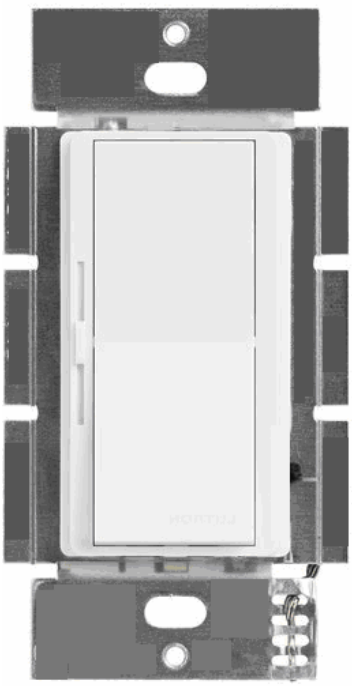
AL-WS-DR2

Decorator style Switch/Driver

Dual Constant Current
Tunable White
56 watt 3-Way DALI

CV and CC autodetect
12 volt Fan direct drive
Left Slider



Product Description - AL-WS-DR2 wall switch

This switch operates just like any standard residential light switch – however it takes 24-51v DC instead of 120VAC, and directly drives up to 56 watts of LED bulbs. This Decorator style switch in a standard residential style outline fits into any home, looks like any switch yet meets NEC article 411 for Low Voltage lighting.

It supports fixed color temperature or tunable white LED fixtures for time of day light controls. With tunable white, it support dim to warm.

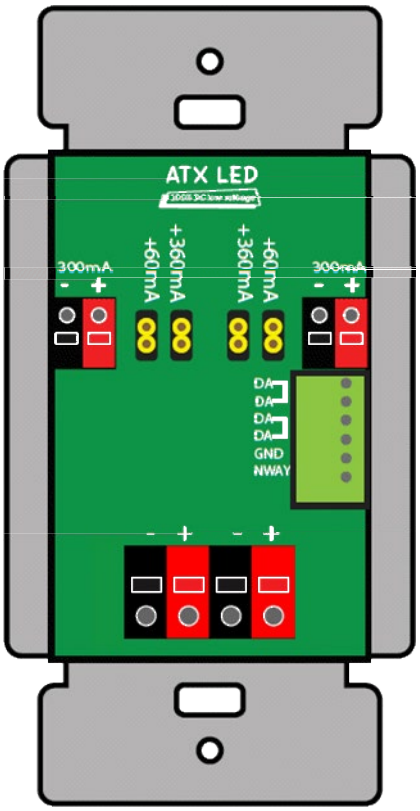
Stand alone it operates as a simple switch for 2 strings of LED's. Jumper selections for 2 channels with 300, 360, 660 or 720 mA for up to 30 watts per channel. For example, 10 x 6 Watt LEDs can connected, 4 in series to each of the 2 outputs on this switch / dimmer device. Use AWG 16 or 18 to bring 48v (or 24 to 52 volts) from a central power supply over to the switches, then use AWG 20 to connect to your LEDs – no crimping tools are required to wire this device.

For 3-way operation – a simple 2 wire link with AWG24 or better allows 2, 3, or an unlimited numbers of switches to control one set of LED's. Any single pole switch found at Home Depot can be used to add a 3-Way remote switch, or the AL-WS-M momentary switch can be used for unlimited 3-Way connections.

A proven mechanical switch and brightness slider leverages mass production of Decorator switches, now for low voltage applications – a casual user requires no training, no App to use this switch. Perfect, flicker free dimming from off to 0.1% to 100%. No network setup is required.

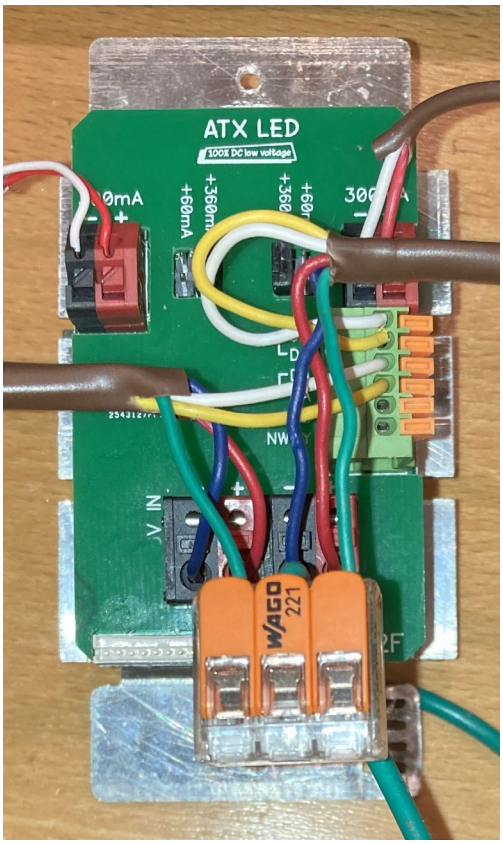
To enable Home / Business automation – the AL-WS-DR2 includes a DALI opto isolated serial bidirectional port for remote and voice control. Use the AL-DALI-Pi Hub to connect to Alexa or Google home voice control. The DALI protocol is supported, with automatic addressing. Use low cost wire in uncomplicated topology to implement remote management. Power and DALI have in and out connectors to avoid wire nuts.

Connect 24 volt strip lights up to 15 watts per side, or connect a 12 volt DC Fan with up to 12 watts.

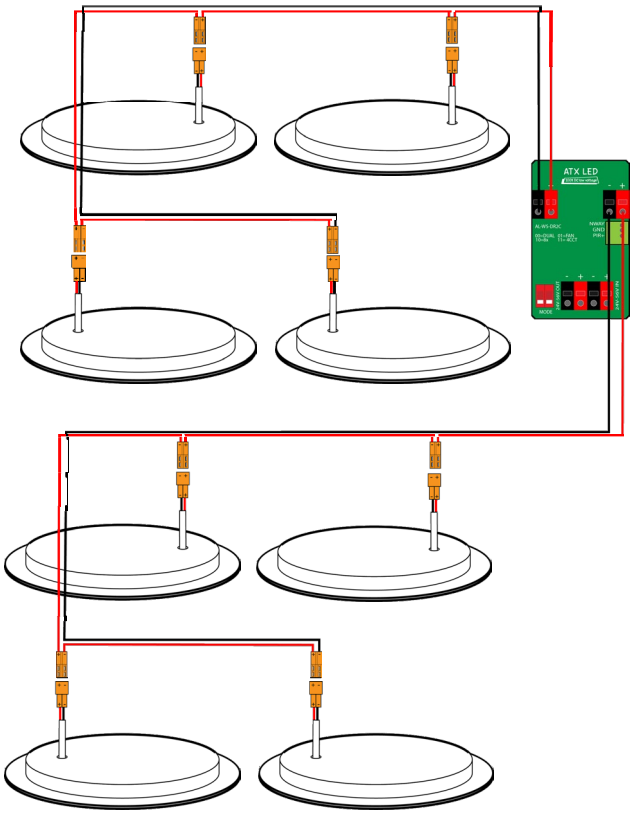


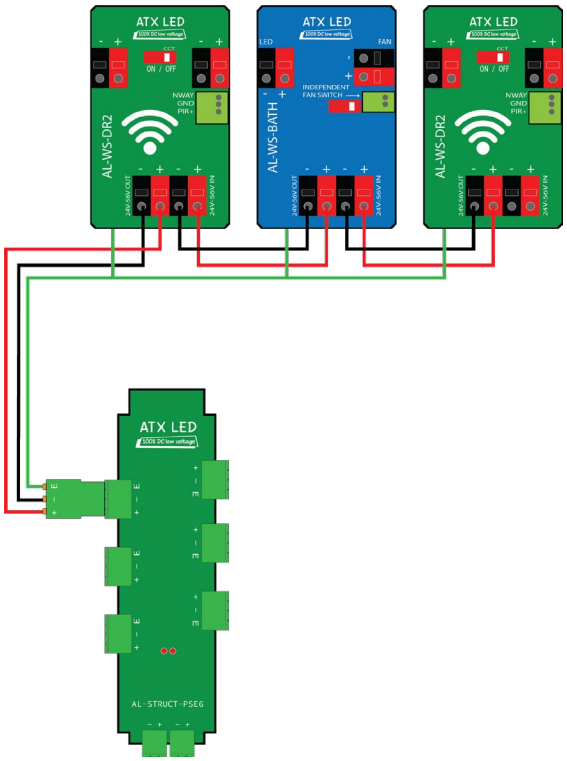
Specifications

Power source and Pass Thru	Spring loaded connectors (2 pairs) for AWG 16-20 wire
LED constant current output	300 mA base current, jumper options for 360, 660 or 720 mA per channel Spring loaded connectors (2 pairs)
Input voltage range	44v to 52 volts (power for LEDs)
Standby power consumption	50 milliwatts
Conversion efficiency	Over 95%
Protection	Reverse protection and static protection
Operating Temperature	0°C ~ 50°C
Size	108H (metal) 70H x 34 D x 42 W mm
Dimming	100% to 1% (V3) or 5% (v2) Current control with temperature tracking
FCC and interference	All outputs are RF filtered for minimal interference
Maximum output voltage	Input minus 5 volts
Minimum output voltage	6 volts, self calibrating
Strip LED support (CV Mode)	Autodetect 12v, 24v, 48v CV strips
Protection	Short Circuit, Overvoltage, hot swap – you can unplug and connect LEDs with power applied.
User Error tolerant	Detects and displays most user errors
DALI interface Individual, group and scene support	Opto Coupled AWG 18-24 gauge wire spring fit short and long addresses 16 to 24 volts 2 mA
N-Way input	Simple contact for 3-Way or Fan control
LED output A	Top Left
LED / PIR / Fan output B	Top Right
LED Timer	Configurable auto off
FAN output	12 volts, 1 amp with speed control
FAN Timers	Configurable Auto On and Auto Off



Wiring the AL-WS-DR2 for up to 8 LEDs



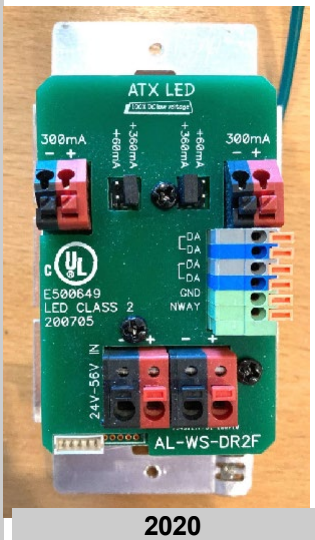
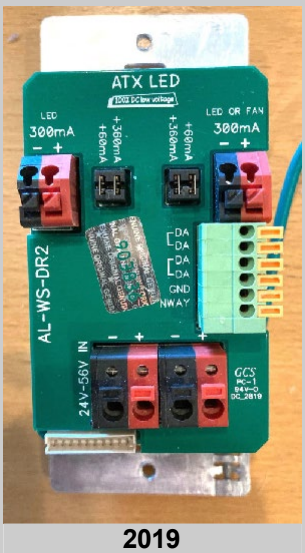
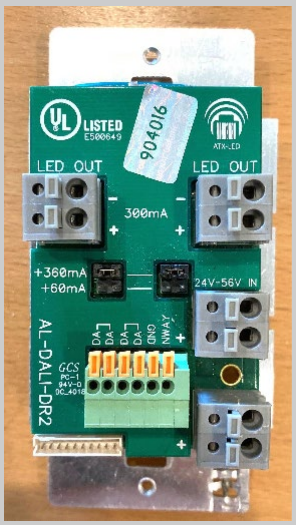


Ordering part numbers

Model	LEDs style
AL-WS-DR2 (8x)	6, 8 or 10 LEDs Fixed color
AL-WS-DR2	Auto Detect all modes*

* 6, 8 or 10 fixed require ATX Hub to enable

DR2 with DALI, Versions

			
2023	**2020**	**2019**	2018
Topology **Tunable low dim Fan**	**Tunable low dim Fan**	**Fixed low dim**	**Fixed**

Powering the AL-WS-DR2

Power the switch via either of the 2 power input connectors, 44 to 52v is recommended. No DALI connection is required. You can pass power thru from one set of power connectors to the other to avoid wire nuts in the box, up to 2 amps. After power up – the first time the switch is operated you will see a flicker while it learns the capability of the attached LED. After that phase – the result is stored in on-board EEprom and will be updated for temperature and aging changes or each time the slider is moved to low dim.

Dual LED current drivers, Fan voltage Driver

The DR2 has two multi mode drivers built in. CCT, Fan + Light and Fan-Only modes are automatically detected. Using the Dali memory write commands, any of these operational modes can be selected.

0	Auto	Default power up state – DR2 will count the attached LEDs or Fans and operate automatically. The DR2 powers up in Auto then changes depending on the attached hardware.
1	Split	Each 30 watt LED output operates independently by switch or by DALI. The Right is controlled by the N-Way input and the Left is controlled by the main switch.
2	FAN (right) LED (left)	The Left output is for 660 mA LEDs – up to 5 in series. The Main switch controls the LED. The Right output is for a 12v 1 amp or less FAN – for example a SLM70-LVDC type fan with a 4000 uF input filtering. The fan is controlled by the N-Way, by DALI, or by timers associated with the LED being turned on.
2a	Fan Only	The Right output is for a 12v 1 amp or less FAN. The fan is controlled by the main switch, by timers, or by DALI.
3	CCT	From 1 to 5 CCT type tunable white 660mA LED fixtures can be connected. Right is warm, Left is cool. 30 watts total is balanced between the two channels
4	Fixed	From 1 to 10 Fixed white fixtures can be connected, 5 on each side operate together. Same dimming levels on both driver outputs – up to 30 watts each side. Requires Hub to activate at 100% power – defaults to 50% until activated
5	PIR	The Right output is always on at a defined current, changes in the load initiate DALI On/Off packets. The Left output is controlled by the main switch or DALI.
6	12v (Right) LED (Left)	Use a resistive or inductive load up to 12 watts on the right side. Dimming is not supported. Left are 660mA LEDs. Control is all together or split depending on N-Way settings.
8	CCT Not Found	AUTO did not detect CCT. Operate at 50% power until either repaired or Fixed is activated

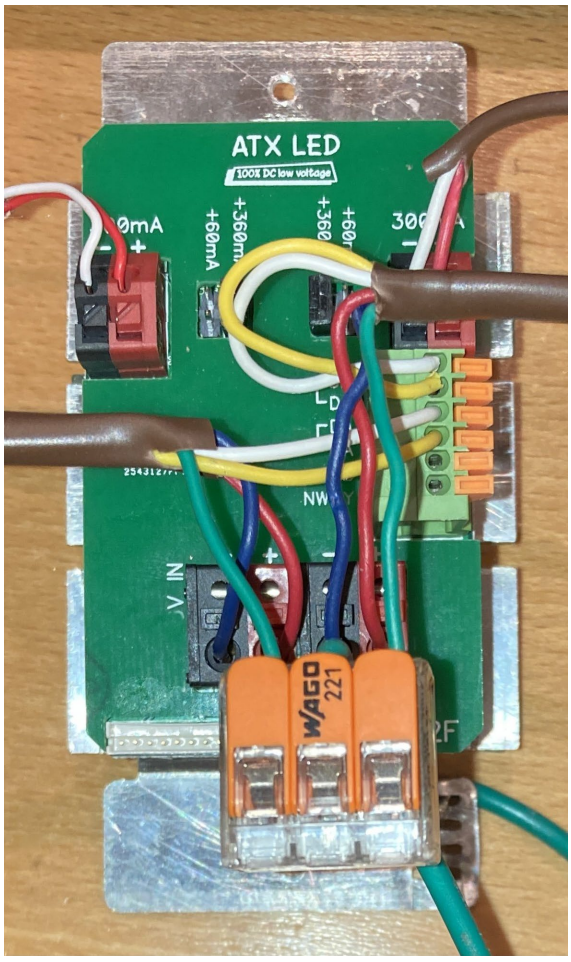
Note: the DR2 will auto detect Fixed (and disable CCT) if there is no match between the number of attached LEDs on the left and right side. If the same count is on both sides, the DR2 will enter CCT mode. NOTE: Operating a CCT LED in fixed color mode will double the watts per fixture. This might exceed the specifications of the fixture and should be avoided.

Use a DALI master to send a DALI command to set Fixed mode at 100%. Memory location bank 5 address 9 is set to 4 for Fixed mode or 3 for CCT mode.

24 volt strip lights will be automatically detected and the device will enter CV mode. Up to 16 watts of strip lights per side can be driven at 24 volts, 32 watts per side at 48 volts. CCT and Fixed are supported, CCT is default.

Connecting the LEDs

Fixed Color Temperature LEDs



Basic Connection up to 10 LEDs with 6 watts each

Power the switch via the Power input connectors, 48 (8 LEDs) or 51v (10 LEDs) is recommended.

Shown here is a brown 18/5 cable for the power input and pass-thru to the next switch, You can feed thru from the input to the output up to 2 amps total.

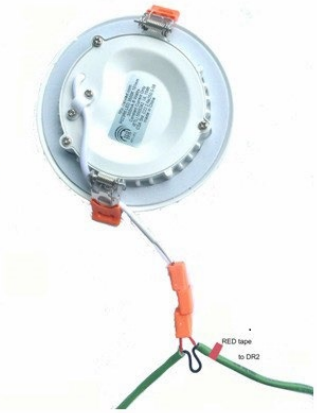
The Red/White wires are to the LEDs.

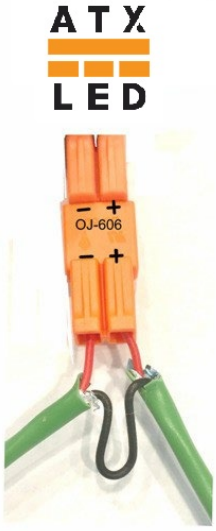
The Yellow and White wires for control (DALI) in and out.

The Green wire is for static protection earth ground

LED series Wiring

OJ-606 Connector





Right to DR2 switch
Left to next LED

The LEDs are wired in series

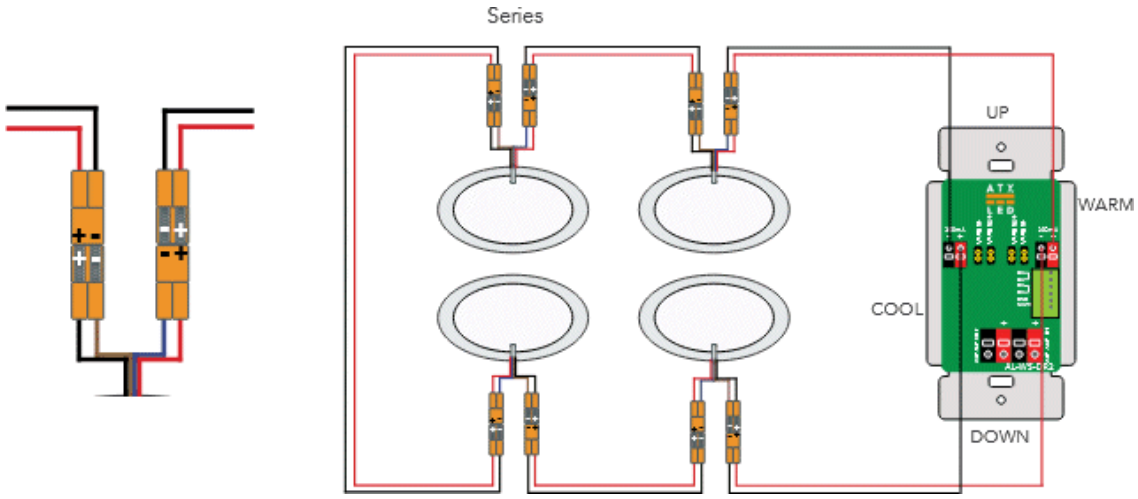
The simple strip and poke OJ-606 connectors are easy to install in ceilings.

If you only cut the Red wire – you can save time and work by wiring as shown at left.

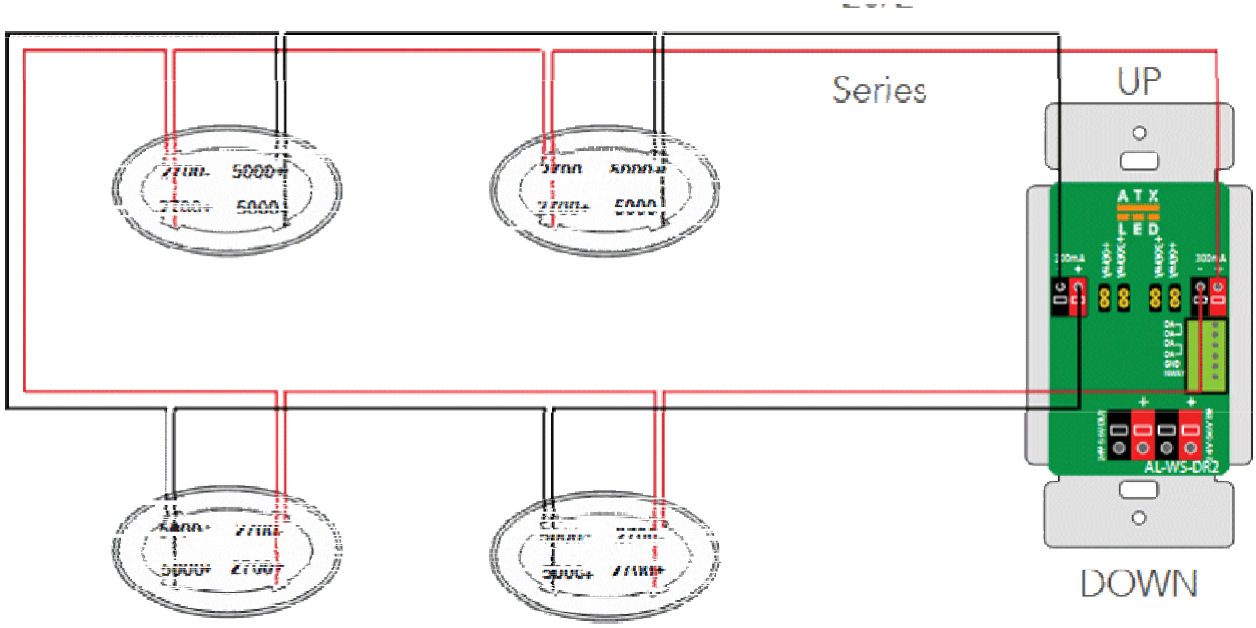
From 1 to 5 LEDs can be connected on each side.

The last LED in the string is Red=+ and Black=-

Tunable White Temperature LEDs (CCT)



P023R6 above and DL-120 below



Drive LEDs with two color temperatures and 1 pair of wire

Shown here is a single loop of AWG 20 wires with 2 conductors for tunable white. The wire colors we suggest are:

- Red for Warm, Red UP is positive and Red Down is negative
- White (or Black) for Cool, Cool UP is negative, Cool Down is positive

Simply mark which end of the loop is the top of the string (UP) of LEDs, and which is the bottom of the string (DOWN)

Following the instructions in the CBOX4 data sheet, results in a clearly marked system. Output current is up to 720 mA, 660 mA is typical for ATX LED fixtures. The LEDs are not damaged if reversed.

From 1 to 5 tunable White LEDs can be wired in series

If upgrading from 48v6w to P023R6 – the ceiling wiring needs no changes - simply replace the fixtures, the Orange connectors need not be changed.

Light Switch operation – Momentary style

A momentary switch springs back to On when the lever is pressed down, an On/Off does not spring back (On/Off see below) When installing a momentary switch type - the slider is on the left and the PCB is upside down.

Function	Press	How to trigger
On / Off	½ second	Push the switch down for under ½ second. The light will turn on and off each time you press.
Automatic Off Timer	½ second	Push the switch down for under ½ second. The light will turn on for 10 minutes then turn off. Repeat press to lengthen on time
Fade Override	½ second	If the light is in fade condition – the fade can be ended by pressing the button a 2nd time. For example – if the fade off time is 90 seconds, and you wish the LED to turn off immediately – press the momentary switch twice – the light will turn off.
Adjust Color Temperature	hold	Press the switch, the Slider now controls the color temperature – release when the color you like is reached. 1 second after release, you can change the brightness
Reset to defaults: Recalibrate the LED currents Set switches to On/Off style	60	Press and hold the button for 60 seconds. The switch will enter self calibration mode the next time the light is turned on. The LED operating mode after a reset will be Auto. The N-Way mode will not be changed, and the N-Way switch will be changed from Momentary to Rocker. The short address will not be changed
Restore to Momentary Style	5 times ½ second	Should the light not stay on when the momentary switch is pressed, the device is in Rocker mode. Press the button 5 times with less than 0.5 seconds each to change to Momentary operation.

Light Switch operation – On/Off style

A momentary switch springs back to On when the lever is pressed down, an On/Off switch does not spring back When installing a On/Off switch type, the Slider is on the right. This mode requires a DALI master to enable

Function	Press	How to trigger
Exit Momentary Style	Turn ON Wait 60 seconds Turn OFF	Should the not act like a simple On/Off switch, then it might be in Momentary style. A Factory reset will fix this. Factory reset – press switch top in, wait 60 seconds, turn switch off. The device will return to On/Off style and will recalibrate.
Adjust Color Temperature		If the LED is off – move the slider. The light will turn on and you can adjust the color temperature. After adjusting the color temperature – turn the switch ON, and you can adjust the brightness. Turn the switch off and the color temperature and brightness will be saved. Color mode will also exit after 10 seconds.
Reset to defaults: waiting to calibrate switches are On/Off type	8	Set the dim to low dim. Turn the switch on for 2 seconds. Now off and on 8 times, quickly, leaving it on after the last flip. The brightness will change to 50%, then go off The switch will enter self calibration mode and the lights will flash.

Light 3-Way Switch Functions – Momentary style

The remote (3-Way) switch can be either momentary or On/Off. If it is the momentary style, then use this table. A momentary switch springs back to On when the lever is pressed down. We recommend the protruding part of the switch be at the bottom, but it is not critical.

The N-Way switch input can use the same DALI address as the main switch – or it can have Its own DALI address. See below for 2nd DALI address

If you press the momentary switch and the lights do not stay on – you will need to reset the DR2 to 3-Way momentary.

Function	Press	How to trigger
On / Off	½ second	Push the switch down for under ½ second. The light will turn on and off each time you press.
Remote Dimming	2 seconds	Press and hold the button to dim down, then up. To dim down again, release and press. Do not hold longer than 45 seconds. Upon release the level will be stored and is normally not the same level as the slider on the main switch.
Setting Momentary Style	5 times ½ second	If a AL-WS-DR2 with a momentary switch is operating in On/Off style – then press the rocker 5 times briefly – it will switch to Momentary operation.

Light 3-Way Switch Functions – On/Off style and contacts

A momentary switch springs back to On when the lever is pressed down, On/Off does not spring back

A On/Off switch can be used with the DR2, as can any other contact – the DR2 will convert to On/Off/Contact operation if the contact is held closed for 45 seconds.

Function	Action	How to trigger
Light On/Off	On or Off	Turn the switch On or Off. Since this is a 3-way, On could be inverted depending on the state of the light. This can also be a Door contact.
Remote Dimming		Not supported
Change from Momentary to On/Off style	45 seconds	Should the switch get confused and only respond to every 2nd On/Off action – then simply leave On for 45 seconds and the system will correct the error.

“N-Way” wire input connection – Hardware Options

The N-Way input has several functional options. The default is simple 3-Way. Other options are enabled by DALI commands – see below.

Many 3-Way Push Buttons in parallel

With the Push Button method – a momentary switch like the AL-WS-M or RH-253 switch can be used. Each momentary action on the N-Way pin will toggle the light on / off. See table above for operation details. Simply wire multiple switches in parallel for unlimited remote switching.

3-Way Operation with On/Off rocker

If you prefer a On/Off type of switch - please use a standard simple 2 or 3 way switch connected to the N-Way input. Simply connect a 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/pdfr. 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 – so ground to change state. The state of the N-Way input is XOR’d with the physical switch, so Up and Down are no directly indicative of the On/Off light state.

Remote Dimming

If Push Button momentary mode is used – 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 45 seconds – since this will change the operation to non-momentary mode. If the DALI bus is configured – DALI dim commands will be transmitted.

PIR Operation

With a P023R6-M type fixture attached to the Right LED output, you can enable PIR mode. In this mode, if the PIR module in the P023R6-M detects motion, the DR2 will send a Level change command to the DALI bus – just like pressing the N-Way switch. You can use this to create macros using the ZWD software. Dimming is supported, and the main switch operates as usual.

Night Operation

Same as Door Jam – connect an electronic Motion sensor to the N-Way input. Use the DALI Fail value to set the current to the LED output.

Alarm Contact – Door switch

A simple Normally Open door alarm switch can be wired to the N-Way input. The current is low so there will be no damage to the contact. Thus – when the door opens – the light will go on. The DR2 will recognize the alarm contact 60 seconds after the door is closed. By default – the function is the same as an On/Off switch. A DALI master can set other modes – for example Right LED output controlled independently of the Left LED (Split) or the contact can have it’s own Short Address (2nd Address) or Split and 2nd Address can be both enabled.

Default Operation – stand alone

By default – the AL-WS-DR2 operates stand alone – no controller or DALI connection is master is required. Connect the dual LED outputs to your LED's. CCT mode will be initiated if the number of LEDs on both sides is the same – if CCT mode is not desired – see reset function below. Fixed color mode will be initiated if the number of LEDs on both sides does not match. If a Fan is attached, it will be automatically detected and managed – see Fan control notes.

DALI Master Controlled Operation

Default DALI Operation

By default – the AL-WS-DR2 only responds to DALI broadcast commands – it will not transmit. There is no 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. DALI received commands are treated like 3-way switch controls.

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-DR2. 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 configuration features. Once a short address is assigned – the device can be understood to operate as two devices in one.

1) LED driver with DALI control – the LED outputs will have a unique DALI short address after provisioning. The LED driver outputs are connected to LED's and each switch can now be individually controlled by DALI commands from the bus. All DALI 60929-2006 commands are supported. The actual address and group is defined and can be changed by the DALI master. See below.

2) Dimmer / Switch with DALI outputs – after provisioning – the mechanical front 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 slider dimming value will cause a DALI command to be sent internally to the LED outputs as well as externally to the DALI bus.

3) A DALI Short Address Reset command will return the device to Broadcast receive mode and disable all On/Off/Dim transmissions.

Use an AL-DALI-PI or other DALI Master or similar provisioning tool to assign short and group addresses.

DALI Fan control

DALI bus control of the FAN uses the 2nd short address method. If a fan is attached, set the 2nd Short Address using the memory bank 5:29, this will become the dedicated address for the fan. On / Off and speed control is possible, local control using the N-Way switch remains active. Only use the Single Address mode. The N-Way switch input can be assigned to the fan only in this mode.

DALI Address Assignment - Auto - Grouping

The switch from the factory has no DALI Short address by default. When a DALI master assigns a short address to the switch, one built-in feature rule has been implemented in all DALI ATX-LED devices.

- 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 – from the switch, slider or N-Way. This method allows multiple DR2 to be configured as a gang – to all operate as one switch. After assigning each DR2 a short address less than 16, add to each DR2 the group address of the others to be ganged together. An AL-WS-010v can also be assigned to the same group.

  An Al-WS-010v can thus be used as a 3-Way switch with full slider dimming. Use the dip switches in the AL-WS-010v to set it to a fixed Group address 0-15 for remote On/Off/Dim. Set the AL-WS-010v via dip switch to a Group (say starting at 15 downward) and use the DALI Master to assign the DR2 target to the same numeric short address as that Group (say 15)

- 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: An AL-WS-010v can be assigned the same short address to implement 3-way control with dimming.

DALI commands also are used to determine the 3-Way state. Therefore, a DALI command with the matching Group or Individual address will set the 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.

Trouble Shooting

If the LEDs do not turn on at full brightness, or flash – please check common causes;

1. Flashing the first time the light is turned on, or if the number of LEDs per side changes, is part of self calibration, please wait 1 minute for this to complete.
2. If no light – then the number of series LEDs is exceeded. The forward voltage of the LEDs is too great. The delivered voltage is between 7 and 42 volts (with a 48 v supply) or 46 volts (with a 51 volt supply). Check the forward voltage of the LEDs and add them up. For example, a 6 watt 360 mA bulb has 18 volts forward, a 6 watt 660 mA bulb is 9v.

   if your LEDs add up to more than 42 or 46 volts - they will not turn on at full brightness, and might not turn on at all.
3. Cross wiring. If the + of one side is connected via the LED to the – of the other side – then the LEDs will cycle on/off every 4 seconds.
4. If CCT LEDs are used – please use ZWD to change the DR2 from fixed color to CCT. Otherwise – the colors will not change, and the LEDs will operate at 12 watts instead of 6 watts – it could be intended by the installer to operate at 12 watts per bulb for example with a P023R11 6 inch fixture. Operating a 6 watt fixture at 12 watts will decrease bulb life and could overload the home run to the power distribution panel.
5. If cable is used that is not copper (see CCA anywhere on the box ?) then there will be substantial loss in the wire. Please do not use CCA type wire of any kind
6. If the FAN does not turn on – see the DALI configuration via ZWD.
7. Use the ZWD “pulse all” feature to verify that all devices are connected to the DALI bus
8. Use the ZWD / Advanced / Query DALI Power Status to verify that the DALI bus has 14 to 17 volts and no more than 260 mA
9. If the DR2 is operating in CCT mode when Fixed is expected, change to Fixed mode by holding the front switch down for 60 sections. Repeat that hold-operation to change back to CCT. This can also be done using a DALI master.
10. If two adjacent DR2 are interfering with the led output – apply Ferrous tape model “” ½ inches by ¾ inches to shield.

Software 3-Way Options

DALI commands also are used to determine the 3-Way state. Therefore, an Alexa to DALI interface will set the 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.

The Virtual 3-Way 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 it's 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. Since each DR2 or 010v device supports the N-Way input – the number of control points is limitless.

Note: 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.

N-Way signal options set via DALI command 35

Using the Dali command 35 (or memory location 0:15) – several modes are available. A DALI command 35 with the following values will select these advanced features

0	THREE WAY	Default – the external switch is "XOR" with the internal switch
1	DUAL SWITCH	The external switch operates independently. It can be used to control one of the 2 LED Driver outputs or can be used Set the 2nd DALI address mode via memory bank 5:29
2	FAN	Right output is for a FAN – turn the FAN on after a setable Delay time and keeps on for a settable Hold time
3	NIGHT	Input signal (active High) on N-way pin sets an ON command at the Min Dim level, two operation options: a) in sends that DIM level command to bus. System can detect this and send dim sequence. Main switch operates normally
4	PIR mode	A PIR on the N-Way will turn the light on and keep it on until there is no Motion. This can turn either all lights on/off or can control lights on the Right side only.
6	TIMEOUT	Each press of the button – turns the light on for a programmable delay – default is 10 minutes, this time can be changed by a DALI master. Main and N-Way initiate the timer.

Software defined N-Way Operations

DUAL Switch

With the Dual Output method enabled – the built-in switch will control the Left LED output and the N-Way will control the right LED (or Fan) output with independent level control. See memory bank 5:29

Night mode

In this mode an active High signal on the Right output is always on, with the dimming level is set by the slider. Intended for LEDs with built in PIR. The Left output tracks the rocker switch.

PIR – detect motion

Intended for LEDs with built in PIR. If the load changes, an On/Off packet will be sent on the DALI bus – On when the load appears, and off if the load is removed. This allows Motion sensing LEDs to be used to detect motion and control other groups or scenes based on motion. A PIR detection sends a DALI group On/Off command to the Group default Group address of the DR1 or DR2, plus 1.

2nd DALI Address operation from N-Way

The N-Way input can be given it's own DALI address to be used on the DALI bus. Dimming is supported. Use the memory command to set the 2nd DALI address at address 5:29, set memory 0:15 to Split mode (=1).

Memory 5:29	Switch Action
0-63	Transmit Short Address
64-79	Transmit Group Address
208-223	Transmit Scene
224-239	Transmit Scene with Recall
252	Send Broadcast off
253	Send Broadcast on max
254	Send Broadcast on/off/dim
255	Disabled

The AL-WS-DR2 can have this 2nd DALI address assigned to the Right side output. This could be either the fan or a single color LED. See notes in the LED driver section. The device will operate as follows

Memory 0:15 (N-Way)	Memory 5:9 (driver)	Function
Split mode (1)	Split mode (1, 2, 6)	N-Way controls Right device and sends DALI signals
Split mode	Not Split	N-Way sends DALI signals and does not affect Right directly
Not Split	Split	Right Driver controlled by DALI only
Not Split	Not Split	DR2 operates as one device only

Bath Fan and Light Configuration

Intended for exhaust fans, the Left output can be a dimmable light, the Right driver powers the fan.. The main switch and DALI control the light. A 2nd address can be configured for DALI control of the fan independent of the light. A delay time is set such that after Light the light goes on, the Fan will turn on. Once on, Fan stays for for the "hold" time. An idle speed can be defined for make up air, the fan will always run at that speed. The maximum speed can be defined as well.

Memory bank:address	Function	Value	Default	Scale
0:15	N-Way Mode	2 - Use N-Way as the Fan On/Off switch		
5: 9	Driver mode	2 – Enable 12v fan operation		
5:22	Fan Idle	Sets the speed of the fan when it is 'off'	0	0-254
5:21	Delay before ON	Seconds x 4	90 seconds	0 – 1020
5:20	Hold-ON	Minutes	10 minutes	0 - 254
5:23	Fan Operate	Sets the speed of the fan when it is 'on'	254	50-254

Fan Only Operation

If no LED is attached on the left side, the right driver output will power the fan from the front main switch. In this case, the slider sets the fan speed. The Default values are used until a DALI hub changes them. A short tap of the main switch starts the fan, each tap after that, adds 5 minutes, and a long press turns the fan off. In this operation mode, the DALI hub can control the fan directly.

Fan + LED Operation without N-Way

When an LED is connected on the left side, the main switch controls the light, and a timer controls the Fan. The times shown below can be changed by the DALI hub.

Function	Function – (times are user settable) use DALI master to change times	N-Way wiring	User operation
Follow	Fan and Light operate together (default)	Open	n/a – no fan switch needed
Auto Timer	Fan turns on after 90 seconds of light on, turns off automatically after 10 minutes	Connect to Gnd	n/a – no fan switch needed

Fan + LED Operation with N-Way

When an LED is connected on the left side, the main switch controls the light, and an optional external switch controls the Fan. The times shown below can be changed by the DALI hub. Either a rocker style or momentary style switch can be used to control the fan.

Fan Switch Functions – N-Way Momentary style

Function	Function – (times are user settable) use DALI master to change times	User operation
Auto Timer	Fan turns on after 90 seconds of light on, turns off automatically after 10 minutes	User enables via short press if light is on. If fan is running, short press adds 5 minutes. Disabled by long press.
Manual Timer	Fan turns on immediately, turns off automatically after 10 minutes	Starts via short press if light are off. Another short press adds 5 minutes, long press to stop
Manual Off	Turn fan off, disables Auto Timer	Stop the fan when running with long press

Fan Switch Functions – N-Way On/Off style

Function	Function – (times are user settable) use DALI master to change times	User operation
Auto Timer	Fan turns on after 90 seconds of light on, turns off automatically after 10 minutes	Leave Rocker On
Manual Timer	Fan turns on when switch is flipped on, turns off automatically after 10 minutes	Turn Rocker On, stop the fan by turning Rocker off
Manual Off	Turn fan off, disable Auto Timer	Turn Rocker Off.

LED Driver operation modes

CCT mode

In this mode, the total wattage between two connected strings of LEDs is the same, as the color is changed from one to the other. This implements color tuning. Press and hold the momentary main switch, and move the slider to change the color temperature. Right is warm, Left is cool. These can be swapped after installation if needed. Color tuning is supported by DALI DT8 standards. CCT mode is auto detected if the number of LEDs on both outputs is the same count.

Fixed mode

In this mode, both outputs will have the same level. Move the slider to control brightness. If the number of LEDs is the same on both sides, the DR2 will default to CCT mode (and appear as ½ brightness) – use the ZWD configuration tool force fixed mode.

Split Fixed mode*

In this mode, the outputs can be operated independently. Enable N-Way split mode to allow the right output to be controlled by the N-Way switch, and by the 2nd DALI address if desired. Use the ZWD configuration tool force split mode.

PIR – detect motion

Intended for LEDs with built in PIR. If the load changes, an On/Off packet will be sent on the DALI bus – On when the load appears, and off if the load is removed. This allows Motion sensing LEDs to be used to detect motion and control other groups or scenes based on motion. Use the 2nd DALI address to set the destination, and the dimming left of the right output, the Right side is always powered.

FAN*

An attached fan will be auto detected, enabling the fan modes, It can be set with ZWD to have it's own address.

Split CC + CV mode*

In this mode, the left output is Constant Current, 0-660 mA. The Right output is Constant Voltage, 12v. These outputs can be operated independently or in tandem. Enable N-Way split mode to allow the right output to be controlled by the N-Way switch, and by the 2nd DALI address if desired. Use the ZWD configuration tool force split CC+CV (12) mode.

* 2nd DALI address – see "Split DALI"

Split DALI 2nd address

The AL-WS-DR2 can have a 2nd DALI address assigned to the Right side output. This could be either the fan or a single color LED. The N-Way signal can be optionally connected to the same 2nd address.

This allows these functions:

- The N-Way input can operate independently of the Main switch with a unique DALI address. See N-Way operation above
- The Right driver can operate independently of the Main switch and the left driver with a unique DALI address. In this mode, the Right channel operates as a basic DALI device with minimal features.
- The N-Way can operate the Right driver sharing one DALI address that is unique from the main switch and left driver

Memory 5:29	Driver Action
0-63	Driver Short Address
64-79	Driver Group Address
128-192	Driver Short Address 0-64 *
193-207	Driver Group Adress 0-15 *
208-255	No action

* no response to DALI queries

Advanced Diagnostics - Self Calibration

The AL-WS-DR2 attempts to make installation easy. To do this, it self calibrates the first time that it has power, and the lights are turned ON. The self calibration is a sequence of flashing lights – it takes up to 20 seconds, after that, it will not do that again – unless changes are made to the jumper settings, the # of LEDs or the type of LED. If needed – a recalibration can be forced – see the switch controls on how to force a reset and thus recalibration.

LEDs can be open, shorted, cross wired, backwards and nothing should break. You can hot swap the LEDs, change the number in series and the device will learn the setting at the next power cycle. The input voltage can be reversed without damage. However – connecting the input voltage to the LED output will cause immediate and permanent failure.

Flashing 4 times per second is a warning that the LEDs are cross wired – the Left and Right LEDs are cross wired (Plus of one goes to the Minus of the opposite channel).

If the left and right channels have the same number of LEDs the device will operate in CCT mode. See Reset for how to change this. If Fixed LEDs are attached – they will operate at ½ power in CCT mode, and the light levels from the left and right side will change if ‘Color Tuning‘ is conducted from the main switch.

The Memory Read function can be used to extract a lot of data about the operating state of the switch. See our application note for more information. Most of this information is in Memory Bank #5.

Memory Location 68-69/70-71 provides the following information:

LED status bit 0:1	Register Value
1	LED output was shorted, the voltage is stored
3	The ohms was high – the ohms calculated is stored
0	Normal operation – the ohms per chip is stored

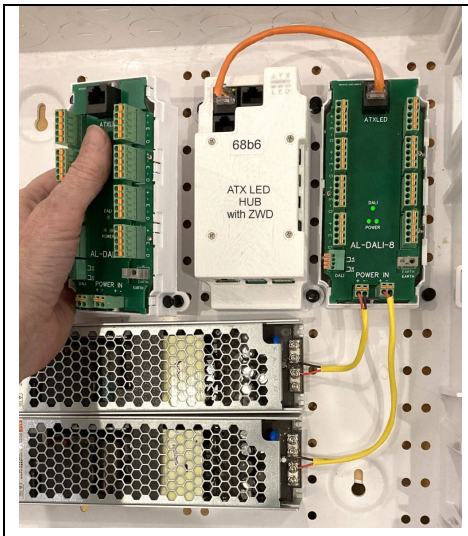
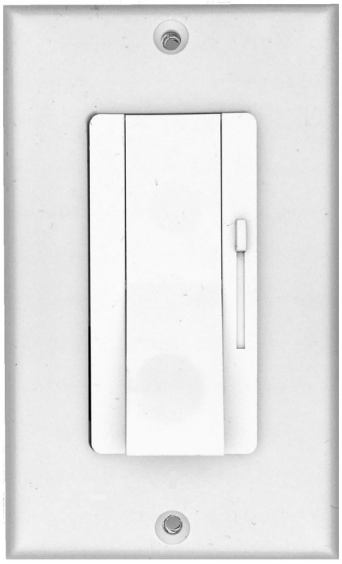
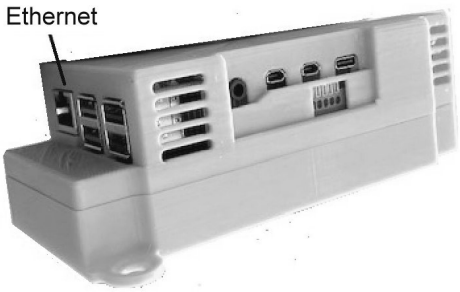
Recommended ETL listed LED's with 51v DC supply

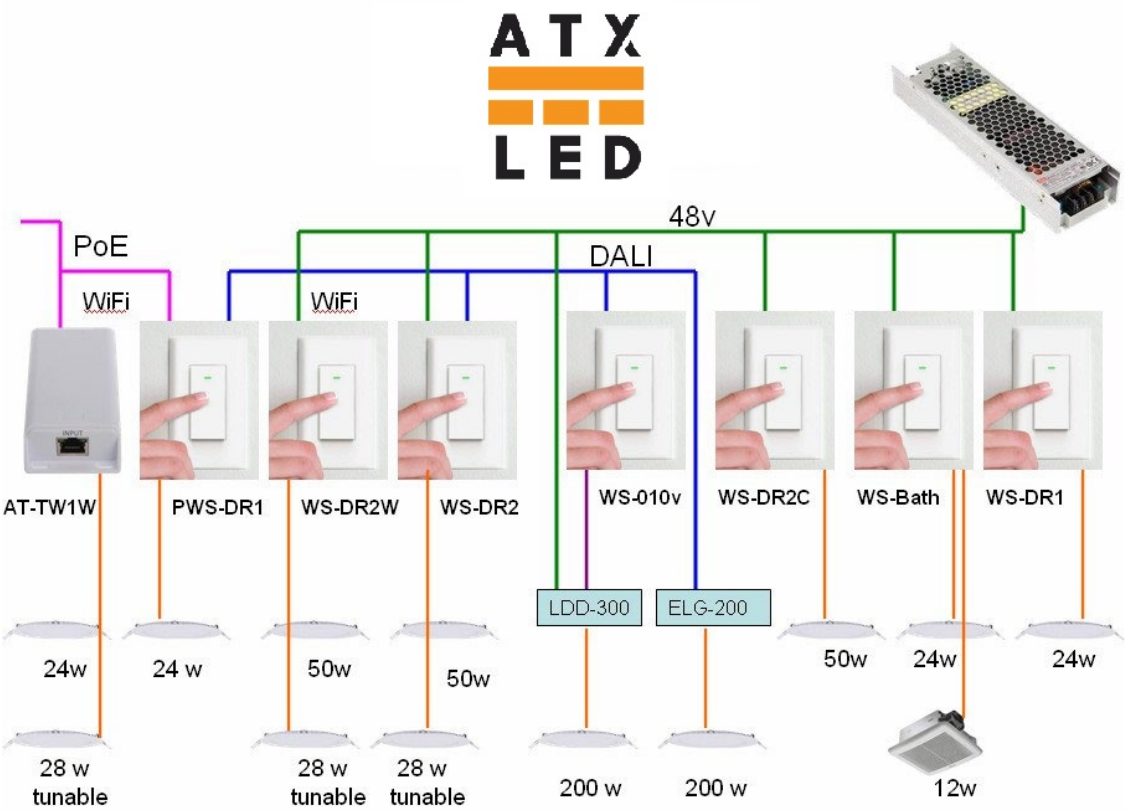
LED rated watts	Type	Model	Size inches *	LED rating	DR2 Max Count	Total power output Watts	Note
6	Flat Ceiling	P023R6	3 / 5	660 mA	10	60	2x 5 series
6	Flat Ceiling	P023R6 CCT	3 / 5	660 mA	5	30	5 in series
12	Flat Ceiling	P023R11	6 / 7.5	720 mA	10	60 **	2x 5 in series
12	Flat Ceiling	P023R11 CCT	6 / 7.5	720 mA	5	30 **	5 in series
6	Recessed	DL-120 fixed	1 / 5	660 mA	10	60	2x 5 in series
6	Recessed	DL-120 CCT	1 / 5	660 mA	5	30	5 in series
6	Gimbal Spot	DL-98B CCT	2.75	660 mA	10	60	2x 5 in series
6	Bulb	RL-E26-660mA	E26	660 mA	10	60	2x 5 series
4	Bulb	RL-E12-660mA	E12	660 mA	14	56	2x 7 series
6	Bulb	E26-48v6w	E26	120 mA	12	72 ***	2x 6 Parallel
3	Bulb	E12-48v3w	E12	65mA	22	66 ***	2x 11 Parallel
14	Closet	FMMCL 18 840 S1 M4	18	360 mA	2	28	2x Parallel
7	Closet	FMMCL 840 S1 M4	7	360 mA	4	28	2x 2 in series
8w /ft	linear	P023S4	18****	1440mA	7.5 ft	60 **	
4w /ft	linear	P023S4	18****	720mA	15 ft	60 **	
4w /ft	linear	P023S4 CCT	18****	720mA	7.5 ft	30 **	
2w /ft	linear	P023S2	7****	660mA	30 ft	60	
2w /ft	linear	P023S2 CCT	7****	660mA	15 ft	30	
4w /ft	linear	48v CCT resistive strip	5****	700 mA	60 ft	75 **	Parallel
4w /ft	linear	24v CCT resistive strip	3****	700 mA	60 ft	75 **	Cut in half – wire series
6	Outdoor Small	ODB6	5	660 mA	8	6	2x 4 series

*size 3 / 5 means 3 inch light source and 5 inch trim diameter
** higher power using a 1440 mA driver like SRP-2309-75CCT

*** 96 watts with a simple On/Off switch
**** minimum cut length – can mix and match for any length.

DALI bus products from ATX LED Consultants

		
Structured Wiring DALI power supply with easy wiring	Wall Switch + 0-10v Driver with DALI AL-DALI-010v	ATX LED Hub



DALI Commands Supported

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

Individual Short Address Commands

	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	
A	35	Set N-Way mode (DTR is the value)	See table below
A	38	Set light on/off to reflect Mechanical switch Up/Down	
	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 (see table)	
	47	Store DTR as Fade Down duration (see table)	
		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	
A	49	Set UPS mode and use DTR as temporary Max Level Min to 254	255 = reset
*	129	Enable memory Bank write	
	144	Query Status (1 indicates status below)	
	bit 0	Right Led Connected, or Fan connected	
	bit 1	Left Led Connected	
	bit 2	Either Led ON	
	bit 3	ARC setting out of range, or LED shorted	
	bit 4	Fade in action, or Fan in spooling up/down	
	bit 5	Device not configured after reset	
	bit 6	Missing Short Address	
	bit 7	No ARC level set after power failure or last change not stored in EEprom	
	145	Query if Short Address matches one stored	
	146	Query if either attached LED fail	
	147	Query if LED on	
	148	Query if ARC command exceeded Min / Max limits	
	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 (== 6)	
	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	

	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)	
	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 (auto increment DTR to next address)	DTR1 is memory bank, DTR is address
	255	extended DALI version (209)	

Global Commands – processed by all DALI devices on the bus

	256	Terminate	
	257	Set DTR	
*	258	Initial Addressing Mode	
*	259	Randomize	
	260	Compare Random Address	
	261	Withdraw from Random Addressing	
	264	Set High Byte	
	265	Set Middle Byte	
	266	Set Low Byte	
	267	Set Short Address if match	
	268	Query Short Address	
	269	Query Long Address Match	
	273	Set DTR1	
	274	Set DTR2	
	275	Write Data at Memory Bank DTR1:DTR	Send confirm
	276	Write Data at Memory Bank DTR1:DTR	no response

N-Way Modes sent with command 35 / Memory 0:15

value	Switch Operation Mode	Description
0	Three Way	Main and N-Way switches operate in 3-Way
1	Split / Dual	Main and N-Way switches operate independently see 2nd short address operation option
2	FAN	Main switch controls the Light, N-Way switch controls the Fan
3	Night	N-Way turns the lights on at minimum Dim
4	PIR	N-Way input is for PIR, high Pulse sets timer sets N-Way input to On/Off not pushbutton mode
5	Vacancy	N-Way input is for PIR, high Pulse sets timer if user turned light on first sets N-Way input to On/Off not pushbutton mode
6	Timer	Main and N-Way switches turn lights on/off, timer turns them off

Memory Bank 0 (DTR1 = 0)

DTR register	Bank 0 Name	Bank 0 Value
0	Bytes per Bank (minus 1)	63
1	Checksum	Calculated
2	Number of Banks (minus 1)	3
3	UPC code – msb	See table
4	UPC code	
5	UPC code	
6	UPC code	
7	UPC code	
8	UPC code – lsb	
9	FW Version	
10	HW Version	
11	Serial Number – msb	Assigned by Master
12	Serial Number	
13	Serial Number	
14	Serial Number – lsb	
15	N-Way Mode	Read/Write See details
17-63	Storage	User Defined

UPC Codes:

722512407176	AL-WS-DR2 v0	(2018)
722512407183	AL-WS-DR2 v1	(2019)
784099948268	AL-WS-DR2 v2	(2019)
784099948190	AL-WS-DR2 v3	(2020)
784099947797	AL-WS-DR2 v4	(2023)

Memory Bank 1-3 (DTR1 = 1,2,3)

DTR register	Name	Value
0	Bytes per Bank (minus 1)	63
1	Checksum	calculated
2	Number of Banks (minus 1)	3
3-63	User Storage	

Memory Bank 4 real time data (DTR1 = 4)

DTR register	Name	Value
3, 4	Up Time lsb (3) msb (4)	Hours
5, 6	On Time lsb (5) msb (6)	Hours
12	Wh/10	99 = 990 Wh add to kWh below
7, 8	kWh lsb (7) msb (b)	kWh
9	Average Watts since boot	Watts
10	Peak Watts	Peak when LEDs at 100% Watts
11	UPS mode Now	Power limited output level 20-254
13	Watts Now	Watts Total
14, 15	Input Voltage Now lsb (14) msb (15)	Vin Milli Volts
16, 17	Right Wattage Now lsb (16) msb (17)	Vled milli Watts
18, 19	Left Wattage Now lsb (18) msb (19)	Vled milli Watts

Read/Writable Memory Bank 5 (DTR1 = 5)

1	Transmit Group	0-15 means send group 255 means send short address
6	Right Max Voltage	Volts 9-52
7	Left Max Voltage	Volts 9-52
9	Driver Operation mode	0 = Auto and calibrate 1 = Fixed Split 2 = 12v FAN 3 = CCT 4 = Fixed 5 = PIR 6 = CC left, 12v CV Right
10	(DALI limit for Right / Warm) /2	Default is 176 = Right is Warm
11	(DALI limit for Left / Cool) /2	Default is 0 = Left is Cool
20	Fan Hold time	Minutes (up to 4 hours)
21	Fan Delay to On / 4	255 = 1020 seconds
22	Fan Idle Voltage	0 = 5.5 volts, 254 = 10 volts
23	Fan Max Voltage	0 = 5.5 volts, 254 = 12 volts
28	Warm Shift (S) mA threshold for Dim to Warm (m)	S * 16 + m / 2
29	DALI address of Split N-Way DALI Group address 0-15, Scene 0-15 broadcast / Disable	see detail
30	Slider Left/Right	Non zero is left, 0 is right
40/41	Max MP driver Right*	Read 16 bits = 20 to 660 mA
42/43	Max MP driver Left*	Read 16 bits = 20 to 660 mA
76	CCT fade time /10	Seconds / 10 (255 = 40 minutes)
78/79	LED Vf adjustment	+- mV per LED rung (/ 10)
80/81	Physical Max Right/Left /4	Value 165 = 660 typically

In V3 hardware – the power assumes a 660 mA LED is attached; the DR2 measures how many LEDs are connected and does the correct power calculation.

Read Only Diagnostics in Memory Bank 5 (DTR1 = 5)

8	CCT_Level Ratio of Left to Right outputs	0-100
13	N Way Mode	See command 35
14	Last Control	1=local off 2=local on 4=DALI off 5=DALI on
24/25 26/27	High Power converter minimum LSB/MSB Right, Left	mVolts
32/33 34/35	Low current driver Turn on LSB/MSB (Right, Left) real time	120 typically 70-220 counts
36/37 38/39	LED Voltage at 3 mA	7500 to 50000 mVolts
40/41 42/43	High Power Converter Max LSB/MSB Right, Left	660 typically 600-720 range
44, 45	Number of series LED chips Right, Left	Number of 3v chips
46, 47	High Power Driver Max mA Right, Left	1 or 3 = 660/720 mA 2 or 6 = 300/360 mA
48 49 50	Driver Status Right, Fan Left	1 = Short 2 = Open 3 = Crossed LEDs 4 = Good LED, Fan, off 12 = Good LED, on
52/53 54/55	Low current driver Max LSB/MSB Right, Left	200-1023 35 uA per step
56/57 58/59	Voltage of the LEDs real time	0 to 56000 mVolts
60-63	WattMinutes (32 bits)	Wh*60
64/65 66/67	Low Drive max	0-1000 is 0-30mA
68/69 70/71	LED array diagnostics	See notes
72/73 74/75	LED Voltage at 660 mA	7500 to 50000 mVolts
76	CCT Fade time	10s of seconds