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zencontrol

Application note: 3rd Party Interface – Ethernet UDP

Overview

The zencontrol platform has been designed for modern buildings with integrated system from HVAC, BMS, Security to Fans, Shades and Audio Visual systems. One of the ways in which zencontrol encourages connected buildings is the provision of a UDP based network lighting protocol for control of connected DALI luminaires from 3rd party systems. The UDP system allows integration to existing systems and networks infrastructure. The following describes the specification and usage of the network based lighting interface.

Requirements

Requires firmware version 0.11.018 or above

Specification

Utilising the UDP networking protocol, the zencontrol ethernet interface can communicate with any external system that adheres to the following command structure.

Following this command structure, DALI commands can be sent to an individual device, group or to all devices using broadcast.

The ethernet interface is hosted on UDP port 5108.

Command structure

The zencontrol UDP Ethernet Interface uses a 7-byte structure as shown below.

7 Bytes:

- **Control:** 1 byte
- **Data (if required):** 3 bytes
- **Address:** 1 byte
- **Command:** 1 byte
- **Checksum:** 1 byte

Control	Data (if required)			Address	Command	Checksum
Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7

Answer structure

The zencontrol UDP Ethernet Interface responds using a 3-byte structure as shown below.

3 Bytes:

- **Answer type:** 1 byte
- **Answer (if required):** 1 byte
- **Checksum:** 1 byte

Answer type	Answer (if required)	Checksum
Byte 1	Byte 2	Byte 3

***Note** all values are binary not ASCII strings.*

Control byte

Bit	7	6	5	4	3	2	1	0
	0	Identify/ nDALI	Echo	DSI/ nDALI	0	Mode select		

Bit 7-3: Unused: For UDP, these bits are unused and should be set to zero

Bit 2-0: Mode select

Mode select

- **Mode Select 0 (0b000):** DALI Lighting Commands
- **Mode Select 1 (0b001):** Communication Control Commands
- **Mode Select 2 (0b010):** Virtual Instance Interaction Commands
- **Mode Select 3 (0b011):** Quick Query Commands

Data bytes

Byte	1	2	3
Data	HI	MID	LO

Data HI: High data byte as required by command
Data MID: Mid data byte as required by command
Data LO: Low data byte as required by command

Address byte

Mode select 0

In Mode Select 0, DALI commands are separated in to Direct Lighting commands, and Indirect Lighting commands based on the indirect/direct selector bit in the Address Byte. Please ensure this bit is set correctly for the right command set.

Bit	7	6	5	4	3	2	1	0
	Address							[In]direct Command

Bit 7-1: Target DALI address

Bit 0: High: Send indirect lighting command
Low: Send direct lighting command

DALI addresses

Address value	*Mapped DALI address*
0 – 63	Address 0 – 63
64 – 79	Group 0 – 15
127	Broadcast

Mode select 1

In Mode select 1, Address Byte is as per Mode select 0, Bit 0 is unused and should be left as 0.

Mode select 2

In Mode select 2, Address byte is a full byte used to target the virtual instances of the controller where applicable.

Instance addresses

zencontrol Controller	*Virtual instance addresses*
LCM/RCM	Instance 10, 11
Application Controller	Instance 0-9

Mode select 3

In Mode select 3, Address byte is as per Mode Select 0, Bit 0 is unused and should be left as 0.

Command byte

Mode select 0

In Mode select 0, DALI commands are separated in to Direct Lighting commands, and Indirect Lighting commands based on the indirect/direct selector bit in the Address Byte. Please ensure this bit is set correctly for the right command set. No Mode Select 0 commands use the Data bytes, which should be left unset (all zero).

Direct commands – used to specify a particular light level.
Indirect commands – provide relative instructions such as step up or step down.

Direct commands

Command byte	*Action*
0 – 255	ARC LEVEL

Arc level:
Arc level 0 will turn lights off, and Arc level 254 will turn lights on to their maximum level. Values in between will cause lights to run at a percentage of their maximum. Interpretation of the Arc level command is subject to each lights own physical and configurable maximums and minimums. Arc level 255 is defined as 'No Change', and can be considered a no-operation command for testing.

Indirect commands

Command byte	*Action*
0	OFF
1	UP
2	DOWN
3	STEP UP
4	STEP DOWN
5	MAX
6	MIN
16 – 31	SCENE 0 – SCENE 15

Replies:
A correctly processed command should result in a *Reply – No Answer* result.
A *Reply Error – Invalid* indicates the command was unsupported
A *Reply Error – Short Circuit* indicates a physical error on the DALI bus

Mode select 1

In Mode select 1, Control commands can be sent to modify how the controller sends commands on the bus.

Control commands

Command byte	*Action*
0	INHIBIT
1	PROFILE

Inhibit:
Inhibit will prevent the Controller from sending DALI commands to the target in response to sensor stimuli for the duration of the seconds specified. Set to zero to end the inhibit condition. Maximum duration is 65535 second (~18.2 hours).

Arguments:
This command takes a duration of 0 to 65535 seconds in Big Endian format, split across the 3 Data bytes. The Data HI byte should remain as zero for now, and this range may be expanded in the future. The address byte should reflect the address / group that is to be inhibited.

Replies:
A correctly processed command should result in a *Reply OK* result. A *Reply Error – Invalid* indicates the command was unsupported.

Profile Change:
Profile Change will enact an unscheduled profile change on the controller. The Profile needs to be pre-configured. Command will fail if requested profile is not found, or if a higher priority profile is currently active. If required, this command can also be used to return the controller to is scheduled profile.

Arguments:
This command takes a profile number of 0 to 65535 Big Endian format, split across the 3 Data bytes. The Data HI byte should remain as zero. Values 0 – 65534 will attempt to change to that profile, Value 0 will attempt to return the controller to its scheduled profile. The address byte should always be set to 0.

Replies:
A correctly processed command should result in a *Reply – Answer* result. An answer value of 1 means the current profile was changed, a value of 0 means that the profile could not be changed at this time. A *Reply Error – Invalid* indicates the command was unsupported.

Mode select 2

In Mode select 2, Commands can be sent to emulate triggers on virtual instances. zencontrol room controllers can be configured to have up to two such virtual instances. Zencontrol application controllers can have up to 10. Both uses the instance addresses described in the Address Byte section. These instances can be of the type Push Button, Absolute Input or Occupancy Sensor.

Command byte	Instance Command
1	Instance Command 1
2	Instance Command 2
…	…
10	Instance Command 10

Instance Type	Instance Command 1	Instance Command 2
Push Button	Short Press Action	Long Press Action
Absolute Input	Off	On
Occupancy Sensor	Unoccupied	Occupied

Replies:
A correctly processed command should result in a *Reply OK* result. A *Reply Error – Invalid* indicates the command was unsupported.

Mode select 3

In Mode select 3, Commands can be sent to perform Quick Queries on the controller.

Quick Query Commands

Command byte	Action
0x10	Quick Query Last Heard Scene
0x11	Quick Query Current Scene
0xA0	Quick Query Actual level

Quick Query Last Heard Scene:

Quick Query Last Heard Scene reports the last heard scene of an address, group or broadcast target. A return value of 255 indicates that no Scene has currently been observed for the requested target.

Replies:
A correctly processed command should result in a *Reply – Answer* result.

Quick Query Current Scene:

Quick Query Current Scene reports the current scene of an address, group or broadcast target. A return value of 255 indicates that the target is currently not in a Scene. Either no Scene has been observed, or a lighting command has taken the target out of the scene.

Replies:
A correctly processed command should result in a *Reply – Answer* result.

Quick Query Actual level:
Quick Query Actual Level aggregates the Actual Level of an address or group, broadcast target is currently unsupported. A return value of 255 indicates 'Mixed', for when DALI gear has different actual levels.

Replies
A correctly processed command should result in a *Reply – Answer* result. A *Reply Error – Invalid* indicates the command was unsupported.

Checksum byte

The checksum of the packet is the XOR-combination of the proceeding 6 bytes

Answers

Answers to UDP command packets result in a

Answer Type Byte

Bit	7	6	5	4	3	2	1	0
	0	1	0	1	Answer type enum			

Bit 7-4: Fixed: For UDP, these bits must have a value of 0b0101
Bit 3-0: Answer type enum

Answer Type Enum

- **Answer Type 0 (0b00):** Reply okay
- **Answer Type 1 (0b01):** Reply – Answer (See Answer Byte)
- **Answer Type 2 (0b10):** Reply – No answer
- **Answer Type 3 (0b11):** Reply – Error (See Answer Byte)

Error Answer

- **Error Answer 1:** Invalid Command
- **Error Answer 2:** Short Circuit

Examples

The following examples are included to help explain the specification

Example 1

Set group 4 to max

Control	Data			Address	Command	Checksum
0x00	0x00	0x00	0x00	0x89	0x05	0x8C
Mode select 0	Unused			Group 4 indirect	MAX	

Command string:
"\x00\x00\x00\x00\x89\x05\x8C"

Example 2

Set group 15 to arc level 240

Control	Data			Address	Command	Checksum
0x00	0x00	0x00	0x00	0x9E	0xF0	0x6E
Mode select 0	Unused			Group 15 direct	Arc level 220	

Command string:
"\x00\x00\x00\x00\0x9E\xF0\x6E"

Example 3

Inhibit address 42 for 8 hours

Control	Data			Address	Command	Checksum
0x01	0x00	0x70	0x80	0x54	0x00	0xA5
Mode select 1	28800 seconds (0x007080)			Address 42	Inhibit	

Notes on calculating data:
8 hours which is 28800 seconds, or hexadecimal is 0x007080. Splitting each byte gives 0x00, 0x70, 0x80.

Command string:
"\x01\x00\x70\x80\0x54\x00\xA5"

Example 4

Send a short press on instance 10 (virtual instance 0) on a Room Controller

Control	Data			Address	Command	Checksum
0x02	0x00	0x00	0x00	0x0A	0x01	0x09
Mode select 2	Unused			Instance 10	Instance action 1	

Notes on calculating data:
The Room Controller has instance 10 and instance 11 configured as Push Buttons. Instance Action 1 on a Push Button is "Short press".

Command string:
"\x02\x00\x00\x00\0x0A\x01\x09"