AL-WS-010v
smart 0-10v Dimmer switch with 3-Way, DALI or DC power

Product Description - wall switch with 0-10v output and Tunable White

This wall switch has four major applications

- as a smart wall switch for controlling many LED drivers via manual switch, DMX or DALI
- as a simple stand alone 0-10v wall switch for controlling LED lighting via 0-10v controls.
- for tunable white applications with color and brightness controls for 2 0-10v switches
- for motor speed and direction control using 0-10v operation.

External LED drivers can be 0-10 type, PWM type, DMX or DALI. This wall switch creates a simple multi master bus that controls the LED drivers. It optionally works with our Hue Emulating Hub – allowing a large network to be controlled by App or Voice.

Wall Switch with Lighting control bus

Up to 63 of the AL-WS-010v can be wired in parallel to form a large multi master bus. The output of the bus can be either DMX or DALI. You can mix and match DMX and DALI LED drivers as needed. Each switch can have a unique address – or the same address can be used many times. When the same address is re-used – each one operates as a virtual 3-Way switch. Allowing the same LED driver to be controlled by multiple wall switches.

A proven rocker switch and brightness slider leverages mass production of 120 VAC switches, for a low voltage application – any casual user requires no training, no App to use this switch.

Smart control hub option

Connect a single Hub to the network. Our ZWD hub emulates the Philips Hue device and allows integration with Control 4, with Amazon Alexa and Google Home.

DMX interface option for DMX LED drivers

One AL-DALI-DMX device connects up to 63 switches to a DMX bus for control of any DMX based drivers. Up to 192 DMX addresses can be generated. See the AL-DALI-DMX device specs for details.

DMX interface from DMX consoles

Your DMX console can now control audience white lighting. The AL-DMX-DALI device accepts data from your existing DMX console, and merges that with the physical wall switches. The resulting combined physical switch and DMX console allows house lighting to be controlled by the DMX Stage console during performance, and also controlled by staff when the stage is not managed.

Dimming and Tunable White operation

The slider allows the brightness to be adjusted. A remote switch can also be used to adjust brightness. In additional – if you enter Tunable White mode – you can adjust the color temperature of CCT fixtures using either the DALI or DMX control method.
**Specifications**

- **Power requirements**: DA pins - DALI bus – 5 ma max
- **Input Voltage (DALI bus)**: 14 to 24 volts – (DALI Bus)
- **Input Voltage (without DALI)**: 24 volts via a 1800 ohm resistor
- **Power consumption**: 64 milliwatts @ 15 volts plus the load on the 0-10v outputs if any.
- **0 – 10v outputs**: Off = 0 – 1 volt
- **Protection**: On is dimming from 1.2 volt to 10 volts
- **Static Electricity**: Reverse protection and static protection on all pins
- **Operating Temperature**: Ground Metal plate to protect from Static Discharge – please ground it.
- **Size**: 0°C ~ 50°C
- **Receive Addressing**: 108H (metal) 70H x 34 D x 42 W mm
- **Transmit addressing**: Switch addressable by onboard DIP or use a DALI master to assign a short address or group
- **FCC and interference**: DALI standard 8 and 16 bits.
- **DMX support**: All outputs are RF filtered for minimal interference
- **DALI BUS interface**: See the AL-DALI-DMX device for control of a DMX universe
- **3-Way switching – physical**: DA Bus In and Out – 300 mA max
- **3-Way switching – virtual**: Simple contacts on the N-Way / Gnd terminals via AWG 18 – 24 wire
- **Allowing virtual N-Way control**

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Connecting a AL-WS-010v to a DALI driver (like Meanwell)

```
<table>
<thead>
<tr>
<th>DALI Master</th>
<th>DA+</th>
<th>DA-</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL-WS-010v</td>
<td>DA+</td>
<td>DA-</td>
</tr>
</tbody>
</table>
```

**120 VAC**

```
<table>
<thead>
<tr>
<th>ELG-200-24DA</th>
</tr>
</thead>
<tbody>
<tr>
<td>+Vout</td>
</tr>
<tr>
<td>AL-WS-010v</td>
</tr>
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</table>
```
## Hardware Versions

<table>
<thead>
<tr>
<th>2019 model</th>
<th>2023 model</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.jpg" alt="2019 model" /></td>
<td><img src="image2.jpg" alt="2023 model" /></td>
</tr>
</tbody>
</table>

DALI power

- On/Off Rocker switch
- Slider on Right
- (or resistor power)

DALI power

- Momentary Switch
- Slider on Left
- (or simple DC input)
**0-10v and 1-10v Outputs**

Connect the 0-10v output(s) to your LED driver(s). The dimming range is .4% to 100% to 254 steps. There are two 0-10v outputs, A and B.

- A and B are the same in normal operation (stand alone, until configured by DALI) in fixed color mode
- A is cool white in CCT mode.
- B is the warm white in CCT mode.

In fact – by default these are 1-10v outputs – below 1 volt is OFF, 1.2 volts is minimum Dim. Use the Write Memory Bank in DALI to change the minimum and maximum voltage levels in 39.2 mV steps. For example: 31 = 1.2 volts (the default for minimum voltage). Default is 31 for min and 255 for max.

<table>
<thead>
<tr>
<th>Memory Bank 17 Minimum</th>
<th>Off Voltage</th>
<th>Minimum voltage</th>
<th>Memory Bank 18 Maximum</th>
<th>Maximum Brightness</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>0</td>
<td>1.2 Volts</td>
<td>255</td>
<td>10 volts</td>
</tr>
<tr>
<td>0-254 = value</td>
<td>0</td>
<td>Value times 39.2 mV</td>
<td>1 to 255</td>
<td>Value times 39.2mV</td>
</tr>
</tbody>
</table>

**Powering the AL-WS-010v by DALI**

Power the switch via the DA pins, it needs about 4.5 mA to operate, minimum 13 volts. Polarity is not significant.

**Powering the AL-WS-010v by DC Voltage (2019 model)**

1. 24 volt power supply – use a 1800 Ohm resistor in series to limit the maximum current
2. 48 volt power supply – use a 4700 Ohm ¼ watt resistor in series, the device will limit the voltage to 24 volts

**Powering the AL-WS-010v by DC Voltage (2023 model)**

Power the switch via the 12-24 DC input connector, it needs about 4.5 mA to operate, minimum 13 volts. This connector can also supply up to 10 mA from the DALI bus to an external device.

**Default Operation – Stand Alone**

By default – the AL-WS-010v operates stand alone – no controller or master is required. By default – this is a DC powered 0-10v dimmer for any driver. If you need 3-Way switching please use a standard Decorator simple 2 or 3 way switch. Another use is door jam contacts. See 3-Way comments below
Hardware 3-Way Operation

N-Way signal functions

The N-Way input has several functional options. A simple low cost switch or alarm contact can be used to activate this. The options are: 3-Way, Push Button or Dual Output. Default is simple 3-Way. No DALI operation is required.

3-Way Operation without configuration

If you need 3-Way switching please use a standard simple 2 or 3 way switch connected to the N-Way input. Simply connect an wire (solid CAT-3 or better is recommended, solid awg20 is best) between the N-WAY pins and a remote standard wall switch. If more control switches are needed – see our application note “AN-3Way” at http://atxled.com/pdf. No controller is required; an unlimited number of switches can control one light. 3-Way works in default or DALI modes. The N-Way input has an internal pull-up (active low in computerspeak). The state of the N-Way input is XOR’d with the physical switch.

Push Button Operation

With the Push Button method - a switch like the RH-253 can be used. Each momentary action on the N-Way pin will toggle the light on / off. At power on – the AL-WS-010v will observe the “ON” time of any attached N-Way switch. If the N-Way is connected less than 500 milliseconds on 3 pushes after power on, then the AL-WS-010v operates in pushbutton mode. Each press of the push button will toggle an internal 3-Way function.

If the Push Button mode is incorrectly, set, then setting a normal switch to ON for more than 16 seconds will indicate to the AL-WS-010v that a regular ON/Off switch is connected.

Remote Dimming

If Push Button mode is active – then the switch connected to the N-Way input can be used to dim the LED. Press and hold to dim the LED down. To Dim up – hold the switch down until it fades to low, and continue to hold so it will brighten back up again. If you reach to high a dim level – then release and press again – the level will decrease. Do not hold the button longer than 15 seconds – since this will trigger non-momentary mode.

Door Jam Operation

With the default or Dual Output method enabled – a simple Normally Open or Normally Closed door alarm switch can be wired to the N-Way input. Then – when the door opens – the light will go on.
**Manual Address DALI Bus Transceiver**

In this mode, – the device accepts and sends DALI ARC commands – so any DALI switch or master can connect to this device remotely for on/off/dimming – the 0-10v and PWM outputs are controlled by either the built in physical switch or from the DALI bus. DALI will override the On/Off DIM setting of the physical switch and force the output on or off. Physical Switch changes will be sent to the DALI bus on the individual, group or broadcast addresses set by dip switch. After a DALI command – flipping the physical switch will change the output again, with DALI acting as a virtual 3-Way switch – this is the main advantage of Transceiver mode vs. Transmitter mode.

Connect the DA+ and DA-to your DALI bus – polarity is not important – and a DALI power supply. Set the address according to the switches below. The device will respond to a single address, broadcast, or group commands.

This mode allows implementation with multiple switches controlling hundreds of watts of power in 2-way, 3-way and higher switch counts without complex wiring or DALI master.

The device receives and transmits only DALI ARC commands, plus the DALI Min/Max commands. See page 3 for the Min/Max logic. No DALI configuration commands will be processed. At power on the device will restore local outputs and remote DALI drivers to the last known values.

### Switch Settings for Manual Address DALI Transceiver

<table>
<thead>
<tr>
<th>Mode</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>The built in 0-10v and PWM outputs will receive commands on the DALI short address set by 1-6. Switch changes will be output on this group address</td>
</tr>
<tr>
<td>Group</td>
<td>The built in 0-10v and PWM outputs will receive commands on the DALI group address set by 1-4 Switch changes will be output on this group address Set the DALI group address in 1-4, LSB is switch 1, therefore DALI group 3 has switch 1 and 2 ON</td>
</tr>
<tr>
<td>Broadcast</td>
<td>Switch values will be broadcast to all DALI fixtures, including those with no short addresses assigned.</td>
</tr>
</tbody>
</table>
Dip Switch settings for individual address

<table>
<thead>
<tr>
<th>Code</th>
<th>Dip Switch Number</th>
<th>Code</th>
<th>Dip Switch Number</th>
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</tr>
<tr>
<td>33</td>
<td>1 0 0 0 0 0 1 0</td>
<td></td>
<td></td>
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</table>

Dip Switch Settings for Group 0-15

<table>
<thead>
<tr>
<th>Code</th>
<th>Dip Switch Number</th>
</tr>
</thead>
<tbody>
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<td>14</td>
<td>0 1 1 1 0 0 0 1</td>
</tr>
<tr>
<td>15</td>
<td>1 1 1 1 0 0 0 1</td>
</tr>
</tbody>
</table>
**Manual Address DALI bus Transmitter**

The on-board switch will broadcast changes in the switch settings according to the address set below: The 0-10v / PWM outputs simply track the local dim and On/Off levels. Only DALI ARC commands are transmitted. No DALI configuration commands will be processed, but Min and Max will be determined automatically and listened to as explained on page 3. Virtual 3-way is disabled – if another DALI master has turned a Light on/off – the rocker switch might need a double throw.

Power on DIM is set to turn the 0-10v and PMW outputs to off, no Power On DALI packets will be sent.

**Switch Settings for Manual Address DALI Transmitter**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td>The built in switch will transmit on the DALI short address set by 1-6</td>
</tr>
<tr>
<td></td>
<td>LSB is switch 1, therefore DALI address 6 has switch 2 and 3 ON.</td>
</tr>
<tr>
<td>Group</td>
<td>The built in switch will transmit the group address set by 1-4,</td>
</tr>
<tr>
<td></td>
<td>LSB is switch 1, therefore DALI group 3 has switch 1 and 2 ON</td>
</tr>
<tr>
<td>Scene</td>
<td>The built in switch will transmit the scene address set by 1-4,</td>
</tr>
<tr>
<td></td>
<td>LSB is switch 1, therefore DALI address 6 has switch 2 and 3 ON.</td>
</tr>
<tr>
<td>Broadcast</td>
<td>Switch values will be broadcast to all DALI fixtures, including those with no short addresses assigned.</td>
</tr>
</tbody>
</table>
Configurable (full) DALI Operation

?? = 00   DT6   mode
?? = 10   DT8   mode
?? = 01   Fan   mode

Default DALI Operation

By default – the AL-WS-010v only responds to DALI broadcast commands. There is no individual group or short address assignment. Since the device accepts DALI broadcast commands – any DALI switch or master that sends broadcast commands can connect to this device remotely for on/off/dimming – the LED outputs are controlled by the switch or DALI broadcast packets. In Default mode – no DALI transmissions occur, the AL-WS-010v management functions can be read back in broadcast mode, but the responses will collide with other DALI devices.

Full DALI Operation

For full DALI operation - connect your powered DALI bus to the DA+ and DA- pins (polarity is not significant) of the AL-WS-010v. The device responds to the provisioning commands from a DALI master. In order for addressable functions to work, a ‘short’ address [ 0 thru 63 ] needs to be assigned. This can be done by a DALI Master with provisioning features. Once a short address is assigned – the device can be understood to operate as two devices in one.

1) 0-10v driver with DALI control – the 0-10v outputs will have a unique DALI short address after provisioning. The 0-10v outputs are connected typically to LED’s (or motors) and they can now be controlled by DALI commands from the bus. All DALI commands are supported. The actual address and group is defined and can be changed by the DALI master. See below.

2) Dimmer / Switch for other DALI drivers. After provisioning, the switch in this device is placed into either short address or Group mode – see below – flipping the switch, or the 3-way remote switches, or the dimming value will cause a DALI command to be sent internally to the PWM and 010v outputs as well as externally to the DALI bus.

3) Setting the short address to 255 will return the device to Broadcast receive-only mode.

Use an ATX LED Hub or similar provisioning tool to assign short and group addresses.

Note: The DALI bus and the Main and N-way switches all operate as a virtual 3-Way setup. DALI commands for On/Off will execute, making the physical switch Up/Down position potentially inverted.
DALI Address Assignment - Auto - Grouping

The AL-WS-010v from the factory has no DALI Short address by default. When a DALI master using provisioning assigns a short address to the switch, we have implemented a feature to allow inter switch communication in all DALI ATX-LED devices.

- If the short address is from address 16-63, then the switch will output these state changes using its short address, not a group address: This info is used by the DALI master to know the on/off state of every light, fan etc in the network. It can also be used as a trigger for macros to then create a sequence of light changes.

- If the short address assigned is from 0-15, then the built-in switch will send a Group On/Off/Dim command to the DALI bus each time the local status changes – On, Off, Dim, CCT – from the switch, slider or N-Way. This method allows multiple AL-WS-010v to be configured in ‘tandem’ – to all operate as one switch. After assigning each device a short address between 0 and 15, create a tandem virtual 3-way combo. To do this, use the DALI group feature to share multiple groups. For example any ATX switch at short address 1, 2, 3, would each be members of group 1, 2, 3 – allowing perfect 3-Way control – mix AL-WS-010v, AL-WS-DR2 etc with different loads on each. Any AL-WS-DR2 or AL-WS-010v can thus be used as a 3-Way switch with full slider dimming.

DALI commands also are used to determine the 3-Way state. Therefore, a DALI command with the matching Group or Individual as the AL-WS-010v address will set any attached 0-10v light on or off – and all local switches – physical or virtual – will reflect that change – so that the next flip of any switch will turn the light off or on as intended. This may result in UP and DOWN being reversed – like any conventional 3-way mechanical switch.

Minimum/Maximum slider range

After power up, the first OFF to ON transition of the switch will cause the switch to check the DALI bus for optimal slider operation. It will scan the DALI bus to find a driver with a matching address and will read back the Min / Max levels. In individual mode – just one address will be read. In Group mode – the 64 short addresses will be scanned to find a member belonging to the group – the first member discovered in the group will then be individually read and the search ends. The Min/Max levels will then be used for the bottom and top of the slider. Therefore, dimming control remains in the useful range. This scan of the DALI bus will occur with the next flip if the short address or the group address is changed (locally or by DALI command) or at power on. Finally – the device is listening to DALI bus Min / Max settings and storing them locally to adapt as needed to changing external fixtures. These settings do not change the 0-10v outputs – only the Slider Values – they are not stored and are refreshed if power is restarted.
Software 3-Way Operation – DALI configuration

Virtual 3-Way

The Virtual method uses 2 or more AL-WS-010v devices with the same short or group address which communicate via the DALI bus. Using the Virtual method just means that each AL-WS-010v will XOR its physical switch state with the data it receives to its address from the DALI bus. The result allows unlimited numbers of switches to dim and control a common light. See section below on addressing.

By extension – DALI commands from other devices – such as AL-DALI-Wiz or AL-DALI-Pi receive commands from the Cloud (Alexa, Google, etc) and output those on the DALI bus. These commands (on, off, dim) override the local switch setting – operating as 3-Way switches. Therefore, rocker UP or DOWN will be inverted if a command has arrived from the cloud.

In FW 43 and later – the virtual 3-Way group address can be set by memory location 21. In all versions, if the address of the AL-WS-010v is set to 015, it will use that number for bus transactions as a group. See Auto Grouping.

Physical N-Way operation

A momentary or rocker switch such as the AL-WS-M can be connected to the N-Way input of the AL-WS-010v. This will operate as documented on page 4.

Group Operations

In all modes, if more than one Group is set – the device will respond to those groups – but will only broadcast physical switch and dim level changes using one group. Either the DIP switch is used, or the group set when a short address is set by a DALI master. If the short address is < 16, then the transmit group is that same address. See Auto Grouping

Independent N-Way Operations

The N-Way input can be split from the main switch and used to send independent packets. Set the N-Way mode to 1, and set the 2nd Short Address register to these values: (note: the local button could be out of sync with the state of the short address.

| 0-63       | Send Short Address ARC | 0-63       |
| 64-79      | Send Group Address ARC | 0-15       |
| 80-95      | Send DAbus 271 (0xBF)  | 0-15       |
| 96-111     | Send DAbus 271 + OnOff | 16-31 off  |
|            |                         | 32-95 on   |
| 127        | Broadcast ARC           | 254        |
Configurable (full) DALI Operation – simple DT6 mode

Set to this setting to enable configuration by a DALI Master

This mode allows the AL-WS-010v short address and all other settings to be set via a DALI configuration device – a DALI Master - for example the ATX LED Hub. Until configured – the device will only respond to broadcast commands, and will not transmit DALI packets on switch changes. By default – no short address is defined. Use a DALI Master to assign a short address – and all other DALI features.

For DALI operation - connect your powered DALI bus to the DA+ and DA- pins ( polarity is not significant ). DALI allows multiple masters – we use collision detection to avoid conflicts on the bus.

The device responds to the provisioning commands from a DALI controller. In order for individual, scenes and group addressable functions to work, a ‘short’ address [ 0 thru 63 ] needs to be assigned. This can be done by a DALI Master. Once a short address is assigned – the device can be understood to operate as two devices in one.

1) DALI driver – the 0-10v outputs will have a unique DALI short address after provisioning. This address is automatically assigned by the DALI Master – commands from the bus or will set the level of the 0-10v outputs. The 0-10v outputs are connected to the LED drivers to affect brightness. The device responses to Group and Scene commands as configured by the Master.

2) DALI Dimmer / Switch – after a short address is assigned, user actions locally will affect the local 0-10v outputs and will transmit these levels to the bus. There are two operation modes for this feature:

   a) Single address – the changes by the user ( On/Off, Dimming ) will be sent to the bus to inform the Hub of the status and level of the lights.

   b) Group mode – the switch can be set by the Master to operate in Group mode – this will cause the user initiated On/Off/Dimming to be set to the group defined – this allows all DALI devices that are members of this group to receive DALI On/Off and Dimming commands.

See Auto-Grouping instructions above.
Configurable DALI Operation – DT8 CCT

Set to this setting to enable configuration by a DALI DT8 Master

DALI DT8 operation allows color tuning using one DALI address. The short explanation is that the two 0-10v outputs can be used to drive two LED drivers attached to two strings of LEDs with different color temperatures. The result is human centric lighting on a large scale, one AL-WS-010v can then drive a large number of LEDs.

This mode allows the AL-WS-010v short address and all other settings to be set via a DALI configuration device – a DALI Master - for example the ATX LED Hub. Until configured – the device will only respond to broadcast commands, and will not transmit DALI packets on switch changes. By default – no short address is defined. Use a DALI Master to assign a short address – and all other DALI features.

For DALI operation - connect your powered DALI bus to the DA+ and DA- pins ( polarity is not significant ). Our implementation allows multiple masters – we use collision detection to avoid conflicts on the bus.

The device responds to the provisioning commands from a DALI controller. In order for individual, scenes and group addressable functions to work, a ‘short’ address [ 0 thru 63 ] needs to be assigned. This can be done by a DALI Master. Once a short address is assigned – the device can be understood to operate as two devices in one.

1) DALI driver – the 0-10v outputs will have a unique DALI short address after provisioning. This address is automatically assigned by the DALI Master – commands from the bus or will set the level of the 0-10v outputs. The 0-10v outputs are connected to the LED drivers to affect brightness. The device responds to Group and Scene commands as configured by the Master.

2) DALI Dimmer / Switch – before and after a short address is assigned, user actions locally will affect the local 0-10v outputs. After an address is assigned, the switch will transmit these levels to the bus. There are two operation modes for this feature:

   a) Single address – the changes by the user ( On/Off, Dimming ) will be sent to the bus to inform the Hub of the status and level of the lights.

   b) Group mode – the switch can be set by the Master to operate in Group mode – this will cause the user initiated On/Off/Dimming to be set to the group defined – this allows all DALI devices that are members of this group to receive DALI On/Off and Dimming commands.

   See Auto-Grouping instructions below.

DT8 commands are documented in the IEC 62386 part 209 specifications. DALI masters support this and the details are embedded into the Master software and the firmware of this device.
Tunable White Color Control to DALI bus (DT8)

When the switch is set to send CCT mode (see CCT Mode) – a CCT tunable DALI driver on the DALI bus will be given Color adjustment commands according to DALI type 8 commands. Therefore color can be adjusted in a CCT LED Fixture. The AL-WS-010v switch sends a broadcast command 272, with DTR set to 8, to enable CCT modes in the destination. The next command sets DTR1 and DTR to the color temperature using the command 231; finally a command 226 is sent to activate the color. Note – commands 231 and 226 can be individual or group or broadcast commands. The low end of the slider by default is 2700 K (DALI 353) and the top end is 5000K (DALI 0). These values are normally saved in the fixture. These DALI values can be updated from the DALI Master via memory bank settings.

Tunable White 1-10v Color Control from DALI bus

When the switch has CCT enabled (dip switches set to 225), the dual 1-10v outputs will operate in CCT mode – the values will be color shifted as selected. Therefore color can be adjusted if wired to a CCT LED fixture with dual 0-10v inputs.

If a DALI master is used to set the color by 0-10v, the AL-WS-010v switch listens for a broadcast command 272, with DTR set to 8, to enable CCT mode. The next command sets DTR1 and DTR to the color temperature using the command 231; finally a command 226 is sent to activate the color. Note – commands 231 and 226 can be individual or group or broadcast commands. The low end of the slider by default is 2700 K (DALI 353) and the top end is 5000K (DALI 0). These values are normally saved in the fixture. These DALI values can be updated from the DALI Master via memory bank settings so that standard dimming functions operate at the selected color temperature.

Tunable White – local selection

Moving the slider with the 0-10v outputs OFF changes the Color temperature. The slider will go from warm (bottom) to cool (top). Turning the switch On exits CCT mode and the slider controls the brightness again.
Set to this setting to enable operation for Motors with 0-10v controls

This setting enables the two outputs of the AL-WS-010v to control a fan. The output A is the fan speed (0-10v) and the output B is the fan direction (0v for reverse, 10v for forward). We re-use the DT8 commands.

This mode allows the AL-WS-010v short address and all other settings to be set via a DALI configuration device – a DALI Master - for example the ATX LED Hub. Until configured – the device will only respond to broadcast commands, and will not transmit DALI packets on switch changes. By default – no short address is defined.

For DALI operation - connect your powered DALI bus to the DA+ and DA- pins (polarity is not significant). Our implementation allows multiple masters – we use collision detection to avoid conflicts on the bus.

The device responds to the provisioning commands from a DALI controller. In order for individual, scenes and group addressable functions to work, a ‘short’ address [0 thru 63] needs to be assigned. This can be done by a DALI Master. Once a short address is assigned – the device can be understood to operate as two devices in one.

1) DALI driver – the 0-10v outputs will have a unique DALI short address after provisioning. This address is automatically assigned by the DALI Master – commands from the bus or will set the level of the 0-10v outputs. The 0-10v outputs are connected to the motor for speed and direction.

The device responses to Group and Scene commands as configured by the Master.

2) DALI Dimmer / Switch – before and after a short address is assigned, user actions locally will affect the local 0-10v outputs. After a short address is assigned, it will transmit these levels to the bus. There are two operation modes for this feature:

   a) Single address – the changes by the user (On/Off, Dimming) will be sent to the bus to inform the Hub of the status and level of the lights.

   b) Group mode – the switch can be set by the Master to operate in Group mode – this will cause the user initiated On/Off/Dimming to be set to the group defined – this allows all DALI devices that are members of this group to receive DALI On/Off and Dimming commands.

   See Auto-Grouping instructions below.

The Slider functions to set the speed. Turn the switch on to turn the fan on, and control the speed from the slider. The minimum level will default to about 4 volts – this can be changed by the DALI master.

To change direction – turn the fan off, then move the slider to the top for forward, and to the bottom for reverse. Turn the switch on to control speed. Turn the switch off to turn the fan off.

From the DALI master – we implemented the forward and reverse feature as “Warm” and “Cool” – this allows the fan to be easily controlled by any existing DALI DT8 (CCT) controller.
Example of Driver Connections

Carro Ceiling Fan Motor

Connecting a AL-WS-010v to a Carro Fan

Dali Power

16v @260mA

AL-WS-010v

ABGnd

Carro Fan

To LED driver

Meanwell LDD-350H-DA   DALI

Connecting a AL-DALI-010v to Meanwell LDD-350H-WDA

DALI Power

DA

DA

AL-DALI-010v

DA

DA

0-10v

+48V

GND

+Vin

-Vin

+Vout

-Vout

red wire

black wire

yellow wire

blue wire
Example of Driver Connections

Sunricher SRP-2309-75

Connecting a AL-WS-010v to a DALI driver

DALI Master

Yellow

White

AL-WS-010v

DA+ and DA− are interchangeable

120 VAC

SRP-2309-75

+Vout −Vout +Vout −Vout

+ LED− + LED−

200 ft or more
DALI Commands Supported

Notes: * = 2x in 100ms,  A = ATX LED,  C = CCT modes

0  LED Off
1  UP  8 steps
2  Down 8 steps
3  UP one step but don’t turn on
4  Down one step but not off
5  Set to MAX level
6  Set to Min level
7  Down one step and Off if needed
8  Up one step or on if needed
32  Reset to defaults ( don’t change Short Address)
33  Save ARC level to DTR
35  Set N-Way mode ( DTR is the value ) See table below
A  38  Reset switches to mechanical state ( Up = On )
42  Store DTR as new Max Level,
43  Store DTR as new Min Level
44  Store DTR as new system Fail Level Not used
45  Store DTR as new power up level
46  Store DTR as Fade Up duration
47  Store DTR as Fade Down duration
        FADE times in seconds ( 0-7 )  0, .7, 1.0, 1.4, 2.0, 2.8, 4.0, 5.6
        ( 8-15) , 8.0, 11.3, 16.0, 22.6, 32.0, 45.2, 64.0, 90.0
49  Set UPS mode, DTR => temporary Maximum Min-254 Reset with 255
 128  Store DTR as short address
 129  Enable memory Bank write
144  Query Status
    bit 0  Left Led Fail ( DR2 )
    bit 1  Right LED Fail ( DR2 )
    bit 2  ARC Level greater than 0
    bit 3  ARC setting out of range
    bit 4  Fade in action
    bit 5  Device not configured after reset
    bit 6  Missing Short Address
    bit 7  No ARC level set after power failure
145  Query if Short Address matches one stored
146  Query if either attached LED failed or missing
147  Query if LED on
148  Query if ARC command exceeded Min / Max
149  Query if in Reset state
150  Query if no address assigned
151  Query DALI version number ( == 1 )
152  Query DTR
153  Query LED type ( return 6 normally, or 8 if CCT mode enabled
154  Query Physical DIM level ( See DR2 info)
155  Query Power Failure
156  Query DTR 1
157  Query DTR 2
A  158  Query N-Way mode
160  Query Actual Dim Level
DALI Commands Supported

161  Query Max Level
162  Query Min Level
163  Query Power On Dim Level
164  Query System Fail Level
165  Query Fade Rate value
A 166  Query HW Type ( 2 = 0-10v, 1 = DR2)
171  Query presence of 0-10v in transceiver mode = response == 0xA5
192  Query group association 0-7
193  Query group association 8-15
194  Query Random High bits
195  Query Random Middle bits
196  Query Random Low bits
197  Query Memory Bank address DTR1:DTR

C 226  Save CCT setting
C 231  Set CCT color ( value from DTR )
C 232  Step CCT Cooler
C 233  Step CCT Warmer
C 250  Query Color

255  Test CCT mode  Response is 209

Global Commands – processed by all DALI devices on the bus

Hex

256  Terminate  A1
257  Set DTR   A3
* 258  Initial Addressing Mode  A5
259  Randomize  A7
260  Compare Random Address  A9
261  Withdraw from Random Addressing  AB
264  Set High Byte  B1
265  Set Middle Byte  B3
266  Set Low Byte  B5
267  Set Short Address if match  B7
268  Query Short Address  B9
269  Query Long Address Match  BB
272  If value == 8, enable CCT mode  C1
273  Set DTR1  C3
274  Set DTR2  C5
275  Write Data at Memory Bank DTR1:DTR  Send confirm  C7
276  Write Data at Memory Bank DTR1:DTR  no response  C9
### Memory Bank 0

<table>
<thead>
<tr>
<th>Address</th>
<th>Fw version</th>
<th>Bank 0 Name</th>
<th>Bank 0 Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>Bytes per Bank ( minus 1)</td>
<td>63</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Checksum</td>
<td>Calculated</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Number of Banks ( minus 1)</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>UPC code – msb</td>
<td>722512407282</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>UPC code</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>UPC code</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>UPC code</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>UPC code</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>UPC code – lsb</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>FW Version</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>HW Version</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>Serial Number – msb</td>
<td>Assigned by Master</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>Serial Number</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>Serial Number</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>Serial Number – lsb</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>43</td>
<td>N-Way Mode</td>
<td>0 = normal, 1 = 2&lt;sup&gt;nd&lt;/sup&gt; Short Add</td>
</tr>
<tr>
<td>16</td>
<td>43</td>
<td>N-Way Short Address</td>
<td>255</td>
</tr>
<tr>
<td>17</td>
<td></td>
<td>0-10v Minimum Dimming Voltage ( off is always 0 volts)</td>
<td>Default: 25 = 1.0v</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td>0-10v Maximum Voltage</td>
<td>Default: 254 = 10 volts</td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>DALI value for cool divided by 2</td>
<td>Default is 0</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>DALI value for warm divided by 2</td>
<td>Default is 176 ( 354 )</td>
</tr>
<tr>
<td>21</td>
<td>43</td>
<td>Group used to send switch changes 255 or 0-15</td>
<td>Default is 255 ( send short address)</td>
</tr>
</tbody>
</table>

### Memory Bank 1-3

<table>
<thead>
<tr>
<th>Address</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Bytes per Bank ( minus 1)</td>
<td>63</td>
</tr>
<tr>
<td>1</td>
<td>Checksum</td>
<td>Calculated</td>
</tr>
<tr>
<td>2</td>
<td>Number of Banks ( minus 1)</td>
<td>3</td>
</tr>
<tr>
<td>3-63</td>
<td>User Storage</td>
<td></td>
</tr>
</tbody>
</table>

p20    AL-WS-010v
Memory Bank 4 (read only)

<table>
<thead>
<tr>
<th>Address</th>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Up Time</td>
<td>Hours / 256</td>
</tr>
<tr>
<td>4</td>
<td>Up Time</td>
<td>Hours (8 years max)</td>
</tr>
<tr>
<td>5</td>
<td>On Time</td>
<td>Hours / 256</td>
</tr>
<tr>
<td>6</td>
<td>On Time</td>
<td>Hours (8 years max)</td>
</tr>
<tr>
<td>11</td>
<td>Read back switch</td>
<td>-</td>
</tr>
</tbody>
</table>
System Configuration and Debug Tools

Version 31 and later firmware supports these debug operations: Note – these are broadcast commands, so every device on the bus will be programmed to these settings. Use with care.

Mode 253 Pulse mode: (1011 1111)

Setting the DIP switches to 253 enables pulse mode. The lights will all be set to Warm, then Cool, then off, each 2 seconds. The cycle will stop if the switch is turned off – it can be stopped in Warm, Cool or Off. FW 42 or later.

Mode 252 Local 0-10v outputs - Minimum dim setting (0011 1111)

Setting the DIP switches to 252 (all on, #1 and #2 off) enables physical minimum dim mode of this switch. Turn the Rocker off. When the rocker switch turned from OFF to ON, moving the slider will adjust the physical minimum dim level, this value will be stored into device memory when you turn the slider OFF. When off, change the DIP switch settings to the operational mode needed.

Mode 251 set Minimum dim setting of ALL remote devices 1101 1111 (contact factory)

Setting the DIP switches to 251 (all on, #3 off) enables setting the minimum dim value. After turning the rocker switch from Off to On, moving the slider will adjust the Minimum dim level of ALL connected DALI devices on the bus, these values will be stored into device memory of every device on the bus. Take note! Turn the slider OFF when done, then change the DIP switch settings. Disconnect any device that should not be programmed!

Mode 249 set Power On/Fail level of ALL remote devices 1001 1111 (contact factory)

Setting the DIP switches to 249 (all on, #2 and #3 off) enables setting Power / Fail values. Turning the rocker switch from Off to On, the slider will adjust the Fail and Power On dim level of ALL connected DALI devices on the bus, these values will be stored into device memory of every device on the bus. Take note! Turn the slider OFF when done, then change the DIP switch settings.

Power Up ID

If the AL-WS-010v is not in managed mode – then the first time a switch is flipped, 2 DALI packets will be output. These 2 bytes sent with global command 0xC3 – this loads the DTR2 register – and informs a bus master or logger of the hardware and firmware version