1 Table of Contents

2 Introduction

This document provides detailed information on each component in the elitedali system.

3 Prerequisites

elitedali requires Niagara version 4.1 or greater.

4 Overview

This section provides an overview of the basic elitedali component layout as shown in Figure 1.

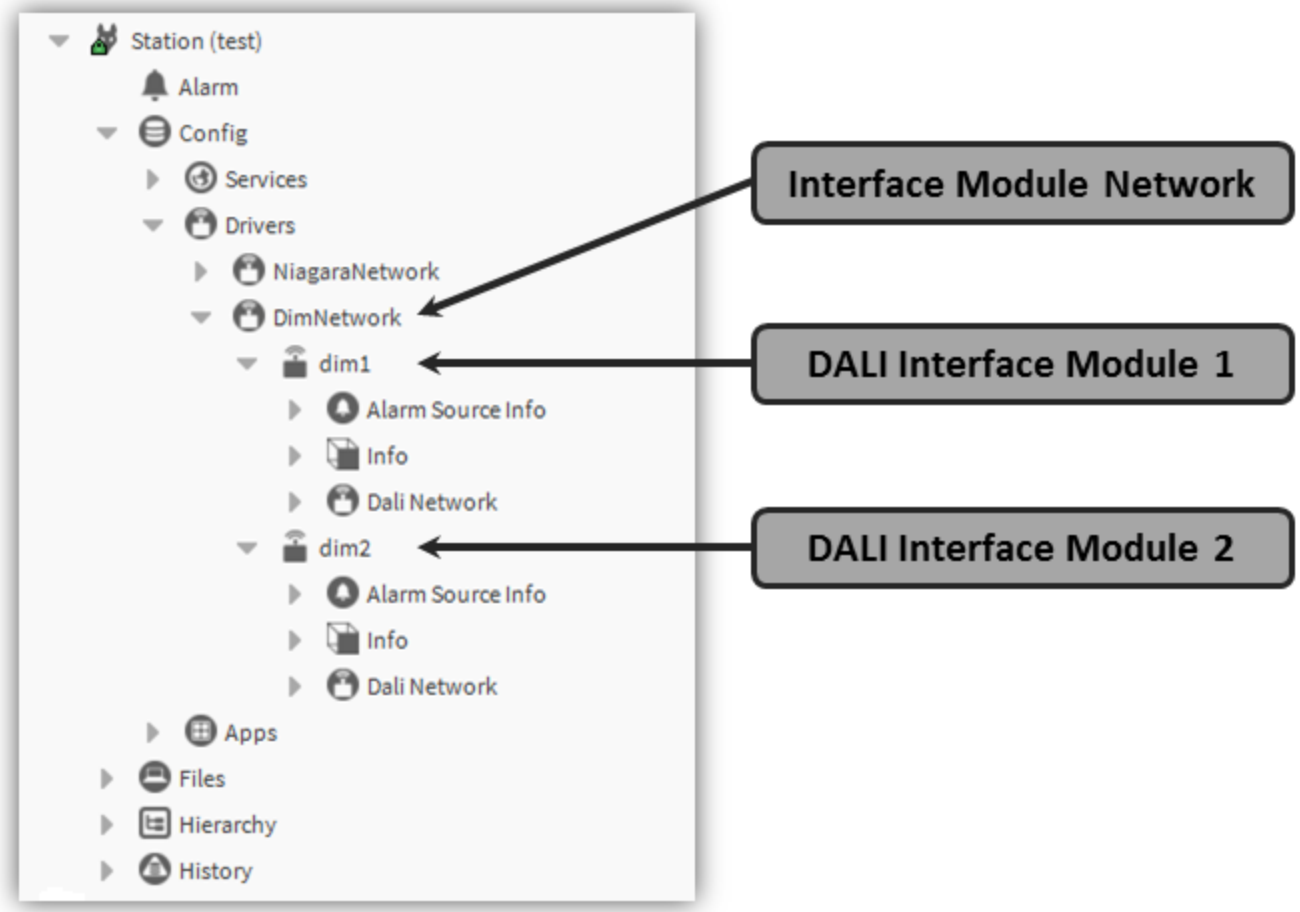

Figure 1: elitedali Layout Overview

A DALI Interface Module (DIM) network that will be used to communicate with the physical DALI Interface Module devices over a RS485 connection must be added to the Niagara station Drivers container.

Each DALI Interface Module Network can have more than one DALI Interface Module device installed.

Currently each network (i.e. RS485 port) is limited to a maximum of 4 modules.

Each installed DALI Interface Module device contains a DALI Network component which represents the physical DALI network connected to the associated device.

5 DALI Interface Components

This section describes all the basic components of the elitedali driver software.

5.1 DALI Interface Module Network

The Dim Network component represents a network of elitedali DALI Interface Modules attached to a single RS485 port.

5.1.1 Dim Network Property Sheet

Figure 2 shows the property sheet for the Dim Network.

Most of the properties are standard Niagara network properties, please refer to the standard Niagara documentation for an explanation of what these values represent.

The Serial Port property must have the correct Port Name set before the DimNetwork will be able to communicate with the devices attached to the hosts RS485 port.

The Description property is an optional textual description of the DIM network. This is not used by the system and may be left blank or null.

The Driver Version property indicates the current version of the elitedali driver software installed on the host.

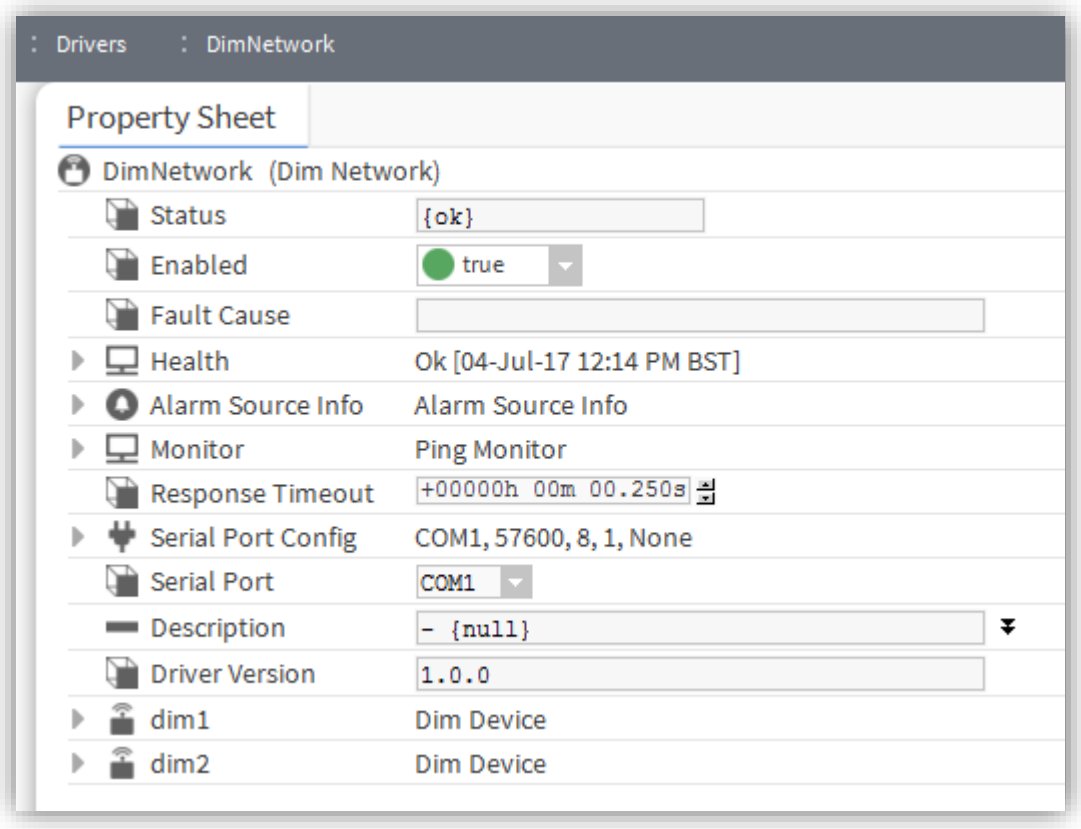

Figure 2: Dim Network Property Sheet

5.1.2 Dim Network Actions

The Dim Network component has two actions: 'Set Com Port' and 'Identify All', as shown in Figure 3.

The 'Set Com Port' action is just provided as a convenient way to configure the Dim Network serial port without having to view and edit the Dim Network property sheet.

The 'Identify All' action will cause all DALI Interface Modules correctly connected to the selected RS485 port to flash their DALI transmit and receive LEDs together for approximately 15 seconds.

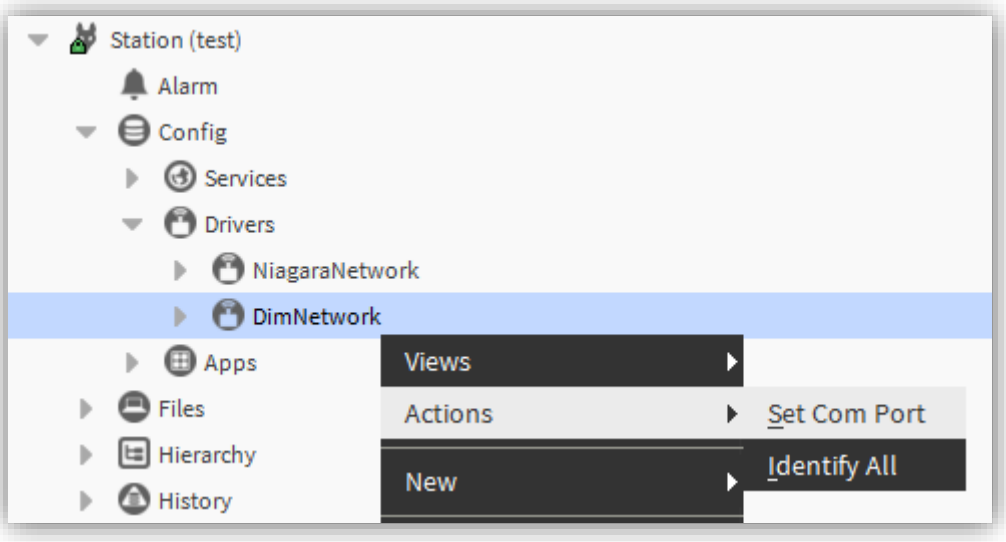

Figure 3: Dim Network Actions

5.2 DALI Interface Module Device

The DALI Interface Module Device component represents an individual DALI Interface Module on a RS485 network (the Dim Network).

5.2.1 Dim Device Property Sheet

Figure 4 shows the property sheet for the Dim Device.

Most of the properties are standard Niagara device properties, please refer to the Niagara documentation for an explanation of what these values represent.

The Description property is an optional textual description of the DIM device. This is not used by the system and may be left blank or null.

The 'Address' property shows the address of the device on the RS485 network. No two devices on the same network should have the same address value.

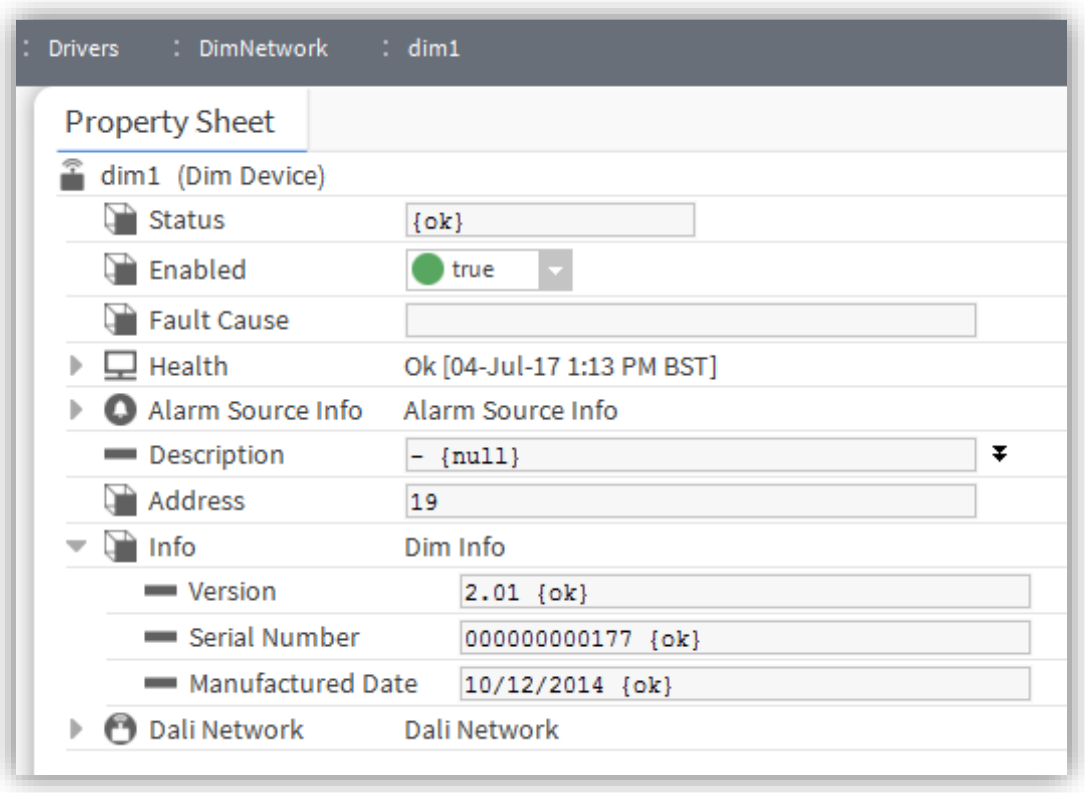

Figure 4: Dim Device Property Sheet

The 'Info' item contains device identification properties as described in Table 1.

Table 1: Dim Device Points

Info Property Name	Description
Version	The firmware version of the software installed in the DALI Interface Module device.
Serial Number	The unique serial number of the DALI Interface Module device.
Manufactured Date	The date the DALI Interface Module device was manufactured.

The Dali Network item represents the DALI network connected to the DALI Interface Module and is described in section 6.

5.2.2 Dim Device Actions

The Dim Device component actions are shown in Figure 5 and described in Table 2.

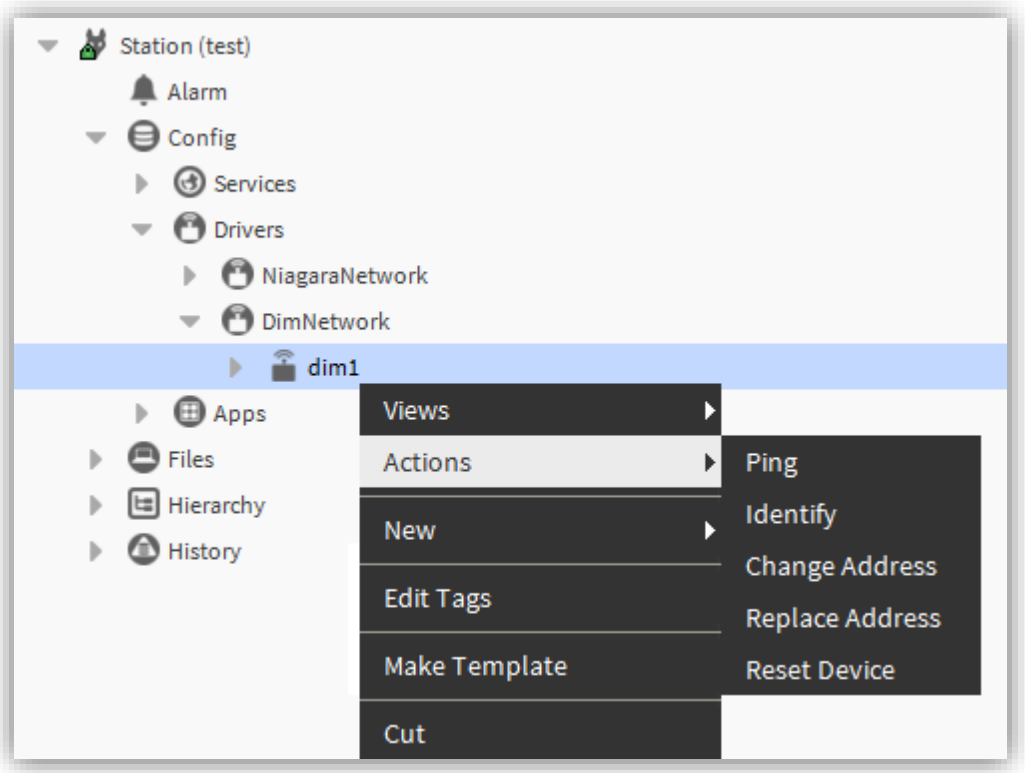

Figure 5: Dim Device Actions

Table 2: Dim Device Actions

Action	**Description**
Ping	This action will confirm that the DALI Interface Module device can be successfully contacted. If there is a communication problem with the device it will be shown in the standard device fault and health properties.
Identify	This action will cause the DALI Interface Module device to flash its DALI transmit and receive LEDs together for approximately 15 seconds.
Change Address	This action will cause the DALI Interface Module device to actively change its RS485 address. When invoked the user will be prompted to enter a new RS485 address which will then be set as the new address for the physical device and the device component.
Replace Address	This action is used to change the RS485 address of the DALI Interface Module device component only. The address of the physical device is not changed. This action is useful to change the address in Niagara when a physical device has been changed and the new device has a different address.
Reset Device	This action causes the DALI Interface Module firmware to restart.

6 DALI Components

6.1 DALI Network

The DALI Network component represents a single physical DALI network that is connected to the DALI Interface Module represented by the parent component.

6.1.1 Dali Network Manager

Figure 6 shows the network manager for the Dali Network.

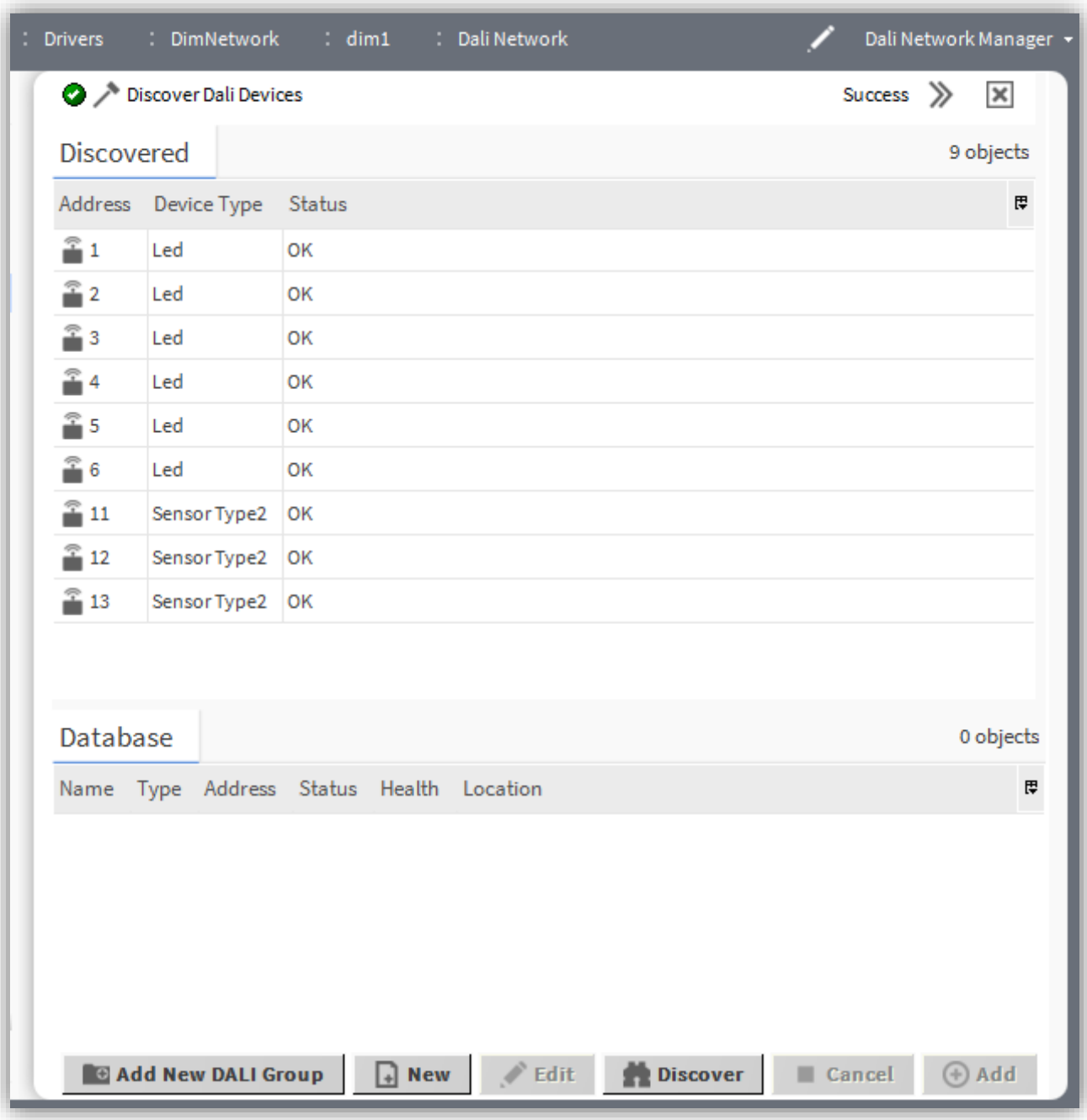

Figure 6: Dali Network Manager

The Dali Network Manager is used to manually commission and manage the DALI network.

DALI devices attached to the network can be addressed, discovered and added to the Niagara station database using the buttons at the bottom of the DALI Network Manager view.

Table 3: Dali Network Manager Buttons

Dali Network Manager Button	Description
Add New DALI Group	Add a new DALI Group folder to the DALI network. For more information on DALI Group folders go to section 6.2. The user will be prompted for the DALI group address value and for the DALI Group folder name.
New	Manually add a DALI device to the DALI network. This is an alternative to using the DALI discovery method described below. The user will be prompted for the DALI address of the device to be added and the DALI device name.
Discover	Discover all devices on the DALI network and display them in the network manager. Devices listed can then be selected and added to the station database using the Add button. Go to section 7.1.2 for a more detailed description of DALI discovery.
Add	Once one or more DALI devices have been selected from the network manager discovery table the Add button will cause them to be added to the station database for subsequent use.
Address DALI Network	Assign DALI addresses to devices. Go to section 7.1.1 for a more detailed description of DALI addressing.

6.1.2 Dali Network Property Sheet

Figure 7 shows the property sheet for the Dali Network.

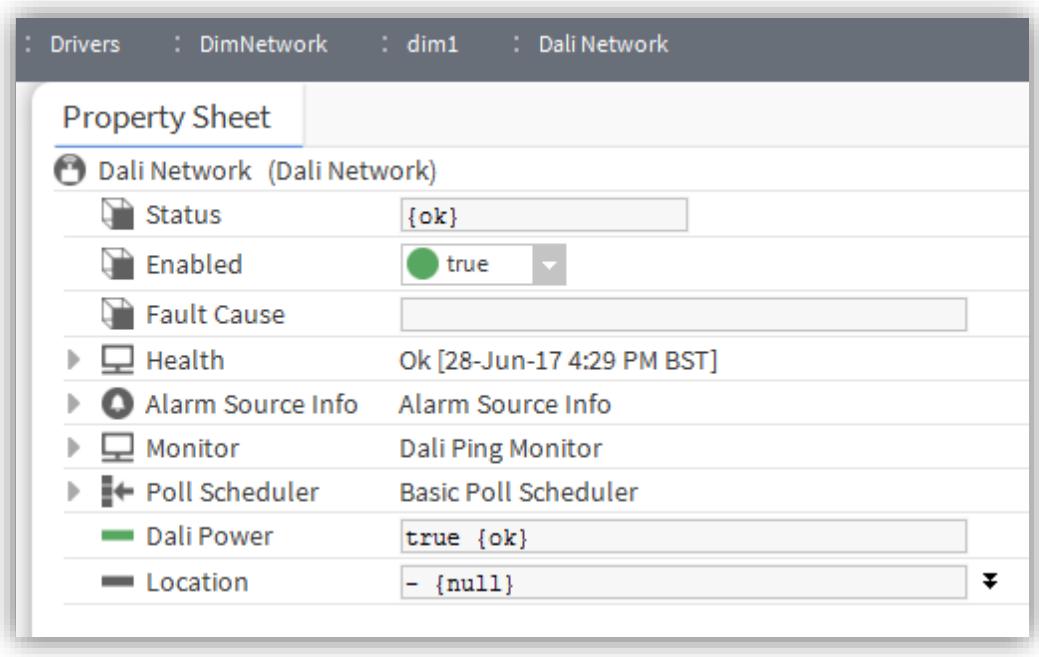

Figure 7: Dali Network Property Sheet

Most of the properties are standard Niagara network properties, please refer to the Niagara documentation for an explanation of what these values represent.

The 'Dali Power' property indicates if there is DALI power applied to the attached DALI network. Note that this property is only updated when a DALI operation is performed.

The ‘Location’ property is not used by the system and may be left blank. It is provided for users to be able to optionally enter a textual description for the DALI network.

6.1.3 Dali Network Actions

The Dali Network actions are shown in Figure 8 and described in the Table 4.

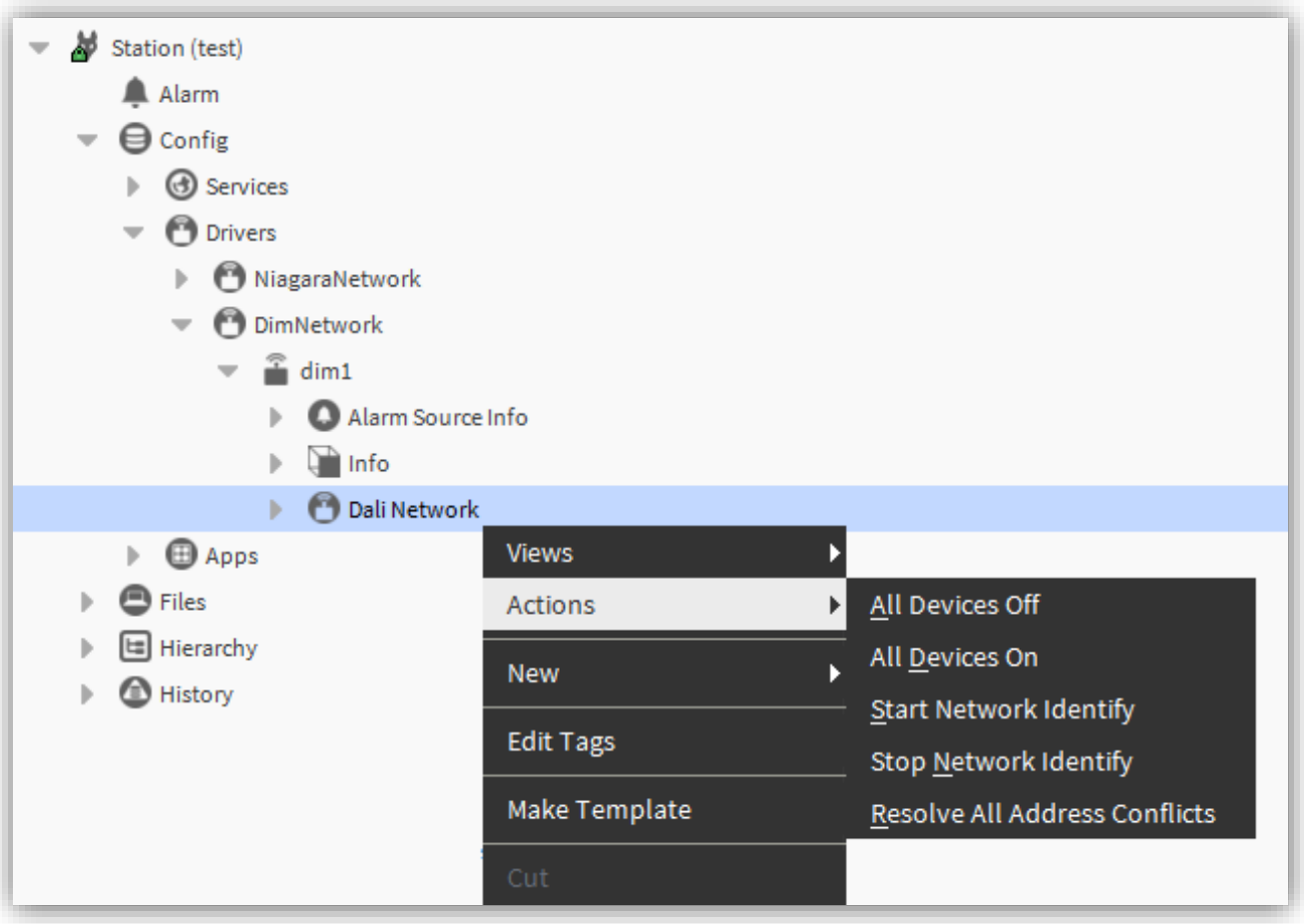

Figure 8: Dali Network Actions

Table 4: Dali Network Actions

Action	Description
All Devices Off	This action will send a broadcast DALI message to turn all the lights on the network off.
All Devices On	This action will send a broadcast DALI message to turn all the lights on the network on (to Max Level).
Start Network Identify	This action will cause all lights on the DALI network to start an identify sequence, turning on for a few seconds then turning off for a few seconds, then repeating this sequence.
Stop Network Identify	This action will stop the identify sequence for all lights on the DALI network.
Resolve All Address Conflicts	This action will scan all addresses on the DALI network and try to detect any address conflicts where two or more devices have the same address. If conflicts are found the addresses of these devices will be cleared and an DALI addressing job run to give new addresses to the previously conflicted devices.

6.2 DALI Group Folder

The DALI Group Folder component represents a group of lighting devices that are to be controlled together.

DALI lighting devices placed in the Dali Group Folder can be controlled individually by linking directly to the device component or as a group by linking to the Dali Group Folder component.

The Dali Group Folder default view is the same as the Dali Network Manager shown in section 6.1.1.

Devices discovered and added through the Dali Group Folder manager are added to the group rather than the network.

6.2.1 Dali Group Folder Property Sheet

Figure 9 shows the property sheet for the Dali Network, each property is described in Table 5.

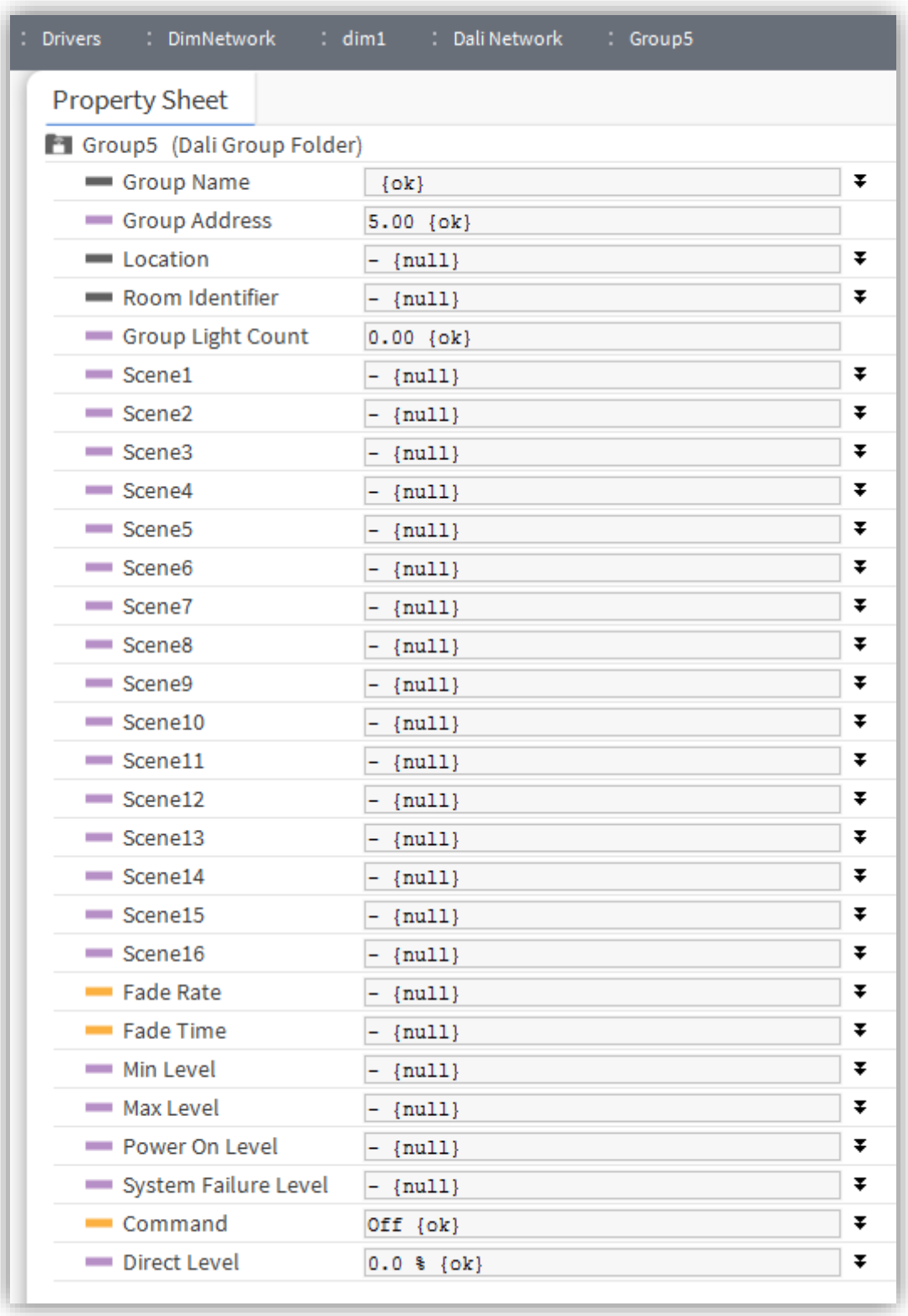

Figure 9: Dali Group Folder Property Sheet

The Dali Group Folder has three types of property:

- Information properties describe the group.
- Configuration properties change the configuration values that are stored in all lighting devices contained in the group. If the configuration property is null then the value stored in the devices are left unchanged.
- Control properties change the operating state of all lighting devices in the group.

Table 5: Dali Group Folder Properties

Property	Type	Description
Group Name	Information	An optional textual description of the group. This is not used by the system and may be left blank.
Group Address	Information	The DALI group address, or null if this is a virtual group (see section 6.2.3).
Location	Information	This property is not used by the system and may be left blank. It is provided for users to be able to optionally enter a textual description for the DALI group.
Room Identifier	Information	This property is an optional user defined group, zone or room identifier. This is intended to be some sort of code that can uniquely identify an area where lights are grouped. The value may be used in future commissioning tools.
Group Light Count	Information	The total number of lighting devices in the group.
Scene1 – Scene16	Configuration	Controls the scene level configuration values for all devices in the group.
Fade Rate	Configuration	Controls the fade rate configuration values for all devices in the group. This enumeration is described in section 8.4. See the DALI specification IEC 62386-102: 2009 section 9.5 for more information.
Fade Time	Configuration	Controls the fade time configuration values for all devices in the group. This enumeration is described in section 8.5. See the DALI specification IEC 62386-102: 2009 section 9.5 for more information.
Min Level	Configuration	Controls the minimum arc power level configuration values for all devices in the group.
Max Level	Configuration	Controls the maximum arc power level configuration values for all devices in the group.
Power On Level	Configuration	Controls the power on level configuration values for all devices in the group.
System Failure Level	Configuration	Controls the system failure level configuration values for all devices in the group.
Command	Control	Send a DALI command to all the devices in the group. The property type is an ‘elitedali2:StandardCommands’ enumeration, (see section 9.1).
Direct Level	Control	Set the arc power level for all devices in the group (in percent). This property has a numeric type.

6.2.2 Dali Group Folder Actions

The Dali Group Folder actions are shown in Figure 10 and described in Table 6.

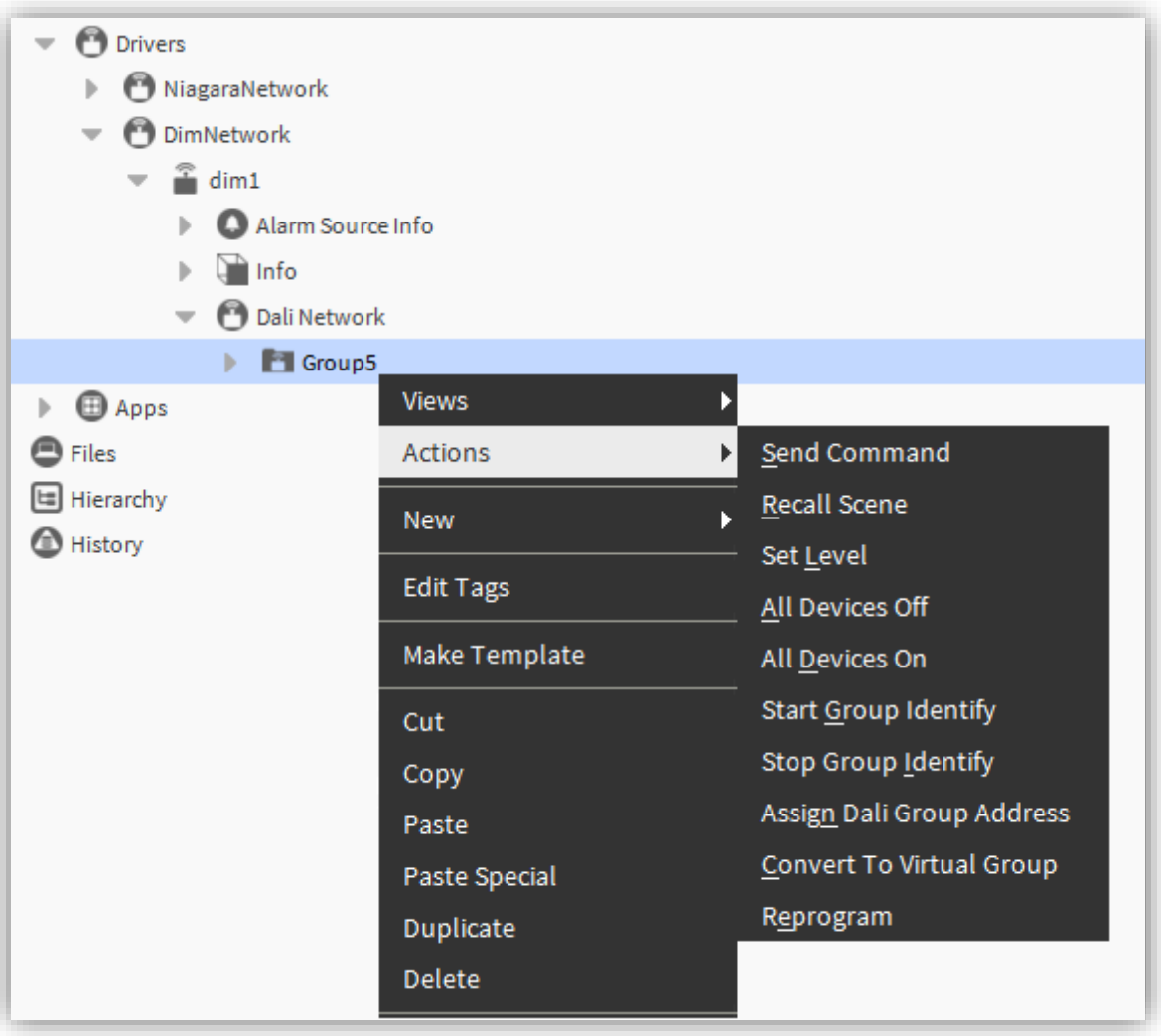

Figure 10: Dali Group Folder Actions

Table 6: Dali Group Folder Actions

Action	Description
Send Command	Send the specified command to all devices in the group.
Recall Scene	Instruct all devices in the group to set their arc power level to the value defined by the specified scene configuration.
Set Level	Instruct all devices in the group to set their arc power level to the specified value.
All Devices Off	This action will turn off all the devices in the group.
All Devices On	This action will turn on all the devices in the group (to Max Level).
Start Group Identify	This action will cause all lights in the Dali Group Folder to start an identify sequence, turning on for a few seconds then turning off for a few seconds, then repeating this sequence.
Stop Group Identify	This action will stop the identify sequence for all lights on the Dali Group Folder.
Assign Dali Group Address	Assign a new DALI group address to the Dali Group Folder. This action requires reconfiguration of all the devices in the group so should not be performed if one or more of the devices are inaccessible (unless the 'Repropgam' actions is used, see below).
Convert To Virtual Group	Convert a real DALI group into a virtual group (see section 6.2.3). This action requires reconfiguration of all the devices in the group so should not be performed if one or more of the devices are inaccessible (unless the 'Repropgam' actions is used, see below).
Reprogram	Reprogram all devices in the group with the correct configuration values and group assignments.

6.2.3 Virtual Groups

The DALI standard defines 16 DALI groups.

Standard DALI groups allow for efficient multi-casting of DALI messages to more than one DALI device, therefore using less bandwidth on the DALI bus than would be required if a message was sent to each device individually.

If for a particular lighting application 16 groups on a single DALI network is not enough then elitedali provides virtual groups to allow for more than 16 groups per DALI network.

Virtual groups work by sending a separate message to each lighting device in the Dali Group Folder. Virtual groups are therefore less efficient than standard DALI groups as they use more bandwidth on the DALI bus.

If virtual groups are used it is best to use the standard DALI groups for groups with the highest number of devices in them and the virtual groups for the groups with the fewest number of devices.

As virtual groups are not standard DALI groups they do not have a DALI group address, therefore the Dali Group Folder Group Address property is null.

Virtual groups can be created from standard DALI groups by using the ‘Convert To Virtual Group’ action on the group. Similarly a virtual group can be converted to a standard DALI group by using the ‘Assign Dali Group Address’ to give the group a real DALI group address.

Other than the way DALI messages are sent to the devices virtual groups behave the same as standard DALI groups.

But the impact of the less efficient communications should be considered to avoid performance problems on the DALI network.

6.3 DALI Lighting Device

There are a number of different DALI lighting device components which represent physical DALI devices such as LEDs, fluorescent ballasts, halogens, etc.. Most of the DALI lighting device Niagara components have the same properties.

6.3.1 DALI Lighting Device Property Sheet

Figure 11 shows the property sheet for a LED device.

Most of the properties are standard Niagara device properties, please refer to the Niagara documentation for an explanation of what these values represent.

The elitedali properties are described in Table 7.

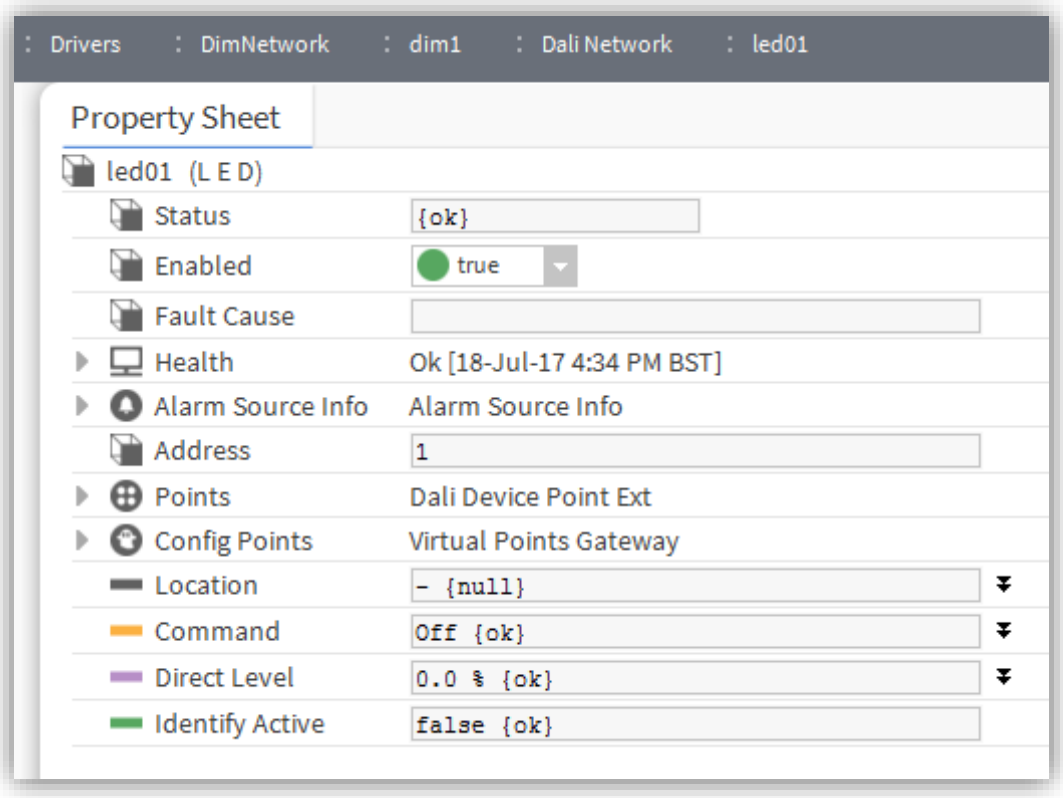

Figure 11: LED Device Property Sheet

Table 7: LED Device Properties

Property	Description
Address	The DALI device address.
Points	DALI lighting device proxy points container, see section 6.3.3.
Config Points	DALI lighting device configuration points container, see section 6.3.3.
Location	This property is not used by the system and may be left blank. It is provided for users to be able to optionally enter a textual description for the location of the DALI lighting device, (for example a floor plan identifier).
Command	Send a DALI command to the device. The property type is an 'elitedali2:StandardCommands' enumeration, (see section 9.1).
Direct Level	Set the arc power level for the device in percent. This property has a numeric type.
Identify Active	This property is true when the device is following an identify sequence.

6.3.2 DALI Lighting Device Actions

The DALI lighting device actions are shown Figure 12 in and described in Table 8.

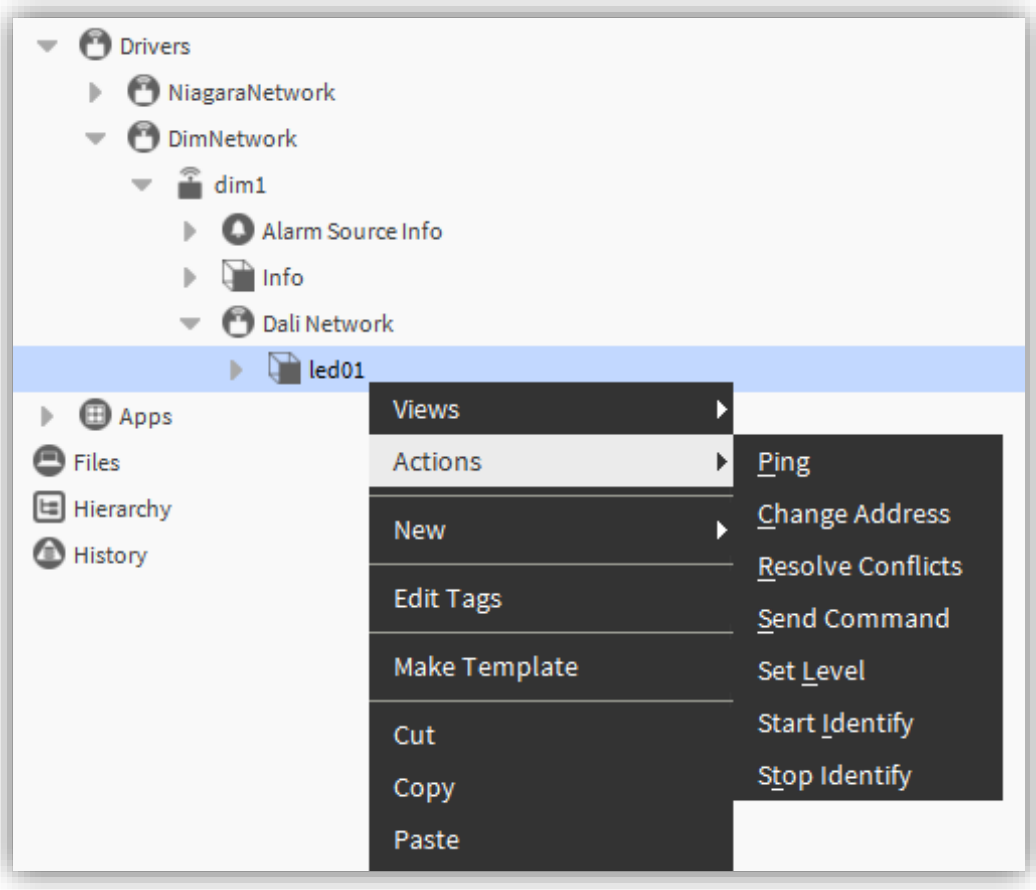

Figure 12: DALI Lighting Device Actions

Table 8: DALI Lighting Device Actions

Action	Description
Ping	This action will confirm that the DALI device can be successfully contacted. If there is a communication problem with the device it will be shown in the standard device fault and health properties.
Change Address	This action will cause the DALI device to actively change its DALI address. When invoked the user will be prompted to enter a new DALI address which will then be set as the new address for the physical device and the device component.
Resolve Conflicts	This action will clear the addresses of all DALI devices with the address given to this device. It will then initiate a DALI addressing job to reassign new DALI addresses to any devices that do not have them.
Send Command	Send the specified command to the device.
Set Level	Instruct the device to set its arc power level to the specified value.
Start Identify	This action will cause the lights to start an identify sequence, turning on for a few seconds then turning off for a few seconds, then repeating this sequence.
Stop Identify	This action will stop the identify sequence for the lights.

6.3.3 DALI Lighting Device Points

DALI lighting device points are items of data that are dynamically read from the physical DALI device and made available in Niagara. The basic layout of these is shown in Figure 13.

DALI lighting devices have two sets of data points: Proxy Points and Config Points.

The Proxy Points contain the most common information that is required to monitor the status of a device.

The Config Points are Niagara virtual points that can be used to configure or check the various parameters that are stored in the device.

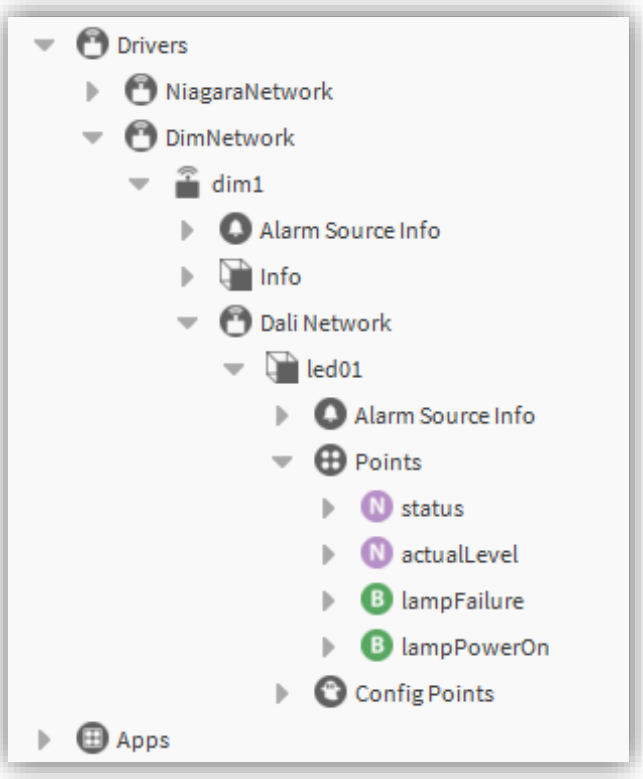

Figure 13: DALI Lighting Device Point Layout

DALI Lighting Device Proxy Points

The DALI lighting device Proxy Points can be accessed from the 'Points' property found on the device property sheet.

DALI lighting device Proxy Points must be discovered and added to the station in the normal Niagara way.

Table 9 contains a list of the proxy points available.

Table 9: DALI Lighting Device Proxy Points

Point Identifier	Point Type	Description
status	Dali Status Point	This point is a numeric value representing a bit-field. Each bit represents a separate boolean status value of the device. elitedali uses a special type to represent this point so each boolean value can be accessed separately. Each boolean state value is described in Table 10.
actualLevel	Numeric Point	This point represents the actual lamp arc power level that the lighting device is set to. A null value represents a lamp fault.
lampFailure	Boolean Point	This point has a value of true if the lighting device is reporting a lamp fault. If the lamp is OK then the point is false.
lampPowerOn	Boolean Point	This point has a value of true if the lamp arc power level is above zero (i.e. the lamp is on). If the lamp level is zero or there is a lamp fault then the point is false.

The following table describes the boolean properties made available as part of the 'status' proxy point.

Table 10: DALI Lighting Device Status Point Properties

Dali Status Point property	Description
Status Of Control Gear	This property indicates if there is any problem with the DALI lighting device (control gear). A value of false (0) means there are no detected problems. A value of true (1) means there is a problem with the device, other status values should be used to determine the details of the problem.
Lamp Failure	This property has a value of true if the device is reporting a lamp fault. If the lamp is OK then the point is false.
Lamp Arc Power On	This property has a value of true if the lamp arc power level is above zero (i.e. the lamp is on). If the lamp level is zero or there is a lamp fault then the point is false.
Limit Error	This property has a value of true if the last requested arc power level was not a valid value. Valid arc power level values are either zero or any value equal to or between the device minimum arc power level (minLevel) and the maximum arc power level (maxLevel).
Fade Running	This property has a value of true if the device is in the process of fading the lamp level. The value is false if no fading is in progress.
Reset State	This property has a value of true if all the device configuration values equal the DALI standard reset state values.
Missing Short Address	This property has a value of true if the device has no short DALI address assigned to it.
Power Failure	This property has a value of true if the device has not received any control commands since it was last powered on. The value changes to false as soon as an arc power level or lamp control command is received.

DALI Lighting Device Config Points

The DALI lighting device Config Points can be accessed from the 'Config Points' property found on the device property sheet and these points do **not** need to be discovered.

Config Points each have Read and Write properties for accessing or changing the values in the DALI device. Each point also has one or more 'Set' actions as an alternate method of changing the values.

Table 11 contains a list of the DALI lighting device proxy points available.

Table 11: DALI Lighting Device Config Points

Point Identifier	Point Type	Description
group1 - group16	Boolean Point	These booleans indicate if a device is a member of a group.
scene1 - scene16	Numeric Point	Controls the scene level configuration values that are stored in the device. If any of these values are null then assigning the device to the associated scene will have no effect on the device light level.
fadeRate	Enum Point	The speed of change of the light output. This enumeration is described in section 9.4. See the DALI specification IEC 62386-102: 2009 section 9.5 for more information.
fadeTime	Enum Point	The time taken for the light output to change from the actual dim level to the target dim level specified by the received command. This enumeration is described in section 9.5. See the DALI specification IEC 62386-102: 2009 section 9.5 for more information.
minLevel	Numeric Point	The minimum light level that can be assigned to the device, excluding the value zero (off). This value must be greater than the device's 'physicalMinLevel' value.
maxLevel	Numeric Point	The maximum light level that can be assigned to the device.
powerOnLevel	Numeric Point	The light level that will be assigned to the device when it is powered on (before receiving any other commands).
systemFailureLevel	Numeric Point	The light level that will be assigned to the device if the DALI power supply fails (or is disconnected from the device). If this value is null then the device will not change its light level when the DALI power supply fails.
physicalMinLevel	Numeric Point	The absolute minimum light level that can be assigned to the device as restricted by the hardware, excluding the value zero (off). This value cannot be changed.

6.4 DALI Sensor

DALI sensors are devices attached to the DALI network that measure Lux levels and occupancy state.

These devices are polled, so a DALI message must be sent periodically to read the Lux and occupancy values from the device.

It is **important** to consider the DALI network performance when managing sensors, as discussed in section 8.2.

The values read are made available as device properties, as shown in Figure 14.

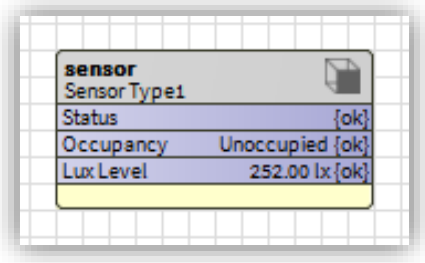

Figure 14: DALI Sensor

There are a number of different DALI sensor devices available, only devices that are fully approved or supplied by Control Network Solutions Ltd will work with elitedali. Connecting any sensor devices to a DALI network that are not approved by CNS (even if they are not being used) is strictly forbidden as this situation is likely to cause functional and performance problems. If in any doubt please contact Control Network Solutions Ltd for advice.

The details of the approved DALI sensor types are described in the following sections.

6.4.1 DALI Sensor Type 1

6.4.1.1 Sensor Type 1 Property Sheet

Figure 15 shows the property sheet for the Sensor Type 1 device.

Many of the properties are standard Niagara device properties, please refer to the Niagara documentation for an explanation of what these values represent.

The elitedali Sensor Type 1 properties are described in Table 12.

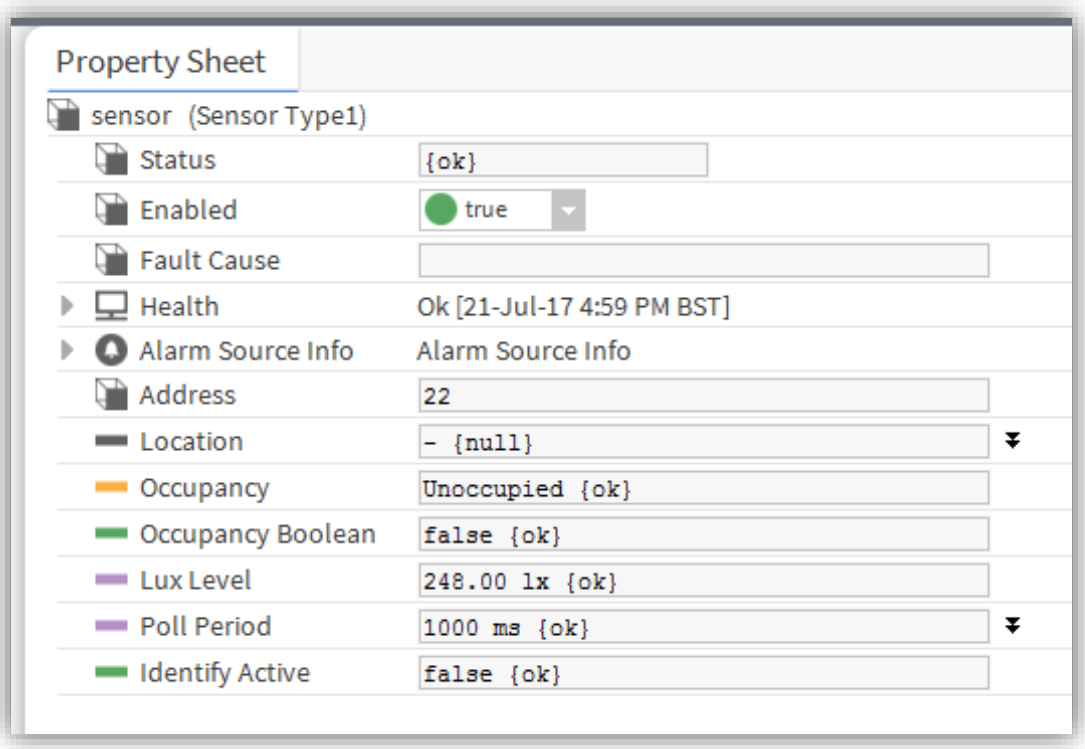

Figure 15: Sensor Type 1 Property Sheet

Table 12: Sensor Type 1 Properties

Property	Description
Address	The DALI device address.
Location	This property is not used by the system and may be left blank. It is provided for users to be able to optionally enter a textual description for the location of the DALI sensor, (for example a floor plan identifier).
Occupancy	This property represents the occupancy state last reported by the DALI sensor device. The property type is an 'elitedali2:Occupancy' enumeration, (see section 9.3).
Lux Level	This property represents the Lux level last reported by the DALI sensor device. The property type is numeric.
Poll Period	This property controls how often the DALI sensor device is polled. The value is the time between each read of the sensor state, in milliseconds. If this value is null then polling is disabled. It is **important** to consider the network performance when setting this value, as discussed in section 8.2.
Identify Active	This property is true when the sensor is following an identify sequence.

6.4.1.2 Sensor Type 1 Actions

The Sensor Type 1 actions are shown Figure 16 in and described in Table 13.

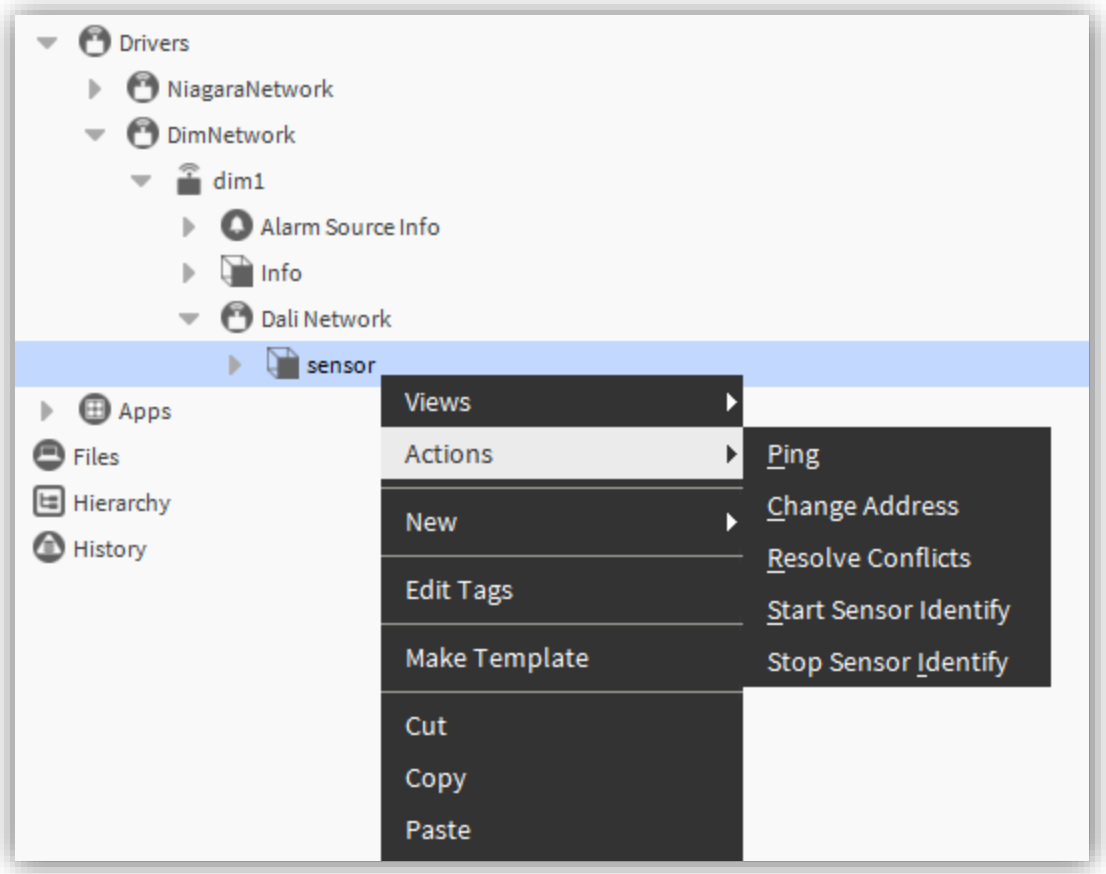

Figure 16: Sensor Type 1 Actions

Table 13: Sensor Type 1 Actions

Action	Description
Ping	This action will confirm that the DALI sensor device can be successfully contacted. If there is a communication problem with the device it will be shown in the standard device fault and health properties.
Change Address	This action will cause the DALI sensor device to actively change its DALI address. When invoked the user will be prompted to enter a new DALI address which will then be set as the new address for the physical device and the device component.
Resolve Conflicts	This action will clear the addresses of all DALI devices with addresses that same as this devices (including this device). It will then initiate a DALI addressing job to reassign new DALI addresses to any devices that do not have them.
Start Sensor Identify	This action will cause the sensor to start an identify sequence, flashing a red LED.
Stop Sensor Identify	This action will stop the sensor identify sequence.

6.4.2 DALI Sensor Type 2

6.4.2.1 Sensor Type 2 Property Sheet

Figure 17 shows the property sheet for the Sensor Type 2 device.

Many of the properties are standard Niagara device properties, please refer to the Niagara documentation for an explanation of what these values represent.

The elitedali Sensor Type 2 properties are described in Table 14.

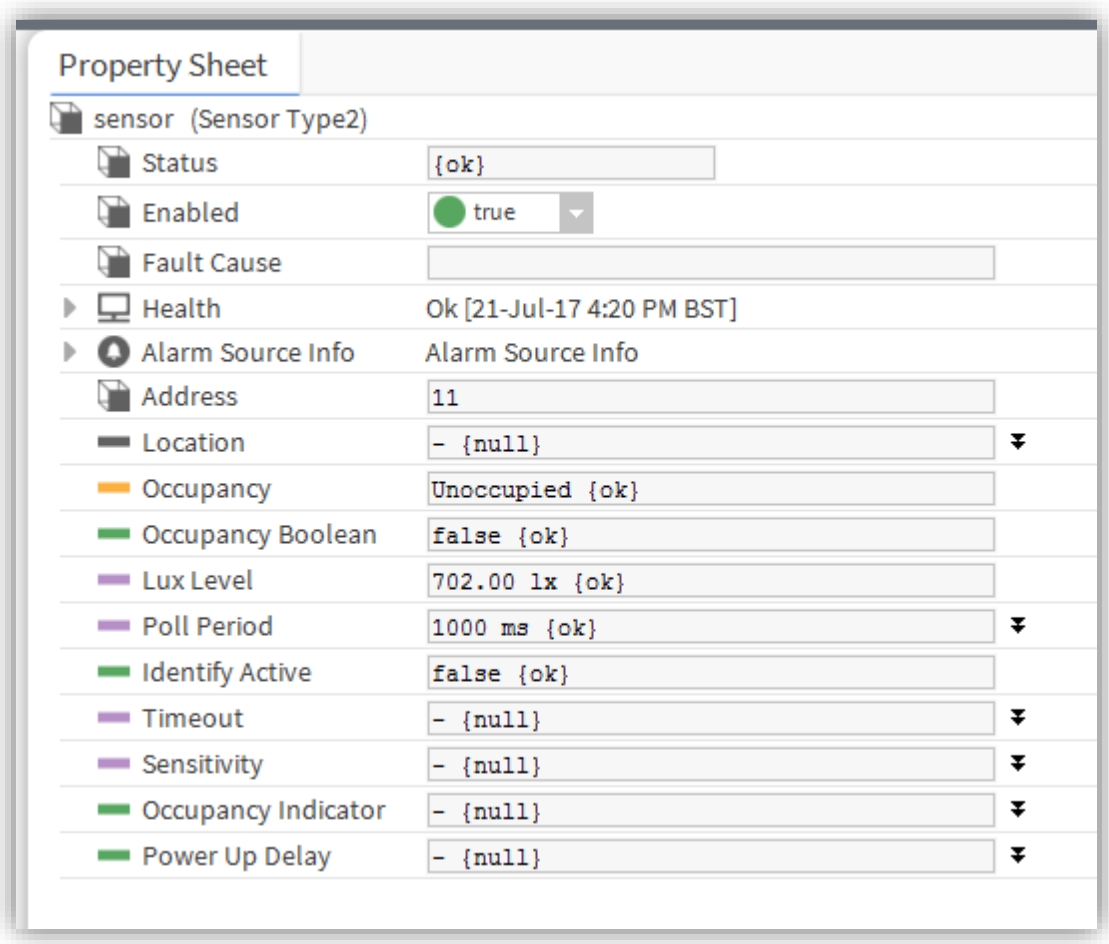

Figure 17: Sensor Type 2 Property Sheet

Table 14: Sensor Type 2 Properties

Property	Description
Address	The DALI device address.
Location	This property is not used by the system and may be left blank. It is provided for users to be able to optionally enter a textual description for the location of the DALI sensor, (for example a floor plan identifier).
Occupancy	This property represents the occupancy state last reported by the DALI sensor device. The property type is an 'elitedali2:Occupancy' enumeration, (see section 9.3).
Occupancy Boolean	This property represents the occupancy state last reported by the DALI sensor device. The property type is a Boolean were the value true represents the occupied state.
Lux Level	This property represents the Lux level last reported by the DALI sensor device. The property type is numeric.
Poll Period	This property controls how often the DALI sensor device is polled. The value is the time between each read of the sensor state, in milliseconds. If this value is null then polling is disabled. It is **important** to consider the network performance when setting this value, as discussed in section 8.2
Identify Active	This property is true when the sensor is following an identify sequence.
Timeout	This property is a configuration value stored in the sensor device. The value determines the time from the last detection of movement to when the sensor reports an unoccupied state. If the property is null the value will not be written to the device.
Sensitivity	This property controls the sensitivity of the occupancy detection. Valid values range from 1 (least sensitive) to 9 (most sensitive). This value does not have any units. If the property is null the value will not be written to the device.
Occupancy Indicator	This property controls whether the sensor will show a visible indication when occupancy is detected. When true the sensor will illuminate its red LED when occupancy is detected. When false the sensor will not show any visible indication that occupancy has been detected.
Power Up Delay	This property controls whether the sensor delays occupancy detection for a period after powering on. When true the sensor will indicate an unoccupied state for 40 seconds after powering on, regardless of the actual occupancy state. After the 40 seconds the occupancy state will be detected normally. When false the sensor will initially return an occupied indication immediately after power on for approximately 20 seconds before detecting the occupancy state normally. Note that the Lux measurement is unaffected by this delay.

6.4.2.2 Sensor Type 2 Actions

The Sensor Type 2 actions are shown Figure 18 in and described in Table 15Table 13.

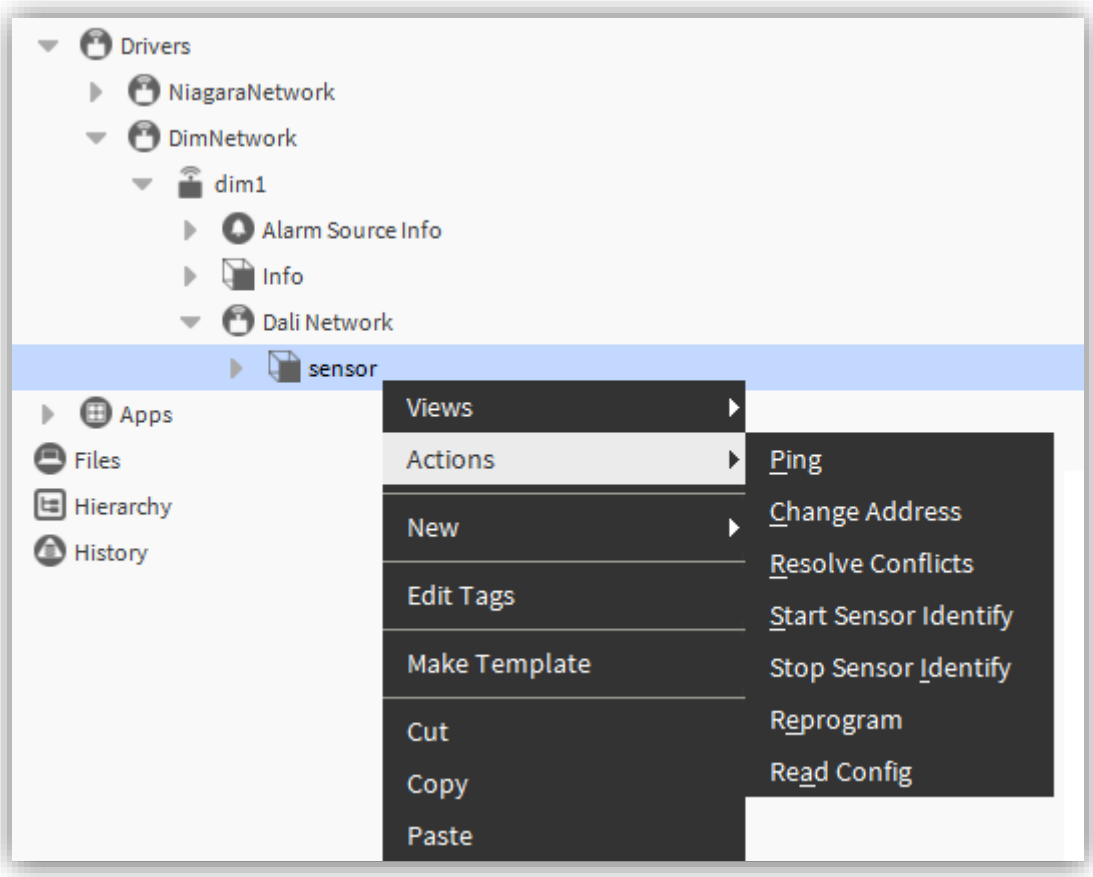

Figure 18: Sensor Type 2 Actions

Table 15: Sensor Type 2 Actions

Action	Description
Ping	This action will confirm that the DALI sensor device can be successfully contacted. If there is a communication problem with the device it will be shown in the standard device fault and health properties.
Change Address	This action will cause the DALI sensor device to actively change its DALI address. When invoked the user will be prompted to enter a new DALI address which will then be set as the new address for the physical device and the device component.
Resolve Conflicts	This action will clear the addresses of all DALI devices with addresses that same as this devices (including this device). It will then initiate a DALI addressing job to reassign new DALI addresses to any devices that do not have them.
Start Sensor Identify	This action will cause the sensor to start an identify sequence, flashing a red LED.
Stop Sensor Identify	This action will stop the sensor identify sequence.
Reprogram	This action will write the configuration values (Timeout and Sensitivity), if defined, to the sensor device memory.
Read Config	This action will read the current configuration values (Timeout and Sensitivity) from the sensor device memory and update the device properties.

7 DALI Device Management

7.1 DALI Device Commissioning

DALI device commissioning is controlled from the Dali Network Manager view.

There are two main stages to DALI device commissioning: Addressing and Discovery.

7.1.1 DALI Device Addressing

DALI devices are often delivered by manufacturers with no DALI address (i.e. unaddressed).

Addressing is the process of giving unique DALI addresses to each device on a network.

To start the addressing process click the 'Address DALI Network' button on the Dali Network Manager view.

There are two addressing options as described in Table 16 and shown in Figure 19.

Table 16: DALI Addressing Options

Addressing Option	Description
Address new devices	This option will only assign addresses to devices that do not already have addresses. This option should be used if devices have been added to an existing network.
Address all devices	This option will assign new addresses to **all** devices on the network. Any devices that already have addresses will have their addresses re-assigned (so their addresses will probably change). This option should be used only for new networks when it does not matter if any devices that already have addresses will be re-assigned.
Reverse Addressing	This separate option causes new devices to be numbered from the highest available address down to the lowest. This option can be selected together with either the new or all addressing options.

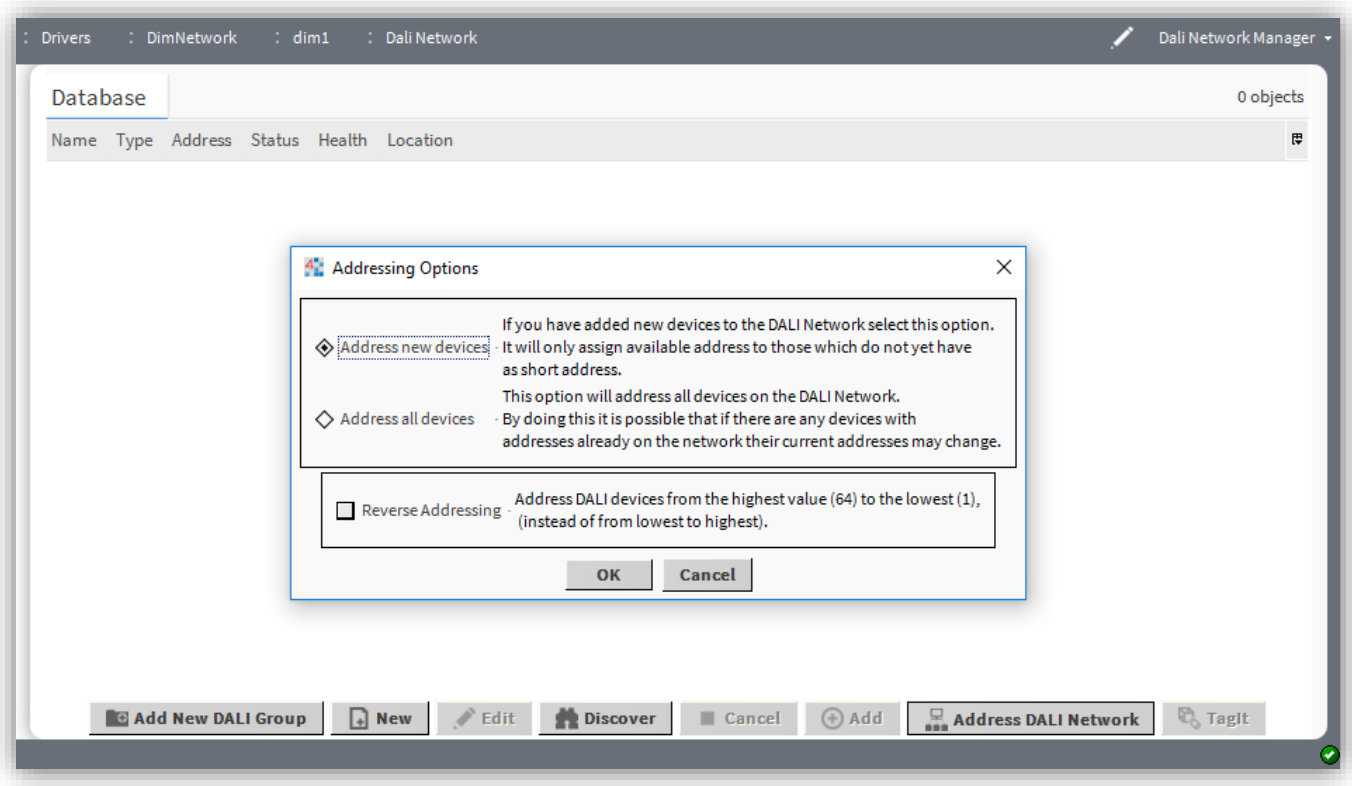

Figure 19: DALI Device Addressing

The DALI device addressing process is performed in a Niagara ‘Job’.

These Jobs can be monitored by navigating to the Niagara ‘JobService’ view (found under ‘Services’).

As a full addressing job can take up to 30 minutes (for 64 devices), it is recommended that no other tasks are performed on the same DALI network while the addressing job is in progress.

7.1.2 DALI Device Discovery

Discovery is the process of finding all the addressed DALI devices on a network so they may be added to the Niagara station database.

To start the discovery process click the ‘Discover’ button on the Dali Network Manager view.

Once the devices have been discovered, as shown in Figure 20, individual devices (or all devices) may be selected from the ‘Discovered’ list in the top window and added to the Niagara station database (in the bottom window) in a similar way to other networks on the Niagara platform.

The DALI device discovery should take less than 10 seconds.

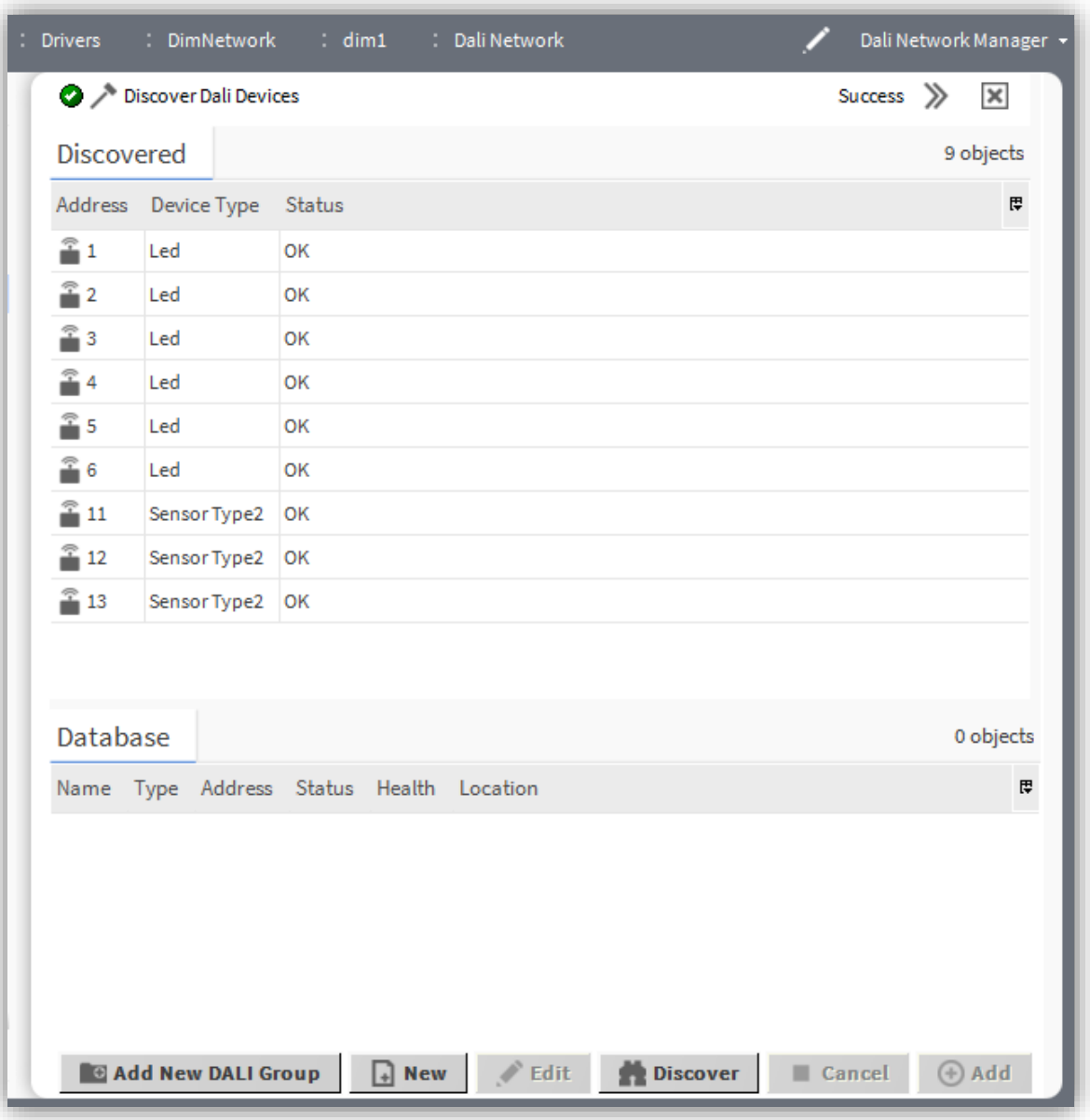

Figure 20: DALI Device Discovery

Whenever one or more devices are added to the Niagara station database these devices must be configured. This involves assigning parameters to the individual devices that are being added to the station. These parameters include the devices group assignment and any values defined a group's property sheet when a device is added to a group.

The DALI device configuration process is performed in a Niagara 'Job'.

These Jobs can be monitored by navigating to the Niagara 'JobService' view (found under 'Services').

Depending on the number of parameters that have to be assigned to each device and the number of devices that each have to be configured this configuration process can take considerable time and a commissioning engineer should be careful not to overload the system by initiating too many DALI communications intensive activities at the same time (e.g. device addressing and configuration).

Normally when a device is added to a network only the group assignment has to be performed and this should only take a few seconds per device.

An important requirement for successful configuration of DALI devices added to a network or group is that elitedali can successfully communicate with the physical DALI devices. This is because data has to be sent to the devices so they can store the values in their memory.

Therefore when devices are added to a DALI network or group the devices should be powered and correctly connected to a functioning network.

7.2 DALI Device Layout

elitedali devices and groups must be arranged as children of the ‘Dali Network’ component in the Niagara station navigation tree.

As well as being placed directly in the ‘Dali Network’ element, devices and groups can be nested inside standard Niagara folders as long as these folders are children of the ‘Dali Network’ component.

As elitedali devices and groups cannot be discovered directly into a standard Niagara folder they must be discovered in the ‘Dali Network’ and cut and pasted into the required nested location.

Figure 21 shows an example of valid component layouts.

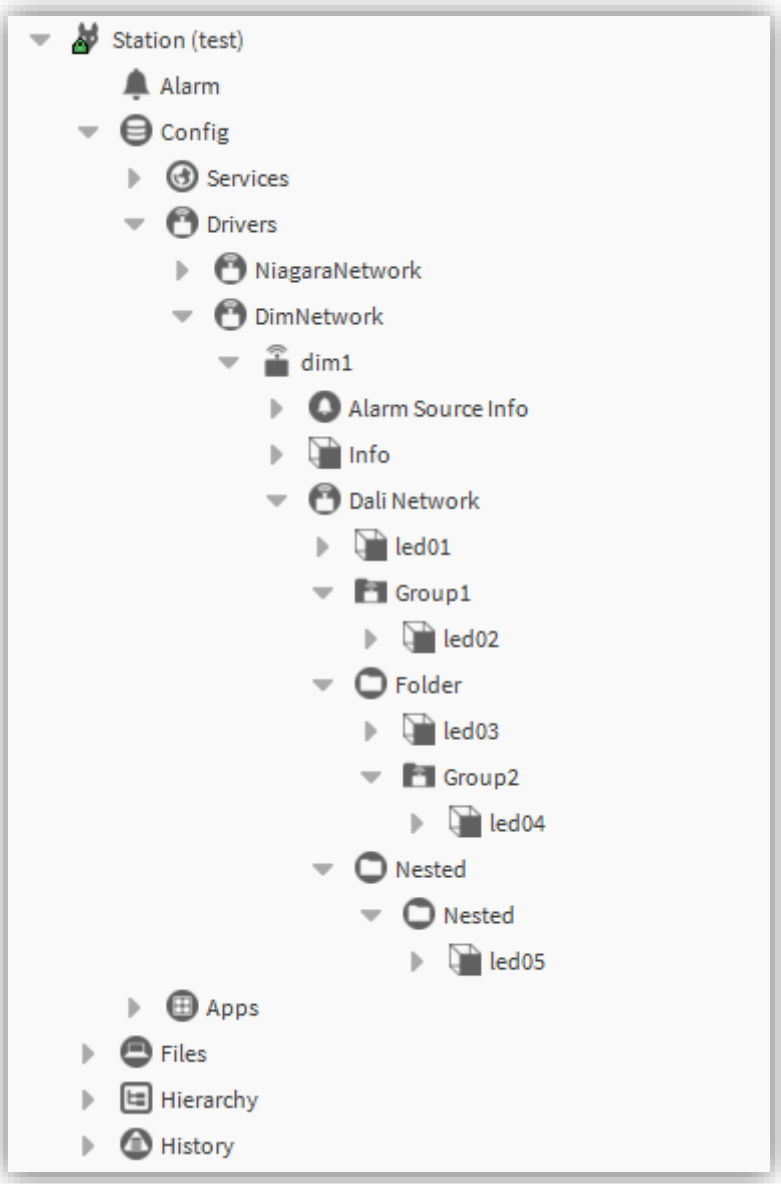

Figure 21: Component Layout

Although it is possible to have duplicate devices (two device components in the same Dali Network with the same address), it is strongly recommended that you avoid this situation as it can lead to confusion regarding how a device is controlled and can waste bandwidth on the DALI bus.

Devices can be cut and pasted from one folder or group into another but the user should be very careful not to have duplicate devices in Niagara.

It should be noted that when devices are moved from one location to another they must be reconfigured. This requires DALI communication with the device to change configuration values in the physical device. Therefore devices should

not be moved in Niagara when the devices are not accessible (e.g. do not move a device in Niagara when the device is turned off). Also these reconfiguration tasks are performed in Niagara Jobs (see the Niagara JobService). If there are many devices to reconfigure then these jobs may take considerable time (in some cases a few minutes), which will have an impact on other DALI communications on the same network (e.g. they may be delayed).

7.3 Controlling DALI Lights

DALI devices and DALI groups are controlled using one of the two inputs the devices and groups share:

- Command
  DALI standard commands can be sent to devices or groups.
  The Command input has a Status Enum type that uses the 'elitedali2:StandardCommands' facet therefore this input must be linked to a compatible Status Enum output.
  A complete list of standard DALI commands can be found in section 9.1.
- Direct Level
  Devices or groups can be instructed to set their light output to a specific percentage level.
  The Direct Level input has a Status Numeric type and therefore must be linked to a Status Numeric output.
  As this value is percentage of the maximum possible light level it should be in the range 0 to 100.

Any compatible output can be linked to the device or group inputs in the usual Niagara way.

8 Performance

There are two main performance issues that must be considered when creating an elitedali installation: processing performance and communication performance.

8.1 Processing Performance

Processing performance refers to the ability of a Niagara host's microprocessor to complete the tasks assigned to it in an acceptable time.

If too many processing tasks are assigned to run on a host at the same time this may cause any actions that the tasks initiate to be delayed. For example, if a task (e.g. a control component) decides that a light must be switched on then the instruction to the lighting system may be delayed if the host processor is busy executing other tasks. This will have an obvious impact on the behaviour of the overall lighting system.

Assessing the effect that a particular set of tasks will have on processing performance is difficult as it depends on the capabilities of the host hardware as well as the full range of tasks executing on that host.

The Niagara platform has a Station Resource Monitor view that provides numeric and graphical information representing the amount of processing the host is currently performing. This is measured in percent, with value 100% indicating that the host is using all of it's processing capability (and therefore there may be performance problems) and 0% (or more likely just low percentage values) indicating that the host is free to perform other tasks.

The ability of an engineer to assess the performance requirements of a system or application develops with experience. Careful monitoring of performance monitors as systems develop is essential to avoid problems and gather information that adds to an engineering teams knowledge.

8.2 Communication Performance

Communication performance refers to the amount of data that can be exchanged over the physical communications medium that connects one or more devices that need to communicate.

With elitedali the most important communications are those on the DALI network.

Like all communications buses the DALI network has a limit to the amount of data that can be exchanged between connected devices. This limit must be considered when deciding what information is required to be obtained from devices and the frequency and responsiveness required of the instructions that must be sent to devices.

The simplest method to measure the capacity of a communications network is the number of messages that can be exchanged between two devices in a single second.

There are two basic types of messages that elitedali sends to the DALI network: commands and queries.

8.2.1 DALI Command Performance

DALI commands send instructions to DALI devices.

A single instruction can be sent to a single device, a group of devices (a DALI group) or a whole network of devices at the same time.

Each DALI command takes 50 milliseconds to complete (actually this is the time to send two commands which is done in most situations to ensure reliability, a single command takes 25 ms).

Therefore if only commands are being used a maximum of 20 commands can be sent to each DALI network each second.

8.2.2 DALI Query Performance

DALI queries are used to read information from DALI devices.

Because a query must return data this means that each query can only be sent to a single device at a time. If the same data is required from a number of devices then a separate query must be made for each device.

Each DALI query takes from 36 to 50 milliseconds (depending on the type of data).

Therefore if only queries are being used a maximum of 27 queries can be sent to each DALI network each second.

8.2.3 Communications Assessment Summary

As shown in the previous sections the worst-case scenario is that every separate command or query to the DALI network will take 50 milliseconds.

Therefore when designing a lighting system it is best to plan for less than 20 transactions per second on each DALI network.

It is normal for DALI occupancy sensors to be polled once every second (although this can be increased or decreased). Therefore every sensor on the network is likely to generate one query per second.

It is also common for DALI devices to have their status monitored.

Consideration should be made for DALI network capacity for every sensor or lighting device point that is added to the system.

Lighting system designers should decide which pieces of information obtained from the DALI network are the most important (e.g. occupancy status) and ensure this information has appropriate poll (query) rates without overloading the network. Less important information should be given lower poll rates.

Estimates should be made of the average total traffic on the DALI network to ensure that this does not exceed to total capacity of the network (i.e. 20 transactions per second).

Obviously a proportion of the capacity of the network (e.g. 10%) should be reserved for the non-regular commands that may be send to the DALI network at any time (e.g. due to occupancy changes).

9 elitedali Enumerations

The enumerations defined by elitedali are described in this section.

9.1 StandardCommands

This elitedali enumeration represents the standard DALI commands that are most commonly used to control DALI devices.

Table 17: Standard Command Enumeration

Name	Value	Description
off	0	Turn the lamp off immediately without fading.
up	1	Increase the lamp light level for 200 milliseconds at the defined fade rate. If the lamp is off then this command will not turn the lamp on.
down	2	Decrease the lamp light level for 200 milliseconds at the defined fade rate. If the lamp light level is already at the defined minimum level then there will be no change to the light level. This command will not turn the lamp off.
stepUp	3	The lamp light level will change to one step higher immediately without fading. If the lamp is off then this command will not turn the lamp on.
stepDown	4	The lamp light level will change to one step lower immediately without fading. If the lamp light level is already at the defined minimum level then there will be no change to the light level. This command will not turn the lamp off.
recallMax	5	The lamp light level will be set to the defined maximum level without fading. If the lamp is off then this command will turn the lamp on.
recallMin	6	The lamp light level will be set to the defined minimum level without fading. If the lamp is off then this command will turn the lamp on.
stepDownOff	7	The lamp light level will change to one step lower immediately without fading. If the lamp light level is already at the defined minimum level then the lamp will be turned off.
onStepUp	8	The lamp light level will change to one step higher immediately without fading. If the lamp is off then this command will set the lamp light level to the defined minimum level.
scene1	16	The lamp light level will change to the value defined in the lighting device for scene 1.
scene2	17	The lamp light level will change to the value defined in the lighting device for scene 2.
scene3	18	The lamp light level will change to the value defined in the lighting device for scene 3.
scene4	19	The lamp light level will change to the value defined in the lighting device for scene 4.
scene5	20	The lamp light level will change to the value defined in the lighting device for scene 5.
scene6	21	The lamp light level will change to the value defined in the lighting device for scene 6.
scene7	22	The lamp light level will change to the value defined in the lighting device for scene 7.
scene8	23	The lamp light level will change to the value defined in the lighting device for scene 8.
scene9	24	The lamp light level will change to the value defined in the lighting device for scene 9.
scene10	25	The lamp light level will change to the value defined in the lighting device for scene 10.
scene11	26	The lamp light level will change to the value defined in the lighting device for scene 11.
scene12	27	The lamp light level will change to the value defined in the lighting device for scene 12.
scene13	28	The lamp light level will change to the value defined in the lighting device for scene 13.
scene14	29	The lamp light level will change to the value defined in the lighting device for scene 14.
scene15	30	The lamp light level will change to the value defined in the lighting device for scene 15.
scene16	31	The lamp light level will change to the value defined in the lighting device for scene 16.
idle	255	Do nothing.

9.2 Scenes

This elitedali enumeration represents the DALI scene commands, (there is no difference between these scene commands and the ones found in the StandardCommands enumeration shown in section 9.1).

Table 18: Scenes Enumeration

Name	Value	Description
scene1	16	The lamp light level will change to the value defined for scene 1.
scene2	17	The lamp light level will change to the value defined for scene 2.
scene3	18	The lamp light level will change to the value defined for scene 3.
scene4	19	The lamp light level will change to the value defined for scene 4.
scene5	20	The lamp light level will change to the value defined for scene 5.
scene6	21	The lamp light level will change to the value defined for scene 6.
scene7	22	The lamp light level will change to the value defined for scene 7.
scene8	23	The lamp light level will change to the value defined for scene 8.
scene9	24	The lamp light level will change to the value defined for scene 9.
scene10	25	The lamp light level will change to the value defined for scene 10.
scene11	26	The lamp light level will change to the value defined for scene 11.
scene12	27	The lamp light level will change to the value defined for scene 12.
scene13	28	The lamp light level will change to the value defined for scene 13.
scene14	29	The lamp light level will change to the value defined for scene 14.
scene15	30	The lamp light level will change to the value defined for scene 15.
scene16	31	The lamp light level will change to the value defined for scene 16.

9.3 Occupancy

This elitedali enumeration represents an occupancy state.

The enumeration is designed to be compatible with the 'lonworks:LonOccupancyEnum' enumeration so that occupancy data from LON sensors (or elitedali sensors) can be easily integrated into elitedali.

Table 19: Occupancy Enumeration

Name	Value	Description
occupied	0	State is occupied.
unoccupied	1	State is unoccupied.
bypass	2	Not used.
standby	3	Not used.
occNull	-1	Not used.

9.4 FadeRate

This elitedali enumeration represents the DALI Fade Rate configuration value that can be stored in a DALI lighting device.

The fade rate is the speed of change of the light output when using the DALI dim up and dim down commands.

See the DALI specification IEC 62386-102: 2009 section 9.5 for more information on the Fade Rate and also Table 1 which contains the definition of the logarithmic dimming curve steps.

Table 20: Fade Rate Enumeration

Name	Value	Description
NotApplicable	0	Not applicable.
Steps_360	1	358 steps per second.
Steps_250	2	253 steps per second.
Steps_180	3	179 steps per second.
Steps_120	4	127 steps per second.
Steps_90	5	89.4 steps per second.
Steps_60	6	63.3 steps per second.
Steps_45	7	44.7 steps per second.
Steps_30	8	31.6 steps per second.
Steps_20	9	22.4 steps per second.
Steps_15	10	15.8 steps per second.
Steps_10	11	11.2 steps per second.
Steps_8	12	7.9 steps per second.
Steps_5	13	5.6 steps per second.
Steps_4	14	4.0 steps per second.
Steps_3	15	2.8 steps per second.

9.5 FadeTime

This elitedali enumeration represents the DALI Fade Time configuration value that can be stored in a DALI lighting device.

The fade time is the time taken for the light output to change from the actual dim level to the target dim level specified by the received direct level command. This configuration value applies when the 'Direct Level' input is used or when devices are instructed to go to a stored scene value.

See the DALI specification IEC 62386-102: 2009 section 9.5 for more information.

Table 21: Fade Time Enumeration

Name	Value	Description
NoFade	0	No fade.
Seconds0_7	1	0.7 seconds.
Seconds1	2	1.0 seconds.
Seconds1_4	3	1.4 seconds.
Seconds2	4	2.0 seconds.
Seconds3	5	2.8 seconds.
Seconds4	6	4.0 seconds.
Seconds6	7	5.7 seconds.
Seconds8	8	8.0 seconds.
Seconds11	9	11.3 seconds.
Seconds16	10	16.0 seconds.
Seconds23	11	22.6 seconds.
Seconds32	12	32.0 seconds.
Seconds45	13	45.3 seconds.
Seconds64	14	64.0 seconds.
Seconds90	15	90.5 seconds.

10 Glossary

Term	Description
DALI	The Digital Addressable Lighting Interface standard and its implementations. The international standards reference is IEC 62386.
DALI Address	The unique address of a device on the DALI network
DALI Bus	The physical DALI wired network that connects all the DALI devices together. The DALI wired network consists of two insulated but unscreened and untwisted cables connected to the two DALI terminals of each DALI device in a polarity insensitive configuration.
DALI Command	A message transmitted on the DALI bus to one or more DALI devices that instructs the device to perform an action.
DALI Group	A collection of DALI devices that can be addressed together.
DALI Loop	Same as DALI Bus.
DALI Network	Same as DALI Bus.
DALI Query	A message transmitted on the DALI bus to a DALI device requesting that the device return a specific item of data.
DIM	The DALI Interface Module.
Direct Level	A percentage value representing a DALI devices' lamp brightness.
Scene	A pre-defined percentage brightness value that is stored in a DALI device and can be recalled using a DALI command.

11 Contact Details

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