of the 8 stages ind. 1-bit telegrams

– This allows to integrate easily also further loads controlled via other actuators which have no 1-byte object load shedding stage

→ **The max. brightness of the DG/S groups/ballasts can be temporarily limited via the "Receive load shedding stage" group object**
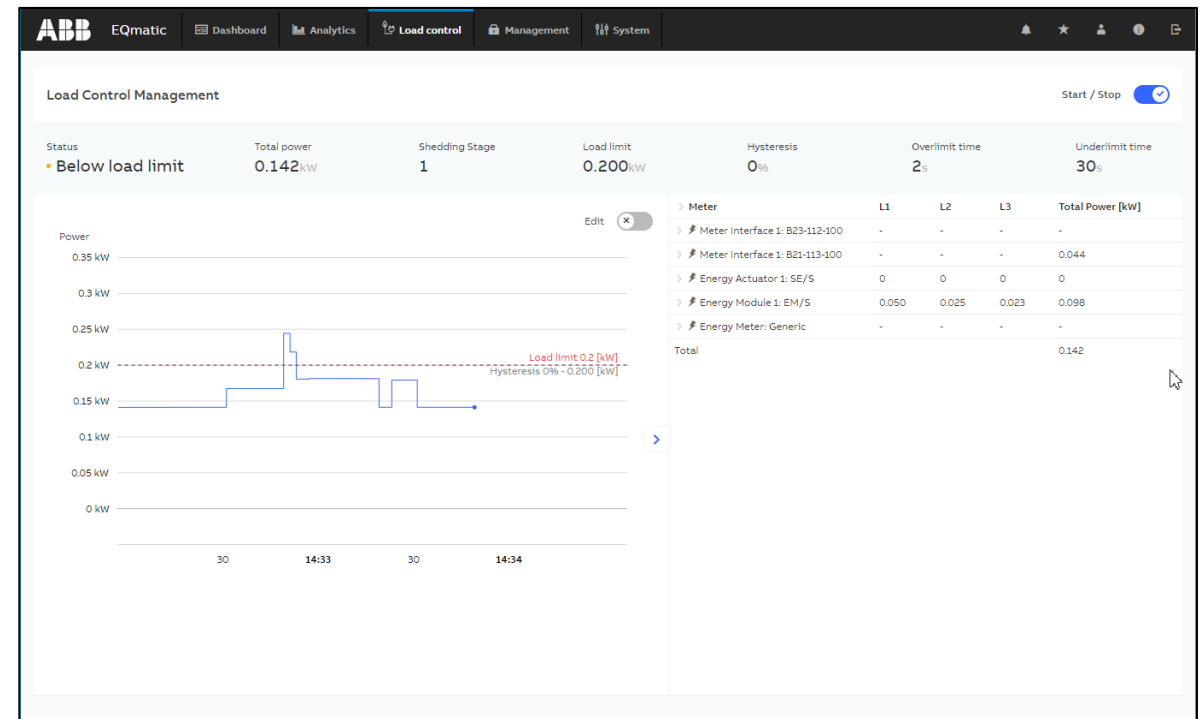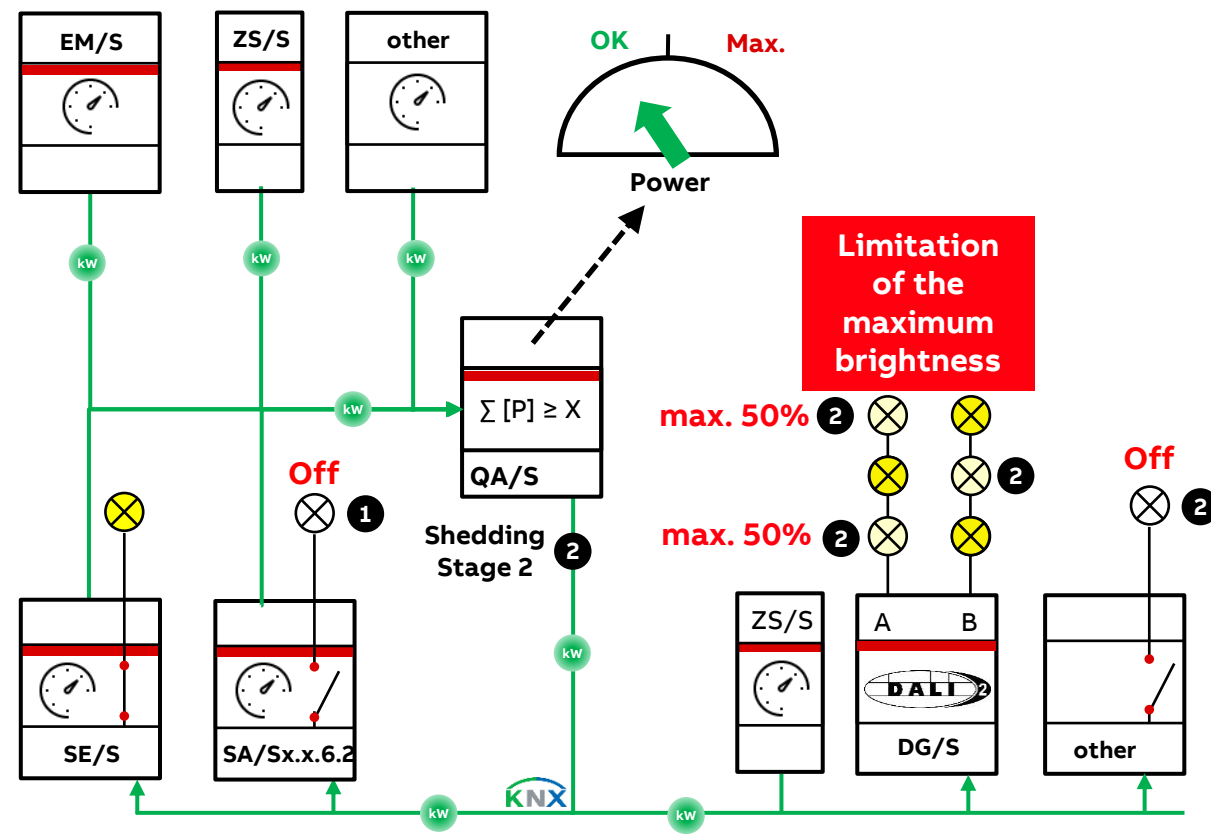
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Load shedding"

Overview "Load shedding"
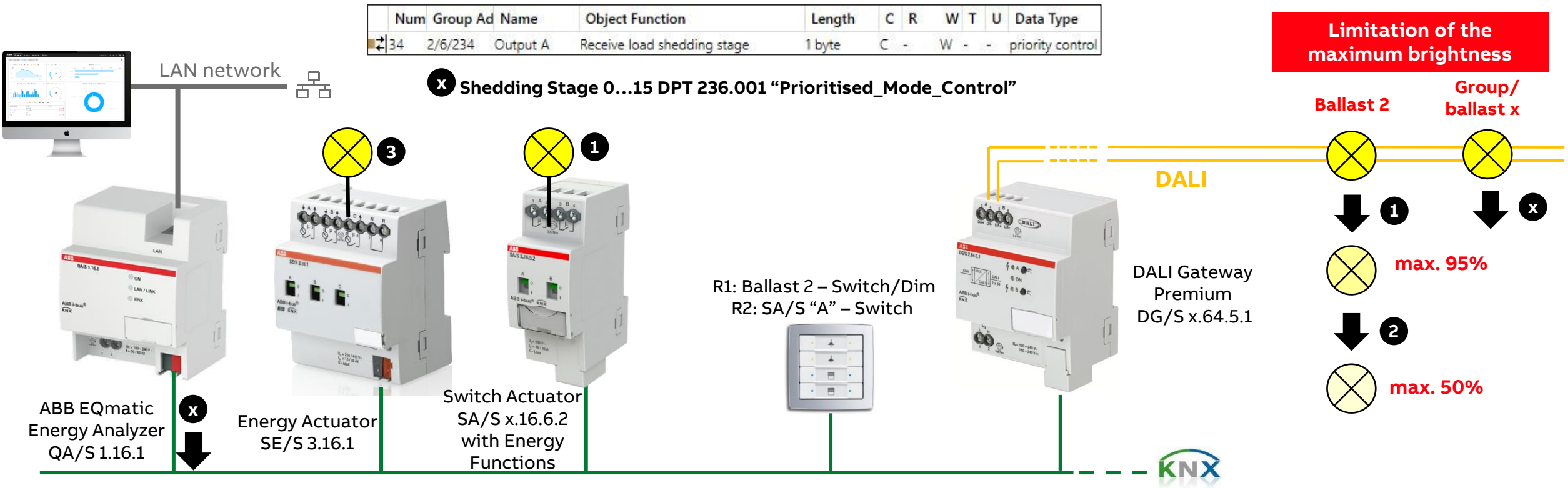
Num	Group Ad	Name	Object Function	Length	C	R	W	T	U	Data Type
34	2/6/234	Output A	Receive load shedding stage	1 byte	C	-	W	-	-	priority control

X Shedding Stage 0…15 DPT 236.001 "Prioritised_Mode_Control"

LAN network

Limitation of the maximum brightness

Ballast 2   Group/ ballast x

DALI

max. 95%

max. 50%

ABB EQmatic Energy Analyzer QA/S 1.16.1

Energy Actuator SE/S 3.16.1

Switch Actuator SA/S x.16.6.2 with Energy Functions

R1: Ballast 2 – Switch/Dim
R2: SA/S "A" – Switch

DALI Gateway Premium DG/S x.64.5.1

KNX

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Operating duration"

Operating duration

– The operating duration indicates how long a group or ballast remains switched on

– It enables you to identify and plan timely maintenance for a lamp change → over time, the lamps lose their luminosity

– The operating hours counter is <u>not</u> a mandatory function according to the DALI standard and is therefore <u>not</u> supported by many ballasts!!!

– The DALI Gateway counts the operating duration when a ballast is considered to be switched on
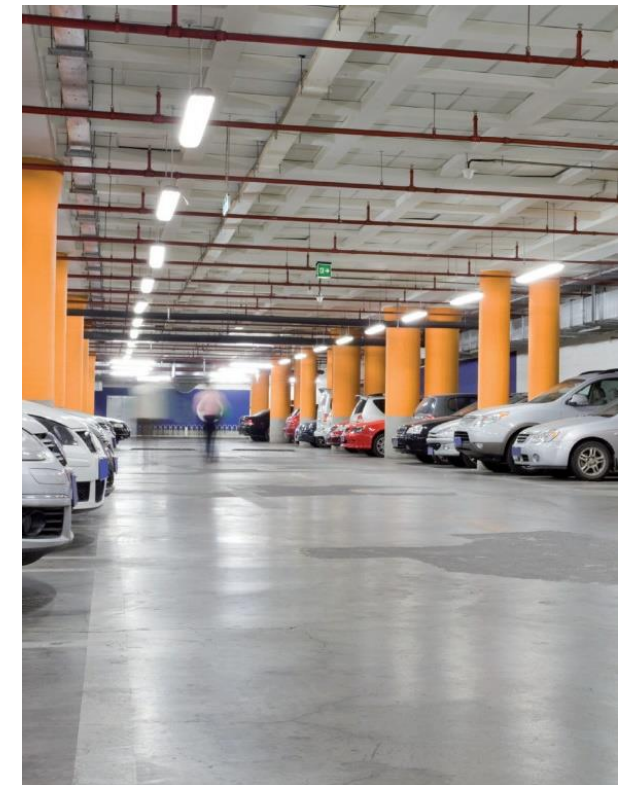→ The current brightness value is greater than 0% and there is no ballast or lamp fault

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Operating duration"

Operating duration

– Operating duration function

  • Per group and ballast (incl. alarm function and value)

  • Addressed (one group object for all ballasts and groups)

– Depending on the DPT format selected, the operating duration is sent on the bus in seconds or hours

– The operating duration can also be set with a write command (e.g. after a lamp has been replaced)

– The alarm function sends an alarm ("1") when the operating duration reaches its alarm threshold

– The operating time of a group is the operating time of the ballast with the most operating time within this group

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways
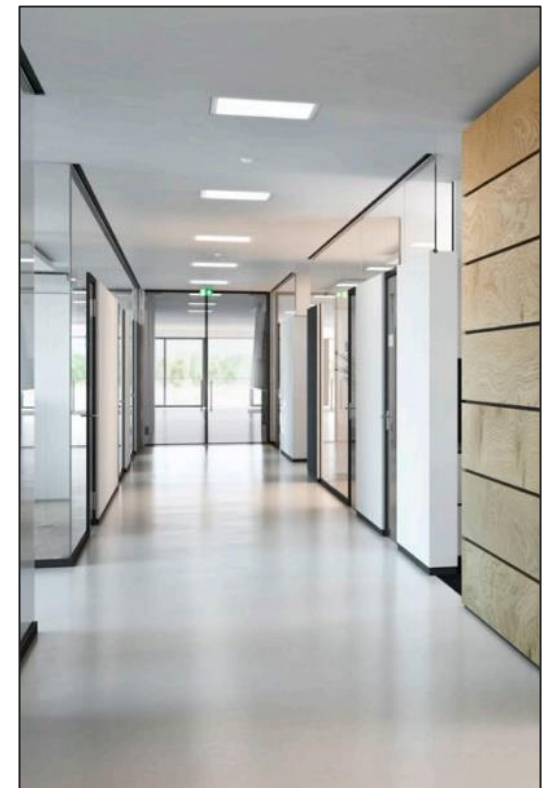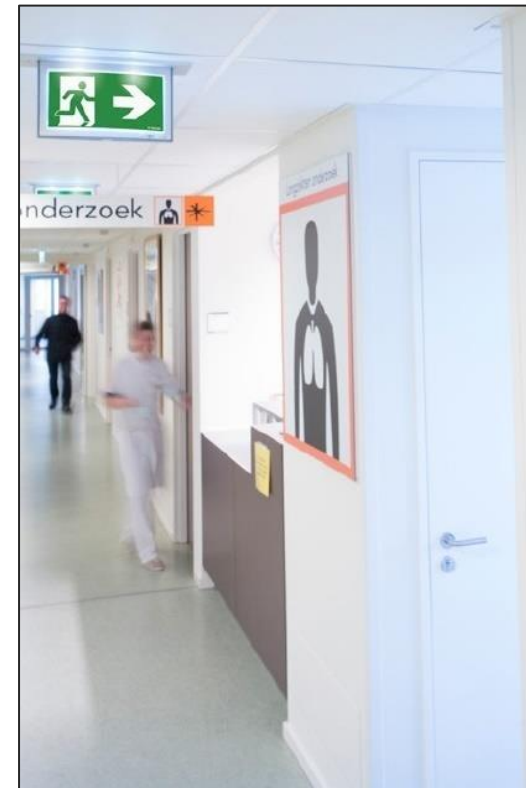
DALI Gateways Premium – Function "Standby switch-off"

Standby switch-off

All ballasts are permanently connected to the supply voltage

A modern ballast has a power loss of approx. 0.12 to 0.2 Watts in stand-by mode (switched off)

With a large number of ballasts in a building, this leads to a not inconsiderable energy requirement

The "Standby switch-off" function saves energy by switching off the supply voltage of ballasts when they are <u>all</u> in standby (switched off)

→This serves to save energy
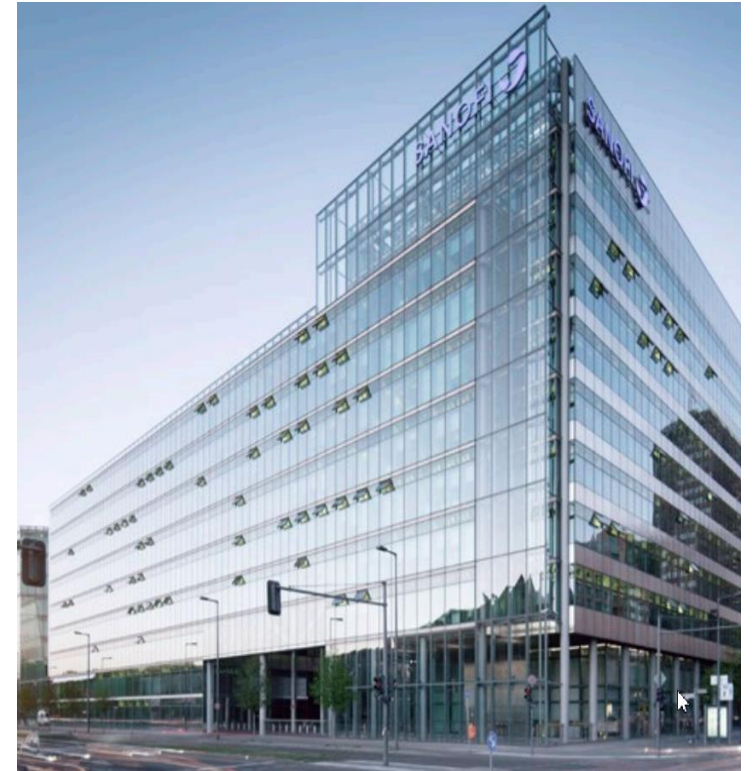
Source: Internet

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

Standby switch-off

If only one ballast remains on at a DALI output, no standby switch-off can be carried out

Standby switch-off is available for each DALI output, not for every ballast or group

The supply voltage can, but does not have to, be switched off for all ballasts

The supply voltage of the ballasts is switched on or off in combination with a KNX Switch Actuator SA/S and with a higher load via an installation contactor (e.g. ESB40)

The message "Ballast fault" is suppressed when the ballasts are switched off using the standby switch-off function

Installation contactor
(e.g. ESB40)

Switch Actuator
SA/S

Source: Lunatone Industrielle Elektronik GmbH

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

Standby switch-off

DALI emergency converter are not be integrated in Standby switch-off function

Requirements for the ballasts:

– Ballasts must support individual DALI power-on level (last value before failure), to be adjusted in the ETS Application under "Fault"

Installation contactor
(e.g. ESB40)

Switch Actuator
SA/S

Source: Lunatone Industrielle Elektronik GmbH

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

How does a "Standby switch-off" function work?

Some lights are turned on and all ballasts are supplied with supply voltage

→ no standby switch-off is possible

Supply voltage

DALI

Emergency converter

Ballast

standby switch-off

DALI Gateway
DG/S x.64.5.1

Switch
Actuator
SA/S

KNX

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

How does a "Standby switch-off" function work?

All lights are turned off and all ballasts are in standby at a DALI output

– After an adjustable delay time (1…65,535sec.) the standby switch-off function is <u>activated</u>

– A switch "OFF" telegram is sent on KNX

– All Switch Actuator SA/S channels linked with this group address switches off the ballasts supply voltage
→ All connected ballasts are deenergized

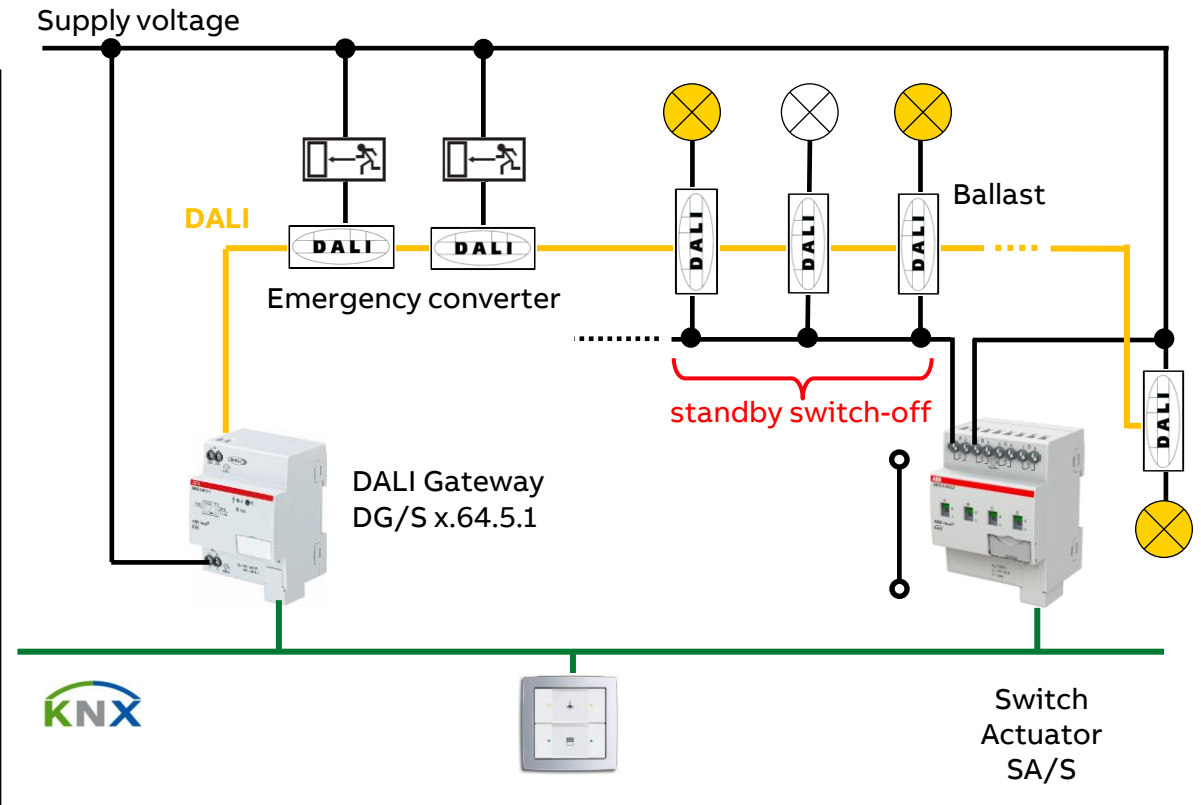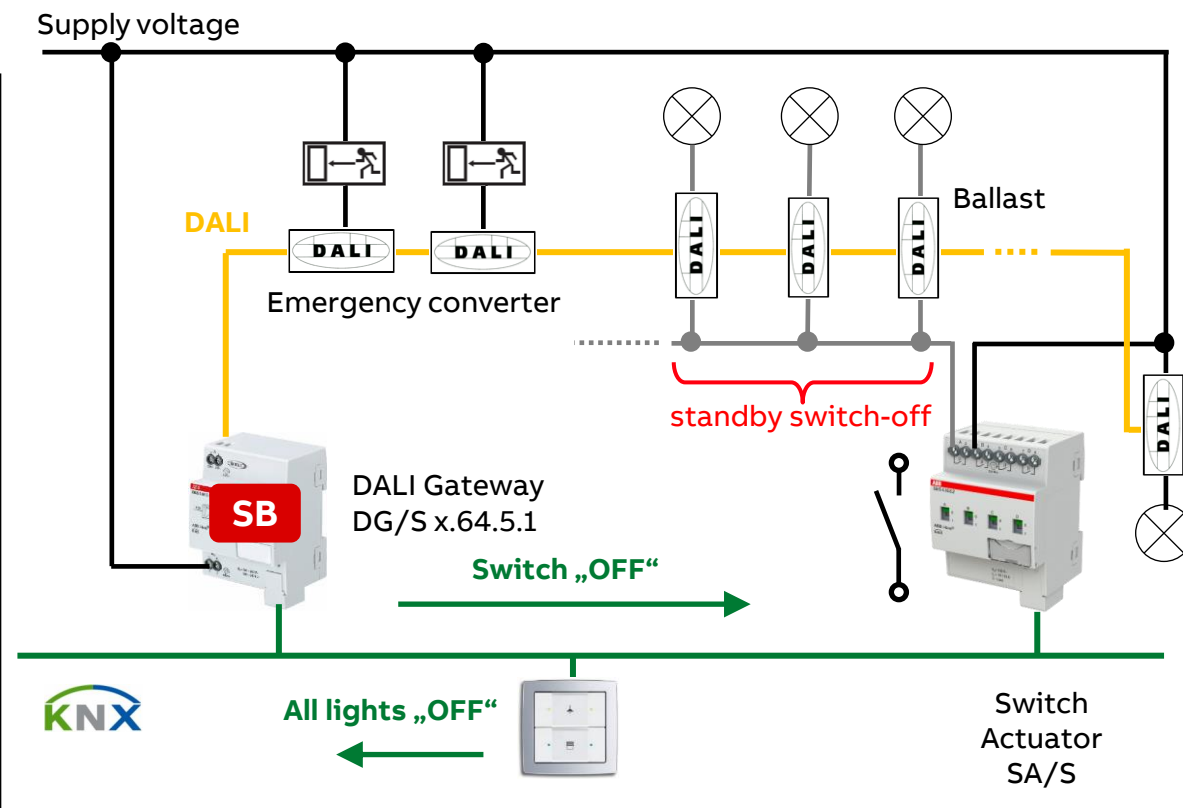– The DG/S message "Ballast fault" is suppressed

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

How does a "Standby switch-off" function work?

When the function is <u>active</u>, a KNX sensor (e.g. control element or presence detector) sends a group address to the DALI Gateway to switch on a DALI ballast/group

- The standby switch-off function is <u>deactivated</u>

- A switch "ON" telegram is sent on KNX

- All Switch Actuator SA/S channels linked with this group address switches on the ballasts supply voltage
  → All connected ballasts are energized

- After adjustable delay time (1…10sec., needed for restart of ballasts) all ballasts are ready to work

- The DALI Gateway sends an "ON" command to the DALI ballast/group and the light switches on

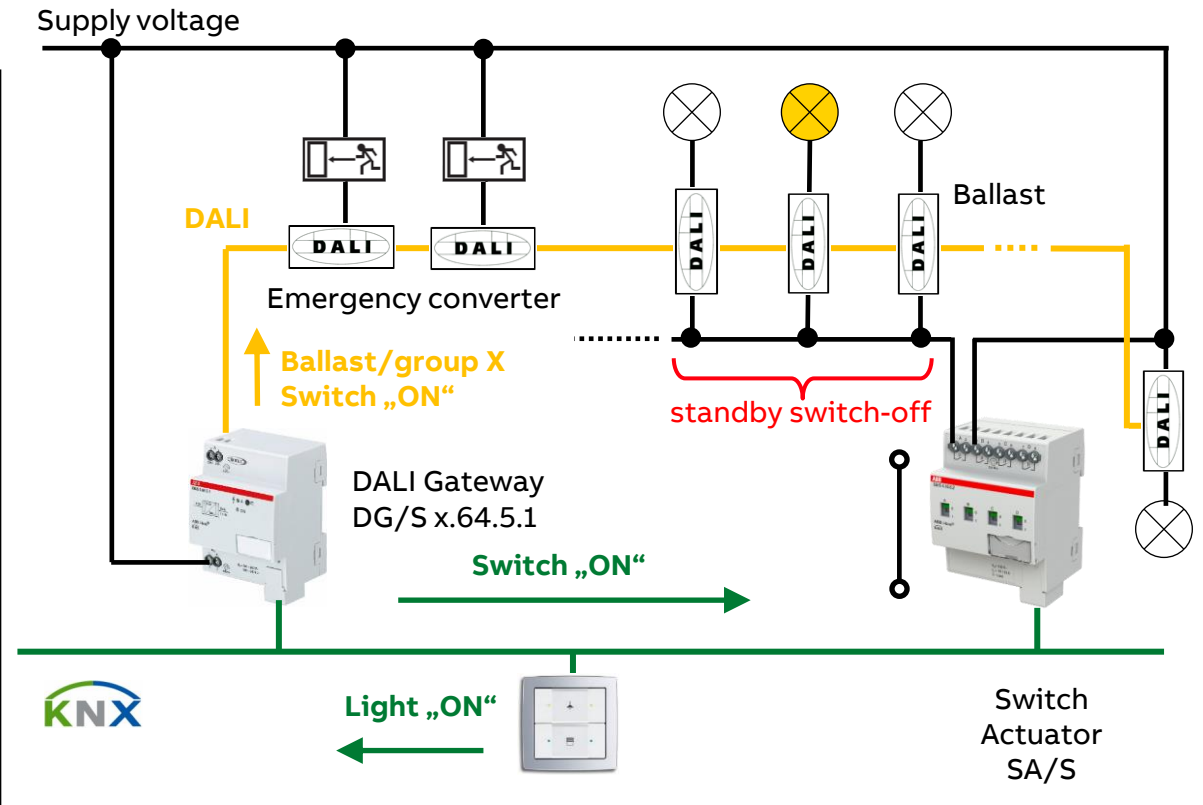- Further actions to turn on lights are without delay

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Gateways Premium – Function "Standby switch-off"

Commissioning of a "Standby switch-off" function

Set ETS parameter: DALI Output A → <u>Output</u> → Functions

– Enable DALI standby switch-off

– Set time of delay till switch-off (e.g. 5 min to avoid standby switch-off in case of short term standby situation)

– Optional: Enable group object "*Enable DALI standby switch-off*"

– Set time (1 ...10s) of delay after restart (needed for restart of ballasts, ballast restart time less than 1 sec. according to DALI standard)

Set ETS parameter: DALI Output A → <u>Group X or ballast X</u> → Fault template ... (template or individual)

– Select the "Last value before failure" parameter for <u>all</u> ballasts involved in Standby switch-off function

Connect the "*Standby switch-off*" group object to a Switch Actuator SA/S channel(s)

1.2.1 DG/S2.64.5.1 DALI Gateway,Premium,2f,MDRC > DALI output A > A Output > Functions

General	Enable group object "Activate Slave offset/Status"	No ● Yes
DALI output A	Enable function "Partial failure"	No ● Yes
A DALI configuration		
A Output	Fct. Enable standby switch-off	No Yes ●
Status	Switch off ballast power supply when all ballasts are switched off (Switch Actuator required)	
Fault	Delay time to switch-off	300 s
Functions	The delay time begins soon as all ballasts are switched off	
Colour functions	Enabling also via group object "Fct. Enable standby switch-off"	No ● Yes
A Group x/ballast x template	Delay time after switching back on	1 s
A Groups	Delay between switching on ballast power supply and first DALI command	
A Ballasts		

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

Constant Lighting Control with DALI

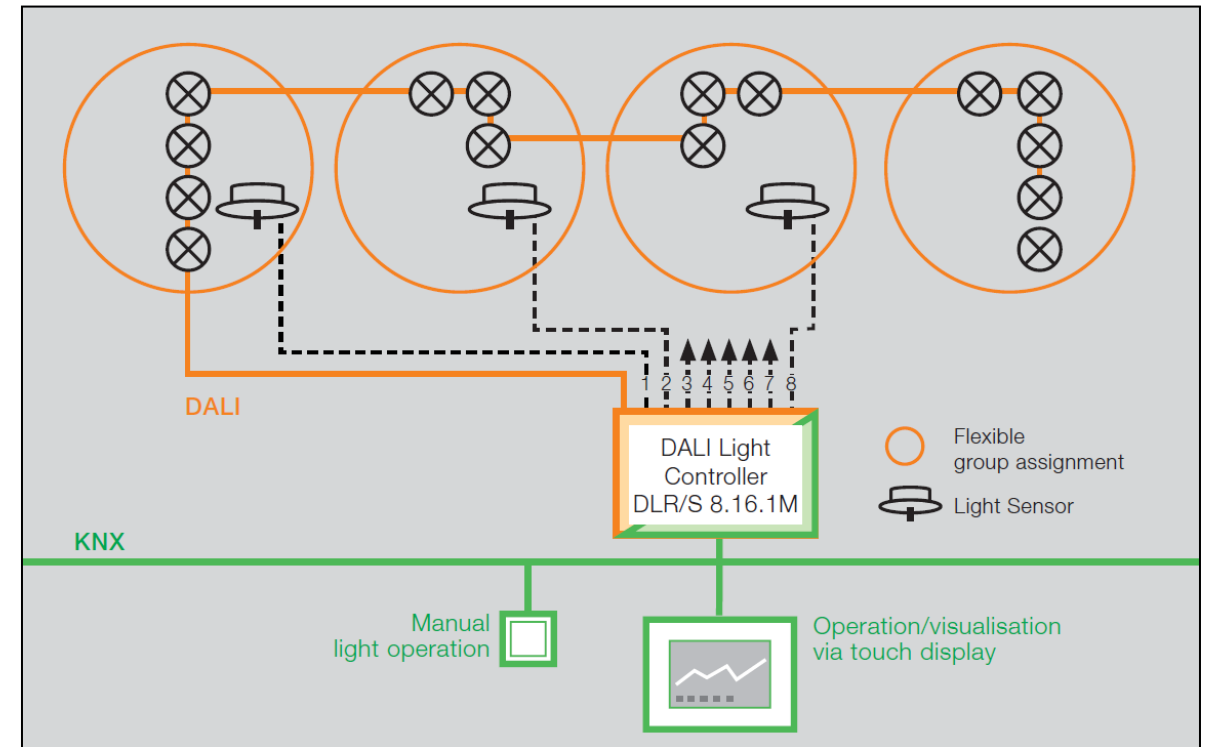# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Light Controller DLR/x

Constant Lighting Control with DALI

Principle

– In constant lighting control a light sensor installed on the ceiling measures the luminance of the surfaces in its detection range, e.g. the floor or the desks

– This measured value is compared with the predefined setpoint value, and the control value is adjusted so that the divergence between the setpoint and actual values is minimal

- If it is brighter outside, the share of artificial light is reduced

- If it is darker outside, the share of artificial light is increased

→ Energy saving and reduction of operating costs

→ Optimized working conditions with constant brightness

→ Energy Efficiency

**Together with a presence detector an ideal solution for lighting control in many commercial projects !**

DALI

KNX

DALI Light Controller DLR/S 8.16.1M

Flexible group assignment

Light Sensor

Manual light operation

Operation/visualisation via touch display

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Light Controller DLR/x

Constant Lighting Control with DALI
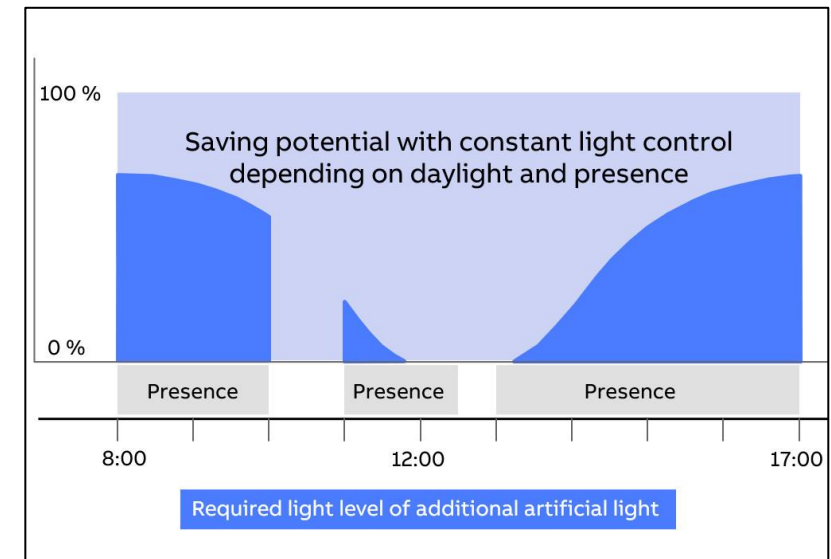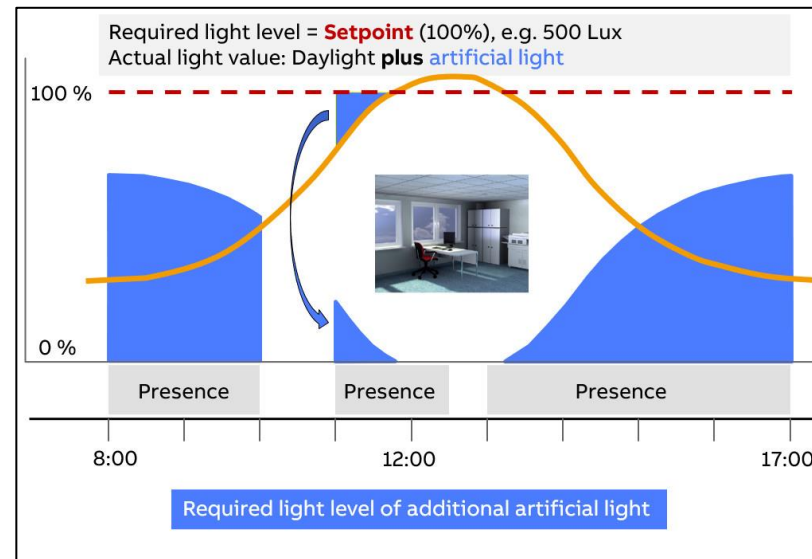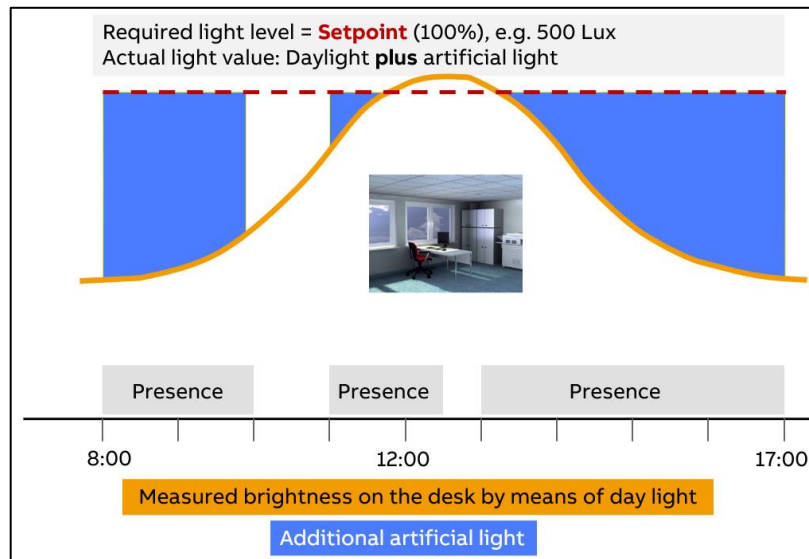
By combining constant light control and presence detection **up to 50% energy savings** are possible in a reference building according to DIN V 18599 resp. EN 15232 in comparison to manual switching (ON / OFF)

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Light Controller DLR/x

DALI Light Controller and Light Sensor

– DLR/S 8.16.1M
- 1 DALI channel controls 16 DALI groups (max. 64 DALI devices)
- 8 groups for constant lighting control
- Connection of eight light sensors (LF/U2.1)

– DLR/A 4.8.1.1
- Surface-mounted unit for decentralized DALI solution with integrated constant light control
- 1 DALI channel controls 16 DALI groups (max. 64 DALI devices)
- 4 groups for constant lighting control
- Connection of four light sensors (LF/U2.1)
- Housing IP54

– LF/U 2.1
- The light sensor measures brightness values in closed rooms
- It is connected directly to the DALI Light Controller

LF/U 2.1

DLR/A 4.8.1.1

DLR/S 8.16.1M

ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI Light Controller DLR/x

Constant Lighting Control with DALI

– A calibration must be carried out for each light control (different light reflections on the walls and floors, incidence of light on the windows, …)

– Easy and user-friendly commissioning and calibration by means of the ABB i-bus® Tool

– Calibration process includes a

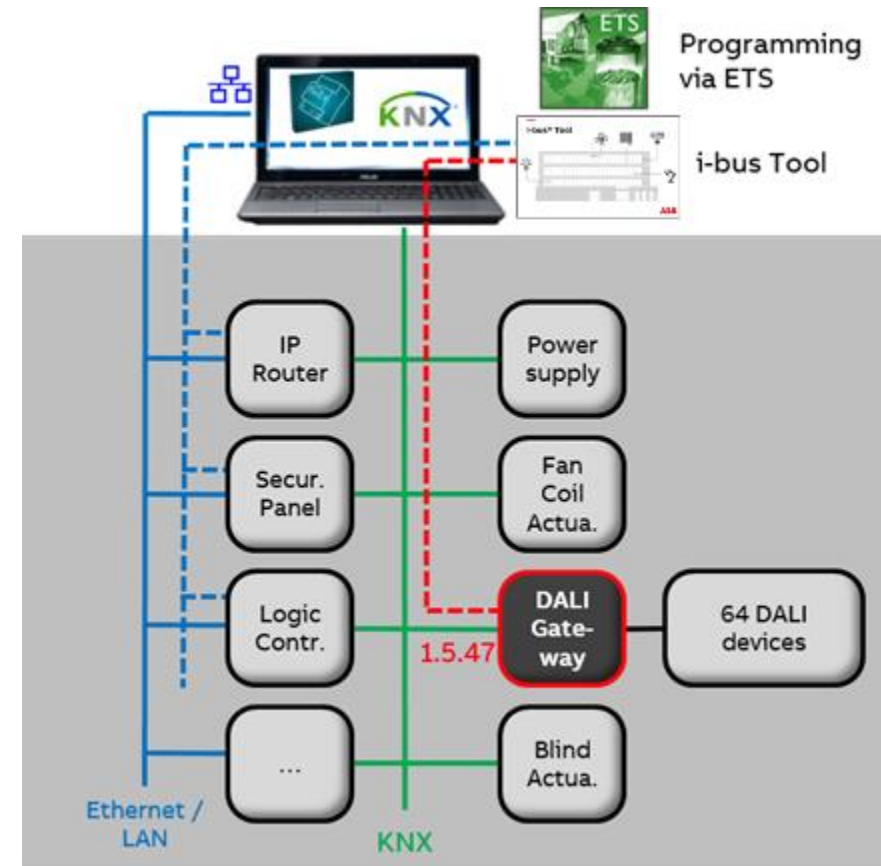- Artificial light calibration

- Daylight calibration
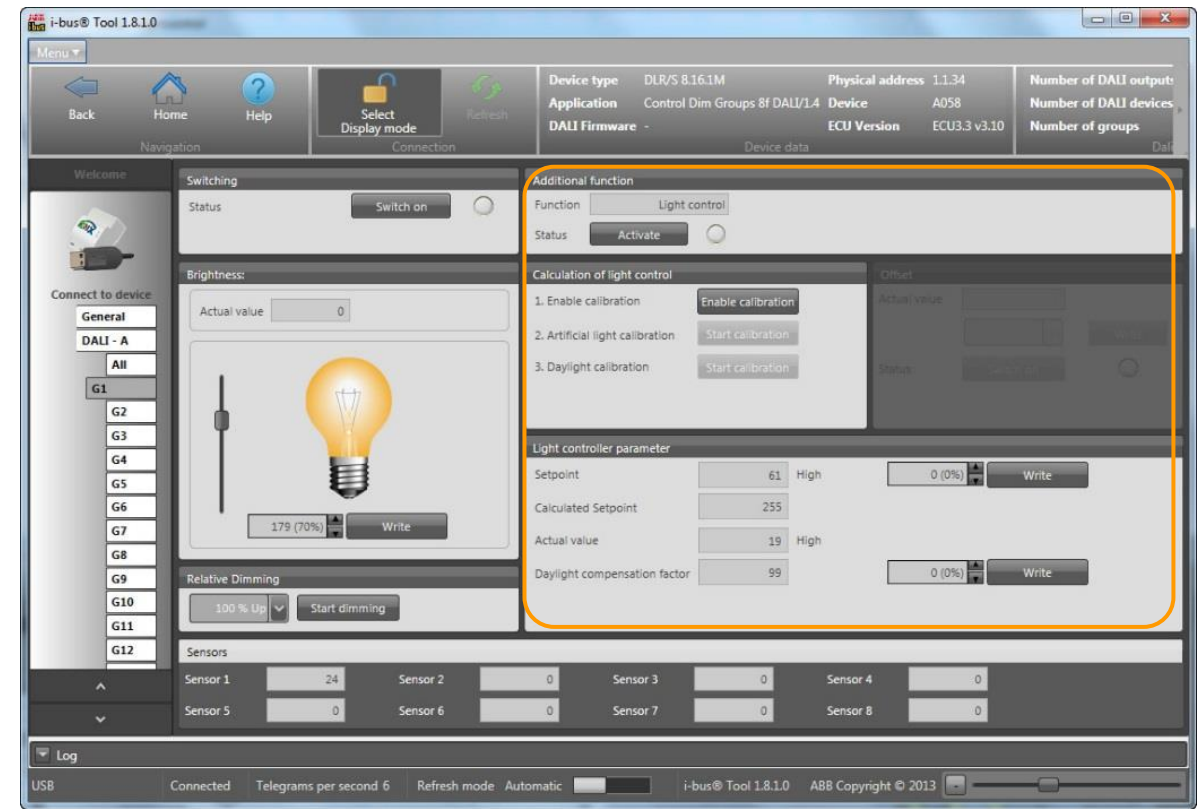
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

– ABB i-bus® Tool is an additional software tool to make life easier when working with ABB i-bus® KNX devices

– It supports system integrators and installers during commissioning and service

– The ABB i-bus® Tool accesses an ABB i-bus® KNX device via a standard KNX interface USB or IP (individual address)

– Internal information and states of the device hardware and software applications are now available in a transparent manner

– Device functions can be carried directly from the tool

– The i-bus® Tool is optional, i.e. the ABB i-bus® KNX devices must still be commissioned using just the ETS

– An important principle is that no divergences to the ETS project can result through the i-bus® Tool

– Most of the KNX products from ABB are supported by the ABB i-bus® Tool

# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

<u>Needed</u> to parametrize the DALI part of ABB's KNX DALI Gateways

Unique way to approach the DALI parametrization independent of the ETS in a user friendly way plus a lot of options to make live easier for integrators and installers during commissioning but also during maintenance and troubleshooting

Main features:

– Addressing DALI devices

– Assignment of the DALI devices into DALI groups

– Display of all lamp and ballast faults

– Status information and control of individual ballasts or DALI groups

– Tests and monitoring of DALI emergency light

– Commissioning of constant light control (DALI Light Controller)
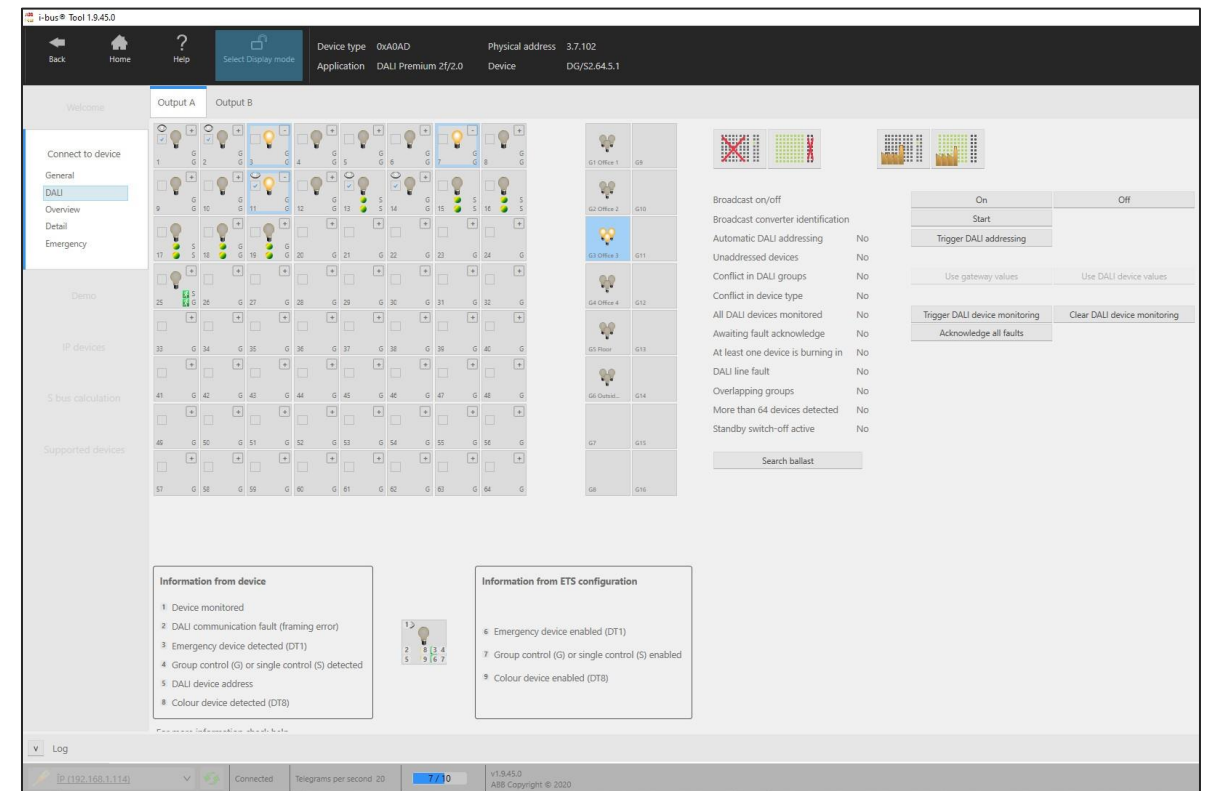
ABB

Back   Home   Help   Select Display mode

Device type   0xA0AD   Physical address   3.7.102

Application   DALI Premium 2f/2.0   Device   DG/S2.64.5.1

Light

Dark

Welcome

Connect to device

General

DALI

Overview

Detail

Emergency

Demo

IP devices

S bus calculation

Supported devices

DALI output(s) status

	DALI devices	Monitored	Conflict	Lamp fault	Ballast fault	DALI fault
Output A	20	5	No	0	0	No
Output B	0	0	No	0	0	No

DALI ballast selection

Brightness level (selected)   100% ⌄

Brightness level (unselected)   No change ⌄

Select emergency converters   By identification ⌄

Selection mode   Switching ⌄

Fade time   1s ⌄

Apply

Gateway status

Power supply   ■

Man. operation locked   No

Man. operation active   No

Used communication object memory space   0.0%

Report

☑ HTML

☐ TXT

File name   DaliReport_2021_7_6_13_55_35

Generate report   Cancel

v Log

IP (192.168.1.114)   Connected   Telegrams per second 20   7 / 18   v1.9.45.0   ABB Copyright © 2020   145%

Back | Home | Help | Select Display mode

| Device type | 0xA0AD | Physical address | 3.7.102 |
| Application | DALI Premium 2f/2.0 | Device | DG/S2.64.5.1 |

Light
Dark

Welcome

Connect to device

General

DALI

Overview

Detail

Emergency

Demo

IP devices

S bus calculation

Supported devices

Output A | Output B

G1 Office 1 | G9
G2 Office 2 | G10
| G11
| G12
| G13
| G14
| G15
| G16

Broadcast on/off
Broadcast converter identification
Automatic DALI addressing   No
Unaddressed devices   No
Conflict in DALI groups   No
Conflict in device type   No
All DALI devices monitored   No
Awaiting fault acknowledge   No
At least one device is burning in   No
DALI line fault   No
Overlapping groups   No
More than 64 devices detected   No
Standby switch-off active   No

Search ballast

On | Off
Start
Trigger DALI addressing

Use gateway values | Use DALI device values

Trigger DALI device monitoring | Clear DALI device monitoring
Acknowledge all faults

Information from device

1 Device monitored
2 DALI communication fault (framing error)
3 Emergency device detected (DT1)
4 Group control (G) or single control (S) detected
5 DALI device address
8 Colour device detected (DT8)

Information from ETS configuration

6 Emergency device enabled (DT1)
7 Group control (G) or single control (S) enabled
9 Colour device enabled (DT8)

v | Log

IP (192.168.1.114)   Connected   Telegrams per second 20   7 / 10   v1.9.45.0   97%
ABB Copyright © 2020

Back | Home | Help | Select Display mode

Light
Dark

| Device type | 0xA0AD | Physical address | 3.7.102 |
| Application | DALI Premium 2f/2.0 | Device | DG/S2.64.5.1 |

Output A | Output B

Welcome

Connect to device

General
DALI
Overview
Detail
Emergency

Demo

IP devices

S bus calculation

Supported devices

Device/Group   Device 13 Entrance ∨

Status

Status	🟩
Current level	255 (100 %)
Current colour (RGBW in HEX)	AD0EB000 🟪
Color enabled (ETS/Runtime)	True/True
Color type	CT_RGBW

Control

Control   On | Off

Level   199 (78 %)

Burn in and timers

Burn in	Inactive	Activate	Deactivate
Burn in time left	0h 0min		
Operating hours	8h	0 h ∧ ∨	Write

Additional function

| Staircase lighting | - | Activate | Deactivate |
| Slave | - | Activate | Deactivate |

Statuses

| Force lock | ⬜ | Lamp fault | 🟩 |
| Base brightness | ⬜ | Ballast fault | 🟩 |

Colour

| Selected colour function | None |
| Colour function status | Inactive |

Device supported colour types

Colour temperature Tc	No
XY coordinates	No
RGB(W) channels	4

Color control

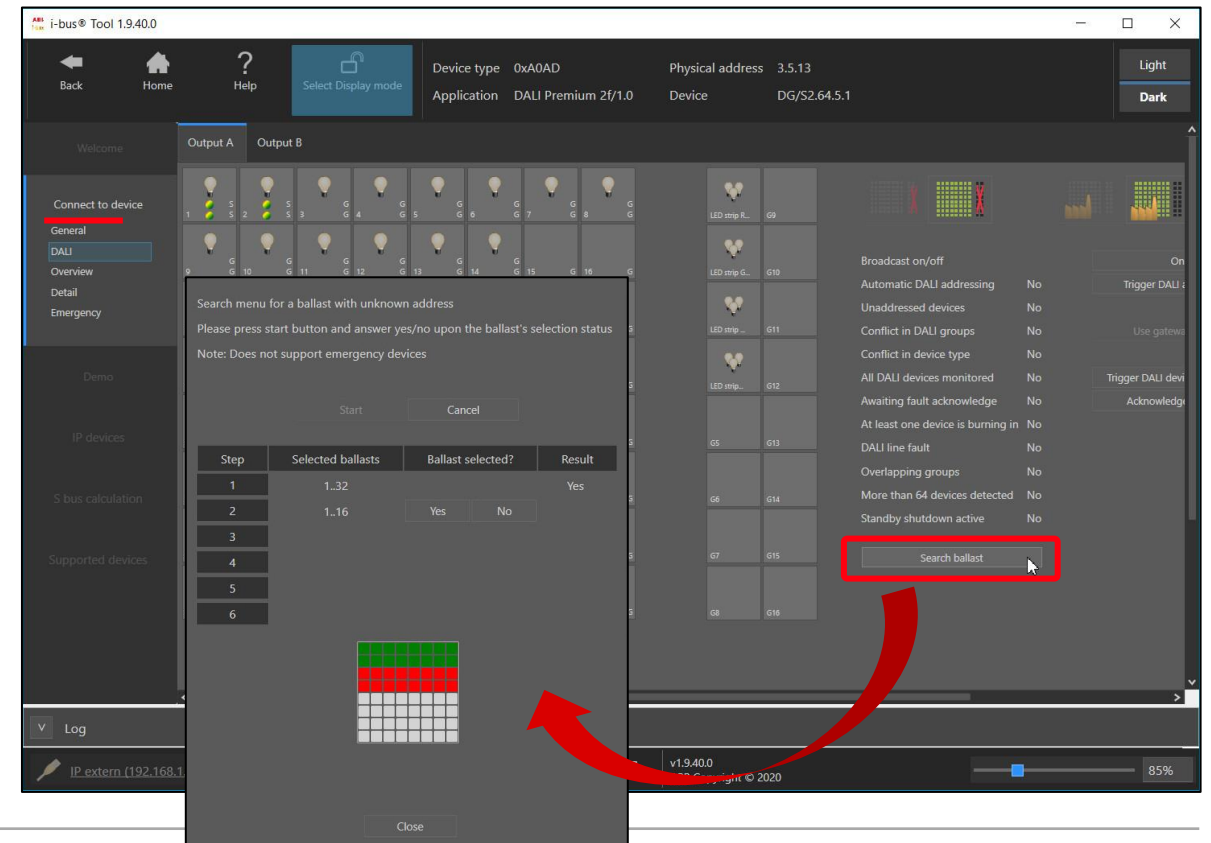| R | 173 |
G	14
B	176
H	298°
S	92%
V	69%
W	0%

Selected color

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

ABB i-bus® Tool – Search Ballast Function

– Search menu for a ballast with unknown address

– Current situation:
In the worst case, up to 64 address buttons must be pressed to identify the address of a ballast

– Search ballast function reduces it to max. 6 clicks!

– Press "Start" button and answer yes/no upon the ballast´s ON/OFF status
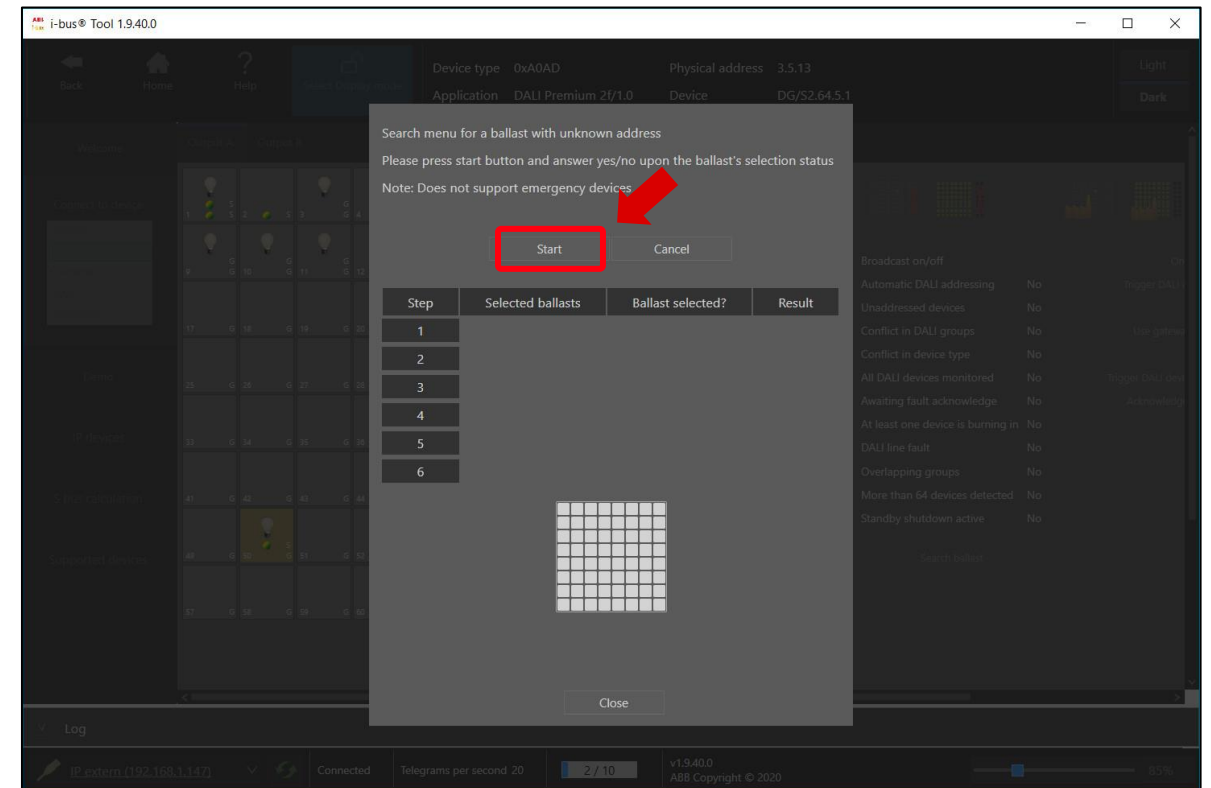
– Emergency devices are not supported

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

ABB i-bus® Tool – Search Ballast Function

– Press "Start" button

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

ABB i-bus® Tool

ABB i-bus® Tool – Search Ballast Function

Is the light of the ballast to be searched on?

- Press the "Yes" or "No" button → 1st click
  e.g. "No" (no address between 1…32)

- Press the "Yes" or "No" button → 2nd click
  e.g. "No" (no address between 33…48)

- Press the "Yes" or "No" button → 3rd click
  e.g. "YES" (no address between 49…56)

- Press the "Yes" or "No" button → 4th click
  e.g. "YES" (address between 49…52)

- Press the "Yes" or "No" button → 5th click
  e.g. "YES" (address between 49…50)

- Press the "Yes" or "No" button → 6th click
  e.g. "No" (address 49?)

→ Result, e.g. address 50
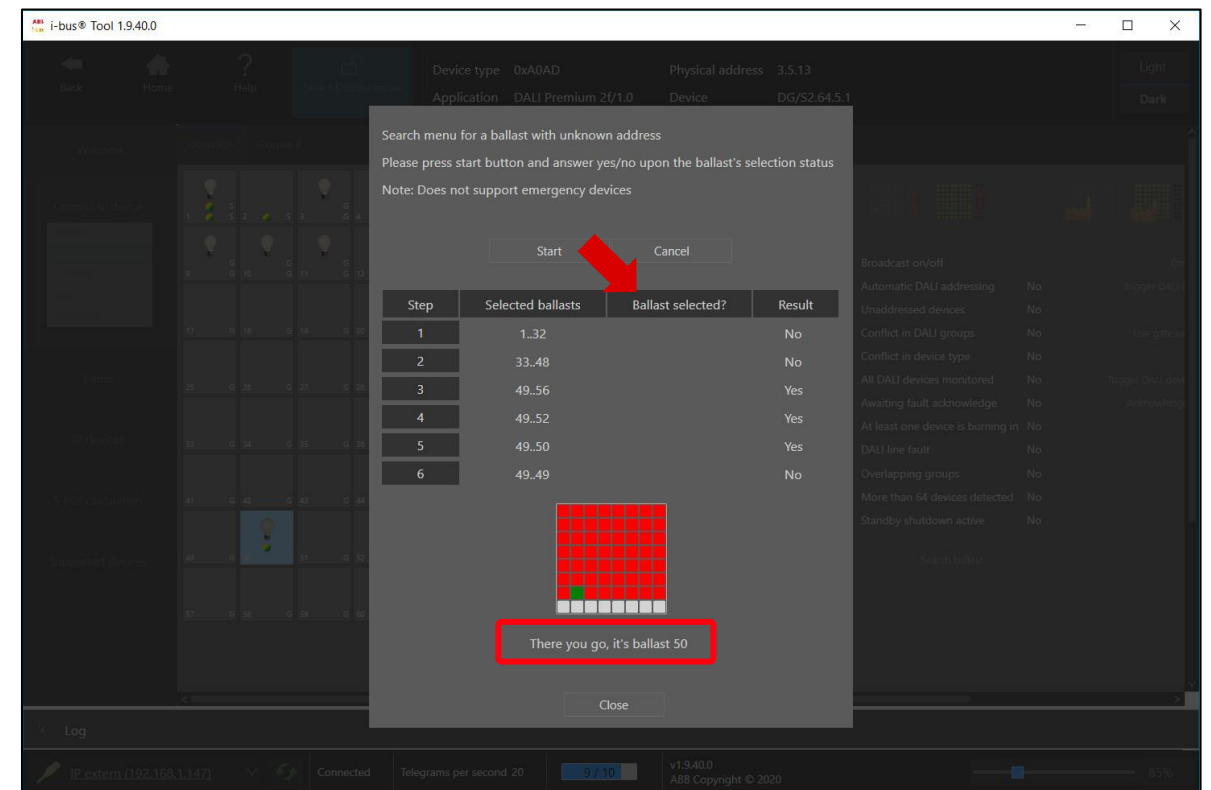
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

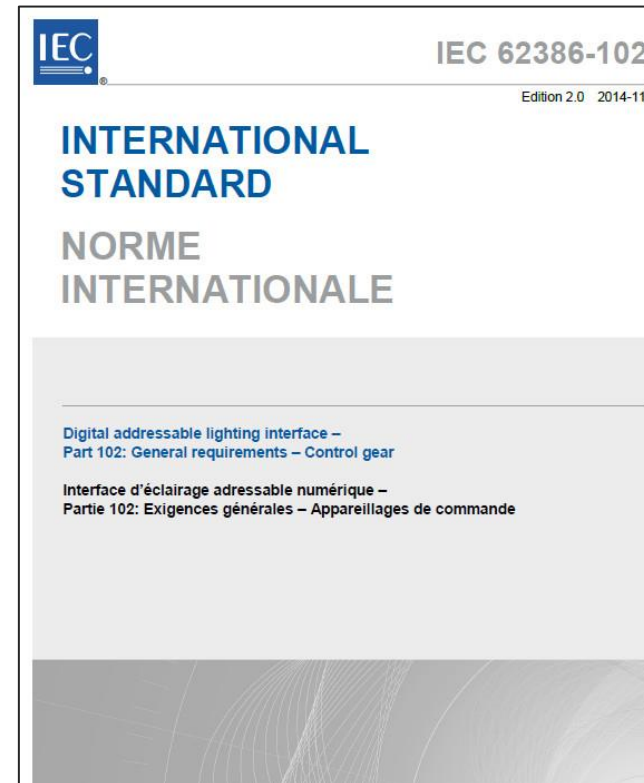# Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

Diagnostic with "DALI Monitor" and DALI USB Interface

– IP Router IPR/S or IP Interface IPS/S
  (5 tunneling connections)

– ETS with Group-/Bus Monitor

  • Recording and analysis of KNX telegrams

– DALI USB Interface with DALI Monitor software
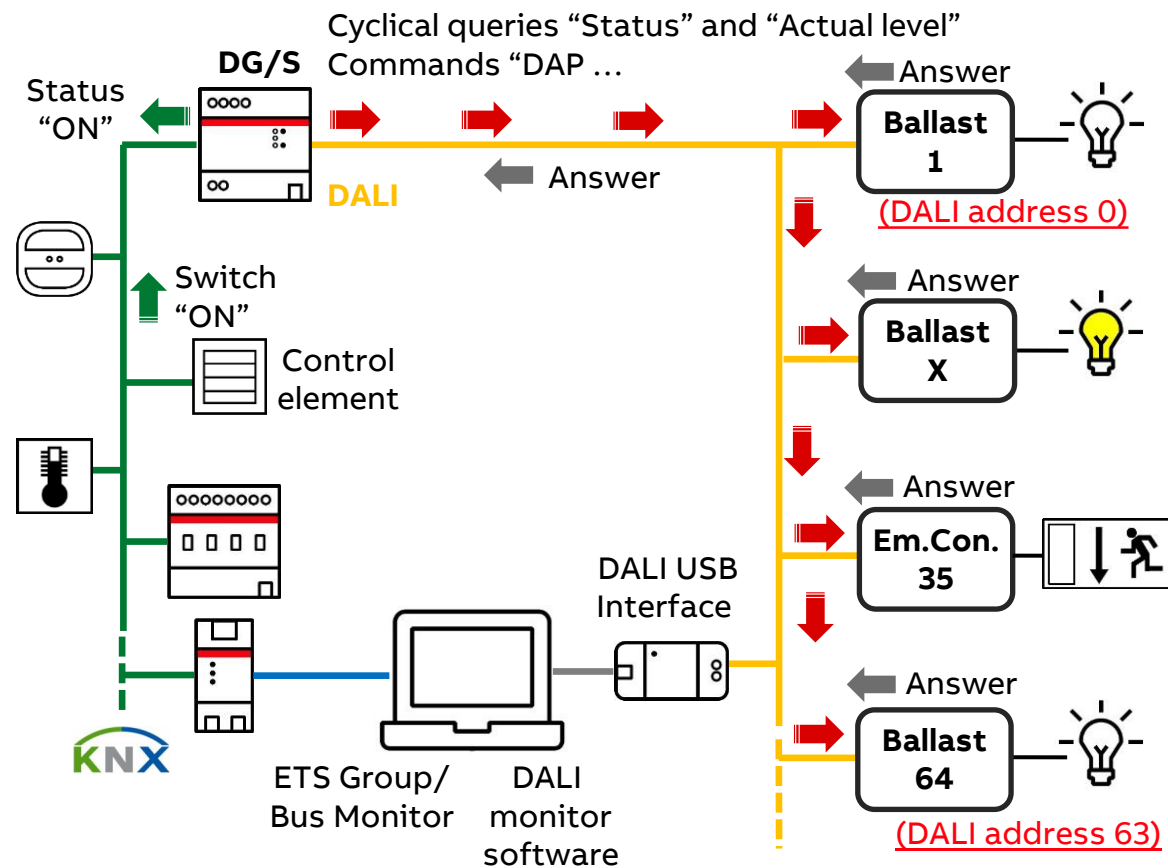
  • Recording and analysis of DALI telegrams
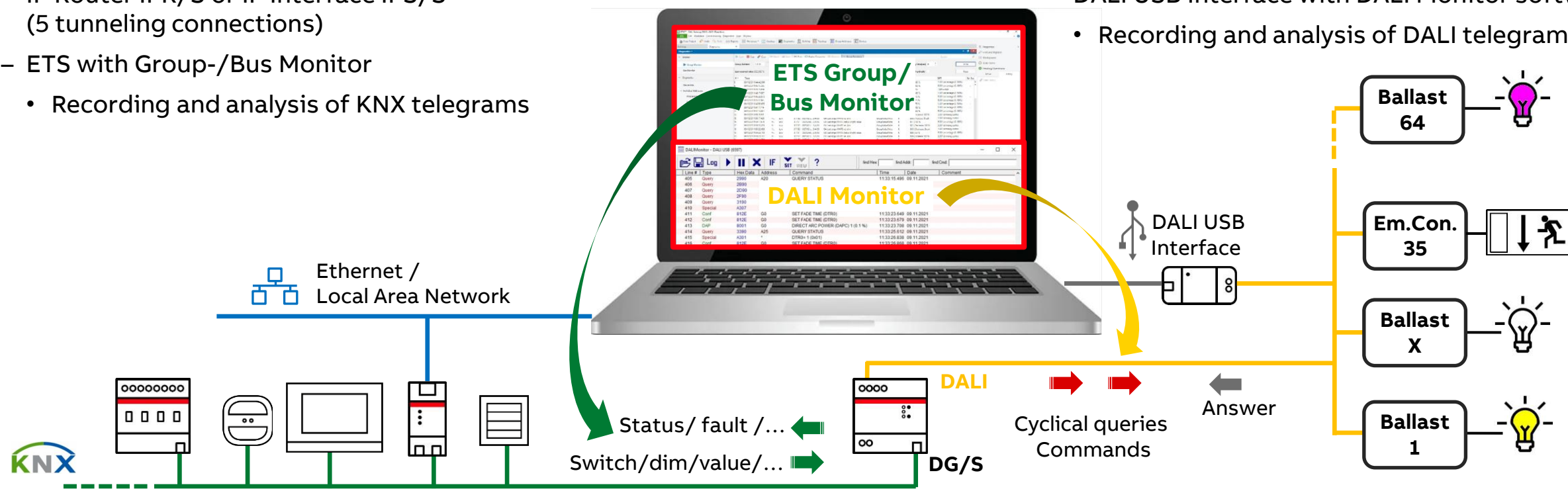
Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

– The DALI commands are specified in the International Standard IEC 62386 Part 102 "General requirements – Control gear"

– The DALI Gateway as the Master sends <u>commands</u>

- Level instructions (direct arc power, go to scene, …)

- Special commands (program short address, write memory location, initialize, ping, …)

- Configuration instructions (set min/max level, set fade time, store actual level, add to group, …)

and <u>cyclical queries</u> to all DALI devices (slaves), e.g. status, actual level

IEC | IEC 62386-102

Edition 2.0 2014-11

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Digital addressable lighting interface –
Part 102: General requirements – Control gear

Interface d'éclairage adressable numérique –
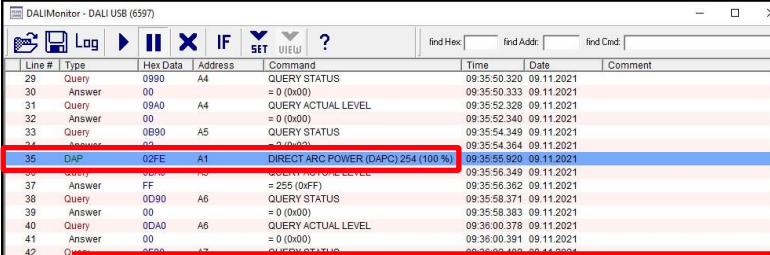Partie 102: Exigences générales – Appareillages de commande

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

- ETS: The group- /bus monitor records the KNX telegrams
- DALI monitor software: Records the queries and commands sent by the DALI Gateway and answers from the devices
- Note: All DALI addresses are shifted by the value "1"
  - Address range KNX 1...64 → DALI 0...63
  - KNX DALI device 1 → DALI address 0
    ...
    KNX DALI device 64 → DALI address 63
  - KNX DALI group 1 → DALI group 0
    ...
    KNX DALI group 16 → DALI group 15
  - KNX DALI scene 1 → DALI scene 0
    ...
  - KNX DALI scene 16 → DALI scene 15

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

The most common <u>DALI commands</u>

– Direct Arc Power Control (ballast or group)

- When "DAP (*level*)" is received, the ballast starts fading to the desired level

- The transition begins with the corresponding fade time

Level instruction "Direct Arc Power Control" – <u>DALI address 1</u>: 254 level (100% light output)
→ KNX ballast 2 !

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

The most common <u>DALI commands</u>

– Direct Arc Power Control (ballast or group)

- When "DAP (*level*)" is received, the group starts fading to the desired level

- The transition begins with the corresponding fade time

Level instruction "Direct Arc Power Control" – <u>DALI group 3</u>: 204 level (26% light output)
→ KNX group 4 !

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

The most common <u>DALI commands</u>

– Go To Scene

• The scene value stored in the ballast is recalled

Level instruction "Go to DALI scene <u>0</u>" – broadcast
→ KNX scene 1 !

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

DALI <u>cyclical queries</u> (DALI address <u>0…63</u>)

- Queries are used to retrieve property values from a device
- The addressed device returns the queried property value in a backward frame
  - Query status
  - Query actual level
  - Query power on level
  - Query lamp fault
  - Query missing short address
  - Query control gear present
  - Query device type
  - ….


```
IEC 62386-102:2014 © IEC 2014          – 5 –

11.5    Queries ............................................................. 63
  11.5.1    General ........................................................ 63
  11.5.2    QUERY STATUS ........................................... 63
  11.5.3    QUERY CONTROL GEAR PRESENT ............... 63
  11.5.4    QUERY CONTROL GEAR FAILURE ................ 63
  11.5.5    QUERY LAMP FAILURE ............................... 63
  11.5.6    QUERY LAMP POWER ON ............................ 63
  11.5.7    QUERY LIMIT ERROR .................................. 63
  11.5.8    QUERY RESET STATE .................................. 63
  11.5.9    QUERY MISSING SHORT ADDRESS ............... 63
  11.5.10   QUERY VERSION NUMBER ........................... 64
  11.5.11   QUERY CONTENT DTR0 ............................... 64
  11.5.12   QUERY DEVICE TYPE ................................. 64
  11.5.13   QUERY NEXT DEVICE TYPE ........................ 64
  11.5.14   QUERY PHYSICAL MINIMUM ........................ 64
  11.5.15   QUERY POWER FAILURE .............................. 64
  11.5.16   QUERY CONTENT DTR1 ............................... 64
  11.5.17   QUERY CONTENT DTR2 ............................... 64
  11.5.18   QUERY OPERATING MODE ........................... 65
  11.5.19   QUERY LIGHT SOURCE TYPE ...................... 65
  11.5.20   QUERY ACTUAL LEVEL ............................... 65
  11.5.21   QUERY MAX LEVEL ..................................... 65
```

| 606 | Query | 0B90 | A5 | QUERY STATUS |
| 607 | Answer | 02 | | = 2 (0x02) |

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

DALI <u>cyclical queries</u> (DALI address <u>0...63</u>)

– The DALI Gateway automatically and cyclically sends queries on the DALI line

– The commands are sent between the queries

– This queries are used to determine whether there is a DALI device with a DALI address, lamp fault, ...

– The pause between DALI queries can be parameterized
  - Options: 0...20...255 x 100 msec.
  - This parameter setting has an impact on the DALI telegram load
  - A long interval reduces the load significantly
    → However, a fault on a DALI device may not be detected straight away
    → Pause of 2 sec and 2 queries per device → a fault is detected after 126 seconds at the latest

3.7.151 DALI DG/S > DALI output A > A DALI configuration

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

DALI cyclical queries (DALI address 0...63)

– The DALI Gateway DG/S Basic and Premium as the Master sends

  - Query "Status" (8-bit, combination of device properties)
    Bit 0: Ballast fault
    Bit 1: Lamp fault
    Bit 2: Lamp on
    Bit 3: Limit error
    Bit 4: Fade running
    Bit 5: Reset state
    Bit 6: Short address is masked
    Bit 7: Power cycle seen
    → The answer is transferred and sent to KNX, e.g. lamp fault

  - Query "Actual level" (8-bit)
    The answer is not evaluated and can be used for diagnosis with DALI monitor tool

Query "Status" to DALI address 5 (A5)
Answer from addressed ballast: 02hex → 00000010
Bit 0: No ballast fault
Bit 1: Lamp fault
Bit 2: No lamp on
Bit 3: No limit error
Bit 4: No fade running
Bit 5: No reset state
Bit 6: No short address is masked
Bit 7: No power cycle seen
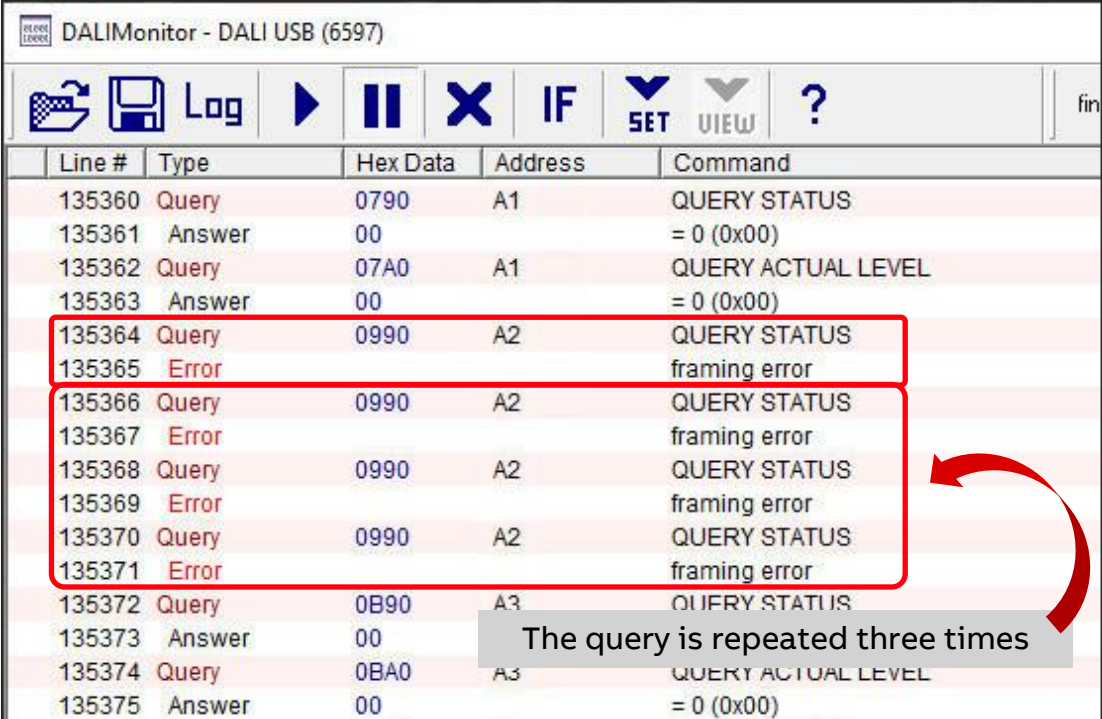
ABB

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

DALI commands and cyclical queries

Example: "FE" – Framing Error

– A framing error exists if no clear DALI telegram is received when the DALI device is polled

– This can occur if

- The DALI device does not send a DALI compliant telegram
- The DALI telegram was disrupted by external signal interference
- Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received (DALI double addresses)

DALIMonitor - DALI USB (6597)

Line #	Type	Hex Data	Address	Command
135360	Query	0790	A1	QUERY STATUS
135361	Answer	00		= 0 (0x00)
135362	Query	07A0	A1	QUERY ACTUAL LEVEL
135363	Answer	00		= 0 (0x00)
135364	Query	0990	A2	QUERY STATUS
135365	Error			framing error
135366	Query	0990	A2	QUERY STATUS
135367	Error			framing error
135368	Query	0990	A2	QUERY STATUS
135369	Error			framing error
135370	Query	0990	A2	QUERY STATUS
135371	Error			framing error
135372	Query	0B90	A3	QUERY STATUS
135373	Answer	00		= 0 (0x00)
135374	Query	0BA0	A3	QUERY ACTUAL LEVEL
135375	Answer	00		= 0 (0x00)

The query is repeated three times

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

Diagnostic with "DALI Monitor" and DALI USB Interface

- Manufacturers offer interfaces between USB and DALI, e.g. Tridonic, Lunatone
- Together with software, the telegrams can be recorded and analyzed on the DALI line
  - Commands and queries sent by the DALI Gateway
  - Answers from the devices
- It can also be used to address, program DALI devices and set parameters (e.g. Tridonic "masterCONFIGURATOR" software)
  → With the KNX DALI Gateway DG/S, however, this is done via the i-bus® Tool and the ETS
- The DALI USB interface has no DALI address

DALIMonitor - DALI USB (6597)

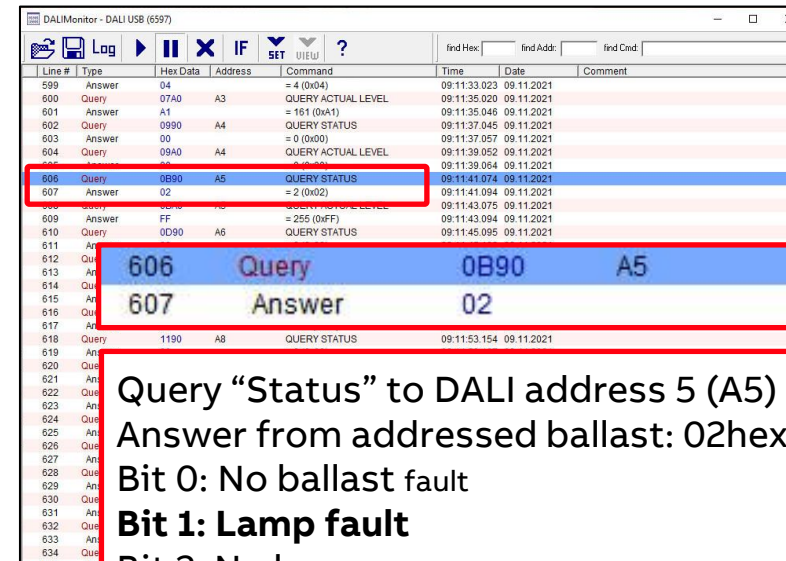| Line #	Type	Hex Data	Address	Command	Time	Date	Comment
493	Query	7990	A60	QUERY STATUS	08:57:43.390	09.11.2021	
494	Query	7B90	A61	QUERY STATUS	08:57:45.412	09.11.2021	
495	Query	7D90	A62	QUERY STATUS	08:57:47.429	09.11.2021	
496	Query	7F90	A63	QUERY STATUS	08:57:49.454	09.11.2021	
497	Query	0190	A0	QUERY STATUS	08:57:53.479	09.11.2021	
498	Answer	00		= 0 (0x00)	08:57:53.492	09.11.2021	
499	Query	01A0	A0	QUERY ACTUAL LEVEL	08:57:55.483	09.11.2021	
500	Answer	00		= 0 (0x00)	08:57:55.497	09.11.2021	
501	Query	0390	A1	QUERY STATUS	08:57:57.504	09.11.2021	
502	Answer	04		= 4 (0x04)	08:57:57.542	09.11.2021	
503	Query	03A0	A1	QUERY ACTUAL LEVEL	08:57:59.509	09.11.2021	
504	Answer	B7		= 183 (0xB7)	08:57:59.521	09.11.2021	
505	Query	0590	A2	QUERY STATUS	08:58:01.536	09.11.2021	
506	Answer	04		= 4 (0x04)	08:58:01.546	09.11.2021	
507	Query	05A0	A2	QUERY ACTUAL LEVEL	08:58:03.539	09.11.2021	
508	Answer	FE		= 254 (0xFE)	08:58:03.552	09.11.2021	
509	Query	0790	A3	QUERY STATUS	08:58:05.561	09.11.2021	
510	Answer	04		= 4 (0x04)	08:58:05.574	09.11.2021	
511	Query	07A0	A3	QUERY ACTUAL LEVEL	08:58:07.567	09.11.2021	

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

Diagnostic with an Oscilloscope

– PC oscilloscope with USB connection, e.g.

- From the company "Pico Technology"

- Software "PicoScope" can decode DALI waveforms (DALI protocol is available)

- Further information: https://www.picotech.com/library/oscilloscopes/dali-serial-protocol-decoding

– DALI uses Manchester (biphase) encoding to send the start bit and the information bits

– The nominal data rate is 1,200 bit per second, so one bit time is 833.33 µs

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Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

Diagnostic with an Oscilloscope

Solutions for Lighting Control with ABB i-bus® KNX DALI Gateways

DALI communication and diagnostic

Diagnostic with an Oscilloscope

1 Command to address 07 with data 90 → query status

2 Answer with data 04 → Bit 2 = "1": Lamp on

3 Command to address 07 with data A0 → query actual level

4 Answer with data 44

Time between forward frame and backward frame 2.4 …12.4 ms

File   Edit   Views   Measurements   Tools   Help

1 s/div   1 MS   1 of 1   x 275

A   Auto   DC   B   Off   DC

Time between forward frame and backward frame 2.4 …12.4 ms

Address - 01   Data - 90   Data - 04

Zoom Overview

19,5 V
17,43
15,36
13,28
11,21
9,138
7,065
4,992
2,919
0,846
-1,22

DALI - Ch A

25,08   28,71   32,35   35,99   39,62   43,26   46,89   50,53   54,17

x1,0   ms   +2,0s

Serial Decoding

Link   Export   View   Statistics   Hex   Current Buffer   Filter   [Field]   Search

Packet	Start Time	End Time	Frame	Start Bit	Y	Address	Selector Bit	Data	Address Type	Control Command	Special Command	Valid
22	1,58s	1,594s	Forward	1	0	3F	Command	90	Short	QUERY STATUS		✔
23	1,803s	1,817s	Forward	1	0	00	Command	90	Short	QUERY STATUS		✔
24	1,822s	1,83s	Backward	1				00				✔
25	1,905s	1,919s	Forward	1	0	00	Command	A0	Short	QUERY ACTUAL …		✔
26	1,925s	1,932s	Backward	1				00				✔
27	2,029s	2,043s	Forward	1	0	01	Command	90	Short	QUERY STATUS		✔
28	2,048s	2,056s	Backward	1				04				✔
29	2,132s	2,146s	Forward	1	0	01	Command	A0	Short	QUERY ACTUAL …		✔
30	2,151s	2,159s	Backward	1				FE				✔
31	2,254s	2,268s	Forward	1	0	02	Command	90	Short	QUERY STATUS		✔
32	2,274s	2,281s	Backward	1				00				✔
33	2,361s	2,375s	Forward	1	0	02	Command	A0	Short	QUERY ACTUAL …		✔
34	2,381s	2,389s	Backward	1				00				✔
	2,484s	2,498s	Forward	1	0	00	Command	00	Short	QUERY STATUS		

Typical communication

- Forward frames sent by the DALI Gateway to the DALI device
- Backward frame is sent back as a response from the DALI device to the DALI Gateway
- The voltage level is pulled below 10V

DALI - Ch A

Stopped   Trigger   Auto   A   10 V   10 %   0s   Measurements   Rulers   Notes

Typical communication

- Forward frames sent by the DALI Gateway to the DALI device
- Backward frame is sent back as a response from the DALI device to the DALI Gateway
- The voltage level is pulled below 10V

Forward frames

Backward frame

Packet	Start Time	End Time	Frame	Start Bit	Y	Address	Selector Bit	Data	Address Type	Control Command	Special Command	Valid
22	1,58s	1,594s	Forward	1	0	3F	Command	90	Short	QUERY STATUS		✔
23	1,803s	1,817s	Forward	1	0	00	Command	90	Short	QUERY STATUS		✔
24	1,822s	1,83s	Backward	1				00				✔
25	1,905s	1,919s	Forward	1	0	00	Command	A0	Short	QUERY ACTUAL ...		✔
26	1,925s	1,932s	Backward	1				00				✔
27	2,029s	2,043s	Forward	1	0	01	Command	90	Short	QUERY STATUS		✔
28	2,048s	2,056s	Backward	1				04				✔
29	2,132s	2,146s	Forward	1	0	01	Command	A0	Short	QUERY ACTUAL ...		✔
30	2,151s	2,159s	Backward	1				FE				✔
31	2,254s	2,268s	Forward	1	0	02	Command	90	Short	QUERY STATUS		✔
32	2,274s	2,281s	Backward	1				00				✔
33	2,361s	2,375s	Forward	1	0	02	Command	A0	Short	QUERY ACTUAL ...		✔
34	2,381s	2,389s	Backward	1				00				✔
	2,484s	2,498s	Forward	1	0	00	Command	00	Short	QUERY STATUS		

Serial Decoding

Packet	Start Time	End Time	Frame	Start Bit	Y	Address	Selector Bit	Data	Address Type	Control Command	Special Command	Valid
40	3,12s	3,127s	Backward	1				00				✔
41	3,221s	3,235s	Forward	1	0	03		90	Short	QUERY STATUS		✔
42	3,284s	3,292s	Invalid	1				3F				✗
43	3,265s	3,279s	Forward	1	0	03		90	Short	QUERY STATUS		✔
44	3,284s	3,292s	Invalid	1				3F				✗
45	3,308s	3,322s	Forward	1	0	03		90	Short	QUERY STATUS		✔
46	3,328s	3,335s	Invalid	1				3F				✗
47	3,352s	3,366s	Forward	1	0	03		90	Short	QUERY STATUS		✔
48	3,372s	3,379s	Invalid	1				1F				✗
49	3,4s	3,414s	Forward	1	0	04		90	Short	QUERY STATUS		✔
50	3,419s	3,427s	Backward	1				00				✔
51	3,499s	3,513s	Forward	1	0	04		A0	Short	QUERY ACTUAL ...		✔
52	3,519s	3,526s	Backward	1				00				✔
	3,622s	3,626s	Forward	1		05		00	Short	QUERY STATUS		

Framing error

- Forward frames sent by the DALI Gateway to the DALI device
- No clear DALI telegram is received
- Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received

→ DALI double addresses of device 4 (address 03)

The page is a full screenshot of a PicoScope 6 application window displaying DALI serial decoding analysis.

Annotations visible on the screenshot:

- **Forward frames**
- **Backward frame**

Decoded frame labels: Address - 03, Data - 90, Data - 3F, 1, Y - 0

Framing error

- Forward frames sent by the DALI Gateway to the DALI device
- No clear DALI telegram is received
- Several DALI devices reply and their superimposed telegrams result in an unidentifiable DALI telegram being received

→ DALI double addresses of device 4 (address 03)

Serial Decoding table:

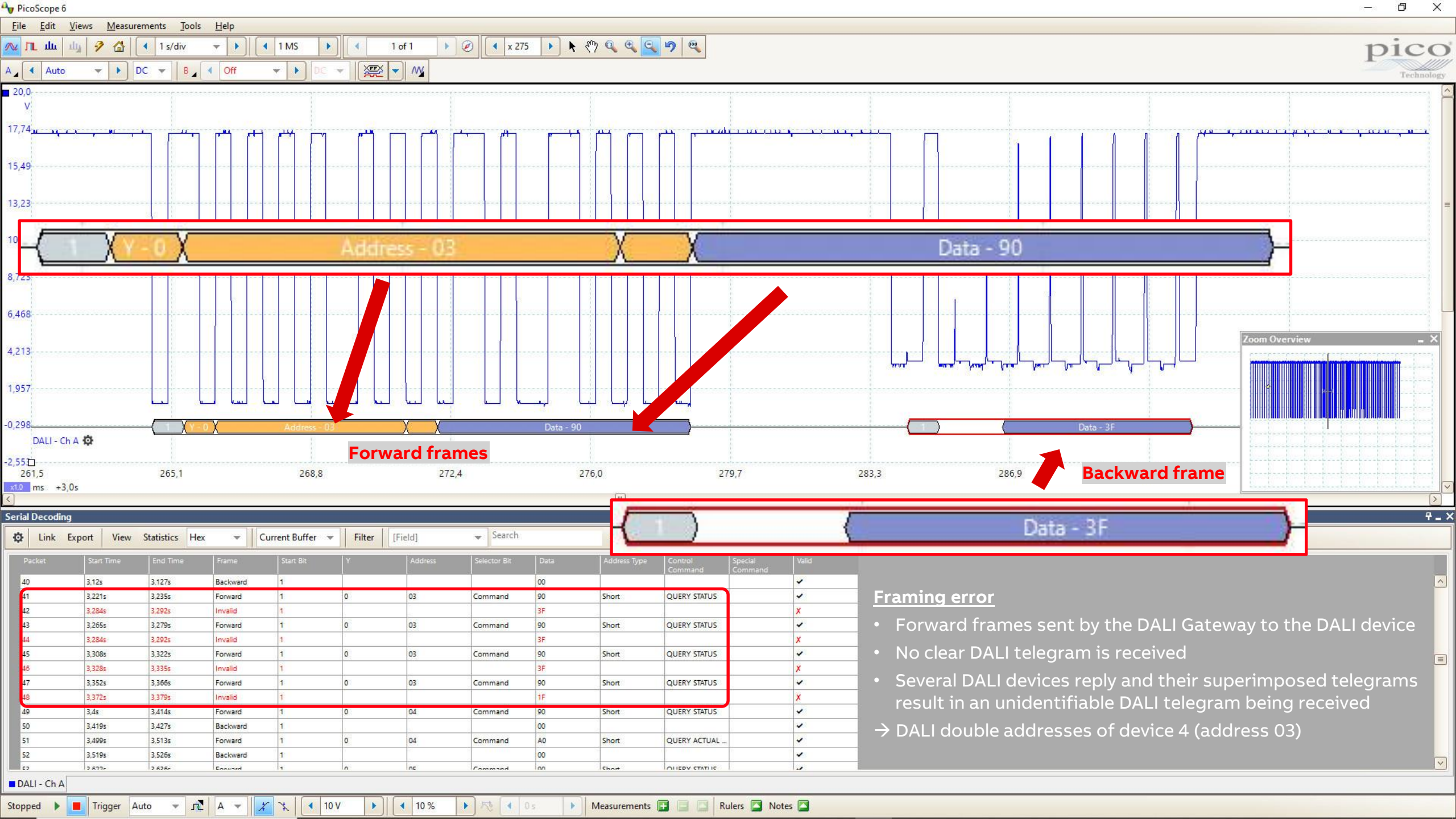| Packet	Start Time	End Time	Frame	Start Bit	Y	Address	Selector Bit	Data	Address Type	Control Command	Special Command	Valid
40	3,12s	3,127s	Backward	1				00				✓
41	3,221s	3,235s	Forward	1	0	03		90	Short	QUERY STATUS		✓
42	3,284s	3,292s	Invalid	1				3F				X
43	3,265s	3,279s	Forward	1	0	03		90	Short	QUERY STATUS		✓
44	3,284s	3,292s	Invalid	1				3F				X
45	3,308s	3,322s	Forward	1	0	03		90	Short	QUERY STATUS		✓
46	3,328s	3,335s	Invalid	1				3F				X
47	3,352s	3,366s	Forward	1	0	03		90	Short	QUERY STATUS		✓
48	3,372s	3,379s	Invalid	1				1F				X
49	3,4s	3,414s	Forward	1	0	04		90	Short	QUERY STATUS		✓
50	3,419s	3,427s	Backward	1				00				✓
51	3,499s	3,513s	Forward	1	0	04		A0	Short	QUERY ACTUAL ...		✓
52	3,519s	3,526s	Backward	1				00				✓
	3,622s	3,626s	Forward	1		05		90	Short	QUERY STATUS		✓

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