L-DALI™

DALI Light Controller

User Manual

LOYTEC electronics GmbH

Contact

LOYTEC
Blumengasse 35
A-1170 Vienna
AUSTRIA/EUROPE
support@loytec.com
http://www.loytec.com

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Contents

Abbreviations

100BaseT	100 Mbps Ethernet network with RJ-45 plug
Aggregation	Collection of several CEA-709 packets into a single CEA-852 packet
AST	Alarming, Scheduling, Trending
BACnet	Building Automation and Control Network
BBMD	BACnet Broadcast Management Device
BDT	Broadcast Distribution Table
CA	Certification Authority
CC	Configuration Client, also known as CN/IP Device
CEA-709	Protocol standard for LONWORKS networks
CEA-852	Protocol standard for tunneling CEA-709 packets over IP channels
CN	Control Network
CN/IP	Control Network over IP
CN/IP Channel	logical IP channels that tunnels CEA-709 packets according CEA-852
CN/IP packet	IP packet that tunnels one or multiple CEA-709 packet(s)
COV	change-of-value
CR	Channel Routing
CS	Configuration Server that manages CEA-852 IP devices
DA	Data Access
DALI	Digital Addressable Lighting Interface, see IEC 62386
DHCP	Dynamic Host Configuration Protocol, RFC 2131, RFC 2132
DiiA	Digital Illumination Interface Association
DL	Data Logger (Web service)
DNS	Domain Name Server, RFC 1034
DST	Daylight Saving Time
EEP	EnOcean Equipment Profile
GMT	Greenwich Mean Time
HCL	Human Centric Lighting
IP	Internet Protocol
IP-852	logical IP channel that tunnels CEA-709 packets according to CEA-852
LAN	Local Area Network
LSD Tool	LOYTEC System Diagnostics Tool
MAC	Media Access Control
MD5	Message Digest 5, a secure hash function, see Internet RFC 1321
MS/TP	Master/Slave Token Passing (this is a BACnet data link layer)
NAT	Network Address Translation, see Internet RFC 1631
NV	Network Variable
OPC	Open Process Control
OPC UA	OPC Unified Architecture
PEM	Privacy Enhanced Mail

PLC ..... Programmable Logic Controller
RNI ..... Remote Network Interface
RSTP ..... Rapid Spanning Tree Protocol (Standard IEEE 802.1D-2004)
RTT ..... Round-Trip Time
RTU ..... Remote Terminal Unit
SCPT ..... Standard Configuration Property Type
SL ..... Send List
SMI ..... Standard Motor Interface
SMTP ..... Simple Mail Transfer Protocol
SNTP ..... Simple Network Time Protocol
SNVT ..... Standard Network Variable Type
SSH ..... Secure Shell
SSL ..... Secure Socket Layer
TLS ..... Transport Layer Security
UCPT ..... User-defined Configuration Property Type
UI ..... User Interface
UNVT ..... User-Defined Network Variable Type
UTC ..... Universal Time Coordinated
WLAN ..... Wireless LAN
XML ..... eXtensible Markup Language

1 Introduction

1.1 Overview

The L-DALI controllers for LONMARK and BACnet systems are DALI gateways with built-in light controller functionality.

DALI (Digital Addressable Lighting Interface) is defined in the international standard IEC 62386. It is used to dim and switch luminaries from most leading manufacturers. DALI also supports devices like multi-sensors (e.g. for brightness, occupancy, etc.) and intelligent switches.

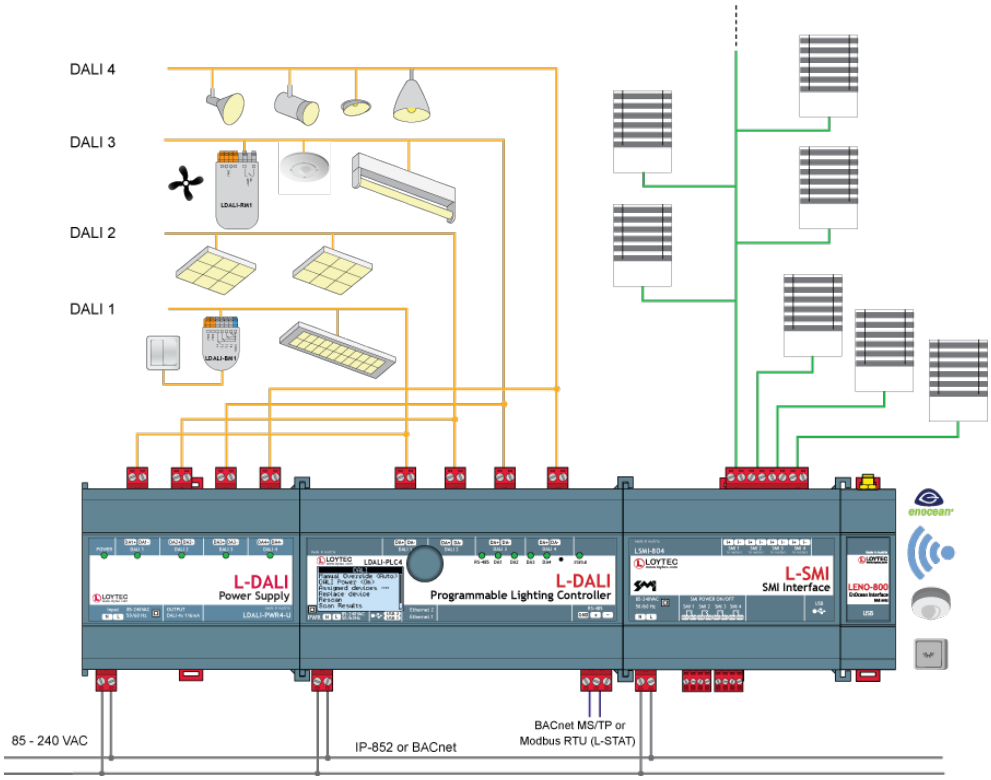


Figure 1: L-DALI supports up to four DALI channels.

The L-DALI lineup features 1, 2, or 4 independent DALI channels. Up to 64 DALI-based luminaries per DALI channel can be controlled individually or via 16 groups. All luminaries are monitored for lamp defect. L-DALI can provide this information to the Building Management System (BMS) through its NV or BACnet interface respectively. For CEA-709 communication IP-852 (Ethernet/IP) and TP/FT-10 are supported, for BACnet

communication BACnet/IP and BACnet MS/TP are supported. In addition, all L-DALI models support Modbus/TCP for integration into an existing Modbus SCADA system.

LDALI-3E101-U, LDALI-3E102-U, and LDALI-3E104-U are gateways connecting a DALI network to a CEA-709/LONMARK network, LDALI-ME201-U, LDALI-ME202-U and LDALI-ME204-U as well as LDALI-PLC2 and LDALI PLC4 are gateways connecting a DALI network to a BACnet network. On the DALI network the L-DALI controller represents a DALI master controller. On the CEA-709 or BACnet network the L-DALI controller offers a NV interface or BACnet server objects respectively to control the ballasts and the sensors connected for the DALI network.

The constant light controller (LONMARK functional profile #3050, BACnet Loop object) allows controlling DALI ballasts with lighting nodes on the CEA-709 or BACnet network. Occupancy and lux-level sensors for constant light control and buttons for manual operation can be integrated via the CEA-709/BACnet interface, directly on the DALI side or via EnOcean using the LENO-80x interface.

Using the LSMI-804 SMI interface up to four SMI channels with up to 16 SMI drives each can be connected to an L-DALI controller. The built-in sunblind controller application (LONMARK functional profile #6111, various BACnet objects) can be used to control these SMI drives. Interaction between the sunblind and constant light controller applications allows adjusting sunblinds depending on the constant light controller output, e.g. for energy saving concepts.

L-DALI supports automation functions such as alarming, scheduling, and trending. The L-DALI controllers offer local scheduling services including the possibility to configure several local and remote 24 hour schedulers through the Web UI. Alarming includes the functionality to generate, deliver, acknowledge, and display alarm conditions and logs regardless whether the condition comes from the DALI or the CEA-709/BACnet network. The trending capability includes periodic and event triggered data logging of values and time stamps. Alarms and trend data are stored on the device accessible via an FTP connection as CSV files.

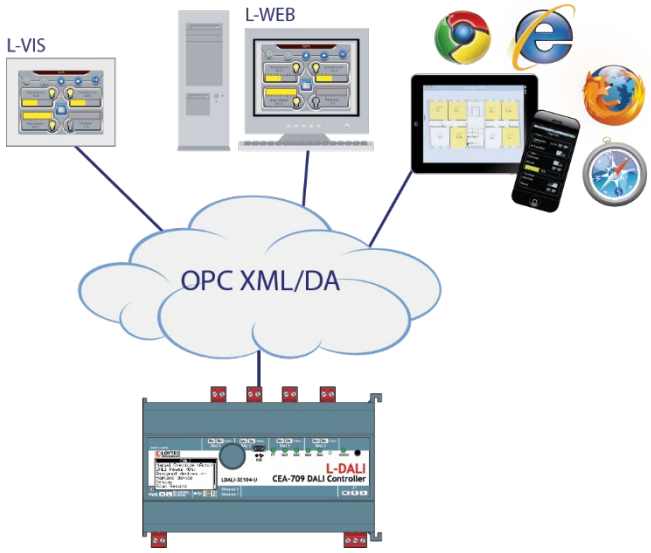


Figure 2: Using L-DALI together with the L-WEB product family.

L-DALI devices can be integrated with LWEB-802/803 visualization and LWEB-900 using OPC XML-DA. LWEB-802/803 and LWEB-900 can be used for visualization of an L-DALI based lighting control system. LWEB-900 offers additional functionality like saving trend

and log files for long term storage, easy managing of remote schedulers and calendars, data analysis and report generation. L-DALI supports event-driven e-mail notification as a result of a predefined action triggered by a specific status or an exceeded high limit. E-mail notification can also be used to forward trend and log files to central SQL databases for long term storage (see LWEB-900 for details).

L-DALI supports common mathematical operations and functions, as well as Boolean expressions (see also chapter 3.2 in the LINX-Configurator User Manual [2]).

Some lighting controller applications do not need a connection to the CEA-709 or BACnet network. Therefore the L-DALI controller can control a complete DALI network as a standalone device with the aid of the supported automation functions (alarming, scheduling, and trending). Connected to an IP network, remote access allows to set parameters and to read the system status.

The LDALI can be completely configured via a PC using the LOYTEC LINX Configurator. Additionally, the LDALI offers a built-in webserver through which commissioning and maintenance of a DALI system can be done using a web browser.

The L-DALI offers the following features:

- DALI gateway and controller
- Supports 1, 2, or 4 DALI channels (dependent on model)
- Integrated DALI bus power supply, can be switched off, 16 V DC, 230 mA (guaranteed) / 250 mA (maximum) (LDALI-3E101-U, LDALI-3E102-U / LDALI-ME201-U, LDALI-ME202-U / LDALI-PLC2) or 116mA (guaranteed) / 125mA (maximum) (LDALI-3E104U / LDALI-ME204-U / LDALI-PLC4).
- Direct control of up to 64 DALI devices per DALI channel
- Direct control of up to 16 DALI groups per DALI channel
- Scene control for up to 16 groups and one broadcast scene per DALI channel
- Detect lamp and ballast failure on DALI luminaries and signals
- Simple replacement of (broken) DALI devices (no configuration tool required)
- DALI multi-master capable
- Support for DALI sensors and buttons
- Supports DALI-2 standard
- Supports DALI-Data
- DALI-2 certified interface
- Built-in DALI protocol analyzer
- Direct control of SMI drives using LSMI-804
- Integration of EnOcean multi-sensors and push-buttons using LENO-80x
- Built-in constant light controller application

- Built-in sunblind controller application
- Built-in Human Centric Lighting feature
- Alarming, Scheduling, and Trending (AST™)
- Common mathematical operations and functions as well as Boolean expressions
- Event-driven e-mail notification
- Periodic testing of emergency lights
- Lamp burn-in mode
- Calculation of energy consumption and run-hours
- OPC XML/DA (L-WEB integration)
- Supports WLAN through LWLAN-800 Interface
- Configuration via Web interface
- Firmware update via CEA-709 or Ethernet port
- DIN rail mountable

LONMARK/CEA-709 models only:

- Fully compliant with CEA-709, CEA-852, and EN 14908 standard
- Supports LONMARK TP/FT-10 or CEA-852 Ethernet (IP-852) channels (selectable)
- Control of DALI capable ballasts via NVs
- Retrieve information from DALI capable sensors via NVs
- Supports LONMARK Functional Profiles:
    - Lamp Actuator #3040
    - Light Sensor #1010
    - Occupancy Sensor #1060
    - Constant Light Controller #3050
    - Sunblind Controller #6111
    - Open Loop Sensor (button) #1
    - Scheduler #0007
    - Calendar #0006

BACnet models only:

- Fully compliant with BACnet standards ANSI/ASHRAE 135-2012 and ISO 16484-5:2012
- BACnet/IP or BACnet MS/TP (selectable)
- B-BC (BACnet Building Controller) functionality, BTL certified
- Control of DALI capable ballasts and sensors via BACnet server objects
- Retrieve information from DALI capable sensors via BACnet server objects
- BACnet client functionality (configurable)
- Supports the following BACnet server objects:
    - Analog Output objects to control DALI ballasts, groups, and channels
    - Multi-State Output objects for scene control of DALI groups and channels
    - Analog Input objects providing feedback from DALI ballast, groups, and channels
    - Analog Input objects providing status information from DALI groups and channels
    - Accumulator objects providing estimated energy usage of DALI groups and channels
    - Multi-State Output objects to issue commands (start/stop emergency test or burn-in, change colour temperature, etc.) to DALI ballasts, groups and channels
    - Analog Input objects providing battery status of emergency ballasts, groups
    - Multi-State Input objects providing detailed status of emergency ballasts
    - Analog Input objects providing lux level information from supported DALI sensors
    - Binary Input objects providing occupancy information from supported DALI sensors
    - Loop objects providing constant light controller functionality
    - Binary Input objects providing button information from supported DALI buttons
    - Binary Output objects for controlling feedback LEDs of supported DALI buttons
    - Various objects to control sunblinds
    - Various objects for Bluetooth beacons & asset tracking

1.2 L-DALI Models

This Section provides an overview of the different L-DALI models in Table 1. This table identifies the different features of the L-DALI models. Models that possess a certain feature have a check mark (✓) in the respective column. If a feature is not available in the particular model, the column is left blank.

Feature \ Model	3E102	3E104	3101-U	E101-U	ME204	E201-U	3E101-U	3E102-U	3E104-U	ME201-U	ME202-U	ME204-U	PLC4	PLC2
DALI Power Supply			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
DALI Channels	2	4	1	1	4	1	1	2	4	1	2	4	4	2
DALI Emergency Lights Test	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Constant Light Controller	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Sunblind Controller	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓		
LCD Display with Jog Dial			✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
LON TP/FT-10	✓	✓	✓				✓	✓	✓					
LON IP-852 (Ethernet/IP)	✓	✓		✓			✓	✓	✓				✓	✓
BACnet MS/TP					✓					✓	✓	✓	✓	✓
BACnet IP and SC					✓	✓				✓	✓	✓	✓	✓
Modbus RTU										✓[1]	✓[1]	✓[1]	✓	✓
Modbus TCP							✓	✓	✓	✓	✓	✓	✓	✓
Configuration via WEB UI	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Configuration via Software	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Serial Console	✓	✓			✓									
LWEB-802/803 Hosting							✓	✓	✓	✓	✓	✓	✓	✓
OPC XML-DA	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
OPC UA							✓	✓	✓	✓	✓	✓	✓	✓
OPC Client							✓	✓	✓	✓	✓	✓	✓	✓
SNMP							✓	✓	✓	✓	✓	✓	✓	✓
SSH, HTTPS, Firewall, VPN							✓	✓	✓	✓	✓	✓	✓	✓
WLAN (with LWLAN-80x)							✓	✓	✓	✓	✓	✓	✓	✓
Ethernet Switch/Hub				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
USB							✓	✓	✓	✓	✓	✓	✓	✓
EnOcean (with LENO-80x)							✓	✓	✓	✓	✓	✓	✓	✓
SMI (with LSMI-804)							✓	✓	✓	✓	✓	✓	✓	✓
RS232 (with LRS232-802)							✓	✓	✓	✓	✓	✓	✓	✓
DALI-2 support							✓	✓	✓	✓	✓	✓	✓	✓
DALI-Data support							✓	✓	✓	✓	✓	✓	✓	✓
Built-in HCL support							✓	✓	✓	✓	✓	✓		
Script Support							✓	✓	✓	✓	✓	✓	✓	✓
Asset Tracking							✓[2]	✓[2]	✓[2]	✓[2]	✓[2]	✓[2]	✓[2]	✓[2]
Programmable controller													✓	✓

[1] A license LIC_MOD5 must be purchased

[2] A license LIC_ASSET must be purchased

Table 1: Available features in different L-DALI models.

Important:	***In the following text models with BACnet interface are referred to as LDALI-20X and models with LONMARK/CEA-709 interface are referred to as LDALI-10X.***

1.3 Scope

This document covers L-DALI devices with firmware version 8.2.8 and the L-INX Configuration Software version 8.2.8. Basic device operations are covered in the LOYTEC Device User Manual [1] and device configuration using the PC configuration software is covered by the LINX Configurator User Manual [2]. Detailed information about LDALI devices is covered by the LOYTEC LDALI Device User Manual [13].

2 Disclaimer Cyber Security

LOYTEC offers a portfolio of products, solutions and systems with cyber security functions that enable the secure operation of devices, systems and networks in the field of building automation and control technology. To ensure that devices, systems, and networks are always protected against online threats, a holistic security concept is required that is implemented using the latest technology and is being kept up-to-date. The LOYTEC portfolio is only one component of such an overall concept.

The customer is responsible for preventing unauthorized access to the devices, systems and networks. These should only be connected to a network or the Internet if adequate security measures are in place (e.g. firewalls, separate networks) and a connection is required for operation. In addition, LOYTEC's recommendations for securing devices in the Security Hardening Guide (Chapter 10) must be followed. For additional information, please contact your support person at LOYTEC or visit our website.

LOYTEC is constantly working on improving the existing products in order to follow the latest cyber security standards. Therefore, LOYTEC strongly recommends installing updates as soon as they become available and always using the latest software versions. LOYTEC explicitly points out that using older versions or refraining from updates increases the risk of online security threats.

3 Safety Instructions

ATTENTION

General Safety Instructions

Please regard the following general instructions for project planning and execution:

- Regard all measures or prohibitions of the respective country to avoid danger of electricity and high voltage.
- Other relevant regulations of the respective country.
- House installation regulations of the respective country.
- Regulations of the utility company.
- Any specifications, diagrams, dispositions, cable lists and regulations of the customer or system integrator.
- Any third-party regulations (e.g., general contractor or client).

ATTENTION

Country-specific Safety Regulations

Failure to observe country-specific safety regulations can lead to property damage and personal injury. Therefore, comply with the country-specific regulations and the corresponding safety guidelines.

CAUTION

Electrical Safety

Essentially, electrical safety in building automation systems from LOYTEC is based on the use of extra-low voltage and safe isolation from mains voltage.

CAUTION

IEC (SELV, PELV) (world-wide)

Depending on the extra-low voltage earthing (24VAC), this results in an application according to SELV or PELV in accordance with IEC 60364-4-41:

	• Ungrounded = SELV (Safety Extra Low Voltage), • Earth ground = PELV (Protected Extra Low Voltage).

	**CAUTION**
	NEC (North America) Class 2 transformers with energy limitation to 100 VA or Class 2 circuits with max. 100 VA (using a non-energy-limiting transformer of max. 400VA) combined with overcurrent limits (T-4A fuses) can be used for each individual 24VAC device. Several fuses for several isolated secondary circuits per transformer are possible. The same applies to power supplies with 24VDC.

	**CAUTION**
	Device Safety Device safety is guaranteed by supply with low voltage 24VAC or 24VDC and a double insulation between mains voltage 230VAC, 24VAC circuits and the housing or by supply via Power over Ethernet (PoE Class 1). In addition, the specific regulations for electrical wiring according to this manual must be observed.

	**ATTENTION**
	Installation Personnel Only qualified staff may carry out electrical installations.

	**CAUTION**
	Installation according Safety Class II LOYTEC devices, which are designed in compliance with safety class II, must be mounted accordingly. The following requirements apply: • Protection against electric shock has to be ensured by an appropriate enclosure. • Ensure proper working cable relief for installation in safety class II equipment.

	ATTENTION

Mounting Location

LOYTEC devices are designed to be installed in an enclosure:

- Switching cabinets
- Distribution boxes
- Mounting in false ceilings
- Luminaire integration

ATTENTION

Environment Conditions

LOYTEC devices have to be installed in a dry and clean environment. In addition the permissible environment conditions specified in the product data sheet must be observed.

CAUTION

Earth Ground of ⊥ (System Zero AC/DC 24V)

The following items must be observed when earth-grounding system zero ⊥ 24VAC:

- In principle, both earth-grounding and non-grounding of system zero of the operating voltage 24VAC is permitted. Important are the local regulations and customs. Due to functional requirements, earth ground may be necessary or inadmissible.
- It is recommended to ground 24VAC systems unless this contradicts the manufacturer's instructions.
- To avoid earth loops, systems with PELV may only be connected to earth ground at one point in the system. Unless otherwise stated, usually at the transformer.
- The same applies to 24VDC power supplies.

CAUTION

Functional Earth ⏚

Functional earth must be connected to the building's protective earthing (PE) system on the installation side.

CAUTION

Operating Voltage 24V AC/DC

The power supply must meet the requirements for SELV or PELV. Permitted deviation of the nominal voltage:

- At the transformer or power supply: 24V AC/DC ±10%

	• At the device: 24V AC or DC ±10 %

CAUTION

Specification for 24VAC Transformers

IEC: safety transformers according to IEC 61558 with double insulation, designed for 100% duty cycle to supply SELV or PELV circuits.

U.S.: Class 2 circuits according to UL 5085-3.

For efficiency reasons, the power drawn from the transformer should be at least 50% of the nominal load.

The nominal power of the transformer must be at least 25 VA. Using a transformer of smaller size, the ratio of open circuit voltage to voltage at full load becomes unfavorable (> + 20%).

CAUTION

Specification for 24VDC Power Supplies

Power supplies must be designed for 100% duty cycle to supply SELV or PELV circuits.

U.S.: Class 2 circuits according to UL 5085-3.

For efficiency reasons, the power drawn from the power supply should be at least 50% of the nominal load.

CAUTION

Protection of the 24VAC Supply Voltage

Transformers must be protected on the secondary circuit, according to the transformer dimensions and the effective load of all connected devices:

Always protect the 24VAC conductor (system potential),

Additionally protect the conductor ⊥ (system zero) where required.

CAUTION

Protection of the 24VDC Supply Voltage

24 VDC power supplies must be short-circuit proof or have an internal microfuse.

Local regulations must be observed.

	CAUTION

Protection of Mains Voltage

Transformers/24VDC power supplies must be protected on the primary circuit using a control cabinet fuse.

CAUTION

Power over Ethernet (PoE)

LPAD-7 Touch Panels require a PoE Class 1 power supply (max. 12W), which must be compliant to IEEE 802.3at-2009.

For the power supply of the PoE switches observe the manufacturer's specifications.

CAUTION

Device Installation/Removal in De-Energized State Only

Ensure that power supply is switched off before starting to install or uninstall LOYTEC devices. Do NOT connect or disconnect equipment with the power switched on, unless instructed otherwise. Do NOT assemble or disassemble devices with power switched on, unless instructed otherwise.

CAUTION

Power supply protection

When installing LOYTEC devices, ensure that the power source is adequately protected by means of a suitably-rated fuse or thermal circuit breaker.

CAUTION

Power supply voltage

Do not connect a voltage supply greater than the specified maximum rating. Refer to product label and/or datasheet for the correct voltage.

CAUTION

DALI is FELV (Functional Extra Low Voltage)

A DALI-line is treated to be FELV. Since it is non-SELV the relevant installation regulations for low voltage apply.

ATTENTION

DALI wiring

A DALI-line may be installed within the same cable or as single conductors within the same tube as mains supply. The DALI-line is either limited to a maximum length of 300 m using a minimum cross-section of 1.5 mm^2 (AWG15) or it must be ensured that the voltage drop on the DALI-line does not exceed 2 V.

CAUTION

Attention to External Voltages

Any kind of introduction or spreading of dangerous voltages onto the low-voltage circuits of the system (e.g. due to incorrect wiring) must be avoided at any circumstance and represents an immediate life danger or can lead to the entire or partial destruction of the building automation system.

4 What's New in L-DALI

This section describes the major changes and new features. For a full list of changes refer to the Readme file.

4.1 New in L-DALI 8.2.8

Support for DALI-Data

Luminaire Data (DALI Part 251), Energy Data (DALI Part 252) and Diagnostics Data (DALI Part 253) are queried periodically from DALI control gear that supports the corresponding feature. The information is mapped to the register data points ***DaliData*** and ***DaliDataRaw*** in the Lamp Actuator folder.

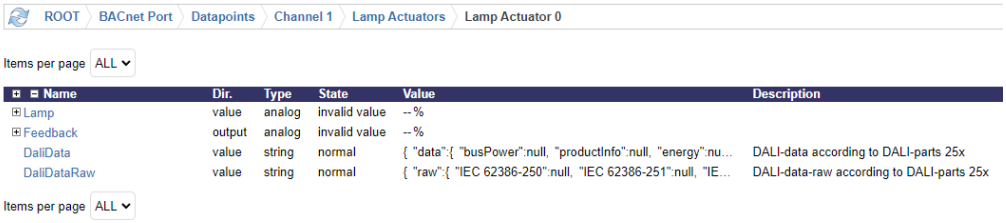


Figure 3: DALI-Data related data points

DaliData provides the decoded and interpreted data in a readable format. ***DaliDataRaw*** provides the raw data read from the memory banks. The data points are OPC-exposed by default.

The data points provide periodic updates of device statistics and data, but are not suitable for any real-time monitoring (e.g. energy consumption). This is due to the high traffic requirement for reading the data from the DALI devices. One device is updated every 10 minutes, so depending on the number of control gear supporting the DALI-data parts the update interval may vary from 10 minutes to nearly 12 hours.

For the case that the data is required urgently a new command QUERY_DALI_DATA has been added to the ***Command*** data point, initiating an update of the DALI-data.

Human Centric Lighting (HCL)

The ability to automatically change the colour temperature over the day has been added as feature to the CLC-object. The implemented circadian daylight function is a type of human centric lighting.

The new CLC-property **HCL_Profile** allows to activate one of four predefined profiles. The colour temperature is calculated based on the profile and applied to the light bands controlled by the CLC. As a result each tunable white capable DALI-luminaire that is a member of the light bands will follow accordingly.

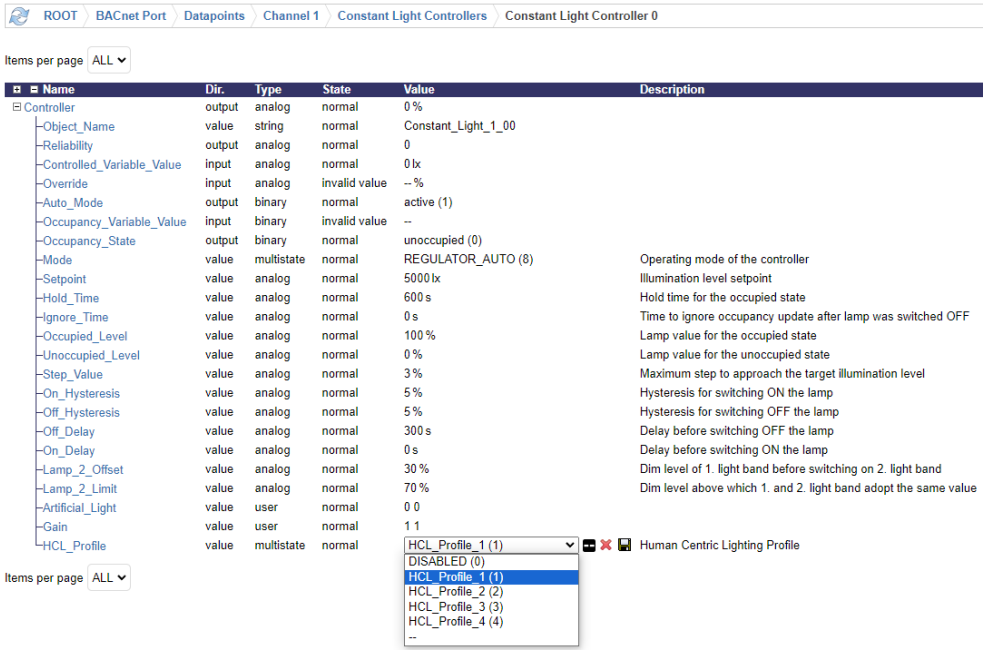


Figure 4: HCL_Profile property in the CLC-loop-object

Button Identification in button configuration wizard on Web UI

In the button configuration wizard all buttons of a button module or device with button instances can be configured. Any button input that is currently pressed or switched on is indicated in the configuration wizard. This allows to easily assign an instance in the configuration wizard to the corresponding physical button.

Improved support for emergency control gear

A new object EmergencyStatus has been added for emergency control gear. It contains the DALI-parameters *EmergencyStatus*, *EmergencyFailureStatus* and *EmergencyMode* and allows to exactly identify the current state of an emergency control gear. Furthermore some emergency related commands have been added to the ***Command*** datapoint.

New generic trend mode “Interval+COV” (from version 8.2.0)

Generic trends now offer a new trending mode: Interval+COV. This is a combination of periodic logging and COV trends. Data records are recorded when the COV condition is met and in a periodic fashion.

New historic filter “Current Value” (from version 8.2.0)

Historic filters can be configured to use an offset correction data point. In order to process the current value including offset correction, the “Current value” filter item was added. This item contains the offset-corrected value of the underlying data point. It can be used, for example, to trend an offset-corrected meter value after replacing a meter.

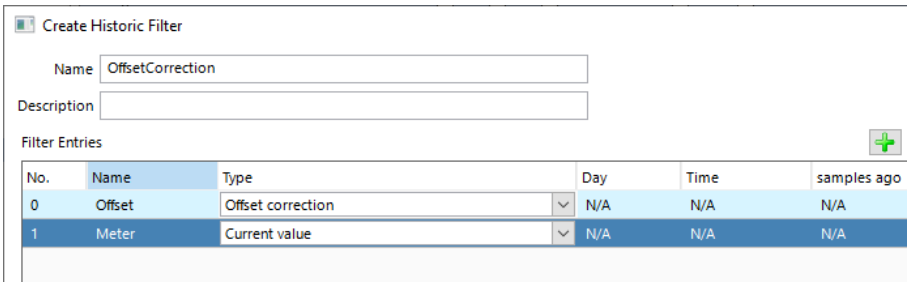


Figure 5: Current value filter item for offset-corrected historic filters.

Edit BACnet Priority Array on Web UI (from version 8.2.0)

The detailed data point Web UI for BACnet objects now offers an editor for the priority array of the underlying BACnet object. The editor allows editing each priority slot, including a clear option to withdraw a slot.

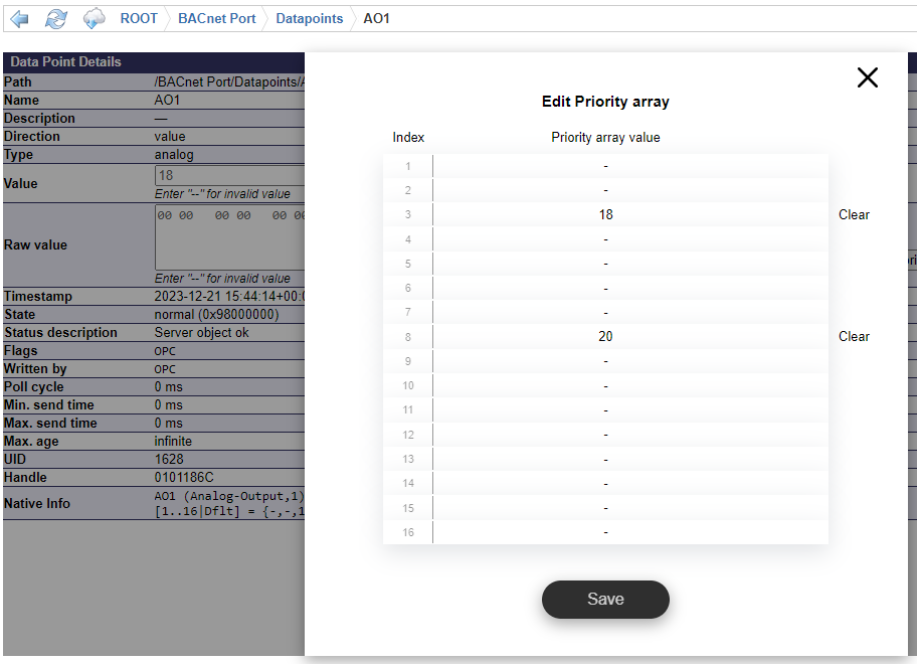


Figure 6: BACnet priority array editor on the data point Web UI.

4.2 New in L-DALI 8.0

Support for LDALI-PWM8 types

Support has been added for the **LDALI-PWM8**, a constant voltage LED-driver with 8 output channels, each of which can be controlled via as separate DALI-address. The LDALI controller also supports the Loytec devices **LDALI-PWM8-TC** and **LDALI-PWM8-RGBW**. These modules support colour control either of tunable white (acc. IEC62386-209, colour type Tc) or colour (acc. IEC62386, colour type RGBWAF) constant voltage LED-ballasts.

Support for LOY-DALI-SBM1 sunblind module on LDALI-PLCx/LROC types

The LOY-DALI-SBM1 sunblind module is now supported on programmable controller types. That is, instead of relays of a LROC or LIOB controller a LOY-DALI-SBM1 module can be used for sunblind control. The module is connected via the DALI-line and operated in a manufacturer specific mode that is perfectly suited for sunblind control.

For detailed information about the module refer to the LOYTEC DALI Device User Manual [13] and the LOYTEC Device User Manual [1].

Persistent datapoints for colour control

Improvement on the datapoints for colour control of LDALI-devices. On the BACnet controllers the BACnet properties *Colour_Temp, Hue* and *Saturation* are stored persistently. On the programmable controllers the datapoints *Colour, Hue* and *Saturation* provided by the LampActuatorColourContol.ldali template and the datapoints *ColourGrp*, *HueGrp* and *SaturationGrp* provided by the LampActuatorColourContol_XY_TC_HSV.ldali template are persistent. This allows to recover the last colour after a power cycle.

Improved Mains-Off handling

The Mains-Off handling for all channels has been improved. For a detailed description refer to the LOYTEC Device User Manual [1].

Refinement of DALI-statistics

Detailed information about the DALI-devices going offline and sending power cycle seen eventmessages are provided via a tooltip window when scrolling over the corresponding counter-parameter on the DALI-statistics site.

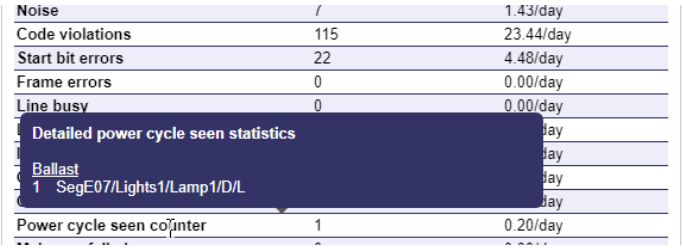


Figure 7: Detailed power cycle seen statistics

New iCalendar Schedulers

LOYTEC devices support a new scheduler object class that is based on iCalendar events. This scheduler class can be selected as an alternative to the generic scheduler class. It supports extended features such as events that span over midnight or last for several days, flexible recurrence patterns known from Outlook, and booking information. The Web interface has been extended to display an event view of the scheduler. External iCalendar data sources can be imported by using a calendar URL, which allows pulling in data from published Outlook or Google calendars.

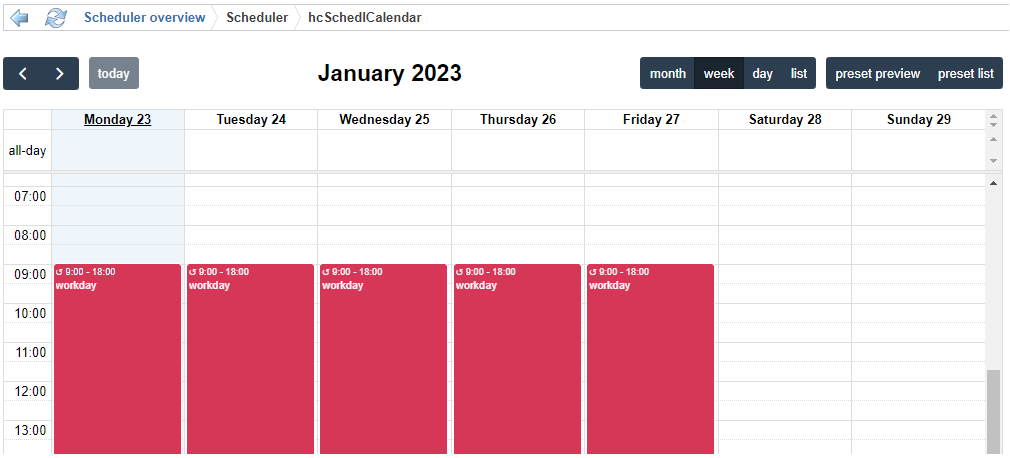


Figure 8: New iCalendar scheduler view on the Web interface.

The new upcomingEvent and upcomingTime data points can be used to display booking information of a meeting room, while the known timeToNext and nextEvent data points allow optimum start algorithms on the controller.

Edge Trigger Mode

Trends and alarms can be based on trigger conditions. There are two new trigger modes available: rising edge and falling edge. These can be used to trigger a recording, if the trigger data point changes from inactive to active (rising) or from active to inactive (falling).

Folder Component Placeholder for Alarm Messages

In addition to the full data point path, individual folder components of the path can now be addressed using the %{f*N*} placeholder, where *N* refers to the *N*-th folder part above the data point. For example on the data point "/User Registers/Building2/Floor3/Room101/temp" the placeholder %{f1} expands to "Room101" and %{f2} to "Floor3". This way, individual compositions of the folder components can be assembled to form the alarm message.

New WLAN Configuration Tabs and System Registers

The WLAN configuration of the port configuration has been re-modelled to better match the client and access point (AP) use cases. The tabs are now labelled **WLAN Client** and **WLAN Access Point**. These tabs are restricted to settings that apply to their respective use.

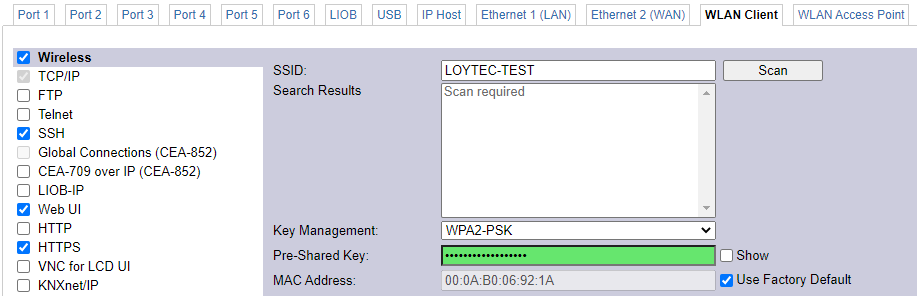


Figure 9: New WLAN configuration tabs

The system registers have also been moved to sub-folders named WLAN Client and WLAN Access Point. Setting SSID, Key and writing the new Enable system register under either port allows enabling the client or AP, respectively.

BACnet/SC

LOYTEC devices support the BACnet/SC node function. This allows LOYTEC devices to register with BACnet/SC hubs and be integrated in BACnet/SC networks, thus benefitting from increased security including TLS encryption and authentication. On devices with a BACnet router, BACnet/SC can be enabled in addition to or as a replacement of BACnet/IP. Devices without the BACnet routing function can enable either BACnet/SC or BACnet/IP.

The internal device certificate can be used out-of-the-box, and CA-signed operational certificates can be installed as needed. When BACnet/SC and BACnet/IP and/or MS/TP are enabled, the device acts as a router between those interfaces. It is also possible to run BACnet/SC on a separate network than BACnet/IP.

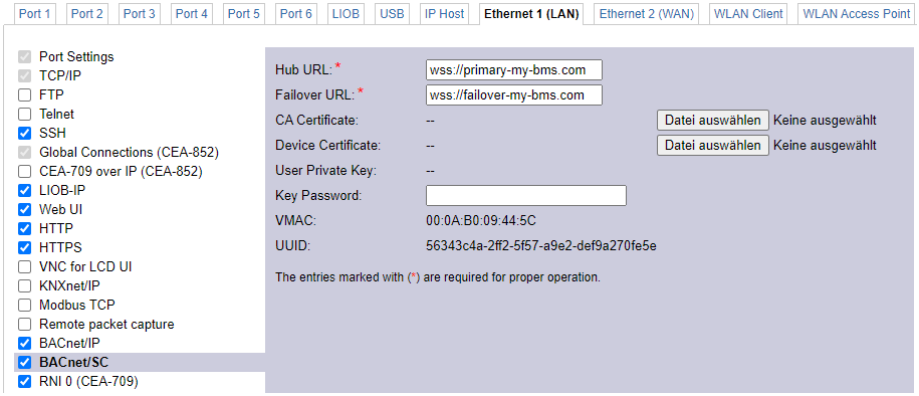


Figure 10: BACnet/SC configuration on EthernetNode-RED™ 3.0

The scripting support on LOYTEC devices has been improved by supporting Node-RED™ 3.0. This includes new editor UI features. The underlying node.js has been updated to 18.x. This allows up-to-date palettes and script packages to work on LOYTEC devices.

4.3 New in L-DALI 7.6

LDALI-PWM4-Tc and LDALI-PWM4-RGBW support

The LDALI controller now supports the Loytec devices **LDALI-PWM4-TC** and **LDALI-PWM4-RGBW**. These modules support colour control either of tunable white (acc. IEC62386-209, colour type Tc) or colour (acc. IEC62386, colour type RGBWAF) constant voltage LED-ballasts. In addition for RGB-capable DALI-ballasts the conversion from *Hue* and *Saturation* datapoints to DALI RGBWAF values has been improved.

Improvements on DALI communication and LDALI-Devices Firmware Update procedure

The reliability of DALI-communication, especially with high traffic on multiple channels, has been increased. Moreover, the stability of the firmware update of LDALI-devices has been improved and the process is now also documented in the systemlog.

Minor Changes on WebUI

- The first line of DALI scene and DALI group tables is still shown when scrolling.
- GTIN of a DALI-device in the info field is shown as decimal number
- DALI-Statistics: added new statistical values for current DALI bandwidth utilization

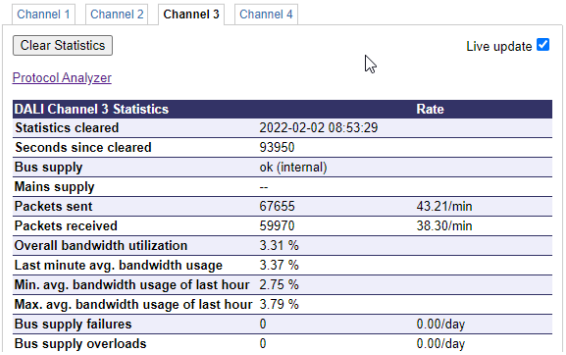


Figure 11: DALI-Statistics

Support for pre-addressed DALI-devices on programmable controllers

A workflow for automatic integration of pre-addressed DALI-devices has been added.

The “Manage DALI-devices”-dialog in the configurator offers the option to define DALI short addresses for each lamp actuator object.

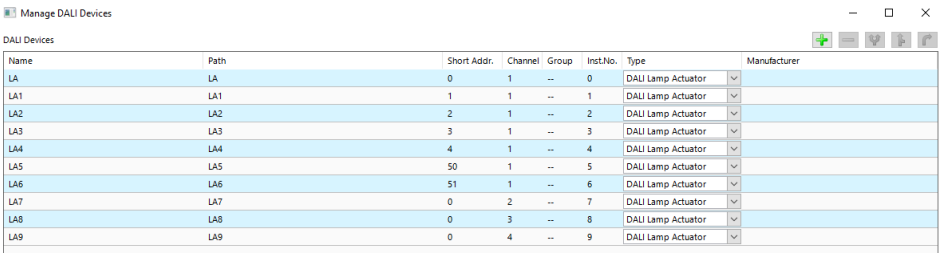


Figure 12: LINXCFG - Manage DALI-devices

After downloading the configuration the LDALI-PLCx or LROC initiates a search and assign procedure. If the short-address of a DALI-device on the DALI-line matches the “precommissioned” address it is automatically assigned. If there is no DALI-device with the “precommissioned” address available on the bus the device is considered as “Offline”.

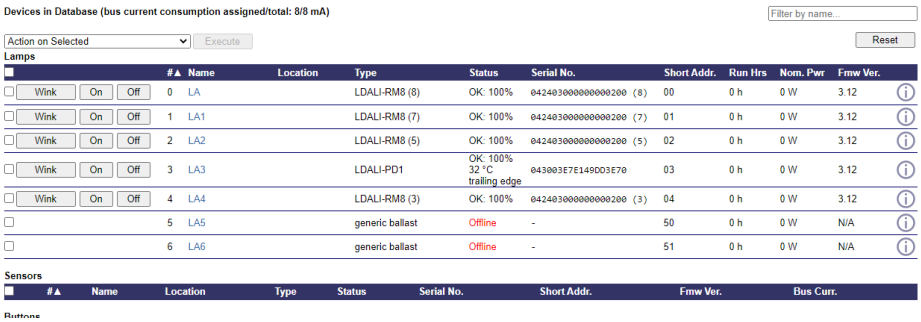


Figure 13: Automatically found and assigned pre-addressed DALI-devices

The new datapoint *DeviceCfg* in the device template allows to activate/deactivate the automatic assignment procedure for the device and also to hide the device from the list of Unassigned Devices.

New System Registers

The system registers have been re-organized under a folder structure. The old system register locations are available for back-ward compatibility. A new system register “Time Zone Name” has been added that allows configuration of the time zone offset and DST settings according to the timezone database. Writing a valid time zone name to that register sets the new timezone information, e.g., “CET” for Central European Time.

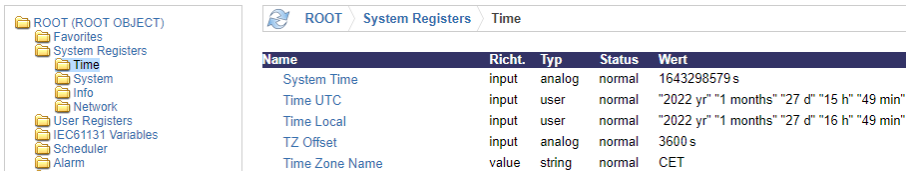


Figure 14: New system register layout.

WiFi Enterprise

To further increase security in a WiFi network, IT departments support the 802.1X authentication method on WiFi also known as WiFi Enterprise. LOYTEC devices can enable WiFi Enterprise in the WiFi settings by selecting WPA2-ENTERPRISE key management. The authentication methods Protected EAP (PEAP), Tunneled TLS (TTLS) and EAP-TLS (using certificates) are supported.

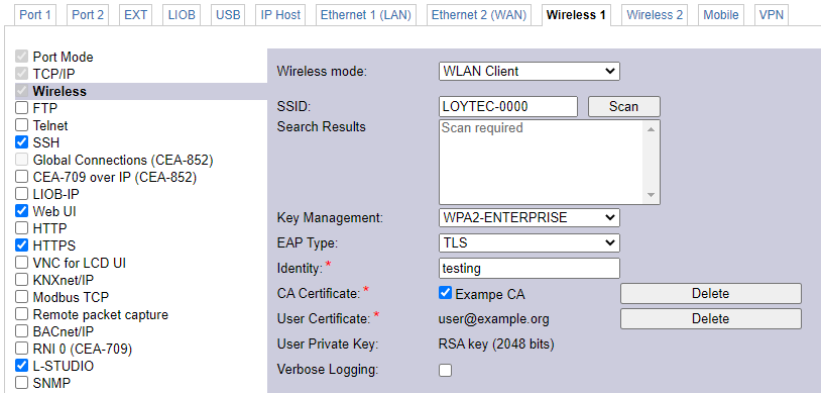


Figure 15: Configure WiFi Enterprise

Historic Filters

A new filter item type has been added to historic filters: The Offset Correction item. This item allows correcting the underlying meter value by a given offset. That offset will be added to the measured value before the value is processed by other historic filters. After replacing a meter, the offset correction can be used to maintain continuous consumption.

In addition, historic filter items can now be written to on the Web interface to set historic values. For example, it is now possible to set the value of Jan 1 or any other historic value. On the details page, all historic filter values can be exported to a CSV file. That file can be imported on other historic filter data points allowing the simple transfer of historic values.

Node-RED™ 2.0

The scripting support on LOYTEC devices has been improved by supporting Node-RED™ 2.0. This includes new editor UI features. A new safe mode allows debugging problems in third-party packages.

BTL Testplan 16 Certified

The BACnet certification of all BACnet models has been updated to comply with protocol revision 16. All new device models are now BTL certified. New BACnet features in that release include

- Support Fault_Type and Fault_Parameters in the Event Enrollment object,
- Fault_High_Limit and Fault_Low_Limit properties,
- Support extended “jumbo” MS/TP frames.

4.4 New in L-DALI 7.4

LDALI-RM5/RM6, LDALI-PWM4 and LDALI-PD1 support

The LDALI controller now supports the Loytec devices **LDALI-RM5** and **LDALI-RM6**. These modules can either be used as simple relay-modules (according to IEC62386-208 Switching function) or as converter for a control gear with 1-10V interface (according to IEC62386-206 converter).

Support has been added for the **LDALI-PWM4**, a constant voltage LED-driver with 4 output channels, each of which can be controlled via as separate DALI-address.

Support is also provided for the **LDALI-PD1**, a phase-cut dimmer module suited for integration of LED-retrofit and halogen bulbs in DALI-lighting applications.

For detailed information refer to the LOYTEC Device User Manual [1]. Supported devices are listed in the “L-DALI Compatibility List (AN011E)” [10].

New datapoints for bluetooth-based functions of LDALI-MS2/4-BT:

LDALI-MS2-BT and LDALI-MS4-BT come with bluetooth interface and thus can broadcast bluetooth beacon information as well as scan for other beacons in their radio range. This opens various application scenarios:

- iBeacon or Eddystone-UID beacon used for indoor localization and navigation by a mobile device
- LWEB-beacon: support for advanced mobile room control functions using the new LWEB-app for iOS and Android smartphones.
- detect beacons nearby each sensor, the collected information can be used for asset tracking (license LIC-ASSET is required to enable this function)

For a detailed description of the bluetooth functions refer to [12]

L-DALI models with BACnet interface (LDALI-20X, LDALI PLCx): A new BT-sensor object contains the datapoints *UUID*, *Major* and *Minor* for configuration of iBeacons and *Name* and *Instance* for Eddystone-UID beacons. The beacon is automatically enabled if *UUID* or *Name* are configured. The datapoints *LocalName*, *ClientConfig*, *View1* and *View2* and the system register *Beacon Authentication Code* are used for the configuration of the LWEB beacon. Scanned beacons are represented by *AssetCount* and *AssetData*.

On L-DALI models with LON-interface (LDALI-10x), the datapoints are provided as user registers.

New datapoints: sensitivity for PIR and acoustic presence detection

L-DALI models with BACnet interface (LDALI-20X, LDALI PLCx):

Pir_Sensitivity and *Acoustic_Sensitivity* data points were added to the occupancy sensor objects/template, allowing easy setup of sensitivity for different detection methods. Note: *Acoustic_Sensitivity* datapoint only works for LDALI-MS2-BT and LDALI-MS4-BT, whereas the *Pir_Sensitivity* can be used for any sensor supporting sensitivity according to IEC62386-303.

L-DALI models with LONMARK interface (LDALI-10X):

The configuration network variables *nciPirSen* and *nciAcousticSen* in the occupancy sensor object have been added.

Integration of DiiA vendor database

The certification database of the DiiA, also known as DALI Alliance, is integrated and used for device recognition. DALI-2 certified devices are identified based on their GTIN and shown with correct type and brand in the scan results. The database is also used for improvements e.g. on current consumption calculation.

DALI-Scan: partial scan & recovery of LDALI devices in bootloader

In addition to the “Full scan”, two new options have been added to the DALI-scan. A “Partial Scan (unaddressed only)” does only scan for unaddressed devices, which is useful if new devices are added to an existing installation. “Search for lost LDALI devices” is a tool which can help to find devices that have been lost (e.g caused by a power loss during firmware update). This feature searches exclusively for LDALI-devices in this state.

Figure 16: Options for DALI-scan

Improvements on Usability and WebUI

The progress visualization of DALI-scan, firmware update and assign procedure is now embedded in the installation site.

The light behavior during firmware update can be configured.

Furthermore there are some minor improvements on DALI statistics, DALI protocol analyzer, DALI communication, scene and group configuration site and naming of groups and devices.

New Menu Structure on Web UI

The menu structure on the Web UI has been redesigned to be more intuitive and group frequent actions together. New top-level menus help keeping the menus organized into typical tasks, such as statistics, data viewing, commissioning, configuration, programming, security, and maintenance.

User Management on the Device

LOYTEC devices now provide a simple user management to create users and passwords on the go. Users can be assigned roles, such as 'admin', 'operator' or 'lweb' roles. Users having the 'lweb' role are limited to using LWEB-802/803 visualization projects only and have no other device operation capabilities.

The Web UI on the device allows creating, deleting and modifying users and assigning roles. As an example, an additional admin user can be created who is allowed to configure the device without knowing the master admin password. This user account can easily be disabled again.

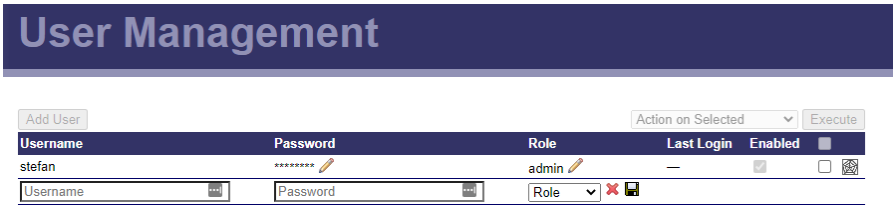


Figure 17: User management on the device.

Support for LRS232-802

The new LRS232-802 interface supports two RS-232 ports and is connected to the device's USB port. LOYTEC devices that support the LRS232-802 can be configured to run Modbus ASCII on it or a custom RS-232 serial protocol implemented by a script module. The protocol settings can be found on port tabs under the USB port.

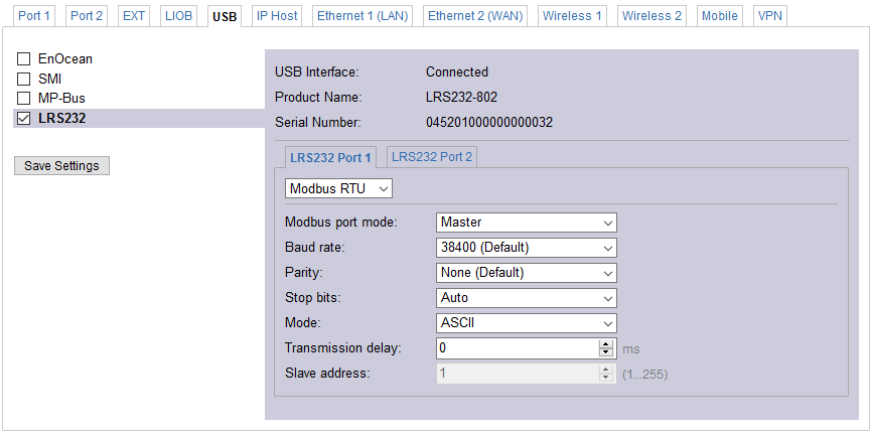


Figure 18: Configure Modbus ASCII on LRS232-802.

BACnet Features for AMEV AS-B Profile and Protocol Rev 1.15

The BACnet implementation now supports additional features to comply with the AMEV AS-B profile. This includes:

- Additional properties for the Loop object,
- New properties for intrinsic reporting, including event and reliability inhibition, alarm message texts config, time delay normal,
- External Notification-B (AE-N-E-B) in the Event_Enrollment object,
- Minimum_On/Off_Time properties for commandable binary objects,
- Min/Max_Pres_Value properties for Analog Value objects,
- Current_Command_Priority for all commandable objects.

Alarming

Both BACnet and generic alarms now support an option to define a different delay for the to-normal transition. Simply select the Time delay normal option and set a delay in the alarm condition dialog. On BACnet, intrinsic reporting and algorithmic reporting facilitate the property Time_Delay_Normal to carry this value. Also, the layout of the alarm dialog has been reorganized to better group the settings by the different alarm transitions.

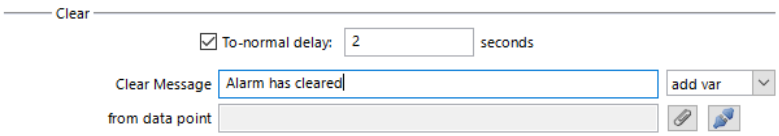


Figure 19: Option to define a different to-normal delay.

Network Port Authentication

To further increase security in a network installation, IT departments support the 802.1X port authentication method. This standard requires a device to authenticate its port on the network switch, before traffic into the network is allowed.

LOYTEC devices can enable 802.1X port authentication in the port mode settings. The authentication methods Protected EAP (PEAP), Tunneled TLS (TTLS) and EAP-TLS (using certificates) are supported.

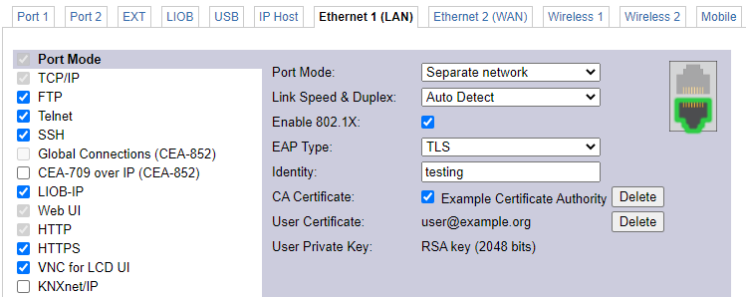
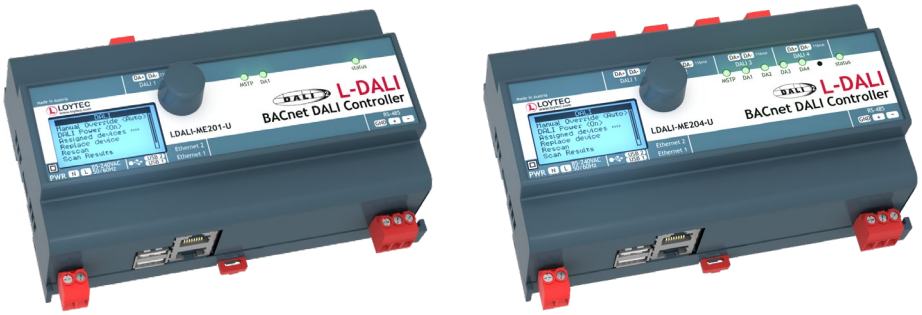


Figure 20: Configure 802.1X port authentication

4.5 New in L-DALI 7.2

DALI-2 certified interface

With this firmware version the LDALI-controllers come with a DALI-2 compliant interface according to the standards IEC62386-101:2014+AMD1:2018 and IEC62386-103:2014+AMD1:2018. The first certified products are the BacNet types LDALI-ME201-U and LDALI-ME204-U, both now marked with the DALI-2 logo.



Internal buspower enabled on 2- and 4-channel devices

LDALI-controllers with programmable logic (“PLCx”) or ending with an “-U” in the model type provide an integrated DALI-bus power supply for each channel. This internal supply can be enabled and disabled on all new devices, which are delivered with firmware version 7.2 and higher.

LDALI RM3/RM4 and RM8 support

The LDALI controller now supports the Loytec devices **LDALI-RM3** and **LDALI-RM4**. These modules can either be used as simple relay-modules (according to IEC62386-208 Switching function) or as converter for a control gear with 1-10V interface (according to IEC62386-206 converter).

Furthermore the firmware provides support for the **LDALI-RM8**. The module comes with 8 built-in relay contacts, each of which can be controlled individually by a separate DALI-address. An override on the relay modules (100%) caused by the digital inputs on the module is indicated in the WebUI (the information is available on datapoint level as well).

For **DALI devices with multiple logical units** the number of the logical units has been added to the serial number (and to the type). Hence all logical units (or DALI-addresses) which are part of the same physical device can be identified easily.

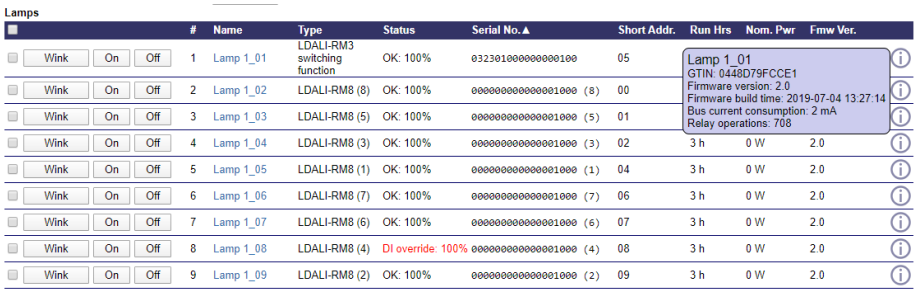


Figure 21: Web-UI - relay modules LDALI-RM3 and LDALI-RM8

For all relay modules the number of relay operations is shown in the info-field.

For detailed information refer to the LOYTEC Device User Manual [1]. Supported devices are listed in the “L-DALI Compatibility List (AN011E)” [10].

Button Function: Support feedback feature for DALI input instances

The feedback feature for button instances according to IEC62386-332 is now configurable. The feedback-LEDs of a button module can either be switched On/Off permanently or be used to indicate the state (or inverted state) of the assigned area (destination of the button function). As an alternative the feedback LEDs can be controlled via a network data point.

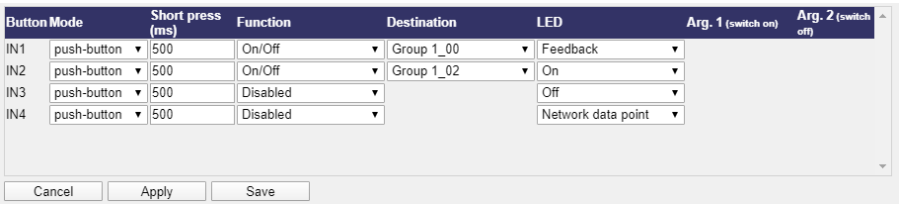


Figure 22: Button configuration with feedback feature

New datapoints: mains on, temperature and humidity, button input feedback

L-DALI models with BACnet interface (LDALI-20X, LDALI PLCx):

Humidity and *Temperature* data points were added to the Light Sensor objects/template, allowing easy monitoring of these values measured by the new DALI MS2 sensor.

For the feedback feature of DALI-2 compliant push button instances the feedback-LED can be controlled via the *Feedback INx* datapoint in the button object/template.

The status of the Mains On/Off algorithm is now provided by the *Mains On* datapoint in the channel object/template.

L-DALI models with LONMARK interface (LDALI-10X):

The network variables *nvoTemperature* and *nvoHumidity* in the sensor object have been added as well as the network variable *nviFeedbackState* in the button object to control the button-feedback LEDs.

The *MainsOnx* datapoints are available in the system registers.

Web-UI: Improvements on DALI-Installation page

Some actions in the drop-down menu have been improved or changed to improve usability:

Unassign: by performing an "unassign"-action the physical DALI device (afterwards listed under "Scanned Devices not in Database") is separated from the lamp/sensor/button object (afterwards listed under "Unassigned Devices").

Delete: this action can only be executed on "Unassigned Devices", deleting the configuration of the object and restoring factory default settings to the object.

New entry "**Reset converter settings**": allows to reset the device type specific parameters of DALI converters (device type 5).

Additional DALI-related actions have been added for scanned (but not assigned) devices:

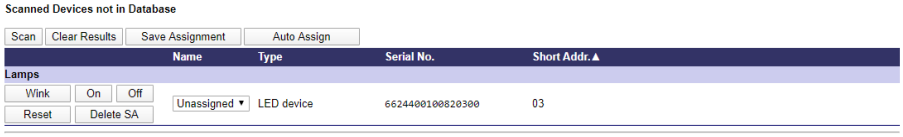


Figure 23: WebUI: Additional actions for scanned devices

"On"/"Off"-Buttons in addition to the Wink-Button for easy identification and/or control of an unassigned DALI-device. Pressing the **"Reset"-Button** sends a "DALI Reset"-command to the DALI-device which sets all parameters in the device to default. The **"Delete SA"** deletes the DALI short address.

Furthermore the DALI-scan procedure can be aborted now.

Improved button function for sunblinds

The **button function "Up/Down/Auto"** for sunblind control has been improved – now the current state of the sunblind control is considered.

Support for LTE

LOYTEC devices now support the LTE-800 mobile interface. This interface is connected via the USB port and offers LTE/UMTS/GSM mobile network access. A SIM card from your provider needs to be inserted and the LOYTEC device is ready on the mobile network. A **Mobile** tab has been added to the port configuration interface for configuring the LTE-800. Simply enable Mobile Network, enter your APN data and select which protocols shall be run on LTE.

New system registers offer mobile communication statistics such as Bytes transferred or SMS sent. The VPN client is also ready to be used on the LTE mobile network.

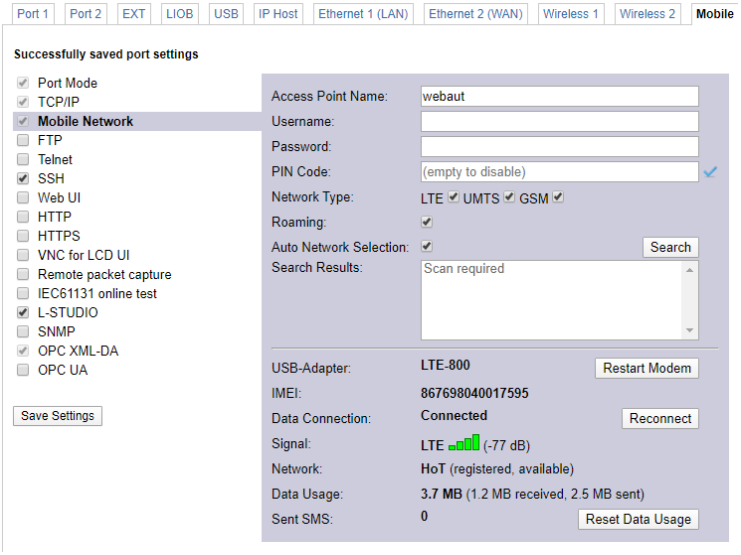


Figure 24: LTE-800 mobile configuration

Internet Connection Sharing

Combined with an LTE-800 mobile interface a LOYTEC device can act as a NAT router to share the mobile Internet connection with other devices on the LAN. For doing so, the **Internet connection sharing** feature can be enabled on the **IP Host** tab, where the default router interface is selected. Other devices on the LAN need to specify the IP address of the LOYTEC device offering connection sharing as their default gateway. This way, local devices can use NTP, VPN client or other Internet services.

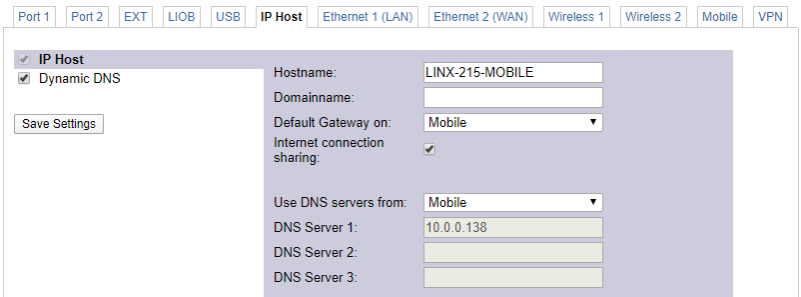


Figure 25: Internet connection sharing

Dynamic DNS

LOYTEC devices can now make use of a dynamic DNS service to register a public DNS name. This makes the device reachable over a publich IP address that can change over time, for instance an LTE-800 mobile interface using a public IP address assigned by the mobile carrier. A number of dynamic DNS providers are preconfigured and can be selected on the **IP Host** tab of the port configuration as shown in Figure 26.

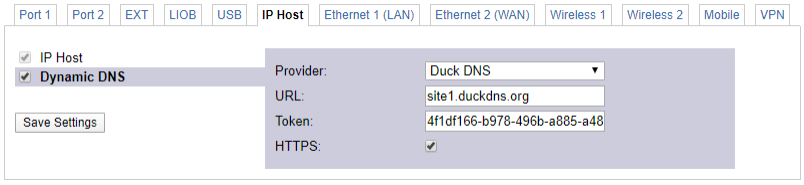


Figure 26: Dynamic DNS Settings

Secure Building Automation Protocols using VPN

This firmware version enhances flexibility and control over which building automation protocols are directly available on the VPN. A separate **VPN** tab has been added to the port configuration that allows configuring IP-based control protocols to be running directly on the VPN client. This effectively secures otherwise unsecured automation protocols such as BACnet/IP, Modbus TCP, KNXnet/IP or CEA-852. When running on the VPN interface, the protocols are assigned the VPN's IP address and as a protocol node, the LOYTEC device is also reachable over multi-NAT access networks, such as LTE.

For example, simply set up the CEA-852 configuration server on the VPN interface and add all other CEA-852 clients on the same VPN. The same can be done for BACnet/IP. Each node establishes a secure channel to the OpenVPN server hub, which routes the traffic between the communicating peer nodes. No unencrypted traffic will ever be transmitted.

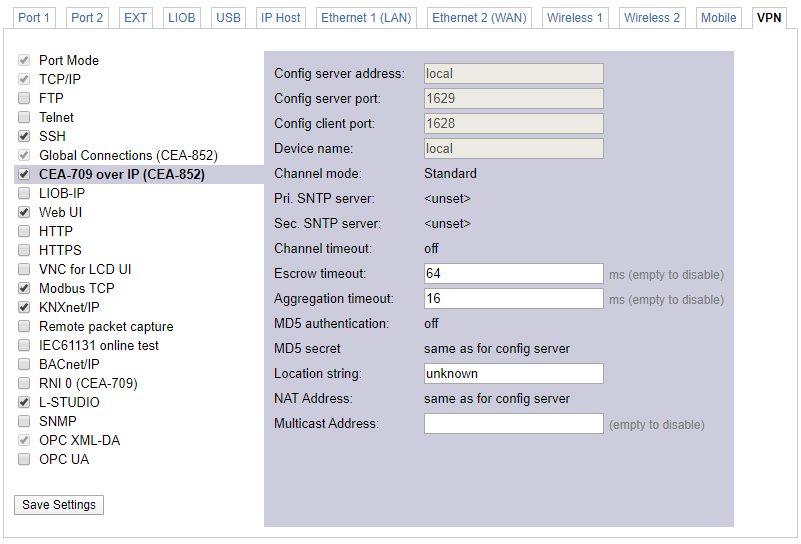


Figure 27: VPN tab on the port configuration interface.

SMS Delivery

The new SMS template message type can be used to configure SMS transmittion just like E-Mail templates for E-Mail transmission. SMS can be triggered and contain arbitrary variable text and placeholders. One application is SMS alarm delivery.

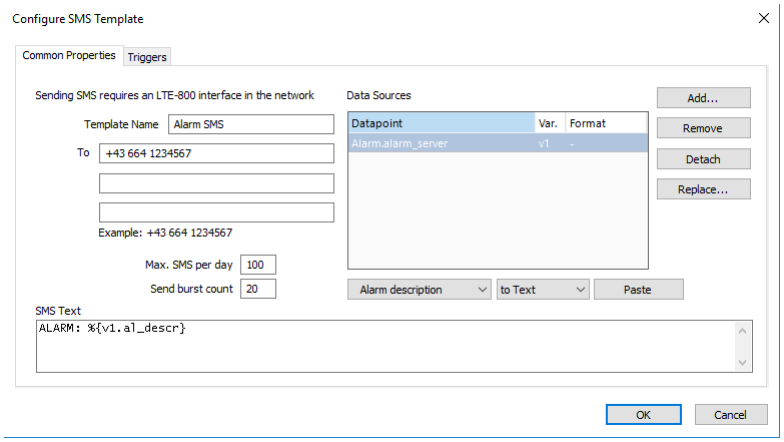


Figure 28: SMS template configuration.

SMS can be sent using a locally attached LTE-800 mobile interface or over the network using another LOYTEC device acting as an SMS proxy for its LTE-800 mobile interface. SMS proxy mode can be configured in the new SMS configuration menu on the Web UI. As a result, only one LTE-800 is required to offer SMS service for an entire local network.

Node-RED™ Integration

LOYTEC devices that support the scripting feature now also natively integrate the Node-RED™ run-time. The Web interface provides a configuration menu to open the Node-RED™ editor UI. As a default, the run-time is not executing and needs to be enabled. Once enabled, the run-time automatically starts the configured flows. An example is shown in Figure 29.

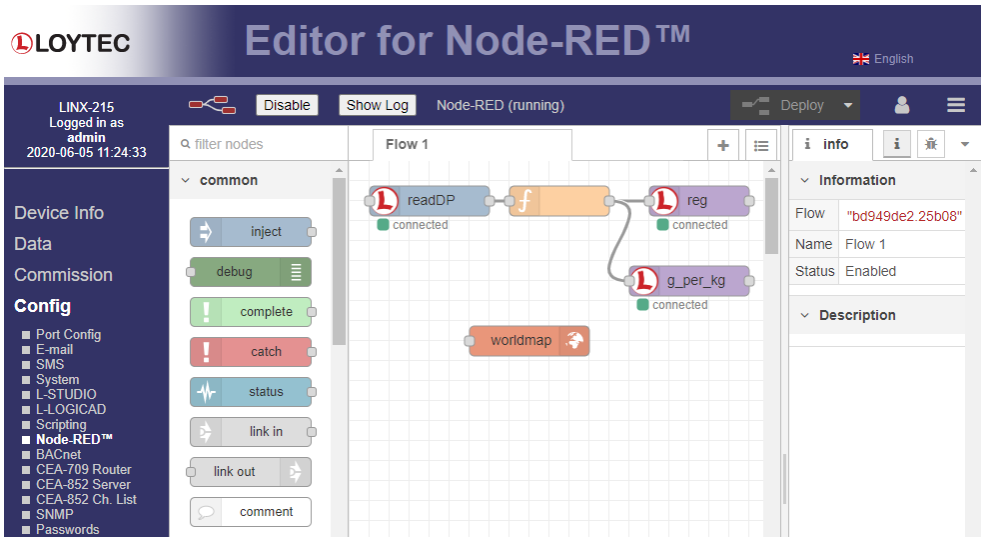


Figure 29: Node-RED™ editor UI on the device.

The user can access data points on the device using the pre-installed ‘readDP’ and ‘writeDP’ palette items. Custom palette items can also be installed, like the ‘worldmap’. The editor UI is also accessible on a stand-alone Web browser page under the ‘/nodered’ device URL.

Parameter and Default Values

A new *Parameter Value* property has been introduced in the data point configuration that tracks the current parameter value on the device. This is in addition to the *Default Value* property. When uploading parameter values from the device into the configuration, the parameter value property is updated where selected so in the parameter merge dialog. The default value property remains unaffected by a parameter upload. This way it is possible to track current parameter values while still keeping their original default values. When desired, parameter values can be reset to their default values.

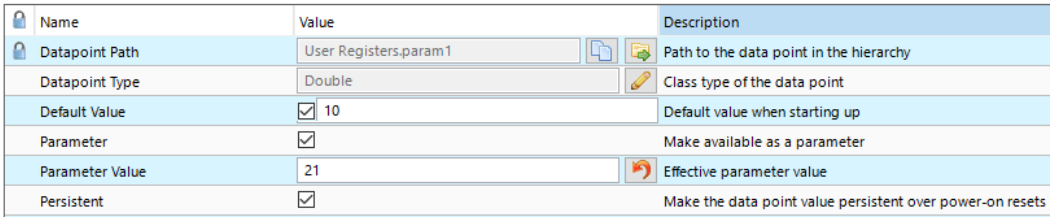


Figure 30: The new Parameter Value property.

IPv6

LOYTEC devices now support IPv6 using stateless address autoconfiguration (SLAAC) or having a configured, fixed IPv6 address. The IPv6 feature is available on all Ethernet and WLAN ports. With SLAAC no further configuration (except the required IPv6 router equipment) is required. The static IPv6 address can be configured on the TCP/IP settings on the port configuration.

Protocols that support IPv6 are the Web interface, SSH, HTTPS, NTP and BACnet/IPv6. Additional IPv6 statistics have been added to the IP statistics pages for troubleshooting.

BACnet Dynamic Object Creation and Event Enrollment

New BACnet protocol features have been added to LOYTEC devices. First, dynamic object creation is now supported for Trend_Log, Scheduler, Calendar, Notification_Class objects. This means that a BACnet OWS can dynamically create and delete those objects during run-time. No reserved BACnet objects are required in the data point configuration.

Second, algorithmic reporting has been implemented in the Event_Enrollment object. This object can be created and configured by a BACnet OWS to dynamically add and remove alarm conditions on any BACnet object in the device.

In combination with IPv6 support, the BACnet protocol can be configured to run on the BACnet/IPv6 data link. Simply choose IPv6 in the BACnet/IP protocol configuration.

4.6 New in L-DALI 7.0

Support of additional features for DALI input instances

Analog input devices (e.g. slider, dial, etc.) according to IEC62386-302 are supported now. Furthermore minor changes due to the DiiA clarifications on input device instance types (part IEC 62386-3xx) have been implemented.

A new button function for simulating occupancy/vacancy has been added.

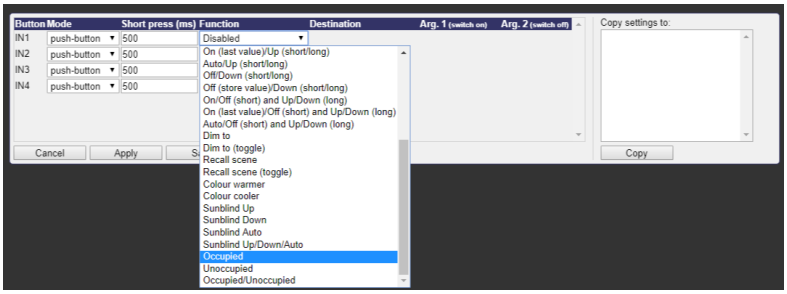


Figure 31: Occupancy Triggered by Button

Improved Troubleshooting in WebUI & DALI-Scan:

- Detection of duplicate DALI random addresses during scan
- Show LDALI field devices with missing firmware (after failed firmware update)
- Show firmware info for DALI devices in web UI
- Minor improvements in DALI sensor calibration web UI

Alarming

The data point alarming brings two new features for alarm messages: First, the new placeholders %{bacName}, %{bacDescr} have been added. These expand to the native BACnet server object name and description. Since these may be updated by an OWS at run-time, alarm messages will now reflect those updates when using the new placeholders.

Another change to alarmed data points are new property relation data points for alarm message texts: msgNormal, msgOffnormal, msgHigh, msgLow, and msgFault. The content of these property data point overwrite the pre-configured alarm messages and can be changed at run-time. This allows easy configuration of alarm messages by linking to common string data points that are parameters. For example, all temperature alarms may lnk their msgHigh property relation to the string parameter msgTempHigh configured to a local text such as “Temperature %{name} exceeds %{hi}”.

VPN

LOYTEC devices support joining a virtual private network (VPN). This feature is based on the widely-used and open-protocol OpenVPN technology. An OpenVPN configuration file (.ovpn) can be installed on the Web interface and makes the LOYTEC device a VPN client and dial into the OpenVPN server defined by that file. Any standard OpenVPN configuration

file can be used, which is auto-login, i.e. does not require entering a password when connecting. After having registered, the LOYTEC device can be reached via its VPN address.

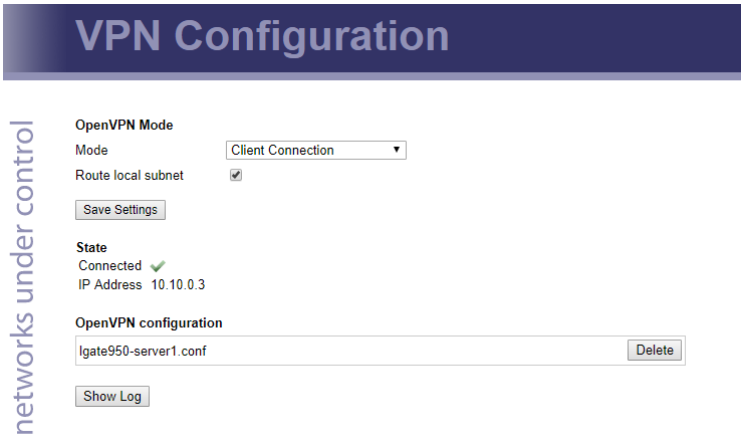


Figure 32: VPN client configuration on the Web interface

Setting up a VPN client on the LOYTEC device may solve NAT router issues, because no port forwarding rules need to be configured. The device dials out to the OpenVPN server running on a public IP and establishes the VPN channel. This VPN channel provides a secure connection for building automation protocols, such as BACnet/IP, Modbus TCP or CEA-852. Being part of a VPN the LOYTEC device is also reachable over multi-NAT access networks, such as LTE.

An alternative method is to enable simple server mode on the LOYTEC device. In this mode, the device provides an OpenVPN server and allows downloading a client configuration file from the Web interface. This file can be installed on any OpenVPN client and allows that client connect to the LOYTEC device over the secure VPN channel. Only one client may connect at a time.

Data Point Web UI

The LOYTEC device is now tracking information on the source of a written value for each data point. This information is shown on the data point details Web UI next to the modification timestamp and can be used for troubleshooting, for example, whether a value was modified over the Web UI or is written by a local connection.

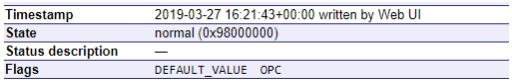


Figure 33: Write source info on the data point Web interface

Make protocol logs more verbose

LOYTEC devices have been improved to decode protocol logs of its supported technologies to be displayed in a more verbose manner. This makes it easier for Modbus, M-Bus, MP-Bus, SMI, DALI, EnOcean to analyze communication problems with other third-party devices. Simply click the Protocol Analyzer link on the statistics Web page of the respective protocol.

EnOcean over L-STAT

L-STAT devices with EnOcean capability can now be used by LOYTEC devices as remote EnOcean antennas like a LENO-800 interface. This EnOcean over Modbus feature expands the air coverage of EnOcean in a multi-room setup. An EnOcean repeater setup that is

cumbersome and difficult to troubleshoot is no longer needed. Simply add EnOcean L-STATs to extend the wireless reach of the LOYTEC device.

BACnet for Japan

This software release includes some minor changes to improve BACnet interoperability in Japan. First, a new client mapping mode was added: COV unsolicited + poll. In this mode the client map not only accepts updates via unsolicited broadcast messages but also actively polls the remote devices. Second, any kind of UnconfirmedEventNotification broadcast (event or alarm) can be used to receive value updates. Third, also status flags of client mappings are updated by event/COV notifications that include status flags.

Support Custom Serial Port in JavaScript

A new API has been added that allows using the serial port on a LOYTEC device in JavaScript. This feature can be used to implement custom serial protocols. The port Web interface offers a choice to select such a custom serial implementation based on meta data provided by the JavaScript module. An example for such custom protocol support is DMX, which is distributed as an add-on script resource.

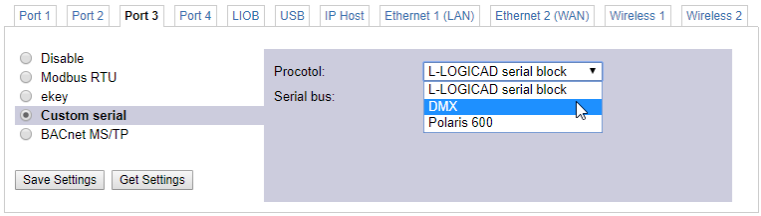


Figure 34: New Web interface to select custom serial protocols.

Other scripting features added to this release are defining debug filter keywords on the Web interface, enabling and disabling scripts, and a new system API to allow firewall ports on the LOYTEC device.

4.7 New in L-DALI 6.4

Unified Firmware

The L-DALI firmware is now included in the unified LOYTEC controller firmware package for L-INX, L-ROC, L-GATE and L-IOB devices.

Colour control via data points

On L-DALI models with BACnet interface (LDALI-20X), *Hue* and *Saturation* data points were added to the Lamp Actuator, Group Actuator and Channel Actuator objects, allowing easy control of DALI ballasts with colour control functionality (device type 8, DT8). For more information, see Section 8.2.2.10.

On L-DALI models with LONMARK interface (LDALI-10X), the network variables *nviGPSetting* (Group Actuator) and *nviCHSetting* (Channel Actuator) can now be used to change output colour. For more information, see Section 8.1.1.11.

Support for DALI primary-N and RGBWAF colour control options

In addition to the DALI colour control options *colour temperature Tc* and *xy-coordinate* the L-DALI now supports DALI device type 8 (DT8) devises using *primary-N* and *RGBWAF* colour control. Colour control is possible via scenes or via the new data points for colour control (see above).

Improved DALI Installation web-UI

The DALI Installation web-UI was redesigned for improved usability (see Figure 35). Besides many more smaller improvements buttons and selection check boxes were moved to left side of screen to avoid scrolling. For more information on the DALI Installation web-UI see the LOYTEC Device User Manual [1].

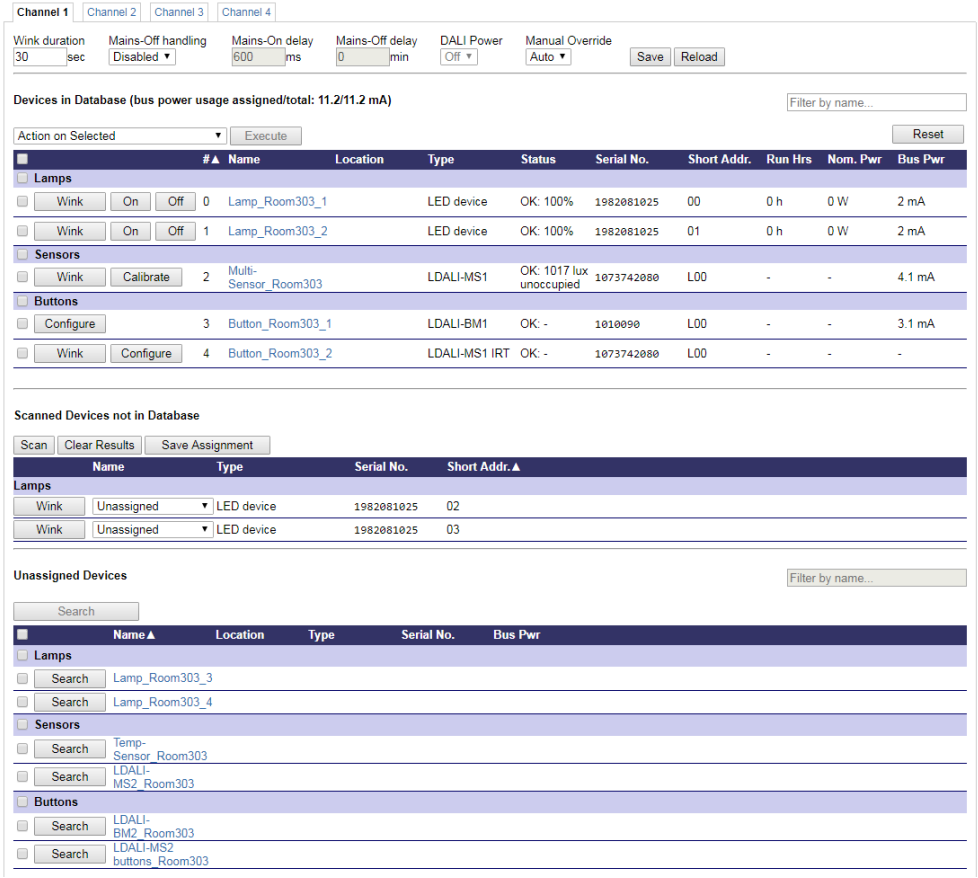


Figure 35: New DALI Installation web-UI layout.

Localized Web Interface

The entire Web interface of the device has been localized to German, French, and Chinese language. Simply change the language on the LCD display or directly on the Web interface via the new flag symbol on the upper right corner. Changing language is instant and does not require a reboot.

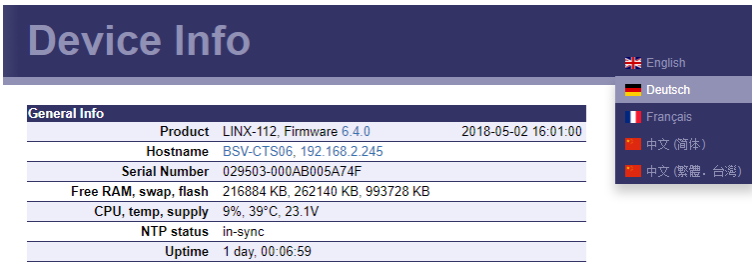


Figure 36: Language selection on the Web interface

Safe Reboot and Auto-Login

Changing IP settings and rebooting could end in a device unreachable, if something was different than expected. The new safe reboot feature helps out by reverting the changes made, if not logged in on the Web interface within 5 minutes after the reboot. Locking oneself out by entering a mistaken IP address is no longer possible.

Figure 37: Safe reboot screen suggesting new IP address.

Another new feature that helps getting logged in again is the session auto-login. After a device has rebooted the Web interface restores the session and automatically logs in again. Even when changing a static IP address the device tries to connect to the new IP or suggests links for opening the device info page under the new IP address.

Backup before Upgrade

The firmware upgrade feature has been made safer by creating a backup before executing the upgrade. This feature has been added to firmware and Configurator upgrade paths. It is, however, optional and can be turned off by deselecting the check box.

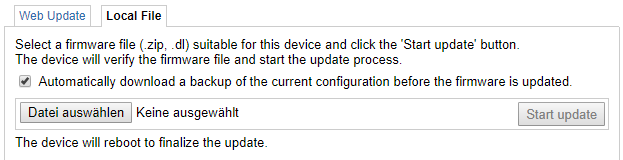


Figure 38: Backup before Upgrade on the Web interface.

Support Custom Protocols and IoT by Scripting

All L-DALI models now include a JavaSript-based scripting engine. This engine allows users to implement their own protocol support for the IoT world using RESTful APIs, JSON or Web services. The LOYTEC data point server allows integrating data points into the scripting language using the dpal-js API. The script modules can be embedded into and deployed along with the data point configuration.

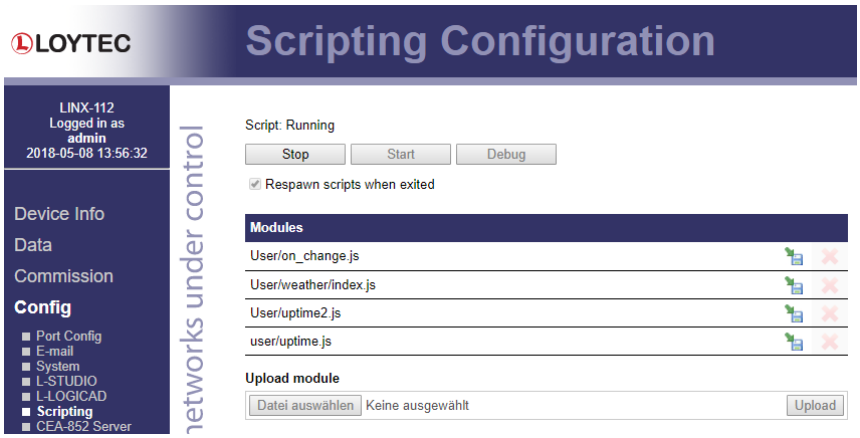


Figure 39: Web interface for scripting engine

The Web interface of the device offers an overview of installed script modules and allows starting scripts in debug mode. Use the Google Chrome inspector to debug JavaScript on the device. For more information read the new Scripting Chapter in the LINX Configurator User Manual [2].

4.8 New in L-DALI 6.3

Support for DALI 2.0 Input Devices

The L-DALI now supports DALI input device based on the new DALI-2 standard. The term "input devices" covers sensors (occupancy, lux, etc.) and buttons (push-buttons, switches, sliders, etc.).

Prior to DALI-2 sensors and buttons were not covered by the DALI standard. Different vendors, including LOYTEC, were using proprietary extensions of the DALI protocol to be able to connect this type of devices to the DALI network. As each vendor was using it's own proprietary extension the L-DALI controllers were supporting many but by far not all such proprietary extensions. Supported sensors and buttons were listed in the "L-DALI Compatibility List (AN011E)" [10].

With DALI-2 those type of devices is standardized in the IEC 62386-103, with different profiles (push-button, absolute input, occupancy sensor, lux sensor, etc.) specified in the parts IEC 62386-3XX (XX = 00..99). Similar to DALI ballasts, this allows supporting a wide range of sensors and button devices from many different vendors in the L-DALI as long as they are compliant to the DALI-2 standard.

To ensure device interoperability DALI-2 compliant devices – input devices and ballasts – can be certified by the Digital Illumination Interface Association (DiiA). Only certified devices may bear the DALI-2 logo shown in Figure 40 and are listed in the product database on the DiiA website (https://www.digitalilluminationinterface.org).

Figure 40: DALI-2 Logo.

LOYTEC recommends using only DALI-2 certified devices wherever possible. For more information on DALI-2 input devices support see the LOYTEC Device User Manual [1].

Improved Button Functions

In addition to DALI buttons, button function are now applicable to EnOcean buttons and binary data points. Binary data points can be used to configure button functions for buttons created in L-WEB graphic projects, for buttons connected to digital inputs of remote IO modules and for DALI buttons connected to DALI channels on other LDALI controllers. Consequently, the button function configuration was moved to a separate page on the web-UI (see Figure 41).

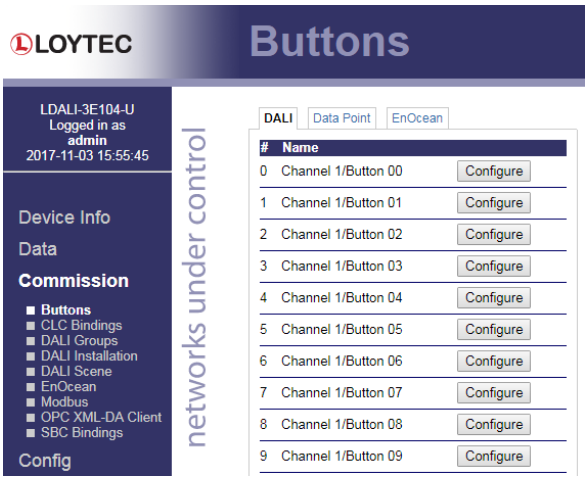


Figure 41: Button function configuration web-UI.

Further, new button function allowing control of sunblind were added. These button functions interact with the sunblind controller application of the L-DALI.

For more information on the button functions see Section 8.4.3.

Bindings Support for EnOcean Devices

Any analog data point can now be used in Constant Light Controller bindings and Sunblind Controller bindings as lux level inputs. Similar any binary data point can be uses as occupancy input (see Figure 42). This allows to use EnOcean multi-sensors in a more convenient way with the L-DALI's lighting and sunblind control applications. For more information please refer to Sections 8.4.1 and 8.4.2.

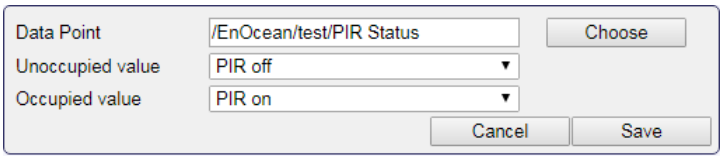


Figure 42: Use data point as CLC input.

New Objects for BACnet Interface on LDALI-20X Models

New objects were added to the BACnet interface of the LDALI-20X models:

- *Multi-State Output objects (see Section 8.2.2.16)*: This object allows to issue commands to single DALI ballasts, DALI groups or DALI channels (start/stop emergency test or burn-in, change colour temperature, etc.).
- *Analog Input objects (see Section 8.2.2.17)*: This object allows to determine the battery status of self-contained emergency lights.

With these two new object types, additional functionality becomes available via the BACnet interface:

- Starting and stopping self-tests of DALI self-contained emergency lights.
- Reading the battery status of DALI self-contained emergency lights.
- Starting and stopping the burn-in function.
- Resetting run hours and energy counters.
- Relative dimming (up/down).
- Relative changes of colour temperature (warmer/cooler) for DALI lamps with tunable white support.

In addition, the L-DALI's project settings allow configuring which BACnet object are available with a much finer granularity (see Figure 43). This allows removing BACnet objects not required in a specific application, thus, reducing the number of objects on the L-DALI's BACnet interface. For more information see Section 8.2.

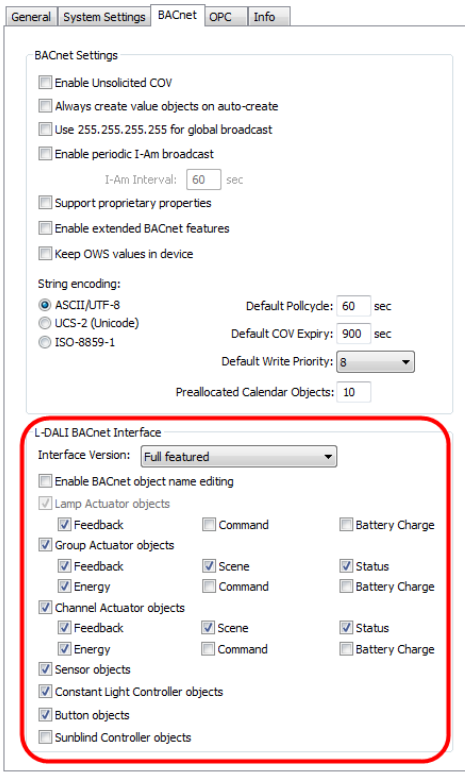


Figure 43: BACnet interface configuration.

Calculation of Sun Position

The L-DALI has two new system registers for sun azimuth and elevation, which are calculated based on the current day time and the geographical location. These system registers can be used for the corresponding inputs of the sunblind controller application. For more information see the LINX Configurator User Manual [2].

LCD Interface

The user interface on the LCD display has been extended by a firmware upgrade menu. This menu allows installing a new firmware image from an attached USB memory stick. This is beneficial for WLAN-only devices. When plugging in a USB memory stick, a menu pops up (Figure 44) on the LCD interface that shows selected quick options, including firmware upgrade and backup.

Figure 44: LCD pop-up menu for USB storage

Web UI

The data point details page on the Web UI provides write usage information. This information can now be used to determine by which objects a certain data point is being written to. The Web UI design has also been reworked according to the latest security standards, now suggesting usage of strong passwords.

4.9 New in L-DALI 6.1

Enhanced Sunblind Functionality

The LDALI-ME20X-U and LDALI-3E10X-U models offer additional functionality to control sunblinds in addition to the artificial light in a room or area:

- **SMI Support**: The LDALI-ME20X-U and LDALI-3E10X-U models now support the LSMI-804 interface. This is a four-channel SMI interface connected to the USB port of the L-DALI. SMI (Standardized Motor Interface) is a bus system used for controlling sunblinds. The LSMI-804 also contains four relays for SMI channel power-on functionality. This saves energy while the SMI bus is idle. The LINX Configurator provides SMI device templates, which can be commissioned on the L-DALI Web interface. The Web interface supports manual address assignment, scanning for SMI devices and calibration. For more information on SMI read the respective Chapters in the LOYTEC Device User Manual [1] and the LINX Configurator User Manual [2].

- **BACnet Sunblind Controller**: The L-DALI sunblind controller application was equipped with a BACnet interface and added to the L-DALI BACnet models with SMI support. The BACnet sunblind controller application provides similar functionality as the LONMARK version (e.g. glare protection, heating/cooling optimization, constant light controller interaction etc.). For more information on the BACnet sunblind controller application see Section 8.2.6.

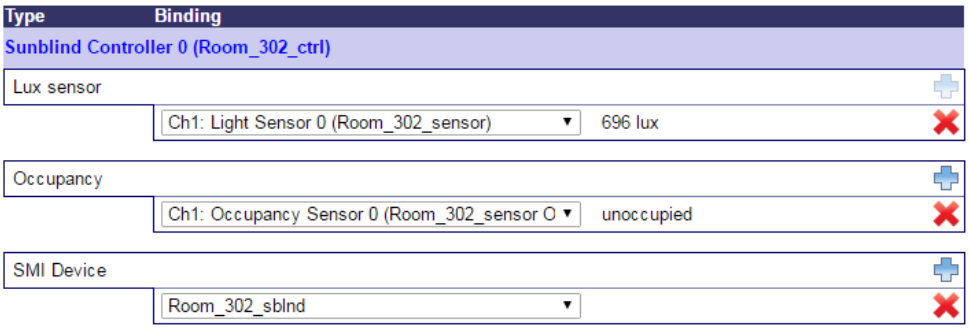


Figure 45: Sunblind Controller Bindings web UI.

- **Sunblind Controller Bindings**: To facilitate the usage of SMI sunblinds with the L-DALI's sunblind controller application a sunblind controller bindings functionality similar to the constant light controller bindings functionality was added to the SMI capable L-DALI models. Using sunblind controller bindings, DALI multi-sensors can be selected as lux and occupancy sensor inputs and SMI devices as an output of a sunblind controller instance. For more information on sunblind controller bindings see Section 8.4.2 and the respective Chapters in the LINX Configurator User Manual [2].

With the enhance sunblind controller functionality and SMI support the L-DALI becomes a powerful solution to fully integrate lights and sunblind control of a room or an area.

Constant Light Controller Improvements

The constant light controller application was extended by some new functions:

- A new regulator and controller mode was added, which does not switch on lights automatically when an area becomes occupied but requires manual activation (e.g. by a button). When the area becomes unoccupied lights are switched off. Depending on whether the CLC stays active during times with enough natural light or requires manual activation in any case when lights were switched off, the mode is called REGULATOR_MANUAL/CONTROL_MANUAL or REGULATOR_MANUAL_LUX/CONTROL_MANUAL_LUX respectively. For more information on the new operating modes see Sections 8.1.4.3 (LONMARK) and 8.2.4.3 (BACnet), respectively.

- The new function "neighboring CLCs" allows defining adjacent Constant Light Controller instances as typically found in open office spaces, where different CLC instances are used to control the different zones of the space. Whenever a zone is occupied and its lights are on, all neighboring zones/CLCs are also kept at a defined minimum level even if they are not occupied. Neighboring CLC instances can be configured using the Constant Light Controller Bindings web UI (see Section 8.4.1) and the DALI Parameters tab in the LINX Configurator (LINX Configurator User Manual [2]).

- The artificial light factor of a constant light controller parameterizes the amount of light (in lux) provided by the artificial light sources controlled by the controller at a certain dim level. The new firmware will try to determine the artificial light factor automatically instead of using a default value for this parameter. Thus, the calibration process to determine the artificial light factor in untypical lighting setups can be omitted.

User NVs on LDALI-10X Models

On LDALI-10X models (LONMARK) user NVs can be created in addition to the static interface of the controller. The NVs created can be used as inputs and outputs to Math objects and similar functions of the L-DALI controller, adding more flexibility when custom adoptions to the standard lighting and sunblind application of the L-DALI are required.

Tunable White Support on LDALI-20X Models

On LDALI-20X models, a new custom property (*Colour_Temp*) was added to Lamp Actuator, Group Actuator and Channel Actuator objects which allows changing the colour temperature of DALI tunable white lights based on the DALI standard IEC 62386 209 (Colour control, device type 8, DT8). See Section 8.2.2.10 for details.

Selective Backup and Restore

The backup and restore interface on the Web interface has been extended by content options. It is now possible to decide whether a created backup shall contains passwords, IP settings or historical data (trend logs, alarm logs). Also when restoring a backup archive it can be selected whether password and IP settings shall be accepted from the backup or not. This makes it easier to replicate devices without scarifying the IP configuration and password settings. An example is shown in Figure 46.

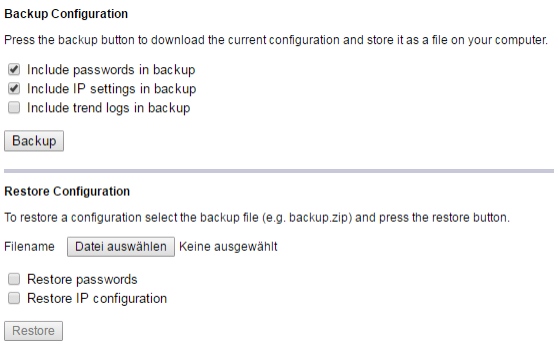


Figure 46: Backup and restore options on the Web UI.

Advanced WLAN Mesh Configuration

The WLAN Mesh configuration has been enhanced by a graphical floorplan editor as well as an online monitor of inter-link communication quality. This tool allows not only easier setup of a Mesh network but also simple troubleshooting by identifying radio bottleneck between Mesh points (see Figure 47).

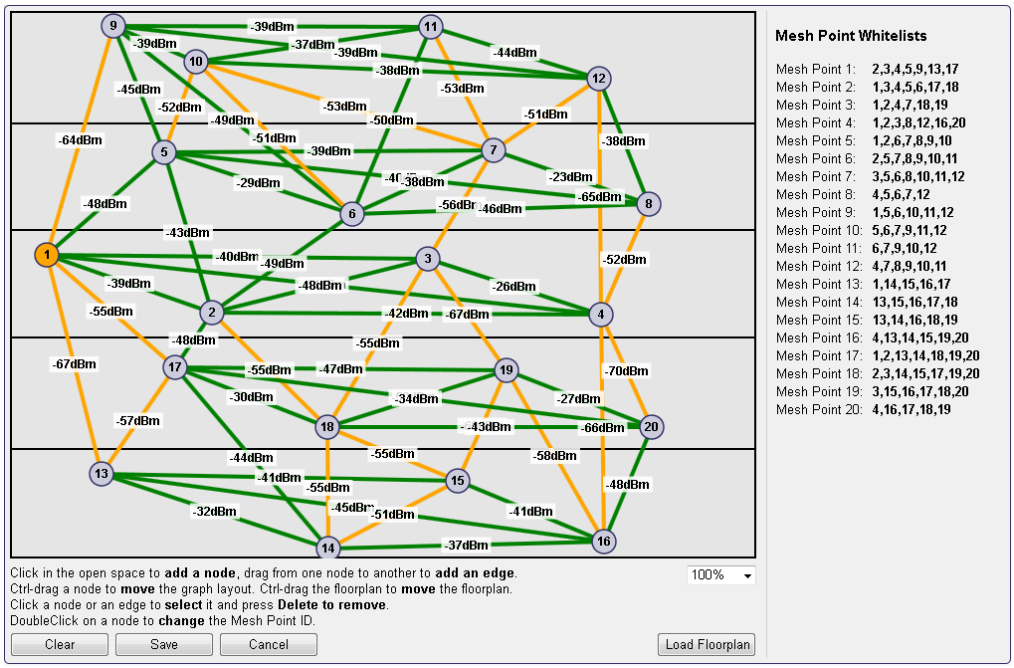


Figure 47: Mesh floorplan and online link quality monitor

LCD Interface

The user interface on the LCD display has been localized for the Chinese simplified and traditional language sets. The language can be selected from the main page and is switched immediately without a device reboot.

Another feature on the LCD display is the option to rotate the display 180 degrees. This is a useful setting, if the device is mounted upside down.

4.10 New in L-DALI 6.0

New User Manual Structure

The L-DALI User Manual has been split up into three parts: The L-DALI User Manual, which now covers the specific functions of the L-DALI device models. The LINX Configurator User Manual [2] is a common description for using the Configurator software for the L-INX, L-GATE, L-ROC, L-IOB, and L-DALI product line. And the LOYTEC Device User Manual [1] covers hardware, Web interface, LCD display and operating interfaces topics common to all LOYTEC devices.

New L-DALI Models

A new generation of L-DALI models replaces the existing models. The LDALI-ME20X-U replaces the LDALI-ME204 and LDALI-E201-U, while the LDALI-3E10X-U models replace the LDALI-3E104, LDALI-3E102, LDALI-E101-U and LDALI-3101-U models respectively. The new generation offers a higher performance and has more resources available. It therefore allows to host LWEB-802/803 projects directly on the device. Furthermore, it comes with a number of interfaces (USB, LIOB-Connect), which allows extending the capabilities of the device by connecting different peripherals directly to the controller, e.g. LENO-80x modules add EnOcean , while the LWLAN-800 module provides Wi-Fi connectivity.

Constant Light Controller Improvements

The constant light controller application was extended by some new functions:

- The constant light controller can be reactivated from manual override by recalling a special scene on a linked group.
- A new data point – *nvoOccupState* (CEA-709/LDALI-10X) or *Occupancy_State* (BACnet/LDALI-20X) – shows the current occupancy state as calculated by the constant light controller application.
- Two new data points – *Override* and *Auto_Mode* – were added to the constant light controller BACnet interface (LDALI-20X) to provide similar functionality as via the CEA-709/LONMARK interface (LDALI-10X).

New DALI Button Functions

The state of a button device input can now be forwarded to a BACnet Binary Input object as an alternative to directly control DALI lights on LDALI-20X models, too (see Section 8.2.5).

DALI Status CSV-File

A new file on the device provides the current status of the devices on the DALI channel in CSV file format. The file is dynamically generated when read and therefore always reflects the most recent status of all devices. It can be downloaded from the device (e.g. via FTP) or sent as an e-mail attachment. In addition to detailed status and error information on every ballast, the file contains test results and battery status for the DALI emergency lights on the channel.

DALI Protocol Analyzer

A DALI protocol analyzer was added to the LINX Configurator and the devices web-UI. In the LINX Configurator the protocol analyzer is available via the DALI Installation tab, while on the web-UI it is available via the DALI statistics Web interface. Logging can be started and stopped. Filters allow showing only relevant traffic. Protocol logs can be stored in a disk file in CSV format.

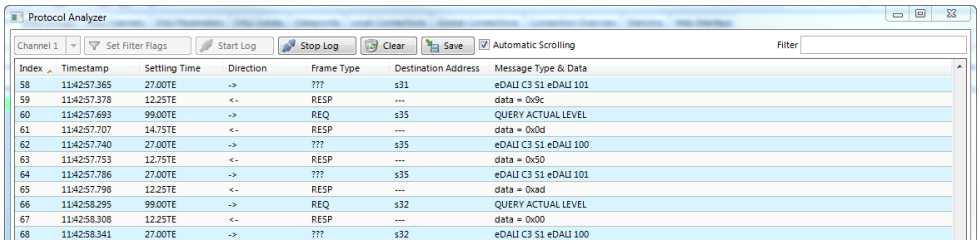


Figure 48: LINX Configurator DALI protocol analyzer window.

DALI Scene Tab in LINX Configurator

DALI scene configuration tab was added to the LINX Configurator. Similar to the DALI scene web-UI introduced in L-DALI firmware version 5.2 it also supports colour scenes with colour temperature and changeable light colour. Scenes can be configured online and offline.

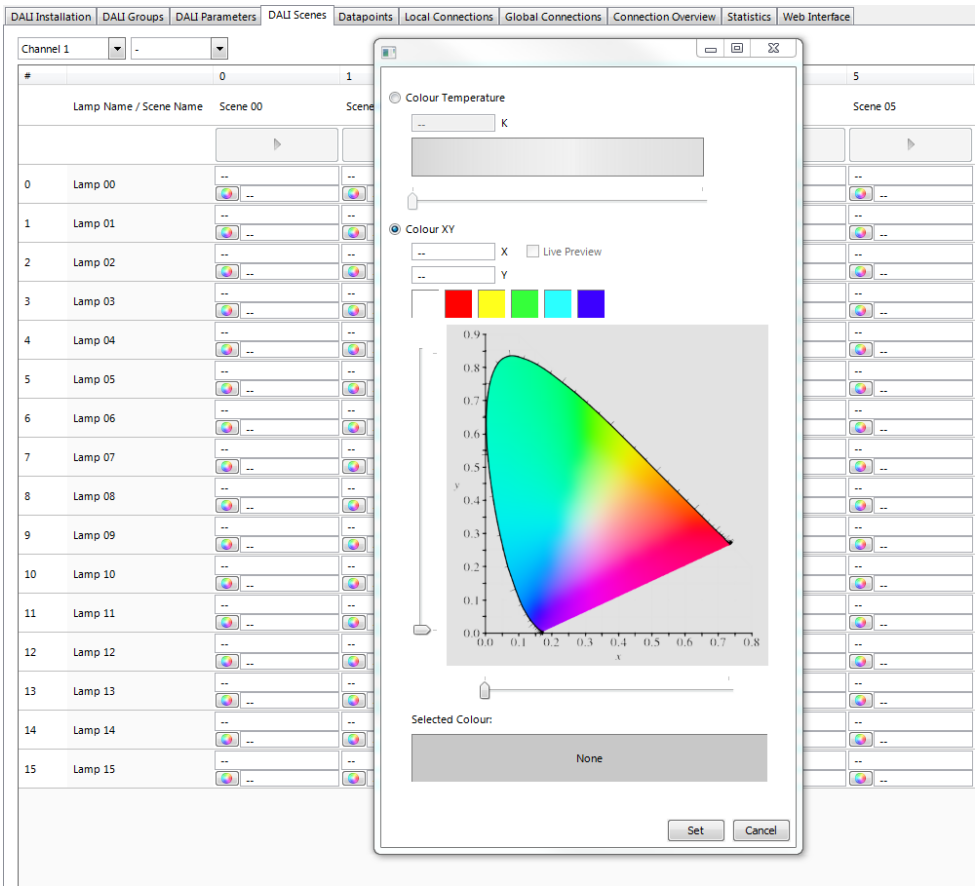


Figure 49: LINX Configurator DALI scene configuration.

DALI Physical Selection Workflow support in LINX Configurator

Identification of a DALI sensor or DALI button device via physical selection is now also possible via the LINX Configurator software.

Override Function for Data Points

The data point model in LOYTEC devices has been extended with a manual override function. On the Web interface and on the LCD display data point values can be overwritten to manual values. If an override value is set, the running control logic no longer affects the data point value, neither does network communication. The override value is in effect until it is removed again by the user.

Data Point Details	
Path	/CEA709 DALI Channel 1/Datapoints/Group Actuators/Group Actuator 0/nviGPValue
Name	nviGPValue
Description	Used to set up value of the group
Direction	input
Type	analog
Value	100 % Set Set override Clear override *Enter "--" for invalid value*
Raw value	00 00 59 40 00 00 00 00 Set Set override Clear override *Enter "--" for invalid value*
Timestamp	2016-03-02 11:17:23+01:00
State	overridden (0x880a0001)

Figure 50: Overriding a data point on the Web interface.

Manual overrides done on the DALI Installation web-UI (for the channel) or the DALI Groups web-UI result in an override of all the data point which can be used to control any

lights on the channel or group respectively (Lamp Actuators, Group Actuators, Channel Actuators).

Enhanced Structure Support on the Web UI

The display of data point structures has been improved on the Web UI. The data point listing shows a textual short version of the structured value instead of a hexadecimal Byte buffer. Also CEA-709 structures of NVs without sub-data points are displayed and can be edited.

4.11 New in L-DALI 5.3

Print L-DALI Configuration

The complete configuration of a L-DALI device including all DALI specific configuration data can now be printed using the Print function of the LINX Configurator. The Print option allows selecting, which parts of the configuration shall be included in the output. The output format can be either HTML or PDF.

New DALI Button Functions

The functions, which can be executed when pressing a DALI button was extended by the function **Auto**. This will reactivate the constant light controller linked to the functions target group in case it was manually overridden.

4.12 New in L-DALI 5.2

LINX Configurator replaces LDALI Configurator

The L-DALI models are now supported by the LINX Configurator PC software. The LDALI Configurator software therefore is no longer available.

LINX Configurator support for LDALI-20X models

The LINX Configurator now supports LDALI-20X models, including DALI offline configuration workflow and the configuration of alarming, scheduling and trend log objects, e-mail templates, math objects, data point connections etc. Custom user registers and BACnet objects can be created and data points belonging to the static L-DALI application interface can be OPC exposed. Further, the BACnet network can be scanned and client maps can be created from local BACnet objects to remote BACnet objects.

Support for LOYTEC LDALI-MS1, LDALI-BM1 and LDALI-RM1

The L-DALI now supports the LDALI-MS1 multi-sensor, the LDALI-BM1 push-button coupler and the LDALI-RM1 relay module. These devices are an optimal addition to the L-DALI controller and allow designing cost effective and flexible DALI lighting systems. For more information on these devices see the corresponding datasheet and the LOYTEC Device User Manual [1].

DALI Button Functions

For DALI button devices supporting configurable button functions these functions can be configured using the Web-UI (online) and the LINX Configurator (online and offline). The following functions are available to control DALI groups (see LOYTEC Device User Manual [1] and LINX Configurator User Manual [2]):

- Dim up, dim down,

- Off,
- On with last dimming value,
- Scene recall: 1–15,
- Dim to a specified value in %,
- Colour temperature warmer/colder.

On LDALI-10X models the state of a button device input can be forwarded to a network variable as an alternative to directly control DALI lights (see Section 8.1.7.1).

DALI Scene Configuration

A new page was added to the L-DALI Web-UI allowing configuration of DALI scenes (see LOYTEC Device User Manual [1]). Scene configuration also supports colour scenes with colour temperature and changeable light colour.

DALI Installation Wizards

A DALI search wizard was added to the DALI installation Web-UI to quickly locate and assign DALI devices. When preconfiguring DALI devices in an offline workflow (name, group assignment, DALI parameters etc.) the wizard assists in locating the corresponding physical device once online (see LOYTEC Device User Manual [1]).

On the Constant Light Controller Web-UI a sensor search wizard was added. Once groups were configured to a CLC instance this wizard allows to automatically search for corresponding DALI sensors in the areas lit by these groups (see Section 8.4.1).

Identification of DALI Devices using Physical Selection

Devices which can be physically selected can be identified by selection during the installation and commissioning process of the DALI network. A DALI button can be selected by pressing one of the buttons, an occupancy sensor can be selected by triggering occupancy. Now the last physically selected device is marked in the DALI scan results on the DALI Installation Web-UI and can be therefore identified.

Online Commissioning

The Web interface of the device now provides an online commissioning tool for the respective networking technologies. Using this tool, data point configurations can be created based on placeholder devices, which are marked to be commissioned later. The necessary addressing information can be assigned later on the Web interface by scanning for devices online or be entered manually. Device replacement is also possible in the commissioning Web interface without the need to edit devices in the data point configuration. For more information on the commissioning Web UI please refer to the LOYTEC Device User Manual [1].

Web Interface

The Web interface of the device offers a number of new features:

- A new device info page provides a quick overview of all relevant operational parameters, such as CPU load, active protocols, time synchronization and many more.
- The trend log configuration on the Web UI now also provides a preview tab, which shows a chart of the trend log data. The trend chart allows zoom, scrolling and hiding specific data curves, as shown in Figure 51.

Figure 51: New trend chart on the Web UI

- An improved DALI sensor calibration Web-UI allows to dim DALI groups directly from the sensor calibration Web-UI page making it easier to adjust the artificial light near the calibrated sensor. Further the calibration page can be accessed directly from the CLC Bindings page.

Scheduler

The scheduler objects have been extended by the following new features:

- Colour support in BACnet and generic schedulers allows consistent assignment and display of preset colours in L-WEB, L-VIS and the Configurator scheduler UIs.
- Event auto-prune removes passed events, if the capacity of exception events in a scheduler gets low.
- The scheduler default for LONMARK and generic schedulers is extended by a “silent” mode. In this mode the scheduler becomes inactive as soon as the last event is withdrawn. This mode can be used in event-driven scheduler models.
- Generic schedulers allow specifying an existing value preset as the schedule default. LONMARK and BACnet schedulers try identifying a matching preset name from the schedule default value.

Format Strings in E-Mails

Data point variables used in e-mail templates can now use format strings to specify their numeric appearance in the e-mail text.

Storing Project Documentation directly on the Device

A new page on the L-DALI Web-UI allows uploading project documentation and setting-up links to external documentation files (see LOYTEC Device User Manual [1]). Storing documentation directly on the device ensures its availability (e.g. for a service technician) later on.

4.13 New in L-DALI 3.2

This section describes the major changes and new features. For a full list of changes refer to the Readme file.

New Constant Light Controller Modes

The constant light controller application offers some new Modes:

- The modes CONTROL, REGULATOR and PRESENCE are now available in variations with the extension AUTO. In these modes any active override will be automatically relinquished when the room enters "unoccupied" state. This allows to reactivate automatic mode when the room is unoccupied. The light will be switched off and – if necessary – switched on when someone enters the room.

- As a special variation of the AUTO modes, modes with the extension BEDROOM are available. In this mode the manual override is only relinquished when the lights are switched on. This ensures lights are switched off when the room is unoccupied, but stay off when commanded to off manually.

- The mode AMBIENT allows switching on and off lights depending on the measured lux level. It is therefore suitable for decorative lighting (facade illumination, shop window lighting, floor lighting, etc.).

The modes CONTROL and REGULATOR (incl. all variations) now consider the configured Unoccupied Level when switching off, similar to the mode PRESENCE. This allows dimming down to a configured level when the room is unoccupied instead of switching off. Typical applications are a reception area or similar areas where the light is never turned off completely.

Note: *If the an LDALI-10X device was not shipped with firmware 3.2 the new modes are only available after the datapoint configuration was up- and downloaded again using the LINX Configurator.*

Further information on the constant light controller modes can be found in Sections 8.1.4.3 and 8.2.4.3 and for the behavior when switching off in Sections 8.1.4.8 and 8.2.4.8.

Overriding the Constant Light Control with DALI Buttons

When using internal manual bindings the constant light controller now detects when one of the groups it controls is dimmed by another DALI master. Such and override is interpreted similar to an override using the CEA-709/LONMARK or BACnet interface. Typically such a DALI master is a DALI push-button coupler or a similar device for manual control of DALI lights. As these devices directly control the DALI groups, they allow local operation of the lights independent of the L-DALI.

Constant Light Controller Bindings across Channels

DALI groups and DALI sensors can be linked to constant lights controller instances using internal bindings across DALI channels (see Sections 8.4.1 and LINX Configurator User Manual [2]).

Support for DALI ballasts with Colour Control

In the LDALI-10X models DALI ballasts of type "colour control" (device type 8, DT8) can be controlled. The LDALI-10X supports devices with changeable colour temperature and with coloured light. The latter can be used for effect lighting, while the previous can be used

to simulate the colour temperature of the sun during the course of a day (warmer white during morning and evening, cooler white at noon).

Support for additional DALI Sensors

Support for the ThebenHTS PlanoSpot 360 DALI multi-sensor was added.

Change the DALI Short Address

If required the DALI short address, which was assigned to a DALI device by the L-DALI, can be changed via the Web-UI (see Section LOYTEC Device User Manual [1]).

Generic Scheduler

Generic schedulers – like generic trends and alarms – can now be created, that are neither CEA-709 nor BACnet objects. Generic schedulers appear next to the generic alarm folder and are ready-to-use on any device. This is beneficial for creating technology-independent applications. Generic schedulers can write to any technology as well as data point favorites and are the ideal solution, if configured via LWEB-900 only. For more information on creating generic schedulers refer to the LOYTEC Device User Manual [1].

Web Interface

The Web interface of the device offers a number of new features:

- Live update of values in the data point list. This allows monitoring values without repeated pressing of reload. Data point structures can be expanded or collapsed for better overview.
- Breadcrumb navigation has been added to the data point list. This gives faster access to sub-folders.
- A new firmware upgrade menu on the Web interface allows online checking for firmware updates and upgrading by selecting a local firmware file. All this is possible without starting the Configurator.
- The trend overview page displays current trend log states and provides controls for easy trend data upload in CSV format.
- The DALI group page allows switching groups on and off to test the group assignment.

Application Objects

Application objects such as math objects, e-mail templates, and alarm logs can now be organized in folders. Copy and paste of application objects between Configurators has been improved. Math objects now allow single constants and single variable assignments, such as “=5” or “=v1”. Input variables can be configured to trigger a new calculation or not.

5 Quick-Start Guide

This Chapter contains step-by-step instructions on how to configure the L-DALI for the simple project shown in Figure 52.

The project consists of a single room (Room 306) which is illuminated by four DALI lamps. Two of those lamps form a light band near the windows of the room and the other two lamps form a light band near the corridor. The room is equipped with a DALI multi-sensor which acts as both a light sensor and an occupancy sensor. The build-in constant light controller of the L-DALI device uses the input from the DALI multi-sensor and dims the DALI ballasts accordingly. For manual override a DALI push-button is installed. The sunblind controller is not used in this quick-start example.

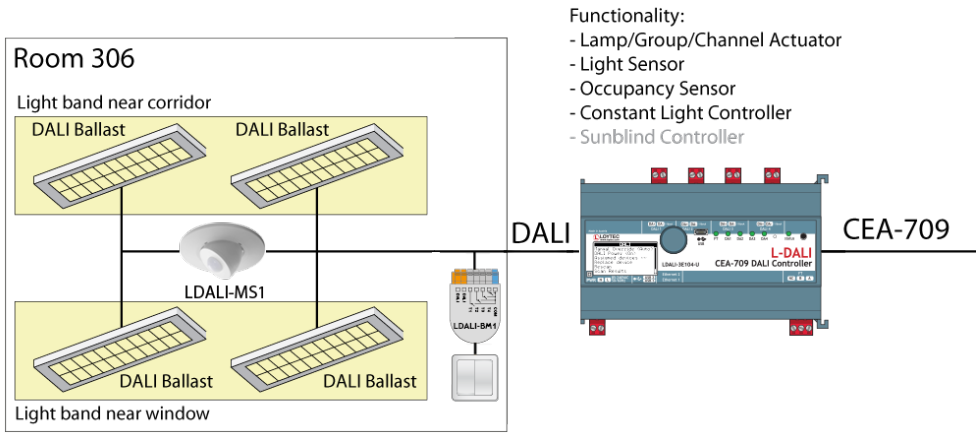


Figure 52: Quick-Start Example Project.

5.1 Hardware Installation

5.1.1 Models without built-in DALI Bus Power Supply

For models without built-in DALI bus power supply it is recommended to use the LDALI-PWR4-U or LDALI-PWR2-U power supply together with the L-DALI. Connect the L-DALI to the LDALI-PWR4-U and to the DALI network as shown in Figure 53. To allow for easy configuration it is recommended to always connect the L-DALI to the Ethernet network. More detailed instructions are given in Chapter 6.

Important:	***Do not connect terminal 26 to earth ground!***

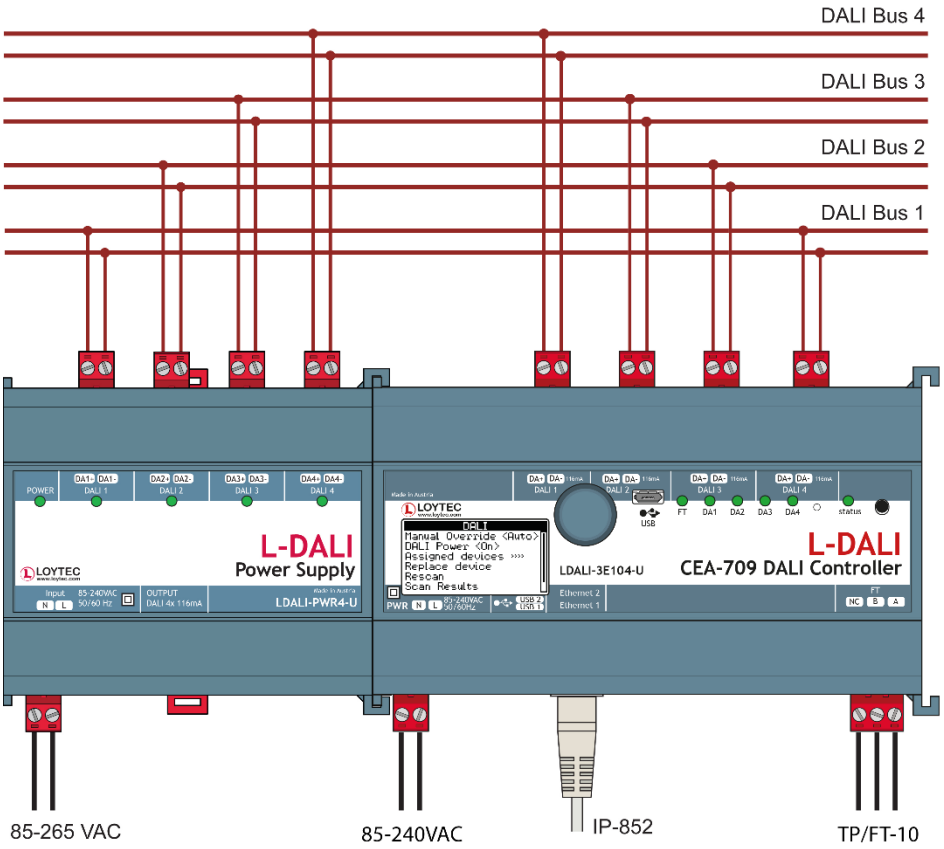


Figure 53: Basic Hardware Installation with external DALI bus power.

5.1.2 Models with built-in DALI Bus Power Supply

Connect the L-DALI to the power and to the DALI network as shown in Figure 54. To allow for easy configuration it is recommended to always connect the L-DALI to the Ethernet network (if available). More detailed instructions are given in Chapter 6.

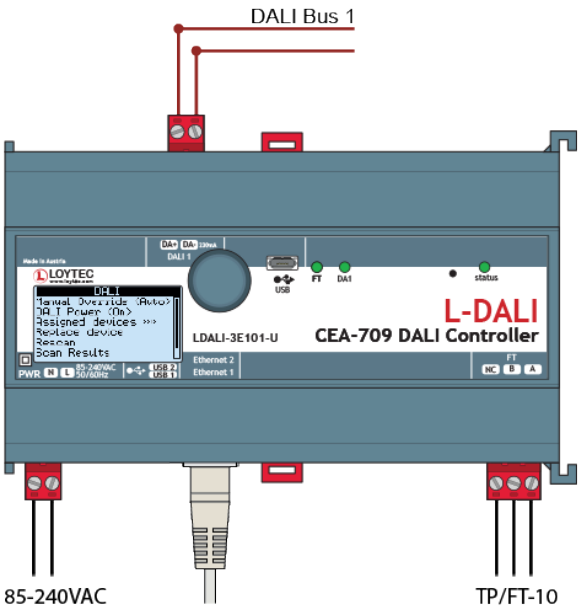


Figure 54: Basic Hardware Installation with integrated DALI bus power.

5.2 Test proper wiring of DALI devices

After the DALI ballasts have been installed and connected to the DALI network, the installation can be tested by following these steps:

5.2.1 Models without LCD display

1. Check that the DALI LEDs (“DALI x ACT”, where x is 1 to 4) do not light up red. If one of these LEDs is red, check the proper connection of the bus power supply for the corresponding channel and check the DALI wiring for short-circuits.

2. Press the DALI mode button (“ON/OFF/AUTO”) on the front panel of the L-DALI once. Now all DALI ballasts should be switched on (maximum level) and the DALI LEDs on the L-DALI should light up green.

3. Press the DALI mode button again. Now all DALI ballasts should be switched off and the DALI LEDs on the L-DALI should light up orange.

4. Press the DALI mode button again. This should not change the state of the DALI ballasts but return the L-DALI to the auto-mode (control via CEA-709/BACnet interface).

5.2.2 Models with LCD display

1. On LDALI models with only one DALI channel check that status LED does not light up red, on models with multiple DALI channels check the DALI LEDs (“DALI x ACT”, where x is 1 to 4). If the LED is red, check the DALI wiring for short-circuits. In case an external bus-power supply is used check the proper connection of the bus power supply for the corresponding channel.

2. Turn the jog dial to navigate to the DALI menu item.

3. Press down to jog dial to enter the DALI menu.

4. On devices with multiple DALI channels select menu item “Channel” and select the DALI channel to be tested.

5. Turn the jog dial to navigate to the menu item “Manual Override: Auto”.

6. Press down the jog dial. Then turn it one step to the right. The manual override must change to “On”.

Now all DALI ballasts should be switched on and the status LED on the L-DALI should light up green.

7. Turning the dial one more step right the manual override must change to “Off”.

Now all DALI ballasts should be switched off and the status LED on the L-DALI should light up orange.

8. Turn the dial one step right once more. This should not change the state of the DALI ballasts but return the manual override back to the auto-mode (control via L-DALI light application).

5.3 Device configuration

The L-DALI can be configured via a console interface or via the Web interface. To configure the L-DALI, the following steps have to be performed:

1. Setup IP configuration (see Sections 5.3).

2. Setup the DALI network (see Section 5.5 or 5.6).

Note: *This setup procedure assumes the use of the IP interface.*

5.4 Configuration of IP Address

5.4.1 IP Configuration via the LCD Display

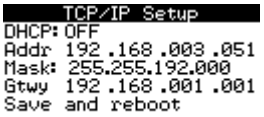
Device models with an LCD display can also be configured to their basic settings through jog dial navigation on the LCD UI. Turn the jog dial to navigate between menu items and press to enter a menu or go into selection mode. When in selection mode turn the jog dial to alter the value and press again to quit the selection. Some input fields provide acceleration. This means turning faster changes the value in larger increments.

To Set the IP Address on the LCD Display

1. On the LCD main screen set the desired language. Navigate to the flag symbol, press the button and choose the desired language.

2. Navigate to the IP address on the main screen and press the button.

3. There navigate to the needed input fields, press and change the value. Press again to set the value. Continue to the next field.



4. Finally navigate to **Save and reboot** and press.

5. Acknowledge the reboot and the device reboots with the new IP address.

5.4.2 IP Configuration via the Web Interface

LOYTEC devices are shipped with DHCP and will acquire an IP address as soon as they are connected to the network. To use a static IP you can use the Web interface to configure the client device. In a Web browser enter the IP address of the device which can be read on the LCD display. Note that your PC must be attached to the same subnet as the device. For devices with a default IP address choose the setup on the LCD display.

Configuration of the Device

1. Open your Web browser and type in the default IP address.

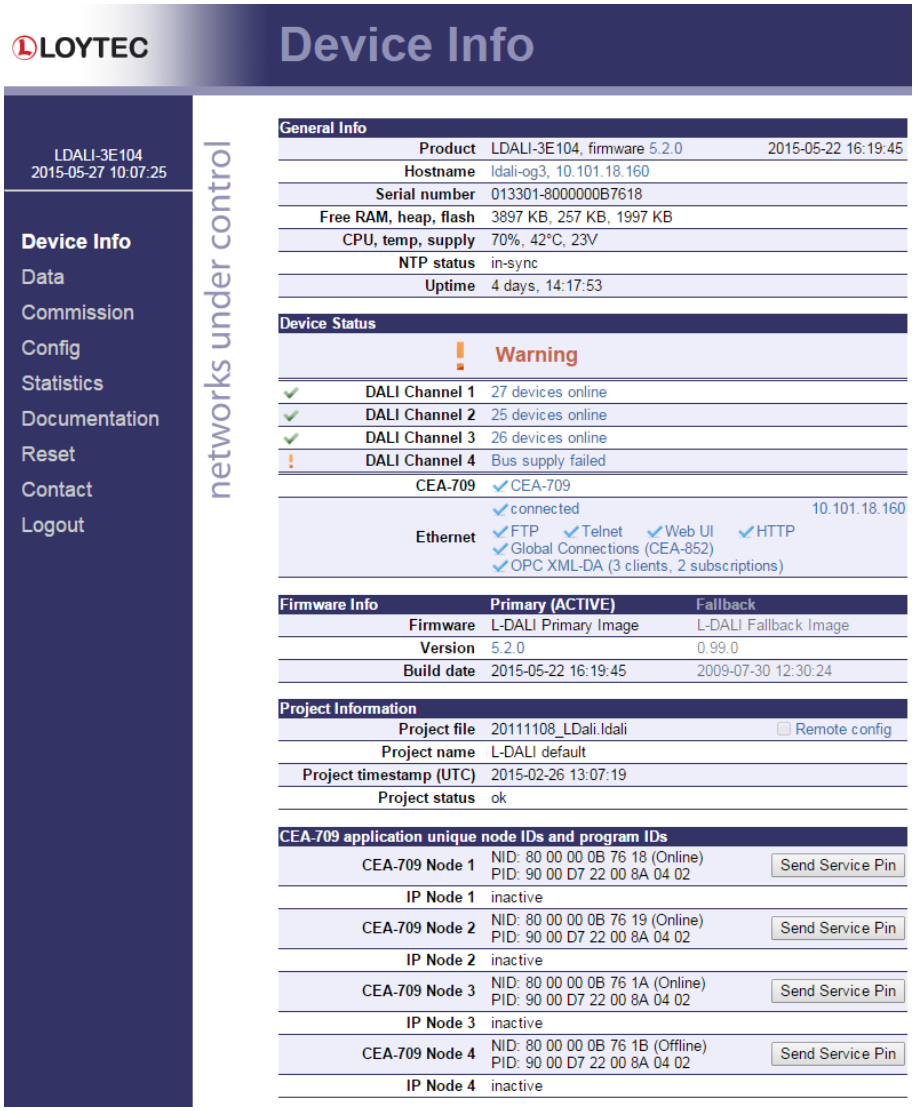


Figure 55: Example Start Screen.

2. Click on **Config** in the left menu. You will be asked to enter passwords for the administrator and operator accounts before proceeding

Figure 56: Enter passwords for admin and operator accounts

3. The Config menu opens. Click on **Port Config** in the Config menu and select **Ethernet 1 (LAN)** tab. Enter the IP address, the IP netmask, and IP gateway for this device as shown in Figure 57 .

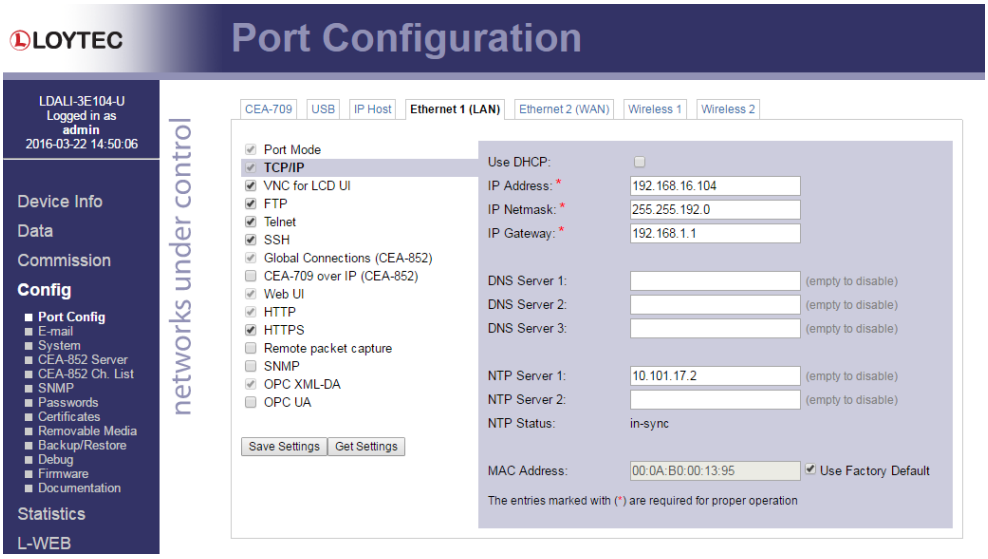


Figure 57: Enter IP-address and gateway

4. Press **Save Settings** and then reset the device by selecting **Reset** in the highlighted text. This changes the IP settings of the device.

5.5 Configuration with PC Software

For the LDALI product family a PC based configuration software – the LINX Configurator – is available. As an alternative the web interface can be used for configuration (see Section 5.6).

Install the LINX Configurator software from the setup.exe. This file can be downloaded from www.loytec.com. This tool can be used as a stand-alone tool or as LNS plug-in. In this example we will use the LINX Configurator software as a stand-alone tool.

A detailed description of the LINX Configurator configuration software can be found in the LINX Configurator User Manual [2].

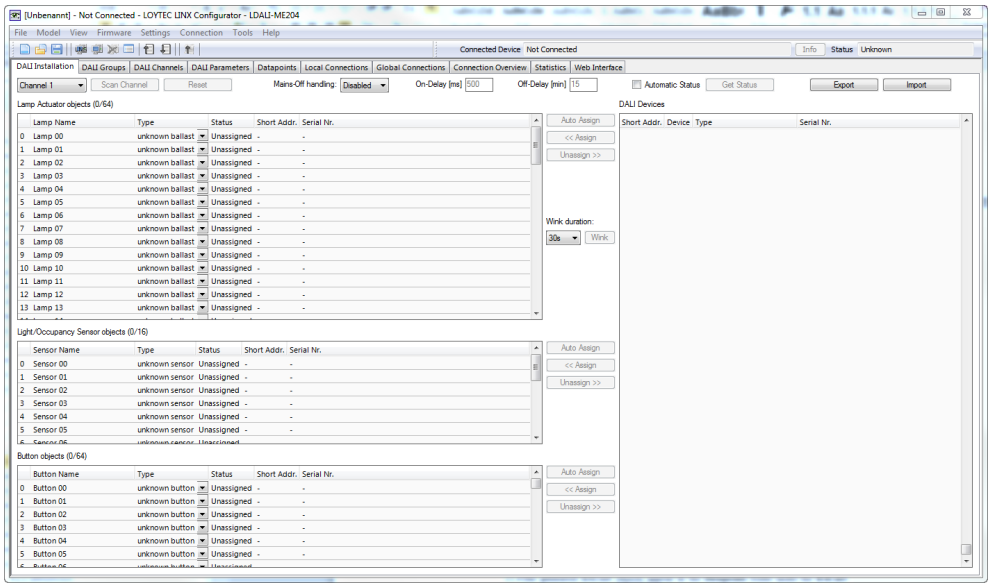


Figure 58: LINX Configurator software, Start.

5.5.1 Connect to Device in Stand-Alone Mode

1. Select the IP connection method by clicking on the **Connect to device** button in the tool bar as shown in Figure 59.

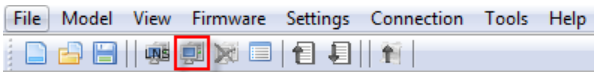


Figure 59: LINX Configurator software, Connect to device

2. In the Connection dialog (see Figure 60) choose connection type “Web Service”, enter the IP address or hostname of the L-DALI and the devices “admin” password. The default “admin” password is ‘loytec4u’ (older firmware versions used ‘admin’).

3. Optionally, click on **New** and enter a user-defined name for this connection. That name can be selected later to connect. Click on **Save** to store that connection.

4. Click on **Connect**. This establishes the connection to the device.

5. The LINX Configurator software asks if you want to upload the current configuration of the device. You can cancel this dialog because in this quick-start we configure the device from scratch.

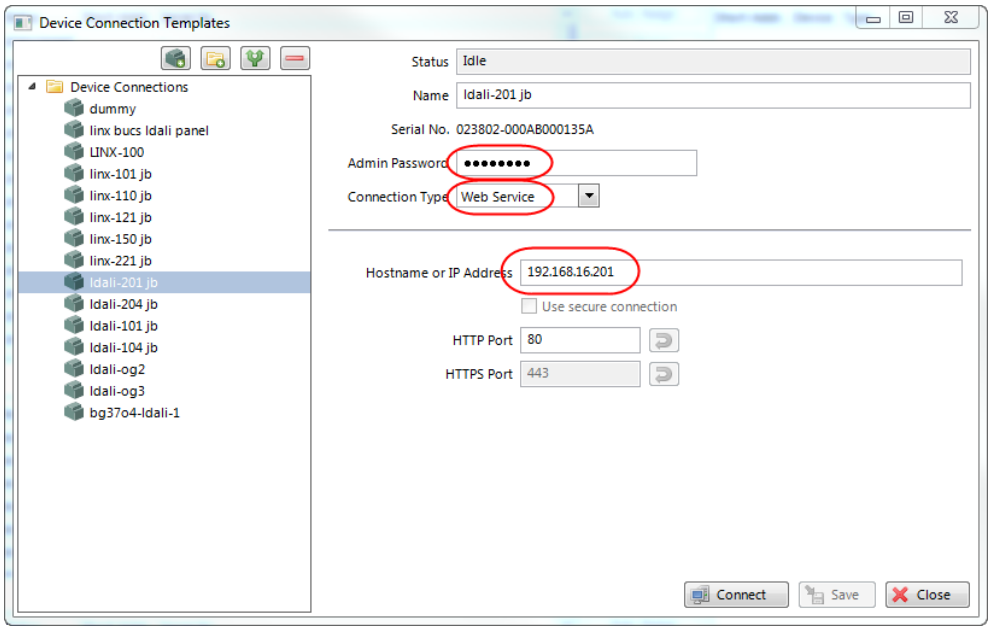


Figure 60: LINX Configurator software, Connection Dialog.

6. In the **Settings -> ProjectSettings** menu the LDALI BacNet Interface or CEA709 NV interface can be set up. The interface can be configured to provide several DALI-specific parameters as datapoints or network variables like humidity, temperature, button-feedback or battery charge (emergency). Not all of the parameters are supported by the default interface.

5.5.2 Scan DALI Channel

1. Change to the **DALI Installation** tab.

2. Select the DALI channel and click on the **Scan Channel** button shown in Figure 61.

Figure 61: LINX Configurator software, scan DALI Channel.

3. The L-DALI device scans the selected channel and displays all detected devices as shown in Figure 62. In case an error occurs see the LOYTEC Device User Manual [1] for a description of the error codes and possible reasons.

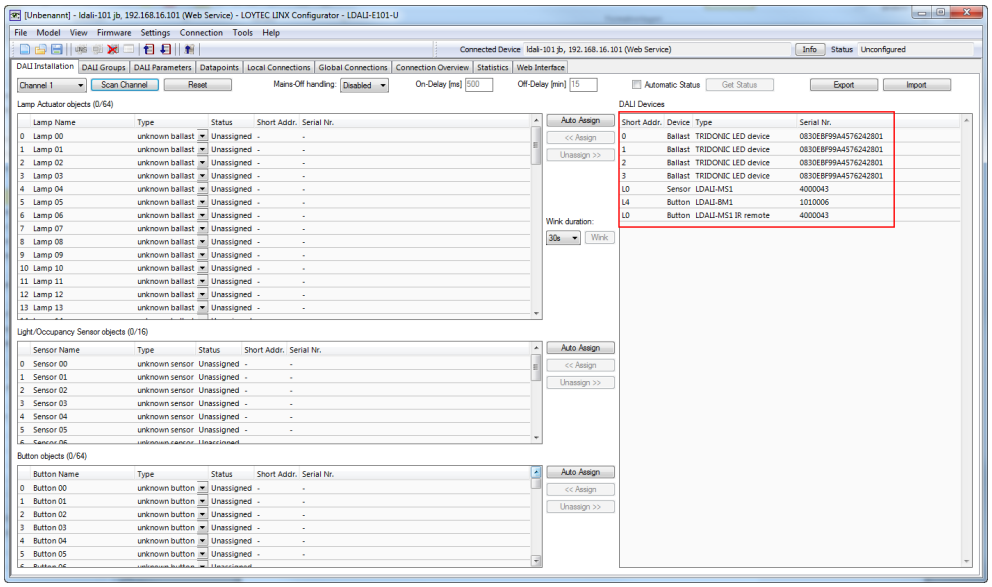


Figure 62: LINX Configurator software, detected DALI devices.

5.5.3 Assign Lamps, Sensor and Button to LonMark/BACnet Objects

1. To identity which of the four detected DALI ballasts is which physical lamp, select one and click the **Wink** button. The corresponding lamp blinks for the configured wink duration.

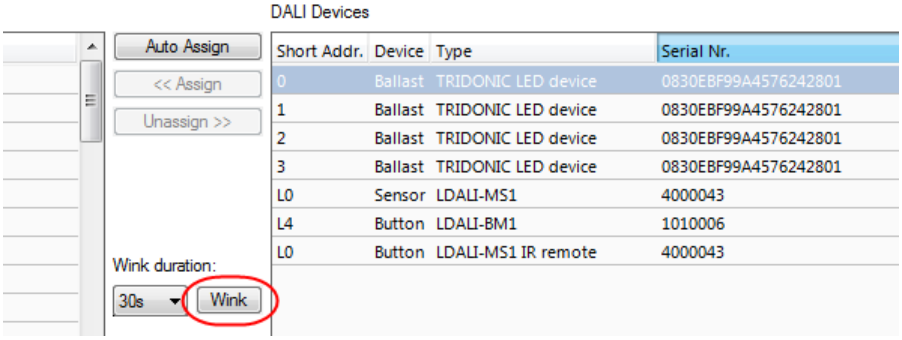


Figure 63: LINX Configurator software, Wink button.

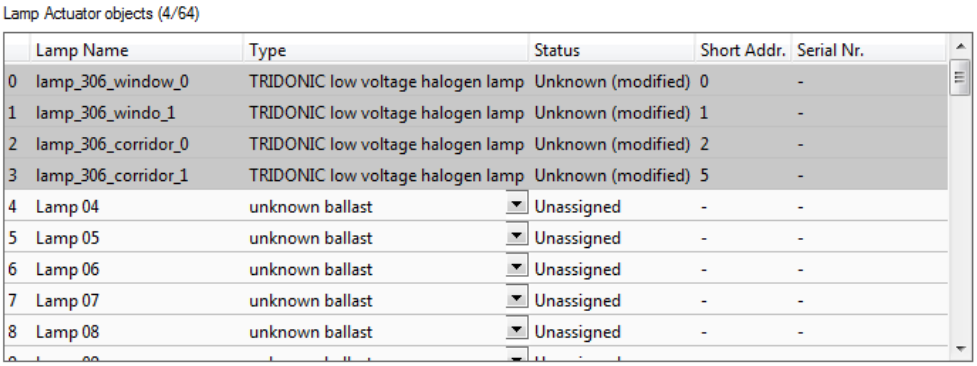


Figure 64: LINX Configurator software, assigned Lamp Actuator objects.

2. To assign an DALI ballast to an object, select the ballast in the list of **DALI Devices** and drag it to the desired position in the **Lamp Actuator objects** list on the left side. You

can change the names of the lamp actuator objects. After you have assigned all lamps and changed the names the configuration should look as shown in Figure 64.

3. To assign the DALI multi-sensor to an object, select the sensor in the list of **DALI Devices** and drag it to the desired position in the **Light/Occupancy Sensor objects** list on the lower left side. After you have changed the names of the sensor object the configuration should look as shown in Figure 65.

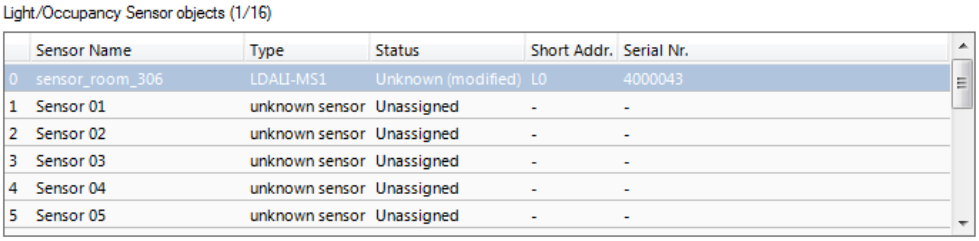


Figure 65: LINX Configurator software, Assigned Light/Occupancy Sensor Object.

4. Similar, assign the DALI button by dragging it to the desired position in the **Button objects** list.

5.5.4 Grouping Lamps

Lamps which are assigned to a group can be controlled together by the corresponding group object. We will create three groups: One for the lamps near the window, one for the lamps near the corridor and one for all lamps in the room.

1. In the LINX Configurator software switch to the **DALI Groups** tab.

2. Add the two lamps near the window to group 0, the two lamps near the corridor to group 1 and add all lamps in the room to group 2. Assign names to the groups as shown in Figure 66.

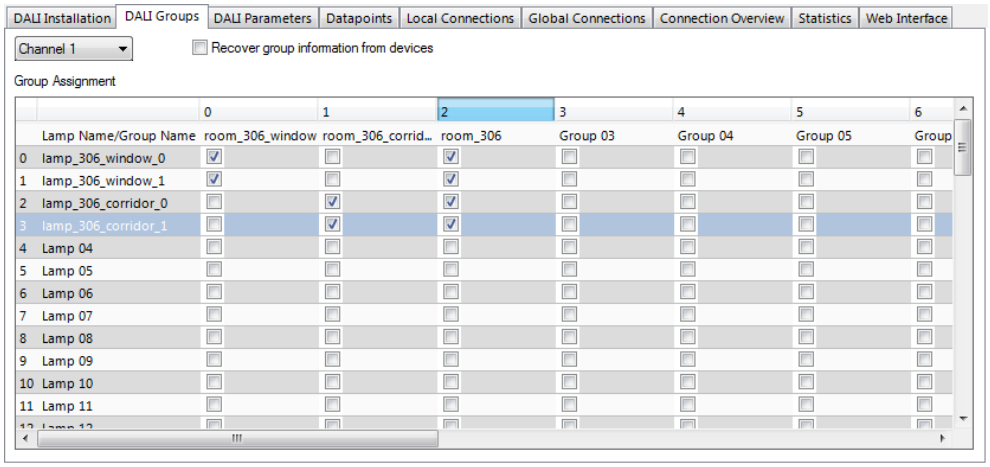


Figure 66: LINX Configurator software, DALI group configuration.

5.5.5 Parameterize the Constant Light Controller

1. In the LINX Configurator software switch to the **DALI Parameters** tab.

2. Select the constant light controller with index 0 as shown in Figure 67. The parameters of the selected constant light controller are displayed in the middle of the window (1).

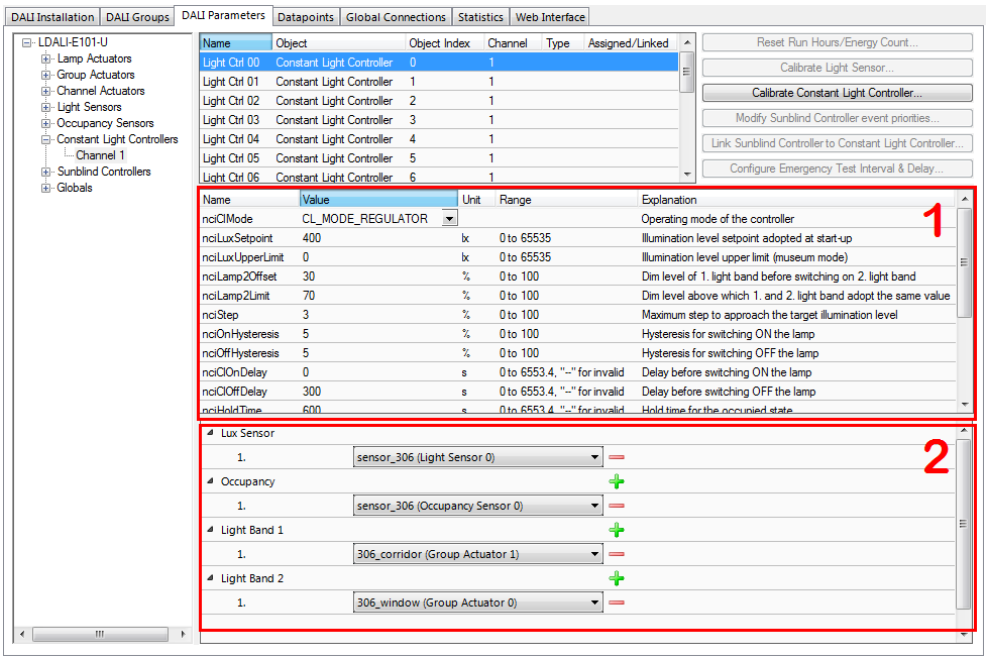


Figure 67: Parameterize Constant Light Controller.

3. Change the parameter *nciClMode* to CL_MODE_REGULATOR. This parameter selects the operating mode. The REGULATOR mode is used if a light/occupancy sensor is installed which measures the indoor illumination.

4. Change the setpoint of the constant light controller (*nciLuxSetpoint*) to the desired light level (e.g. 400 lux).

5. You can leave the default values for the remaining parameters. For a description of the constant light controller functionality and the parameters refer to Section 0.

6. Determine which sensors (occupancy & lux) are used as inputs to the constant light controller instance and which groups are controlled in the lower part of the window (2).

7. Click on the  to add an input or output. Use the drop down box to select a sensor (input) or a light group (output). In our example we use “sensor_306” for lux and occupancy sensor inputs, group “306_corridor” as output of the first (brighter) light band and group “306_window” as output for the second (darker) light band.

5.5.6 Parameterize the DALI button

1. Stay on the **DALI Parameters** tab and select the button object to which you have assigned your DALI button as shown in Figure 68.

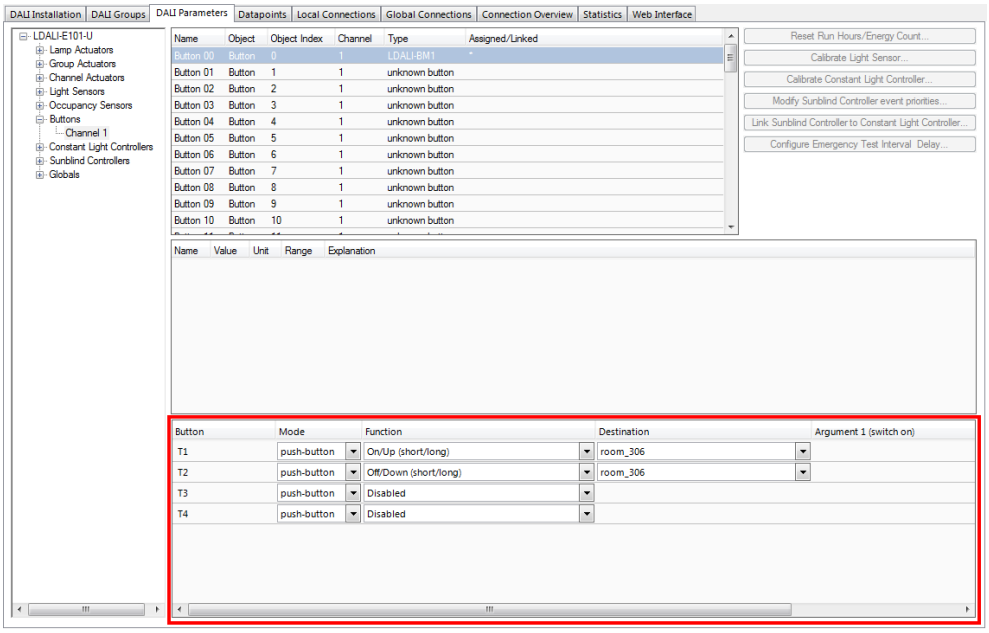


Figure 68: Parameterize DALI button functions.

2. Determine which function is executed and which group is controlled by which button input in the lower part of the window. In our example we use button T1 for “On/Up” and T2 for “Off/Down”, both controlling group “room_306”. This will allow us to control all lights in the room together.

5.5.7 Download Configuration

1. To download the configuration into the L-DALI device click on the **Download Configuration** button in the toolbar.

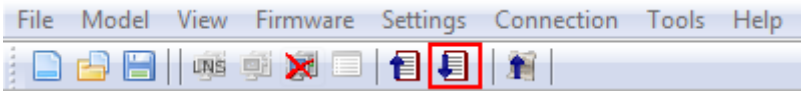


Figure 69: LINX Configurator software, Download Configuration.

2. Because we have changed only the DALI configuration and the parameters it is sufficient to check only DALI Configuration and Parameters in the following dialog. This speeds up the download process.

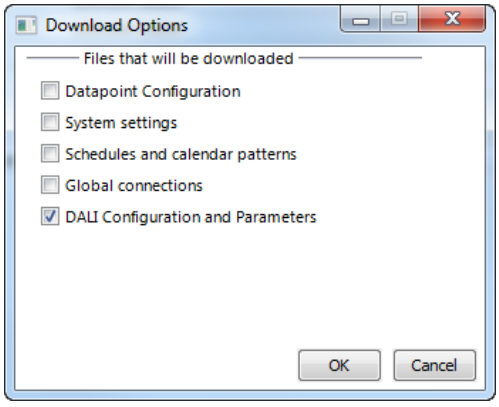


Figure 70: LINX Configurator software, Download DALI Configuration and Parameters.

3. After the download is complete, go back to the DALI Installation tab and press the **Get Status** button. Now the assigned DALI devices are displayed on a green background (see Figure 71). The green background colour indicates that the communication with the device is OK. If there is a communication error, the device will be displayed with a red background colour.

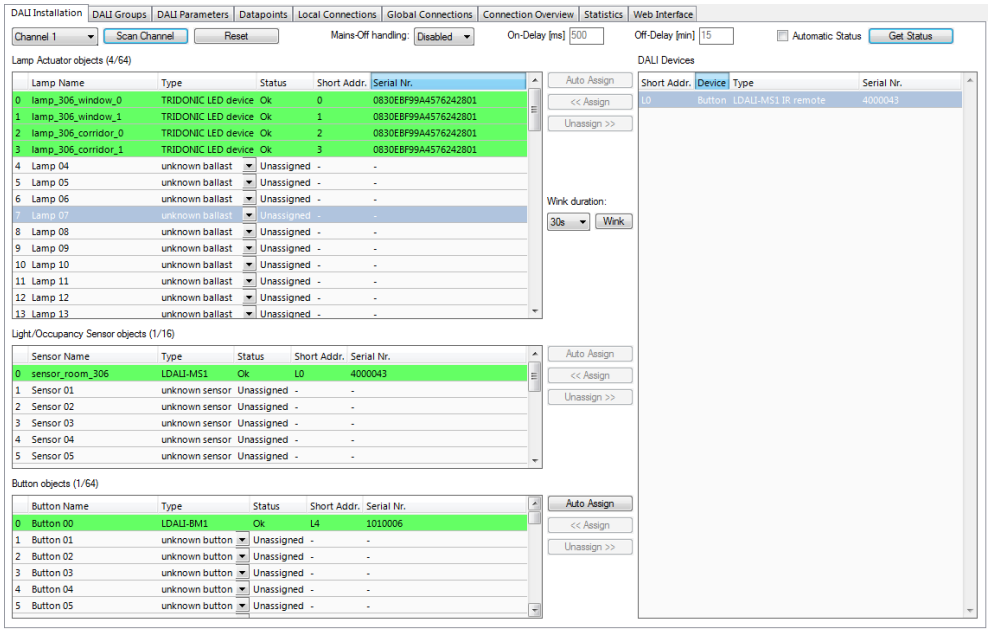


Figure 71: LINX Configurator software, After Configuration Download.

5.5.8 Calibrate Light Sensor

The L-DALI device allows calibrating the light sensor under up to seven different light conditions to counter any non-linearity of the sensor. However, in many cases it is enough to calibrate the sensor with a single light condition which is near the setpoint. In this quick-start only one lux measurement is performed.

1. In the LINX Configurator software switch to the **Parameters** tab.

2. Select the light sensor index 0 and click on the **Calibrate Light Sensor…** button as shown in Figure 72. The light sensor calibration window as shown in Figure 73 in displayed.

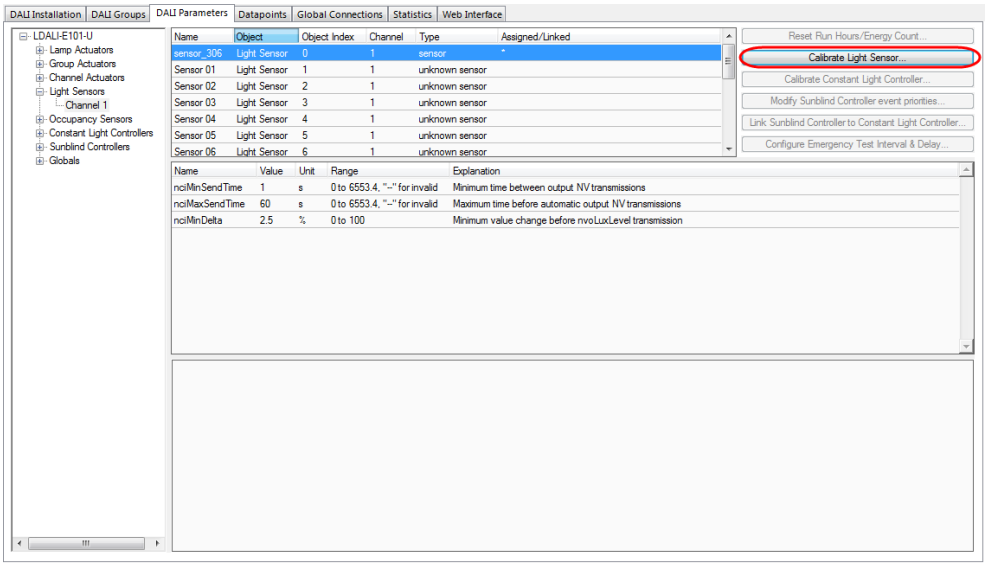


Figure 72: Parameterize Light Sensor.

3. Measure the current lux level at the reference area (e.g. desk) using a luxmeter.

4. Enter the measured lux level in the input field and select the index 0.

5. Press the **Calibrate** button.

6. Close the dialog by pressing the **Done** button.

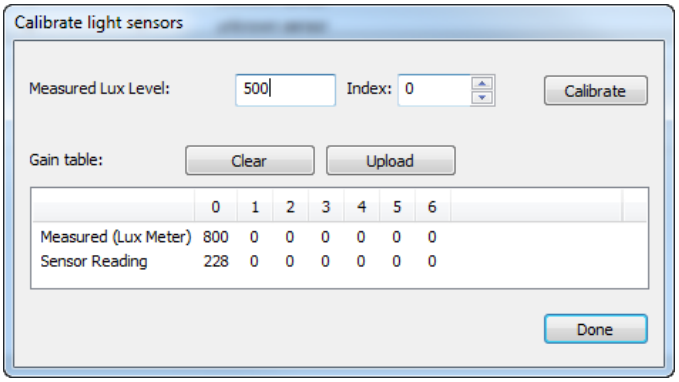


Figure 73: Calibrate Light Sensor.

5.6 Configuration using Web Interface

As an alternative to the LINX Configurator PC Software the Web interface of the L-DALI can be used. In a Web browser enter the IP address as set up in Section 5.4.

A detailed description of the L-DALI Web interface can be found in the LOYTEC Device User Manual [1].

5.6.1 Scan DALI Channel

1. In the L-DALI Web interface click on **Commission** in the left menu. If not already logged in you will be asked to enter the administrator password. Enter the password and select **Login**.

2. The Commission menu opens. Click on **DALI Installation** in the Commission menu. The DALI installation page opens as shown in Figure 74.

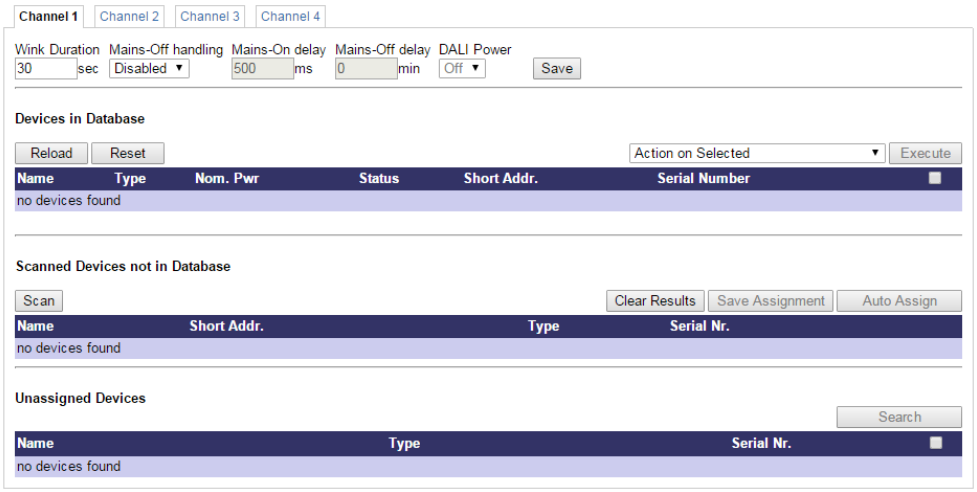


Figure 74: DALI Installation Web Interface: Initial view.

3. If the device supports more than one DALI channel select the DALI channel by clicking on the different tabs at the top of the page labeled **Channel 1**, **Channel 2**, etc. and press the **Scan** button.

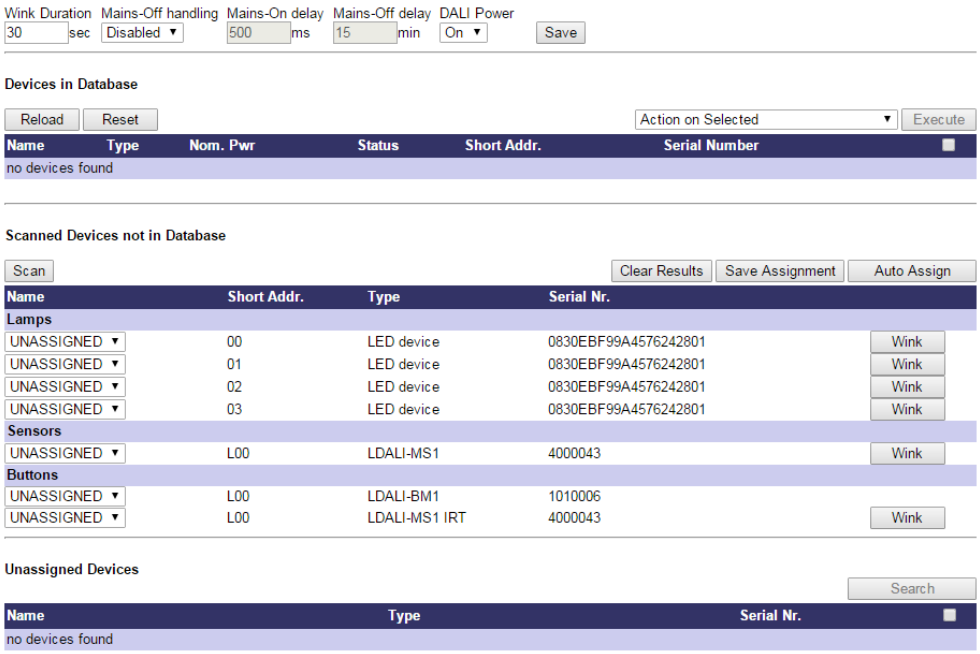


Figure 75: DALI Installation Web Interface: Detected DALI devices.

4. The L-DALI scans the DALI channel and lists the detected devices under **Scanned Devices not in Database** in the lower halve of the Web interface (see Figure 75). In case an error occurs see the LOYTEC Device User Manual [1] for a description of the error codes and possible reasons.

5.6.2 Assign Lamps, Sensor and Button to LONMARK/BACnet Objects

1. To identity which of the four detected DALI ballasts is which physical lamp, select one and click the **Wink** button. The corresponding lamp blinks for the configured wink duration.

2. To assign a DALI device to a LONMARK or BACnet object, use the drop-down list available for each device in the **Scanned Devices not in Database** section (left column). This list contains all available fieldbus objects. When you are done, press the button **Save Assignment**. Alternatively to manual assignment press the button **Auto Assign** for random assignment. After you have assigned all lamps the configuration should look as shown in Figure 76.

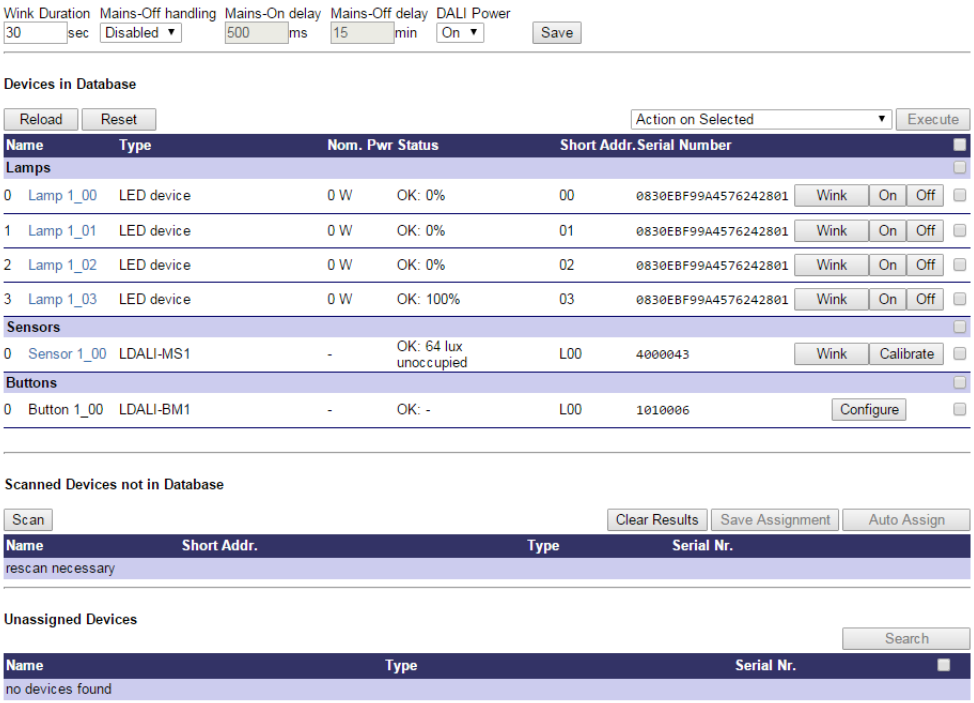


Figure 76: DALI Installation Web Interface: Device assignment done.

5.6.3 Grouping Lamps

Lamps which are assigned to a group can be controlled together by the corresponding LONMARK or BACnet group object. We will create two groups: One for the lamps near the window and one for the lamps near the corridor.

1. Click on **DALI Groups** in the Config menu. The DALI Groups page opens.

2. Again, selected the DALI channel by clicking on the different tabs at the top of the page labeled **Channel 1**, **Channel 2**, etc.

3. Add the two lamps near the window to group 0, the two lamps near the corridor to group 1 and all lamps to group 2 by checking the corresponding check boxes. Press the **Save** button. The result will look like in Figure 77.

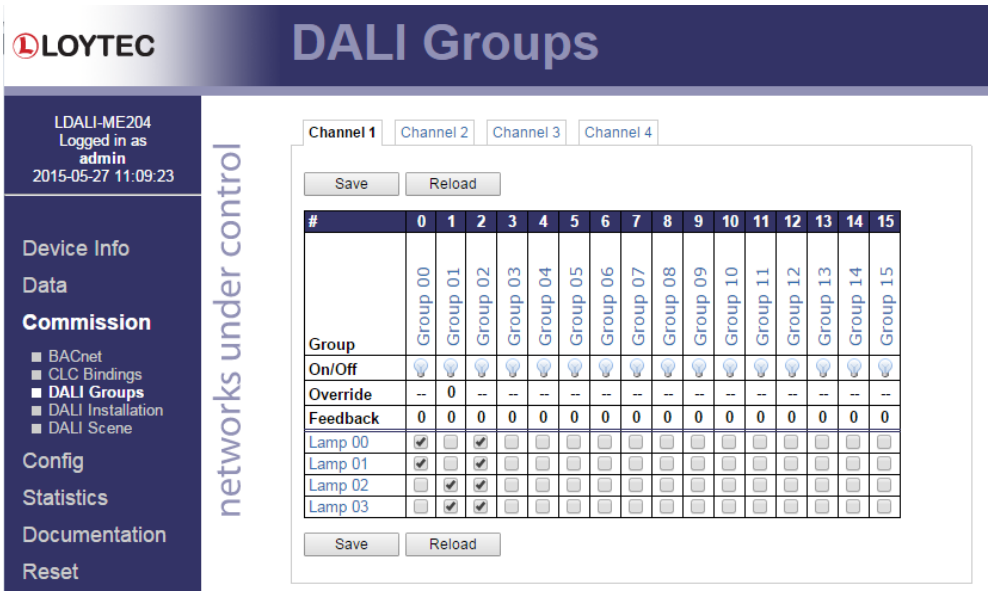


Figure 77: DALI Installation Web Interface: Group Configuration.

4. To test the group assignment, lights can be switched on and off by clicking on the bulb below the group name. Similar entering a value in the override row will dim the corresponding group. Entering – in the field will relinquish an active override.

5.6.4 Calibrate Light Sensor

The L-DALI device allows calibrating the light sensor under up to seven different light conditions to counter any non-linearity of the sensor. However, in many cases it is enough to calibrate the sensor with a single light condition which is near the setpoint. In this quick-start only one lux measurement is performed.

1. Go to the DALI Installation page and press the **Calibrate** button next to the sensor that is to be calibrated. The DALI sensor calibration page is shown in Figure 78.

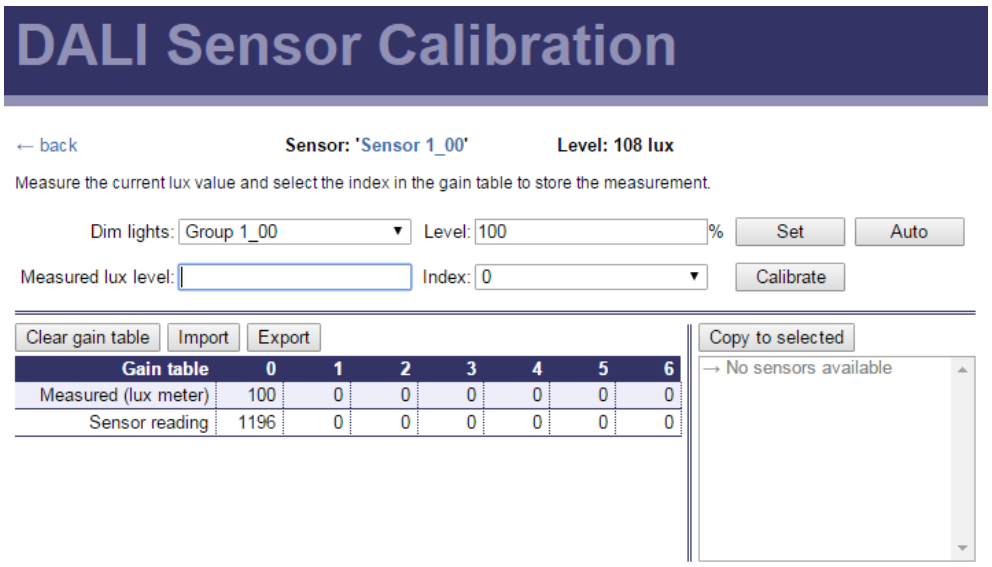


Figure 78: DALI Installation Web Interface: Sensor Calibration.

2. Measure the current lux level at the reference area (e.g. desk) using a luxmeter.

3. If possible dim artificial light in room until luxmeter show desired lux setpoint. To dim the light select the rooms DALI group in the **Dim lights** drop down box, enter a desired dim value in the field **Level** and press the **Set** button.

4. Enter the measured lux level in the input field and select index 0.

5. Press the **Calibrate** button.

5.6.5 Parameterize the DALI button

1. On the **Buttons** page, stay on the **DALI** tab (see Figure 79) and click on the **Configure** button next to the button device that is to be configured. The dialog shown in Figure 80 appears.

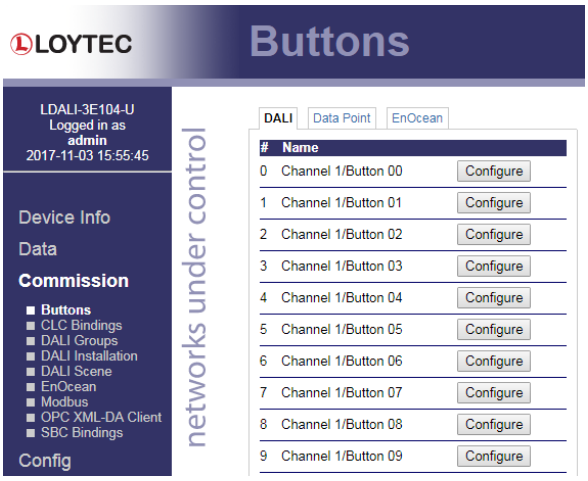


Figure 79: Button Functions.

2. Use the drop-down boxes to determine which function is executed and which group is controlled by which button input. In our example we use button T1 for “On/Up” and T2 for “Off/Down”, both controlling group 2. This will allow us to control all lights in the room together.

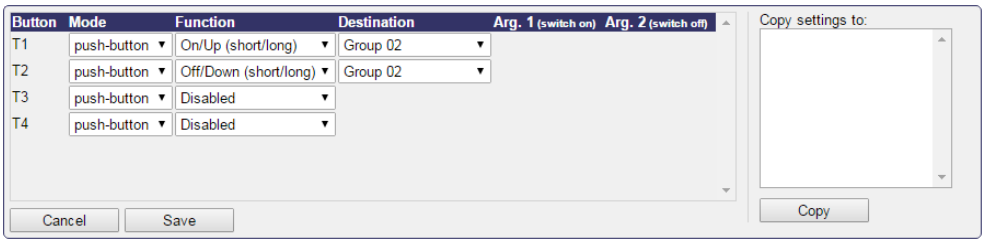


Figure 80: Configure DALI button functions.

3. Click on **Save** to write the configuration to the button device.

5.6.6 Parameterize the Constant Light Controller

1. Go to the **Data Points** page and select the data point path of constant light controller application instance 0.

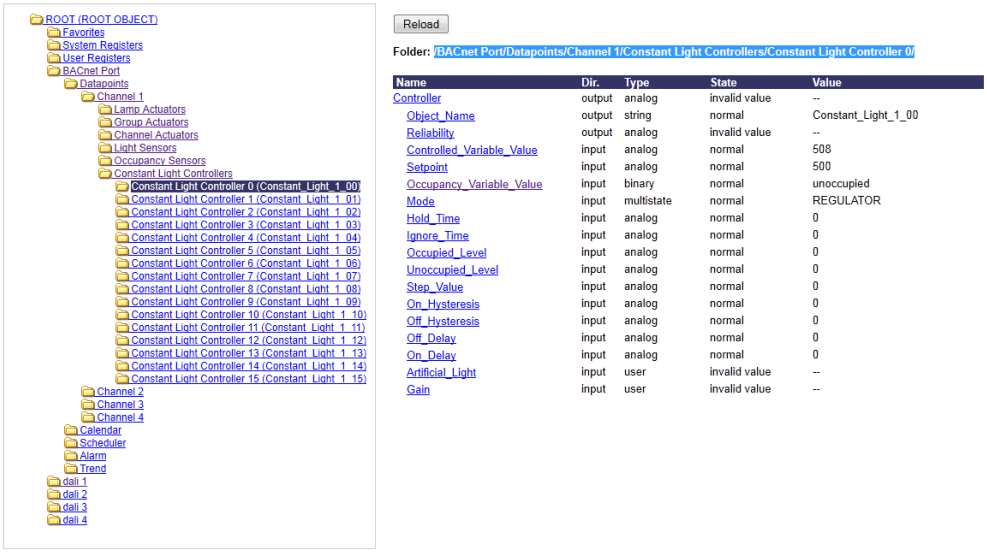


Figure 81: DALI Installation Web Interface: Parameters.

BACnet L-DALI: /BACnet Port/Datapoints/Channel 1/Constant Light Controllers/Constant Light Controller 0/

CEA-709 L-DALI: /CEA709 DALI Channel 1/Datapoints/Constant Light Controllers/Constant Light Controller 0/

The page will look like in Figure 81.

2. The parameters of the selected constant light controller are displayed on the right side. Change the constant light controller mode (parameter *nciClMode* or *Mode*) to REGULATOR. This parameter selects the operating mode. The REGULATOR mode is used if a light/occupancy sensor is installed which measures the indoor illumination.

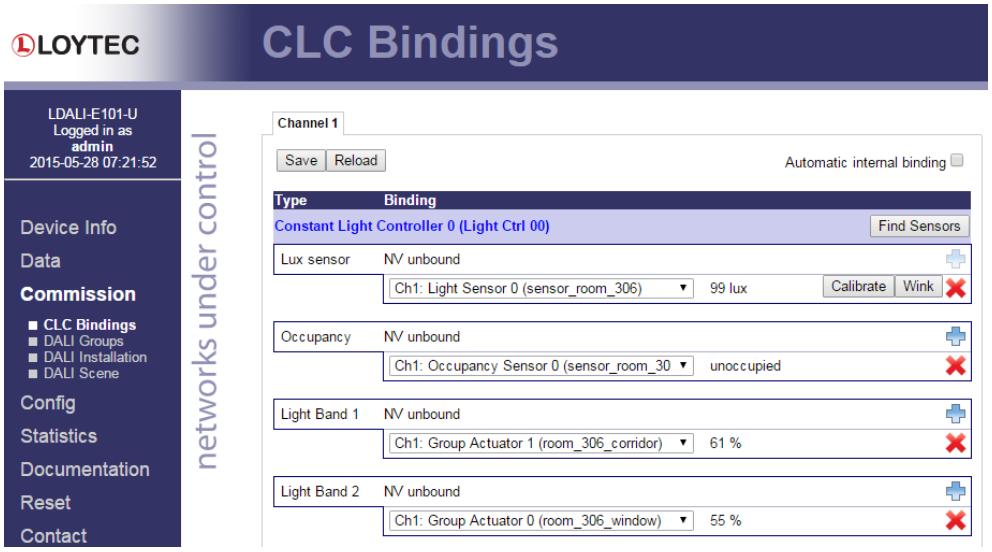


Figure 82: DALI Installation Web Interface: CLC Bindings.

3. Change the setpoint of the constant light controller (parameter *nciLuxSetpoint* or *Setpoint*) to the desired light level (e.g. 400 lux).

4. You can leave the default values for the remaining parameters. For a description of the constant light controller functionality and the parameters refer to Section 0 (CEA-709) and 0 (BACnet).

5. To determine which sensors (occupancy & lux) are used as inputs to and which light groups are controlled by a constant light controller instance go to the **CLC Bindings** page (see Figure 82).

6. Again, selected the DALI channel by clicking on the different tabs at the top of the page labeled **Channel 1**, **Channel 2**, etc.

7. Click on the **Add** to add an input or output. Use the drop down box to select a sensor (input) or a light group (output). In our example we use “sensor_306” for lux and occupancy sensor inputs, group “306_corridor” as output of the first (brighter) light band and group “306_window” as output for the second (darker) light band.

5.7 Configuration of BACnet Interface (LDALI-20X only)

5.7.1 Configure BACnet Interface

To allow integrating the L-DALI to a BACnet network a network wide unique device ID and device name must be configured. This is best done using the web interface:

1. Similar to the configuration of the IP address connect to the L-DALI using your Internet browser.

2. Click on **Config** and then **BACnet Config** in the left menu.

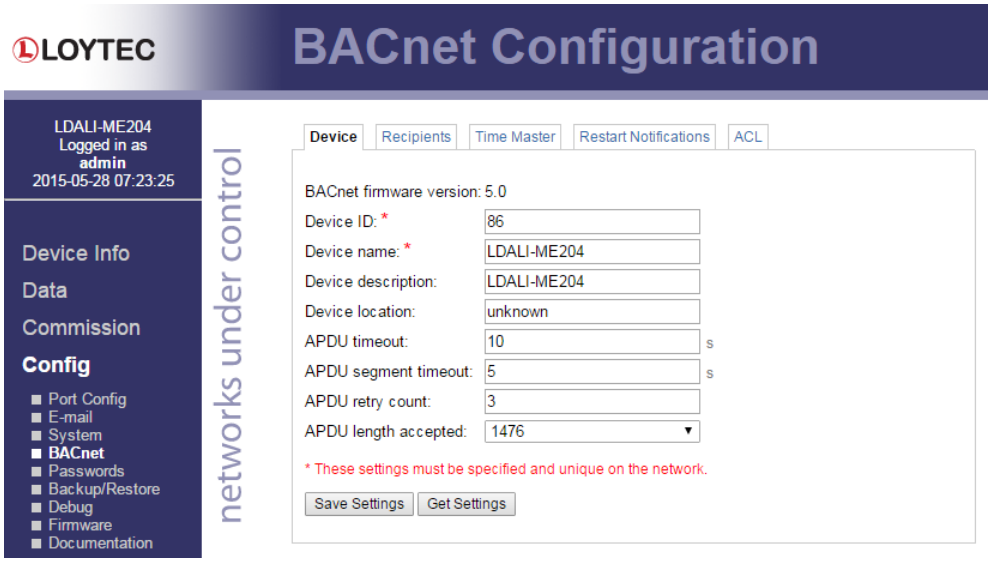


Figure 83: BACnet Device Configuration.

3. Enter a unique device ID and device name as shown in Figure 83.

For further details see the LOYTEC Device User Manual [1].

6 Hardware Installation

6.1 Enclosure

The enclosure of the product and its terminal layout are shown on the installation sheet found in the product's box.

6.2 Product Label

The product label on the side of the L-DALI contains the following information:

- Order number (e.g. LDALI-3E104-U),
- Serial number with bar-code (Ser#).

Unless stated otherwise, all bar codes are encoded using "Code 128". An additional label is also supplied with the L-DALI for documentation purposes. The specific contents of the product label are shown on the installation sheet found in the product's box.

6.3 Mounting

The device comes prepared for mounting on DIN rails following DIN EN 50 022. The device can be mounted in any position. However, an installation place with proper airflow must be selected to ensure that the temperature of the L-DALI device does not exceed the specified range (see Chapter 11).

6.4 LED signals

6.4.1 LDALI-3E10X-U and LDALI-ME20X-U

6.4.1.1 FT Activity LED (LDALI-10X only)

The FT port on the LDALI-3E10X-U has a three-colour LED (green, red, and orange). Table 2 shows different LED patterns of the port and their meaning.

Behavior	Description	Comment
GREEN flashing fast	Traffic	
GREEN flashing at 1Hz	L-DALI is unconfigured	
RED permanent	Port damaged	
RED flashing fast	Traffic with high amount of errors	
RED flashing at 1 Hz (all ports)	Firmware image corrupt Please upload new firmware	
ORANGE permanent	Port disabled	e.g. using LSD Tool

Table 2: CEA-709 Activity LED Patterns.

6.4.1.2 MSTP Activity LED (LDALI-20X only)

The MS/TP port on the LDALI-ME20X-U has a three-colour MSTP Activity LED. Table 3 shows the different LED patterns of the port and their meaning. A permanent colour reflects a state. Flicker is for 25 ms when there is activity on the MS/TP data link layer.

Behavior	Description	Comment
GREEN permanently, flicker off	Multi-Master, token ok, flicker when traffic	Normal condition on a multi-master MS/TP network.
ORANGE flicker	Sole master, flicker when traffic	Normal condition on a single-master MS/TP network.
RED permanent, flicker GREEN	Token lost state, flicker when transmit attempt	Cable might be broken.
RED flash fast	Transmission or receive errors	This indicates bad cabling.

Table 3: MS/TP Activity LED Patterns.

6.4.1.3 DALI Activity LEDs

Each DALI interface on the L-DALI has a three colour LED (green, red and orange). Table 4 shows different LED patterns and their meaning.

Behavior	Description
GREEN flashing	Traffic
RED flashing fast	Traffic with errors
RED permanent	No bus power-supply/bus-power supply failed
ORANGE permanent	Manual override to off or interface is selected
GREEN permanent	Manual override to on

Table 4: DALI Activity LED patterns.

6.4.1.4 Status LED

On the LDALI-3E10X the Status LED is a three colour LED that indicates different operating states of the L-DALI's CEA-852 device.

Green: The CEA-852 device is fully functional and all CEA-852 configuration data (channel routing info, channel membership list, send list) are up-to-date.

Green flicker: If a valid CEA-709 packet is received or transmitted over the IP channel, the CNIP LED turns off for 50 ms. Only valid CEA-709 IP packets sent to the IP address of the L-DALI can be seen. Stale packets or packets not addressed to the L-DALI are not seen.

Yellow: The CEA-852 device is functional but some configuration data is not up-to-date (device cannot contact configuration server but has configuration data saved in Flash memory)

Red: The CEA-852 device is non-functional because it was rejected from the CEA-852 IP channel or shut-down itself due to an internal error condition.

Off: The CEA-852 device is non-functional because it has not been started. This can be the case if the L-DALI uses DHCP and it has not received a valid IP configuration (address) from the DHCP server.

Flashing Red at 1 Hz: The CEA-852 device is non-functional because it is started but has not been configured. Please add the device to a CEA-852 IP channel (register in configuration server).

Flashing green or orange at 1 Hz: The L-DALI's CEA-709 side of the gateway has not been commissioned yet. The colour indicates the CEA-852 IP channel status as described above.

On the LDALI-ME20X-U the Status LED reflects the status of the BACnet/IP communication. It flashes green for 25 ms when BACnet packets are transmitted or received over the BACnet/IP interface.

6.4.2 LDALI-3E10X and LDALI-ME204

6.4.2.1 Power LED

The L-DALI power LED lights up green when power is supplied to terminals 24, 25, and 26.

6.4.2.2 Status LED

The L-DALI is equipped with a red status LED. This LED is normally off. During boot-up the status LED is used to signal error conditions (red). If the fall-back image is executed the status LED flashes red once every second.

6.4.2.3 FT Activity LED (LDALI-10X only)

The FT port on the LDALI-3E10X has a three-colour LED (green, red, and orange). Table 2 shows different LED patterns of the port and their meaning.

6.4.2.4 MSTP Activity LED (LDALI-20X only)

The MS/TP port on the LDALI-ME20X has a three-colour MSTP Activity LED. Table 3 shows the different LED patterns of the port and their meaning. A permanent colour reflects a state. Flicker is for 25 ms when there is activity on the MS/TP data link layer.

6.4.2.5 Ethernet Link LED

The Ethernet Link LED lights up green whenever an Ethernet cable is plugged-in and a physical connection with a switch, hub, or PC can be established.

6.4.2.6 Ethernet Activity LED

The Ethernet Activity LED lights up green for 6 ms whenever a packet is transmitted or received or when a collision is detected on the network cable.

6.4.2.7 Ethernet Config LED

Currently the Ethernet Config LED has no function.

6.4.2.8 CN/IP LED

On the LDALI-3E10X the CNIP LED is a three colour LED that indicates different operating states of the L-DALI's CEA-852 device.

Green: The CEA-852 device is fully functional and all CEA-852 configuration data (channel routing info, channel membership list, send list) are up-to-date.

Green flicker: If a valid CEA-709 packet is received or transmitted over the IP channel, the CNIP LED turns off for 50 ms. Only valid CEA-709 IP packets sent to the IP address of the L-DALI can be seen. Stale packets or packets not addressed to the L-DALI are not seen.

Yellow: The CEA-852 device is functional but some configuration data is not up-to-date (device cannot contact configuration server but has configuration data saved in Flash memory)

Red: The CEA-852 device is non-functional because it was rejected from the CEA-852 IP channel or shut-down itself due to an internal error condition.

Off: The CEA-852 device is non-functional because it has not been started. This can be the case if the L-DALI uses DHCP and it has not received a valid IP configuration (address) from the DHCP server.

Flashing Red at 1 Hz: The CEA-852 device is non-functional because it is started but has not been configured. Please add the device to a CEA-852 IP channel (register in configuration server).

Flashing green or orange at 1 Hz: The L-DALI's CEA-709 side of the gateway has not been commissioned yet. The colour indicates the CEA-852 IP channel status as described above.

On the LDALI-ME20X the CNIP LED reflects the status of the BACnet/IP communication. It flashes green for 25 ms when BACnet packets are transmitted or received over the BACnet/IP interface.

6.4.2.9 DALI Activity LEDs

Each DALI interface on the L-DALI has a three colour LED (green, red and orange). Table 4 shows different LED patterns and their meaning.

6.4.3 LDALI-E101-U, LDALI-3101-U and LDALI-E101-U

6.4.3.1 Status LED

The L-DALI has a three colour status LED (green, red and orange). Table 5 shows different LED patterns and their meaning.

Behavior	Description
GREEN flashing	DALI Traffic
RED flashing fast	DALI Traffic with errors
RED permanent	DALI bus-power supply failed/short
ORANGE permanent	Manual override to off
GREEN permanent	Manual override to on

Table 5: Status LED patterns.

6.4.4 Wink Action

If the L-DALI receives a wink command on any of its network ports, it shows a blink pattern on the

- CEA-709 or CNIP activity LEDs and the DALI activity LEDs (LDALI-3E10X and LDALI-ME204) or
- Status LED (LDALI-E101-U, LDALI-3101-U and LDALI-E101-U).

The LEDs turn green/orange/red (each 0.15 s). This pattern is repeated six times. After that, the activity LED of the DALI channel corresponding to the CEA-709 node on which the wink was received flashes orange six times. After that the L-DALI LEDs resume their normal behavior.

6.5 Buttons

6.5.1 Status Button

Some L-DALI models are equipped with a status button. When pressing the status button shortly during normal operation of the L-DALI, it sends a “Service Pin Message” on every active CEA-709 node or a BACnet “I Am” message on all active BACnet data link layers respectively.

LDALI-10X only: Note that there is one CEA-709 node for each DALI channel and each has its own unique node ID (“Neuron ID”). Pressing the status button longer than 2 seconds will allow you to select the node to send out the “Service Pin Message” message: The DALI port LED of the currently selected node will light up orange. After 2 seconds the next available node will be selected. When the status button is released the “Service Pin Message” is sent out on the currently selected node.

As an alternative to pressing the status button, a service pin message can be sent via the Web interface (see LOYTEC Device User Manual [1]).

The status button can also be used to switch the device back to factory default state. Press the service button and power-cycle the device. Keep the button pressed until the LEDs illuminate orange permanently. Release the button within five seconds from that time on to reset the device to factory defaults.

6.5.2 DALI Mode Button

L-DALI without LCD display are equipped with a DALI mode button (“ON/OFF/AUTO”). It is used to manually override the dim values of the attached DALI devices and constant light controller instances. Press it once and all DALI devices on the selected channels are switched on (“on mode”), press it again and all DALI devices on the selected channels are switched off (“off mode”), press it a third time and the selected channels go back to “auto mode”.

In the “on mode” and “off mode” the dim levels of the DALI devices and constant light controller instance cannot be changed via the CEA-709 or BACnet interface (“manual override”). In the “auto mode” the dim level of the DALI devices is controlled via the CEA-709 or BACnet interface respectively.

Channels are selected via the DALI Channel button (see Section 6.5.3). The current state of a DALI channel can be determined based on the corresponding DALI Activity LED (see Section 6.4.2.9).

The main purpose of the mode button is to test the wiring during installation of the DALI system.

6.5.3 DALI Channel Button

L-DALI without LCD display are equipped with a DALI Channel button (“CHANNEL”). It is used to select a specific channel. All other functions which can be performed via the DALI button interface (e.g. select DALI mode, see Section 6.5.2) are applied only to the selected DALI channel(s).

By default all DALI channels are selected. If the DALI Channel button is pressed once the first channel is selected and the corresponding DALI Activity LED lights up orange. Now each time the button is pressed the next channel is selected. If the last DALI channel is selected and the button is pressed once again, all DALI channels are selected. If no button is pressed for more than 15 seconds, the current selection is canceled.

6.5.4 DALI Program Button

L-DALI without LCD display are equipped with a DALI Program button (“PROG”). It is used to replace a broken ballast. When the button is pressed, the L-DALI scans the selected DALI channel for missing and unconfigured ballasts. If exactly one missing ballast and one unconfigured ballast are found on a channel, the unconfigured ballast is used to replace the missing ballast. That is, the unconfigured ballast is configured with the address and the configuration parameters of the missing ballast. If multiple missing ballasts or multiple unconfigured ballasts are found, the Web UI or LINX Configurator software must be used to replace the missing ballast(s) (see LOYTEC Device User Manual [1] and LINX Configurator User Manual [2]).

During the replace operation, the DALI Activity LED of the corresponding channel lights up orange. If the operation was successful, the LED lights up green for 0.5 seconds, if it failed, the LED lights up red for 0.5 seconds.

Which channels are selected can be controlled via the DALI Channel button (see Section 6.5.3).

6.6 DIP Switch Settings

L-DALI models without LCD display are equipped with a DIP switch. The DIP switch assignment is shown in Table 6. Please leave all switches at default state.

DIP Switch #	Function	Factory Default
1	Must be OFF	OFF
2	Must be OFF	OFF
3	Must be OFF	OFF
4	Must be OFF	OFF
5	Must be OFF	OFF
6	Must be OFF	OFF
7	Must be OFF	OFF

Table 6: DIP Switch Settings for L-DALI.

6.7 Wiring

The wiring information of the product and its terminal layout are shown on the installation sheet found in the product’s box.

7 Workflows for the L-DALI

This section discusses a number of work flows for configuring the L-DALI in different use cases in addition to the simple use case in the quick-start scenario (see Chapter 5). The description is intended to be high-level and is depicted in flow diagrams. The individual steps refer to later sections, which describe each step in more detail. The following use cases are defined:

- On-Line using LINX Configurator (see Section 7.1.1)
- Off-Line (see Section 7.1.2)

7.1.1 On-Line

The flow diagram in Figure 84 shows the steps that need to be followed in order to configure the L-DALI when the device and the DALI network including all DALI devices (e.g. ballasts, sensors, etc.) are available on-line. For details on the LINX Configurator see LINX Configurator User Manual [2].

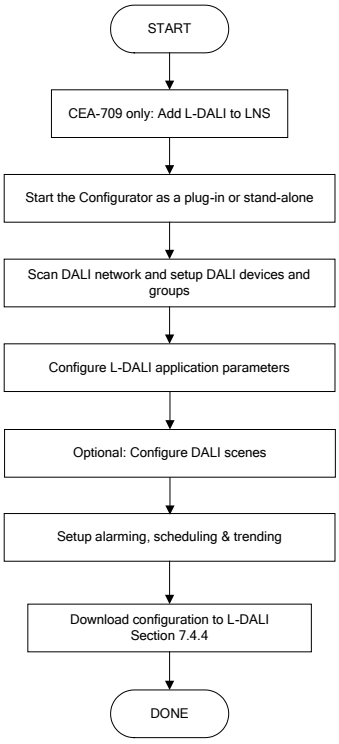


Figure 84: Basic on-line design-flow.

In case of LDALI-10X models are used in a LonWorks network, which is managed by an LNS network management tool, in the first step the L-DALI device must be added to LNS. Then the LINX Configurator must be started to configure the L-DALI. Use Plug-In mode if working with an LNS based tool (CEA-709 only) or stand-alone mode otherwise. In the Configurator, the DALI network is scanned for DALI devices and the devices are setup and assigned to DALI groups. Then the parameters for the light application and the sunblind

application can be configured. Optionally, DALI scenes and alarming, scheduling and trending functionality can be set up. Finally, the configuration needs to be downloaded to the L-DALI. It is recommended to save the complete configuration to a file for being able to replace an L-DALI in the network. Additionally a backup should be created.

To add more DALI devices, change DALI group assignment or application parameters simply repeat the steps described above.

7.1.2 Off-Line

The flow diagram in Figure 85 shows the steps that need to be followed in order to configure the L-DALI off-line. In this scenario the first steps can be performed without the L-DALI and the DALI network being physically available. This allows to prepare the on-line commissioning and thus to speed up the time required for on-site installation. Further, some steps of the on-line commissioning part can be performed by less skilled personnel using the L-DALI Web Interface.

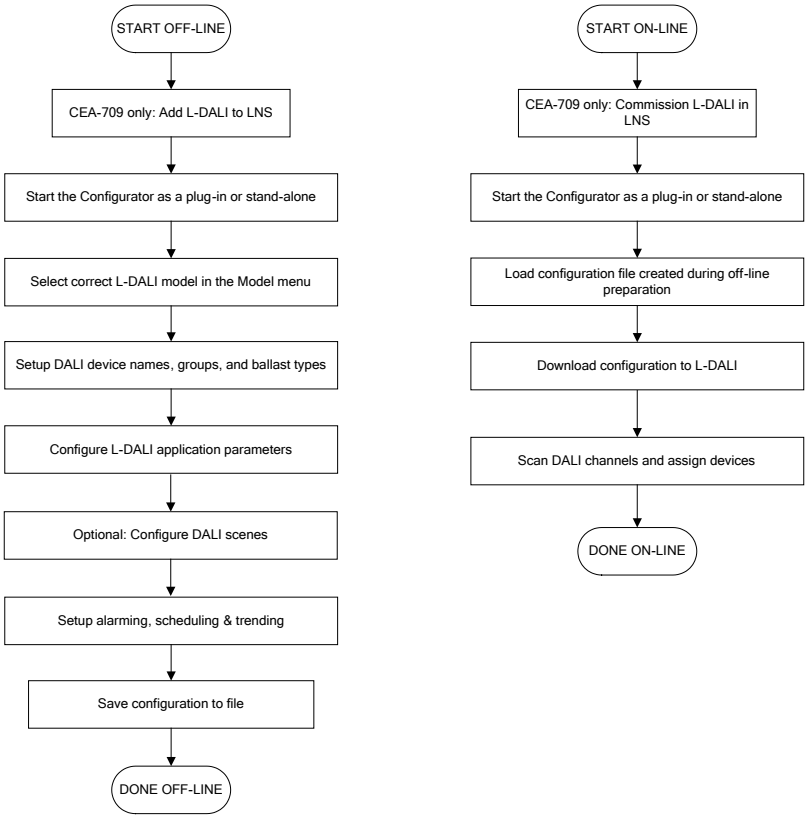


Figure 85: Basic off-line design-flow.

In case of LDALI-10X models are used in a LonWorks network, which is managed by an LNS network management tool, in the first step the L-DALI device must be added to LNS. Then the LINX Configurator must be started to configure the L-DALI. Use Plug-In mode if working with an LNS based tool (CEA-709 only) or stand-alone mode otherwise. Select the correct L-DALI model in the **Model** menu. Note, that the device is off-line. Next setup names, groups and optionally device type for the DALI devices. The names assigned must allow identifying physical devices later on (e.g. “Room 301-1” for first ballast in room 301). The device type (e.g. emergency light) must be selected if any device type specific parameters shall be configured in the next step. Then configure the parameters for the light application and the sunblind application. Optionally, DALI scenes and alarming, scheduling and trending functionality can be set up. Save the created configuration to a file.

When the L-DALI is physically available, in case of a LDALI-10X model, first commission all ports of the device in LNS. Then again start the Configurator in plug-in mode. Load the file created during the off-line preparation and download the configuration to the L-DALI. Now, scan the DALI channels, either using the Configurator or the Web Interface and assign the DALI devices found to the names entered during off-line preparation. Finally, it is recommended to upload and save the complete configuration to a file for being able to replace an L-DALI in the network. Additionally a backup should be created.

To add more DALI devices, change DALI group assignment or application parameters it is recommended to use the on-line work flow (see Section 7.1.1).

7.1.3 Replace an L-DALI

An L-DALI can be replaced in the network by another unit. This might be necessary if a hardware defect occurs. If a backup of the latest configuration is available, restoring the backup is the best option.

The work flow to restore a device from the corresponding LINX Configurator project file is depicted in Figure 86. First of all, the replacement L-DALI needs to be configured with the appropriate IP settings and all relevant system settings (BACnet device ID, CEA-852 device settings, etc).

Start the LINX Configurator software stand-alone and connect via direct method. Load the LINX Configurator project file from the directory, which has been saved when the original L-DALI has been configured or modified. Double-check, if the DALI configuration seems ok and all DALI devices in use are assigned, that is, have a valid short address assigned. Then download the configuration to the L-DALI.

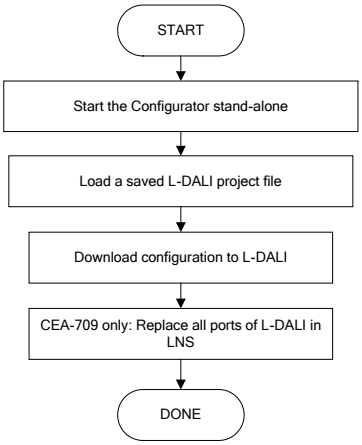


Figure 86: Basic work flow to configure a replacement device.

If using an LNS-based tool, all ports of the L-DALI device need to be replaced in that tool at some later point in time as the NID has changed. If you are not using LNS, then refer to your network management tool's reference manual on how to replace a device.

7.1.4 Enable Legacy NM Mode (LDALI-10X only)

For CEA-709/LonWorks network management tools, which do not support the ECS (extended command set) network management commands, the legacy network management mode must be configured. Please contact the tool's vendor for information whether ECS is supported or not. Note, that changing to legacy network management mode changes the static interface of the device and thus requires different XIF files.

The legacy mode can be enabled using the Web Interface (see LOYTEC Device User Manual [1]) or the **System Settings** tab in the **Project Settings** dialog of the Configurator Software (see LINX Configurator User Manual [2]).

7.1.5 Configuration Upload and Download

When uploading or downloading the configuration of an L-DALI device using the LINX Configurator the following items are available for download (see Figure 87):

- **Datapoint Configuration**: Contains everything configured on the Datapoints tab, the Local and Global connections tabs and in the project settings except for the system settings. Typically this includes any changes to the L-DALI's NV or BACnet interface (Project Settings), local alarm, scheduler, calendar, and trendlog objects, e-mail templates, math objects and user created data points.

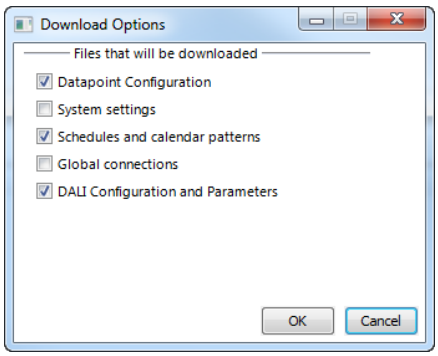


Figure 87: Download Options Dialog.

- **System settings**: Contains the configuration setup in the System Settings tab of the Project Settings.

- **Scheduler and calendar patterns**: Contains the schedule and calendar configuration ("contents" of scheduler and calendar objects).

- **Global connections**: Contains everything configured in the Global connections tab. Do not download Global connections using the LINX Configurator if using LWEB-900 software to configure and manage global connections!

- **DALI Configuration and Parameters**: The DALI Configuration contains the configuration of the DALI network, including device names, device types, device assignment (DALI short address), scene values, group names and group assignment as configured on the DALI Installation, DALI Groups, DALI Channel and DALI Scenes tabs. The Parameters contain the parameters of the L-DALI light and (if available) sunblind applications, including CLC Bindings and button functions as configured on the Parameters tab.

In the default settings all items are uploaded and downloaded. The **Project Settings** allow to select items for the download in the tab **General** (see Figure 88).

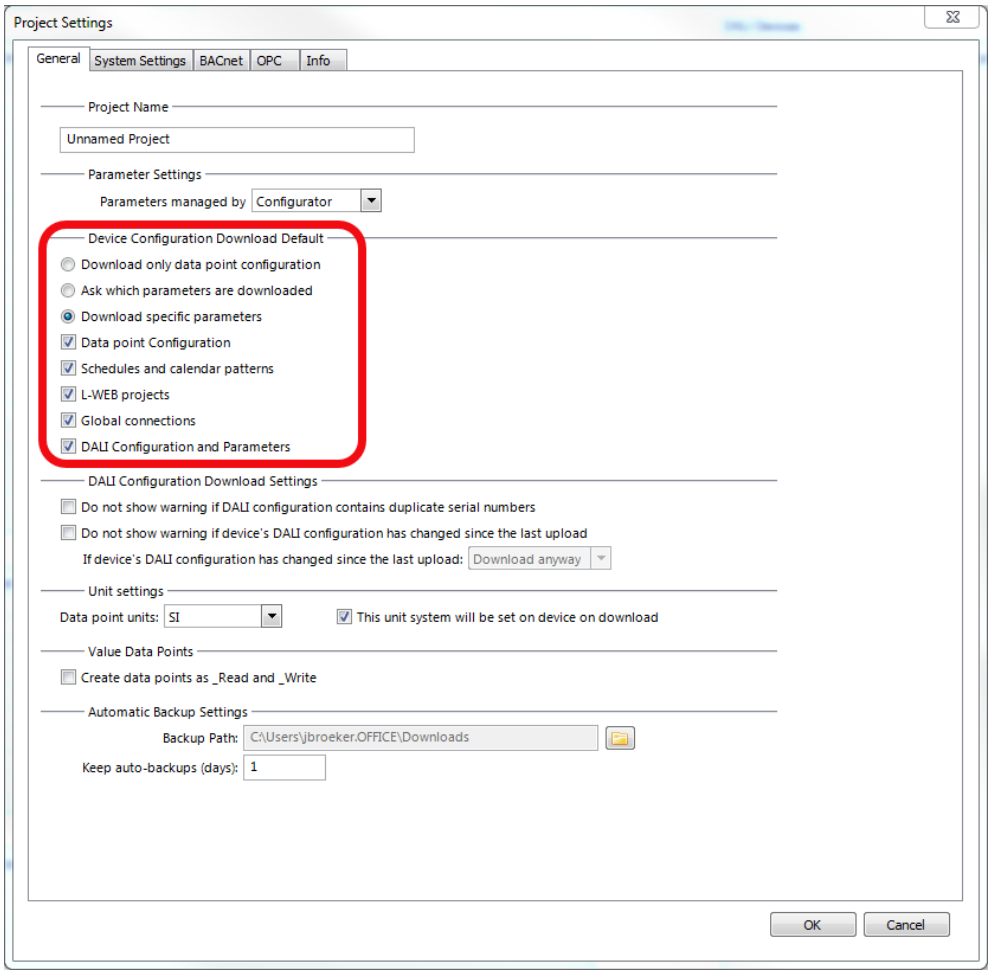


Figure 88: Device Configuration Download settings.

Tip!	*To speed up your work flow only download the configuration items changed. In applications where no AST features are used it is* ***sufficient to download DALI Configuration and Parameters****!*

8 L-DALI Lighting Application

The L-DALI controllers come with a standard lighting application. The behavior of the application and the data points available are slightly different for the BACnet and the CEA-709 version of the L-DALI. The following sections describe the application, the data point interface available and the web interface specific for the L-DALI lighting application.

8.1 CEA-709 Interface and Application (LDALI-10X only)

Depending on the L-DALI device type 1 (LDALI-3E101-U/LDALI-E101-U/LDALI-3101-U), 2 (LDALI-3E102/ LDALI-3E102-U), or 4 (LDALI-3E104/ LDALI-3E104-U) DALI channels are supported. Each DALI channel is implemented as a separated CEA-709 node. Every one of these up to four CEA-709 nodes is a full grown CEA-709 node, including its own unique node id ("Neuron ID"), network address, network variable tables etc. However, all these nodes share one common physical network connection.

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

Note: *It is recommended to start the LINX Configurator as LNS-Plug-In, whenever using a LDALI-10X with an LNS based network management tool (LonMaker, NL220, etc.)! This allows the Plug-In to keep the device configuration in-sync with the LNS database.*

The L-DALI can be used with different static network interface configurations. Depending on the application the different object types can be enabled or disabled to add functionality (e.g. button support or additional network variables for applications with emergency lights) or to reduce the number of objects, network variables and configuration properties respectively.

The interface configuration can be chosen via the Project Settings in the Configurator Software (see LINX Configurator User Manual [2]).

The LONMARK objects not specific to the L-DALI (Node Object, Real-Time Keeper Object, Calendar Object, Scheduler Object, etc.) are described in the LOYTEC Device User Manual [1].

8.1.1 Lamp actuator Object #3040

There are three different types of the lamp actuator objects:

- Lamp actuator object: related to DALI lamp (64 per channel)
- Group actuator object: related to DALI group (16 per channel).
- Channel actuator object: related to the DALI channel (1 per channel).

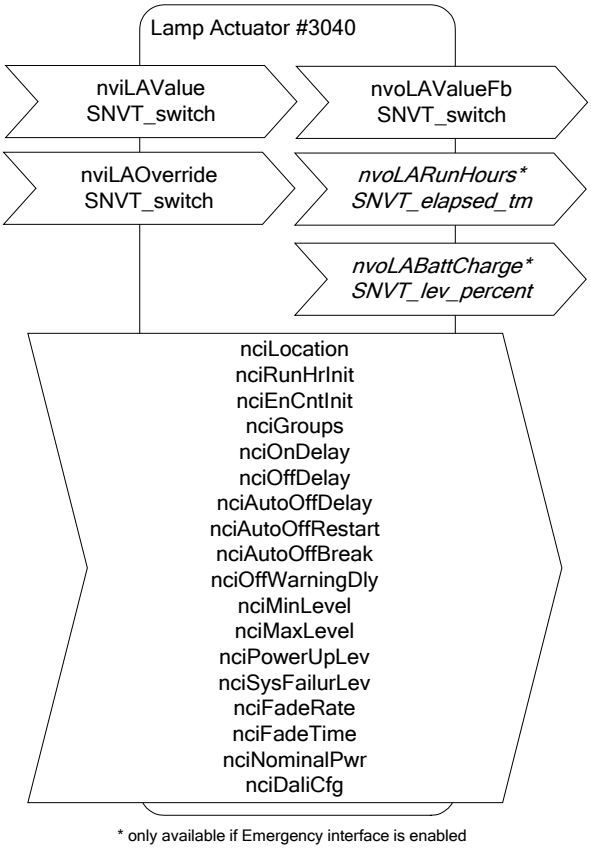


Figure 89: Lamp Actuator Object

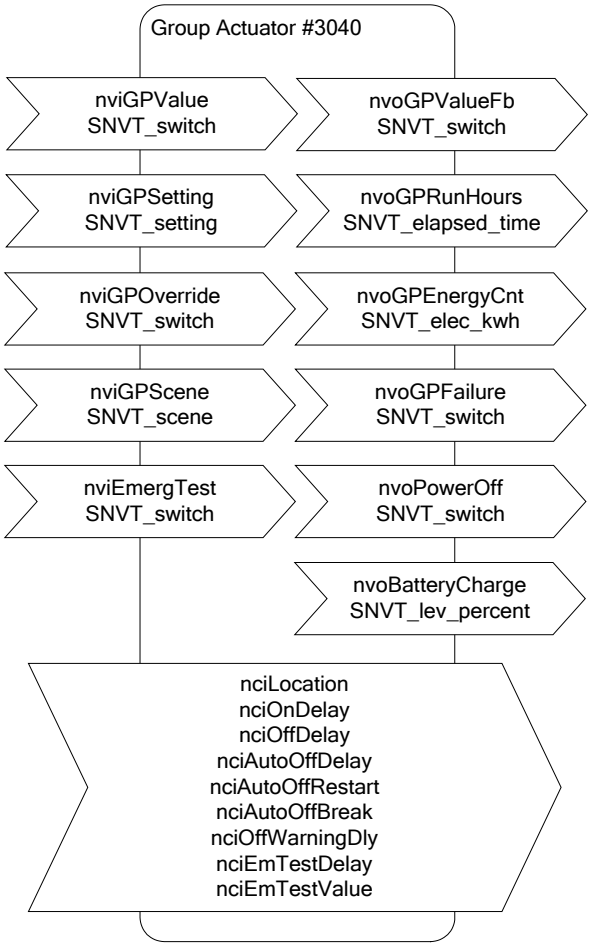


Figure 90: Group Actuator Object

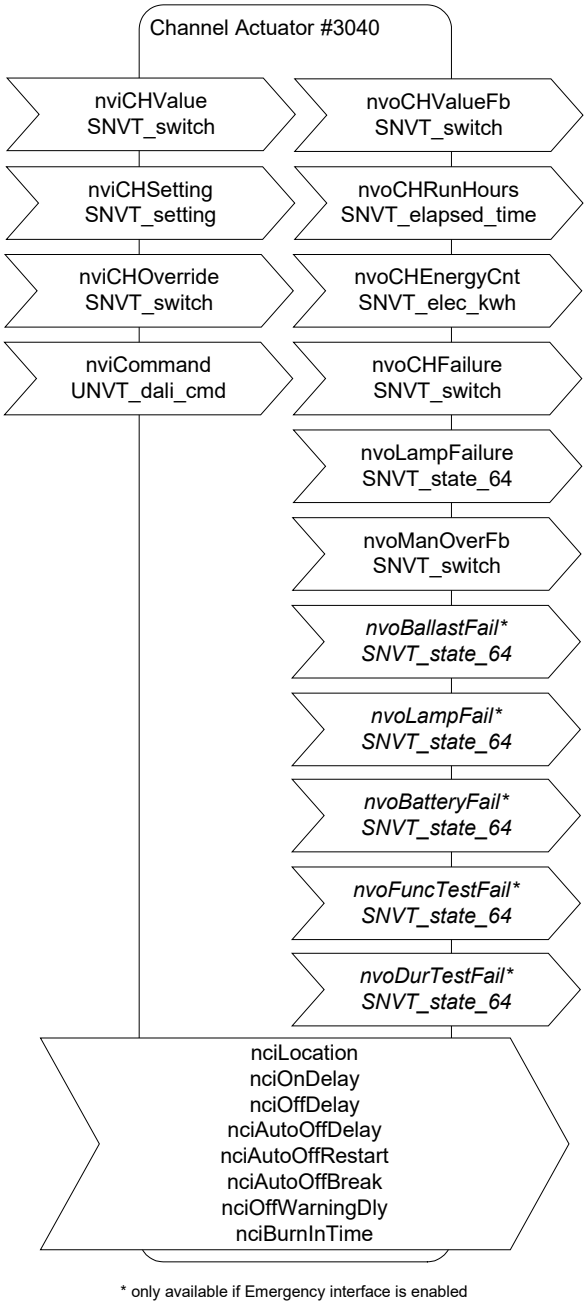


Figure 91: Object for channel

These object types are enabled in the default interface. They can be disabled.

Note: If the Lamp Actuator objects are disabled, the functional blocks are still present, but only contain the configuration properties corresponding to the DALI parameters of the corresponding ballast.

8.1.1.1 Control

The L-DALI offers different methods to control lamps. All network variables described below have the same priority. This means that the last network variable update determines the state of the lamp.

Individual Control

Each lamp can be controlled individually via the switch input network variable *nviLAValue* of the lamp actuator object. Any new value received is transmitting to the corresponding DALI lamp in fading mode (configuration property *nciFadeTime* is used).

Group Control

Lamps belonging to a group can be controlled together by the following network variables of the group actuator object.

- ***nviGPValue*:** This network variable has the same functionality as *nviLAValue* but controls a whole group. Any new value received is transmitting to the DALI lamps in the group using fading mode (configuration property *nciFadeTime* is used).

- ***nviGPSetting*:** Using this input network variable of type SNVT_setting dimming devices can change the brightness relatively. By *function* = SET_UP or *function* = SET_DOWN the light is dimmed relatively by the amount defined in the corresponding *setting* field. By *function* = SET_STOP ongoing fades are stopped. When the light is switched off by *function* = SET_OFF, the last light level is saved temporarily. When the light is switched on again (function = SET_ON) the remembered light level is restored. An absolute light level can be set by *function* = SET_STATE. The corresponding *setting* field defines the target light level. The light value is changed in ramping mode (configuration property *nciFadeRate* is used).

- ***nviGPScene*:** Using this input network variable of type SNVT_scene up to 16 DALI scenes can be saved and recalled. The command SC_LEARN stores the current light levels of all lamps of the group in the specified scene number. Alternatively DALI scenes can be configured using the DALI Scenes page in the web interface (see LOYTEC Device User Manual [1]) or the DALI Scenes tab in the LINX Configurator (see LINX Configurator User Manual [2]). By a SC_RECALL command previously stored scenes can be recalled. Recalling scene 255 will relinquish any manual override and (re-)activate a constant light controller linked to the group (see Section 8.1.4.4). Scenes can be deleted by a SC_RESET command. When a new scene is selected the lamp values are adjusted in fading mode (configuration property *nciFadeTime* is used). As scene numbers in SNVT_scene start with 1, while DALI scene numbers start with 0, SNVT_scene number minus 1 will give the DALI scene number (SNVT_scene number 1 maps to DALI scene number 0, SNVT_scene number 2 maps to DALI scene number 1 etc.).

Channel Control

All lamps on the same DALI channel can be controlled together by the following network variables of the channel actuator object.

- ***nviCHValue*:** This input network variable works in the same way as *nviLAvalue* and *nviGPvalue* but affects all lamps on a channel.

- ***nviCHSetting*:** This input network variable works in the same way as *nviGPSetting* but affects all lamps on a channel.

8.1.1.2 Maximum and Minimum Light Level

For a dimmable lamp the maximum and minimum light level of a lamp can be configured via the configuration properties *nciMinLevel* and *nciMaxLevel* of type SNVT_switch.

For a non-dimmable lamp set *nciMinLevel* = *nciMaxLevel* = 100%.

8.1.1.3 Timing Parameters

Figure 92 shows the behavior of the lamp actuator if the light is switched on/off via one of the switch (*nviLAValue, nviGAValue, nviCHValue*) or via one of the setting input network variables (*nviGASetting, nviCHSetting*). When the ON command is received, the lamp is switched to the specified value after the time *nciOnDelay* has expired. When the lamp is already on and a new ON command is received the lamp is switched to the new value immediately. If the lamp is on and an OFF command is received the lamp is switched off after the time *nciOffDelay*.

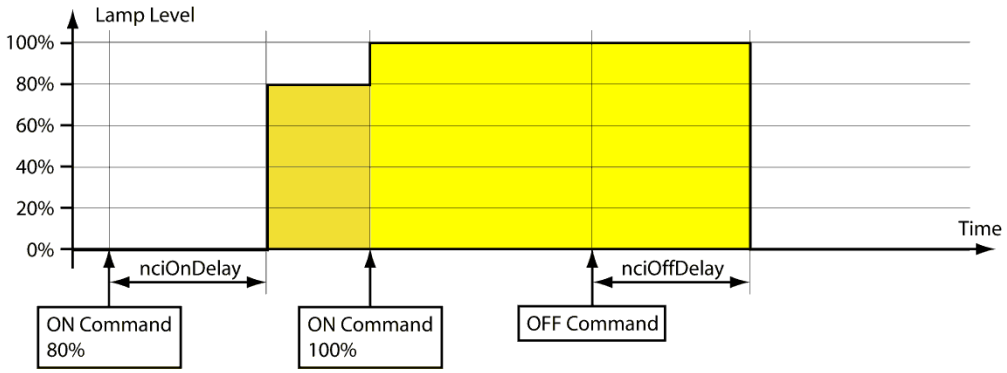


Figure 92: Timing Parameters

For staircase lighting an automatic cutoff can be configured in *nciAutoOffDelay* as shown in Figure 93. When this time expires, the lamp switches off automatically. To warn the user that the light is going to turn off, an off-warning delay (*nciOffWarningDly*) can be configured. During this time the light is dimmed to 50% of the previous level. For non-dimmable lights (*nciMinLevel=nciMaxLevel*) the light is blinking.

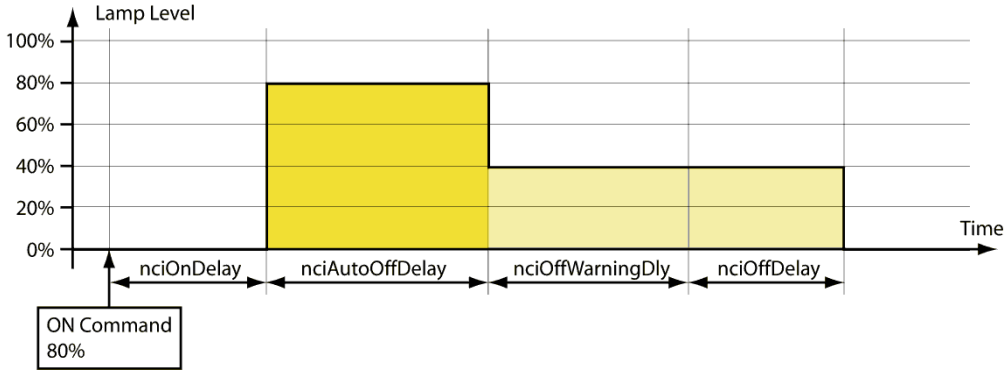


Figure 93: Timing Parameters with *nciAutoOffDelay* and *nciOffWarningDly*

The behavior of the auto-off timer can be modified with the two configuration properties *nciAutoOffRestart* and *nciAutoOffBreak*. If *nciAutoOffRestart* is set to ST_ON, the auto-off timer can be restarted by a new ON command (see Figure 94). If *nciAutoOffBreak* is set to ST_ON the auto-off timer can be stopped before the time has expired by switching the light off via one of the applicable input network variables (see Figure 95).

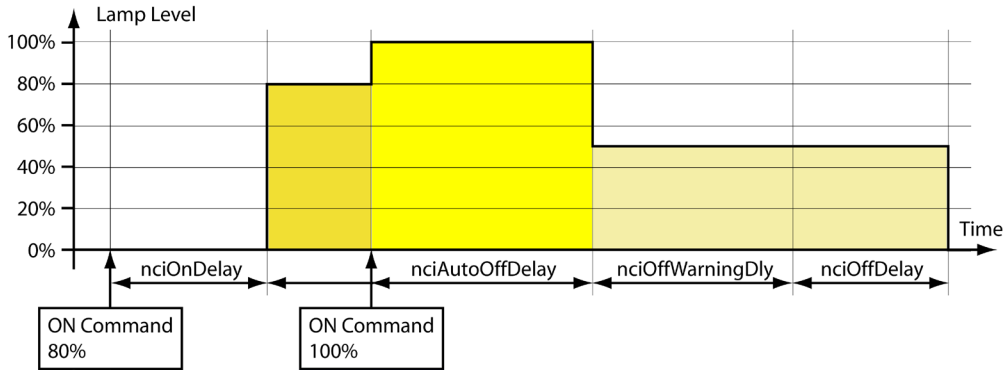


Figure 94: Timing Parameters (*nciAutoOffRestart*=ST_ON)

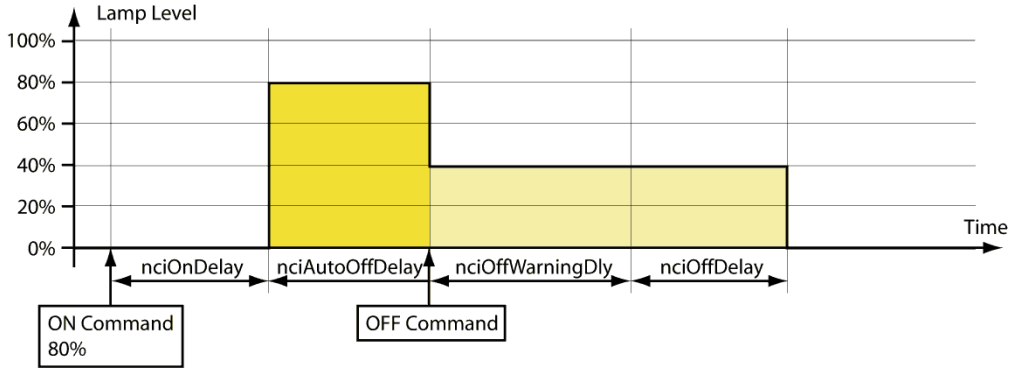


Figure 95: Timing Parameters (*nciAutoOffBreak*=ST_ON)

8.1.1.4 Prioritized Control

Lamp values can be overridden by the following network variables:

- ***nviLAOverride**:* This input network variable of type SNVT_switch overrides the value of *nviLAValue*.
- ***nviGPOverride**:* This input network variable of type SNVT_switch overrides the value of *nviGPValue*, *nviGPSetting*, and *nviGPScene*.
- ***nviCHOverride**:* This input network variable of type SNVT_switch overrides the value of *nviCHValue* and *nviCHSetting*.

If *nviXXOverride* is valid (.state=0/1) it controls the lamp/group/channel output. Updates of on the non-priorized input network variables (see Section 8.1.1.1) are ignored. If *nviXXOverride* is set to invalid (.state=-1) control of the lamp/group/channel output is returned to the non-priorized input network variable.

The light value is changed in fading mode (configuration property *nciFadeTime* is used).

Prioritized control commands are not affected by the timing parameters described in Section 8.1.1.3.

8.1.1.5 Feedback

The lamp object, group object and channel object each report the current state via a feedback variable of type SNVT_switch:

- *nvoLAValueFb*: lamp object feedback

- *nvoGPValueFb*: group object feedback
- *nvoCHValueFb*: channel object feedback

The channel object reports if it is in manual override mode via the network variable *nvoManOverFb*.

8.1.1.6 Emergency Lights

The L-DALI supports testing of emergency lights using its CEA-709 interface. The test is started and stopped by using the network variable input *nviEmergTest*, which is available in each Group Actuator object. To start the test the *state* part of the *SNVT_switch* must be set to SW_ON (1). The *value* part selects one of the following tests:

- **Function test** (*value* = 1%): Starts the function test of all DALI emergency lights in this group, which support this function. For details on the DALI emergency lighting function test see IEC 62386-202. If the Emergency interface is enabled the *nvoFuncTestFail* will show whether the last function test performed has failed (see below).
- **Duration test** (*value* = 2 %): Starts the duration test of all DALI emergency lights in this group, which support this function. For details on the DALI emergency lighting duration test see IEC 62386-202. If the Emergency interface is enabled the *nvoDurTestFail* will show whether the last duration test performed has failed (see below).
- **Mains test** (*value* = 100%): Typically used in a central battery system, to verify lights are dimmed to the emergency level when mains fail. When the test is started via *nviEmergTest*, the power of the emergency lamps is cut by setting the switch network variable output *nvoPowerOff* to ON. After the delays *nciEmTestDelay*, the value of all lamps in the group is compared to the reference value specified in *nciEmTestValue*. If a lamp does not reach the reference value (dim value above or below reference value) or if a lamp is offline, an alarm is generated as shown in Figure 96.

Test results will be stored in the appropriate emergency light test log (see LOYTEC Device User Manual [1]). To abort any active test the *SNVT_switch* must be set to {SW_OFF, 0%}. To periodically execute tests a scheduler controlling *nviEmergTest* can be configured.

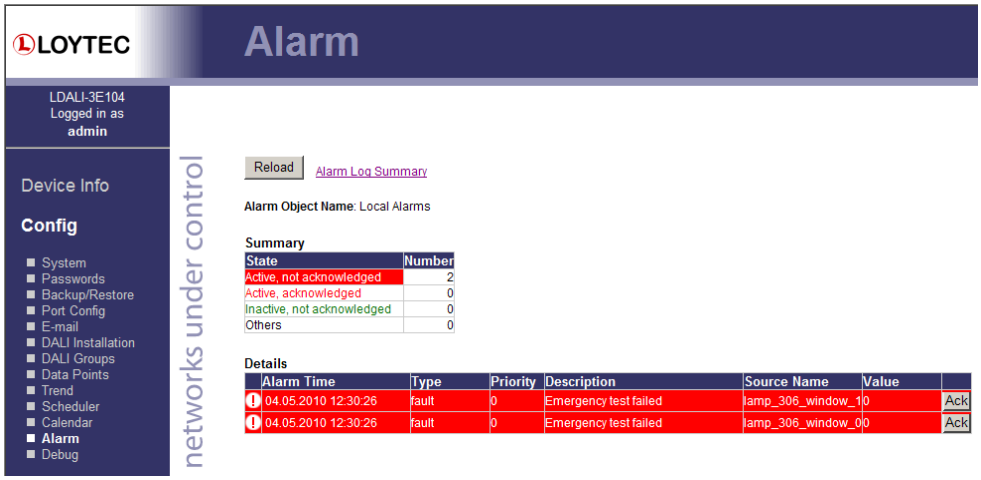


Figure 96: Emergency Light Test Alarm

If the interface configuration **Emergency** is selected the following additional, emergency light related network variables and register data points are available:

- *nvoLARunHour* (Lamp Actuator): Report run-hours per ballast.
- *nvoLABattCharge* (Lamp Actuator): Report battery charge per emergency light ballast (if ballast supports it).
- *nvoLABattRatedDur* (Lamp Actuator, register data point): Report rated battery duration of emergency light ballast.
- *nvoLAEmergMode* (Lamp Actuator, register data point): Report emergency mode of emergency light ballast.
- *nvoLAEmergStatus* (Lamp Actuator, register data point): Report emergency status of emergency light ballast.
- *nvoLAEmergFailStatus* (Lamp Actuator, register data point): Report emergency failure status of emergency light ballast.
- *nvoBatteryFail* (Channel Actuator): Report battery failure for each emergency light ballast.
- *nvoFuncTestFail* (Channel Actuator): Report whether last function test failed for each emergency light ballast.
- *nvoDurTestFail* (Channel Actuator): Report whether last function test failed for each emergency light ballast.

8.1.1.7 Status Monitoring

The L-DALI monitors the DALI lamps and reports any failure in the output network variables *nvoGPFailure* (group object) and *nvoCHFailure* (channel object).

A lamp failure is reported if either

- bus power for the related DALI channel fails,
- the DALI ballast is not reachable via the DALI channel, or
- the DALI ballast reports a failure (e.g. lamp failure) in its DALI status register.

The value of the network variable *nvoGPFailure* of the group object reflects the percentage of failed ballasts in this group.

The value of the network variable *nvoCHFailure* of the channel object reflects the percentage of failed ballasts in this channel.

The network variable *nvoLampFailure* of type SNVT_state_64 reports the status of the all lamps in a channel. Each bit corresponds to the lamp with the same index. In case of a failure the bit is set.

8.1.1.8 Statistics

The L-DALI reports the run hours and energy consumptions of the DALI lamps.

Run Hours

The L-DALI determines how long each DALI lamp was switched on. If a lamp is replaced the run hours can be initialized via the configuration property *nciRunHrInit* of the lamp object. To limit the number of network variables the run hours are reported not separately for each lamp but for a whole group or channel.

The group object reports the maximum run hours of all lamps in the groups via the output network variable *nvoGPRunHours*.

The channel object reports the maximum run hours of all lamps on the channel via the output network variable *nvoCHRunHours*.

Energy Consumption

The L-DALI device can calculate the energy consumption of the DALI lamps. For that purpose it needs to know the nominal power of all connected DALI lamps. If the configuration property *nciNominalPwr* of the lamp object is set to 0 (AUTO), the L-DALI tries to obtain the energy consumption from the DALI device. However, not all DALI ballasts support this proprietary extension. In this case the *nciNominalPwr* has to be configured with the nominal power of the ballast. The energy consumption can be initialized via the configuration property *nciEnrgyCntInit* of the lamp object.

To reduce the number of network variables the energy consumption is reported not separately for each lamp but for a whole group or channel. The group object reports the sum of energy consumed by all lamps in the groups via the output network variable *nvoGPEnergyCnt*. Equally the network variable *nvoCHEnergyCnt* reports the sum of energy consumed by all lamps on the channel.

8.1.1.9 Burn-In Function

Some lamps require a burn-in time during which they must not be dimmed. The burn-in mode can be activated by setting the *nviCommand* network variable of the channel object to START_BURN_IN. The burn-in time is defined by the configuration property *nciBurnInTime*. During this time the lamps will only be switched to on (100%) or off (0%) but not dimmed. To abort the burn-in mode prematurely *nviCommand* can be set to STOP_BURN_IN.

8.1.1.10 Fail Safe Functions

The light level a lamp adopts after power-up is defined in the configuration property *nciPowerUpLev*.

The light level a lamp adopts in case of a DALI system failure is defined in the configuration property *nciSysFailureLev*. According to the DALI standard a DALI device will enter system failure state if DALI bus power is interrupted for more than 550 ms.

8.1.1.11 Colour Control

Controlling the colour of devices of type “colour control” (device type 8) is possible

- **absolute** using *nviCommand* (Channel actuator object): Using the command (*.cmd* field) *DALI_CMD_SET_COLOUR*, DALI native colour control commands can be triggered. For details see the description of *nviCommand* below (Section 8.1.1.12).

- **absolute** using *nviGPSetting* (Group actuator object) and *nviCHSetting* (Channel actuator object): For a more convenient operation via a UI, colour control is possible via two additional functions of the *nviXXSetting* NVs. The function (*.function* field) *SET_TC* (126) allows to set the colour temperature in Kelvin, while *SET_COLOUR* (127) allows to change the lamp colour by supplying hue and saturation values. In the latter case the different native DALI colour control methods (xy-coordinate, RGBWAF, primary-N) are abstracted (converted). Hue is an angular value, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. Saturation can be in the range of 0% to 100%. For details see the description of *nviXXSetting* below (Section 8.1.1.12).

- **absolute** by setting the colour temperature in degree Kelvin via the register data point nviXXColourTemp (Lamp, Group or Channel actuator object).

- **absolute** by using the register data points nviXXHue and nviXXSaturation (Lamp, Group or Channel actuator object). Hue is an angular value, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. Saturation can be in the range of 0% to 100%. The controller converts the hue and saturation values given to the respective native DALI colour control values (xy-coordinate, RGBWAF or primary-N) as supported by the luminaire. This abstraction allows to use a control algorithm or user interface independent of the supported DALI colour control method.

- **via scene** using *nviGPScene* (Group actuator object): This NV allows recalling DALI scenes. DALI scenes can contain lamp colour settings (for ballasts with DT8 support) as well as dim levels. These scenes can be defined using the DALI scenes tab in the LINX Configurator (see LINX Configurator User Manual [2]) or in the DALI scenes web-UI (see LOYTEC Device User Manual [1]). Note, that DALI scenes can be used to change lamp colour without affecting the dim level (and vice versa). For details see the description of *nviGPScene* below (Section 8.1.1.12).

8.1.1.12 Input Network Variables

nviXXValue	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 On: .state = 1 and .value > 0 Off: .state = 0 and .value=any or .state=1 and .value = 0
Default Value	-
Description	Used to control the lamp/group/channel. This input is effective only if *nviXXOverride.state* is invalid (-1). If an update is received on this network variable the corresponding DALI lamp/group/channel is dimmed in fading mode (constant time, configuration property *nciFadeTime* is used). Lamp actuator only: If an invalid value is received, the lamp adopts the level defined by the *nciSysFailurLev*.

nviXXSetting	
Type	SNVT_setting
Valid Range	.function: SET_OFF, SET_ON, SET_UP, SET_DOWN, SET_STATE .setting: 0..100%
Default Value	-

Description

Used to control the group/channel. This input is effective only if *nviXXOverride.state* is invalid (-1).

Function	Description
SET_UP, SET_DOWN	The light is dimmed relatively by the amount defined in the .setting field.
SET_STOP	Stop an ongoing fade.
SET_OFF	The light is switched off and the last light level is saved temporarily.
SET_ON	The light is switched on to the light level saved at the time of the last SET_OFF command.
SET_STATE	Set the light to the level defined by the .setting field.
SET_EMERGENCY_LIGHT_RESET_ TEST_DONE_FLAGS(118)	The corresponding bits for executed duration or function test are cleared. Affects all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports this option. For more information on testing of emergency lights see Section 8.1.1.6.
SET_QUERY_DALI_DATA(119)	This command forces an update of the DALI-data. The information is queried from the DALI-devices. Affects DALI group address or DALI broadcast address, which is associated with this network variable.
SET_IDENTIFY(120)	Send the IDENTIFY command (WINK feature). Affects DALI group address or DALI broadcast address, which is associated with this network variable.
SET_LAMP_OFF(121)	Send the OFF-command to device. Affects DALI group address or DALI broadcast address, which is associated with this network variable.
SET_GO_TO_LAST_ACTIVE_LEVEL(122)	Recall the last recent active level. Affects DALI group address or DALI broadcast address, which is associated with this network variable.
SET_EMERGENCY_LIGHT_REST(123)	Self-contained emergency lights are switched into REST-mode. Affects all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports this mode. For more information on testing of emergency lights see Section 8.1.1.6.
SET_EMERGENCY_LIGHT_INHIBIT(124)	Self-contained emergency lights are switched into INHIBIT-mode.

nviXXSetting		
Type	SNVT_setting	
		Affects all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports this mode. For more information on testing of emergency lights see Section 8.1.1.6.
	SET_EMERGENCY_LIGHT_RESET_INHIBIT(125)	Self-contained emergency lights are forced to leave REST- or INHIBIT-mode. Affects all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports these modes. For more information on testing of emergency lights see Section 8.1.1.6.
	SET_TC (126)	Set the colour temperature of a luminaire supporting DT8 Tc colour control (tunable white) to the value given in the *.rotation* field. The value in the *.rotation* field is interpreted as raw value in Kelvin (0-32767 Kelvin, 1 Kelvin resolution).
	SET_COLOUR(127)	Set the lamp colour of a luminaire supporting DT8 xy-coordinate, RGBWAF or primary-N colour control. The value in the *.rotation* field is interpreted hue, while the *.setting* field is interpreted as saturation. Hue is an angular value, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. Saturation can be in the range of 0% to 100%. The controller converts the hue and saturation values given to the respective native DALI colour control values (xy-coordinate, RGBWAF or primary-N) as supported by the luminaire. This abstraction allows to use a control algorithm or user interface independent of the supported DALI colour control method
	The light is dimmed in ramping mode (constant rate, configuration property *nciFadeRate* is used). For colour changes the *nciFateTime* is used.	

nviXXOverride	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1
Default Value	-
Description	If *nviXXOverride* is valid (.state=0/1), the current lamp/group/channel output is saved temporarily and the lamp/group/channel output is set to the specified value. If *nviXXOverride* is set to invalid (.state=-1), the lamp/group/channel output is set to the previously saved value. The light is dimmed in fading mode (constant time, configuration property *nciFadeTime* is used).

nviGPScene	
Type	SNVT_scene
Valid Range	.function: SC_LEARN, SC_RECALL, SC_RESET .scene_number: 1..16, 255
Default Value	-
Description	Using this input network variable up to 16 DALI scenes can be saved and recalled. **Function** / **Description** SC_LEARN: Stores the current light levels of all lamps of the group in the specified scene number. SC_RECALL: Recall a previously stored scenes. SC_RESET: Delete a scene. As values for scene_number start with 1, while DALI scene numbers start with 0, the DALI scene number is scene_number minus 1 (scene_number 1 maps to DALI scene number 0, scene_number 2 maps to DALI scene number 1 etc.). Recalling scene 255 will relinquish any manual override and (re-)activate a constant light controller linked to the group (see Section 8.1.4.4). When a new scene is selected the lamp values are adjusted in fading mode (configuration property *nciFadeTime* is used).

nviEmergTest	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1
Default Value	-
Description	Used to start the test of emergency lamps in a group. To start the test the *state* part of the *SNVT_switch* must be set to SW_ON (1). The *value* part selects one of the following tests: • **Function test** (value = 1%): Starts the function test of all DALI emergency lights in this group, which support this function. For details on the DALI emergency lighting function test see IEC 62386-202. If the Emergency interface is enabled the *nvoFuncTestFail* will show whether the last function test performed has failed. • **Duration test** (value = 2 %): Starts the duration test of all DALI emergency lights in this group, which support this function. For details on the DALI emergency lighting duration test see IEC 62386-202. If the Emergency interface is enabled the *nvoDurTestFail* will show whether the last duration test performed has failed. • **Mains test** (value = 100%): Typically used in a central battery system, to verify lights are dimmed to the emergency level when mains fail. When the test is started via *nviEmergTest*, the power of the emergency lamps is cut by setting the switch network variable output *nvoPowerOff* to ON. After the delays *nciEmTestDelay*, the value of all lamps in the group is compared to the reference value specified in *nciEmTestValue*. If a lamp does not reach the reference value (dim value above or below reference value) or if a lamp is offline, an alarm is generated as shown in Figure 96. Test results will be stored in the appropriate emergency light test log (see LINX Configurator User Manual [2]). To abort any active test the *SNVT_switch* must be set to {SW_OFF, 0%}.

nviCommand	
Type	UNVT_dali_cmd
Valid Range	.cmd: START_BURN_IN=0, STOP_BURN_IN=1, DALI_CMD_SET_COLOUR=2 .data.type: BALLAST=0, GROUP=1, CHANNEL=2 .data.index: 0..63 .data.arg: Union containing arguments depending on selected command.
Default Value	-

<table>
<tr><th colspan="2">nviCommand</th></tr>
<tr><td>Type</td><td>UNVT_dali_cmd</td></tr>
<tr><td>Description</td><td>Used to start and stop the burn-in mode.
<table>
<tr><th>Function</th><th>Description</th></tr>
<tr><td>START_BURN_IN</td><td>Start the burn-in mode for a ballast, group, or channel. The burn-in time is defined by the configuration property nciBurnInTime.</td></tr>
<tr><td>STOP_BURN_IN</td><td>Abort the burn-in mode for a ballast, group, or channel.</td></tr>
<tr><td>DALI_CMD_SET_COLOUR</td><td>Change light colour for ballast, group, or channel. The argument field is defined as follows:
<pre>
struct set_colour {
  dali_colour_type_t type;
  union value {
     struct xy_coordinate {
        uint16 x;
        uint16 y;
     };
     uint16 colour_temperature_tc;
     uint16 primary_n_dim_level[6];
     struct rgbwaf {
        uint8 control;
        uint8 red;
        uint8 green;
        uint8 blue;
        uint8 white;
        uint8 amber;
        uint8 freecolour;
     };
  };
};
</pre>
The field type defines the way the colour is specified:

DALI_COLOUR_TYPE_XY_COORDINATE (0): The light colour is defined by the x any y coordinates in the CIE1931 colour space chromaticity diagram. The x and y values are given in the structure value.xy_coordinate.
DALI_COLOUR_TYPE_TC (1): The light colour is defined by the colour temperature Tc. Its value is given in the field value.colour_temperature_tc. The value has to be supplied in Mirak (=1.000.000/T).
DALI_COLOUR_TYPE_PRIMARY_N (2): The light colour is defined by the dim level of up to 6 channels. The corresponding values are given in the array value.primary_n_dim_level.
DALI_COLOUR_TYPE_RGBWAF (3): The light colour is defined by colour channels red, green, blue, white, amber and freecolour. See IEC 62386-209 on details. The corresponding values ar given in the structure value.rgbwaf.

Note: Not all colour control types are supported by all DALI colour control ballasts. Check the documentation of the DALI ballast on which types are supported.</td></tr>
</table>
If the command requires an address the field data.type defines whether the command addresses a single ballast, a group or the all devices on the channel (broadcast). The field data.index gives the index of the associated lamp actuator (0-63) or group actuator (0-15) object, respectively. In case of type CHANNEL the index is ignored.</td></tr>
</table>

8.1.1.13 Output Network Variables

nvoXXValueFb	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 On: .state = 1 and .value > 0 Off: .state = 0 and .value=any or .state=1 and .value = 0
Default Value	-
Description	Feedback value of the lamp/group/channel object. For a lamp actuator object this value is the current state and percentage of level intensity of the corresponding DALI ballast. The *.state* part is –1 (invalid) if the ballast is not present. For a group actuator or channel actuator object this value changes, whenever all ballasts of the group/channel adopt the same dim vale.

nvoXXRunHours	
Type	SNVT_elapsed_tm
Valid Range	.day: 0..65534 .hour: 0..23 .minute: 0..59 .second: 0..59
Default Value	-
Description	Reports the run (ON) hours. L-DALI calculates the run hours of each DALI ballast. The network variable *nvoGPRunHours* reports the maximum run hours of the lamps in a group. The network variable *nvoCHRunHours* reports the maximum run hours of the lamps in a channel. The network variable *nvoLARunHours* reports the run hours of each lamp. This network variable is only present if the Emergency interface is enabled (see Section 8.1). To reduce the number of network variables, the value is not available as a network variable on the Standard interface. If a lamp is replaced the run hours of a lamp can be initialized using the configuration property *nciRunHrInit*. If the ballast is capable of maintaining the run hours by itself (e.g. some DALI emergency lights), resetting the run hours via *nciRunHrInit* will also reset the run hours counter in the ballast.

nvoXXEnergyCnt	
Type	SNVT_elec_kwh
Valid Range	0..65534 Resolution: 1kWh
Default Value	-
Description	This network variable reports the energy consumption of a group or channel. L-DALI calculates the energy consumption of each DALI ballast. To reduce the number of network variables, the calculated value is not available as a network variable on the lamp actuator object but is used to calculate the total energy consumption for the group and channel actuator objects. The network variable *nvoGPEnergyCnt* reports the total energy consumption of all lamps in a group. The network variable *nvoCHEnergyCnt* reports the total energy consumption of all lamps in a channel. The nominal power of a lamp can be configured using the configuration property *nciNominalPwr.* The energy consumption of a lamp can be initialized with the configuration property *nciEnCntInit*.

nvoXXFailure	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1
Default Value	-
Description	This network variable reports the status of the lamps in a group or channel. The network variable *nvoGPFailure* reports the percentage of failed ballasts in a group. The network variable *nvoCHFailure* reports the percentage of failed ballasts in a channel. A ballast failure is reported if either • Bus power for the related DALI channel fails, • The DALI ballast is not reachable via the DALI channel, or • The DALI ballast reports a failure (e.g. lamp failure) in its DALI status register.

nvoPowerOff	
Type	SNVT_switch
Valid Range	.value: 0, 100 .state: 0, 1
Default Value	-
Description	This network variable is used during the emergency light test to cut the power. The power is cut with an ON value (100.0, 1) and reapplied with an OFF value (0.0, 0).

nvoLampFailure	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the status of the ballasts in the channel. Each bit corresponds to the lamp with the same index. In case of a failure the bit is set. A failure occurs if the corresponding ballast is offline or if it indicates a lamp failure or a ballast failure.

nvoBatteryCharge, nvoLABattCharge	
Type	SNVT_lev_percent
Valid Range	-163.840..163.830 Resolution: 0.005
Default Value	-
Description	Reports the battery charge of a self-contained emergency light or a group of self-contained emergency lights (if supported by the emergency light). The network variable *nvoBatteryCharge* reports the minimum battery charge of the emergency lights in a group. The network variable *nvoLABattCharge* reports the battery charge of each self-contained emergency light. This network variable is only present if the Emergency interface is enabled (see Section 8.1). To reduce the number of network variables, the value is not available as a network variable on the Standard interface.

nvoManOverFb	
Type	SNVT_switch
Valid Range	.value: 0, 100 .state: 0, 1, -1 On: .state=1 and .value=100 Off: .state=0 and .value=0 Auto: .state=-1 and .value=0
Default Value	-
Description	This network variable reports the current state of manual override for a channel.

nvoBallastFail	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the status of the ballasts in the channel. Each bit corresponds to the ballast with the same index. In case the ballast indicates a ballast failure the bit is set. This network variable is only available if the Emergency interface is enabled (see Section 8.1.1.6).

nvoLampFail	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the status of the lamps in the channel. Each bit corresponds to the ballast with the same index. In case the ballast indicates a lamp failure the bit is set. This network variable is only available if the Emergency interface is enabled (see Section 8.1.1.6).

nvoBatteryFail	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the battery status of the self-contained emergency lights in the channel. Each bit corresponds to the ballast with the same index. In case the ballast indicates a battery failure the bit is set. Note, that this function is not supported by all types of self-contained emergency lights. This network variable is only available if the Emergency interface is enabled (see Section 8.1.1.6).

nvoFuncTestFail	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the result of the last function test performed by each self-contained emergency light in the channel. Each bit corresponds to the ballast with the same index. In case the ballast indicates a failed function test the bit is set. Note, that this function is not supported by all types of self-contained emergency lights. This network variable is only available if the Emergency interface is enabled (see Section 8.1.1.6).

nvoDurTestFail	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the result of the last duration test performed by each self-contained emergency light in the channel. Each bit corresponds to the ballast with the same index. In case the ballast indicates a failed duration test the bit is set. Note, that this function is not supported by all types of self-contained emergency lights. This network variable is only available if the Emergency interface is enabled (see Section 8.1.1.6).

Additional Network Variables (not available in standard interface):

nvoDigitalInputOverride	
Type	SNVT_state_64
Valid Range	.bit0: 0, 1 … .bit63: 0, 1
Default Value	-
Description	This network variable reports the digital input override state of the ballasts in the channel (e.g. LDALI RM8). Each bit corresponds to the lamp with the same index. In case of a digital input override the bit is set.

8.1.1.14 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciLocation	
Type	SCPTLocation (SNVT_str_asc)
Valid Range	31 ASCII characters
Default Value	Lamp X/Group X/Channel X
Description	This configuration property can be used to specify the name of the lamp/group/channel.

nciRunHrInit	
Type	SCPTrunHrInit (SNVT_elapsed_tm)
Valid Range	.day: 0..65534 .hour: 0..23 .minute: 0..59 .second: 0..59
Default Value	0
Description	This configuration property is used to store or reset the initial value of the run hours counter *nvoRunHours* (only for lamp actuator objects). To reset the value set it to its invalid value (all 0xFF).

nciEnCntInit	
Type	UCPTenrgyCntInit (SNVT_elec_whr_f)
Valid Range	0..3.40282E38 Wh
Default Value	0
Description	This configuration property is used to store or reset the initial value of the energy counter *nvoEnergyCnt (*only for a lamp actuator objects). To reset the value set it to its invalid value (NaN).

nciGroups	
Type	UCPTgroups (SNVT_state)
Valid Range	.bit0: 0, 1 … .bit15: 0, 1
Default Value	0
Description	This configuration property defines the group membership of a lamp. Each bit corresponds to the group of the same index. If the bit is set, the lamp is member of the group.

nciOnDelay	
Type	UCPTonDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0
Description	This configuration property determines the delay after which the lamp value output is switched on.

nciOffDelay	
Type	UCPTOffDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0
Description	This configuration property determines the delay after which the lamp value output is switched off.

nciAutoOffDelay	
Type	UCPTautoOffDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec 0s means disabled (no delay)
Default Value	0
Description	This configuration property determines the delay after which the lamp output is switched off automatically. The timer is started after receiving a lamp ON command via the *nviXXValue* or *nviXXSetting* network variable inputs. The configuration properties *nciAutoOffRestart* and *nciAutoOffBreak* modify the behavior of the auto-off timer.

nciAutoOffRestart	
Type	UCPTautoOffRestart (SNVT_lev_disc)
Valid Range	ST_ON, ST_OFF
Default Value	ST_OFF
Description	This configuration property determines if the auto off timer can be restarted by an ON command via the *nviXXValue* or *nviXXSetting* network variable inputs.

Function	**Description**
ST_ON	While the auto-off timer is running, the timer can be restarted by an ON command via the *nviXXValue* or *nviXXSetting* network variable inputs.
ST_OFF	While the auto-off timer is running, all ON command via the *nviXXValue* or *nviXXSetting* network variable inputs are ignored.

nciAutoOffBreak	
Type	UCPTautoOffBreak (SNVT_lev_disc)
Valid Range	ST_ON, ST_OFF
Default Value	ST_OFF
Description	This configuration property determines if the auto off timer can be aborted prematurely by an OFF command via the *nviXXValue* or *nviXXSetting* network variable inputs.

Function	**Description**
ST_ON	While the auto-off timer is running, the timer can be aborted prematurely by an OFF command via the *nviXXValue* or *nviXXSetting* network variable inputs.
ST_OFF	While the auto-off timer is running, all OFF command via the *nviXXValue* or *nviXXSetting* network variable inputs are ignored.

nciOffWarningDly	
Type	UCPToffWarningDly (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec 0s means disabled (no delay)
Default Value	0
Description	This configuration property defines the time during which the user will be notified that the light will be switched off shortly. During this time, the light is dimmed to 50% of the current level. Lamps which cannot be dimmed (*nciMinLevel* = *nciMaxLevel*) blink during this time.

nciMinLevel	
Type	UCPTminLevel (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	0.1%
Description	This configuration property specifies the minimum dim level of a lamp. Corresponds to the DALI-Register MIN LEVEL.

nciMaxLevel	
Type	UCPTmaxLevel (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	100%
Description	This configuration property specifies the maximum dim level of a lamp. Corresponds to the DALI-Register MAX LEVEL.

nciPowerUpLev	
Type	UCPTpowerUpLevel (SNVT_lev_cont)
Valid Range	0..100% (for some ballasts 0% is not allowed) Resolution: 0.5
Default Value	100%
Description	Initial dim level of DALI lamp after power has been applied to lamp. Corresponds to the DALI-Register POWER ON LEVEL.

nciSysFailurLev	
Type	UCPTsysFailureLevel (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5 255/invalid value means keep current dim level
Default Value	100%
Description	This configuration property determines the dim value of a DALI lamp in case of a DALI system failure. Corresponds to the DALI-Register SYSTEM FAILURE LEVEL.

nciFadeRate	
Type	UCPTfadeRate
Valid Range	2.8..360 steps/s
Default Value	45 steps/s
Description	This configuration property determines the fade rate of a lamp in percent per second in ramping mode. Corresponds to the DALI-Register FADE RATE.

nciFadeTime	
Type	UCPTfadeTime (SNVT_time_sec)
Valid Range	0..100 sec
Default Value	0 sec
Description	This configuration property determines the duration of a fade time in fading mode. Corresponds to the DALI-Register FADE TIME.

nciNominalPwr	
Type	UCPTnominalPwr (SNVT_power)
Valid Range	0..6553.5 W Resolution: 0.1 W 0 means AUTO
Default Value	AUTO
Description	This configuration property specifies the nominal power of the lamp. It is used to calculate the energy consumption. Some DALI ballasts can report their nominal power. In this case the configuration property should be set to 0 (AUTO).

nciEmTestDelay	
Type	UCPTtestDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0
Description	This configuration property is used for the emergency light test which is started by the network variable input *nviEmergTest*. It defines the time after which the dim level of the emergency lamps is compared with the reference value *nciEmTestValue*.

nciEmTestValue	
Type	UCPTtestValue (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	0
Description	This configuration property is used for the emergency light test which is started by the network variable input *nviEmergTest*. It defines the reference value to which the dim level of the emergency lamps will be compared.

nciBurnInTime	
Type	UCPTburnInTime (SNVT_time_hour)
Valid Range	0..65,535 h
Default Value	100 h
Description	This configuration defines the burn-in time for new lamp. The burn-in mode is started via the network variable input *nviCommand*.

nciDaliCfg	
Type	UCPTdaliCfg
Valid Range	-
Default Value	-
Description	This configuration property contains the device type specific DALI-Registers. It is only available if the device type of a device is known, either because it was assigned or because the device type was set in the DALI Installation tab.

8.1.2 Light Sensor Object #1010

The L-DALI provides 16 light sensor objects for each DALI channel. A light sensor object makes the measured lux level of a DALI light sensor available on the CEA-709 network.

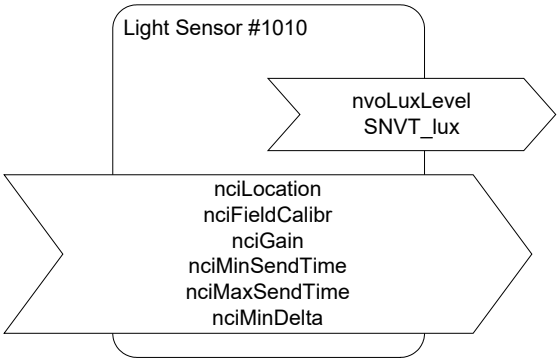


Figure 97: Light Sensor Object

This object type is enabled in the default interface. It can be disabled (together with the Occupancy Sensor objects).

8.1.2.1 Sensor Calibration

To provide a reliable measurement the light sensor needs to be calibrated. The calibration is best performed with the LINX Configurator software (see LINX Configurator User Manual [2]) or using the Web Interface (see LOYTEC Device User Manual [1]).

8.1.2.2 Output Network Variables

nvoLuxLevel	
Type	SNVT_lux
Valid Range	0..65,335 lux
Default Value	0
Description	This network variable provides the lux level measured by the light sensor. If no corresponding light sensor is present on the DALI network the value is 0.

Additional Network Variables (not available in standard interface, activation in project settings required):

nvoTemperature	
Type	SNVT_temp_p
Valid Range	-273.17°C ... 327.66°C Resolution: 0.01°C
Default Value	-
Description	This network variable provides the temperature measured by the sensor. If no corresponding sensor is present on the DALI network the value is invalid.

nvoHumidity	
Type	SNVT_lev_percent
Valid Range	-163.840..163.830 Resolution: 0.005
Default Value	-
Description	This network variable provides the humidity measured by the sensor. If no corresponding sensor is present on the DALI network the value is invalid

8.1.2.3 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciLocation	
Type	SCPTLocation (SNVT_str_asc)
Valid Range	31 ASCII characters
Default Value	Sensor X
Description	This configuration property can be used to specify the name of the light sensor.

nciFieldCalibr	
Type	UCPTfieldCalibArray
Valid Range	.index: 0..6 .value: 0..65,535 lux
Default Value	0/0
Description	This configuration property is used to calibrate the light sensor. To counter any non-linearity the sensor can be calibrated under up to seven different illumination levels (table with index 0-6). The *.index* field specifies the index into the gain table (*nciGain*) for different illumination levels. The *.value* field is used to specify the lux value measured with an external luxmeter. It is used together with the lux value reported by the sensor to compute the corresponding entry in the gain table. When reading the value from the device (CP upload) the value 0/0 will be returned. Writing this value will be ignored. This protects the calibration values from accidently being overwritten during (re-)commissioning.

nciGain	
Type	UCPTgainArray
Valid Range	.gain_mul[7]: 0..65,535 lux .gain_div[7]: 0..65,535 lux
Default Value	All 0/0.
Description	This configuration property is used to store the calibration data. .gain_mul[i] contains the lux value measured by a luxmeter. .gain_div[i] contains the lux value measured by the light sensor. Default values 0/0 are ignored.

nciMinSendTime	
Type	SCPTminSendTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	1.0 sec
Description	Minimum time between updates of the *nvoLuxLevel* output.

nciMaxSendTime	
Type	SCPTmaxSendTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	60.0 sec
Description	Maximum time between updates of the *nvoLuxLevel* output (heartbeat functionality).

nciMinDelta	
Type	SCPTminDeltaLevel (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	2.5%
Description	This configuration property specifies the amount by which the lux level must change before *nvoLuxLevel* is updated.

8.1.3 Occupancy Sensor Object #1060

The L-DALI provides 16 occupancy sensor objects for each DALI channel. The occupancy sensor object makes the state of a DALI occupancy sensor available on the CEA-709 network.

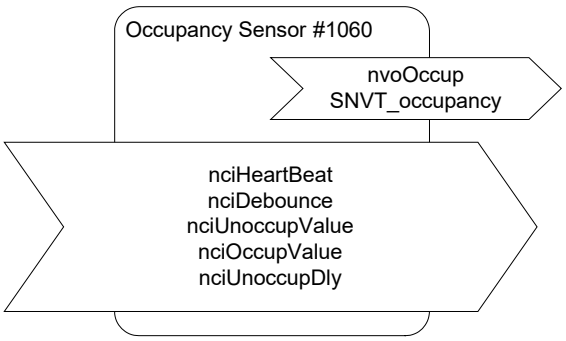


Figure 98: Occupancy Sensor Object.

This object type is enabled in the default interface. It can be disabled (together with the Light Sensor objects).

8.1.3.1 Timing Description

The timing diagram shown in Figure 99 defines the different timers used by the occupancy sensor object.

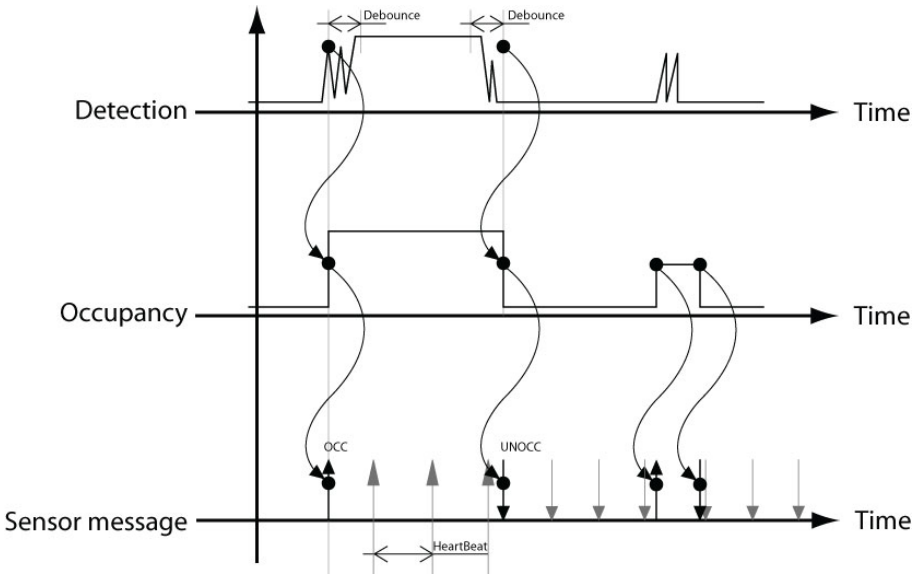


Figure 99: Timing of occupancy detection.

8.1.3.2 Output Network Variables

nvoOccup	
Type	SNVT_occupancy
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Area is temporarily occupied for the bypass period OC_STANDBY (3): Area is temporarily unoccupied
Default Value	OC_NUL
Description	This network variable provides the occupancy state measured by the occupancy sensor. If no corresponding occupancy sensor is present on the DALI network the value is OC_NUL.

8.1.3.3 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciHeartBeat	
Type	SCPTheartbeat (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	120.0 sec
Description	Maximum period of time that expires before the object automatically transmits the present value of the *nvoOccup* output NV.

nciDebounce	
Type	SCPTdebounce (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0 sec
Description	Debouncing time to generate the detection envelope for occupancy detection and the OCCUPIED and NON OCCUPIED message.

nciUnoccupValue	
Type	UCPTunoccupiedValue (SNVT_occupancy)
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Area is temporarily occupied for the bypass period OC_STANDBY (3): Area is temporarily unoccupied
Default Value	OC_UNOCCUPIED
Description	This configuration property defines what value is transmitted via *nvoOccup* when the sensor detects that the room is unoccupied.

nciOccupValue	
Type	UCPToccupiedValue (SNVT_occupancy)
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Area is temporarily occupied for the bypass period OC_STANDBY (3): Area is temporarily unoccupied
Default Value	OC_ OCCUPIED
Description	This configuration property defines what value is transmitted via *nvoOccup* when the sensor detects that the room is occupied.

nciUnoccupDly	
Type	UCPTunoccupDly (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec 0s means disabled (no delay)
Default Value	0 sec
Description	This configuration property specifies the delay after which *nvoOccup* adopts the unoccupied value. The timer is started when the occupancy sensor detects that the room is unoccupied

nciPirSen	
Type	SNVT_lev_cont
Valid Range	0%-100%
Default Value	100%
Description	PIR-sensitivity (0% disables detection)

nciAcousticSen	
Type	SNVT_lev_cont
Valid Range	0%-100%
Default Value	0%
Description	Acoustic sensitivity (0% disables detection)

8.1.4 Constant Light Controller Object #3050

The L-DALI provides 16 constant light controller objects with built in occupancy controller functionality for each DALI channel.

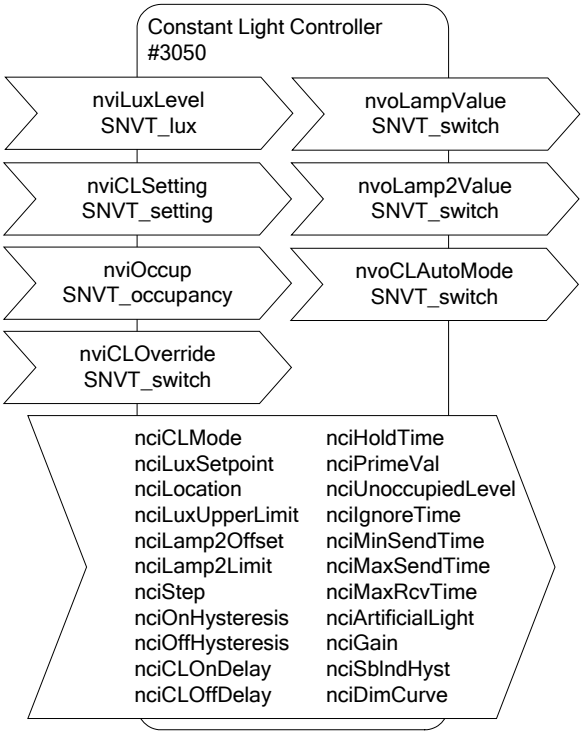


Figure 100: Constant Light Controller Object

This object type is enabled in the default interface. It can be disabled.

8.1.4.1 Interaction with other LONMARK Objects

To minimize the number of bindings that have to be created the constant light controller uses default connections to the local light sensor, occupancy sensor, and group objects in case no "real" bindings are done. This function is referred to as **Automatic Internal Bindings**. Figure 101 shows these default connections of the constant light controller object. Per default the constant light controller with index X controls the group object with index X. The current lux level is received from the light sensor object with index X and the occupancy state is received from the occupancy sensor X. The default connections can be changed by creating bindings with the network management tool. A detailed description under which conditions the default connections apply is given in Table 7.

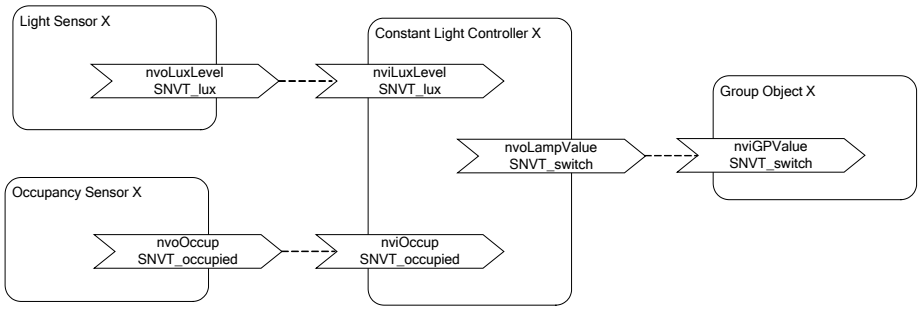


Figure 101: Default Connections to other LONMARK Objects

Per default automatic bindings are disabled. They can be enabled using the project settings in the LINX Configurator software (see LINX Configurator User Manual [2]) or the Web-Interface (see Section 8.4.1).

Default Connection	Condition
Lux Level	The default connection applies if the following network variables are not bound: • *nviLuxLevel* (Constant Light Controller X) • *nviOccup* (Constant Light Controller X)
Occupancy State	The default connection applies if the following network variables are not bound: • *nviLuxLevel* (Constant Light Controller X) • *nviOccup* (Constant Light Controller X)
Lamp Value	The default connection applies if the following network variables are not bound: • *nvoLampValue* (Constant Light Controller X) • *nviGPValue* (Group Object X) • *nviGPSetting* (Group Object X) • *nviGPOverride* (Group Object X) • *nviGPScene* (Group Object X)

Table 7: Default Connections for Automatic Internal Bindings.

When using local DALI sensors and/or DALI groups internal manual CLC bindings can be configured in the DALI Parameters tab of the LINX Configurator software (see LINX Configurator User Manual [2]) or the Web-Interface (see Section 8.4.1). The Web-Interface for CLC Bindings can also be used to verify the current status of all bindings (internal and NVs).

8.1.4.2 Setpoint

The desired setpoint for the illumination level is configured via the configuration property *nciLuxSetpoint*. The input network variable *nviCLSetting* of type SNVT_setting switches the constant light controller on or off. Furthermore this network variable can be used to temporarily adjust the setpoint.

8.1.4.3 Operating Modes

The operating mode of the constant light controller is set via the configuration property *nciCLMode*. The main modes are:

- REGULATOR: closed loop constant lighting control using an local light sensor as direct feedback for the illuminance (typ.: indoor sensor in a room)
- CONTROL: open loop lighting control using an global light sensor as set point indicator for light level for the luminaires (typ.: sensor for outdoor illuminance)
- PRESENCE: no lighting control. This mode works with fixed output levels.

These basic modes may have different behaviors on how automatic lighting control is switched On/Off and how overrides of automatic dimming is handled. Table 8 shows the different operating modes and under which conditions they are used:

Mode \ Parameter	Automatic Dimming based on Local Lightsensor	Automatic Dimming based on Global Lightsensor	Occupancy Sensor	Lighting Control: ON-Event	Lighting Control: OFF-Event	Override Automatic Dimming (Button)	Relinquish Override
REGULATOR	✓	-	✓	Occ	UnOcc	✓	Man
REGULATOR_NO_OCC	✓	-	-	Man	Man	✓	Man
REGULATOR_AUTO	✓	-	✓	Occ	UnOcc	✓	UnOcc
REGULATOR_BEDROOM	✓	-	✓	Occ	UnOcc	✓	UnOcc/NotOff
REGULATOR_MANUAL	✓	-	✓	Man	UnOcc	✓	Man
REGULATOR_MANUAL_LUX	✓	-	✓	Man	Lux	✓	Man
REGULATOR_NO_MANUAL	✓	-	✓	Occ	UnOcc	-	Man
CONTROL	-	✓	✓	Occ	UnOcc	✓	Man
CONTROL_NO_OCC	-	✓	-	Man	Man	✓	Man
CONTROL_AUTO	-	✓	✓	Occ	UnOcc	✓	UnOcc
CONTROL_BEDROOM	-	✓	✓	Occ	UnOcc	✓	UnOcc/NotOff
CONTROL_MANUAL	-	✓	✓	Man	UnOcc	✓	Man
CONTROL_MANUAL_LUX	-	✓	✓	Man	Lux	✓	Man
CONTROL_NO_MANUAL	-	✓	✓	Occ	UnOcc	-	Man
PRESENCE	-	-	✓	Occ	UnOcc	✓	Man
PRESENCE_AUTO	-	-	✓	Occ	UnOcc	✓	UnOcc
PRESENCE_NO_MANUAL	-	-	✓	Occ	UnOcc	-	Man
MANUAL_ON_AUTO_OFF	-	-	✓	Man	Occ	✓	Man
AMBIENT	O	O	-	Lux	Lux	✓	Man
UPDATER	O	O	O	-	-	-	-

Table 8: Constant Light Controller Operating Modes

✓… in use; O … optional; Man … Manually, Occ … Occupied; UnOcc … UnOccupied; UnOcc/NotOff … UnOccupied if Light is not Off; Lux …at defined LuxLevel

Note: *Changing CLC operating mode during runtime is not allowed, after mode setup a reboot is required to initialize the CLC correctly.*

Regulator Mode

The REGULATOR mode has to be selected if the installed light sensor measures the indoor illuminance of the area of interest and this quantity is directly used as actual value for a closed loop control. The constant light controller receives the current indoor lux level via the input network variable *nviLuxLevel* and adjusts the lamp level (from 0% to 100%) by means of a fuzzy control algorithm.

When the light is switched on the control algorithm tries to select a lamp value which results in a lux level close to the desired setpoint, the minimum starting value is defined by *nciPrimeVal.* After a minute at this value the control algorithm becomes active and adjusts the lamp value in increments once every second until the configured setpoint is reached. The size of increments is adjusted dynamically but will never exceed the percentage value defined in the configuration property *nciStep* (Exception: at least one luminaire in the group controlled by the CLC is in burn-in mode).

Note:	*Setting the nciPrimeVal to invalid, will always result in switching on to the calculated value, which is effected by the difference between nviLuxLevel and nciLuxSetpoint and nciGain.*

The regulator mode is available in different flavors:

- **With or without occupancy sensor**: If an occupancy sensor is installed and the room becomes unoccupied, the current light level is saved and the light is dimmed to unoccupied level (see Section 8.1.4.8). If the room becomes occupied before the light has reached the unoccupied level, the saved light level is restored.

- **With automatic relinquish of manual override**: Any manual override will be automatically relinquished when the room becomes unoccupied. In a special bedroom mode the automatic relinquish will only take place if the lights are on. If they were switched off manually, the controller does not return to automatic mode when the area turns unoccupied.

- **With manual activation**: In this flavor, the automatic lighting control must be manually activated (e.g. via a button) and lights will not be switched on automatically when the room becomes occupied. To give the user some visual feedback lights will be switched on, even if the light level in the room is above the setpoint, whenever the automatic mode is activated (either via a data point or via a DALI button). When the room becomes unoccupied the automatic mode is deactivated (REGULATOR_MANUAL). In the REGULATOR_MANUAL_LUX flavor, the lighting control is deactivated whenever lights are switched off (e.g. due to the natural light being above the setpoint).

Control Mode

The CONTROL mode has to be selected if the installed light sensor measures the outdoor illumination and this quantity shall be used as reference value for an open loop lighting control. The constant light controller receives the current outdoor lux level via the input network variable *nviLuxLevel* and sets the lamp level (from 0% to 100%) accordingly (see Figure 102).

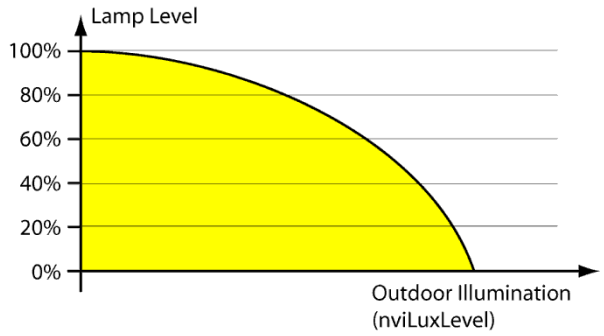


Figure 102: Control Mode

The configuration property *nciStep* ensures that the light level does not change abruptly. Per second the light level is not changed more than the percentage value defined by this configuration property. When the light is switched on or off, *nciStep* is not taken into account.

To ensure that the setpoint is reached under all weather conditions, the control curve shown Figure 102 has to be adjusted by calibrating the constant light controller. The calibration of the constant light controller is best performed with the LINX Configurator software (DALI Parameters tab, see LINX Configurator User Manual [2]).

The control mode is available in different flavors:

- **With or without occupancy sensor**: If an occupancy sensor is installed and the room becomes unoccupied, the current light level is saved and the light is dimmed to unoccupied level (see Section 8.1.4.8). If the room becomes occupied before the light has reached the unoccupied level, the saved light level is restored.

- **With automatic relinquish of manual override**: Any manual override will be automatically relinquished when the room becomes unoccupied. In a special bedroom mode the automatic relinquish will only take place if the lights are on. If they were switched off manually, the controller does not return to automatic mode when the area turns unoccupied.

- **With manual activation**: In this flavor, the automatic lighting control must be manually activated (e.g. via a button) and lights will not be switched on automatically when the room becomes occupied. To give the user some visual feedback lights will be switched on, even if the light level in the room is above the setpoint, whenever the automatic mode is activated (either via a data point or via a DALI button). When the room becomes unoccupied the automatic mode is deactivated. In the CONTROL_MANUAL_LUX flavor, the automatic mode is deactivated whenever lights are switched off (e.g. due to the natural light being above the setpoint).

Presence Mode

In PRESENCE mode the constant light controller shall operate as pure occupancy controller. In this mode the light is switched to the value *nciPrimeVal* if the room is occupied and to the unoccupied level (see Section 8.1.4.8) once the room becomes unoccupied. Different to the Regulator and Control Mode, the light is switched on/off to a constant output level and is not dimmed depending on the current lux level.

Optionally, a light sensor can be used to switch on the light only when the ambient light is below a predefined value (conditional switching). That is, as soon as the network variable input *nviLuxLevel* is bound (optional), the light is switched to the value *nciPrimeVal* only if the lux level is below *nciLuxSetpoint* and the room is occupied.

The presence mode is available in different flavors:

- **With or without automatic relinquish of override**: If automatic relinquish is active any manual override will be automatically relinquished when the room becomes unoccupied (PRESENCE_AUTO).

Manual-On/Auto-Off Mode

The MANUAL_ON_AUTO_OFF mode is a variation of the PRESENCE mode. However, in this mode the constant light controller does not switch on the lights when the room becomes occupied. Rather, it switches the lights to the unoccupied level (*nciUnoccupiedLevel*, see Section 8.1.4.8) when the room becomes unoccupied, using *nciHoldTime* similar to PRESENCE mode.

Lights can be switched on (or off) using *nviCLOverride* or *nviCLSetting* or via some other DALI master (e.g. a DALI push-button).

Ambient Mode

The AMBIENT mode is used if effect lighting (e.g. lights in a shop window, facade lighting, floor lights etc.) has to be switched on or off depending on a measured light level. Lights are switched to the value *nciPrimeVal* when the *nviLuxLevel* is below *nciLuxSetpoint* and to the unoccupied level (see Section 8.1.4.8) when *nviLuxLevel* is higher than *nciLuxSetpoint.*

Updater Mode

The UPDATER mode has to be selected when a DALI light/occupancy sensor with constant light controller functionality is installed on the DALI network. In this mode no light level computation is performed. The controller simply forwards the parameters to the DALI constant light controller and retrieves lamp setting from the DALI light sensor.

In general, LOYTEC does not recommend using UPDATER mode. Wherever possible use REGULATOR or CONTROL mode instead and use DALI sensors only as lux level and occupancy information source via the corresponding sensor objects. These modes allow improved influence of the constant light controller's parameters via the fieldbus side.

8.1.4.4 Prioritized Control

The network variable input *nviCLOverride* can be used to override the constant light controller algorithm. Valid (*.state*=0/1) values received on this inputs are directly passed to the *nvoLampValue* output.

Similar an override is possible via the network variable input *nviCLSetting* when setting the *.function* field to SET_OFF or to SET_STATE. When using SET_STATE the value of the *.setting* field is directly passed to the *nvoLampValue* output.

When internal CLC bindings are used to control DALI groups an override can also be performed using a DALI push-button device controlling the same groups as the constant light controller (see Section 8.1.4.10) or with a scene recall on those groups.

To return to automatic mode the following options exist:

- Set the *.state* field of *nviCLOverride* to -1 (invalid).
- Set the *.function* field of *nviCLSetting* to SET_ON.
- Recalling the scene 255 on the lamp actuator object of a group linked to the constant light controller (see Section 8.1.1.1).
- Using the button function AUTO of a DALI push-button (e.g. LDALI-BM1) with the destination set to one of the constant light controllers groups (see Section 8.1.4.10).
- When using one of the modes with automatic override relinquish (xxx_AUTO or xxx_BEDROOM) the constant light controller will return to automatic mode when it changes its state to unoccupied.

Whether the constant light controller is in automatic mode or in manual/override mode is reflected by the network variable output *nvoCLAutoMode*.

8.1.4.5 Controlling Multiple Light Bands

The L-DALI constant light controller allows controlling two light bands (groups). The primary light band is near the inside of the building, the secondary light band is near the window front. Depending on the outdoor light intensity the primary light band has to be brighter than the secondary light band to illuminate the room evenly.

The primary light band is controlled by the output network variable *nvoLampValue*, the secondary light band by the output network variable *nvoLamp2Value*. Further for both light bands internal bindings to local DALI groups and their corresponding Group Actuator objects can be configured in the DALI Parameters tab of the LINX Configurator software (see LINX Configurator User Manual [2]) or the Web-Interface (see Section 8.4.1).

The maximum difference between the two light bands can be configured via the configuration property *nciLamp2Offset* as shown in Figure 103. The configuration property *nciLamp2Limit* defines the light level above which the values of *nvoLampValue* and *nvoLamp2Value* are identical.

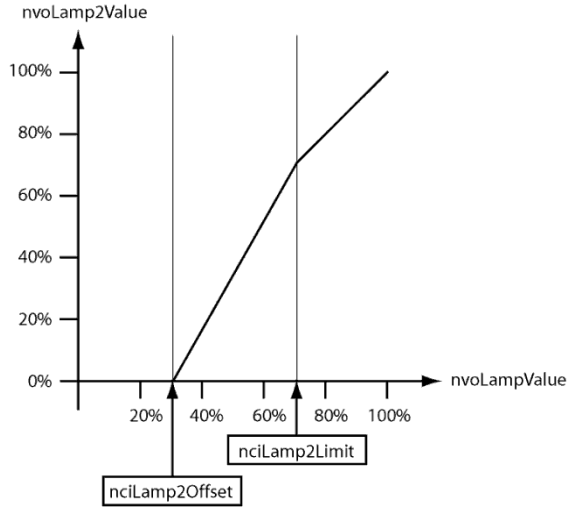


Figure 103: Secondary Light Band

8.1.4.6 Occupancy Detection

The constant light controller receives the occupancy information via the network variable input *nviOccup*.

If a hold time is configured (*nciHoldTime* > 0) occupancy evaluation is event based. That is, the constant light controller changes to the occupied state when the value OC_OCCUPIED is received. When the OC_UNOCCUPIED value is received the constant light controller remains in the occupied state until the hold time configured in *nciHoldTime* has expired and then changes to the unoccupied state. Further, if no OC_OCCUPIED is received for the time configured in *nciHoldTime* the constant light controller changes to the unoccupied state, too.

This behavior typically requires the occupancy sensor to send OC_OCCUPIED with a regular interval (heartbeat). It allows using multiple occupancy sensors with the same constant light controller (fan-in).

If no hold time is configured (*nciHoldTime* = 0) occupancy evaluation is state based. That is, the constant light controller changes to the occupied state when the value OC_OCCUPIED is received and to unoccupied state when the value OC_UNOCCUPIED is received.

This behavior is typically required if the occupancy information is only propagated if the state changes (no heartbeat functionality). It does not allow using multiple occupancy (fan-in) sensors without additional logic (e.g. an Occupancy Controller).

After the light has been switched off any updates on the *nviOccup* input are ignored for the time specified in *nciIgnoreTime*.

The current occupancy state calculated by the constant light controller is available via the network variable *nvoCLOccupancyState*.

Note:	*The network variable nvoCLOccupancyState is not part of the standard interface. It must be enabled in the CEA-709 project settings (see LINX Configurator User Manual [2]).*

8.1.4.7 Timing Parameters

To avoid that the constant light controller switches the light on and off repeatedly if the measured lux value is near the setpoint, a hysteresis can be configured. The configuration parameter *nciOffHysteresis* defines the hysteresis for switching off the lamp and the configuration property *nciOnHysteresis* defines the hysteresis for switching on the lamp. In addition a delay can be configured before the lamp is switched on (*nciClOnDelay*) or off (*nciClOffDelay*). Figure 104 illustrates these configuration parameters.

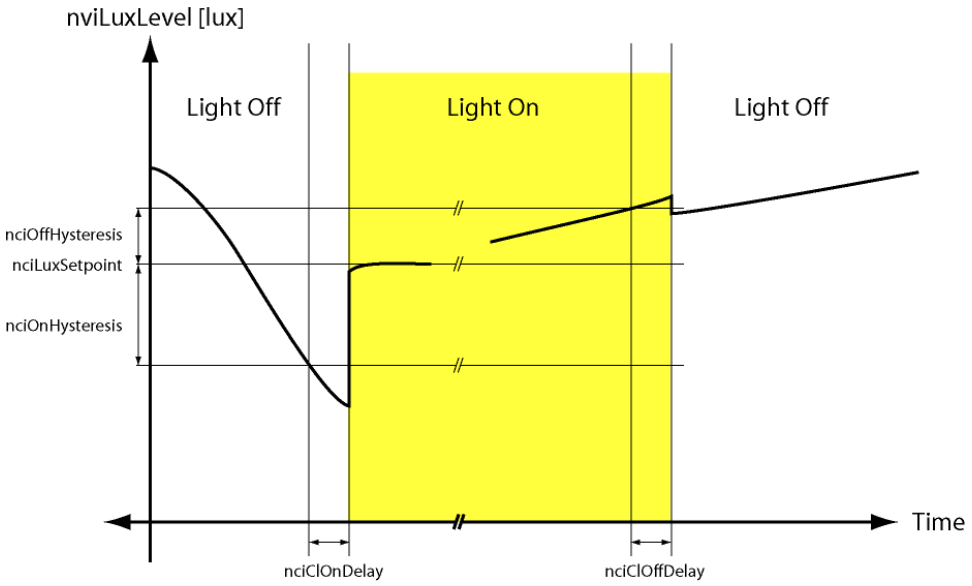


Figure 104: Constant Light Controller Timing

Clarifications on behavior in REGULATOR and CONTROL mode if *nciOnHysteresis* and *nciOffHysteresis* are set to invalid:

If *nciOnHysteresis* is “invalid” and (*nviLuxLevel*>*nciLuxSetpoint*): light is always switched-on (this means that light is switched on on occupancy anyway, regardless of the current light level).

If *nciOffHysteresis* is “invalid” and (*nviLuxLevel*>*nciLuxSetpoint*): light is not switched-off, this allows to dim down without switching off.

8.1.4.8 Unoccupied Level

If the constant light controller enters unoccupied state (see Section 8.1.4.6) *nciUnoccupLev* and *nciCLOffDelay* determine the behavior as shown in Table 9.

nciUnoccupLev	***nciCLOffDelay***	**Behavior**
0	0	Dim down and switch off lights
> 0	0	Dim down lights to value defined in *nciUnoccupLev*.
0	> 0	Dim down to 0.5% and switch off lights after *nciCLOffDelay*.
> 0	> 0	Dim down lights to value defined in *nciUnoccupLev* and switch off lights after *nciCLOffDelay*.

Table 9: Behavior of constant light controller when entering unoccupied state.

In addition the Unoccupied Level is representing the minimum dim level (different from OFF) that can be forced by the CLC. If *nviLuxLevel>nciLuxSetpoint* the CLC will dim down to *nciUnoccupLev* before switching off.

8.1.4.9 Neighboring Controllers

In open office space applications, typically the different zones of the space are controlled by independent constant light controller instances. This ensures, that only the zones, which are still occupied are lit. To reduce the contrast between lit and unlit zones in case only a single zone is occupied amidst many unoccupied zones and to increase user comfort in such a scenario, unoccupied zones adjacent to occupied zones shall be lit up at a configurable low light level (*nciUnoccupLev)*.

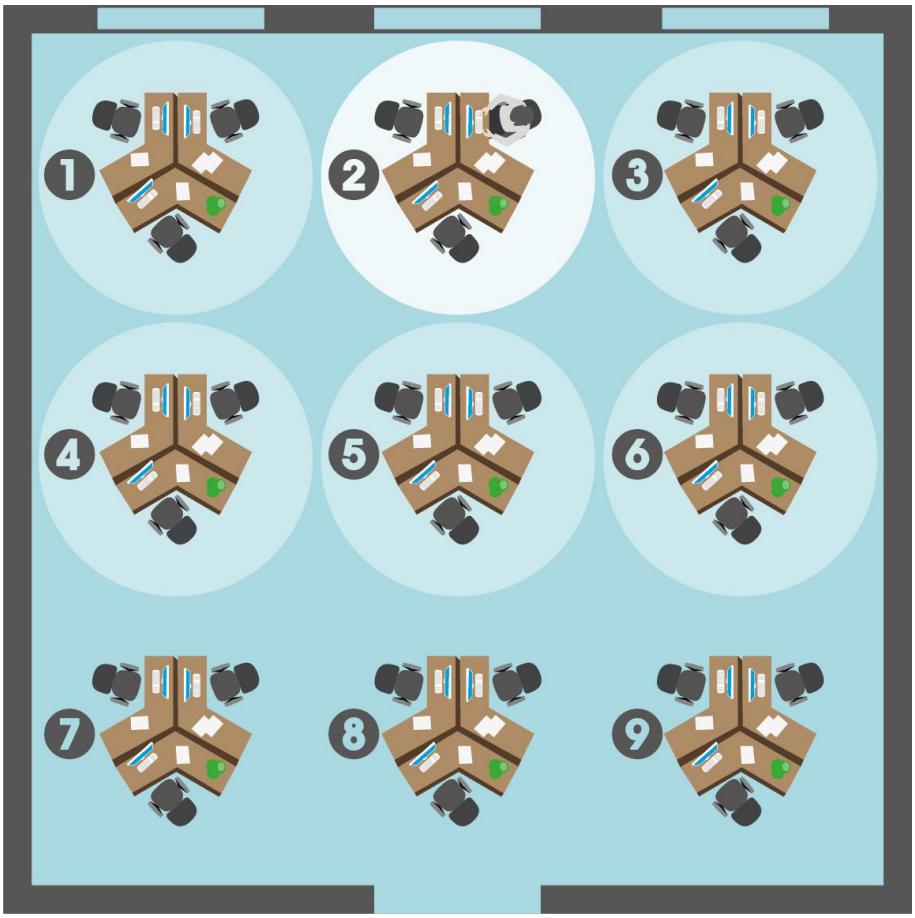


Figure 105: Different zones of an open office space.

Figure 105 shows an example of an open office space with nine zones controlled by independent constant light controller instances. In this example only zone 2 is occupied and fully lit. Zones 1 and 3 to 6 are configured as neighbors of zone 1 and therefore lit at a low dim level, while the remaining zones are switched off.

For this purpose each controller needs to know its neighboring controllers. A controller notifies the CLCs configured as neighbors whenever it switches its lights on. Now, the neighboring controllers, which are unoccupied, can switch to *nciUnoccupLev*. Once the CLC switches lights off (e.g. because it becomes unoccupied) it again notifies the configured neighbors, which in turn can switch off as well.

For each CLC instance up to 16 neighbors can be configured. The neighboring controllers can be configured either via the CLC Bindings page in the web UI (see Section 8.4.1) or via

the DALI parameters tab in the LINX Configurator (see LINX Configurator User Manual [2])

8.1.4.10 Interaction with Buttons Functions

When internal CLC bindings are used to control DALI groups an override can also be performed using a button function (see Section 8.4.3) or some other DALI master (like push-buttons etc.) controlling the same groups as the constant light controller.

Whenever the light level of one of the ballasts controlled by the constant light controller is changed by operating a button the constant light controller will detect this and stop controlling the group and enter override mode. Furthermore, the *nviCLOverride* and the *nvoLampValue* and *nvoLamp2Value* will be updated with the new feedback value of the group controlled by the button. See Section 8.1.4.4 on how to relinquish the override and return to automatic operation.

To disable the manual override via buttons and other DALI masters select the constant light controller operating mode REGULATOR_NO_MANUAL, CONTROLER_NO_MANUAL or PRESENCE_NO_MANUAL, respectively. In this case the constant light controller application will continue control the group and enforce its output value.

See Section 8.4.3 on how to configure button functions via the web interface and the LINX Configurator User Manual [2] how to configure them via the DALI Parameters tab of the LINX Configurator software.

8.1.4.11 Interacting with Sunblind Controller

One or more local sunblind controller objects can be linked to a constant light controller object. Typically sunblind controllers are linked to the constant light controller of the same room. If they change the sunblind's position or rotation the sunblind controllers inform the linked constant light controller. The constant light controller uses this information to "ignore" temporary changes of the rooms illumination levels due to the moving sunblinds and, thus, can avoid to switch on lights unnecessarily.

8.1.4.12 Museum Mode

The museum mode is activated by setting an upper limit for the lux level in the room using the configuration property *nciLuxUpperLimit*. In museum mode the constant light controller cooperates with the linked sunblind controllers to ensure that the measured lux level stays between *nciLuxSetpoint* and *nciLuxUpperLimit*. Therefore at least one sunblind controller has to be linked to the constant light controller.

If the light intensity in the room needs to be increased to reach the lower setpoint (*nciLuxSetpoint*) there are two possibilities: Increase the lamp level or open the sunblinds. The configuration property *nciSblndHyst* defines how much the lamp level is increased or decreased before opening or closing the sunblinds respectively.

8.1.4.13 Human Centric Lighting (HCL)

A circadian daylight algorithm can be activated for each CLC with the help of the *nciHCLProfile* data point. The profile defines the behavior of the colour temperature over the day. The colour temperature is applied to the group members (light bands) controlled by the CLC according to the selected *HCL-Profile_x*. Once enabled, this automatic adaption is stopped only by scene recalls, buttons functions affecting the colour temperature or external DALI-commands affecting the colour temperature of the light bands. For reactivation of the circadian daylight control an AUTO event is required.

The data points for the HCL-Profiles are located in the DALI\HCL folder. Each profile can be configured via the *HCL_Profile_x* datapoint. The current value of the profile is represented by the *HCL_Profile_x_Value* datapoint.

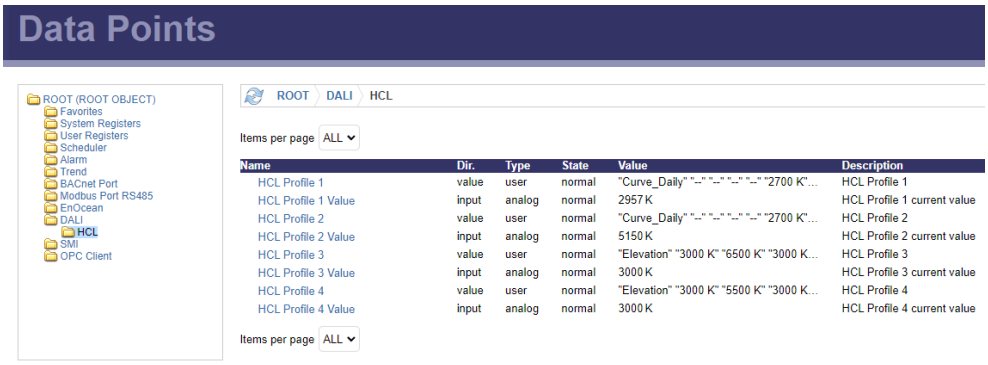


Figure 106: HCL Profile Datapoints

The profile can be configured to the following modes:

- Tc_Mode=”Elevation”: The curve is based on the elevation of the sun. For the longest and shortest day in the year a minimum and maximum Tc value can be defined. The minimum Tc applies to any elevation <=0; the maximum Tc applies to the time of the solar maximum. Between min and max elevation the Tc value is calculated according to the actual elevation.
- Tc_Mode=”Curve_Daily”: 24 values can be defined, one support value for each full hour of the day (00:00 – 23:00). Between the support values for the full hours the Tc values are interpolated
- Tc_Mode=”Off”: Disables the profile.

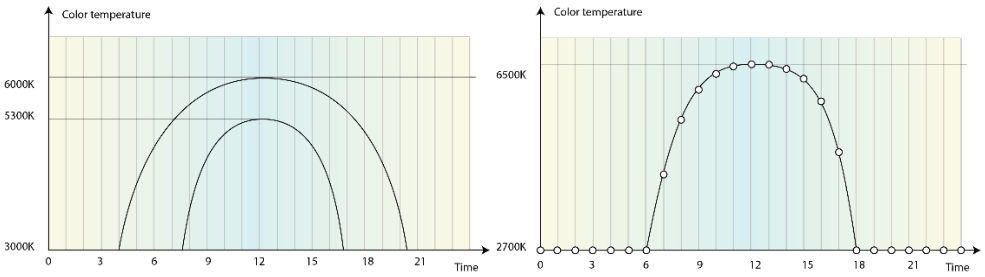


Figure 107: HCL Profile “elevation” based with different Tc max values for summer and winter (left) and “curve daily” with hourly support values (right)

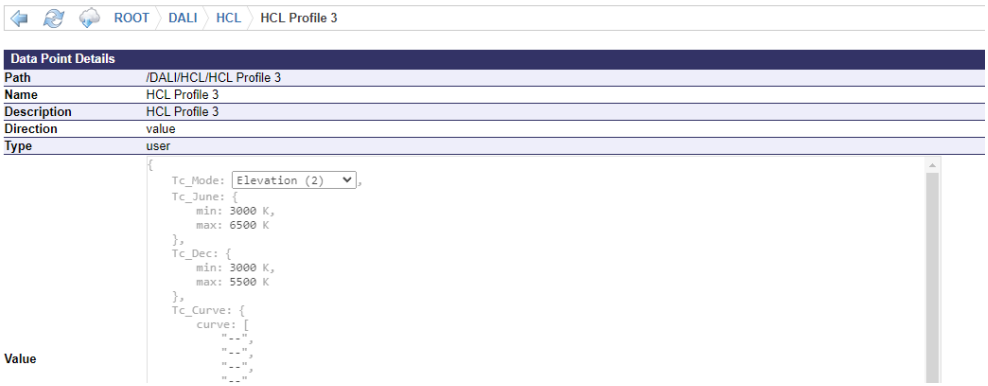


Figure 108: HCL Profile 3 - elevation based with different Tc max values for summer and winter

8.1.4.14 Set-Up Checklist

To get a working constant light controller object at least the following configuration steps have to be performed:

1. Bindings: If the constant light controller is not operated with its default auto-bindings (see Section 8.1.4.1) at least the following NVs have to be bound:

   - nviOccup
   - nviLuxLevel
   - nvoLampValue

   Alternatively internal manual bindings can be configured in the DALI Parameters tab of the LINX Configurator software (see LINX Configurator User Manual [2]) or the Web-Interface (see Section 8.4.1). The Web-Interface for CLC Bindings can be used to verify the current status of all bindings (internal and NVs).

2. Mode: The operating mode of the constant light controller has to be configured using *nciCLMode* (see Section 8.1.4.3).

3. Disable override: Ensure no override is active via the NV *nviCLOverride* (see Section 8.1.4.4).

8.1.4.15 Input Network Variables

nviLuxLevel	
Type	SNVT_lux
Valid Range	0..65,335 lux
Default Value	-
Description	This network variable input provides the illumination level measured by the light sensor. If the variable is not bound, the *nvoLuxLevel* output of the light sensor object with the same instance number as the constant light controller is used.

nviCLSetting	
Type	SNVT_setting
Valid Range	.function: SET_OFF (0): Override to off. SET_ON (1) Enable/Relinquish override. SET_DOWN (2) Decrease setpoint by specified value. SET_UP (3) Increase setpoint by specified value. SET_STATE (5) Override to specified value. .setting: 0..100, resolution 0.5 .rotation: not used
Default Value	
Description	This network variable input is used to enable (SET_ON) or disable (SET_OFF) the controller, to adjust the set point of the constant light controller (SET_UP and SET_DOWN) or to manually update the *nvoLampValue* and the *nvoLamp2Value* (SET_STATE).

Function	**Description**
SET_OFF	Deactivates the constant light controller and switches off the lamp value outputs *nvoLampValue* and *nvoLamp2Value.*
SET_ON	Activates the constant light controller. Relinquishes any override.
SET_UP, SET_DOWN	The set point of the controller can be increased (SET_UP) or decreased (SET_DOWN) temporarily. The *.setting* value is used to define the relative size of the increment/decrement. The changes made to the set point are not stored permanently into the memory. The next SET_ON command restored the original set point value (*nciLuxSetpoint*).
SET_STATE	Deactivates the constant light controller and sets *nvoLampValue* and *nvoLamp2Value* to the value specified in the *.setting* field (see Section 8.1.4.4). *nciLamp2Offset* and *nciLamp2Limit* are not considered.

nviOccup	
Type	SNVT_occupancy
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Ignored OC_STANDBY (3): Ignored
Default Value	OC_NUL
Description	This network variable input provides the occupancy state measured by the occupancy sensor. If the variable is not bound, the *nvoOccup* output of the occupancy sensor object with the same instance number as the constant light controller is used.

nviCLOverride	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1 On: .state=1 and .value>0 Off: .state=0 and .value=0 Invalid: .state=-1
Default Value	
Description	This network variable input can be used to manually override the constant light controller (see Section 8.1.4.4). If a valid value is received (*.state* = 0/1), the constant light controller is disabled and *nvoLampValue* and *nvoLamp2Value* are set to the specified value. *nciLamp2Offset* and *nciLamp2Limit* are not considered. If an invalid value (*.state* –1) is received, the constant light controller returns to automatic mode. When performing an override via a DALI button the network variable will reflect the resulting feedback value of the group controlled by the DALI button (see Section 8.1.4.10).

8.1.4.16 Output Network Variables

nvoLampValue	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1 On: .state=1 and .value>0 Off: .state=0 and .value=0 Invalid: .state=-1
Default Value	
Description	This network variable outputs provides the state (ON or OFF), and the percentage level of intensity for a lamp actuator. If the variable is not bound, the value is transmitted to the *nviGPValue* input of the DALI group object with the same instance number as the constant light controller.

nvoLamp2Value	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1 On: .state=1 and .value>0 Off: .state=0 and .value=0 Invalid: .state=-1
Default Value	
Description	This network variable provides the state (ON or OFF), and the percentage level of intensity for the secondary light band. The value for the secondary light band (*nvoLamp2Value*) is set according to the configuration properties *nciLamp2Offset* and *nciLamp2Limit*.

nvoCLAutoMode	
Type	SNVT_switch
Valid Range	On: .state=1 and .value=100 Off: .state=0 and .value=0
Default Value	
Description	This network variable output provides the current state of the constant light controller. Off: The constant light controller is disabled or overridden by *nviCLOverride* or the DALI Mode button/LCD UI. On: The constant light controller is enabled and not overridden by *nviCLOverride* or the DALI Mode button/LCD UI.

nvoCLOccupState	
Type	SNVT_occupancy
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied
Default Value	
Description	This network variable output provides the current occupancy state calculated by the constant light controller (see Section 8.1.4.6). *Note: This network variable is not part of the standard interface. It must be enabled in the CEA-709 project settings (see LINX Configurator User Manual [2]).*

8.1.4.17 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciLocation	
Type	SCPTLocation (SNVT_str_asc)
Valid Range	31 ASCII characters
Default Value	Light Controller X
Description	This configuration property can be used to specify the name of the constant light controller

nciLuxSetpoint	
Type	SCPTluxSetpoint (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	500 lux
Description	Defines the illumination level setpoint.

nciCLMode	
Type	UCPTclMode (byte)
Valid Range	CL_MODE_DISABLED CL_MODE_REGULATOR CL_MODE_CONTROL CL_MODE_UPDATER CL_MODE_PRESENCE CL_MODE_REGULATOR_NO_OCC CL_MODE_CONTROL_NO_OCC CL_MANUAL_ON_AUTO_OFF CL_MODE_REGULATOR_AUTO CL_MODE_CONTROL_AUTO CL_MODE_PRESENCE_AUTO CL_MODE_AMBIENT CL_MODE_REGULATOR_BEDROOM CL_MODE_PRESENCE_BEDROOM CL_MODE_REGULATOR_MANUAL CL_MODE_REGULATOR_MANUAL_LUX CL_MODE_CONTROL_MANUAL CL_MODE_CONTROL_MANUAL_LUX
Default Value	CL_MODE_DISABLED

Description

This configuration property defines the operating mode of the constant light controller.

Operating Mode	Description
REGULATOR	A light sensor that measures the indoor illumination is installed. An occupancy sensor is installed.
REGULATOR_NO_OCC	A light sensor that measures the indoor illumination is installed. No occupancy sensor is installed.
REGULATOR_AUTO	Similar to REGULATOR, but a manual override is automatically relinquished when the room becomes unoccupied.
REGULATOR_BEDROOM	Similar to REGULATOR_AUTO, but a manual override is not automatically relinquished when the lights are overridden to off.
REGULATOR_MANUAL	Similar to REGULATOR, but the automatic mode must be manually activated (e.g. via a button, not triggered by occupancy). Lights are switched off and automatic mode is disabled when turning unoccupied.
REGULATOR_MANUAL_LUX	Similar to REGULATOR_MANUAL, but the automatic mode is disabled, whenever lights are switched off, either due to becoming unoccupied or due to enough natural light being available.
CONTROL	A light sensor that measures the outdoor illumination is installed. An occupancy sensor is installed.
CONTROL_NO_OCC	A light sensor that measures the outdoor illumination is installed. No occupancy sensor is installed.
CONTROL_AUTO	Similar to CONTROL, but a manual override is automatically relinquished when the room becomes unoccupied.
CONTROL_BEDROOM	Similar to CONTROL_AUTO, but a manual override is not automatically relinquished when the lights are overridden to off.
CONTROL_MANUAL	Similar to CONTROL, but the automatic mode must be manually activated (e.g. via a button, not triggered by occupancy). Lights are switched off and automatic mode is disabled when turning unoccupied.
CONTROL_MANUAL_LUX	Similar to CONTROL_MANUAL, but the automatic mode is disabled, whenever lights are switched off, either due to becoming unoccupied or due to enough natural light being available.
MANUAL_ON_AUTO_OFF	Lights are switched on manually, but shall be switched off when the room becomes unoccupied.
PRESENCE	Based on occupancy the lights shall be switched on and off.
PRESENCE_AUTO	Similar to PRESENCE, but a manual override is automatically relinquished when the room becomes unoccupied.
AMBIENT	Effect or ambient lighting is switched on based on the measured illumination level (switching on ambient lights does not influence measured illumination level).
UPDATER	A DALI sensor with constant light controller functionality shall be mapped to the CEA-709 network. Only the setpoint shall be adjustable via the CEA-709 interface.

nciLamp2Offset	
Type	UCPTlampOffset (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	30%
Description	This configuration property defines the maximum offset between the output for the primary light band (*nvoLampValue*) and the secondary light band (*nvoLamp2Value*).

nciLamp2Limit	
Type	UCPTlampLimit (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	70%
Description	This configuration property specifies the dim level at which the output for the secondary light band (*nvoLamp2Value*) becomes identical to the primary output (*nvoLampValue*).

nciStep	
Type	SCPTstep (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	3%
Description	This configuration property defines the maximum step size that the constant light controller will take to approach the target illumination. Per second the light level is not changed more than the percentage value defined by this configuration property.

nciOnHysteresis	
Type	UCPTonHysteresis (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	5%
Description	This configuration property defines the hysteresis for the input lux level as percentage of the setpoint for switching ON the lamp.

nciOffHysteresis	
Type	UCPToffHysteresis (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	5%
Description	This configuration property defines the hysteresis for the input lux level as percentage of the setpoint for switching OFF the lamp.

nciMinSendTime	
Type	SCPTminSendTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	Minimum time between updates of the *nvoLampValue* and *nvoLamp2Value* outputs.

nciMaxSendTime	
Type	SCPTmaxSendTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	300.0 sec
Description	Maximum time between updates of the *nvoLampValue* and *nvoLamp2Value* outputs (heartbeat functionality).

nciMaxRcvTime	
Type	SCPTmaxRcvTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	This configuration property specifies the expected update interval of the *nviLuxLevel* network variable input. If the time elapses without an update of the variable an alarm is generated. If no update is received on *nviLuxLevel* for 10 intervals the *nvoLampValue* and *nvoLamp2Value* network variable outputs are set to 50%.

nciCLOffDelay	
Type	UCPTclOffDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	300.0 sec
Description	This configuration property specifies the delay after which the lamp value output (nvoLampValue/ nvoLamp2Value) is switched off.

nciCLOnDelay	
Type	UCPTclOnDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec
Description	This configuration property specifies the delay after which the lamp value output (nvoLampValue/ nvoLamp2Value) is switched on.

nciArtificialLight	
Type	UCPTartificialLight (SNVT_muldiv)
Valid Range	.multipier: 0..65,335 lux .divisor: 0..65,335 lux
Default Value	0/0
Description	This configuration property is used • to determine the ratio between a dim value and the amount of artificial light (in lux) corresponding to this dim value and • if the light sensor has a different sensibility for artificial light then for natural light. The default value of 0/0 results in an auto-calibration. Once auto-calibration has been performed the resulting artificial light factor is stored in the configuration property. Until the process is completed a default value is used. To manually determine the artificial light factor do the following: • Darken the room and set the lamp to the maximum value. Measure the lux value on the reference area with a luxmeter and with the light sensor. Then switch off the lamps and measure the lux value again with a luxmeter and the light sensor. • Enter the difference of the lux measured by the luxmeter in *.multiplier* and the lux value difference measured by the light sensor in *.divisor*. The value can be reset by setting the value to its invalid value (all 0xFF).

nciGain	
Type	SCPTgain (SNVT_muldiv)
Valid Range	.multipier: 0..65,335 lux .divisor: 0..65,335 lux
Default Value	1/1
Description	This configuration property is used to calibrate the light sensor. The configuration property is only needed if the light sensor does not have its own way of calibration. To calibrate the light sensor enter the lux value measured by a luxmeter in *.multiplier* and the lux value of the light sensor in *.divisor*. The lux level should be near the setpoint for best results. The value can be reset by setting the value to its invalid value (all 0xFF).

nciDimCurve	
Type	UCPTdimmingCurve
Valid Range	.used: 0, 1 .level_0: 0..100%, Resolution: 0.5 .level_1: 0..100%, Resolution: 0.5 .level_2: 0..100%, Resolution: 0.5 .level_3: 0..100%, Resolution: 0.5 .level_4: 0..100%, Resolution: 0.5 .level_5: 0..100%, Resolution: 0.5 .level_6: 0..100%, Resolution: 0.5 .level_7: 0..100%, Resolution: 0.5 .level_8: 0..100%, Resolution: 0.5 .level_9: 0..100%, Resolution: 0.5 .level_10: 0..100%, Resolution: 0.5
Default Value	.used = 0 .level_0 = 1% .level_1 = 1.5% .level_2 = 2.5% .level_3 = 4% .level_4 = 6.5% .level_5 = 10% .level_6 = 16% .level_7 = 25% .level_8 = 40% .level_9 = 64% .level_10 = 100%
Description	This configuration property permits to adjust the characteristic of the lamp for the human vision. If DALI lights are used the default values can be kept.

nciHoldTime	
Type	SCPTholdTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	600.0 sec
Description	This configuration property defines the hold time for the occupied state. When the OC_OCCUPIED value is received via *nviOccup* the constant light controller remains in the occupied state until the hold time has expired and then changes to the unoccupied state. If set to 0 the unoccupied state is entered when OC_UNOCCUPIED is received. **Note: Setting the *nciHoldTime* to 0 does not work when using the Echelon LonMaker Browser. As a workaround the LINX Configurator can be used to set the parameters. If used in Plug-In mode parameter values will be synced to the LNS database when downloaded to the L-DALI.**

nciPrimeVal	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1, -1 On: .state=1 and .value>0 Off: .state=0 and .value=0
Default Value	100%
Description	If the constant light controller operates in PRESENCE or AMBIENT mode, this configuration property defines the value adopted by *nvoLampValue* when the room is occupied.

nciUnoccupiedLevel	
Type	UCPTunoccupiedLevel (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	0.0%
Description	This configuration property defines the value adopted by *nvoLampValue* when the constant light controller enters unoccupied state (see Section 8.1.4.8).

nciIgnoreTime	
Type	UCPTignoreTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec
Description	This configuration property defines the time during which updates on *nviOccup* are ignored after that lamp was switched off.

nciLuxUpperLimit	
Type	UCPTluxUpperLimit (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	0 lux
Description	The museum mode is activated by setting this configuration property to a value greater than 0. In museum mode the constant light controller cooperates with the sunblind controller to ensure that the measured lux level stays between *nciLuxSetpoint* and *nciLuxUpperLimit*. Therefore a sunblind controller has to be linked to the constant light controller by writing the constant light controller index to the configuration property *nciClNumber* of the sunblind controller.

nciSblndHyst	
Type	UCPTsunblindHysteresis (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	20%
Description	This configuration property applies only for museum mode. It defines by which percentage the lamp dim value is increased before letting more sunlight in by opening the sunblinds.

nciHCLProfile	
Type	Register data point
Valid Range	DISABLED HCL_PROFILE_1 HCL_PROFILE_2 HCL_PROFILE_3 HCL_PROFILE_4
Default Value	DISABLED
Description	This configuration property sets the HCL-Profile used by the CLC instance.

8.1.5 Sunblind Controller Object #6111

The L-DALI provides 16 sunblind controller objects for each DALI channel.

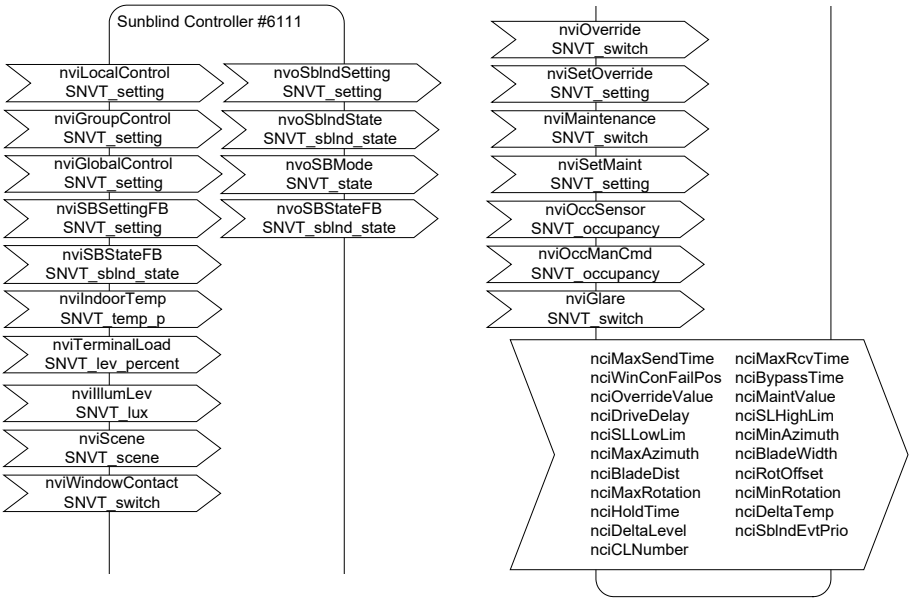


Figure 109: Sunblind Controller Object

This object type is enabled in the default interface. It can be disabled.

8.1.5.1 Glare Protection

The sunblind controller can automatically control the connected sunblind actuator to provide glare protection. To do so the sunblind controller needs to know the geometry of the sunblind blades.

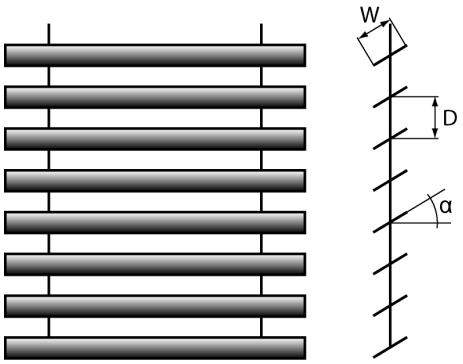


Figure 110: Sunblind Geometry

The blade distance (D) has to be configured in the configuration property *nciBladeDist* and the blade width in *nciBladeWidth*. The minimum and maximum rotation angle (α) is configured in *nciMinRot* and *nciMaxRot*. Based on this geometry data and the current sun elevation (*nviSunElevation*) the glare protection algorithm calculates the rotation angle for the blades. The rotation angle can be optimized for a specific sunblind type by specifying an offset in the configuration property *nciRotOffset*.

The following parameters determine if glare protection is necessary:

- Sun Azimuth (*nviSunAzimuth*): Depending on the orientation of the window, the sun can only shine into the room from a certain azimuth in the morning (*nciMinAzimuth*) to a certain azimuth in the evening (*nciMaxAzimuzh*).

- Outdoor lux level (*nviSunLux*): The glare protection will be activated if the measured outdoor lux level is above *nciSlHiLimGlare*. If the outdoor lux level falls below *nciSlLoLimGlare* the glare protection will be deactivated. These two configuration properties implement a hysteresis.

- Surrounding buildings/objects: The network variable inputs *nviGlobalGlare* and *nviGlobalShadow* can be used to provide geometry information on surrounding buildings/objects. Glare protection is active when the corresponding bit in *nviGlobalGlare* is active and the one in *nviGlobalShadow* is inactive.

Alternatively the need for glare protection can be computed by a separate device. In this case the network variable input *nviGlare* can be used to override the automatic glare detection algorithm.

8.1.5.2 View Protection

To protect rooms against prying eyes the sunblind can be closed automatically when the indoor light is switched on and the outdoor light level (*nviSunLux*) falls below the indoor light level (*nviIllumLev*). To avoid that the sunblind opens and closes repeatedly a hysteresis can be configured using the configuration property *nciViewProtHyst*.

8.1.5.3 Heating/Cooling

If the room is not occupied, the L-DALI can close the sunblind to provide thermal isolation in order to save energy.

The network variable input *nviTerminalLoad* is used to inform the controller of the current heating/cooling demand of the system. Positive values indicate that cooling energy is required, while negative values indicate that heating energy is required.

If *nviTerminalLoad* is not bound, but *nviOutdoorTemp* is bound, heating demand is assumed if the moving average outdoor temperature falls below 12°C/54°F, cooling demand is assumed if it is above 19°C/66°F.

The algorithm takes the following parameters into account:

- **Outdoor lux level (*nviSunLux*):** The energy of the sun can be used to warm a room. The configuration property *nciSlHiLimTem* defines the lux level above which the sun energy will make a noticeable contribution to warm the room if the sunblind is open. The configuration property *nciSlLoLimTem* define the lux level below which the sun energy is too low to warm the room. To avoid that the sunblind opens and closes repeatedly a hysteresis can be specified using the configuration property *nciTermSLHyst*.

- **Temperature:** The outdoor temperature (*nviOutdoorTemp*) is compared with the indoor temperature (*nviIndoorTemp*). Depending on whether the system is in heating or in cooling mode and on the temperature difference the sunblinds are closed to increase thermal isolation of the room. To avoid that the sunblind opens and closes repeatedly a hysteresis can be specified using the configuration property *nciTermTempHyst*.

8.1.5.4 Manual Control

To control the sunblind manually the L-DALI sunblind controller offers the possibilities to directly select a setpoint and to select a scene.

Direct Control

The sunblind can be controlled manually by the following network variable inputs of type SNVT_setting:

- ***nviLocalControl***: Using this input network variable a local control devices can provide the setpoint for the sunblind.

- ***nviGroupControl***: Using this input network variable a control device which controls a group of sunblinds can provide the setpoint for the sunblind.

- ***nviGlobalControl***: Using this input network variable a control device which controls all sunblinds can provide the setpoint for the sunblind.

Per default *nviLocalControl* takes precedence over *nviGroupControl* which in turn takes precedence over *nviGlobalControl*. The priorities can be changes as described in Section 8.1.5.9. Local, group, and global control commands can be cancelled by setting the *.function* field of the corresponding network variable to SET_NUL.

Scenes

Using the input network variable *nviSBScene* of type SNVT_scene up to 16 sunblind scenes can be saved and recalled. The command SC_LEARN stores the current sunblind position and rotation in the specified scene number. By a SC_RECALL command previously stored scenes can be recalled. Scenes can be deleted by a SC_RESET command.

8.1.5.5 Prioritized Control

The L-DALI sunblind controller offers two methods for prioritized control: maintenance mode and override mode. Maintenance mode has the highest priority and cannot be changed. The priority of override mode can be changed as described in Section 8.1.5.9.

Maintenance Mode

There are two alternative ways to control the sunblind in maintenance mode:

- ***nviSetMaint****:* This input network variable of type SNVT_setting overrides the sunblind output. The maintenance mode override is canceled by setting the *.function* field to SET_NULL.

- ***nviMaintenance, nciMaintValue****:* The *nviMaintenance* network variable of type SNVT_switch can be used to switch on/off maintenance mode. If the maintenance mode is active, the sunblind output is set to the value of the configuration property *nciMaintValue* (type *SNVT_setting*).

Override Mode

There are two alternative ways to control the sunblind in override mode:

- ***nviSetOverride****:* This input network variable of type SNVT_setting overrides the sunblind output. The override is canceled by setting the .function field to SET_NULL.

- ***nviSBOverride, nciOverrideValue****:* The *nviSBOverride* network variable of type SNVT_switch can be used to switch on/off override mode. If the override mode is active, the sunblind output is set to the value of the configuration property *nciOverrideValue* (type *SNVT_setting*).

8.1.5.6 Museum Mode

For the museum mode of the constant light controller (see Section 8.1.4.12) a sunblind controller must be linked to the constant light controller.

8.1.5.7 Output and Feedback

The L-DALI sunblind controller supports actuators with a control input of type *SNVT_sblnd_state* (see Figure 111) as well as sunblind actuators with a control input of type *SNVT_setting* (see Figure 112).

The configuration property *nciDriveDelay* defines the delay which the sunblind controller waits until it updates its outputs. If different drive delays are configured for the different sunblind controllers, the sunblinds will not drive at the same time avoiding a power peak.

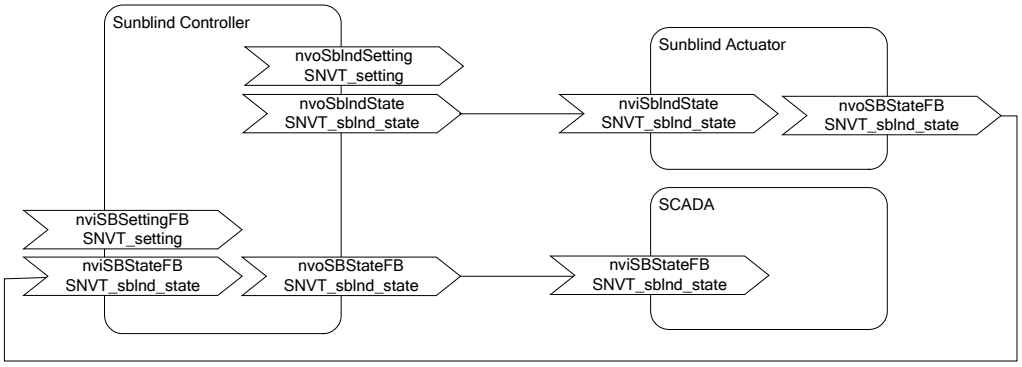


Figure 111: Controlling a Sunblind Actuator via SNVT_sblnd_state

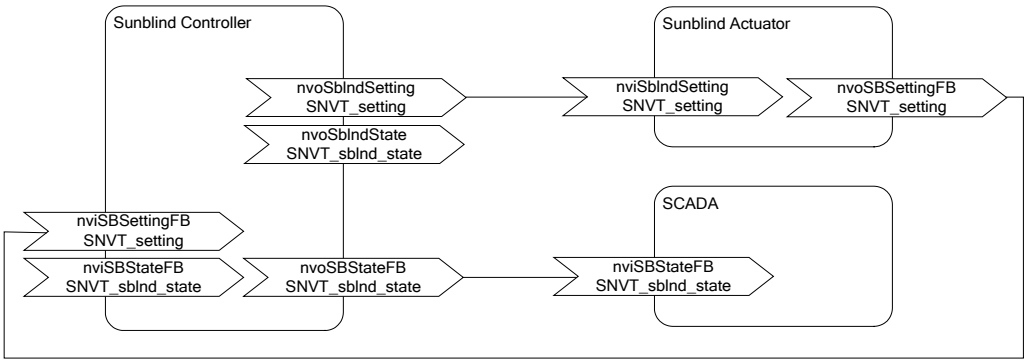


Figure 112: Controlling a Sunblind Actuator via SNVT_setting

The output network variable *nvoSBStateFB* can be used by e.g. a SCADA system to display the current state of the sunblind. It includes status information from the sunblind controller, which is merged with feedback information from the sunblind actuator, if available.

The event state (e.g. maintenance mode, rain condition, wind, etc) of the sunblind controller is reported in the output network variable *nvoSBMode*.

8.1.5.8 Occupancy Detection

The occupied/unoccupied status of the room can be determined by an occupancy sensor and/or a manual command.

Occupancy Sensor

To connect an occupancy sensor the network variable input *nviOccSensor* is used. Its behavior is identical to the *nviOccup* of the Constant Light Controller object (see Section 8.1.4.6).

Manual Command

The network variable input *nviOccManCmd* is used to override the occupancy sensor or if no occupancy sensor is available. This network variable of type *SNVT_occupancy* can have the following values:

- ***OC_OCCUPIED:*** The sunblind controller should operate in the occupied mode.
- ***OC_UNOCCUPIED:*** The sunblind controller should operate in the unoccupied mode.
- ***OC_BYPASS:*** The sunblind controller should operate in the occupied mode for a period of time defined by the configuration property *nciBypassTime*.

8.1.5.9 Sunblind Controller Events and Priority

The operation of the sunblind controller is influenced by a number of events. Table 10 describes the different events and shows their default priority. The priority of events can be changed. Events can be deactivated by setting the priority to -1. Usually this is done on the DALI Parameters tab of the LINX Configurator (see LINX Configurator User Manual [2]).

Priority	Event	Description
18 (highest)	Set maintenance request	The network variable input *nviSetMaint* is active (*function* not SET_NUL). See Section 8.1.5.5 for detail.

Priority	Event	Description
17	Maintenance request	The network variable input *nviMaintenance* is switched on. The sunblind moves to the position specified in *nciMaintValue.* See Section 8.1.5.5 for detail.
16	Weather sensor alarm*	At least one of the weather sensors failed: • No update has been received on *nviWind* for longer than *nciWindRcvT.* • No update has been received on *nviRain* for longer than *nciRainRcvT.* • No update has been received on *nviFrost* for longer than *nciFrostRcvT.* The alarm condition for the wind, rain, and frost sensor is active only if the corresponding network variable input is bound. In case of a weather sensor alarm the sunblind drives to the position defined by *nciWeaSenFailPos.*
15	Window sensor alarm*	Window sensor failed: No update has been received on *nviWindowContact* for longer than *nciMaxRcvTime.* This alarm is only active if the *nviWindowContact* network variable is bound. In case of a window sensor alarm the sunblind drives to the position defined by *nciWinConFailPos*.
14	Frost condition*	The sunblind controller enters the frost state if the network variable input *nviFrost* is active. When *nviFrost* becomes inactive the sunblind controller remains in the frost state for the hold time configured in *nciRainFroOffDly*. The sunblind does not move as long as the sunblind controller is in the frost state.
13	Wind*	The sunblind controller enters the wind alarm state if the measured wind speed (*nviWind*) exceeds the threshold configured in *nciWindLimit*. When the wind speed falls below the threshold the sunblind controller remains in the wind alarm state for the hold time configured in *nciWindOffDly*. The sunblind remains open while the sunblind controller is in the wind alarm state.
12	Rain condition*	The sunblind controller enters the rain state if the network variable input *nviRain* is active. When *nviRain* becomes inactive the sunblind controller remains in the rain state for the hold time configured in *nciRainFroOffDly*. The sunblind remains open while the sunblind controller is in the rain state.
11	Set override request	The network variable input *nviSetOverride* is active (.function !=SET_NUL). See Section 8.1.5.5 for detail.
10	Override request	The network variable input *nviSBOverride* is switched on. The sunblind drives to the position specified in *nciOverrideValue.* See Section 8.1.5.5 for detail.
9	Window open*	The window is open: The network variable input *nviWindowContact* is active. The polarity of the window contact can be changed via the configuration property *nciInvWinCon*. The sunblind does not move as long as the window is open.
8	Local control	The network variable input *nviLocalControl* is active. See Section 8.1.5.4 for detail.
7	Group control	The network variable input *nviGroupControl* is active. See Section 8.1.5.4 for detail.
6	Global control	The network variable input *nviGlobalControl* is active. See Section 8.1.5.4 for detail.
5	Scene selection	Sunblind scene recalled via network variable input *nviScene*. See Section 8.1.5.4 for detail.

Priority	Event	Description
4	Anti-glare*	The sunblind is controlled by the anti-glare algorithm. Only active if room is occupied. See Section 8.1.5.1 for detail.
3	View protection*	The sunblind is controlled by the view protection algorithm. Only active if room is occupied. See Section 8.1.5.2 for detail.
2	Constant light request*	The sunblind is linked to the constant light controller and is controlled by the museum mode algorithm. Only active if room is occupied. See Section 8.1.4.12 for detail.
1	Up if occupied*	The room is occupied. See Section 8.1.5.8 for detail. If the room is occupied the sunblind moves up.
0 (lowest)	Heat/cool request*	The sunblind is controlled by the heating/cooling algorithm. Only active if room is not occupied. See Section 8.1.5.3 for detail.

Table 10: Sunblind Controller Events and Priority

For events marked with *) a minimum time can be configured via the configuration property *nciAutoEvMinTm*. These events will stay active for at least the configured time even if the event condition disappears before this time expires. In this way the sunblind controller ensures that the sunblind does not drive too frequently.

In case none of the events is active the sunblind remains in its current position.

8.1.5.10 Input Network Variables

nviLocalControl	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid value. SET_DOWN (2) Decrease setting by specified value. SET_UP (3) Increase setting by specified value. SET_STOP (4) Stop action. SET_STATE (5) Setting on at specified value. .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This network variable input is used to manually control the sunblind. Usually a local control device gives this command. A local control command can be canceled by setting .function to SET_NUL.

nviGroupControl	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This network variable input is used to manually control the sunblind. Usually a device which is intended to control groups of controllers or actuators gives this command A group control command can be canceled by setting .function to SET_NUL.

nviGlobalControl	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This network variable input is used to manually control the sunblind. Usually a device which is intended to control all controllers or actuators gives this command A global control command can be canceled by setting .function to SET_NUL.

nviSBSettingFB	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid value. SET_DOWN (2) Decrease setting by specified value. SET_UP (3) Increase setting by specified value. SET_STOP (4) Stop action. SET_STATE (5) Setting on at specified value. .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	Feedback from sunblind actuator of type *SNVT_setting*.

nviSBStateFB	
Type	SNVT_sblnd_state
Valid Range	.pos.function: SET_NUL (-1): Invalid value. SET_DOWN (2) Decrease setting by specified value. SET_UP (3) Increase setting by specified value. SET_STOP (4) Stop action. SET_STATE (5) Setting on at specified value. .pos.setting: 0..100, resolution 0.5 .pos.rotation: -359.98 .. 360.00, resolution 0.02 .cmd_source: SBCS_NUL, SBCS_LOCAL, SBCS_GROUP, … .error_code: SBE_NUL, SBE_NO_ERROR, SBE_IN_PROGRESS, …
Default Value	-
Description	Feedback from sunblind actuator of type *SNVT_sblnd_state*.

nviIndoorTemp	
Type	SNVT_temp_p
Valid Range	-273.17°C...327.66°C Resolution: 0.01°C
Default Value	-
Description	This network variable input provides the room temperature measured by a temperature sensor. This input is used if the sunblinds are used for heating/cooling (see Section 8.1.5.3).

nviTerminalLoad	
Type	SNVT_lev_percent
Valid Range	-163.840..163.830 Resolution: 0.005
Default Value	
Description	This network variable input is used if the sunblinds are used for heating/cooling (see Section 8.1.5.3). The input informs the controller of the current heating/cooling demand. Positive values indicate that cooling energy is required, while negative values indicate that heating energy is required. If the network variable in not bound, the heating/cooling feature is disabled.

nviIllumLev	
Type	SNVT_lux
Valid Range	0..65,335 lux
Default Value	-
Description	This network variable input provides the illumination level in the room. The input is used for view protection (see Section 8.1.5.2). If *nviIllumLev* is higher than the *nviSunLux* then the sunblind is closed to protect the room against prying eyes.

nviScene	
Type	SNVT_scene
Valid Range	0..65,335 lux
Default Value	.function: SC_LEARN, SC_RECALL, SC_NUL .scene_number: 1..16
Description	Using this input network variable up to 16 sunblind scenes can be saved and recalled.

Function	**Description**
SC_LEARN	Stores the current sunblind position and rotation in the specified scene number.
SC_RECALL	Recall a previously stored scene.
SC_RESET	Delete a scene.

nviWindowContact	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 Open: .state=1 and .value=100 Closed: .state=0 and .value=0
Default Value	-
Description	This network variable input informs the controller if the window is open or close. If the window is open, the sunblind stops moving.

nviOverride	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 On: .state=1 and .value>=0.5% Off: .state=0 and .value=0
Default Value	-
Description	This network variable input is used to switch on/off override mode. If override mode is activated (.state=1 and .value between 0.5% and 100%), the sunblind adopts the setting specified by *nciOverrideValue*.

nviSetOverride	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This input network variable overrides the sunblind output. The override is canceled by setting the .function field to SET_NULL.

nviMaintenance	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 On: .state=1 and .value>=0.5% Off: .state=0 and .value=0
Default Value	-
Description	This network variable input is used to switch on/off maintenance mode. If maintenance mode is activated (.state=1 and .value between 0.5% and 100%), the sunblind adopts the setting specified by *nciMaitnValue*.

nviSetMaint	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This input network variable overrides the sunblind output. The override is canceled by setting the .function field to SET_NULL.

nviOccupSensor	
Type	SNVT_occupancy
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Ignored OC_STANDBY (3): Ignored
Default Value	-
Description	This network variable input provides the occupancy state measured by an occupancy sensor. A hold time can be configured using the configuration property *nciHoldTime*.

nviOccManCmd	
Type	SNVT_occupancy
Valid Range	OC_NUL (-1): Invalid Value OC_OCCUPIED (0): Area is occupied OC_UNOCCUPIED (1): Area is unoccupied OC_BYPASS (2): Area is temporarily occupied for the bypass period OC_STANDBY (3): Ignored
Default Value	-
Description	This network variable input can be used to manually control the occupancy state.

Value	**Description**
OC_NUL	This is the initial value after power-up and it remains until another value is received. It is used to indicate that this network variable input is invalid, unused or to cancel a previous command.
OC_OCCUPIED	The sunblind controller should operate in the occupied mode.
OC_UNOCCUPIED	The sunblind controller should operate in the unoccupied mode
OC_BYPASS	The sunblind controller should operate in the occupied mode for a period of time defined by *nciBypassTime*.

nviGlare	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1,-1 On: .state=1 and .value>=0.5% Off: .state=0 and .value=0 Auto .state=-1
Default Value	-
Description	This network variable is used to override the automatic glare detection algorithm (see Section 8.1.5.1).

Value	**Description**
On	Glare condition.
Off	No glare condition.
Auto	Use automatic glare detection algorithm.

8.1.5.11 Output Network Variables

nvoSblndSetting	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This network variable output provides the setpoint for the sunblind actuator.

nvoSblndState	
Type	SNVT_sblnd_state
Valid Range	.pos.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .pos.setting: 0..100, resolution 0.5 .pos.rotation: -359.98 .. 360.00, resolution 0.02 .cmd_source: SBCS_NUL, SBCS_LOCAL, SBCS_GROUP, … .error_code: SBE_NUL, SBE_NO_ERROR, SBE_IN_PROGRESS, …
Default Value	-
Description	This network variable output provides the setpoint for the sunblind actuator and reports errors and the cause of the latest change (as determined by the sunblind controller).

nvoSBMode	
Type	SNVT_state_64
Valid Range	.bit0: Heat/cool request .bit1: Up if occupied .bit2: Constant light request .bit3: View protection .bit4: Anti-glare .bit5: Scene selection .bit6: Global control .bit7: Group control .bit8: Local control .bit9: Window open .bit10: Override request .bit11: Set override request .bit12: Rain condition .bit13: Wind .bit14: Frost condition .bit15: Window sensor alarm .bit16: Weather sensor alarm .bit17: Maintenance request .bit18: Set maintenance request .bit19: Not used … .bit64: Not used
Default Value	-
Description	This network variable output reports the active events of the sunblind controller (see Section 8.1.5.9).

nvoSBStateFB	
Type	SNVT_sblnd_state
Valid Range	.pos.function: SET_NUL (-1): Invalid Value SET_OFF (0): Setting off SET_ON (1) Setting on SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .pos.setting: 0..100, resolution 0.5 .pos.rotation: -359.98 .. 360.00, resolution 0.02 .cmd_source: SBCS_NUL, SBCS_LOCAL, SBCS_GROUP, … .error_code: SBE_NUL, SBE_NO_ERROR, SBE_IN_PROGRESS, …
Default Value	-
Description	This network variable output provides a feedback to a SCADA system: • If the sunblind actuator provides a feedback variable of type *SNVT_sblnd_state* and it is bound to *nviSBStateFB* the sunblind actuator feedback value is copied to *nvoSBStateFB*. • If this is not the case, but the sunblind actuator provides a feedback variable of type *SNVT_setting* and it is bound to *nviSBSettingFB* the value is copied to *nvoSBStateFB* with the *cmd_source* field copied from the *nvoSblndState*. • If none of the above is the case, the value of *nvoSblndState* is copied to *nvoSBStateFB*.

8.1.5.12 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciLocation	
Type	SCPTLocation (SNVT_str_asc)
Valid Range	31 ASCII characters
Default Value	Sunblind Ctrl X
Description	This configuration property can be used to specify the name of the sunblind controller.

nciMaxSendTime	
Type	SCPTmaxSendTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0 sec
Description	Maximum time between updates for the *nvoSblndSetting* and *nvoSblndState* outputs (heartbeat functionality).

nciMaxRcvTime	
Type	SCPTmaxRcvTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	This configuration property specifies the expected update interval of the *nviWindowContact* network variable input. If the time elapses without an update of the variable an alarm is generated and the sunblind adopts the safe position defined by the *nciWinConFailPos*.

nciWinConFailPos	
Type	SCPTdefaultSetting (SNVT_setting)
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	SET_STATE, 0%, 0 deg
Description	This configuration property defines the safety position of a sunblind when a failure of the window contact (*nviWindowContact*) has been detected.

nciBypassTime	
Type	SCPTbypassTime (SNVT_time_min)
Valid Range	0..65,535 minutes
Default Value	0
Description	This configuration property defines the amount of time that the sunblind controller is in bypass (occupancy) mode following a single bypass request via *nviOccManCmd*. Additional bypass requests can restart the timer. Setting this configuration property to zero disables the bypass function and no bypass takes place.

nciOverrideValue	
Type	SCPTdefaultSetting (SNVT_setting)
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	SET_NUL
Description	This configuration property defines the override value which is adopts by the sunblind when the *nviOverride* is at ON.

nciMaintValue	
Type	SCPTdefaultSetting (SNVT_setting)
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	SET_NUL
Description	This configuration property defines the maintenance value which is adopts by the sunblind when the *nviMaintenance* is at ON.

nciDriveDelay	
Type	UCPTdriveDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (no delay)
Description	This configuration property defines the delay which the sunblind controller waits before it updates its outputs. If different drive delays are configured for the different sunblind controllers, the sunblinds will not drive at the same time avoiding a power peak. No drive delay is applied for local control (*nviLocalControl*).

nciSlHiLimGlare	
Type	UCPTsunLuxHighLimit (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	30000
Description	This configuration property defines the high limit for the sun lux level input used by the automatic glare detection algorithm (see Section 8.1.5.1)

nciSlLoLimGlare	
Type	UCPTsunLuxHighLimit (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	10000
Description	This configuration property defines the low limit for the sun lux level input used by the automatic glare detection algorithm (see Section 8.1.5.1)

nciMinAzimuth	
Type	UCPTminAzimuth (SNVT_angle_deg)
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	0
Description	This configuration property defines the minimum azimuth for the sun elevation input used by the automatic glare detection algorithm (see Section 8.1.5.1).

nciMaxAzimuth	
Type	UCPTmaxAzimuth (SNVT_angle_deg)
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	0
Description	This configuration property defines the maximum azimuth for the sun elevation input used by the automatic anti-glare algorithm (see Section 8.1.5.1).

nciBladeDist	
Type	UCPTbladeDistance (SNVT_length_mil)
Valid Range	0 ... 6533.5 mm Resolution: 0.1 mm
Default Value	7 cm
Description	This configuration property defines the distance between sunblind blades (see Section 8.1.5.1).

nciBladeWidth	
Type	UCPTbladeWidth (SNVT_length_mil)
Valid Range	0 ... 6533.5 mm Resolution: 0.1 mm
Default Value	9 cm
Description	This configuration property defines the width of the sunblind blades (see Section 8.1.5.1).

nciRotOffset	
Type	UCPTrotationOffset (SNVT_angle_deg)
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	0
Description	This configuration property defines the rotation offset for the glare protection algorithm (see Section 8.1.5.1).

nciMaxRot	
Type	UCPTmaxRotation (SNVT_angle_deg)
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	90
Description	This configuration property defines the maximum rotation for the glare protection algorithm (see Section 8.1.5.1).

nciMinRot	
Type	UCPTminRotation (SNVT_angle_deg)
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	0
Description	This configuration property defines the minimum rotation for the glare protection algorithm (see Section 8.1.5.1).

nciDeltaTemp	
Type	SCPTminDeltaTemp (SNVT_temp_p)
Valid Range	-273.17°C...327.66°C Resolution: 0.01°C
Default Value	1°C
Description	This configuration property defines the amount by which the indoor temperature (*nviIndoorTemp*) value must change before it can take in account.

nciHoldTime	
Type	SCPTholdTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	600 sec
Description	This configuration property defines the hold time for the occupied state. When the OC_OCCUPIED value is received via *nviOccupSensor* the sunblind controller remains in the occupied state until the hold time has expired and then changes to the unoccupied state. If set to 0 the unoccupied state is entered when OC_UNOCCUPIED is received (see Section 8.1.5.8).

nciSblndEvtPrio	
Type	UCPTsunblindEventPriority
Valid Range	.heat_cool_req: -128..127 .up_if_occupied: -128..127 .constant_light_req: -128..127 .view_protect: -128..127 .glare: -128..127 .scene_sel: -128..127 .global_req: -128..127 .group_req: -128..127 .local_req: -128..127 .window: -128..127 .override_req: -128..127 .set_override_req: -128..127 .rain: -128..127 .wind: -128..127 .frost: -128..127 .window_sensor_alarm: -128..127 .weather_sensor_alarm: -128..127 .maintenance_req: -128..127 .set_maintenance_req: -128..127
Default Value	All 0
Description	This configuration property defines the priorities of sunblind events (see Section 8.1.5.9). Higher values render higher priority. If multiple events have the same priority then they are prioritized with the default priority. Events can be disabled by setting a negative value for its priority. Events *maintenance_req* and *set_maintenance_req* will always be the highest priority events. Their value is used to define which of the two events has the higher priority.

nciAutoEvMinTm	
Type	UCPTautoDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	600 sec
Description	Use to specify the minimum time for the following events: • Weather sensor alarm • Window sensor alarm • Frost condition • Wind • Rain condition • Window open • Anti-glare • View protection • Constant light request • Up if occupied • Heating/cooling request The event will stay active for at least the configured time even if the event condition disappears before this time expires. In this way the sun blind controller ensures that the sunblind does not drive too frequently.

nciCLNumber	
Type	UCPTobjectIndex (SNVT_count)
Valid Range	0..15 0xFFFF invalid
Default Value	0xFFFF (no Constant Light Controller linked)
Description	This configuration property specifies the index of the constant light controller that is linked to the sunblind controller (see Section 8.1.4.7 und 8.1.4.12). Object indices start with index 0.

8.1.6 Globals #0005

The L-DALI provides one Globals object for each DALI channel. It provides global network variable inputs and configuration properties which are not specific for a certain constant light controller or sunblind controller.

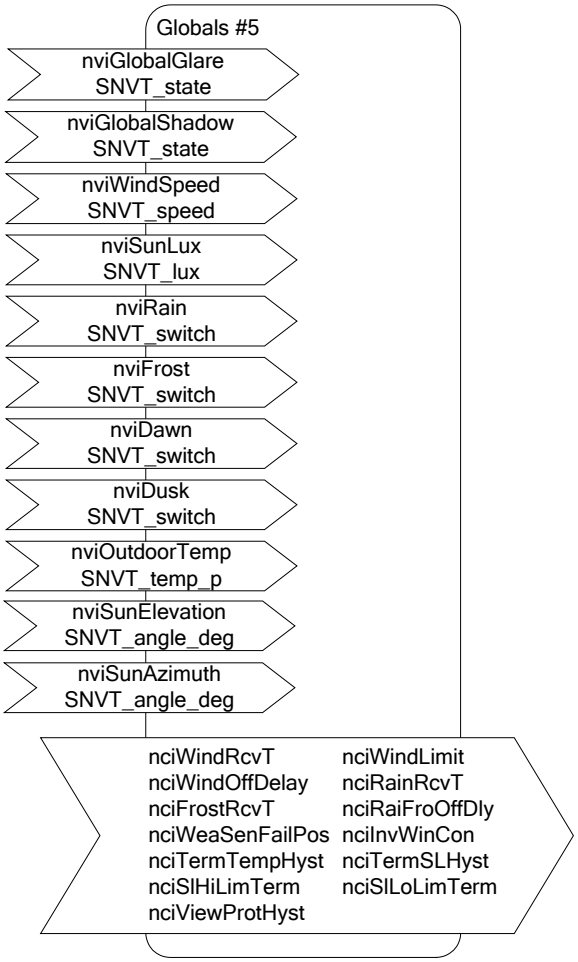


Figure 113: Global Object

This object type is enabled in the default interface. It will be disabled with the Sunblind Controller objects.

8.1.6.1 Network Variable Inputs

nviGlobalGlare	
Type	SNVT_state
Valid Range	.bit0 0, 1 … .bit15 0, 1
Default Value	
Description	This network input permits an external calculation of glare condition for all of the 16 sunblind controllers per channel (see Section 8.1.5.1). Automatic glare protection for the sunblind controller object x is deactivated if the bit with index x is not set.

nviGlobalShadow	
Type	SNVT_state
Valid Range	.bit0 0, 1 … .bit15 0, 1
Default Value	
Description	This network input permits an external calculation of shadow condition for all of the 16 sunblind controllers per channel (see Section 8.1.5.1). Automatic glare protection for the sunblind controller object x is deactivated if the bit with index x is set.

nviWindSpeed	
Type	SNVT_speed
Valid Range	0..6553.5 m/s Resolution: 0.1 m/s
Default Value	
Description	This network variable input provides the current wind speed measured by a wind sensor. If the wind speed is higher than the value configured in *nciWindLimit*, the sunblinds must go up.

nviSunLux	
Type	SNVT_lux
Valid Range	0..65,335 lux
Default Value	
Description	This network variable input provides the current outdoor illumination measured by a light sensor.

nviRain	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 Rain: .state=1 and .value>=0.5% No Rain: .state=0 and .value=0
Default Value	
Description	This network variable input provides the rain status. If it is raining, the sunblinds must go up.

nviFrost	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 Frost: .state=1 and .value>=0.5% No Frost: .state=0 and .value=0
Default Value	
Description	This network variable input provides the frost status. If a frost condition is detected, the sunblinds must not move.

nviDawn	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 Dawn: .state=1 and .value>=0.5% No Dawn: .state=0 and .value=0
Default Value	
Description	Currently not used.

nviDusk	
Type	SNVT_switch
Valid Range	.value: 0..100% .state: 0, 1 Dusk: .state=1 and .value>=0.5% No Dusk: .state=0 and .value=0
Default Value	
Description	Currently not used.

nviOutdoorTemp	
Type	SNVT_temp_p
Valid Range	-273.17°C..327.66°C Resolution: 0.01°C
Default Value	
Description	This network variable input provides the current outdoor temperature. This input is used when the sunblinds are used to heat/cool a room (see Section 8.1.5.3).

nviSunElevation	
Type	SNVT_angle_deg
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	
Description	This network variable input provides the current sun elevation. The elevation is the angle between the horizon and the middle of the sun, considered out of the viewpoint of an observer. The values 0 – 90° are typically used (0= Sunrise/Sunset; 90 = zenith position).

nviSunAzimuth	
Type	SNVT_angle_deg
Valid Range	-359.98..360.00 deg Resolution: 0.02 deg
Default Value	
Description	This network variable input provides the current sun azimuth. The values 0 – 359° are typically used (0 = NORTH, 90 = EAST, 180 = SOUTH, 270 = WEST).

8.1.6.2 Configuration Properties

All configuration properties listed in this section are implemented as Configuration Parameters using configuration files (CPT, CPV, and CPC files). File access is provided via LONMARK FTP.

nciWindRcvT	
Type	SCPTmaxRcvTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	This configuration property specifies the expected update interval of the *nviWindspeed* network variable input. If the time elapses without an update of the variable an alarm is generated and the sunblinds adopt the safe position defined by *nciWeaSenFailPos*.

nciWindLimit	
Type	UCPTwindLimit (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec
Description	This configuration property defines the maximum wind for the sunblinds. If the current wind speed (*nviWindspeed*) is greater than the configured values the sunblinds must go up.

nciWindOffDelay	
Type	UCPTweaSenOffDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec
Description	This configuration property defines the time for which the current wind speed (*nviWindspeed*) must be below the critical wind speed (*nciWindLimit*) before the sunblind controller return to normal operation.

nciRainRcvT	
Type	SCPTmaxRcvTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	This configuration property specifies the expected update interval of the *nviRain* network variable input. If the time elapses without an update of the variable an alarm is generated and the sunblinds adopt the safe position defined by *nciWeaSenFailPos.*

nciFrostRcvT	
Type	SCPTmaxRcvTime (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec (disabled)
Description	This configuration property specifies the expected update interval of the *nviFrost* network variable input. If the time elapses without an update of the variable an alarm is generated and the sunblinds adopt the safe position defined by *nciWeaSenFailPos.*

nciRaiFroOffDly	
Type	UCPTweaSenOffDelay (SNVT_time_sec)
Valid Range	0..6553.4 sec Resolution: 0.1 sec
Default Value	0.0 sec
Description	This configuration property defines the time for which the rain/frost condition (*nviRain*/*nviFrost*) has to be inactive before the sunblind controller returns to normal operation.

nciWeaSenFailPos	
Type	SCPTdefaultSetting (SNVT_setting)
Valid Range	.function: SET_NUL (-1): Invalid Value SET_DOWN (2) Decrease setting by specified value SET_UP (3) Increase setting by specified value SET_STOP (4) Stop action SET_STATE (5) Setting on at specified value .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	SET_STATE, 0%, 0 deg
Description	This configuration property defines the safety position of sunblinds when a failure of a safety relevant weather sensor (e.g. *nviWindspeed*, *nviRain* or *nviFrost*) is detected.

nciInvWinCon	
Type	UCPTautoOffBreak (SNVT_lev_disc)
Valid Range	ST_ON, ST_OFF Inverted: ST_ON Not Inverted: ST_OFF
Default Value	ST_OFF (not inverted)
Description	This configuration property allows inverting the window contact inputs of the sunblind controllers (*nviWindowContact*).

nciTermTempHyst	
Type	SCPTtemperatureHysteresis (SNVT_temp_diff_p)
Valid Range	-327.68°C..327.66°C Resolution: 0.01°C
Default Value	1°C
Description	This configuration property defines the hysteresis for the outdoor temperature (*nviOutdoorTemp*). It is used for the heating/cooling algorithm (see Section 8.1.5.3).

nciTermSLHyst	
Type	UCPTterminalLoadSLhysteresis (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	5.0%
Description	This configuration property defines the hysteresis for the sun lux level input (*nviSunLux*). It is used by the heating/cooling algorithm (see Section 8.1.5.3).

nciSlHighLimTerm	
Type	UCPTsunLuxHighLimit (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	30000
Description	This configuration property defines the high limit for the sun lux level input (*nviSunLux*). It is used by the heating/cooling algorithm (see Section 8.1.5.3).

nciSlLowLimTerm	
Type	UCPTsunLuxLowLimit (SNVT_lux)
Valid Range	0..65,335 lux
Default Value	10000 lux
Description	This configuration property defines the low limit for the sun lux level input (*nviSunLux*). It is used by the heating/cooling algorithm (see Section 8.1.5.3).

nciViewProtHyst	
Type	UCPTviewProtectionSLhysteresis (SNVT_lev_cont)
Valid Range	0..100% Resolution: 0.5
Default Value	5.0%
Description	This configuration property defines the hysteresis for the sun lux level input (*nviSunLux*). It is used by the view protection algorithm (see Section 8.1.5.2).

8.1.7 Button #0001

The L-DALI provides 64 button objects for each DALI channel to represent DALI buttons, switches, remote controls, panels etc. supported by the L-DALI. See the DALI Section in the LOYTEC Device User Manual [1] for supported devices.

This object type is disabled in the default interface. If required these objects must be enabled as described in the project settings (see LINX Configurator User Manual [2]). The network variables available in the button objects depend on the template selected in the project settings.

In any case the object contains the following configuration properties:

nciLocation	
Type	SCPTLocation (SNVT_str_asc)
Valid Range	31 ASCII characters
Default Value	Button X
Description	This configuration property can be used to specify the name of the button.

The following object templates are available:

8.1.7.1 SNVT_switch

This template has to be selected when a DALI button device allowing button function configuration is used and the state of the button has to be available on the LONMARK interface. In this case each Button object contains the following network variables:

nvoButtonState	
Type	SNVT_state
Valid Range	-
Default Value	0
Description	If a button input is configured with the button function *Network data point* the input states are mapped to a bit in the *SNVT-state*, in detail the mapping is done by the DALI instance number (bit0 to instance0, , bit1 to instance 1, etc.). The bit is set to 1 if the button is pressed or the contact is closed and 0 otherwise.

Additional Network Variables (not available in standard interface):

nviFeedbackState	
Type	SNVT_state
Valid Range	-
Default Value	0
Description	If a button feedback is configured with the function *Network data point* the corresponding bit of the *SNVT_state* (bit0 to instance 0, bit1 to instance 1, etc.) toggles the feedback LED.

8.1.7.2 Philips OccuSwitch

This template has to be selected when expanding an IRT 8080 IR-remote control the Philips OccuSwitch DALI LRM2090/20 to controlling sunblinds, fan speed, and temperature setpoint in a room. In this case each Button object contains the following network variables:

nvoSetPtOffset	
Type	SNVT_temp_p
Valid Range	-3°C to +3°C
Default Value	-
Description	This network variable output allows adjusting the HVAC setpoint by supplying an offset to a preconfigured setpoint. Its value is controlled by the temperature setpoint button on the IRT 8080.

nvoFanSpeedCmd	
Type	SNVT_switch
Valid Range	.value: 0%, 33%, 66%, 100% .state: 0, 1 On: .state = 1 and .value > 0 Off: .state = 0 and .value=any or .state=1 and .value = 0
Default Value	-
Description	This network variable output allows control the speed of a ventilation fan. Its value is controlled by the temperature fan speed button on the IRT 8080.

nvoSblndControl	
Type	SNVT_setting
Valid Range	.function: SET_NUL (-1): Invalid value. SET_DOWN (2) Decrease setting by specified value. SET_UP (3) Increase setting by specified value. SET_STOP (4) Stop action. SET_STATE (5) Setting on at specified value. .setting: 0..100, resolution 0.5 .rotation: -359.98 .. 360.00, resolution 0.02
Default Value	-
Description	This network variable output allows control the position and the rotation of a sunblind (via a sunblind controller or sunblind actuator object). Its value is controlled by the sunblind button on the IRT 8080. A long press (> 1 second) of the button will set the network variable to {SET_STATE; 0,0; 65534} (up) or {SET_STATE; 100,0; 65534} (down), respectively. This allows the blinds to drive up and down. A short press (< 1 second) while driving the blinds will set the network variable to {SET_STOP; 0,0; 0,00}. This allows stopping the blinds at the current position. A short press (< 1 second) will set the network variable to {SET_UP; 127,5; 15} (up) or {SET_DOWN; 127,5; 15} (down), respectively. This allows rotating the blades of the sunblinds (open/close).

8.1.8 Access to Bluetooth Sensor Functions

On LDALI-10X devices, the Bluetooth functions of multi-sensors are not mapped to network variables and therefore cannot be accessed via the CEA709 interface. They are represented by User Register datapoints only and can be accessed with other technologies (e.g. OPC XML/DA).

iBeacon:

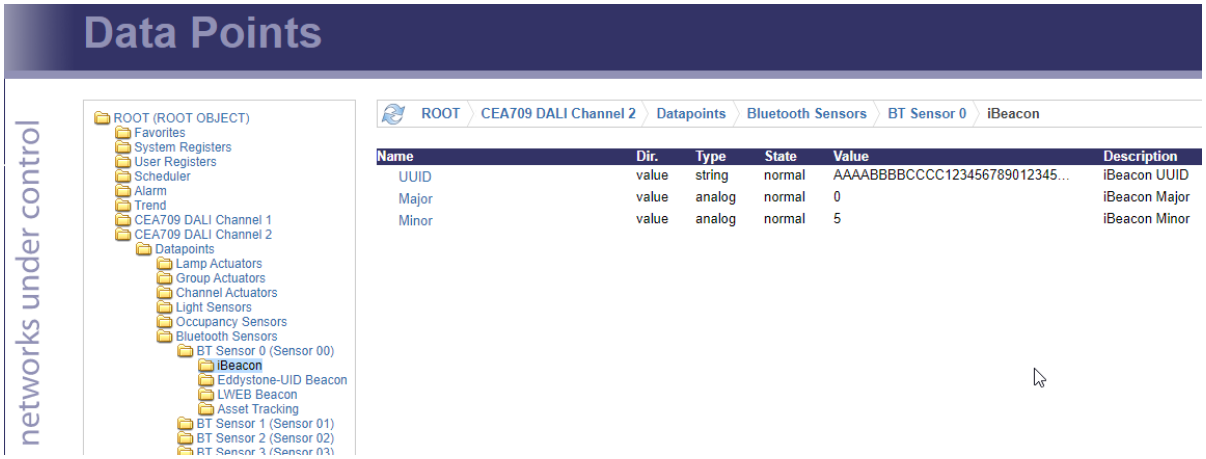


Figure 114: iBeacon datapoints on LDALI-10X devices

UUID	
Type	String
Valid Range	16 byte, representing 32 hex numbers
Default Value	-
Description	iBeacon UUID.
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.iBeacon.UUID

Major	
Type	Double
Valid Range	0 - 65535
Default Value	0
Description	iBeacon Major.
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.iBeacon.Major

Minor	
Type	Double
Valid Range	0 – 65535
Default Value	0
Description	iBeacon Minor
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.iBeacon.Minor

Eddystone-UID beacon:

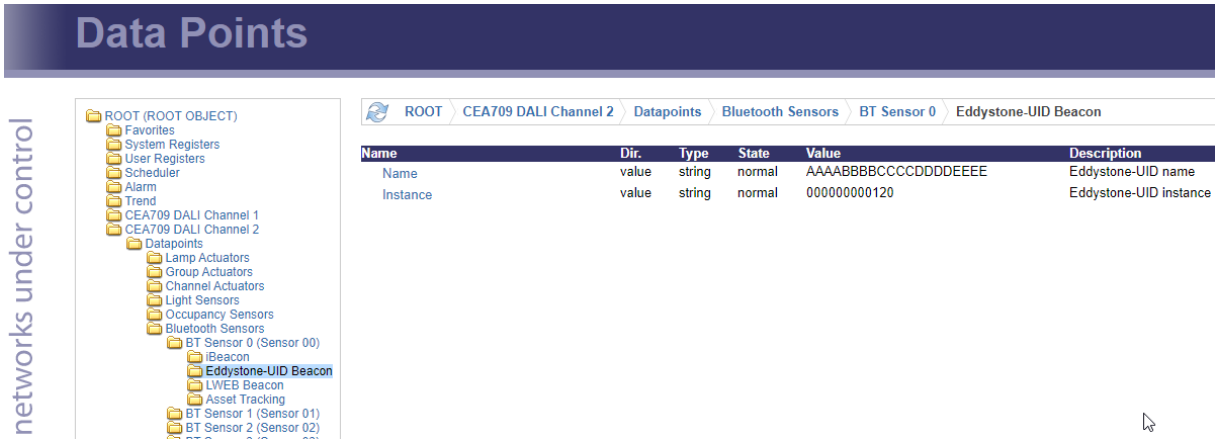


Figure 115: Eddystone-UID beacon datapoints on LDALI-10X devices

Name	
Type	String
Valid Range	20-hex numbers
Default Value	-
Description	Eddystone UID Name
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.Eddystone-UID Beacon.Name

Instance	
Type	String
Valid Range	12-hex numbers
Default Value	-
Description	Eddystone UID Instance
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.Eddystone-UID Beacon.Instance

LWEB beacon:

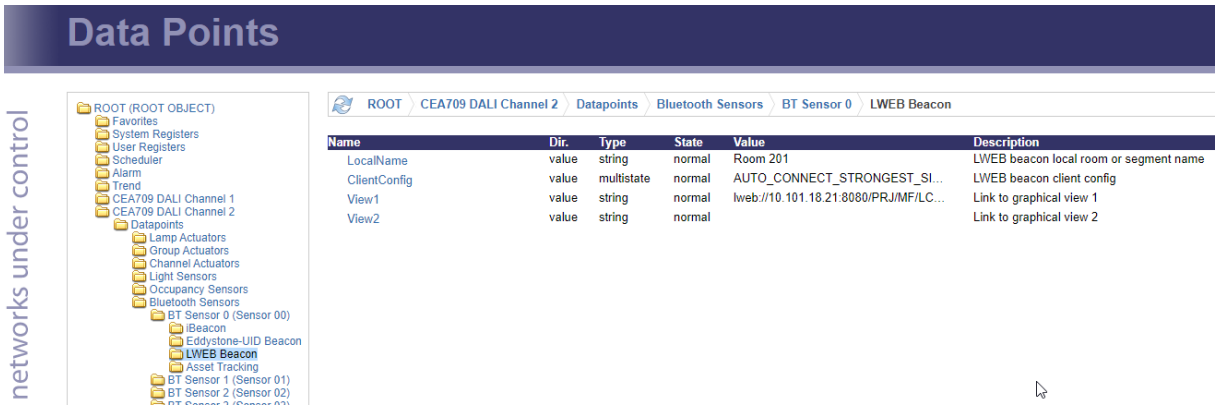


Figure 116: LWEB beacon datapoints on LDALI-10X devices

LocalName	
Type	String
Valid Range	14 chars (14 bytes!)
Default Value	-
Description	LWEB beacon local room or segment name
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.LWEB Beacon.LocalName

Client Config	
Type	Signed Integer
Valid Range	1 … IGNORE BEACON 2 … BEACONS SORTED BY RSSI 3 … AUTOSTART PROJECT WITH STRONGEST BEACON SIGNAL 4+ … reserved
Default Value	1 … IGNORE BEACON
Description	LWEB beacon client configuration (app)
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.LWEB Beacon.ClientConfig

View1, View2	
Type	String
Valid Range	250byte max.
Default Value	-
Description	Link to graphical view1, view2
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.LWEB Beacon.View1 CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.LWEB Beacon.View2

Asset Tracking:

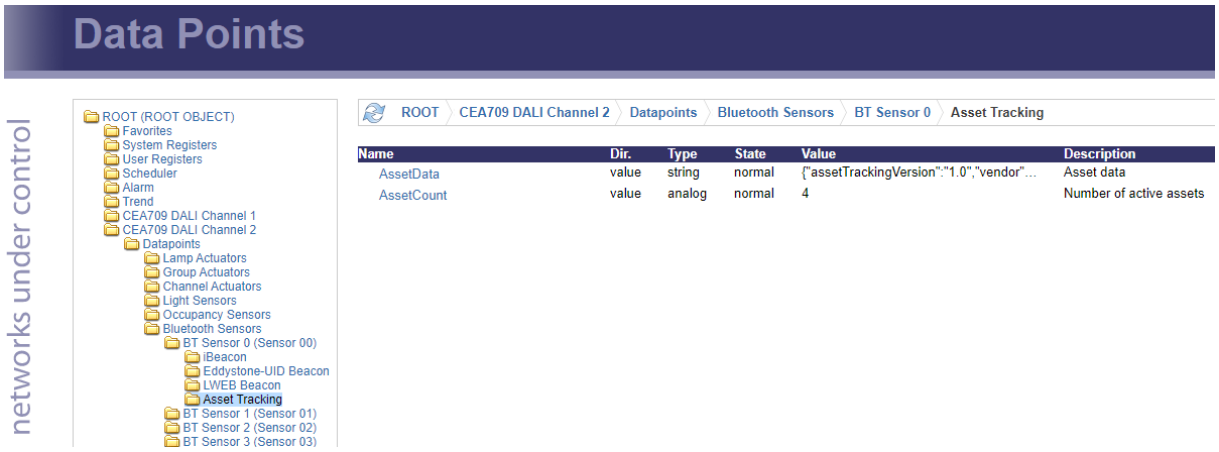


Figure 117: Asset Tracking datapoints on LDALI-10X devices

AssetData	
Type	String
Valid Range	65535byte
Default Value	-
Description	Asset data – JSON formatted
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.Asset Tracking.AssetData

AssetCount	
Type	Double
Valid Range	0-32
Default Value	-
Description	Number of active assets
Path Sensor 0	CEA709 DALI Channel 1.Datapoints.Bluetooth Sensors.BT Sensor 0.Asset Tracking.AssetCount

8.2 BACnet Interface and Application (LDALI-20X only)

Similar to the CEA-709 interface, the BACnet interface allows controlling DALI ballasts and access information from DALI ballasts and sensors via BACnet objects and properties. Additional properties allow configuring the built-in light controller applications (constant light, staircase lighting, etc.).

The objects can be grouped in the following categories:

DALI ballasts

- *Analog Output objects (see Section 8.2.2.11)*:
  - Control output light level.
  - Configure DALI ballast parameters.
  - Configure light application parameters (staircase lighting, etc.).

- *Analog Input objects (see Section 8.2.2.12)*: Output light level feedback.
- *Multi-State Output objects (see Section 8.2.2.16)*: Issue commands (start/stop emergency test or burn-in, change colour temperature, etc.).
- *Analog Input objects (see Section 8.2.2.17)*: Battery status (self-contained emergency lighting)
- *Multi-State Input objects*: Emergency lighting state
- *String register data points*: DaliData (detailed luminaire, energy and maintencance data provided by control gear)

DALI groups

- *Analog Output objects (see Section 8.2.2.11)*:
  - Control output light level.
  - Configure light application parameters (staircase lighting, etc.).
- *Analog Input objects (see Section 8.2.2.12)*: Output light level feedback.
- *Multi-State Output objects (see Section 8.2.2.13)*: Scene control.
- *Accumulator objects (see Section 8.2.2.14)*: Accumulated energy usage (calculated).
- *Analog Input objects (see Section 8.2.2.15)*: Status and health state of group.
- *Multi-State Output objects (see Section 8.2.2.16)*: Issue commands (start/stop emergency test or burn-in, change colour temperature, etc.).
- *Analog Input objects (see Section 8.2.2.17)*: Battery status (self-contained emergency lighting).

DALI channels

- *Analog Output objects (see Section 8.2.2.11)*:
  - Control output light level.
  - Configure light application parameters (staircase lighting, etc.).
- *Analog Input objects (see Section 8.2.2.12)*: Output light level feedback.
- *Multi-State Output objects (see Section 8.2.2.13)*: Scene control.
- *Accumulator objects (see Section 8.2.2.14)*: Accumulated energy usage (calculated).
- *Analog Input objects (see Section 8.2.2.15)*: Status and health state of channel.
- *Multi-State Output objects (see Section 8.2.2.16)*: Issue commands (start/stop emergency test or burn-in, change colour temperature, etc.).
- *Analog Input objects (see Section 8.2.2.17)*: Battery status (self-contained emergency lighting).

DALI sensors

- *Analog Input objects (see Section 8.2.3.2)*: Lux level sensor value.
- *Analog Input objects (see Section 8.2.3.3)*: Temperature sensor value.
- *Analog Input objects (see Section 8.2.3.48.2.3.2)*: Humidity sensor value.
- *Binary input objects (see Section 8.2.3.5)*: Occupancy sensor value.

Constant Light Controller

- *Loop objects (see Section 8.2.4.14)*

Which BACnet objects are available on the L-DALI's BACnet interface can be configured in the. BACnet project settings in the LINX Configurator (see LINX Configurator User Manual [2]). Figure 118 shows the corresponding tab of the project settings.

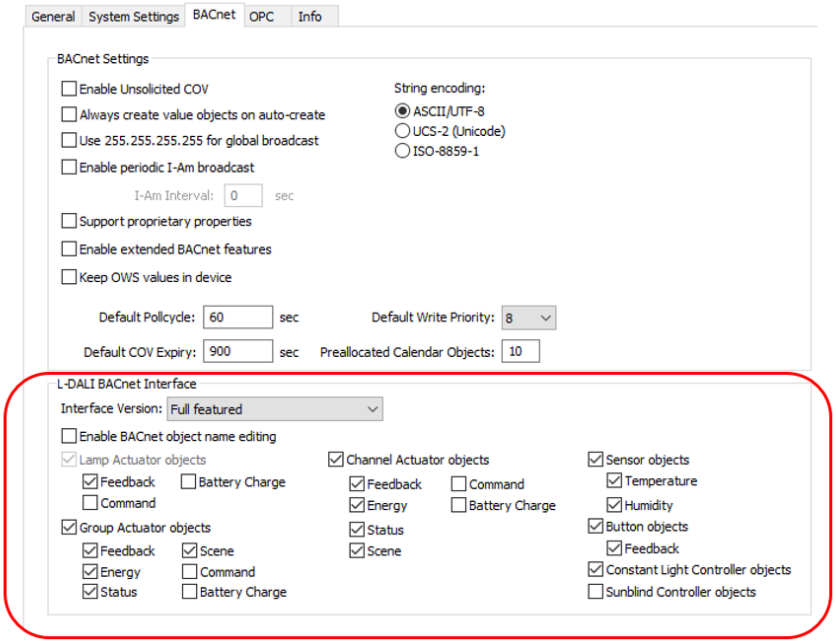


Figure 118: BACnet interface configuration.

All properties not specifically mentioned in the following sections behave as described by the BACnet standard.

The general BACnet objects and functions not specific to the L-DALI (Device Object, Protocol Parameters, Time Master, Backup & Restore, etc.) are described in the LOYTEC Device User Manual [1].

8.2.1 Interface Version

The BACnet interface can be used in two different modes:

Firmware version 1.x compatible interface

This interface is provided for backward compatibility with projects set up with a L-DALI with firmware version before 2.0.

Full featured interface

This interface is recommended for new projects.

The main difference between the two interface versions is the instance number layout. The "Full featured interface" offers better human readability. Further, new features in future firmware versions may be only available via the full featured interface.

The interface version can be configured via the LINX Configurator project settings (see LINX Configurator User Manual [2]).

8.2.2 Light Output Objects

There are three different types of light output objects:

- Objects related to DALI lamps (64 per channel).
- Objects related to DALI groups (16 per channel).
- Objects related to the DALI channels (1 per channel).

8.2.2.1 Control

The L-DALI offers different methods to control lamps.

Individual Control

Each lamp can be controlled individually via the *Present_Value* property of the corresponding Analog Output objects (see Section 8.2.2.11). Any new value received is transmitting to the corresponding DALI lamp in the dimming mode configured with the *Mode* property of the object (property *Fade_Time* or *Ramp_Rate* respectively is used to determine dim speed).

Alternatively, single lamps can be controlled via commands triggered via the *Present_Value* property of the corresponding Multi-State Output objects (see Section 8.2.2.16). The command allows recalling scene values on individual lamps or ramping the dim value up and down.

Group Control

Lamps belonging to a group can be controlled together by the following means:

- ***Dimming:*** Any new value received via the *Present_Value* property of the corresponding Analog Output objects (see Section 8.2.2.11) is transmitting to the corresponding DALI group in the dimming mode configured with the *Mode* property of the object (property *Fade_Time* or *Ramp_Rate* respectively is used to determine dim speed).

- ***Scene control:*** Using the *Present_Value* property of the corresponding Scene Multi-State Output objects (see Section 8.2.2.13) up to 16 DALI scenes can be saved and recalled. The states "*STORE SCENE x*" store the current light levels of all lamps of the group in the specified scene number 'x'. Alternatively DALI scenes can be configured using the DALI Scenes page in the web interface (see LOYTEC Device User Manual [1]) or the DALI Scenes tab in the LINX Configurator (see LINX Configurator User Manual [2]). By setting the state to "*GO TO SCENE x*" previously stored scenes can be recalled. The state "*AUTOMATIC MODE*" will relinquish any manual override and (re-)activate a constant light controller linked to the group (see Section 8.2.4.4). Scenes can be deleted by a using the states "*REMOVE SCENE x*". When a new scene is selected the lamp values are adjusted in fading mode (property *Fade_Time* is used).

- ***Ramping:*** Using the *Present_Value* property of the corresponding Command Multi-State Output objects (see Section 8.2.2.16) DALI groups can be dimmed up and down with a constant rate (ramping) configured in the property *Ramp_Rate* of the Analog Output object of the individual ballasts.

Channel Control

All lamps on the same DALI channel can be controlled together by the following means:

- ***Dimming:*** The *Present_Value* property of the corresponding Analog Output objects works in the same way as for lamps and groups but affects all lamps on a channel.

- ***Scene control:*** The *Present_Value* property of the corresponding Scene Multi-State Output objects works in the same way as for groups but affects all lamps on a channel.

- ***Ramping:*** The *Present_Value* property of the corresponding Command Multi-State Output objects works in the same way as for groups but affects all lamps on a channel.

8.2.2.2 Maximum and Minimum Light Level

For a dimmable lamp the maximum and minimum light level of a lamp can be configured via the properties *Min_Level* and *Max_Pres_Value* of the corresponding Analog Output object.

For a non-dimmable lamp set *Min_Level* = *Max_Pres_Value* = 100%.

8.2.2.3 Timing Parameters

Figure 119 shows the behavior of the lamp actuator if the light is switched on/off via one of the Analog Output objects. When the ON command is received, the lamp is switched to the specified value after the time *On_Delay_Time* has expired. When the lamp is already on and a new ON command is received the lamp is switched to the new value immediately. If the lamp is on and an OFF command is received the lamp is switched off after the time *Off_Delay_Time*.

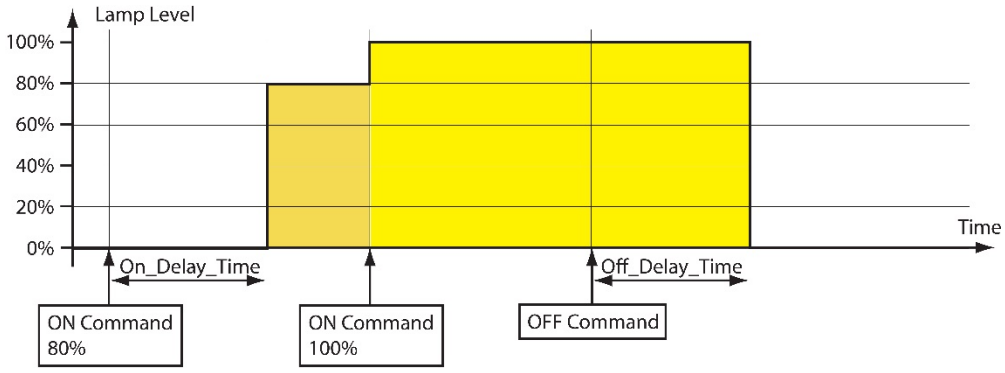


Figure 119: Timing Parameters.

For staircase lighting an automatic cutoff can be configured in *Auto_Off_Time* as shown in Figure 120. When this time expires, the lamp switches off automatically. To warn the user that the light is going to turn off, an off-warning delay (*Warn_Delay*) can be configured. During this time the light is dimmed to 50% of the previous level. For non-dimmable lights (*Min_Level=Max_Pres_Value*) the light is blinking.

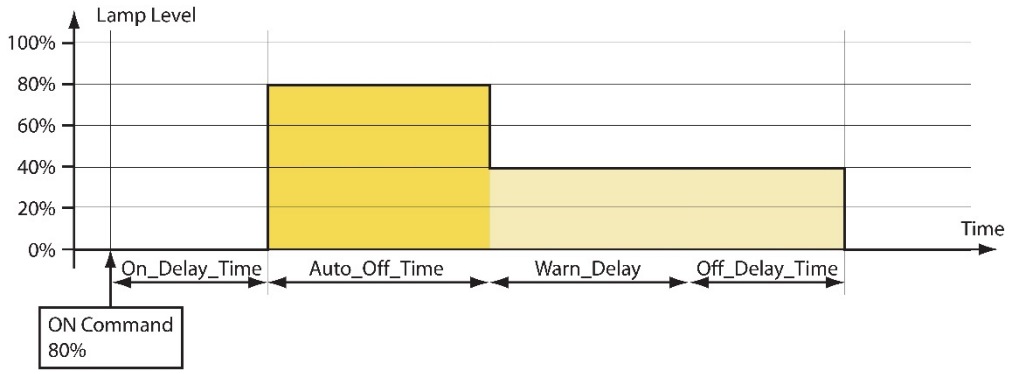


Figure 120: Timing Parameters with *Auto_Off_Time* and *Warn_Delay*.

The behavior of the auto-off timer can be modified with the property *Auto_Off_Mode*. If *Auto_Off_Mode* is set to ENABLE_RESTART or ENABLE_RESTART_BREAK, the auto-off timer can be restarted by a new ON command (see Figure 121). If *Auto_Off_Mode* is set ENABLE_BREAK or ENABLE_RESTART_BREAK the auto-off timer can be stopped before the time has expired by switching the light off via the corresponding *Present_Value* property (see Figure 122).

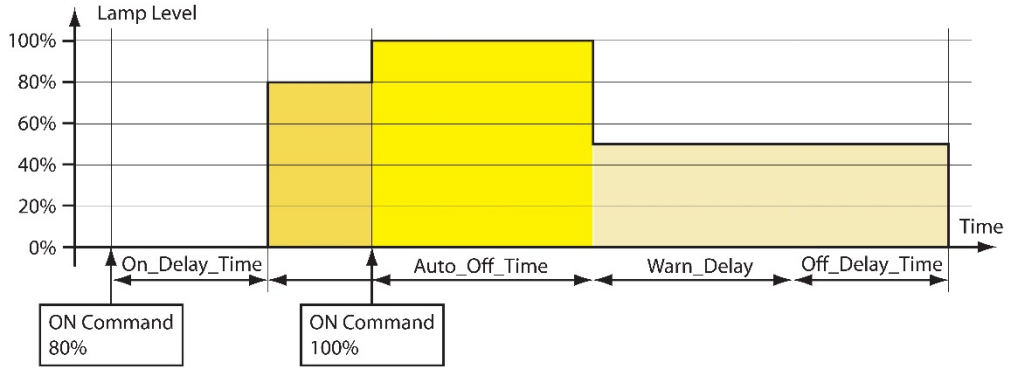


Figure 121: Timing Parameters (restart enabled).

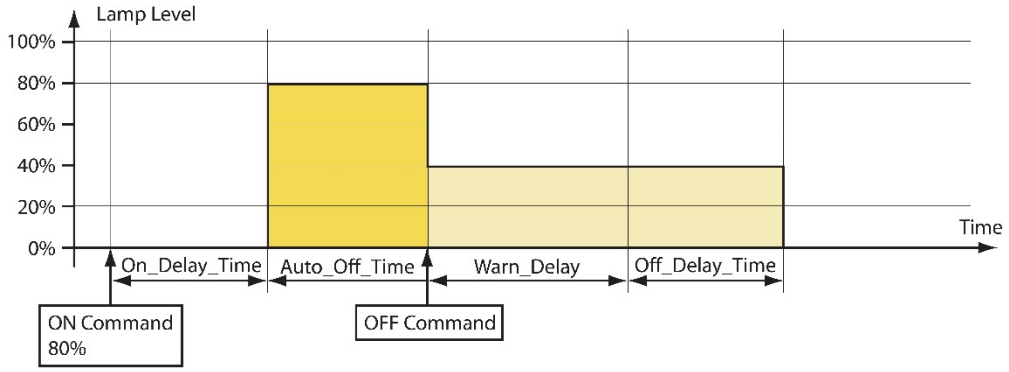


Figure 122: Timing Parameters (break enabled).

8.2.2.4 Feedback

The DALI lamp, group and channel each report the current state via the *Present_Value* of a feedback Analog Input (see Section 8.2.2.12).

All Analog Output objects report if they are in manual override mode by setting the OVERRIDDEN flag in the *Status_Flags* property.

8.2.2.5 Emergency Lights

The L-DALI supports emergency light testing of self-contained DALI emergency lights (Device Type 1, DT1). Tests can be started and stopped via the DALI Installation web-UI (see LOYTEC Device User Manual [1]) or the Command Multi-State Output object (see Section 8.2.2.16). Further, an automatic test schedule can be configured via the web-UI.

Whether the test is executed, pending or failed is shown in the status of the selected devices on the DALI Installation web-UI. A test is pending if its execution is delayed as the current state does not permit the execution of the test (e.g. battery not fully charged, other test being performed, etc.).

The result of the last test and other emergency light related status information is available via the following additional, emergency light related properties of the Channel Health Analog Input object (see Section 8.2.2.15):

- *Battery_Failure*: Report battery failure for each emergency light ballast.
- *Function_Test_Failure*: Report whether last function test failed for each emergency light ballast.
- *Duration_Test_Failure*: Report whether last function test failed for each emergency light ballast.

Test results will be stored in the appropriate emergency light test log (see LOYTEC Devices User Manual [1]).

In addition the current battery charge status of self-contained emergency lights is available via the Battery Status Analog Input object (see Section 8.2.2.17).

Furthermore the emergency status, emergency mode and emergency failure status of self-contained emergency lights is available via the Emergency_State Multi-State Input object (see Section 8.2.2.18).

8.2.2.6 Status Monitoring

The L-DALI monitors the DALI lamps and reports any failure in the property *Device_Failure* of the Channel Health Analog Input object (see Section 8.2.2.15). In this property of type BIT STRING each bit corresponds to the lamp with the same index. In case of a failure the bit is set. Similar properties *Lamp_Failure* and *Ballast_Failure* are used to signal a lamp or a ballast failure reported by a ballast for each DALI ballast.

A device failure is reported if either

- bus power for the related DALI channel fails,
- the DALI ballast is not reachable via the DALI channel, or
- the DALI ballast reports a failure (e.g. lamp failure) in its DALI status register.

The *Present_Value* properties of the group and channel related Analog Input objects (see Section 8.2.2.15) reflect the percentage of failed ballasts in this group or channel respectively.

8.2.2.7 Statistics

The L-DALI reports the run hours and energy consumptions of the DALI lamps.

Run Hours

The L-DALI determines how long each DALI lamp was switched on. The value is reported via the property *Elapsed_Active_Time* of the Analog Output object for each lamp, group, and channel (see Section 8.2.2.11). If a lamp is replaced the run hours can be initialized by writing -1 to this property. The time and date of the last reset is stored in the property *Time_Of_Active_Time_Reset*.

The group related object reports the maximum run hours of all lamps in the groups via the property *Elapsed_Active_Time*.

The channel related object reports the maximum run hours of all lamps on the channel via the property *Elapsed_Active_Time*.

The run hours counter can be reset, either via the DALI Installation Web-UI (see LOYTEC Devices User Manual [1]) or via the Command Multi-State Output object (see Section 8.2.2.16).

Energy Consumption

The L-DALI device can calculate the energy consumption of the DALI lamps. For that purpose it needs to know the nominal power of all connected DALI lamps. If the configuration property *Nominal_Power* of a lamp related Analog Output object (see Section 8.2.2.11) is set to 0 (AUTO), the L-DALI tries to obtain the energy consumption from the DALI device. However, not all DALI ballasts support this proprietary extension. In this case the *Nominal_Power* has to be configured with the nominal power of the ballast.

To reduce the number of objects the energy consumption is reported not separately for each lamp but for a whole group or channel. Accumulator objects (see Section 8.2.2.14) are used to report the sum of energy consumed by all lamps in a group or on a channel respectively. The energy consumption can be reset by writing to the *Value_Set* property of the Accumulator object

The energy consumption counter can be reset, either via the DALI Installation Web-UI (see LOYTEC Devices User Manual [1]) or via the Command Multi-State Output object (see Section 8.2.2.16).

8.2.2.8 Burn-In Function

Some lamps require a burn-in time during which they must not be dimmed. The burn-in mode can be activated/deactivated via the Web-UI. The burn-in time is defined by the property *Burn_In_Time* available via Analog Output objects corresponding to DALI channels (see Section 8.2.2.11). During this time the lamps will only be switched to on (100%) or off (0%) but not dimmed.

8.2.2.9 Fail Safe Functions

The light level a lamp adopts after power-up is defined in the property *Power_On_Level*. The light level a lamp adopts in case of a DALI system failure is defined in the configuration property *System_Failure_Level*. According to the DALI standard a DALI device will enter system failure state if DALI bus power is interrupted for more than 550 ms.

Both values are available via Analog Output objects corresponding to DALI ballasts (see Section 8.2.2.11).

8.2.2.10 Colour Control

Controlling the colour temperature of devices of type “colour control” (device type 8, DT8, “tuneable white”) is possible via the following methods:

- **absolute** by setting the colour temperature in degree Kelvin via the property *Colour_Temp* available on Analog Output objects corresponding to DALI ballasts, groups and channels (see Section 8.2.2.11).

- **relative** by ramping the colour temperature in the direction of warmer or cooler values via the Command Multi-State Output object corresponding to DALI ballasts, groups and channels (see Section 8.2.2.16).

- **absolute** by using the properties *Hue* and *Saturation* (see Section 8.2.2.11) available on Analog Output objects corresponding to DALI ballasts, groups and channels. Hue is an angular value, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. Saturation can be in the range of 0% to 100%. The controller converts the hue and saturation values given to the respective native DALI colour control values (xy-coordinate, RGBWAF or primary-N) as supported by the luminaire. This abstraction allows to use a control algorithm or user interface independent of the supported DALI colour control method.

- **via scenes** by using the Scene Multi-State Output object corresponding to DALI groups and channels (see Section 8.2.2.13). This object allows recalling DALI scenes. DALI scenes can contain lamp colour settings (for ballasts with DT8 support) as well as dim levels. These scenes can be defined using the DALI scenes tab in the LINX Configurator (see LINX Configurator User Manual [2]) or in the DALI scenes web-UI (see LOYTEC Device User Manual [1]). Note, that DALI scenes can be used to change lamp colour without affecting the dim level (and vice versa).

8.2.2.11 Analog Output Object – Control DALI ballast, group, or channel

This object type is used to control the dim level of DALI ballasts (see Table 11), DALI groups (see Table 12), or DALI channel (see Table 13). For DALI devices it also provides access to all its DALI parameters. Further, parameters for light controller applications are available (e.g. staircase lighting, on and off delays, off warning etc.).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	W	✓
Description	28	CharacterString	W	
Device_Type	31	CharacterString	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	W	✓
Priority_Array	87	BACnetPriorityArray	R	
Relinquish_Default	104	REAL	W	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	
Power_On_Level	512	REAL	W	✓
System_Failure_Level	513	REAL	W	✓
Fade_Time	514	REAL	W	✓
Ramp_Rate	515	REAL	W	✓
Min_Level	516	REAL	W	✓
Groups	517	BIT STRING	W	✓
Nominal_Power	518	REAL	W	✓
Dim_Mode	520	BACnetDimMode	W	✓
On_Delay_Time	521	Unsigned	W	✓
Off_Delay_Time	522	Unsigned	W	✓
Warn_Delay	523	Unsigned	W	✓
Auto_Off_Time	524	Unsigned	W	✓
Auto_Off_Mode	526	BACnetAutoOffMode	W	✓
Elapsed_Active_Time	527	Unsigned	W	✓
Time_Of_Active_Time_Reset	528	BACnetDateTime	R	✓
Colour_Temp	567	REAL	W	✓

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Hue	569	REAL	W	✓
Saturation	570	REAL	W	✓

Table 11: Properties of the Analog Output object used to control DALI ballasts.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	W	✓
Description	28	CharacterString	W	
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	W	
Priority_Array	87	BACnetPriorityArray	R	
Relinquish_Default	104	REAL	W	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	
Dim_Mode	520	BACnetDimMode	W	✓
On_Delay_Time	521	Unsigned	W	✓
Off_Delay_Time	522	Unsigned	W	✓
Warn_Delay	523	Unsigned	W	✓
Auto_Off_Time	524	Unsigned	W	✓
Auto_Off_Mode	526	BACnetAutoOffMode	W	✓
Elapsed_Active_Time	527	Unsigned	W	✓
Time_Of_Active_Time_Reset	528	BACnetDateTime	R	✓
Colour_Temp	567	REAL	W	✓
Hue	569	REAL	W	✓
Saturation	570	REAL	W	✓

Table 12: Properties of the Analog Output object used to control DALI groups.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	W	✓
Description	28	CharacterString	W	
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	W	
Priority_Array	87	BACnetPriorityArray	R	
Relinquish_Default	104	REAL	W	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	
Burn_In_Time	519	Unsigned	W	✓
Dim_Mode	520	BACnetDimMode	W	✓
On_Delay_Time	521	Unsigned	W	✓
Off_Delay_Time	522	Unsigned	W	✓
Warn_Delay	523	Unsigned	W	✓
Auto_Off_Time	524	Unsigned	W	✓
Auto_Off_Mode	526	BACnetAutoOffMode	W	✓
Elapsed_Active_Time	527	Unsigned	W	✓
Time_Of_Active_Time_Reset	528	BACnetDateTime	R	✓
Colour_Temp	567	REAL	W	✓
Hue	569	REAL	W	✓
Saturation	570	REAL	W	✓

Table 13: Properties of the Analog Output object used to control DALI channels.

Object_Identifier (Read-Only)

The default instance number is ABCC, where "A" is 0 for the objects associated with DALI devices and 1 for the objects associated with DALI groups, and 2 with DALI channels, "B" is the DALI interface number (0-3) in decimal, and "CC" is the DALI device number (00-63) or the DALI group address (00-15) respectively in decimal (00 for DALI channels). Examples: Ballast 3 on channel 2 has the instance number 103, Group 5 on channel 1 has the instance number 1005, and channel 4 has the instance number 2300.

In compatibility mode the instance number is 0x0ABBCC, where "A" is 0 for the objects associated with DALI devices and 1 for the objects associated with DALI groups, and 2 with DALI channels, "BB" is the DALI interface number (0-3) in hex, and "CC" is the DALI device number (0-63) or the DALI group address (0-15) respectively in hex. Examples: Ballast 3 on channel 2 has the instance number 0x000303 (771), Group 5 on channel 1 has the instance number 0x010205 (66053), and channel 4 has the instance number 0x020300 (131840).

Object_Name (Read-Only)

This property holds the name of the lamp/group/channel. It can be changed via the Web-UI.

Object_Type (Read-Only)

The value of this property is ANALOG_OUTPUT (1).

Present_Value (Read/Write)

This property, of type REAL, indicates the linearized percentage (0..100.00%) of the device's desired light output; 0 being off, 1 being dimmest, 100 brightest. It is used to dim the corresponding DALI ballast, group, or channel.

Depending on the *Dim_Mode* property, a write to this property results in a DALI "DIRECT ARC POWER CONTROL" command (fade) or a series of UP or DOWN commands to the device, group or channel respectively.

Description (Read/Write)

This property can be configured via BACnet. It serves documentation purposes only.

Device_Type (Read-Only)

This property contains the DALI device type (e.g. "*low voltage halogen lamp*") for objects mapping to DALI devices, "*DALI group*" for objects mapping to DALI groups and "*DALI channel*" for objects mapping to DALI channels.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN	Logical TRUE (1) if the associated DALI channel is controlled via the button interface (see Section 6.5.2), FALSE otherwise.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.

NO_OUTPUT	A lamp failure was detected (for groups and channels if at least one lamp failure in the group/on the channel was detected).
COMMUNICATION_FAILURE	Ballast offline (for groups and channels if at least one ballast is offline in the group/on the channel).
UNRELIABLE_OTHER	Other failure detected (e.g. DALI device type specific error, for groups and channels if at least one ballast in the group/on the channel reports a failure)

Units (Read-Only)

The value of this property is 98 (percent).

Min_Pres_Value (Read-Only)

The value of this property is 0.

Max_Pres_Value (Read/Write)

For objects associated to DALI lamps this property is read/write. Its maximum value is 100. It is mapped to the DALI register MAX_LEVEL of the corresponding ballast.

For DALI groups and channels this value is always 100 and read only.

Profile_Name (Read-only)

This property has the following values:

- DALI lamps: "*178-http://www.loytec.com/xsd/DALILampActuator/v1*"
- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupActuator/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelActuator/v1*"

Power_On_Level (Read/Write)

The value of this proprietary property (property ID 512) corresponds to the "POWER ON LEVEL" in the DALI device. A value of NaN corresponds to MASK.

Only present if the object is associated with a DALI lamp.

System_Failure_Level (Read/Write)

The value of this proprietary property (property ID 513) corresponds to the "SYSTEM FAILURE LEVEL" in the DALI device. A value of NaN corresponds to MASK.

Only present if the object is associated with a DALI lamp.

Fade_Time (Read/Write)

The value of this proprietary property (property ID 514) corresponds to the "FADE TIME" in the DALI device. It gives the time in seconds. The FADE TIME closest to the written value will be used.

Only present if the object is associated with a DALI lamp.

Ramp_Rate (Read/Write)

The value of this proprietary property (property ID 515) corresponds to the “FADE RATE” in the DALI device. It gives the fade rate in percent per seconds for ramping. The FADE RATE closest to the written value will be used.

Only present if the object is associated with a DALI lamp.

Min_Level (Read/Write)

The value of this proprietary property (property ID 516) corresponds to “MIN LEVEL” in the DALI device. It must be in the range 0 < Min_Level <= 100.

Only present if the object is associated with a DALI lamp.

Groups (Read/Write)

The value of this proprietary property (property ID 517) is a 16-bit wide BIT STRING. It corresponds to the “GROUPS” of the DALI device. It defines the group membership of a lamp. Each bit corresponds to the group of the same index. If the bit is set, the lamp is member of the group.

Only present if the object is associated with a DALI lamp.

Nominal_Power (Read/Write)

This proprietary property (property ID 518) is used to specify the nominal power of a DALI ballast. A value of 0 is used to specify AUTO. In this case the nominal power is read from the ballast (if available).

Only present if the object is associated with a DALI lamp.

Burn_In_Time (Read/Write)

This proprietary property (property ID 519) is used to configure the burn in time for the channel. The burn-in mode can be activated/deactivated via the Web-UI.

Only present if the object is associated with a DALI channel.

Dim_Mode (Read/Write)

The value of this proprietary property (property ID 520) is used to specify whether to use ramping (1) or fading (0) when changing the current dim level by writing to the *Present_Value* property.

In case of ramping a constant dim rate is used. Thus, the duration of the dim process depends on the difference between start and target value.

Fading is based on a constant dim duration. Thus, the duration of the dim process does not depend on the difference between start and target value.

On_Delay_Time (Read/Write)

This proprietary property (property ID 521) is used to configure an on-delay time in seconds.

Off_Delay_Time (Read/Write)

This proprietary property (property ID 522) is used to configure an off-delay time in seconds.

Warn_Delay (Read/Write)

This proprietary property (property ID 523) is used to configure an off-warning time in seconds. It defines the time during which the user will be notified that the light will be switched off shortly. During this time, the light is dimmed to 50% of the current level. Lamps which cannot be dimmed (*Min_Level = Max_Pres_Value*) blink during this time.

Auto_Off_Time (Read/Write)

This proprietary property (property ID 524) is used to configure an auto-off time in seconds. It determines the delay after which the lamp output is switched off automatically. The timer is started after receiving a lamp ON command via the *Present_Value* property

The property *Auto_Off_Mode* modifies the behavior of the auto-off timer.

Auto_Off_Mode (Read/Write)

The value of this proprietary property (property ID 526) determines the behavior of the auto-off timer. Possible values are:

DISABLE_ALL (0)	ENABLE_RESTART and ENABLE_BREAK not set.
ENABLE_BREAK (1)	The auto-off-timer can be interrupted by writing to the *Present_Value*.
ENABLE_RESTART (2)	The auto-off-timer is restarted whenever the *Present_Value* is written.
ENABLE_RESTART_BREAK (3)	ENABLE_RESTART and ENABLE_BREAK set.

Elapsed_Active_Time (Read/Write)

The value of this proprietary property (property ID 527) gives the accumulated time in seconds, which the corresponding DALI lamp was switched on. For groups or channels it gives the maximum time of all lamps in the group/channel. When writing -1 to this property the value is reset. For groups and channels the value of all lamps in the group/channel are reset.

Time_Of_Active_Time_Reset (Read-Only)

The value of this proprietary property (property ID 528) give the time and date the *Elapsed_Active_Time* property was last reset.

Colour_Temp (Read/Write)

This proprietary property (property ID 567) can be used to control the colour temperature of devices of type “colour control” (device type 8, according to IEC 62386-209). The value of the property gives the colour temperature in Kelvin. On objects corresponding to groups and channels it allows to control the colour temperature of all lights in the group or on the channel, respectively, at once.

Hue, Saturation (Read/Write)

The proprietary properties Hue (property ID 569) and Saturation (property ID 570) can be used to control the light colour of devices of type “colour control” (device type 8, according to IEC 62386-209) according to the HSV colour model. Hue is an angular value, starting at the red primary at 0°, passing through the green primary at 120° and the blue primary at 240°, and then wrapping back to red at 360°. Saturation can be in the range of 0% to 100%.

Intrinsic reporting

This object supports all properties required for intrinsic reporting. Per default only fault alarms are enabled.

8.2.2.12 Analog Input Object – Feedback from DALI ballast, group, or channel

This object is used to give feedback on the current dim level of DALI ballasts, DALI groups, or DALI channels (see Table 14).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Profile_Name	168	CharacterString	R	

Table 14: Properties of the Analog Input object providing feedback from DALI ballasts, groups, and channels.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Output object (see Section 8.2.2.11).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Feedback*".

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property, of type REAL, indicates the linearized percentage (0…100.00%) of the DALI device's, group's or channel's current light output.

Device_Type (Read-Only)

This property contains the value "*Actual Dim Level*".

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	A lamp failure was detected (for groups and channels if at least one lamp failure in the group/on the channel was detected).
COMMUNICATION_FAILURE	Ballast offline (for groups and channels if at least one ballast is offline in the group/on the channel).
UNRELIABLE_OTHER	Other failure detected (e.g. DALI device type specific error, for groups and channels if at least one ballast in the group/on the channel reports a failure)

Units (Read-Only)

The value of this property is 98 (percent).

Min_Pres_Value (Read-Only)

The value of this property is 0.

Max_Pres_Value (Read-Only)

The value of this property is 100.

Profile_Name (Read-only)

This property has the following values:

- DALI lamps: "*178-http://www.loytec.com/xsd/DALILampActuatorFeedback/v1*"
- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupActuatorFeedback/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelActuatorFeedback/v1*"

8.2.2.13 Multi-State Output Object – Scene Control for DALI group or channel

This object is used to control the dim level of DALI groups and DALI channels via scene control. It has states for scene learning, recalling and clearing (see Table 15).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	Unsigned	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Out_Of_Service	81	BOOLEAN	W	
Number_Of_States	74	Unsigned	R	
State_Text	110	BACnetARRAY[N]of CharacterString	W	
Priority_Array	87	BACnetPriorityArray	R	
Relinquish_Default	104	Unsigned	R	
Profile_Name	168	CharacterString	R	

Table 15: Properties of the Multi-State Output object used for scene control of DALI groups and channels.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Output object (see Section 8.2.2.11).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Scene*".

Object_Type (Read-Only)

The value of this property is MULTISTATE_OUTPUT (14).

Present_Value (Read/Write)

The *Present_Value* property can have the following values:

GO TO SCENE X (1-16): Where X is 0-15. Results in recalling the DALI scene X by sending the DALI "GO TO SCENE" command to the DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

STORE SCENE X (17-32): Where X is 0-15. Results in the current values being stored as scene X by sending the DALI "STORE THE DTR AS SCENE" command to the DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

REMOVE SCENE X (33-48): Where X is 0-15. Results in scene X being erased by sending the DALI "REMOVE FROM SCENE" command to the DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

AUTOMATIC MODE (49): Relinquish any manual override and (re-)activate constant light controller linked to the group (see Section 8.2.4.4).

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Logical TRUE (1) if the associated DALI channel is controlled via the button interface (see Section 6.5.2), FALSE otherwise.

Reliability (Read-Only)

The *Reliability* property of this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

Number_Of_States (Read-Only)

This property has the value 49.

State_Text (Read/Write)

Per default this property contains the strings "*GO TO SCENE X*", "*STORE SCENE X*", and "*REMOVE SCENE X*" respectively.

Profile_Name (Read-only)

This property has the following values:

- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupSceneCtrl/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelSceneCtrl/v1*"

8.2.2.14 Accumulator Object – Energy usage of DALI group or channel

This object is used to represent the accumulated energy usage of DALI groups and channels (see Table 16).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	UNSIGNED	R	✓
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Scale	187	BACnetScale	R	
Units	117	BACnetEngineeringUnits	R	
Max_Pres_Value	65	Unsigned	R	
Value_Change_Time	192	BACnetDateTime	R	
Value_Before_Change	190	Unsigned	R	
Value_Set	191	Unsigned	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	

Table 16: Properties of the Accumulator object representing the accumulated energy usage of DALI groups or channels.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Output object (see Section 8.2.2.11).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Energy*".

Object_Type (Read-Only)

The value of this property is ACCUMULATOR (23).

Present_Value (Read-Only)

The value of this property, of type UNSIGNED, indicates the accumulated energy usage in Wh. For objects associated to DALI groups/channels this property reports the sum of the accumulated energy usage of all ballasts in the DALI group/channel.

For calculating the energy usage the nominal power of the affected DALI lamps must be known (see Property *Nominal_Power*, Section 8.2.2.11). The value of this property is just a calculated value and thus is not suitable for billing energy usage.

Device_Type (Read-Only)

This property contains the value "*Accumulated Energy Usage*".

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

UNRELIABLE_OTHER Other failure detected.

Scale (Read-Only)

The value of this property is INTEGER 1.

Units (Read-Only)

The value of this property is 18 (watt-hours).

Max_Pres_Value (Read-Only)

The value of this property is 4.294.967.295 (maximum unsigned 32-bit value).

Value_Set (Read/Write)

This property behaves as defined by the BACnet standard. Resetting the accumulator value is possible via the *Value_Set* property (*Value_Set* is writeable, *Value_Before_Change* is not writeable).

Profile_Name (Read-only)

The value of this property is "*178-http://www.loytec.com/xsd/LightEnergyAccumulator/v1*".

Intrinsic reporting

The object supports all properties required for intrinsic reporting. Per default no alarms are enabled.

8.2.2.15 Analog Input Object – Health State of DALI group or channel

This object is used to represent the health state of DALI groups (see Table 17) or DALI channels (see Table 18).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	

Table 17: Properties of the Analog Input object representing the health state of a DALI group.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	
Device_Failure	529	BIT STRING	R	✓
Ballast_Failure	530	BIT STRING	R	✓
Lamp_Failure	531	BIT STRING	R	✓
Battery_Failure	532	BIT STRING	R	✓
Function_Test_Failure	533	BIT STRING	R	✓
Duration_Test_Failure	534	BIT STRING	R	✓
Digital_Input_Override	571	BIT STRING	R	✓
Bus_Power	563	BACnetBinaryPV	R	✓
Bus_Power_Failure	564	BACnetBinaryPV	R	✓
Bus_Power_Overload	565	BACnetBinaryPV	R	✓

Table 18: Properties of the Analog Input object representing the health state of a DALI channel.

Object_Identifier (Read-Only)

The default instance number is ABCC, where “A” is 3 for the objects associated with DALI groups, and 4 with DALI channels, “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI group address (00-15) in decimal (00 for DALI channels). Examples: Group 5 on channel 1 has the instance number 3005, and channel 4 has the instance number 4300.

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Status*".

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property reports the percentage of failed ballasts on the corresponding group/channel.

A ballast failure is reported if either

- The bus power for the related DALI channel fails,
- the DALI ballast is not reachable via the DALI channel, or
- the DALI ballast reports a failure (e.g. lamp failure) in its DALI status register.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

Units (Read-Only)

The value of this property is 98 (percent).

Min_Pres_Value (Read-Only)

The value of this property is 0.

Max_Pres_Value (Read-Only)

The value of this property is 100.

Profile_Name (Read-only)

This property has the following values:

- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupActuatorStatus/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelActuatorStatus/v1*"

Device_Failure (Read-Only)

The value of this proprietary property (property ID 529) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device fails (offline or failure reported via DALI status bits) the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Ballast_Failure (Read-Only)

The value of this proprietary property (property ID 530) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports a ballast failure the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Lamp_Failure (Read-Only)

The value of this proprietary property (property ID 531) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports a lamp failure the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Battery_Failure (Read-Only)

The value of this proprietary property (property ID 532) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports a battery failure (self-contained emergency lights only) the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Function_Test_Failure (Read-Only)

The value of this proprietary property (property ID 533) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports a function test failure (self-contained emergency lights only) the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Duration_Test_Failure (Read-Only)

The value of this proprietary property (property ID 534) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports a duration test failure (self-contained emergency lights only) the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel.

Digital_Input_Override (Read-Only)

The value of this proprietary property (property ID 571) is a 64-bit wide BIT STRING. It contains one bit for each ballast on the channel. If the device reports an override by a digital input (LDALI RM8) the bit is set, otherwise it is cleared.

Only present if the object is associated with a DALI channel

Bus_Power (Read-Only)

The value of this proprietary property (property ID 563) is *enabled* (active) if the internal bus power is active for the channel and *disabled* (inactive) if not.

Bus_Power_Failure (Read-Only)

The value of this proprietary property (property ID 564) is *failed* (active) if a DALI bus power failure was detected on the channel or *ok* (inactive) if the DALI bus power is present. A bus power failure is detected independent on whether an internal or an external DALI bus power supply is used.

Bus_Power_Overload (Read-Only)

The value of this proprietary property (property ID 565) is *overload* (active) if the internal DALI bus power failed due to an overload or *normal* (inactive) if the internal DALI bus power is either disabled/not present or working properly.

Intrinsic reporting

The object supports all properties required for intrinsic reporting. Per default no alarms are enabled.

8.2.2.16 Multi-State Output Object – Commands for DALI ballast, group, or channel

This object is used to issue commands to DALI ballasts, DALI groups and DALI channels. It has states for scene control, burn-in mode, resetting run-hours and energy counters, emergency light testing, relative dimming (up/down) and changing the colour temperature (see Table 19).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	Unsigned	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Out_Of_Service	81	BOOLEAN	W	
Number_Of_States	74	Unsigned	R	
State_Text	110	BACnetARRAY[N]of CharacterString	W	
Priority_Array	87	BACnetPriorityArray	R	
Relinquish_Default	104	Unsigned	R	
Profile_Name	168	CharacterString	R	

Table 19: Properties of the Multi-State Output object used for commanding DALI devices, groups and channels.

Object_Identifier (Read-Only)

The default instance number is ABCC, where “A” is 3 for the objects associated with DALI devices and 4 for the objects associated with DALI groups, and 5 with DALI channels, “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI device number (00-63) or the DALI group address (00-15) respectively in decimal (00 for DALI channels). Examples: Group 5 on channel 1 has the instance number 4005, and channel 4 has the instance number 5300.

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Command*".

Object_Type (Read-Only)

The value of this property is MULTISTATE_OUTPUT (14).

Present_Value (Read/Write)

The *Present_Value* property can have the following values:

NO COMMAND (1): No command is executed.

RECALL SCENE XX (2-17): Where XX is 00-15. Results in recalling the DALI scene XX by sending the DALI "GO TO SCENE" command to the DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

STORE SCENE XX (18-33): Where XX is 0-15. Results in the current values being stored as scene XX by sending the DALI "STORE THE DTR AS SCENE" command to the DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

CLEAR SCENE XX (34-49): Where XX is 0-15. Results in scene XX being erased by sending the DALI "REMOVE FROM SCENE" command to the DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

START BURN IN (50): Start the burn-in mode on the DALI ballasts, all DALI ballasts in the group or all DALI ballasts on the channel, which is associated with this Multi-State Output object. Some lamps require a burn-in time during which they must not be dimmed. The burn-in time is defined by the corresponding configuration property – e.g. *nciBurnInTime* (LONMARK) or *Burn_In_Time* (BACnet) – of the corresponding channel fieldbus object. During this time the lamps will only be switched to on (100%) or off (0%) but not dimmed. For more information on the burn-in functionality see Section 8.2.2.8.

STOP BURN IN (51): Abort burn-in mode.

RESET RUN HOURS (52): Reset the run hours of the the DALI ballasts, all DALI ballasts in the group or all DALI ballasts on the channel, which is associated with this Multi-State Output object. For more information on the run hours monitoring functionality see Section 8.2.2.7.

RESET ENERGY COUNT (53): Reset the energy counter of the DALI ballasts, all DALI ballasts in the group or all DALI ballasts on the channel, which is associated with this Multi-State Output object. For more information on the energy monitoring functionality see Section 8.2.2.7.

START EMERGENCY FUNCTION TEST (54): Start function test of self-contained emergency lights supporting this function. Depending on the associated Multi-State Output object the function test is started on the DALI self-contained emergency light, all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports execution of a function test. For more information on testing of emergency lights see Section 8.2.2.5.

START EMERGENCY DURATION TEST (55): Start duration test of self-contained emergency lights supporting this function. Depending on the associated Multi-State Output object the duration test is started on the DALI self-contained emergency light, all DALI self-

contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether the ballast supports execution of a duration test. For more information on testing of emergency lights see Section 8.2.2.5.

STOP EMERGENCY TESTS (56): Abort any function and duration test currently executed or pending.

UP (57): Ramp up (fade with constant rate) until command STOP is issued or 100% is reached. Do not switch on if lights are off. Affects DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

ON AND UP (58): Ramp up (fade with constant rate) until command STOP is issued or 100% is reached. Switch on if lights are off. Affects DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

DOWN (59): Ramp down (fade with constant rate) until command STOP is issued or minimum dim level is reached. Affects DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

DOWN AND OFF (60): Ramp down (fade with constant rate) until command STOP is issued or 0% dim level is reached. Affects DALI device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

STOP (61): Stop any dim process.

COLOUR WARMER (62): Ramp down[1] (with constant rate) colour temperature until command STOP is issued or minimum colour temperature is reached. Affects DALI ballast, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object. Only affects DALI ballasts supporting Tc colour control as specified by IEC 62386-209. For more information on colour control see Section 8.2.2.10.

COLOUR COOLER (63): Ramp up[2] (with constant rate) colour temperature until command STOP is issued or maximum colour temperature is reached. Affects DALI ballast, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object. Only affects DALI ballasts supporting Tc colour control as specified by IEC 62386-209. For more information on colour control see Section 8.2.2.10.

IDENTIFY (64): Send the IDENTIFY command (WINK feature). Affects DALI-device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

OFF (65): Send the OFF-command to device. Affects DALI-device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

GOTO LAST ACTIVE LEVEL (66): Recall the last recent active level. Affects DALI-device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

EMERGENCY LIGHT REST (67): Self-contained emergency lights are switched into REST-mode. Affects DALI self-contained emergency light, all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel.

[1] A lower colour temperature value (in degree Kelvin) is considered a warmer colour.

[2] A higher colour temperature value (in degree Kelvin) is considered a cooler colour.

Please refer to the documentation of the ballast vendor to determine whether a ballast supports this mode. For more information on testing of emergency lights see Section 8.2.2.5.

EMERGENCY LIGHT INHIBIT (68): Self-contained emergency lights are switched into INHIBIT-mode. Affects DALI self-contained emergency light, all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports this mode. For more information on testing of emergency lights see Section 8.2.2.5.

EMERGENCY LIGHT RESET INHIBIT (69): Self-contained emergency lights are forced to leave REST- or INHIBIT-mode. Affects DALI self-contained emergency light, all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. Please refer to the documentation of the ballast vendor to determine whether a ballast supports this mode. For more information on testing of emergency lights see Section 8.2.2.5.

QUERY DALI DATA (70): This command forces an update of the DALI-data. The information is queried from the DALI-devices. Affects DALI-device, DALI group address or DALI broadcast address, which is associated with this Multi-State Output object.

EMERGENCY LIGHT RESET TEST DONE FLAGS (71): The corresponding bits for executed duration or function test are cleared. Affects DALI self-contained emergency light, all DALI self-contained emergency lights in the group or all DALI self-contained emergency lights on the channel. For more information on testing of emergency lights see Section 8.2.2.5.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property of this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

Number_Of_States (Read-Only)

This property has the value 63.

State_Text (Read/Write)

Per default this property contains the strings defined for the states in the description of the *Present_Value* property (e.g. NO_COMMAND, RECALL SCENE XX, etc.).

Profile_Name (Read-only)

This property has the following values:

- DALI ballasts: "*178-http://www.loytec.com/xsd/DALILampCommand/v1*"

- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupCommand/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelCommand/v1*"

8.2.2.17 Analog Input Object – Battery Status of DALI emergency ballast, group, or channel

This object is used to report the current battery charge status of self-contained emergency lights (see Table 14). For more information on emergency lighting functionality see Section 8.2.2.5).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Profile_Name	168	CharacterString	R	
Battery_Rated_Duration	578	REAL	R	✓

Table 20: Properties of the Analog Input object providing battery status from self-contained emergency lights.

Object_Identifier (Read-Only)

The default instance number is ABCC, where "A" is 6 for the objects associated with DALI devices and 7 for the objects associated with DALI groups, and 8 with DALI channels, "B" is the DALI interface number (0-3) in decimal, and "CC" is the DALI device number (00-63) or the DALI group address (00-15) respectively in decimal (00 for DALI channels). Examples: Group 5 on channel 1 has the instance number 7005, and channel 4 has the instance number 8300.

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Output object with the addition "*Battery_Charge*".

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property, of type REAL, indicates the battery charge status (0...100.00%) of a self-contained DALI emergency light. For objects associated to groups or channels this property

reports the minimum value of all self-contained emergency lights in the group or channel, respectively.

Device_Type (Read-Only)

This property contains the value "*Battery Charge*".

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

Units (Read-Only)

The value of this property is 98 (percent).

Min_Pres_Value (Read-Only)

The value of this property is 0.

Max_Pres_Value (Read-Only)

The value of this property is 100.

Profile_Name (Read-only)

This property has the following values:

- DALI lamps: "*178-http://www.loytec.com/xsd/DALILampBatteryCharge/v1*"
- DALI groups: "*178-http://www.loytec.com/xsd/DALIGroupBatteryCharge/v1*"
- DALI channels: "*178-http://www.loytec.com/xsd/DALIChannelBatteryCharge/v1*"

Battery_Rated_Duration (Read-only)

This property, of type REAL, indicates the rated duration (in minutes) of the battery of a self-contained DALI emergency light.

8.2.2.18 Multi-State Input Object – Emergency State of DALI emergency ballast

This object is used to report the current emergency state of self-contained emergency lights. For more information on emergency lighting functionality see Section 8.2.2.5).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	Unsigned	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Out_Of_Service	81	BOOLEAN	W	
Number_Of_States	74	Unsigned	R	
Description	28	CharacterString	R	
Device_Type	31	CharacterString	R	
Interface_Value	387	Unsigned		
Reliability	103	BACnetReliability	R	
State_Text	110	BACnetARRAY[N] of CharacterString	W	
Profile_Name	168	CharacterString	R	
Emergency_Status	575	BIT STRING	R	✓
Emergency_Mode	576	BIT STRING	R	✓
Emergency_Failure_Status	577	BIT STRING	R	✓

Table 21: Properties of the Multi-State Input object Emergency_State for self-contained emergency lights.

Object_Identifier (Read-Only)

The default instance number is AABCC, where “AA” is 28 for the Emergency_State object, “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI device number (00-63). Examples: Emergency_State of lamp 5 on channel 1 has the instance number 28005, and Emergency_State of lamp 0 on channel 4 has the instance number 28300.

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated multi-state input object with the addition “*Emergency_State*”.

Object_Type (Read-Only)

The value of this property is MULTISTATE_INPUT (13).

Present_Value (Read-Only)

This property, of type Unsigned, indicates the emergency state of a self-contained DALI emergency light.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

Profile_Name (Read-only)

This property has the following values:

DALI lamps: "*178-http://www.loytec.com/xsd/EmergencyState/v1*"

8.2.3 Sensor Objects

The L-DALI provides objects for 16 DALI sensors per channel. Each sensor is represented by

- an Analog Input object providing the lux level measured by the sensor and
- a Binary Input object providing the occupancy state determined by the sensor.

8.2.3.1 Sensor Calibration

To provide a reliable measurement the light sensor needs to be calibrated. The calibration is best performed with the LINX Configurator software (see LINX Configurator User Manual [2]) or using the Web Interface (see LOYTEC Device User Manual [1]).

8.2.3.2 Analog Input Object – DALI Light Sensor

This object is used to represent the light sensor part of a DALI Sensor (see Table 22). There is a maximum of 16 such objects per channel.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Device_Type	31	CharacterString	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	✓
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	
Lux_2	557	REAL	R	✓

Table 22: Properties of the Analog Input object representing a DALI lux level sensor.

Object_Identifier (Read-Only)

The default instance number is 5BCC, where “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI device number (00-15). Example: DALI sensor 4 on channel 2 has the instance number 5104.

Object_Name (Read/Write)

This property holds the name of the DALI sensor. It can be changed via the Web-UI.

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property reports the current light level reported by the sensor corrected by the calibration function configured via the gain table (see Section 8.2.3.1).

Device_Type (Read-Only)

This property contains the type of DALI sensor (e.g. “Tridonic Sensor”).

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No sensor assigned or some failure reported by the DALI sensor (no light value reported).
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Units (Read-Only)

The value of this property is 37 (lux).

Min_Pres_Value (Read-Only)

The value of this property is 0.

Max_Pres_Value (Read-Only)

The value of this property is “Infinity”.

Profile_Name (Read-only)

The value of this property is “*178-http://www.loytec.com/xsd/DALILightSensor/v1*”.

Lux_2 (Read-only)

If the assigned sensor provides multiple lux level sensor values this property (property ID 557) reports the current second light level value reported by the sensor. No gain table correction is applied.

Intrinsic reporting

The object supports all properties required for intrinsic reporting. Per default only fault alarms are enabled.

8.2.3.3 Analog Input Object – DALI Sensor Temperature

This object is used to represent the temperature part of a DALI Sensor (see Table 23). It is not available in the standard interface, but has to be activated in the project settings (see Figure 118: BACnet interface configuration.).

There is a maximum of 16 such objects per channel.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	

Table 23: Properties of the Analog Input object representing a DALI temperature sensor.

Object_Identifier (Read-Only)

The default instance number is 13BCC, where “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI device number (00-15). Example: DALI sensor 4 on channel 2 has the instance number 13104.

Object_Name (Read/Write)

This property holds the name of the DALI sensor. It can be changed via the Web-UI.

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property reports the current temperature reported by the sensor.

Device_Type (Read-Only)

This property contains the type of DALI sensor (e.g. “Tridonic Sensor”).

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No sensor assigned or some failure reported by the DALI sensor (no light value reported).
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Units (Read-Only)

The value of this property is 62 (°C).

Min_Pres_Value (Read-Only)

The value of this property is “Infinity”..

Max_Pres_Value (Read-Only)

The value of this property is “Infinity”.

Profile_Name (Read-only)

The value of this property is “*178-http://www.loytec.com/xsd/DALISensorTemperature/v1*”.

Intrinsic reporting

The object supports all properties required for intrinsic reporting. Per default only fault alarms are enabled.

8.2.3.4 Analog Input Object – DALI Sensor Humidity

This object is used to represent the humidity part of a DALI Sensor (see Table 24). It is not available in the standard interface, but has to be activated in the project settings (see Figure 118: BACnet interface configuration.).

There is a maximum of 16 such objects per channel.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Device_Type	31	CharacterString	R	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	
Units	117	BACnetEngineeringUnits	R	
Min_Pres_Value	69	REAL	R	
Max_Pres_Value	65	REAL	R	
COV_Increment	22	REAL	W	
Time_Delay	113	Unsigned	W	
Notification_Class	17	Unsigned	W	
High_Limit	45	REAL	W	
Low_Limit	59	REAL	W	
Deadband	25	REAL	W	
Limit_Enable	52	BACnetLimitEnable	W	
Event_Enable	35	BACnetEventTransitionBits	W	
Acked_Transitions	0	BACnetEventTransitionBits	W	
Notify_Type	72	BACnetNotifyType	W	
Event_Time_Stamps	130	BACnetARRAY[3] of BACnetTimeStamp	R	
Profile_Name	168	CharacterString	R	

Table 24: Properties of the Analog Input object representing a DALI humidity sensor.

Object_Identifier (Read-Only)

The default instance number is 14BCC, where “B” is the DALI interface number (0-3) in decimal, and “CC” is the DALI device number (00-15). Example: DALI sensor 4 on channel 2 has the instance number 14104.

Object_Name (Read/Write)

This property holds the name of the DALI sensor. It can be changed via the Web-UI.

Object_Type (Read-Only)

The value of this property is ANALOG_INPUT (0).

Present_Value (Read-Only)

This property reports the current light level reported by the sensor corrected by the calibration function configured via the gain table (see Section 8.2.3.1).

Device_Type (Read-Only)

This property contains the type of DALI sensor (e.g. “Tridonic Sensor”).

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No sensor assigned or some failure reported by the DALI sensor (no light value reported).
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Units (Read-Only)

The value of this property is 98 (%).

Min_Pres_Value (Read-Only)

The value of this property is “0%”.

Max_Pres_Value (Read-Only)

The value of this property is “100%”

Profile_Name (Read-only)

The value of this property is “*178-http://www.loytec.com/xsd/DALISensorHumidity/v1*”.

Intrinsic reporting

The object supports all properties required for intrinsic reporting. Per default only fault alarms are enabled.

8.2.3.5 Binary Input Object – DALI Occupancy sensor

This object is used to represent the occupancy sensor part of a DALI Sensor (see Table 25). There is a maximum of 16 such objects per channel.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	BACnetBinaryPV	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Polarity	84	BACnetPolarity	W	
Inactive_Text	46	CharacterString	W	
Active_Text	4	CharacterString	W	
Profile_Name	168	CharacterString	R	
Debounce	535	Unsigned	W	✓
Unoccupied_Delay	536	Unsigned	W	✓
Heartbeat	558	Unsigned	W	✓
Pir_Sensitivity	572	Real	W	✓
Acoustic Sensitivity	573	Real	W	✓

Table 25: Properties of the Binary Input object representing a DALI occupancy sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*Occupancy*".

Object_Type (Read-Only)

The value of this property is BINARY_INPUT (3).

Present_Value (Read-Only)

This property reports the occupancy status. If the *Polarity* property is *NORMAL* the occupied state corresponds to *ACTIVE*, while the unoccupied state corresponds to *INACTIVE*.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR	No sensor assigned or some failure reported by the DALI sensor (no occupancy value reported).
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Profile_Name (Read-only)

The value of this property is "*178-http://www.loytec.com/xsd/DALIOccupancy Sensor/v1*".

Debounce (Read/Write)

The value of this proprietary property (property ID 535) specifies the debouncing time in seconds (see Section 8.1.3.1).

Unoccupied_Delay (Read/Write)

The value of this proprietary property (property ID 536) determines the delay in seconds after which the state changes to unoccupied. The timer is armed each time the value reported by the sensor changes from occupied to unoccupied. A value of 0 disables the unoccupied delay.

Heartbeat (Read/Write)

The value of this proprietary property (property ID 558) determines the maximum period of time that expires before the object automatically updates its *Present_Value*. This allows using the *Present_Value* as occupancy event input to a constant light controller object.

Pir_Sensitivity (Read/Write)

The value of this proprietary property (property ID 572) determines the sensitivity of the occupancy sensor (acc. IEC62368-303). A value of 0 disables the detection method.

Acoustic_Sensitivity (Read/Write)

The value of this proprietary property (property ID 573) determines the sensitivity of the acoustic precense detection. A value of 0 disables the detection method.

8.2.3.6 CharacterString Value and Analog Value Objects– iBeacon

The objects *UUID*, *Major* and *Minor* are used to represent the iBeacon sensor part of a DALI Sensor (see Figure 123, Table 26 and Table 27). There is a maximum of 16 such objects per channel.

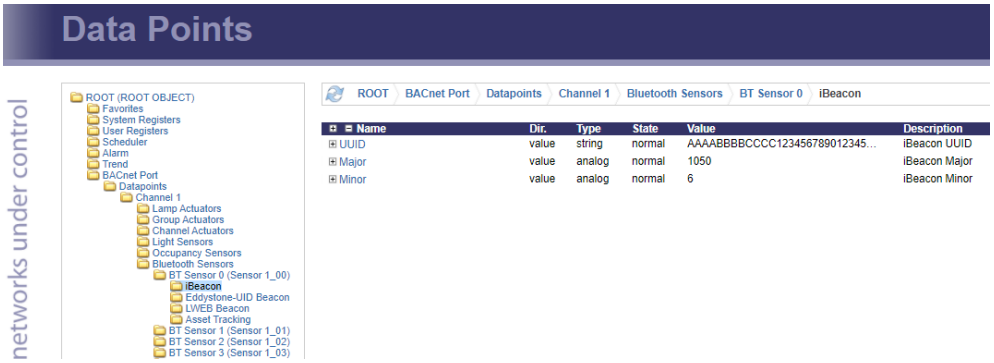


Figure 123: BACnet datapoints for iBeacon

UUID:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	CharacterString	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 26: Properties of the String value objects representing the iBeacon-UUID of a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*iBeacon UUID*".

Object_Type (Read-Only)

The value of this property is CHARACTERSTRING_VALUE (40).

Present_Value (Read/Write)

This property represents the UUID of the iBeacon.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No sensor assigned or some failure reported by the sensor

COMMUNICATION_FAILURE Sensor offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

"178-http://www.loytec.com/xsd/DALIBluetoothIBeaconUuid/v1"

Major, Minor:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	Real	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 27: Properties of the Analog value objects representing the iBeacon-Major and iBeacon-Minor of a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*iBeacon Major*" or "*iBeacon Minor*".

Object_Type (Read-Only)

The value of this property is ANALOG_VALUE (2).

Present_Value (Read/Write)

This property represents the Major or Minor number of the iBeacon.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No sensor assigned or some failure reported by the sensor

COMMUNICATION_FAILURE Sensor offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

"178-http://www.loytec.com/xsd/DALIBluetoothIBeaconMajor/v1"

"178-http://www.loytec.com/xsd/DALIBluetoothIBeaconMinor/v1"

8.2.3.7 CharacterString Value Objects – Eddystone-UID Beacon

The objects *Name* and *Instance* are used to represent the Eddystone-UID beacon part of a sensor (see Figure 124 and Table 28). There is a maximum of 16 such objects per channel.

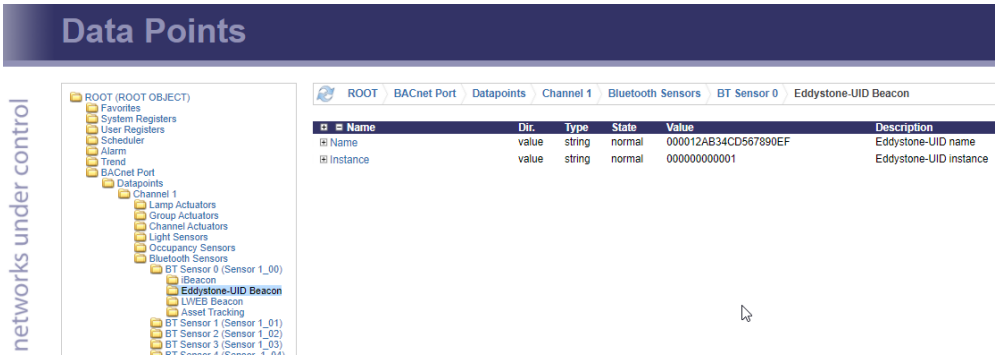


Figure 124: BacNet datapoints for Eddystone-UID beacon

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	CharacterString	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 28: Properties of the String value objects representing the EddyStone Namespace and Instance of a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*Eddystone-UID Name*" or "*Eddystone-UID Instance*".

Object_Type (Read-Only)

The value of this property is CHARACTERSTRING_VALUE (40).

Present_Value (Read/Write)

This property represents the Namespace or Instance of the Eddystone UID beacon.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No sensor assigned or some failure reported by the sensor

COMMUNICATION_FAILURE Sensor offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

"178-http://www.loytec.com/xsd/DALIBluetoothEddystoneBeaconName/v1"

"178-http://www.loytec.com/xsd/DALIBluetoothEddystoneBeaconInstance/v1"

8.2.3.8 CharacterString Value and Multistate Value Objects – LWEB Beacon

This objects *LocalName*, *ClientConfig*, *View1* and *View2* are used to represent the LWEB Beacon part of a sensor (see Figure 125, Table 29 and Table 30). There is a maximum of 16 such objects per channel.

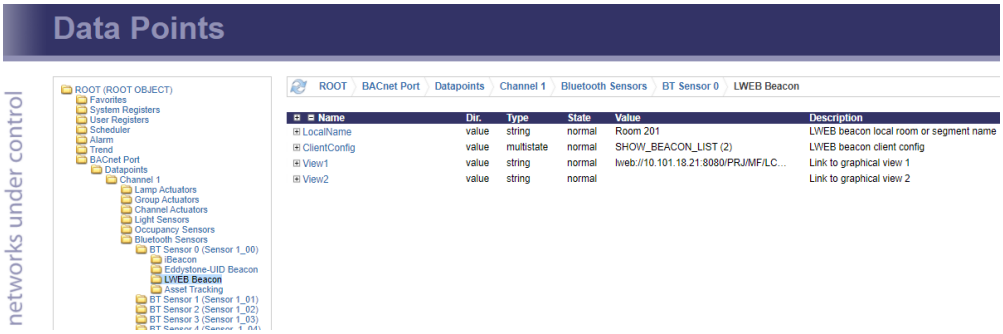


Figure 125: BACnet datapoints for LWEB beacon

LocalName, View1, View2:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	CharacterString	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 29: Properties of the String value objects representing the LWEB beacon LocalName of a sensor and the links to graphical views View1 or View2.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*Local Name*", *"View1"* or *"View2"*.

Object_Type (Read-Only)

The value of this property is CHARACTERSTRING_VALUE (40).

Present_Value (Read/Write)

This property represents the LocalName of the LWEB-beacon or contains the links to graphical views.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No sensor assigned or some failure reported by the sensor

COMMUNICATION_FAILURE Sensor offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

"178-http://www.loytec.com/xsd/DALIBluetoothLwebBeaconLocalName/v1"

"178-http://www.loytec.com/xsd/DALIBluetoothLwebBeaconView1/v1"

"178-http://www.loytec.com/xsd/DALIBluetoothLwebBeaconView2/v1"

Client Config:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	MulitState	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 30: Properties of the multistate value objects representing the Client Configuration of the LWEB beacon of a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*Client Config*".

Object_Type (Read-Only)

The value of this property is MULTISTATE_VALUE (19).

Present_Value (Read/Write)

This property can have the values:

IGNORE BEACON (1): The beacon shall be ignored by the LWEB app.

BEACONS SORTED BY RSSI (2): The beacons in the list of the LWEP app shall be sorted by RSSI.

AUTOSTART PROJECT WITH STRONGEST BEACON SIGNAL (3): The app shall autoconnect to the strongest beacon.

Others: reserved for future use

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN	Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No sensor assigned or some failure reported by the sensor
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Profile_Name (Read-only)

“178-http://www.loytec.com/xsd/DALIBluetoothLwebBeaconClientConfig/v1”

8.2.3.9 CharacterString Value and Analog Output Object– Asset Tracking

The objects *AssetData* and *Asset Count* are used to represent the asset tracking sensor part of a multisensor (see Figure 126, Table 30 and Table 31). There is a maximum of 16 such objects per channel.

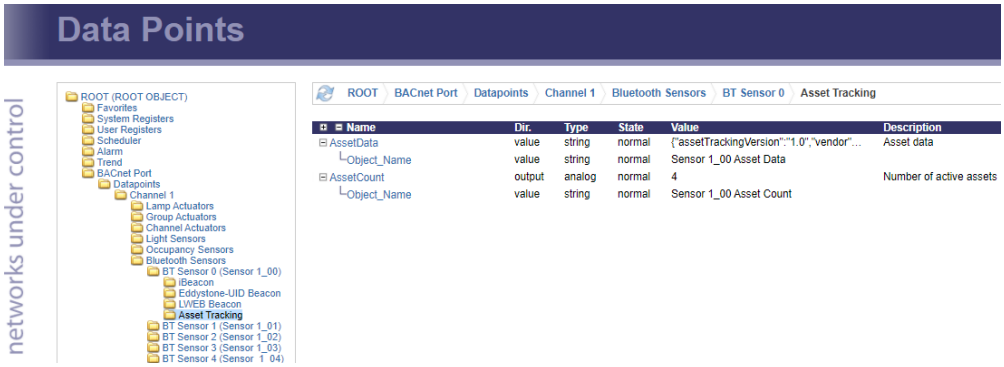


Figure 126: BACnet datapoints for Asset Tracking

AssetData:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	CharacterString	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	W	

Table 31: Properties of the CharacterString value objects representing tracked data of a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*Asset Data*".

Object_Type (Read-Only)

The value of this property is CHARACTERSTRING_VALUE (40).

Present_Value (Read/Write)

This property represents the data of assets scanned by the sensor.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No sensor assigned or some failure reported by the sensor

COMMUNICATION_FAILURE Sensor offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

"178-http://www.loytec.com/xsd/DALIBluetoothAssetTrackingAssetData/v1"

AssetCount:

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	Real	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Profile_Name	168	CharacterString	R	

Table 32: Properties of the Analog Output object representing the number of active assets found by a sensor.

Object_Identifier (Read-Only)

The instance number is equal to the instance number of the corresponding Analog Input object (see Section 8.2.3.2).

Object_Name (Read-Only)

This property holds the value of the *Object_Name* of the associated Analog Input object with the addition "*AssetCount*".

Object_Type (Read-Only)

The value of this property is ANALOG_OUTPUT (1).

Present_Value (Read)

This property, of type REAL, indicates the number of scanned assets pf a sensor.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No sensor assigned or some failure reported by the sensor
COMMUNICATION_FAILURE	Sensor offline.
UNRELIABLE_OTHER	Other failure detected.

Profile_Name (Read-only)”

“178-http://www.loytec.com/xsd/DALIBluetoothAssetTrackingAssetCount/v1”

8.2.4 Constant Light Controller

The L-DALI provides 16 constant light controller instances with built in occupancy controller functionality for each DALI channel. Every instance is represented by a BACnet Loop object.

8.2.4.1 Interaction with other BACnet Objects

When using local DALI sensors and/or DALI groups internal manual CLC bindings can be configured in the DALI Parameters tab of the LINX Configurator software (see LINX Configurator User Manual [2]) or the Web-Interface (see Section 8.4.1). The Web-Interface for CLC Bindings can also be used to verify the current status of all bindings (internal and NVs).

Alternatively, the Loop Object allows automatically retrieving its input values from and writing its output values to other BACnet server objects. To reference the property and server object it provides properties of type *BACnetObjectPropertyReference*. Specifically these are:

- *Manipulated_Variable_Reference*: Writing *Present_Value* (Constant Light Controller output, e.g. to Analog Output controlling DALI lights, see Section 8.2.2.11).
- *Controlled_Variable_Reference*: Reading lux level input (e.g. from DALI lux level sensor, see Section 8.2.3.2).
- *Setpoint_Reference*: Reading setpoint value.
- *Occupancy_Variable_Reference* (property ID 537): Reading occupancy input (e.g. from DALI occupancy sensor, see Section 8.2.3.5), take also care on the usage of the *Hold_Time* (see Section 8.2.4.6).

Note, that the referenced server object must be local.

8.2.4.2 Setpoint

The desired setpoint for the illumination level is configured via the property *Setpoint*.

8.2.4.3 Operating Modes

The operating mode of the constant light controller is set via the proprietary property *Mode* (property ID 539). The main modes are:

- REGULATOR: closed loop constant lighting control using an local light sensor as direct feedback for the illuminance (typ.: indoor sensor in a room)
- CONTROL: open loop lighting control using an global light sensor as set point indicator for light level for the luminaires (typ.: sensor for outdoor illuminance)
- PRESENCE: no lighting control. This mode works with fixed output levels.

These basic modes may have different behaviors on how automatic lighting control is switched On/Off and how overrides of automatic dimming is handled. Table 33 shows the different operating modes and under which conditions they are used:

Parameter / Mode	Automatic Dimming based on Local Lightsensor	Automatic Dimming based on Global Lightsensor	Occupancy Sensor	Lighting Control: ON-Event	Lighting Control: OFF-Event	Override Automatic Dimming (Button)	Relinquish Override
REGULATOR (1)	✓	-	✓	Occ	UnOcc	✓	Man
REGULATOR_NO_OCC (5)	✓	-	-	Man	Man	✓	Man
REGULATOR_AUTO (8)	✓	-	✓	Occ	UnOcc	✓	UnOcc
REGULATOR_BEDROOM (12)	✓	-	✓	Occ	UnOcc	✓	UnOcc/NotOff
REGULATOR_MANUAL (14)	✓	-	✓	Man	UnOcc	✓	Man
REGULATOR_MANUAL_LUX (16)	✓	-	✓	Man	Lux	✓	Man
REGULATOR_NO_MANUAL (18)	✓	-	✓	Occ	UnOcc	-	Man
CONTROL (2)	-	✓	✓	Occ	UnOcc	✓	Man
CONTROL_NO_OCC (6)	-	✓	-	Man	Man	✓	Man
CONTROL_AUTO (9)	-	✓	✓	Occ	UnOcc	✓	UnOcc
CONTROL_BEDROOM (13)	-	✓	✓	Occ	UnOcc	✓	UnOcc/NotOff
CONTROL_MANUAL (15)	-	✓	✓	Man	UnOcc	✓	Man
CONTROL_MANUAL_LUX (17)	-	✓	✓	Man	Lux	✓	Man
CONTROL_NO_MANUAL (19)	-	✓	✓	Occ	UnOcc	-	Man
PRESENCE (4)	-	-	✓	Occ	UnOcc	✓	Man
PRESENCE_AUTO (10)	-	-	✓	Occ	UnOcc	✓	UnOcc
PRESENCE_NO_MANUAL (20)	-	-	✓	Occ	UnOcc	-	Man
MANUAL_ON_AUTO_OFF (7)	-	-	✓	Man	Occ	✓	Man
AMBIENT (11)	O	O	-	Lux	Lux	✓	Man
UPDATER (3)	O	O	O	-	-	-	-

Table 33: Constant Light Controller Operating Modes

✓… in use; O … optional; Man … Manually, Occ … Occupied; UnOcc … UnOccupied, UnOcc/NotOff … UnOccupied if Light is not Off; Lux …at defined LuxLevel,

Note: *Changing CLC operating mode during runtime is not allowed, after mode setup a reboot is required to initialize the CLC correctly.*

Regulator Mode

The REGULATOR mode has to be selected if the installed light sensor measures the indoor illuminance of the area of interest and this quantity is directly used as actual value for a closed loop control. The constant light controller receives the current indoor lux level via the property *Controlled_Variable_Value* and adjusts the lamp level (from 0% to 100%) by means of a fuzzy control algorithm.

When the light is switched on the control algorithm tries to select a lamp value which results in a lux level close to the desired setpoint, the minimum starting value is defined by *OccupiedLevel.* After a minute at this value the control algorithm becomes active and adjusts

the lamp value in increments once every second until the configured setpoint is reached. The size of increments is adjusted dynamically but will never exceed the percentage value defined in the configuration property *StepValue* (property ID 544) (Exception: at least one luminaire in the group controlled by the CLC is in burn-in mode).

Note: *Setting the OccupiedLevel to invalid, will always result in switching on to the calculated value, which is effected by the difference between Controlled_Variable_Value and Setpoint as well as Gain.*

The regulator mode is available in different flavors:

- **With or without occupancy sensor**: If an occupancy sensor is installed and the room becomes unoccupied, the current light level is saved and the light is dimmed to unoccupied level (see Section 8.2.4.8). If the room becomes occupied before the light has reached the unoccupied level, the saved light level is restored.

- **With automatic relinquish of manual override**: A manual override will be automatically relinquished when the room becomes unoccupied. In a special bedroom mode the automatic relinquish will only take place if the lights are on. If they were switched off manually, the controller does not return to automatic mode when the area turns unoccupied.

- **With manual activation**: In this flavor, the automatic lighting control must be manually activated (e.g. via a button) and lights will not be switched on automatically when the room becomes occupied. To give the user some visual feedback lights will be switched on, even if the light level in the room is above the setpoint, whenever the automatic mode is activated (either via a data point or via a DALI button). When the room becomes unoccupied the automatic mode is deactivated (REGULATOR_MANUAL). In the REGULATOR_MANUAL_LUX flavor, the lighting control is deactivated whenever lights are switched off (e.g. due to the natural light being above the setpoint).

Control Mode

The CONTROL mode has to be selected if the installed light sensor measures the outdoor illumination and this quantity shall be used as reference value for an open loop lighting control. The constant light controller receives the current outdoor lux level via the property *Controlled_Variable_Value* and sets the lamp level (from 0% to 100%) accordingly (see Figure 102).

The proprietary property *Step_Value* (property ID 544) ensures that the light level does not change abruptly. Per second the light level is not changed more than the percentage value defined by this configuration property. When the light is switched on or off, *Step_Value* is not taken into account.

To ensure that the setpoint is reached under all weather conditions, the control curve shown Figure 102 has to be adjusted by calibrating the constant light controller.

The control mode is available in different flavors:

- **With or without occupancy sensor**: If an occupancy sensor is installed and the room becomes unoccupied, the current light level is saved and the light is dimmed to unoccupied level (see Section 8.2.4.8). If the room becomes occupied before the light has reached the unoccupied level, the saved light level is restored.

- **With automatic relinquish of manual override**: A manual override will be automatically relinquished when the room becomes unoccupied. In a special bedroom mode the automatic relinquish will only take place if the lights are on. If they were

switched off manually, the controller does not return to automatic mode when the area turns unoccupied.

- **With manual activation**: In this flavor, the automatic lighting control must be manually activated (e.g. via a button) and lights will not be switched on automatically when the room becomes occupied. To give the user some visual feedback lights will be switched on, even if the light level in the room is above the setpoint, whenever the automatic mode is activated (either via a data point or via a DALI button). When the room becomes unoccupied the automatic mode is deactivated. In the CONTROL_MANUAL_LUX flavor, the automatic mode is deactivated whenever lights are switched off (e.g. due to the natural light being above the setpoint).

Presence Mode

In PRESENCE mode the constant light controller shall operate as pure occupancy controller. In this mode the light is switched to the value specified in the proprietary property *Occupied_Level* (property ID 542) if the room is occupied and to the unoccupied level (see Section 8.2.4.8) once the room becomes unoccupied. Different to the Regulator and Control Mode, the light is switched on/off to a constant output level and is not dimmed depending on the current lux level.

Optionally, a light sensor can be used to switch on the light only when the ambient light is below a predefined value (conditional switching). That is, as soon as a light sensor is assigned (optional), the light is switched to the value *Occupied_Level* if the lux level is below *Setpoint* and the room is occupied.

The presence mode is available in different flavors:

- **With or without automatic relinquish of override**: If automatic relinquish is active any manual override will be automatically relinquished when the room becomes unoccupied (PRESENCE_AUTO).

Manual-On/Auto-Off Mode

The MANUAL_ON_AUTO_OFF mode is a variation of the PRESENCE mode. However, in this mode the constant light controller does not switch on the lights when the room becomes occupied. Rather, it switches the lights to the unoccupied level (see Section 8.2.4.8) when the room becomes unoccupied, using the propertiy *Hold_Time* similar to PRESENCE mode.

Lights can be switched on (or off) via some other DALI master (e.g. a DALI push-button).

Ambient Mode

The AMBIENT mode is used if effect lighting (e.g. lights in a shop window, facade lighting, floor lights etc.) has to be switched on or off depending on a measured light level. Lights are switched to the value specified in the proprietary property *Occupied_Level* (property ID 542) when the lux level is below *Setpoint* and to the unoccupied level (see Section 8.2.4.8) when lux level is higher than *Setpoint.*

Updater Mode

The UPDATER mode has to be selected when a DALI light/occupancy sensor with constant light controller functionality is installed on the DALI network. In this mode no light level computation is performed. The controller simply forwards the parameters to the DALI constant light controller and retrieves lamp setting from the DALI light sensor.

In general, LOYTEC does not recommend using UPDATER mode. Wherever possible use REGULATOR or CONTROL mode instead and use DALI sensors only as lux level and

occupancy information source via the corresponding sensor objects. These modes allow improved influence of the constant light controller's parameters via the fieldbus side.

8.2.4.4 Prioritized Control

Manual override of the constant light controller can be accomplished in multiple ways:

- Using the priority array of the controlled lamp actuator Analog Output object using a higher priority than the constant light controller.
- Using the *Override* property of the constant light controller Loop object.
- Using a DALI push-button device on groups linked to the constant light controller (see Section 8.2.4.10).
- With a scene recall on groups linked to the constant light controller (see Section 8.2.2.1).

To return to automatic mode the following options exist:

- Set the value of the *Override* property to -1 or invalid.
- Using the button function AUTO of a DALI push-button (e.g. LDALI-BM1) with the destination set to one of the constant light controllers groups (see Section 8.2.4.10).
- Recalling the scene "AUTOMATIC MODE" on the scene controller object of a group linked to the constant light controller (see Section 8.2.2.1).
- When using one of the modes with automatic override relinquish (xxx_AUTO or xxx_BEDROOM) the constant light controller will return to automatic mode when it changes its state to unoccupied.

Whether the constant light controller is in automatic mode or in manual/override mode is reflected by the property *Auto_Mode*.

8.2.4.5 Controlling Multiple Light Bands

The L-DALI constant light controller allows controlling two light bands (groups). The primary light band (Light Band 1) is near the inside of the building, the secondary light band (Light Band 2) is near the window front. Depending on the outdoor light intensity the primary light band has to be brighter than the secondary light band to illuminate the room evenly.

The primary light band is controlled by the *Present_Value* property of the Loop object. Further for both light bands internal bindings to local DALI groups and their corresponding Analog Output objects can be done (see Section 8.4.1).

The maximum difference between the two light bands can be configured via the configuration property *Lamp_2_Offset* as shown in Figure 127. The configuration property *Lamp_2_Limit* defines the light level above which the output values of light band 1 and 2 are identical.

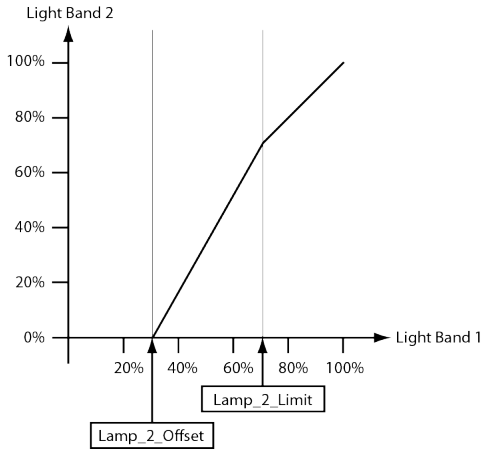


Figure 127: Secondary Light Band

8.2.4.6 Occupancy Detection

The constant light controller receives the occupancy information via the proprietary property *Occupancy_Variable_Value* (property ID 538). How this information is evaluated depends on the hold time configured in the proprietary property *Hold_Time* (propery ID 540).

If a hold time is configured (*Hold_Time* > 0) occupancy evaluation is event based. That is, the constant light controller changes to the occupied state when the value OCCUPIED (1) is received. When the UNOCCUPIED (2) value is received the constant light controller remains in the occupied state until the hold time configured in *Hold_Time* has expired and then changes to the unoccupied state. Further, if no OCCUPIED is received for the time configured in *Hold_Time* the constant light controller changes to the unoccupied state, too.

This behavior typically requires the occupancy sensor to send OCCUPIED with a regular interval (heartbeat). It allows using multiple occupancy sensors with the same constant light controller (fan-in). It is the recommended mode if the occupancy information is received via the local DALI occupancy objects (see Section 8.2.3.5).

If no hold time is configured (*Hold_Time* = 0) occupancy evaluation is state based. That is, the constant light controller changes to the occupied state when the value OCCUPIED is received and to unoccupied state when the value UNOCCUPIED is received.

This behavior is typically required if the occupancy information is only propagated if the state changes (no heartbeat functionality). It does not allow using multiple occupancy (fan-in) sensors without additional logic (e.g. an Occupancy Controller). It is the recommended mode, when using occupancy information from other BACnet devices.

After the light has been switched off any updates on the *Occupancy_Variable_Value* input are ignored for the time specified in *Ignore_Time* (property ID 541).

The current occupancy state calculated by the constant light controller is available via the property *Occupancy_State* (property ID 562).

8.2.4.7 Timing Parameters

To avoid that the constant light controller switches the light on and off repeatedly if the measured lux value is near the setpoint, a hysteresis can be configured. The proprietary property *Off_Hysteresis* (property ID 546) defines the hysteresis for switching off the lamp and the proprietary property *On_Hysteresis* (property ID 545) defines the hysteresis for

switching on the lamp. In addition a delay can be configured before the lamp is switched on (*On_Delay*) or off (*Off_Delay*). Figure 128 illustrates these configuration parameters.

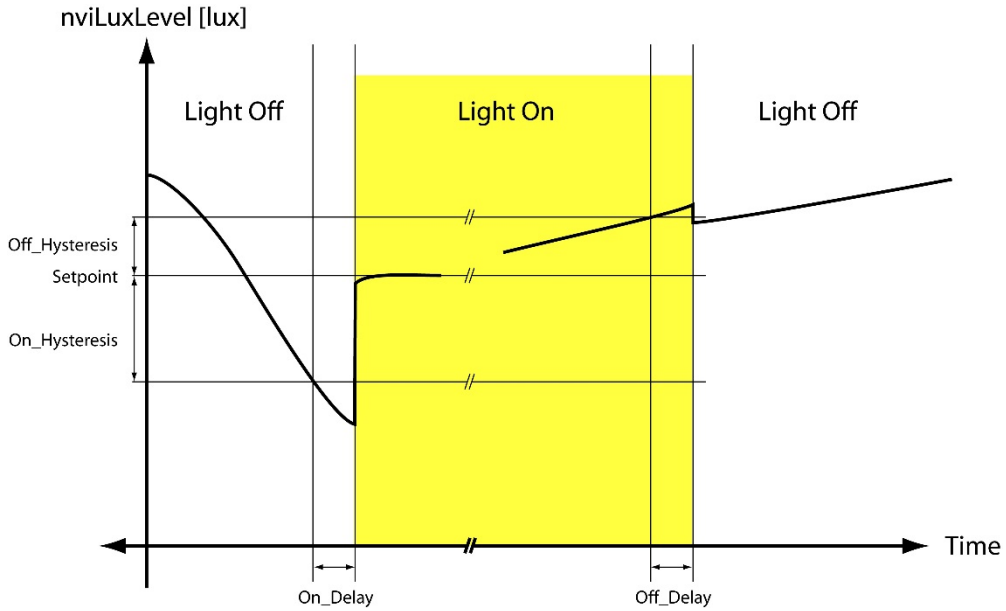


Figure 128: Constant Light Controller Timing.

Clarifications on behavior in REGULATOR and CONTROL mode if *OnHysteresis* and *OffHysteresis* are set to invalid

If *OnHysteresis* is "invalid" and (*Controller_Variable_Value* > *Setpoint*): light is always switched-on (this means that light is switched on on occupancy anyway, regardless of the current light level).

If *OffHysteresis* is "invalid" and (*Controller_Variable_Value* > *Setpoint*): light is not switched-off, this allows to dim down without switching off.

8.2.4.8 Unoccupied Level

If the constant light controller enters unoccupied state (see Section 8.2.4.6) *Unoccupied_Level* (property ID 543) and *Off_Delay* (property ID 547) determine the behavior as shown in Table 34.

Unoccupied_Level	***Off_Delay***	**Behavior**
0	0	Dim down and switch off lights
> 0	0	Dim down lights to value defined in *Unoccupied_Level.*
0	> 0	Dim down to 0.5% and switch off lights after *Off_Delay.*
> 0	> 0	Dim down lights to value defined in *Unoccupied_Level* and switch off lights after *Off_Delay.*

Table 34: Behavior of constant light controller when entering unoccupied state.

In addition the Unoccupied Level is representing the minimum dim level (different from OFF) that can be forced by the CLC. If *Controller_Variable_Value* > *Setpoint* the CLC will dim down to *Unoccupied_Level* before switching off.

8.2.4.9 Neighboring Controllers

In open office space applications, typically the different zones of the space are controlled by independent constant light controller instances. This ensures, that only the zones, which are still occupied are lit. To reduce the contrast between lit and unlit zones in case only a single zone is occupied amidst many unoccupied zones and to increase user comfort in such a scenario, unoccupied zones adjacent to occupied zones shall be lit up at a configurable low light level (*Unoccupied_Level,* property ID 543*)*.

For this purpose each controller needs to know its neighboring controllers. A controller notifies the CLCs configured as neighbors whenever it switches its lights on. Now, the neighboring controllers, which are unoccupied, can switch to *Unoccupied_Level*. Once the CLC switches lights off (e.g. because it becomes unoccupied) it again notifies the configured neighbors, which in turn can switch off as well.

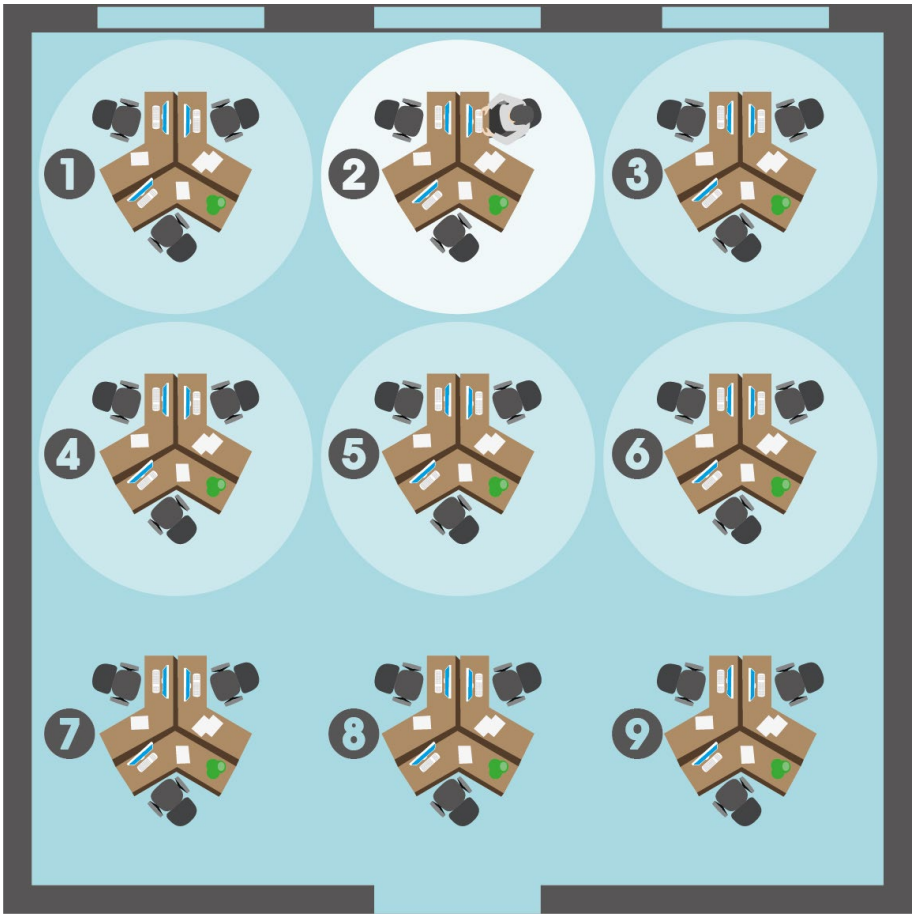


Figure 129: Different zones of an open office space.

Figure 129 shows an example of an open office space with nine zones controlled by independent constant light controller instances. In this example only zone 2 is occupied and fully lit. Zones 1 and 3 to 6 are configured as neighbors of zone 1 and therefore lit at a low dim level, while the remaining zones are switched off.

For each CLC instance up to 16 neighbors can be configured. The neighboring controllers can be configured either via the CLC Bindings page in the web UI (see Section 8.4.1) or via the DALI parameters tab in the LINX Configurator (see LINX Configurator User Manual [2])

8.2.4.10 Interaction with Buttons Functions

When internal CLC bindings are used to control DALI groups an override can also be performed using a button function (see Section 8.4.3) or some other DALI master (like push-buttons etc.) controlling the same groups as the constant light controller.

Whenever the light level of one of the ballasts controlled by the constant light controller is changed by operating a button the constant light controller will detect this and stop controlling the group and enter override mode. Furthermore, the *Present_Value* of the Constant Light Controllers Loop Object will be updated with the new feedback value of the group controlled by the button.

To disable the manual override via buttons and other DALI masters select the constant light controller operating mode REGULATOR_NO_MANUAL, CONTROLER_NO_MANUAL or PRESENCE_NO_MANUAL, respectively. In this case the constant light controller application will continue control the group and enforce its output value.

See Section 8.4.3 on how to configure DALI button functions via the web interface and the LINX Configurator User Manual [2] how to configure them via the DALI Parameters tab of the LINX Configurator software.

8.2.4.11 Interacting with Sunblind Controller

One or more local sunblind controller objects can be linked to a constant light controller object. Typically sunblind controllers are linked to the constant light controller of the same room. If they change the sunblind's position or rotation the sunblind controllers inform the linked constant light controller. The constant light controller uses this information to "ignore" temporary changes of the rooms illumination levels due to the moving sunblinds and, thus, can avoid to switch on lights unnecessarily.

8.2.4.12 Museum Mode

The museum mode is activated by setting an upper limit for the lux level in the room using the proprietary property *Lux_Upper_Limit* (property ID 566). In museum mode the constant light controller cooperates with the linked sunblind controllers to ensure that the measured lux level stays between *Setpoint* and *Lux_Upper_Limit*. Therefore at least one sunblind controller has to be linked to the constant light controller.

If the light intensity in the room needs to be increased to reach the lower setpoint (*Setpoint*) there are two possibilities: Increase the lamp level or open the sunblinds. The proprietary property *Sblnd_Hyst* (property ID 568) defines how much the lamp level is increased or decreased before opening or closing the sunblinds respectively.

8.2.4.13 Human Centric Lighting (HCL)

A circadian daylight algorithm can be activated for each CLC with the help of the proprietary property *HCL_Profile*. The profile defines the behavior of the colour temperature over the day. The colour temperature is applied to the group members (light bands) controlled by the CLC according to the selected *HCL_Profile_x*. Once enabled, this automatic adaption is stopped only by scene recalls, buttons functions affecting the colour temperature or external DALI-commands affecting the colour temperature of the light bands. For reactivation of the circadian daylight control an AUTO event is required.

The data points for the HCL-Profiles are located in the DALI\HCL folder. Each profile can be configured via the *HCL_Profile_x* datapoint. The current value of the profile is represented by the *HCL_Profile_x_Value* datapoint.

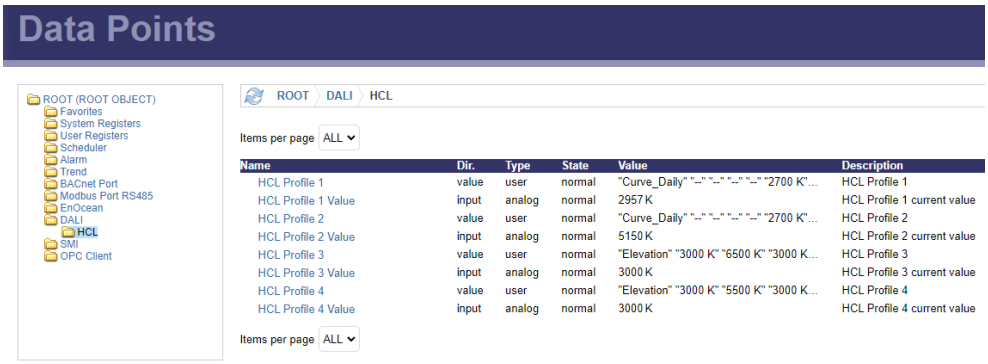


Figure 130: HCL Profile Datapoints

The profile can be configured to the following modes:

- Tc_Mode=”Elevation”: The curve is based on the elevation of the sun. For the longest and shortest day in the year a minimum and maximum Tc value can be defined. The minimum Tc applies to any elevation <=0; the maximum Tc applies to the time of the solar maximum. Between min and max elevation the Tc value is interpolated.
- Tc_Mode=”Curve_Daily”: 24 values can be defined, one support value for each full hour of the day (00:00 – 23:00). Between the support values for the full hours the Tc values are interpolated
- Tc_Mode=”Off”: Disables the profile.

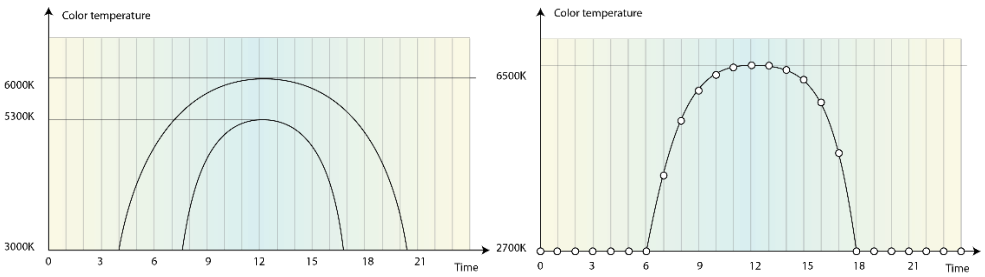


Figure 131: HCL Profile “elevation” based with different Tc max values for summer and winter (left) and “curve daily” with hourly support values (right)

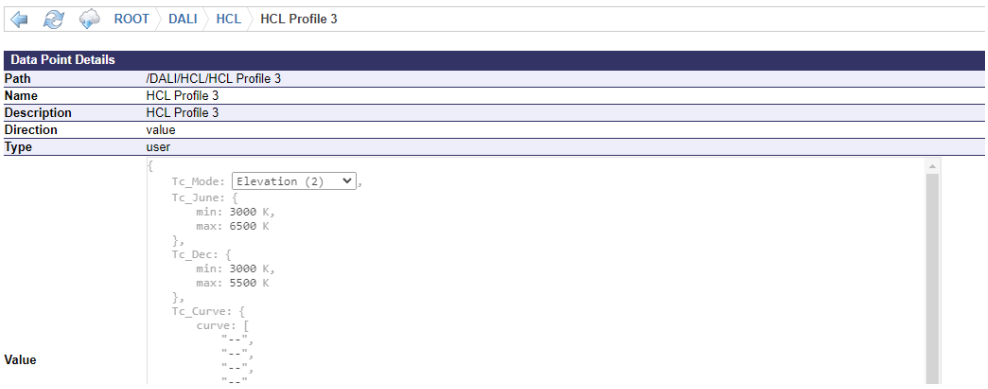


Figure 132: HCL Profile 3 - elevation based with different Tc max values for summer and winter

8.2.4.14 Loop Object – Constant Light Controller application

This object is used to represent a constant light controller instance (see Table 35). There are up to 16 instances per DALI channel available.

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	REAL	R	✓
Description	28	CharacterString	W	
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	✓
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Output_Units	82	BACnetEngineeringUnits	R	
Manipulated_Variable_Reference	60	BACnetObjectPropertyReference	W	
Controlled_Variable_Reference	19	BACnetObjectPropertyReference	W	
Controlled_Variable_Value	21	REAL	W	✓
Controlled_Variable_Units	20	BACnetEngineeringUnits	R	
Setpoint_Reference	109	BACnetSetpointReference	W	
Setpoint	108	REAL	W	✓
Action	2	BACnetAction	R	
Priority_For_Writing	88	Unsigned	W	
COV_Increment	22	REAL	W	
Profile_Name	168	CharacterString	R	
Occupancy_Variable_Reference	537	BACnetObjectPropertyReference	W	
Occupancy_Variable_Value	538	BOOLEAN	W	✓
Mode	539	Unsigned	W	✓
Hold_Time	540	Unsigned	W	✓
Ignore_Time	541	Unsigned	W	✓
Occupied_Level	542	REAL	W	✓
Unoccupied_Level	543	REAL	W	✓
Step_Value	544	REAL	W	✓
On_Hysteresis	545	REAL	W	✓
Off_Hysteresis	546	REAL	W	✓
Off_Delay	547	Unsigned	W	✓
On_Delay	548	Unsigned	W	✓
Lamp_2_Offset	550	REAL	W	✓
Lamp_2_Limit	551	REAL	W	✓
Override	560	REAL	W	✓
Auto_Mode	561	BACnetBinaryPV	R	✓
Occupancy_State	562	BACnetBinaryPV	R	✓
Lux_Upper_Limit	566	REAL	W	✓
Sblnd_Hyst	568	REAL	W	✓
HCL-Profile	574	Unsigned	W	✓

Table 35: Properties of the Loop object representing a Constant Light Controller Application.

Object_Identifier (Read-Only)

The default instance number is BCC, where “B” is the DALI interface number (0-3) in decimal, and “CC” is the Constant Light Controller instance on the channel (00-15).

Object_Name (Read-Only)

This property holds the name of the constant light controller.

Object_Type (Read-Only)

The value of this property is LOOP (12).

Present_Value (Read-Only)

This property, of type REAL, indicates the linearized percentage (0..100.00%) of the constant light controller output.

Description (Read/Write)

This property can be configured via BACnet. It serves documentation purposes only.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
OPEN_LOOP	The sensor value does not change when the output is controlled (CONTROL mode only).
COMMUNICATION_FAILURE	Communication with sensor or light output not working.
UNRELIABLE_OTHER	Other failure detected.

Output_Units (Read-Only)

The value of this property is 98 (percent).

Manipulated_Variable_Reference (Read/Write)

Specifies the object and property the value of the *Present_Value* property is written to.

Controlled_Variable_Reference (Read/Write)

Specifies the object and property the light sensor value is read from.

Controlled_Variable_Value (Read/Write)

This property holds the current light sensor value as read from Controlled_Variable_Reference.

Controlled_Variable_Units (Read-Only)

The value of this property is 37 (lux).

Setpoint_Reference (Read/Write)

Specifies the object and property the setpoint for the constant light controller algorithm is read from.

Setpoint (Read/Write)

This property holds the setpoint for the constant light controller algorithm.

Action (Read-Only)

The value of this property is DIRECT.

Profile_Name (Read-only)

The value of this property is "*178-http://www.loytec.com/xsd/ConstantLightController/v1*".

Occupancy_Variable_Reference (Read/Write)

This proprietary property (property ID 537) specifies the object and property the occupancy sensor value is read from.

Occupancy_Variable_Value (Read/Write)

This proprietary property (property ID 538) holds the current occupancy sensor value as read from Occupancy_Variable_Reference.

Mode (Read/Write)

This proprietary property (property ID 539) holds the constant light controller operating mode (see Section 8.2.4.3).

Hold_Time (Read/Write)

This proprietary property (property ID 540) holds the hold time for the occupancy state in seconds. When the OCCUPIED (1) value is received via *Occupancy_Variable_Value* the constant light controller remains in the occupied state until the hold time has expired and then changes to the unoccupied state. If set to 0 the unoccupied state is entered when UNOCCUPIED (2) is received.

Ignore_Time (Read/Write)

This proprietary property (property ID 541) holds the occupancy ignore time after switching off the light in seconds.

Occupied_Level (Read/Write)

This proprietary property (property ID 542) holds the output levels adopted in the presence modes in occupied state.

Unoccupied_Level (Read/Write)

This proprietary property (property ID 543) holds the output levels adopted in the presence modes in unoccupied state.

Step_Value (Read/Write)

This proprietary property (property ID 544) holds the step value for constant light controller algorithm in percent. It defines the maximum step size that the constant light controller will

take to approach the target illumination. Per second the light level is not changed more than the percentage value defined by this configuration property.

On_Hysteresis (Read/Write)

This proprietary property (property ID 545) holds the constant light controller algorithm hysteresis for switching lights on (percent).

The hysteresis is used in CONTROL or REGULATOR mode.

Off_Hysteresis (Read/Write)

This proprietary property (property ID 546) holds the constant light controller algorithm hysteresis for switching lights off (percent).

The hysteresis is used in CONTROL or REGULATOR mode.

Off_Delay (Read/Write)

This proprietary property (property ID 547) holds the constant light controller off delay in seconds.

On_Delay (Read/Write)

This proprietary property (property ID 548) holds the constant light controller on delay in seconds.

Lamp_2_Offset (Read/Write)

This proprietary property (property ID 550) defines the maximum offset between the output for the primary light band and the secondary light band (see Section 8.2.4.5).

Lamp_2_Limit (Read/Write)

This proprietary property (property ID 551) specifies the dim level at which the output for the secondary light band becomes identical to the primary output (see Section 8.2.4.5).

Override (Read/Write)

This proprietary property (property ID 560) can be used to manually override the constant light controller (see Section 8.2.4.4).

If a valid value is received (0-100%), the constant light controller is disabled and the output is set to the specified value. This also affects the light bands directly linked to the constant light controller. Lamp_2_Offset and Lamp_2_Limit are not considered.

If an invalid value or a value below 0 (e.g. –1) is received, the constant light controller returns to automatic mode.

When performing an override via a DALI button the data point will reflect the resulting feedback value of the group controlled by the DALI button (see Section 8.2.4.10).

Auto_Mode (Read-only)

This proprietary property (property ID 561) provides the current state of the constant light controller (see Section 8.2.4.4).

Inactive: The constant light controller is disabled or overridden by the data point *Override* or the DALI Mode button/LCD UI.

Active: The constant light controller is enabled and not overridden by the data point *Override* or the DALI Mode button/LCD UI.

Occupancy_State (Read-only)

This proprietary property (property ID 562) provides the current occupancy state calculated by the constant light controller (see Section 8.2.4.6).

Inactive (unoccupied): The area is unoccupied.

Active (occupied): The area is occupied.

Lux_Upper_Limit (Read/Write)

By setting the proprietary property (property ID 566) to a value greater than 0 the museum mode is activated. In museum mode the constant light controller cooperates with the sunblind controller to ensure that the measured lux level stays between *Setpoint* and *Lux_Upper_Limit*. Therefore sunblind controller objects have to be enabled and a sunblind controller has to be linked to the constant light controller by writing the constant light controller index to the parameter *Linked_CLC* of the sunblind controller for this property to become effective.

SbInd_Hyst (Read/Write)

This proprietary property (property ID 568) applies only for museum mode. It defines by which percentage the lamp dim value is increased before letting more sunlight in by opening the sunblinds. Therefore sunblind controller objects have to be enabled and a sunblind controller has to be linked to the constant light controller by writing the constant light controller index to the parameter *Linked_CLC* of the sunblind controller for this property to become effective.

HCL_Profile (Read/Write)

This proprietary property (property ID 574) allows to activate a predefined *HCL_Profile*. The profile is applied to the groups defined in the CLC-bindings. The colour temperature of tunable white luminaires in this groups is changed according to the current value of the *HCL_Profile*.

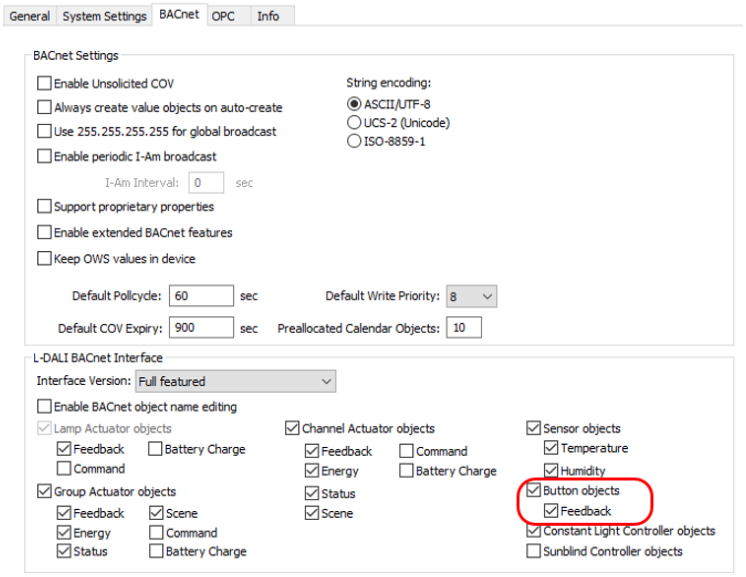
8.2.5 Button Objects

The current state of a DALI button input can be represented by a BACnet Binary Input object.

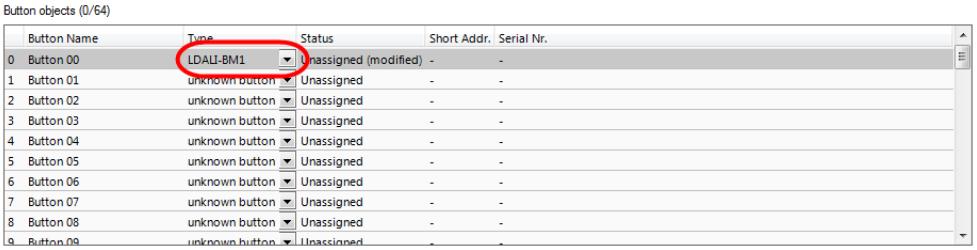
8.2.5.1 Creating BACnet Objects for DALI Button Inputs

To create BACnet Binary Input objects representing DALI button inputs proceed as follows:

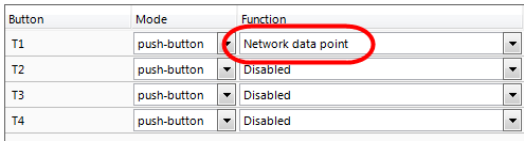
1. Enable Button objects in the BACnet project settings in the LINX Configurator (see LINX Configurator User Manual [2]).



2. Select the DALI button device type in the DALI Installation tab.



3. In the DALI Parameters tab set the button function for the input to "*Network Data Point*".



For each button input with the button function set to "Network Data Point" a separate Binary Input object will be created. All button inputs belonging to the same DALI button device will be grouped in a folder.

Note: *BACnet objects for DALI button inputs can only be created in the LINX Configurator. Setting the button function to "Network Data Point" in the web interface will not create a BACnet object.*

8.2.5.2 Binary Input Object – Button State

This object is used to represent the button state of DALI button input (seeTable 36). The objects are created if required (see Section 8.2.5.1).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	BACnetBinaryPV	R	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	✓
Out_Of_Service	81	BOOLEAN	W	
Polarity	84	BACnetPolarity	W	
Inactive_Text	46	CharacterString	W	
Active_Text	4	CharacterString	W	
Profile_Name	168	CharacterString	R	

Table 36: Properties of the Binary Input object representing a DALI button input.

Object_Identifier (Read-Only)

The instance number is 1BCCDD, where "B" is the DALI interface number (0-3) in decimal, "CC" is the DALI device number (00-63) and "DD" is the input number (00-99). Example: Input "T2" of a LDALI-BM1 assigned to DALI button 4 on channel 2 has the instance number 110401.

Object_Name (Read-Only)

This property holds the value the of the button device as configured in the LINX Configurator DALI Installation tab, complemented by the name of the button input (e.g. "T2").

Object_Type (Read-Only)

The value of this property is BINARY_INPUT (3).

Present_Value (Read-Only)

This property reports the button input status. If the *Polarity* property is *NORMAL* the value *ACTIVE* corresponds to a closed input, while the value *INACTIVE* corresponds to an open input.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED No fault was detected.

NO_SENSOR No button assigned or some failure reported by the DALI button.

COMMUNICATION_FAILURE Button offline.

UNRELIABLE_OTHER Other failure detected.

Profile_Name (Read-only)

The value of this property is "*178-http://www.loytec.com/xsd/DALIButton/v1*".

8.2.5.3 Binary Output Object – Button Feedback

This output object is used to control the feedback LEDs of the buttons (see Table 36). The objects are created if required (see Section 8.2.5.1).

Property Identifier	Property ID	Property Datatype	Conformance Code	Data Point
Object_Identifier	75	BACnetObjectIdentifier	R	
Object_Name	77	CharacterString	R	✓
Object_Type	79	BACnetObjectType	R	
Present_Value	85	BACnetBinaryPV	W	✓
Status_Flags	111	BACnetStatusFlags	R	
Event_State	36	BACnetEventState	R	
Reliability	103	BACnetReliability	R	
Out_Of_Service	81	BOOLEAN	R	
Polarity	84	BACnetPolarity	R	
Priority Array	87	BACnetPriorityArray	R	
Relinguish Default	104	Unsigned	R	
Profile_Name	168	CharacterString	R	

Table 37: Properties of the Binary Output object representing DALI button feedback LEDs

Object_Identifier (Read-Only)

The instance number is 2BCCDD, where "B" is the DALI interface number (0-3) in decimal, "CC" is the DALI device number (00-63) and "DD" is the input number (00-99). Example: Input "T2" of a LDALI-BM1 assigned to DALI button 4 on channel 2 has the instance number 210401.

Object_Name (Read-Only)

This property holds the value the of the button device as configured in the LINX Configurator DALI Installation tab, complemented by the name of the button input (e.g. "T2").

Object_Type (Read-Only)

The value of this property is BINARY_OUTPUT (4).

Present_Value (Read/Write)

The *Present_Value* property can have the values ACTIVE or INACTIVE.

Status_Flags (Read-Only)

Of the four flags the flags IN_ALARM, FAULT, and OUT_OF_SERVICE are linked to the state of the corresponding properties *Event_State*, *Reliability* and *Out_Of_Service* as described by the standard.

OVERRIDDEN Always FALSE.

Reliability (Read-Only)

The *Reliability* property for this object type may have any of the following values:

NO_FAULT_DETECTED	No fault was detected.
NO_SENSOR	No button assigned or some failure reported by the DALI button.
COMMUNICATION_FAILURE	Button offline.
UNRELIABLE_OTHER	Other failure detected.

Profile_Name (Read-only)

The value of this property is "*178-http://www.loytec.com/xsd/DALIButtonFeedback/v1*".

8.2.6 Sunblind Controller Objects

The L-DALI models supporting SMI provide 16 sunblind controller instances for each DALI channel. The sunblind controller application can control sunblinds via a local SMI interface (e.g. LSMI-804) or via its BACnet interface.

8.2.6.1 Glare Protection

The sunblind controller can automatically control the connected sunblind actuator to provide glare protection. To do so the sunblind controller needs to know the geometry of the sunblind blades.

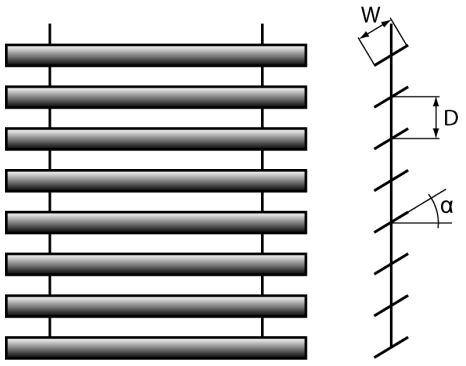


Figure 133: Sunblind Geometry

The blade distance (D) has to be configured in the configuration register *Blade_Distance* and the blade width in *Blade_Width*. The minimum and maximum rotation angle (α) is configured in *Min_Rotation* and *Max_Rotation*. Based on this geometry data and the current sun elevation (BACnet object *Sun_Elevation*) the glare protection algorithm calculates the

rotation angle for the blades. The rotation angle can be optimized for a specific sunblind type by specifying an offset in the configuration register *Rotation_Offset*.

The following inputs and configuration parameters determine if glare protection is necessary:

- Sun Azimuth (BACnet object *Sun_Azimuth*): Depending on the orientation of the window, the sun can only shine into the room from a certain azimuth in the morning (configuration register *Min_Azimuth*) to a certain azimuth in the evening (configuration register *Max_Azimuzh*).

- Outdoor lux level (BACnet object *Outdoor_Lux*): The glare protection will be activated if the measured outdoor lux level is above *Glare_Limit_High*. If the outdoor lux level falls below *Glare_Limit_Low* the glare protection will be deactivated. These two configuration registers implement a hysteresis.

- Surrounding buildings/objects: The BACnet Binary Value object *Glare* can be used to provide geometry information on surrounding buildings/objects. During times when the window is the shadow of a surrounding building/object *Glare* is set inactive, otherwise active.

8.2.6.2 View Protection

To protect rooms against prying eyes the sunblind can be closed automatically when the indoor light is switched on and the outdoor light level (BACnet object *Outdoor_Lux*) falls below the indoor light level (BACnet object *Indoor_Lux*). To avoid that the sunblind opens and closes repeatedly a hysteresis can be configured using the configuration register *View_Protection_Hysteresis*.

8.2.6.3 Heating/Cooling

If the room is not occupied, the L-DALI can close the sunblind to provide thermal isolation in order to save energy.

The Analog Value Object *Terminal_Load* is used to inform the controller of the current heating/cooling demand of the system. Positive values indicate that cooling energy is required, while negative values indicate that heating energy is required.

The algorithm takes the following parameters into account:

- **Outdoor lux level (BACnet object *Outdoor_Lux*):** The energy of the sun can be used to warm a room. The configuration register *Outdoor_Lux_Limit_High* defines the lux level above which the sun energy will make a noticeable contribution to warm the room if the sunblind is open. The configuration property *Outdoor_Lux_Limit_Low* define the lux level below which the sun energy is too low to warm the room. To avoid that the sunblind opens and closes repeatedly a hysteresis can be specified using the configuration register *Outdoor_Lux_Hysteresis*.

- **Temperature:** The outdoor temperature (BACnet object *Outdoor_Temp*) is compared with the indoor temperature (BACnet object *Indoor_Temp*). Depending on whether the system is in heating or in cooling mode and on the temperature difference the sunblinds are closed to increase thermal isolation of the room. To avoid that the sunblind opens and closes repeatedly a hysteresis can be specified using the configuration register *Outdoor_Temp_Hysteresis*.

8.2.6.4 Emergency Control

The sunblind controller offers the following emergency operating modes:

- **Wind Alarm**: If the *Present_Value* of the BACnet Analog Value object *Wind_Speed* is above the value of the configuration register *Wind_Limit* the sunblind controller will open the sunblinds. This measure prevents damage on sunblinds due to high winds.

- **Rain Alarm**: If the *Present_Value* of the BACnet Binary Value object *Rain* is active the sunblind controller will open the sunblinds. This measure prevents potential damage of the sunblinds due to becoming wet.

- **Frost Alarm**: If the *Present_Value* of the BACnet Binary Value object *Frost* is active the sunblind controller will stop movement and remain on its current position. This measure prevents potential damage of the sunblinds or the attached drive due to blades being frozen.

- **Weather Sensor Offline Alarm**: If no update was received on the *Present_Value* of the BACnet object *Wind_Speed*, *Rain* or *Frost* within the time configured in the configuration registers *Wind_Rcv_Timeout*, *Rain_Rcv_Timeout* or *Frost_Rcv_Timeout* respectively the sunblind controller will perform the action configured in the configuration register *Weather_Fail_Pos*. This allows monitoring weather sensor health and taking preventive measures in case a sensor fails.

- **Window Contact Alarm**: If the *Present_Value* of the BACnet Binary Value object *Window_Contact* is inactive the sunblind controller will stop movement and remain on its current position. This measure prevents injury due to moving sunblinds in case the window is opened.

- **Window Contact Offline Alarm**: If no update was received on the *Present_Value* of the BACnet object *Wind Contact Speed* within the time configured in the configuration registers *Window_Rcv_Timeout* the sunblind controller will perform the action configured in the configuration register *Window_Contact_Fail_Pos*. This allows monitoring window contact sensor health and taking preventive measures in case a sensor fails.

8.2.6.5 Museum Mode

For the museum mode of the constant light controller (see Section 8.2.4.12) a sunblind controller must be linked to the constant light controller.

8.2.6.6 Occupancy Detection

The occupied/unoccupied status of the room can be determined by an occupancy sensor. To connect an occupancy sensor via the BACnet network the BACnet Binary Value object *Occupancy* is used. Its behavior is identical to the proprietary property *Occupancy_Variable_Value* of the Constant Light Controller object (see Section 8.2.4.6).

8.2.6.7 BACnet Object Interface

There is a set of objects representing the sunblind controller functionality on the BACnet interface.

Command Input

In general a sunblind is controlled by two values – Position and Rotation. Further, the sunblind can be controlled by directly commanding the target position and rotation or by

relative commands (e.g. move up, down, open, close and stop). Therefore a set of BACnet Output objects representing the sunblind controller input is required:

- Command (Multi-State): Determines the type of sunblind movement requested. SET_STATE allows absolute positioning, while SET_UP, SET_DOWN and SET_STOP allows relative sunblind movements.

- Position (Analog): Determines the absolute position (SET_STATE) or the relative position increment or decrement (SET_UP and SET_DOWN respectively) in percent. 0% corresponds to open, while 100% corresponds to closed sunblinds.

- Rotation (Analog): Determines the absolute blind rotation (SET_STATE) or the relative rotation increment or decrement (SET_UP and SET_DOWN respectively) if supported by the sunblind.

To avoid a glitch in case not all three objects are written at once, the evaluation of the three independent BACnet objects is done as follows:

- If *Command* is SET_STATE and the *Present_Value* of all three objects are on the same priority changes of *Position* and *Rotation* are evaluated without delay.

- If *Command* is SET_STOP, it is only evaluated if *Position* and *Rotation* are on the same priority (even though they are not used for STOP).

- If *Command* is SET_UP or SET_DOWN, *Position* and *Rotation* are only evaluated if *Command* is written and all three data points are on the same priority. Further, no sunblind movement is triggered in case these values come in effect due to a higher priority value being relinquished. Thus, UP/DOWN commands are only executed when they are highest priority at the time they are written. This is necessary since the commands trigger a movement relative to the current position and are usually triggered by user inputs. Thus, they are only valid at the time they are given. If not executed instantly the command should be dropped.

- All other values or value combinations written are ignored and do not lead to any sunblind movement.

These three command input objects can be used for manual operation via BACnet, but are also used for automatic operation. Different control algorithms (e.g. glare protection, heating/cooling support, view protection, etc.) in the sunblind controller applications use different, configurable priorities (see Section 8.2.6.8). Thus, the BACnet priority array mechanism is used to determine the highest pending event.

Sunblind Feedback

To provide the current position and rotation as feedback via the BACnet interface the Analog Input objects *Postion_Fb* and *Rotation_Fb* are available for each sunblind controller instance. If SMI sunblinds are connected via internal sunblind bindings, the *Present_Value* of these objects reflects the position and rotation reported by the SMI drives. Otherwise, the values correspond to the values provided with the latest SET_STATE command and are invalid if the position or rotation was changed by relative commands (SET_UP, SET_DOWN, SET_STOP).

Sunblind Controller Algorithm Inputs

The inputs used by the sunblind controller algorithm are also available as BACnet objects. There are two types of inputs:

- Inputs available for each sunblind controller instance (**individual**).

- Inputs available for a sunblind controller channel (**global**). A sunblind controller channel is a group of 16 sunblind controller instances, which share a common set of global inputs.

Sunblind Controller BACnet Objects (individual)

Table 38 shows a list of all BACnet objects belonging to a Sunblind Controller instance. The column Object ID contains the objects default instance number, where "B" is the Sunblind Controller channel number (0-3) in decimal, and "CC" is the Sunblind Controller instance on the channel (00-15).

Object Name Suffix	Object Type	Object ID	Description
Command	MO	10BCC	Sunblind controller command input.
Position	AO	10BCC	Sunblind controller position input.
Rotation	AO	11BCC	Sunblind controller rotation input.
Position_Fb	AI	10BCC	Sunblind controller current position.
Rotation_Fb	AI	11BCC	Sunblind controller current rotation.
Indoor_Temp	AV	10BCC	This object is used to provide the room temperature measured by a temperature sensor. This input is used if the sunblinds are used for heating/cooling (see Section 8.2.6.3).
Terminal_Load	AV	11BCC	This object is used if the sunblinds are used for heating/cooling (see Section 8.2.6.3). The input informs the controller of the current heating/cooling demand. Positive values indicate that cooling energy is required, while negative values indicate that heating energy is required.
Indoor_Lux	AV	12BCC	This object is used to provide the illumination level in the room. The input is used for view protection (see Section 8.2.6.2). If *Indoor_Lux* is higher than the *Outdoor_Lux* then the sunblind is closed to protect the room against prying eyes.
Window_Contact	BV	10BCC	This object is used to inform the controller if the window is open (inactive) or close (active). If the window is open, the sunblind stops moving (see Section 8.2.6.4).
Occupancy	BV	11BCC	This object is used to provide the occupancy state measured by an occupancy sensor. A hold time can be configured using the configuration register *Hold_Time* (see Section 8.2.6.6).
Glare	BV	12BCC	This object is used to activate the automatic glare protection for the sunblind controller instance (see Section 8.2.6.1). It can be used to deactivate the automatic glare protection, in case a structure (e.g. building, mountain, etc.) currently drops a shadow on the window.

Table 38: Sunblind Controller BACnet Objects (individual)

Sunblind Controller BACnet Objects (global)

Table 39 shows a list of all BACnet objects shared between all Sunblind Controller instances of a channel. The column Object ID contains the objects default instance number, where "B" is the Sunblind Controller channel number (0-3) in decimal.

Object Name Suffix	Object Type	Object ID	Description
Outdoor_Temp	AV	1900B	This object is used to provide the current outdoor temperature. This input is used when the sunblinds are used to support heating/cooling (see Section 8.2.6.3).
Outdoor_Lux	AV	1901B	This object is used to provide the current outdoor illumination measured by a light sensor. It is used for glare protection, view protection and heating/cooling support (see Sections 8.2.6.1, 8.2.6.2 and 8.2.6.3)

Object Name Suffix	Object Type	Object ID	Description
Wind_Speed	AV	1902B	This object is used to provide the current wind speed measured by a wind sensor. If the wind speed is higher than the value configured in *Wind_Limit*, the sunblinds must go up (see Section 8.2.6.4).
Rain	BV	1900B	This object is used to notify the sunblind controller, whether it rains (active) or not (inactive). If it is raining, the sunblinds must go up (see Section 8.2.6.4).
Frost	BV	1901B	This object is used to notify the sunblind controller, whether there is the risk to freezing (active) or not (inactive). If a frost condition is detected, the sunblinds must not move to prevent damage to the blades or the blind's motor (see Section 8.2.6.4).
Sun_Elevation	AV	1903B	This object is used to provide provides the current sun elevation. The elevation is the angle between the horizon and the middle of the sun, considered out of the viewpoint of an observer. The values 0 – 90° are typically used (0= Sunrise/Sunset; 90 = zenith position). This value is used by the glare protection algorithm to calculate the blade angle (see Section 8.2.6.1).
Sun_Azimuth	AV	1904B	This object is used to provide provides the current sun azimuth. The values 0 – 359° are typically used (0 = NORTH, 90 = EAST, 180 = SOUTH, 270 = WEST). This value is used by the glare protection algorithm to determine whether there can be glare depending on the direction of the window (see Section 8.2.6.1).

Table 39: Sunblind Controller BACnet Objects (global)

8.2.6.8 Sunblind Controller Events and Priorities

The operation of the sunblind controller is influenced by a number of events. Table 40 describes the different events and shows their default BACnet priority.

The BACnet priority of events can be changed. Events can be deactivated by setting the priority to 0. Usually this is done on the DALI Parameters tab of the LINX Configurator (see LINX Configurator User Manual [2]).

The BACnet priority of an event is used when the Sunblind controller application writes a value originating from that event to the Command Input objects (see Section 8.2.6.7) of the sunblind controller instance.

Priority	Event	Description
1 (highest)	Weather sensor alarm*	At least one of the (global) weather sensors failed: • No update has been received on *Wind_Speed* for longer than *Wind_Rcv_Timeout.* • No update has been received on *Rain* for longer than *Rain_Rcv_Timeout.* • No update has been received on *Frost* for longer than *Frost_Rcv_Timeout.* In case of a weather sensor alarm the sunblind drives to the position defined by *Weather_Fail_Pos.*
2	Window sensor alarm*	Window sensor failed: No update has been received on *Window_Contact* for longer than *Window_Rcv_Timeout.* In case of a window sensor alarm the sunblind drives to the position defined by *Window_Contact_Fail_Pos*.
3	Frost condition*	The sunblind controller enters the frost state if the Binary Value object *Frost* is in active state. When *Frost* becomes inactive the sunblind controller remains in the frost state for the hold time configured in *Weather_Off_Delay*. The sunblind does not move as long as the sunblind controller is in the frost state.
4	Wind*	The sunblind controller enters the wind alarm state if the measured wind speed (*Wind_Speed*) exceeds the threshold configured in *Wind_Limit*. When the wind speed falls below the threshold the sunblind controller remains in the wind alarm state for the hold time configured in *Wind_Off_Delay*. The sunblind remains open while the sunblind controller is in the wind alarm state.
5	Rain condition*	The sunblind controller enters the rain state if the Binary Value object *Rain* is in active state. When *Rain* becomes inactive the sunblind controller remains in the rain state for the hold time configured in *Weather_Off_Delay*. The sunblind remains open while the sunblind controller is in the rain state.
6	Window open*	The window is open: The Binary Value object *Window_Contact* is in active state. The polarity of the window contacts can be changed via the configuration register *Invert_Window_Contact*. The sunblind does not move as long as the window is open.
12	Anti-glare*	The sunblind is controlled by the anti-glare algorithm. Only active if room is occupied. See Section 8.2.6.1 for detail.
13	View protection*	The sunblind is controlled by the view protection algorithm. Only active if room is occupied. See Section 8.2.6.2 for detail.
14	Constant light request*	The sunblind is linked to the constant light controller and is controlled by the museum mode algorithm. Only active if room is occupied. See Section 8.2.6.5 for detail.
15	Up if occupied*	The room is occupied. See Section 8.2.6.6 for detail. If the room is occupied the sunblind moves up.
16 (lowest)	Heat/cool request*	The sunblind is controlled by the heating/cooling algorithm. Only active if room is not occupied. See Section 8.2.6.3 for detail.

Table 40: Sunblind Controller Events and Priority

For events marked with *) a minimum time can be configured via the configuration register *Auto_Event_Time*. These events will stay active for at least the configured time even if the event condition disappears before this time expires. In this way the sunblind controller ensures that the sunblind does not drive too frequently.

In case none of the events is active the sunblind remains in its current position.

8.2.6.9 Configuration Parameters

Table 41 lists all Sunblind Controller instance specific configuration parameters (individual), while Table 42 lists all configuration parameters shared between the Sunblind Controller instances of a channel (global). All configuration parameters are implemented as registers and are thus not available via the BACnet interface.

Parameter	Description
Window_Rcv_Timeout	This configuration register specifies the expected update interval of the *Present_Value* of the *Window_Contact* object. If the time elapses without an update an alarm is generated and the sunblind adopts the safe position defined by the *Window_Contact_Fail_Pos* (see Section 8.2.6.4).
Window_Contact_Fail_Pos	This configuration register defines the safety position of a sunblind when a failure of the window contact (*Window_Contact*) has been detected (see Section 8.2.6.4).
Drive_Delay	This configuration register defines the delay which the sunblind controller waits before it updates its outputs. If different drive delays are configured for the different sunblind controllers, the sunblinds will not drive at the same time avoiding a power peak. Drive delay is only applied for automatic operation.
Glare_Limit_High	This configuration register defines the high limit for the *Outdoor_Lux* input hysteresis as used by the automatic glare detection algorithm (see Section 8.2.6.1). If the lux level is above this value the glare protection algorithm is activated.
Glare_Limit_Low	This configuration register defines the low limit for the *Outdoor_Lux* input hysteresis as used by the automatic glare detection algorithm (see Section 8.2.6.1). If the lux level is above this value the glare protection algorithm is deactivated.
Min_Azimuth	This configuration property defines the minimum azimuth for the *Sun_Azimuth* input used by the automatic glare detection algorithm (see Section 8.2.6.1). It therefore defines the direction of the window (together with *Max_Azimuth*).
Max_Azimuth	This configuration property defines the maximum azimuth for the *Sun_Azimuth* input used by the automatic glare detection algorithm (see Section 8.2.6.1). It therefore defines the direction of the window (together with *Min_Azimuth*).
Blade_Distance	This configuration register defines the distance between sunblind blades (see Section 8.2.6.1).
Blade_Width	This configuration register defines the width of the sunblind blades (see Section 8.2.6.1).
Rotation_Offset	This configuration register defines the rotation offset for the glare protection algorithm (see Section 8.2.6.1).
Max_Rotation	This configuration register defines the maximum rotation for the glare protection algorithm (see Section 8.2.6.1).
Min_Rotation	This configuration register defines the minimum rotation for the glare protection algorithm (see Section 8.2.6.1).
Hold_Time	This configuration register defines the hold time for the occupied state. When the ACTIVE value is received via the *Present_Value* of the *Occupancy* object the sunblind controller remains in the occupied state until the hold time has expired and then changes to the unoccupied state. If set to 0 the unoccupied state is entered when value INACTIVE is received (Section 8.2.6.6).

Parameter	Description
Auto_Event_Time	Use to specify the minimum time for the following events: • Weather sensor alarm • Window sensor alarm • Frost condition • Wind • Rain condition • Window open • Anti-glare • View protection • Constant light request • Up if occupied • Heating/cooling request The event will stay active for at least the configured time even if the event condition disappears before this time expires. In this way the sunblind controller ensures that the sunblind does not drive too frequently.

Table 41: Sunblind Controller Configuration Parameters (individual).

Parameter	Description
Wind_Rcv_Timeout	This configuration register specifies the expected update interval of the *Present_Value* of the *Wind_Speed* object. If the time elapses without an update an alarm is generated and the sunblinds adopt the safe position defined by *Weather_Fail_Pos* (see Section 8.2.6.4).
Wind_Limit	This configuration register defines the maximum wind for the sunblinds. If the current wind speed (*Wind_Speed*) is greater than this the sunblinds must go up (see Section 8.2.6.4).
Wind_Off_Delay	This configuration register defines the time for which the current wind speed (*Wind_Speed*) must be below the critical wind speed (*Wind_Limit*) before the sunblind controller return to normal operation (see Section 8.2.6.4).
Rain_Rcv_Timeout	This configuration register specifies the expected update interval of the *Present_Value* of the *Rain* object. If the time elapses without an update of the variable an alarm is generated and the sunblinds adopt the safe position defined by *Weather_Fail_Pos* (see Section 8.2.6.4).
Frost_Rcv_Timeout	This configuration register specifies the expected update interval of the *Present_Value* of the *Frost* object. If the time elapses without an update of the variable an alarm is generated and the sunblinds adopt the safe position defined by *Weather_Fail_Pos* (see Section 8.2.6.4).
Weather_Off_Delay	This configuration register defines the time for which the rain/frost condition (*Rain*/*Frost*) has to be inactive before the sunblind controller returns to normal operation (see Section 8.2.6.4).
Weather_Fail_Pos	This configuration register defines the safety position of sunblinds when a failure of a safety relevant weather sensor (e.g. *Wind_Speed*, *Rain* or *Frost*) is detected (see Section 8.2.6.4).
Invert_Window_Contact	This configuration register allows inverting the window contact inputs (*Window_Contact*) of the sunblind controllers (see Section 8.2.6.4).
Outdoor_Temp_Hysteresis	This configuration register defines the hysteresis for the outdoor temperature (*Outdoor_Temp*). It is used for the heating/cooling algorithm (see Section 8.2.6.3).
Outdoor_Lux_Hysteresis	This configuration register defines the hysteresis for the outdoor lux level input (*Outdoor_Lux*). It is used by the heating/cooling algorithm (see Section 8.2.6.3).
Outdoor_Lux_Limit_High	This configuration register defines the high limit for the outdoor lux level input (*Outdoor_Lux*). It is used by the heating/cooling algorithm (see Section 8.2.6.3).
Outdoor_Lux_Limit_Low	This configuration register defines the low limit for the outdoor lux level input (*Outdoor_Lux*). It is used by the heating/cooling algorithm (see Section 8.2.6.3).

Parameter	Description
View_Protection_Hysteresis	This configuration register defines the hysteresis for the outdoor lux level input (*Outdoor_Lux*). It is used by the view protection algorithm (see Section 8.2.6.2).

Table 42: Sunblind Controller Configuration Parameters (global).

8.3 Programmable DALI Controller (LDALI-PLCx)

For detailed information about the programmable version of the DALI controller refer to the LINX Configurator User Manual [2], chapter 15.2 and the LROC_Manual [11].

8.4 Web Interface

8.4.1 Constant Light Controller Bindings (Commission)

To determine which sensors (occupancy & lux) are used as inputs to and which light groups are controlled by a constant light controller instance and which constant light controller instances are linked together go to the **CLC Bindings** page (see Figure 134).

Again, selected the DALI channel by clicking on the different tabs at the top of the page labeled **Channel 1**, **Channel 2**, etc.

Click on the ✚ symbol to add an input or output. Use the drop down box to select a sensor (occupancy/lux) instance or a data point.as input and a light group as output. Click on ✖ symbol to remove an input or output.

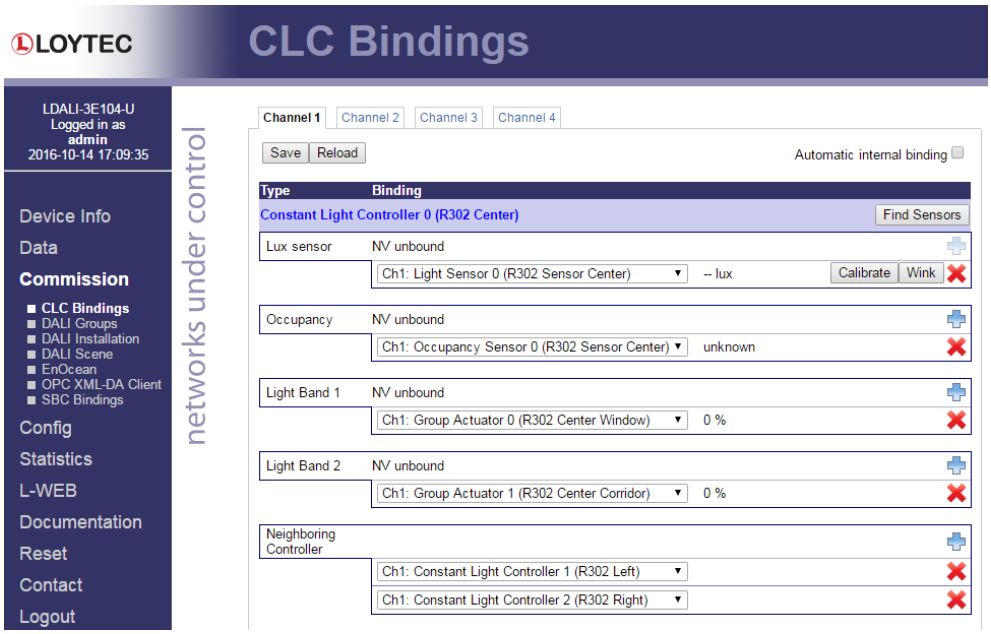


Figure 134: CLC Bindings.

For each constant light controller one lux level sensor, but up to 16 occupancy sensor inputs can be configured. Whenever at least one occupancy sensor reports occupancy the area controlled by the controller instance is considered occupied. The drop down box allows to select a DALI sensor (occupancy/lux) instance or a data point.

To select a data point select **Choose data point…** from the drop down box. The dialog shown in Figure 135 appears. Click on **Choose** and select the intendet data point. Any analog data point can be selected as lux sensor, a binary data point as occupancy sensor. For the latter select, which value shall be considered as unoccupied and which as occupied.

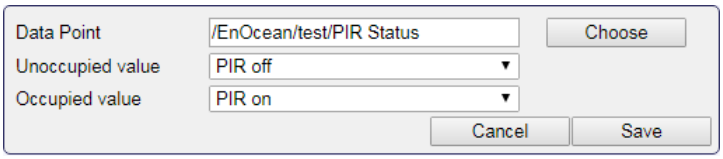


Figure 135: Use data point as CLC input.

Similar for each of the two light bands up to 16 DALI groups can be selected as outputs. The primary light band is near the inside of the building, the secondary light band is near the window front. Depending on the outdoor light intensity the primary light band has to be brighter than the secondary light band to illuminate the room evenly.

In addition to inputs and outputs **Neighboring Controller** instances can be selected in open office space application scenarios. For additional information on the interaction of neighboring controller instances see Sections 8.1.4.9 and 8.2.4.9.

On the LDALI-10X NV bindings can be used in parallel to the internal CLC bindings. The binding status of the corresponding NV is displayed (NV bound/unbound). To enable manual internal CLC bindings the automatic binding algorithm has to be disabled by unchecking the **Automatic internal binding** checkbox. See Section 8.1.4.1 for details on the automatic internal binding algorithm.

On the LDALI-20X the BACnet **Write priority** for the outputs (light bands) can be configured. This priority will be used by the Constant Light Controller application to write to the corresponding Analog Output object controlling the light group.

Once at least one output is configured the button **Find sensors** appears. Click on the button to start a wizard, which automatically tries to find the DALI sensors belonging to the configured light bands. The wizard will switch the light bands on and off. All sensors, which change their lux level reading when switching lights on and off will be considered to belong to the constant light controller instance. The wizard will chose one of the sensors as lux sensor and will add all sensors as occupancy sensor.

Click on the name to jump to the data point configuration page of the fieldbus object corresponding to the Constant Light Controller instance. Once saved the current lux and occupancy sensor reading and the current light level output of the configured groups will be displayed.

To calibrate a lux level sensor click on the **Calibrate** button next to it. This will open the DALI Sensor Calibration page as described in the LOYTEC Devices User Manual [1], with the sensor's Constant Light Controller instance selected.

8.4.2 Sunblind Controller Bindings (Commission)

To determine which DALI sensors (occupancy & lux) are used as inputs to and which SMI drives are controlled by a sunblind controller instance go to the **SBC Bindings** page (see Figure 136).

Selected the sunblind controller channel by clicking on the different tabs at the top of the page labeled **Channel 1**, **Channel 2**, etc.

Click on the ✚ symbol to add an input or output. Use the drop down box to select a DALI sensor (occupancy/lux) instance or a data point.as input and a SMI drive as output. SMI drives must be created in the LINX Configurator as described in the LINX Configurator User

Manual [2] to be available for selection. To select a data point as input select **Choose data point…** from the drop down box. The dialog shown in Figure 136 appears. Click on **Choose** and select the intendet data point. Any analog data point can be selected as lux sensor, a binary data point as occupancy sensor. For the latter select, which value shall be considered as unoccupied and which as occupied. Click on ✖ symbol to remove an input or output.

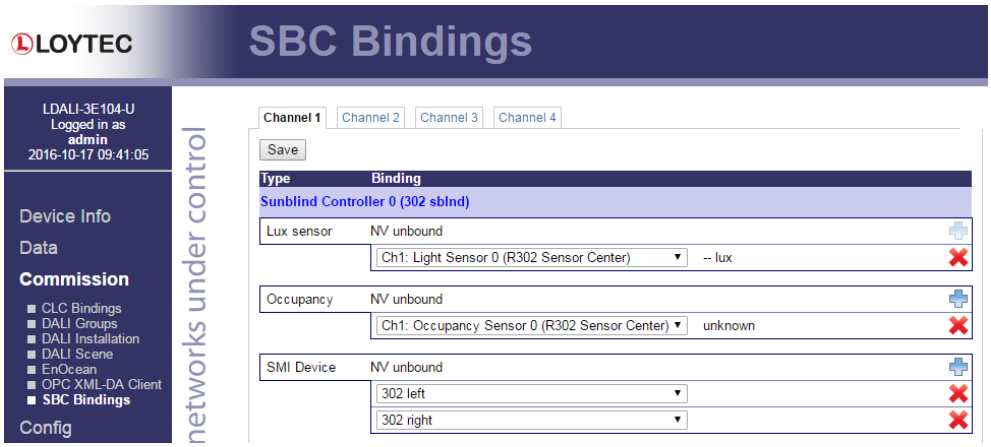


Figure 136: SBC Bindings.

For each sunblind controller one lux level sensor, but up to 16 occupancy sensor inputs can be configured. Whenever at least one occupancy sensor reports occupancy the area controlled by the controller instance is considered occupied. Similar up to 16 SMI drives can be selected as outputs for each sunblind controller instance.

On the LDALI-10X NV bindings can be used in parallel to the internal SBC bindings. The binding status of the corresponding NV is displayed (NV bound/unbound).

Click on the name to jump to the data point configuration page of the fieldbus object corresponding to the Sunblind Controller instance. Once saved the current lux and occupancy sensor reading will be displayed.

8.4.3 Configuration of Button Functions

To configure the function to be performed, when a button is pressed go to the **Buttons** page (see Figure 137).

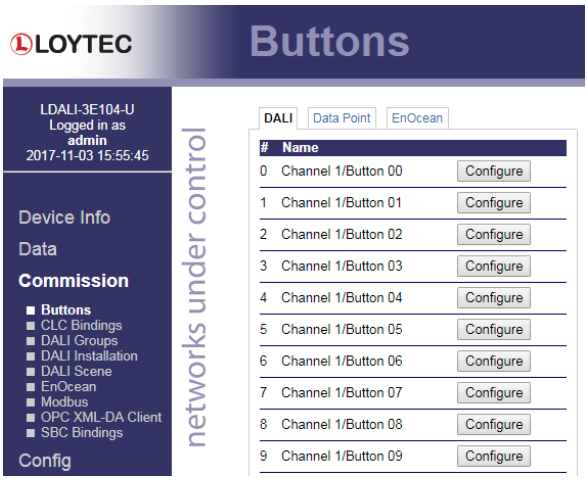


Figure 137: Button Functions.

Currently, button functions can be configured for the following entities:

- **DALI buttons**: See the DALI section in the LOYTEC Devices User Manual [1] for information on which DALI button devices are supported.

- **EnOcean buttons**: Profiles Rocker Switch, 2 Rocker (F6-01) and 4 Rocker (F6-03), and Position Switch (F6-04) are supported. EnOcean devices must be created in the LINX Configurator before being available for button function configuration (see LINX Configurator User Manual [2]).

- **Data Points**: Any binary data point can be used to trigger button functions. Data points can be used to configure button functions for buttons created in L-WEB graphic projects, for buttons connected to digital inputs of remote IO modules (e.g. BACnet, LONMARK, etc.) and for DALI buttons connected to DALI channels on other L-DALI controllers. Data points must be selected as trigger for a button function in the LINX Configurator before being available for button function configuration (see LINX Configurator User Manual [2]).

On the **Buttons** page, first choose the click on the **Configure** button next to the button device that is to be configured. The dialog shown in Figure 138 appears

Figure 138: Configure DALI button functions.

For buttons which can be operated as push-button or as switch the **Mode** drop down box allows to select whether a switch or a push button is connected to the button input. The **Function** drop down box allows selecting the function to be performed when the button is pressed. See Table 43 for a list of available function. If the function is used to control light, the **Destination** column allows selecting the DALI group or channel to be controlled. For functions to operate sunblinds the affected sunblind controller application instance can be chosen. If the function requires additional arguments (e.g. dim values or scene numbers) they are configured in the columns **Argument 1** and **Argument 2**.

If multiple buttons require identical or similar configuration those buttons can be selected in the C**opy settings to** selection box. Click on **Apply** to write the configuration to the button device, **Save** to save and close the dialog.

If buttons are used with L-DALI Constant Light Controller applications to allow manual and automatic operation please see Sections 8.1.4.10 and 8.2.4.10 on how buttons can interact with the Constant Light Controller application.

Button functions controlling sunblinds use the LONMARK NV *nviLocalControl* (LDALI-10X models, see Section 8.1.5.4) or the BACnet object *Command* (LDALI-20X models, see Section 8.2.6.7) with priority 8 (Manual Operation) to control the sunblinds.

Function	Description
Disabled	No action
Network data point	Button input status will be reflected by a data point.
On (maximum)	Switch on (recall maximum).
On (last value)	Switch on to last known value. *Note: Requires storing value when switching off.*
Auto	(Re-)activate L-DALI constant light controller of target group.
Off	Switch off.
Off (store value)	Store last value and switch off.
On/Off	Toggle between on and off whenever button is pressed or switch is changed depending on current status (changeover switch). Switch light on when it is off and switch light off when it is on.
Auto/Off	Toggle between active L-DALI constant light controller and off whenever button is pressed or switch is changed depending on current status (changeover switch). Switch light on when it is off and switch light off when it is on. Note: Switching off will deactivate the L-DALI constant light controller.
Up	Dim up while button is pressed. The dim speed is determined by the fade rate parameter of each ballast.
Down	Dim up while button is pressed. The dim speed is determined by the fade rate parameter of each ballast.
Up/Down	Toggle between dimming up and down whenever button is pressed. Dim as long as button is kept pressed. The dim speed is determined by fade rate parameter of each ballast.
On/Up	Switch on (recall maximum) if button is pressed shortly, dim up when button kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
On (last value)/Up	Switch on to last known value if button is pressed shortly, dim up when button kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
Auto/Up	(Re-)activate L-DALI constant light controller if button is pressed shortly, dim up when button kept pressed. The dim speed is determined by the fade rate parameter of each ballast. Note: Diming up will deactivate the L-DALI constant light controller.
Off/Down	Switch off value if button is pressed shortly, dim down when button kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
Off (store value)/Down	Store last value and switch off if button is pressed shortly, dim down when button kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
On/Off and Up/Down	Toggle between on and off whenever button is pressed shortly depending on current status (changeover switch). Toggle between dimming up and down whenever button is pressed longer. Dim as long as button is kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
Auto/Off and Up/Down	Toggle between active L-DALI constant light controller and off whenever button is pressed shortly depending on current status (changeover switch). Toggle between dimming up and down whenever button is pressed longer. Dim as long as button is kept pressed. The dim speed is determined by the fade rate parameter of each ballast. Note: Diming up/down and switching off will deactivate the L-DALI constant light controller.

Function	Description
On (last value)/Off and Up/Down	Toggle between switching on to last value and off (including storing the last value) whenever button is pressed shortly depending on current status (changeover switch). Toggle between dimming up and down whenever button is pressed longer. Dim as long as button is kept pressed. The dim speed is determined by the fade rate parameter of each ballast.
Dim to	Dim to the value entered as argument 1.
Dim to (toggle)	Toggle between dim value entered as argument 1 and dim value entered as argument 2 whenever button is pressed or switch is changed.
Recall scene	Recall the scene configured with argument 1.
Recall scene (toggle)	Toggle between recalling scene configured with argument 1 and scene configured with argument 2 whenever button is pressed or switch is changed.
Colour warmer	Ramp up colour temperature as long as button is pressed. *Note: Requires ballasts of type colour control (device type 8) supporting the colour type colour temperature.*
Colour cooler	Ramp down colour temperature as long as button is pressed. *Note: Requires ballasts of type colour control (device type 8) supporting the colour type colour temperature.*
Sunblind Up	Short Press: Rotate sunblinds until completely open, then move up – argument 1 defines the rotation-angle for a short press. Long Press: Drive to upper end position. *Note: Requires SMI-interface L-SMI*
Sunblind Down	Short Press: Rotate sunblinds until completely closed, then move down – argument 1 defines the rotation-angle for a short press. Long Press: Drive to lower end position. *Note: Requires SMI-interface L-SMI*
Sunblind Auto	Relinquish manual override of sunblind controller application and resume automatic operation. *Note: Requires SMI-interface L-SMI*
Sunblind Up/Down/Auto	Short Press: Toggle between moving sunblinds up and down, with stop in-between (each second button press). Long Press: Relinquish manual override of sunblind controller application and resume automatic operation. *Note: Requires SMI-interface L-SMI*

Table 43: DALI button functions

8.4.4 Debug (Config)

Log messages can be activated for each LONMARK or BACnet Object present on the L-DALI to allow analyzing the light and the sunblind applications (see Figure 139).

The debug log allows recording all changes on inputs and outputs as well as all application internal transitions in case a fieldbus object does not behave as expected. Debug logs are stored in RAM. The messages logged are in most cases self-explanatory.

Further, LOYTEC support requires a debug log to be able to analyze any potential problems. Therefore, such a log should be created before contacting LOYTEC support.

To enable debugging on one or more objects, specify the desired object(s) by setting a filter using the **Type**, **Channel** and **Object Index** drop down boxes. Then check the **Log Input**/**Log Output**/**Log State** check boxes and click on the **Save** button.

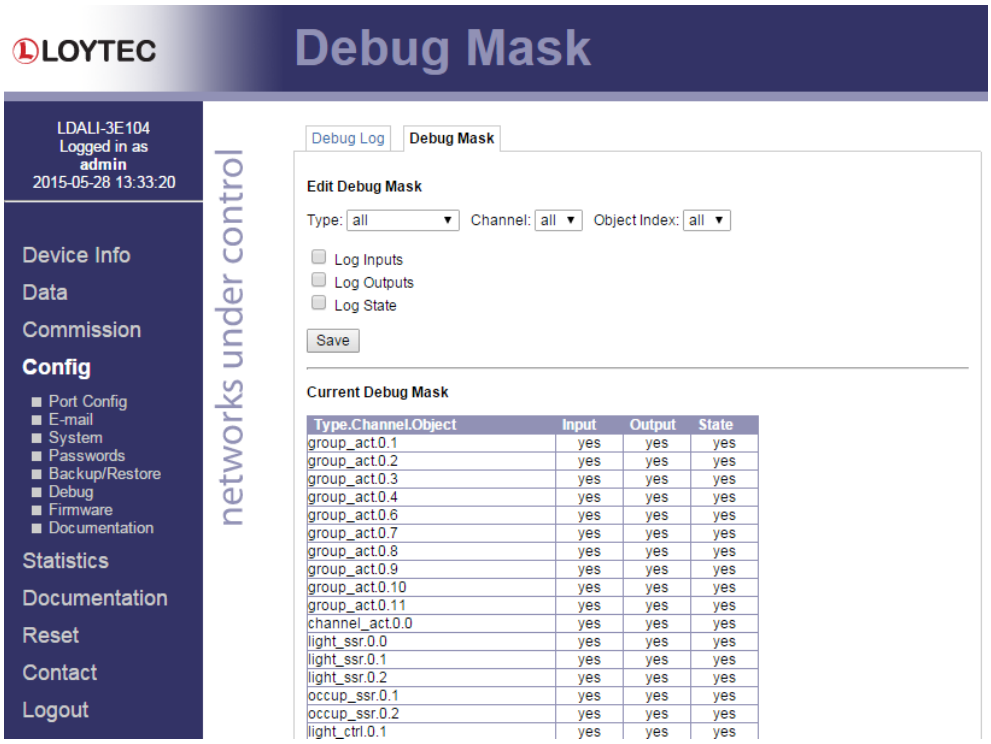


Figure 139: Setup Debug Mask.

To disable debugging select the object(s) by specifying a filter like when enabling debugging, leave the checkboxes **Log Input**/**Log Output**/**Log State** unchecked and click on the **Save** button.

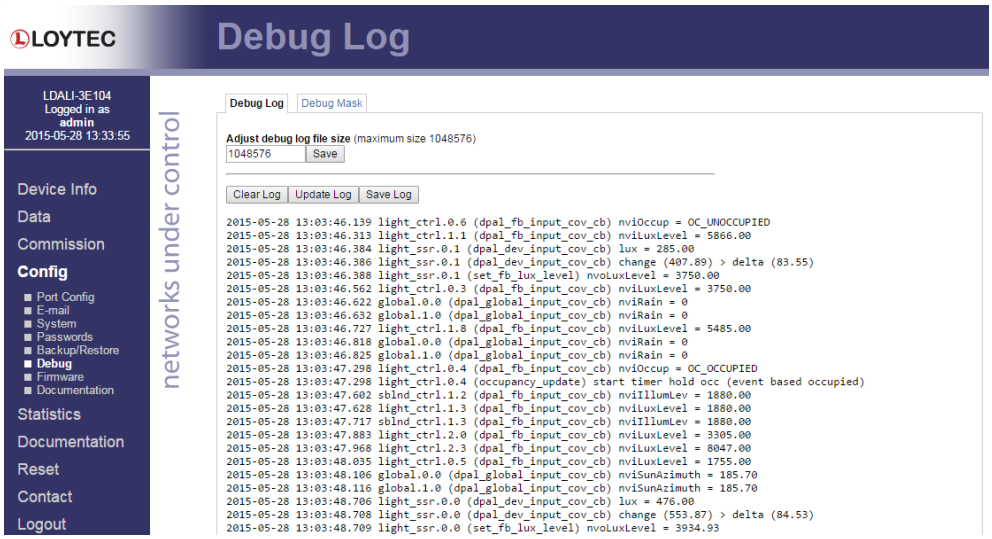


Figure 140: Debug Log.

9 Troubleshooting

9.1 Technical Support

LOYTEC offers free telephone and e-mail support for the L-DALI product series. If none of the above descriptions solves your specific problem please contact us at the following address:

LOYTEC electronics GmbH
Blumengasse 35
A-1170 Vienna
Austria / Europe

e-mail : ***support@loytec.com***
Web : ***http://www.loytec.com***
tel : ***+43/1/4020805-100***
fax : ***+43/1/4020805-99***

or

LOYTEC Americas Inc.
N27 W23957 Paul Road
Suite 103
Pewaukee, WI 53072
USA

e-mail: ***support@loytec-americas.com***
Web: ***http://www.loytec-americas.com***
tel: ***+1 (512) 402 5319***
fax: ***+1 (262) 408 5238***

9.2 Packet Capture

Please refer to the Troubleshooting Chapter in the LOYTEC Device User Manual [1] to learn more about troubleshooting on LOYTEC devices.

10 Security Hardening Guide

This guide contains security-relevant information for operating the product on IT networks. The information refers to the firmware version and the instructions found in the previous chapters of this User Manual.

10.1 Installation Instructions

Install the device over the Web interface:

- Set up the basic device functions and protocol settings as described in Section 5.4. When connecting over the Web UI use https:// in the URL.
- Set a secure password for the admin and operator accounts.
- Disable the HTTP, FTP, and Telnet servers in the IP port configuration as described in the LOYTEC Device User Manual [1]. Note, that FTP and Telnet are disabled in factory defaults as of firmware 7.0.0.
- Create a new HTTPS server certificate as described in the LOYTEC Device User Manual [1].
- Set a password for the "guest" user to protect information of the device info page from unwanted disclosure.

10.2 Firmware

The device is equipped with one piece of software. This is the firmware image and its related firmware version. The firmware is distributed as a downloadable file. The device can be upgraded by placing the firmware image onto the device. The device firmware is signed by LOYTEC and its signature integrity is verified before the upgrade is allowed.

10.3 Ports

This Section lists all ports, which may be used by the device. The ports are default settings for their respective services. If not stated otherwise, the ports can be changed.

Required Ports:

- 443 tcp: This port is opened by the Web server and the OPC XML-DA server. It offers secure communication. Make sure the L-STUDIO deploy method is set to "loytechttps" and the Configurator as well as other clients use secure connection.
- 1628 udp/tcp: This is the data exchange port for CEA-852 (LON over IP). It is required for the primary function of the device to exchange control network data between routers over the IP network. Each device needs this port open. The port can be changed.

- 1629 udp/tcp: This is the configuration server port of CEA-852. Exactly one device in the system needs this port open. Other devices register with the configuration server to form the IP-852 channel list. The port can be changed.
- 47808 udp: This is the data exchange port for BACnet/IP. It is required for the primary function of the device to exchange control network data between routers over the IP network. Each device needs this port open. The port can be changed.

Optional ports not necessary for the primary product function. They can be disabled as described in the installation instructions in Section 10.1:

- 21 tcp: This port is opened by the FTP server. The port can be changed and disabled.
- 22 tcp: This port is opened by the SSH server. The port can be changed and disabled.
- 23 tcp: This port is opened by the Telnet server. The port can be changed and disabled.
- 80 tcp: This port is opened by the Web server and the OPC XML-DA server. It should be disabled and HTTPS (port 443) be used instead. The port can be changed.
- 161 tcp: This port is opened by the SNMP server. This port is disabled by default. The port can be changed.
- 5900 tcp: This port is opened by the VNC server, if it is enabled. This port is disabled by default. The port can be changed.
- 502 tcp: This port is opened, if Modbus TCP is configured in slave mode. This port is disabled by default. The port can be changed.
- 1630 udp/tcp: This port is used by the CEA-709 RNI and for the remote LPA. The port can be changed and disabled.
- 2002 tcp: This port is opened by the Wireshark protocol analyzer front-end. This port is disabled by default. The port can be changed.
- 4840 tcp: This port is opened by the OPC UA server. This port is disabled by default. The port can be changed.
- 61000-62299 udp: This port range is used for IEC-61499 cross-communication between controllers. The ports are assigned automatically by the L-STUDIO programming tool.

10.4 Services

Required services:

- CEA-852 (LON over IP): Primary function of the device. This service is in accordance with the standard ANSI/CEA-852-B.
- BACnet/IP: Primary function of the device. This service is in accordance with the standard ANSI/ASHRAE 135-2010.
- OPC XML-DA: This Web service provides access to data points over the OPC XML-DA standard.

Optional services not necessary for the primary product function. They can be disabled as described in the installation instructions in Section 10.1:

- HTTP: Web server. It provides a Web-based configuration UI. The Web UI can be disabled after setting up the device. The Web service is also used for the Configurator connection for configuration, firmware upgrade, and access to the log file.
- HTTPS: Secure Web server. It provides a Web-based configuration UI using HTTPS. It is also used for a secure Configurator connection.
- SSH: SSH server. It provides secure access to the device console menu over the network.

- FTP and Telnet: The FTP and Telnet server is used for connection to the device by the Configurator for configuration, firmware upgrade, and access to the log file. On devices without SSH these services must be enabled during device configuration.
- VNC: The VNC server can be used for remote access to the LCD display on devices that have it. The service is disabled by default.
- Modbus TCP: A Modbus TCP server is running when Modbus TCP is operated in slave mode. In all other cases this service is not needed.
- RNI: This service provides the remote network interface (RNI) function. It is also used by the remote LPA feature. If these features are not needed the service can be disabled.
- OPC UA: This secure service provides access to data points over the OPC UA standard. The service is disabled by default.
- SNMP: SNMP server. It provides network management information on the device used by standard IT tools. The service is disabled by default.
- Wireshark front-end: The Wireshark protocol analyzer may connect to this service and retrieve online protocol analyzer logs. The service is disabled by default.
- IEC-61499: This service is used by the IEC 61499 runtime for cross-communication between controllers.

10.5 Upgrade Key Strength

The secure services (HTTPS, SSH) rely on certificates to authenticate the device against the connecting client. This is key to prevent man-in-the-middle attacks. The device comes with pre-installed server certificates. It is recommended to upgrade the pre-installed certificate to an individual server-certificate and use stronger key length.

- Server certificate (for HTTPS, OPC UA): Follow the instructions in the LOYTEC Device User Manual [1] Section 3.2.29 Certificate Management on how to upgrade the pre-installed X.509 server certificate to a custom, self-signed or CA-signed certificate with stronger key length.
- SSH key upgrade: If SSH is enabled it is recommended to upgrade the SSH key length. Refer to the LOYTEC Device User Manual [1] Section 3.2.28 SSH Server Config on how to upgrade your RSA key to 2048 bits.

10.6 Logging and Auditing

The device contains a log file, which can be read out over FTP or the Web server. This log contains information when the device started and when crucial communication errors occur. Other information such user log-on are not logged as they are not part of the primary services of this device.

Logged events:

- Time of the last power-on reset of the L-INX/L-GATE device.
- Time and version of the last firmware upgrade.
- Time when the device configuration has been cleared or the device was reset to factory defaults.
- Commission of the CEA-709 node/router.
- Static errors in the device and data point configuration.
- System overload situations as one-time log messages since last power-on.

- Crucial communication errors as they occur.
- Logins and login failures.

10.7 Network Access

Network access can be protected by using 802.1X port authentication (as of firmware 7.4.0) using EAP-TLS, PEAP, or TTLS. Unused Ethernet ports can be disabled.

10.8 Password Protection

Devices provide separate administrative (admin) and operative (operator) user accounts. Passwords are stored using a strong cryptographic hash (salted SHA25). Device login is protected by a login trap that blocks logins after ten consecutive failed login attempts to protect against brute-force password attacks. Initial password setting is enforced.

To protect usage of the admin password, the admin user can create additional user accounts with an admin role. Those additional user accounts can be disabled as needed.

11 Specifications

11.1 Physical Specifications

11.1.1 LDALI-3E10X-U/LDALI-ME20X-U

Operating Voltage	85-240 V AC, 50/ 60 Hz
Power Consumption	typ. 7,5 W
Operating Temperature (ambient)	0°C to + 40°C
Storage Temperature	10°C to +85°C
Humidity (non condensing) operating	10 to 90% RH
Humidity (non condensing) storage	10 to 90% RH
Enclosure	Installation enclosure 9 TE, DIN 43 880
Environmental Protection	IP 40 (enclosure); IP 20 (screw terminals)
Installation	DIN rail mounting (EN 50 022) or wall mounting

11.1.2 LDALI-3E10X/LDALI-ME204

Operating Voltage	12-35 VDC or 12-24 VAC ±10%
Power Consumption	typ. 3 W
In rush current	up to 950 mA @ 24 VAC
Operating Temperature (ambient)	0°C to + 50°C
Storage Temperature	10°C to +85°C
Humidity (non condensing) operating	10 to 90% RH
Humidity (non condensing) storage	10 to 90% RH
Enclosure	Installation enclosure 9 TE, DIN 43 880
Environmental Protection	IP 40 (enclosure); IP 20 (screw terminals)
Installation	DIN rail mounting (EN 50 022) or wall mounting

11.1.3 LDALI-3101-U/LDALI-E101-U/LDALI-E201-U

Operating Voltage	85-240 VAC 50/60 Hz
Power Consumption	typ. 7.5 W
Operating Temperature (ambient)	0°C to + 40°C
Storage Temperature	10°C to +85°C
Humidity (non condensing) operating	10 to 90% RH
Humidity (non condensing) storage	10 to 90% RH
Enclosure	Installation enclosure 6 TE, DIN 43 880
Environmental Protection	IP 40 (enclosure); IP 20 (screw terminals)
Installation	DIN rail mounting (EN 50 022) or wall mounting

11.1.4 LDALI-PLC2/LDALI-PLC4

Operating Voltage	85-240 V AC, 50/ 60 Hz
Power Consumption	typ. 7,5 W
Operating Temperature (ambient)	0°C to + 40°C
Storage Temperature	10°C to +85°C
Humidity (non condensing) operating	10 to 90% RH
Humidity (non condensing) storage	10 to 90% RH
Enclosure	Installation enclosure 9 TE, DIN 43 880
Environmental Protection	IP 40 (enclosure); IP 20 (screw terminals)
Installation	DIN rail mounting (EN 50 022) or wall mounting

11.2 Resource Limits

Table 44 and Table 45 specify the resource limits of the different L-DALI models.

Limits \ Model	3E102	3E104	3101-U	E101-U	3E101-U	3E102-U	3E104-U
OPC Tags	2000	2000	2000	2000	10000	10000	10000
User Registers	1000	1000	1000	1000	2000	2000	2000
Address table entries/legacy[1]	512/15	512/15	512/15	512/15	512/15	512/15	512/15
Alias NVs[1]	1000	1000	1000	1000	1000	1000	1000
LONMARK Calendar objects/patterns per object	2/10	4/10	1/10	1/10	4/10	4/10	4/10
LONMARK Scheduler objects	32	64	16	16	64	64	64
LONMARK Alarm Servers	32	32	32	32	32	32	32
Trend Logs	50	100	25	25	512	512	512
Total trended data points	256	256	256	256	1000	1000	1000
Total aggregated size	1MB	1MB	1MB	1MB	200MB	200MB	200MB
E-mail templates	100	100	n/a	100	100	100	100
Math objects	100	100	100	100	100	100	100
Alarm Logs	10	10	10	10	10	10	10
Modbus data points	n/a	n/a	n/a	n/a	2000	2000	2000
EnOcean data points	n/a	n/a	n/a	n/a	1000	1000	1000
SMI devices	n/a	n/a	n/a	n/a	64	64	64
Local Connections	1000	1000	1000	1000	2000	2000	2000
Global Connections	250	250	n/a	250	250	250	250
L-WEB Clients (concurrent)	8	8	n/a	8	32	32	32
LWLAN-800 AP+Mesh max. clients	n/a	n/a	n/a	n/a	7	7	7

[1] Per CEA-709 interface. 1 interface je channel

Table 44: Resource limits of different LDALI-10X models

Limits \ Model	ME204	E201-U	ME201-U	ME202-U	ME204-U	PLC4	PLC2
OPC Tags	2000	2000	10000	10000	10000	10000	10000
User Registers	1000	1000	2000	2000	2000	2000	2000
BACnet server objects	1100	300	1000	2000	4000	2000	2000
BACnet client mappings	1000	1000	1000	1000	1000	1000	1000
BACnet scheduler objects	100	25	100	100	100	100	100
BACnet calendar objects	25	25	25	25	25	25	25
BACnet notification classes	32	32	32	32	32	32	32
Trend Logs	100	25	512	512	512	512	512
Total trended data points	256	256	1000	1000	1000	1000	1000
Total aggregated size	1 MB	1 MB	200 MB	200 MB	200 MB	200 MB	200 MB
E-mail templates	100	100	100	100	100	100	100
Math objects	100	100	100	100	100	100	100
Alarm Logs	10	10	10	10	10	10	10
Modbus data points	n/a	n/a	2000	2000	2000	2000	2000
EnOcean data points	n/a	n/a	1000	1000	1000	1000	1000
SMI devices	n/a	n/a	64	64	64	64	64
Local Connections	1000	1000	2000	2000	2000	2000	2000
Global Connections	250	250	250	250	250	250	250
L-WEB Clients (concurrent)	8	8	32	32	32	32	32
LWLAN-800 AP+Mesh max. clients	n/a	n/a	7	7	7	7	7

Table 45: Resource limits of different LDALI-20X and LDALI-PCL4 models.

11.3 FCC Warning

This device has been tested and found to comply with limits for a Class B digital device, pursuant to Part 2 and 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates and radiates radio frequency energy and, if not installed and used in accordance with the user's manual, it may cause interference in which case users will be required to correct interference at their own expenses.

11.4 CE Warning

This is a Class B product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

12 References

[1] LOYTEC Device User Manual 8.2, LOYTEC electronics GmbH, Document № 88086512, December 2023.

[2] LINX Configurator User Manual 8.2, LOYTEC electronics GmbH, Document № 88086711, December 2023.

[3] NIC User Manual 4.2, LOYTEC electronics GmbH, Document № 88067217, April 2013.

[4] LWEB-802/803 User Manual 4.4, LOYTEC electronics GmbH, Document № 88074224, April 2022.

[5] LWEB-900 User Manual 4.0.1, LOYTEC electronics GmbH, Document № 88081510, September 2022.

[6] L-VIS User Manual 8.0, LOYTEC electronics GmbH, Document № 88068527, June 2023.

[7] L-IOB I/O ModuleUser Manual 8.2, LOYTEC electronics GmbH, Document № 88078517, December 2023.

[8] L-IP User Manual 8.2.8, LOYTEC electronics GmbH, Document № 88065915, Juni 2024.

[9] LIP-ME20X User Manual 8.2, LOYTEC electronics GmbH, Document № 88073513, December 2023.

[10] AN011E L-DALI Compatibility List, LOYTEC electronics GmbH, Document № 86002011, March 2023.

[11] LROC User Manual 3.2.2, LOYTEC electronics GmbH, Document № 88085418, April 2024

[12] AN018E BLE-enabled DALI multisensors, LOYTEC electronics GmbH, Document № 86002601, January 2021

[13] LOYTEC LDALI Device User Manual 3.32, LOYTEC electronics GmbH, Document № 88094303, January 2024.

13 Revision History

Date	Version	Author	Description
07-05-2010	1.0	AD	Initial revision V1.0
15-06-2010	1.0.1	JB	Minor corrections
08-11-2010	1.1	JB	Updated for L-DALI firmware 2.1 and Configurator 1.1
16-09-2011	2.0	JB	Cover LDALI-ME20X (BACnet) firmware 2.2 Minor improvements related to LDALI-3E10X documentation
14-11-2011	2.0.1	JB	Minor corrections and improvements
29-06-2012	3.0	JB	Cover LDALI-3E10X firmware 3.0 and LDALI Configurator 3.0
07-09-2012	3.0.1	JB	Minor corrections
11-10-2013	3.1	JB	Cover LDALI-10X/20X firmware 3.1 and LDALI Configurator 3.1. Cover LDALI-E101-U, LDALI-3101-U and LDALI-E201-U.
13.08.2014	3.2	JB	Cover LDALI-10X/20X firmware 3.2 and LDALI Configurator 3.2. Cover LDALI-E101-U, LDALI-3101-U and LDALI-E201-U versions with Dual-Ethernet and internal DALI PS which can be switched off.
27.05.2015	5.2	JB	Cover LDALI-10X/20X firmware 5.2 and LINX Configurator 5.2 (replacing LDALI Configurator). Cover LDALI-MS1 and LDALI-BM1. Added more info on DALI basics and troubleshooting info. Added Property IDs for BACnet standard properties.
25.03.2016	6.0	JB	Re-organized User Manual structure, branched out common parts into LOYTEC Device User Manual and LINX Configurator User Manual. Cover LDALI-10X/20X firmware 6.0 and LINX Configurator 6.0. Cover LDALI-3E10X-U and LDALI-ME20X-U models.
21.09.2016	6.1	JB	Cover LDALI-10X/20X firmware 6.1.
31.10.2017	6.3	JB	Cover LDALI-10X/20X firmware 6.3.
21.05.2018	6.4	JB	Cover LDALI-10X/20X firmware 6.4. Added colour control via data points.
15.11.2019	7.0	UR	Cover LDALI-10X/20X firmware 7.0
30.04.2020	7.2	UR	Cover LDALI-10X/20X/PLCx firmware 7.2 Added data points for humidity, temperature and button feedback.
29.01.2021	7.4	UR	Cover LDALI-10x/20x/PLCx firmware 7.4 Added data points for sensitivity and bluetooth functions Documented LRS232-802 usage Updated CLC-mode documentation Updated Chapter 10 Security Hardening Guide
30.01.2022	7.6	UR	Cover LDALI-10x/20x/PLCx firmware 7.6 Updated Chapter 10 Security Hardening Guide Updated Resource Limits
31.03.2023	8.0	UR	Updated for firmware 8.0 Updated Chapter 3 Safety Instructions Clarification on CLC-parameter use
31.07.2024	8.2.8	UR	Update for firmware 8.2.8 (including 8.2.0 LINX features) Cover LDALI-ME202-U Added chapters 8.1.4.13 and 8.2.4.13 about Human Centric Lighting Updated chapters 8.1 and 8.2 for improvements on emergency lighting