

HOW to WIRE

WIRING GUIDE FOR THE ATX LED SYSTEM



AL-CBOX4 Rough-in Junction Box
for easy code-compliant installation

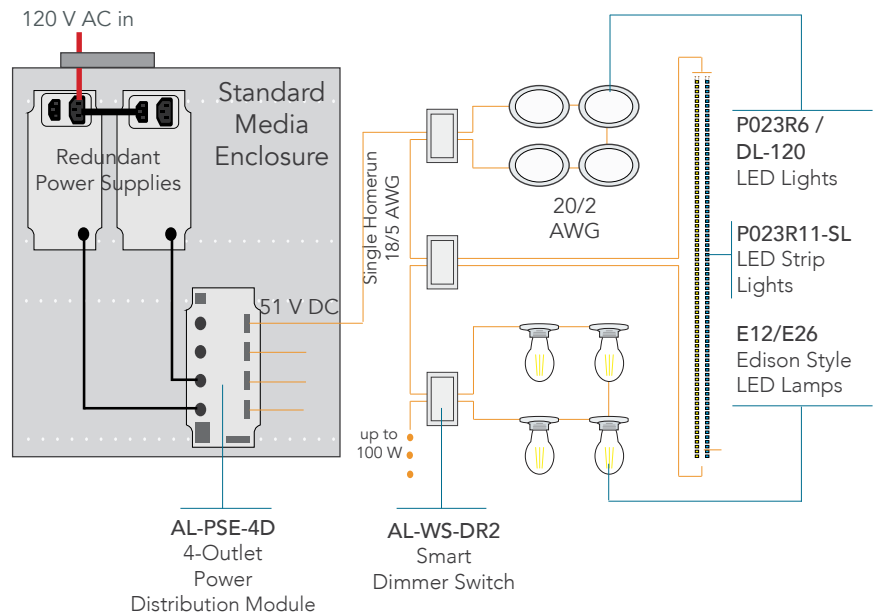
Overview

ATX LED offers home builders a lower-cost, flicker-free, perfectly-dimmable LED lighting system using low-voltage DC power without changing the look and feel of traditional fixtures or switches. ATX LED's solution converts 120 V AC to DC just once per house to provide DC power to lights, fans, and chargers and reduce labor cost, save copper, and improve the end-user experience with higher reliability. ATX LED's innovative technology eliminates the need to run high-voltage ROMEX™ throughout the home and instead uses 18/5 or 18/3 for home runs and 20/2 between switches and lights.

The end product can be value priced with simple on/off standard wall switches, or smart and full-featured without significant additional cost. Designed for volume builders, the labor and schedule savings allow projects to be completed more quickly and at lower costs.

Complete System Solution

ATX LED's innovative system features redundant power conversion hardware to insure continuous operation even in the case of unexpected failure. The system includes a selection of LED lighting, switches, power management hardware, and accessories. All ATX LED products are UL listed and compliant with California Title 24 standards, as well as compatible with common smart home controls. The ATX LED DAbus provides smart home connectivity and control.



Typical ATX LED System Example



Ceiling Fan



Exhaust Fan







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Wiring Overview

Conventional wiring for 120 V AC lighting systems relies on heavy gauge (AWG 14) ROMEX. This wire is designed to carry heavy 1800 W loads; it is not required for low-power LEDs. The ATX LED system saves copper and simplifies installation by using right-sized 18/5 skinny wire for home runs and daisy-chaining switches and 20/2 for wiring between switches and lights. This wiring delivers the appropriate amount of power to each fixture without the need for conversion circuitry in each fixture.

The ATX LED system is wired with 18/5 throughout, though our Value Line products require only three wires. This allows for easy upgrade to a full-featured Signature Line system with the simple swap of switches and fixtures; no wiring changes are required. The diagrams in this manual are simplified for clarity when appropriate, showing only the three wires connected on Value Line examples. For extreme cost savings, 18/3 home runs might be used, but this is not recommended since it precludes future upgrades.

ROMEX	ATX LED
 <p>14AWG @ 15A = 1800 Watts/LED</p>	<div>  <p>20/2 AWG</p> </div> <div>  <p>18/3 AWG</p> </div> <div>  <p>18/5 AWG</p> </div> <p>The ATX LED system utilizes skinny wire for all DC circuits:</p> <ul style="list-style-type: none"> - 18/5 for all home runs and for daisy-chaining switches. - 20/2 from switches to LEDs and between LEDs - For the special case of DALI installations, use 18/5 for home runs.

Comparison of Wiring Types

As shown in the example below, using lower-gauge wiring results in significant cost savings in addition to simplifying installation, saving copper, and allowing the LEDs to run cooler and more efficiently. The below tables compare costs in a typical 1800 ft² home.

Low Voltage Example

Application	Gauge	Price per ft (June 2021)	Feet of wiring	Total cost home
Home Run (standard)	18/5	\$0.28	300	\$84.00
Home Run (not recommended)	18/3	\$0.16	300	\$48.00
Switch to Light	18/2	\$0.12	660	\$79.20
	20/2	\$0.064	660	\$42.24
3-Way simple	CAT5e	\$0.10	120	\$12.00
Low Voltage Total				\$186.24 - \$223.20

120 V Example

Application	Gauge	Price per ft (June 2021)	Feet of wiring	Total cost home
Home Run	14/2	\$0.48	660 lights 220 switches	\$422.40
3-Way	14/3	\$0.64	120	\$76.80
120 V Total				\$499.20

Wire Sources

Application	Gauge	Vendor	\$ / sq ft June 2021	ft / 1800 sq ft home
Home Run (standard)	18 / 5	https://www.homedepot.com/p/Southwire-250-ft-18-5- Brown-Solid-CU-CL2-Thermostat-Wire- 64169644/202316418	28 cents	300 ft
Home Run (not recommended)	18/3	https://www.homedepot.com/p/Southwire-500-ft-18-3- Brown-Solid-CU-CL2-Thermostat-Wire- 64168845/202316308	16 cents	300 ft
Switch to Light	18 / 2	https://www.homedepot.com/p/Southwire-500-ft-18-2- Brown-Solid-CU-CL2-Thermostat-Wire- 64162144/202316306	12 cents	660 ft
		Or https://www.amazon.com/Vertical-Cable-Conductor- Unshielded-1000ft/dp/B01ATXS82E/ref=sr_1_55?	16 cents	
	20 / 2	https://conversionstechnology.com/products/20-2-solid- copper-20awg-2c-unshielded-cmr-br-500-ft-reel	6.4 cents	660 ft
3-Way simple	cat-5e	https://www.amazon.com/dp/B07JBPSVZT/	10 cents	120 ft
120 vac comparison - home run	awg 14/2	https://www.lowes.com/pd/Southwire-Romex-SIMPull-250- ft-14-2-Non-Me-tallic-Wire-By-the-Roll/1193437	48 cents	660 lights 200 switches
120 vac - 3-Way	awg 14/3	https://www.lowes.com/pd/Southwire-Romex-SIMPull-250- ft-14-3-Non-Me-tallic-Wire-By-the-Roll/3129317	64 cents	120 ft

18/5 Wiring Color Chart

Color	Function	Comment
Red	Power to the Wall switches (48 to 52 V)	Up to 100 Watts
Blue	Return power	
Green	Earth ground for static discharge	Detours static electricity from people to earth
White	DALI bus (-)	Polarity not significant
Yellow	DALI bus (+)	Polarity not significant



Optional Time of Day Lighting Rhythm

Flexibility to Choose

ATX LED gives builders the ability to offer home buyers a simple and seamless upgrade path at any stage of the build process because no changes to wiring or other buildout are required. Simply choose lights and switches from the same line to create the optimal lighting experience.

V Value Line

The entry-level products in the Value Line offer a starting point for installing energy-efficient DC lighting, with a selection of fixed true white light colors and standard switches.

S Signature Line

The Signature Line is for customers who want a fully program-mable system that integrates with common wireless smart home controls. Lights in the Signature Line can be color tuned to a wide range of colors and programmed to adjust throughout the day.

SIGNATURE Trim Connections

Wire Color	Wire Marking	Function	Comment	Connector Color
Red	DOWN	+ voltage to the first LED in a string	Warm White +	Red
White	DOWN	- voltage to the first LED in a string	Cool White -	White
Red	UP	- voltage to the last LED in a string	Warm White -	White
White	UP	+ voltage to the last LED in a string	Cool White +	Red

Use blue tape to mark UP. DOWN is not marked.

48 V VALUE Trim Connections

Color	Wire Marking	Function	Comment
Red	UP	+ voltage to the first LED in a string	
White	UP	- voltage to the first LED in a string	
Red	DOWN		Reserved for future use
White	DOWN		Reserved for future use



Meet the DR2

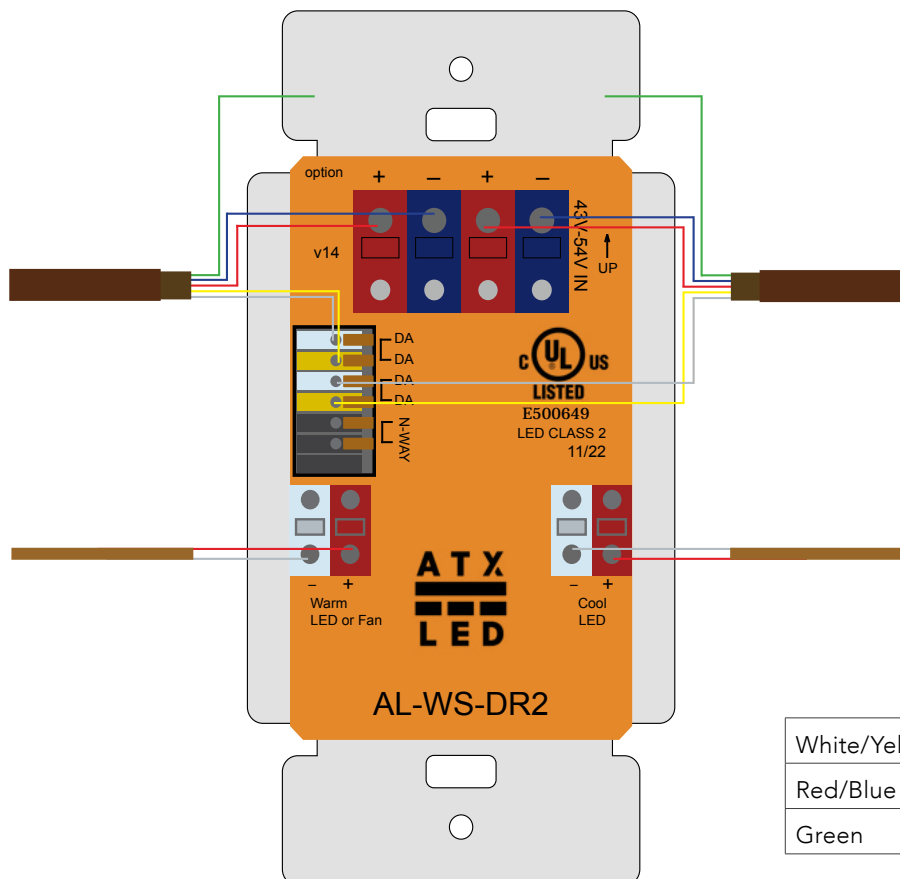
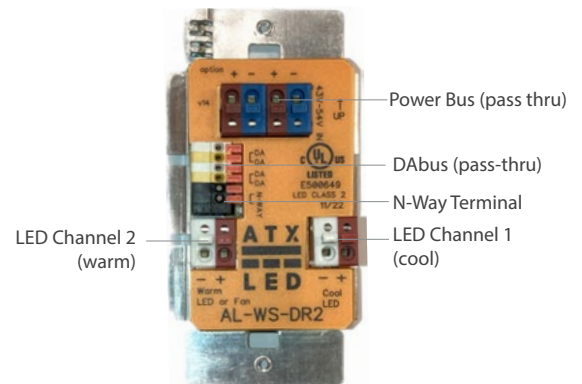
The DR2 is the heart of the entire system. From the front it looks like a typical style wall switch with a slide dimmer. This is where the driver for the LEDs is located. The DR2 uses current control technology to provide perfect dimming to each of its corresponding LEDs. There are several different types of DR2 available, depending on application, as shown starting on page 11 .



RECOMMENDED
Slider on the left
Press bottom



NOT RECOMMENDED
Slider on the right
Press top



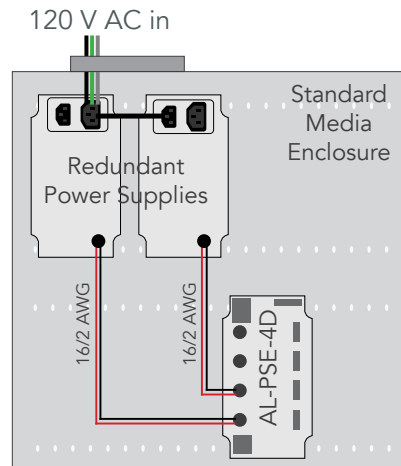
Color Chart

White/Yellow	DABus
Red/Blue	Power
Green	Earth

Typical DR2 Wiring

Power Architecture

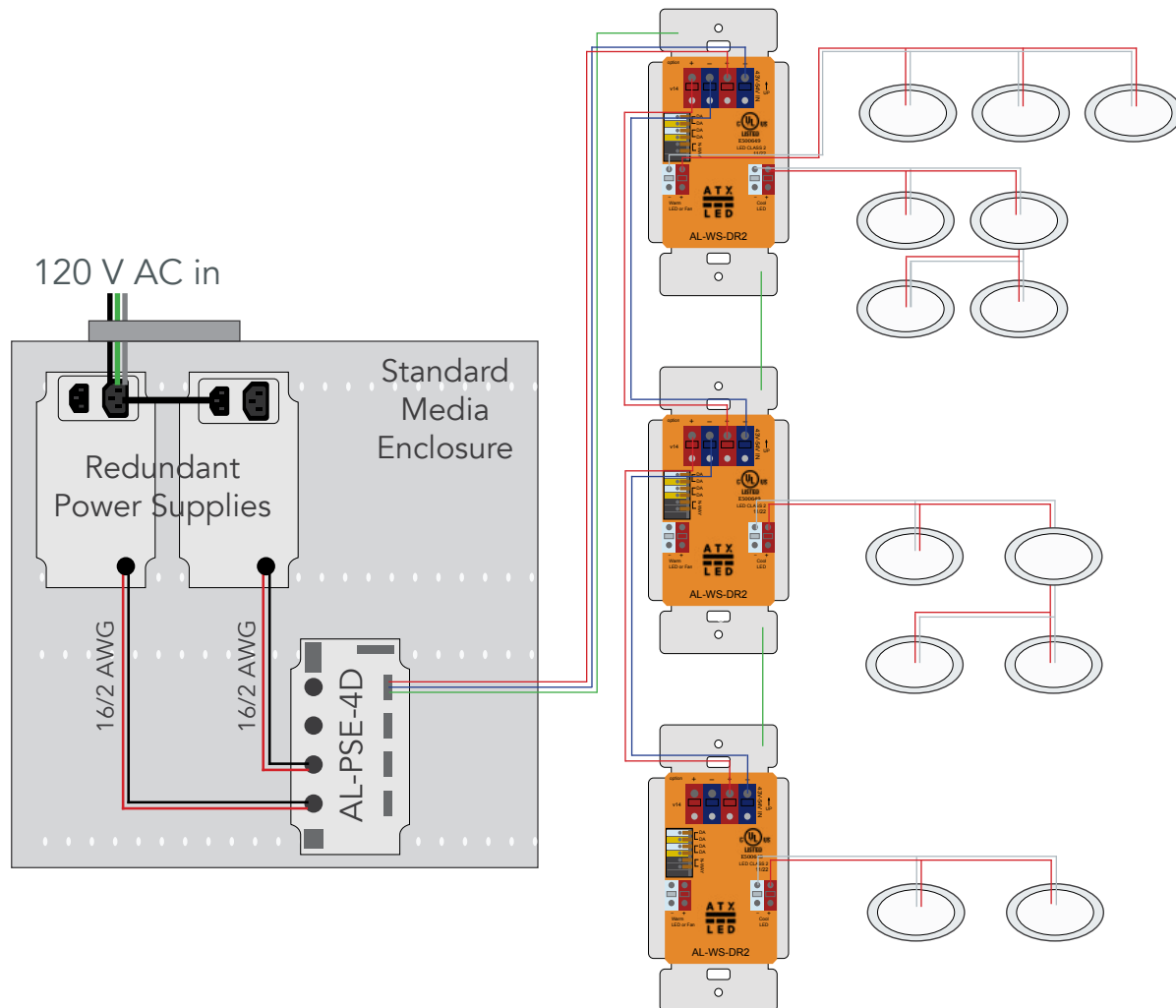
The system is powered by one or more 51v96w AC/DC converters. There are two or more contained in the network panel. Only one is needed for each 100 Watts of load, plus one is recommended for redundancy. The AL-PSE-4D power distribution board is equipped with automatic fail-over, meaning that if a power supply fails, the AL-PSE-4D will automatically go to backup. Backup can also be a battery system. For houses with over 500 Watts of load, 350 and 500 Watt supplies are recommended and are used with AL-PSE-8D.



Power to Room LEDs

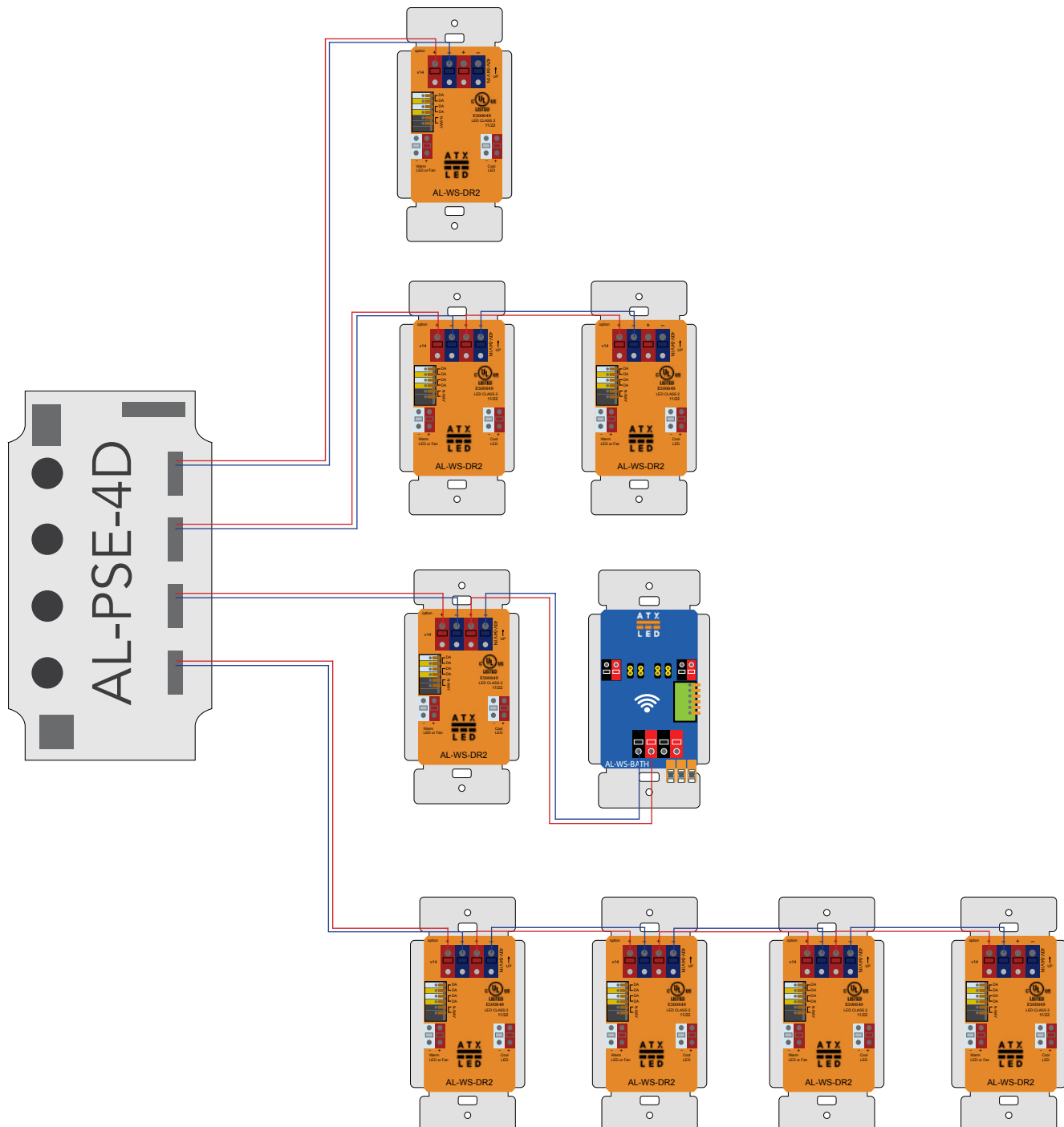
This diagram shows an example arrangement of three wall switches controlling three separate zones of LEDs, all powered from the same home run. Each home run of the AL-PSE-4D (power distribution board) may carry up to 100 Watts. Due to DC line losses, however, it is recommended that only 15 of the 6 Watt LEDs be used in this manner.

Wall switch power may be daisy-chained, as long as the total power demand does not exceed 100 Watts. Again, it is important to consider line losses. Though the max DC power is 100 Watts per home run, 90 Watts of load is recommended. Please see "Typical DR2 Wiring" on page 6 for more detail on complete wiring.



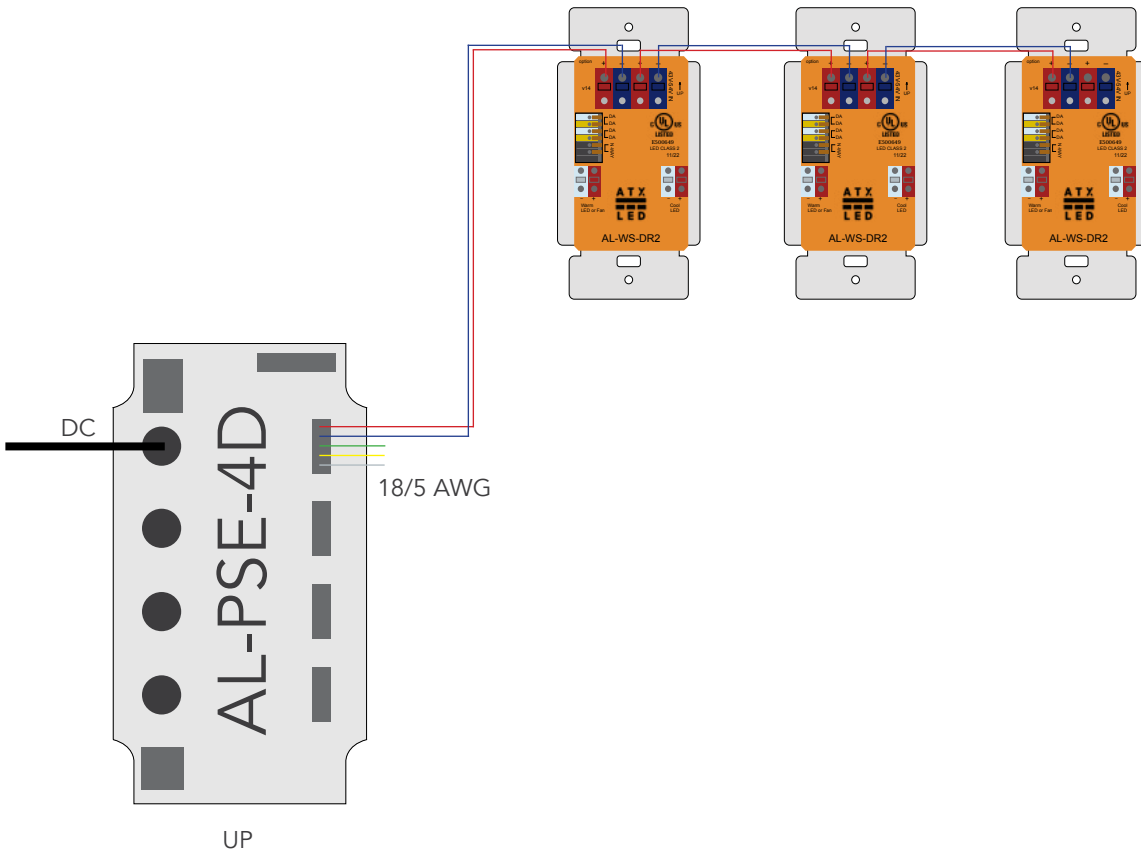
An Example of Power Distribution Architecture

All wires shown in this diagram are 18/5. Earth ground and control lines are omitted for clarity. Please see "Typical DR2 Wiring" on page 6 for more detail on complete wiring.



Switch-to-Switch Power

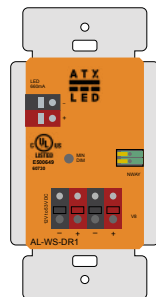

ATX LED switches can be daisy-chained as shown below. Control and ground are omitted for simplicity; please see "Typical DR2 Wiring" on page 6 for more detail on complete wiring.



Control Devices

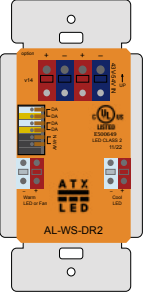
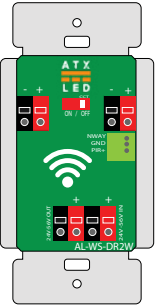

VALUE LINE Switches

The following switches provide simple on/off control and smooth dimming and can be used with fixed-color true white LEDs from the Value Line.

	Lighting Wattage	Dimming	N-way Capable	Fan	Tunable White
AL-WS-DR2C 	60 Watts Fixed 30 Watts Tunable	0.1%	Yes	Yes	Yes
AL-WS-DR1 	30 Watts	10%	Yes	No	No
Simple Switch 	96 Watts	None	Yes	No	No

SIGNATURE LINE Smart Control Devices

The switches in the following table are designed to be used with tunable white LEDs and provide WiFi connectivity, programmability, and can be used with common smart home controls. They also can be used with Value Line fixed-color LEDs, though their added control capabilities would be functional.

	Control Method	Lighting Wattage	Dimming	N-way Capable	Fan	Tunable White
AL-WS-DR2 	DAbus	60 Watts Fixed 30 Watts Tunable	0.1%	Yes	V3	Yes
AL-WS-DR2W 	WiFi	60 Watts Fixed 30 Watts Tunable	0.1%	Yes	No	Yes
AL-WS-8B 	DAbus	Up to 8 zones	--	Yes	Via DALI	Yes

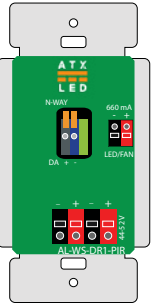


8B Face Options



Other Components

ATX LED offers the following switches to complete a full home lighting system, serving the need for bath/fan switches, occupancy, and momentary switches.

	Lighting Wattage	Dimming	N-way Capable	Fan
AL-WS-DALI 	External	Via DALI	Yes	External
AL-WS-M  Can be used as a remote 3-way or as a bathroom fan timer switch	N/A	Yes	Yes	
AL-WS-DR1-PIR 	30 Watts	Yes	Yes	Yes

Installation Accessories

AL-CBOX-4 Ceiling Mount Receptacle

All of our 4" LED wafers come packaged with optional hanger springs that mount perfectly with our orange rough-in box. The low voltage AL-CBOX4 quickly attaches to the home ceiling flat truss or vertical beams at rough using either standard nails and hanger bars. LEDs such as the P023R6- (wafer) and DL-120- (recessed), R@R temp lighting fixtures, WiFi access points, smoke detectors, and cameras, can be mounted into the CBOX4.



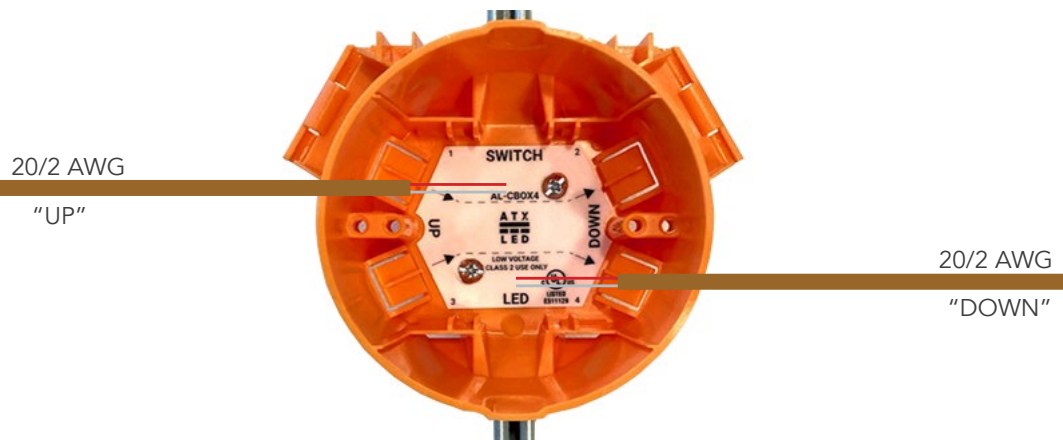
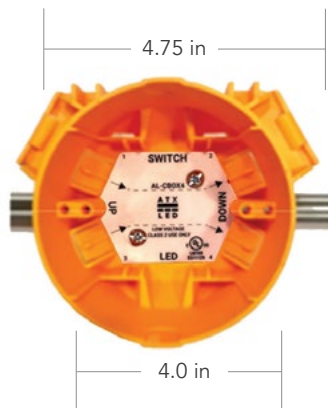
This device solves three requirements for code compliant installation of low voltage devices in ceilings:

- all junctions inside a junction box
- mechanical support by the rafters not the sheetrock
- fire-rated UL94V-0 polycarbonate material

The AL-CBOX4 also simplifies installation by allowing:

- built in depth guide eliminates vertical measurements
- X-Y alignment of the position before sheetrock
- positions low-voltage wire above sheetrock to avoid damage
- holds the R@R temporary light sources for jobsite lighting prior to final electrical inspection
- hole cutting, tape, float, paint to be done by the sheetrock team before installing the lights
- super fast trim installation

Please note: The AL-CBOX4 does not come with a mounting bar.

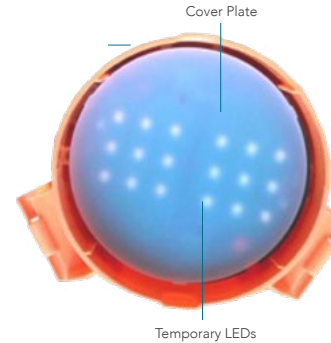


Ready-at-Rough Kit

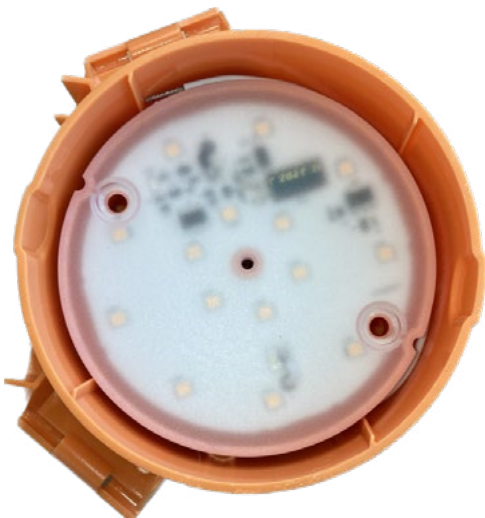
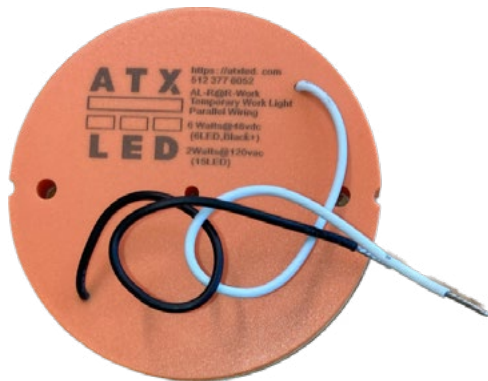
ATX LED's Ready@Rough kit allows lighting installers to validate proper function of the lighting system prior to drywall installation and to cover and protect wiring during the rest of the buildout process. After the CBOX4 and electrical boxes for the switches are installed, lighting installers can use the corresponding components of the R@R "Work" and "Wall" kits to verify the lighting system and protect from accidental cuts during the rest of the buildout process.

Additionally, the included LED lighting works from the moment the wiring is installed and provides lighting for the jobsite during the weeks of finishing work. If a wire is cut during finishing work, the temporary R@R light goes out immediately, making it easy to identify and remedy problems as they arise.

- Protects wires from Rotozip tools, sheetrock mud, and paint
- Provides light during construction before sheetrock
- Verifies all wiring prior to sheetrock
- Saves time at trim
- Optional washable clear lens to allow reuse
- No deformation of the wires



Ceiling Ready-at-Rough Kit



AL-R@R Work – Temporary LED



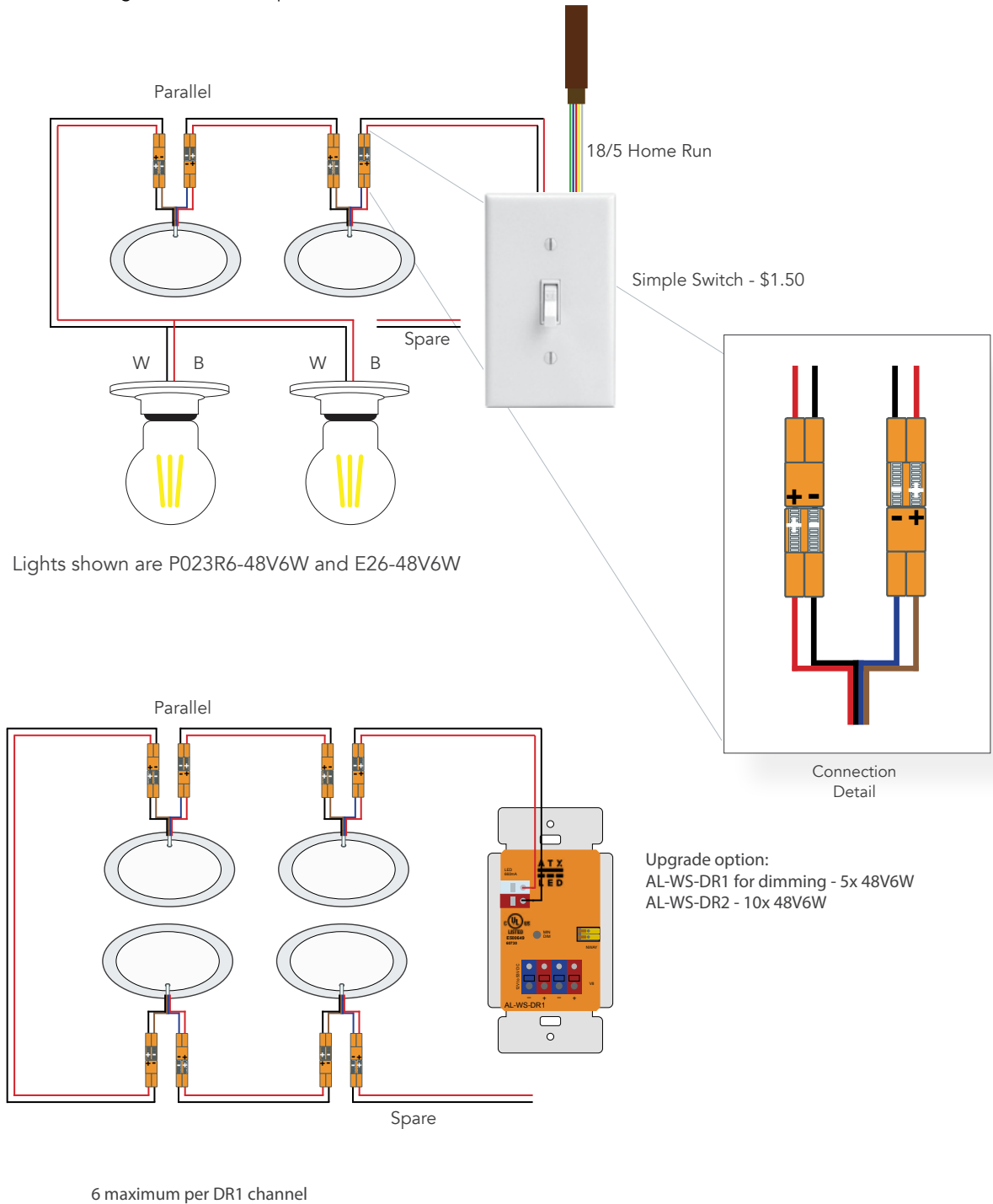
AL-R@R Wall – Temporary Switch

Wiring Examples

Lowest-Cost Option: No Dimming - Up to 16 LEDs

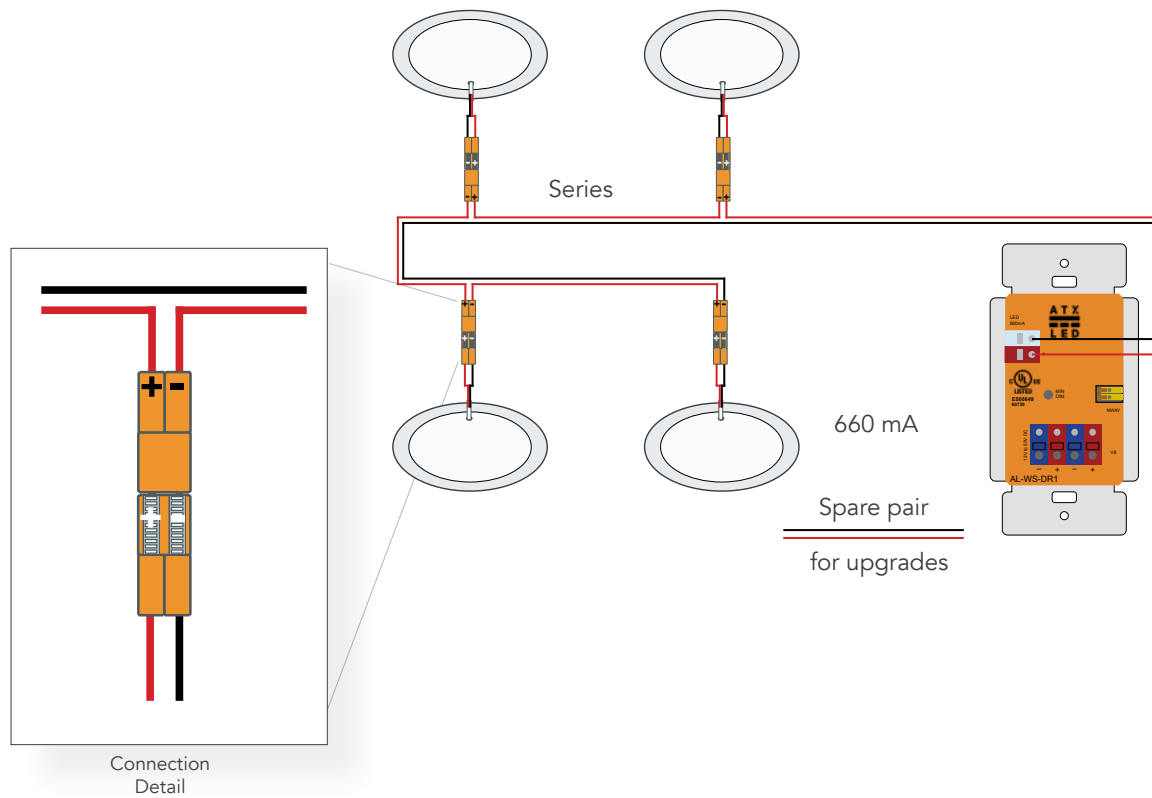
The simple switch architecture allows for up to 16 lamps (96 Watts) of lighting from a single switch and single home run. As with all ATX LED systems, it is recommended to run 18/5 home runs. The top example shown here does not support dimming or smart controls, but the use of the 18/5 home run will make future upgrades easy. It is possible to upgrade this circuit to dimming by replacing the simple switch with a AL-WS-DR1 or an AL-WS-DR2 with 5 (or 10) LEDs.

Please note that the 48 V series of lights are wired in parallel.



1 to 4 LED Upgradable Fixed White with Dimming - Model P023R6

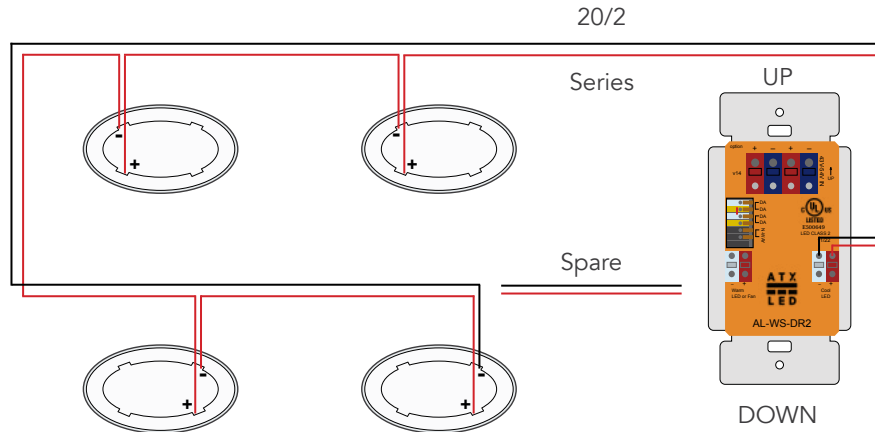
If you might be interested in upgrading to Motion or Tunable White LEDs in your system in the future, wire it using this method. Run an additional (unconnected) 18/2 leg from the location of the last LED in the circuit to the available channel on the DR2 or on the DR1 as shown.



2700K 3000K **Color Options** 3500 4000K 5000K

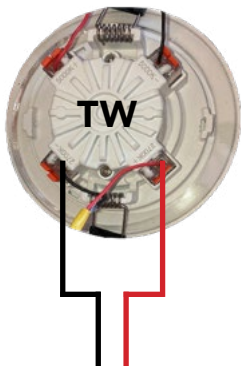
1 to 4 LED Upgradable Fixed White with Dimming - Model DL-120 (Fixed)

If you might be interested in upgrading to Tunable White LEDs in your system in the future, wire it using this method. Run an additional (unconnected) 18/2 leg from the location of the last LED in the circuit to the available channel on the DR2.

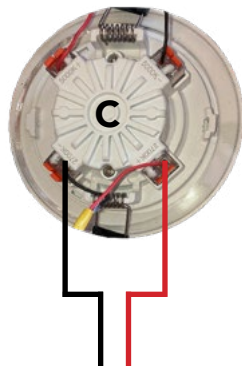


DL-120

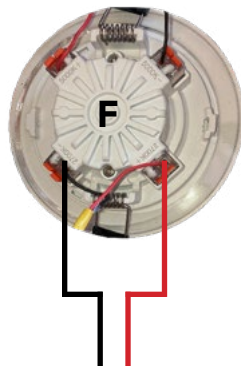
Color Options



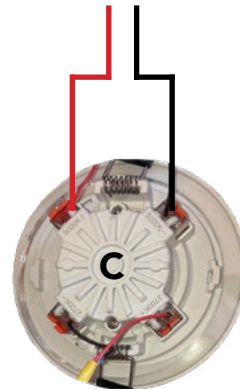
2700K



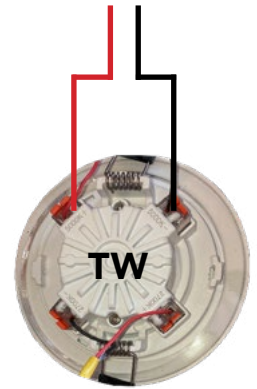
3000K



3500K



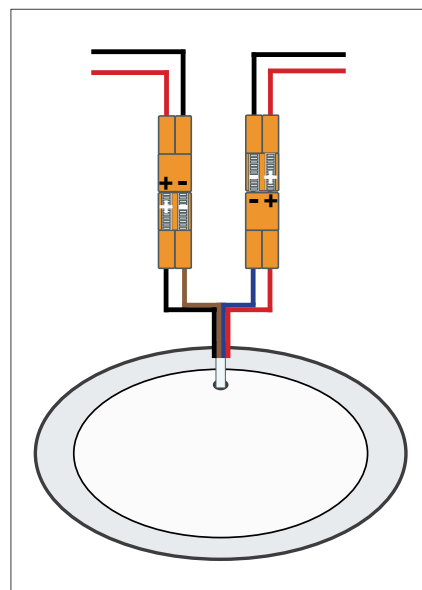
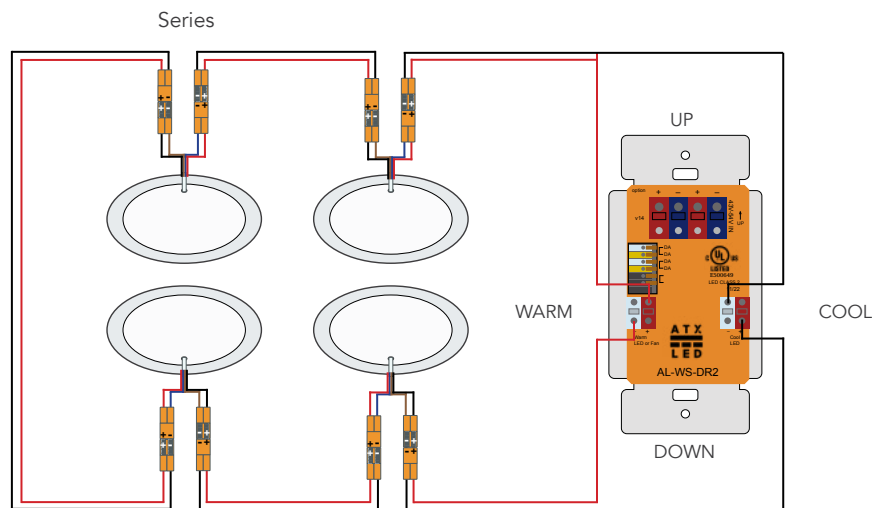
4000K



5000K

1 to 4 LED Tunable White Circuit - Model P023R6

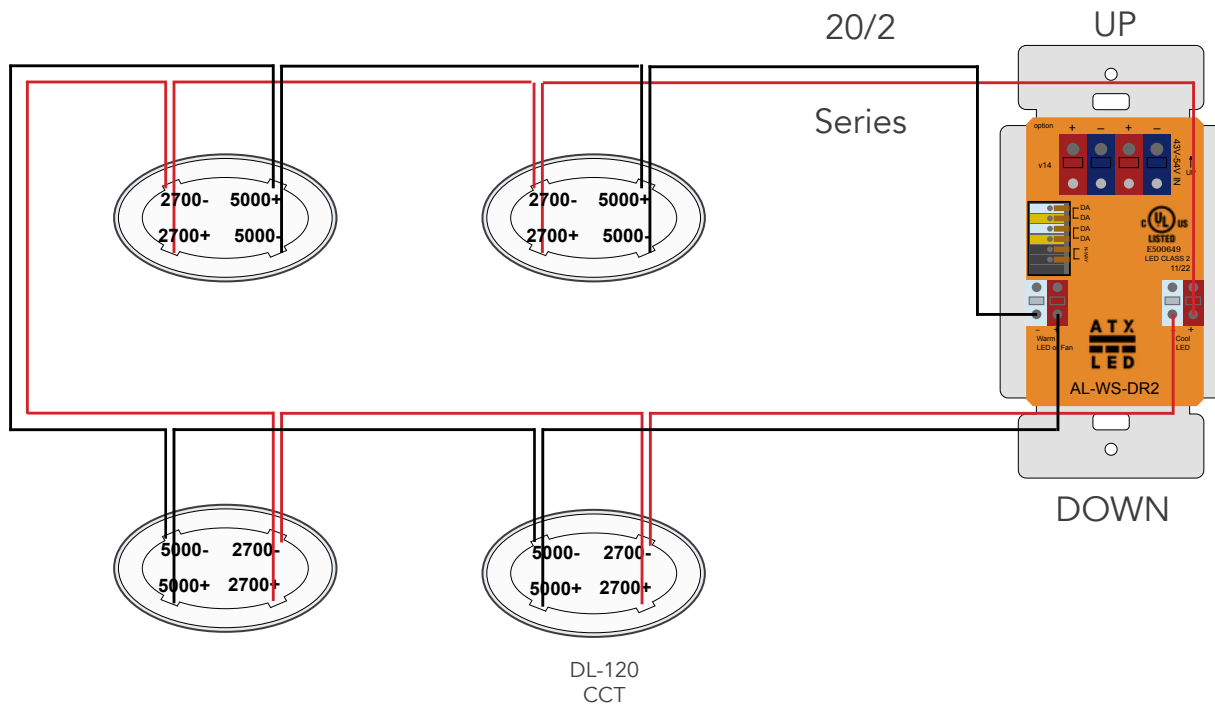
One to four tunable white fixtures per wall switch. Multiple DALI AL-WS-DR2 for larger rooms can be configured in tandem.



Connection
Detail
P023R6
CCT

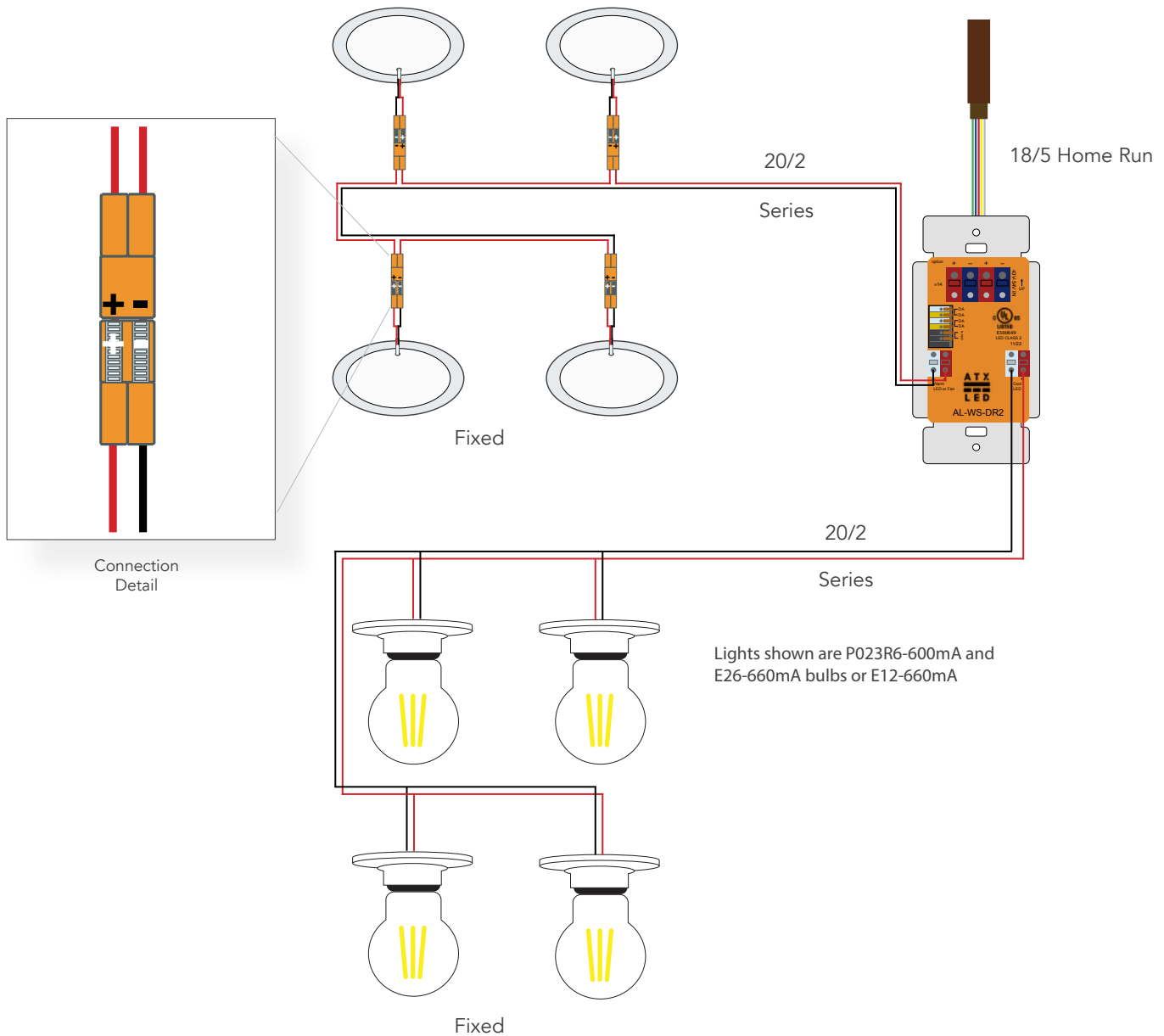
1 to 4 LED Tunable White Circuit - Model DL-120

One to five tunable white fixtures per wall switch. Multiple DALI AL-WS-DR2 for larger rooms can be configured in tandem.



Dimmable 1 to 10 LED Fixed White

The example below includes two separate channels of 1 to 5 LEDs each. Each group of five is connected in series. The red (+) wire first connects to the positive connection of the first LED, then leaves from the negative connector and goes to the positive connector of the next. The idea is that you are making a single series circuit for each channel of LEDs.



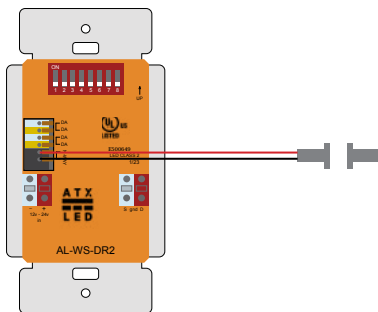
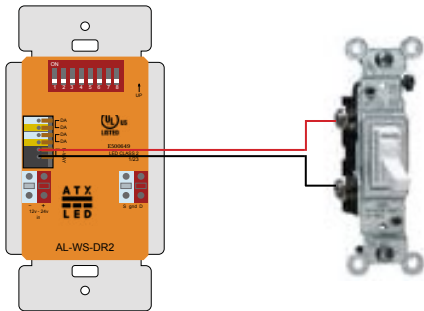
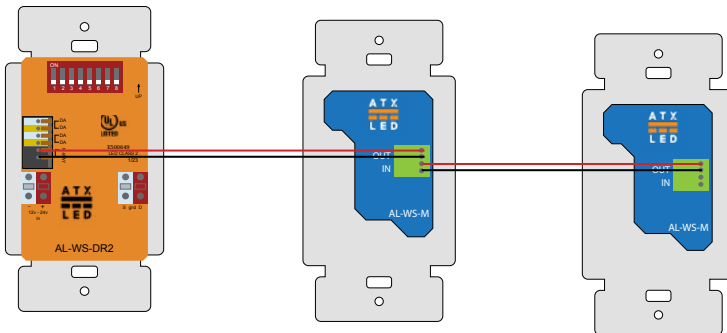
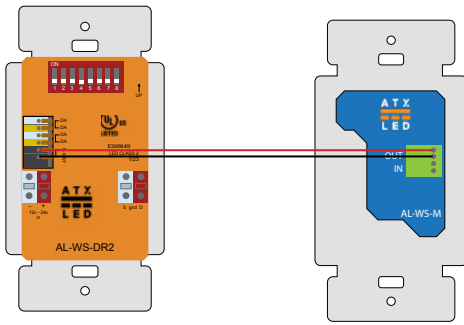
Physical 3-Way (N-Way Connection)

Here are few examples of physical 3-way configuration wiring.

When a 3-way switch is connected, the driver switch automatically detects whether it is a rocker type or momentary type.

Momentary switches can dim the lighting circuit locally, just hold down the switch and the dim level will cycle, release when desired level is achieved.

When used with an AL-WS-DR2, the AL-WS-M can be assigned to control any zone in the house.

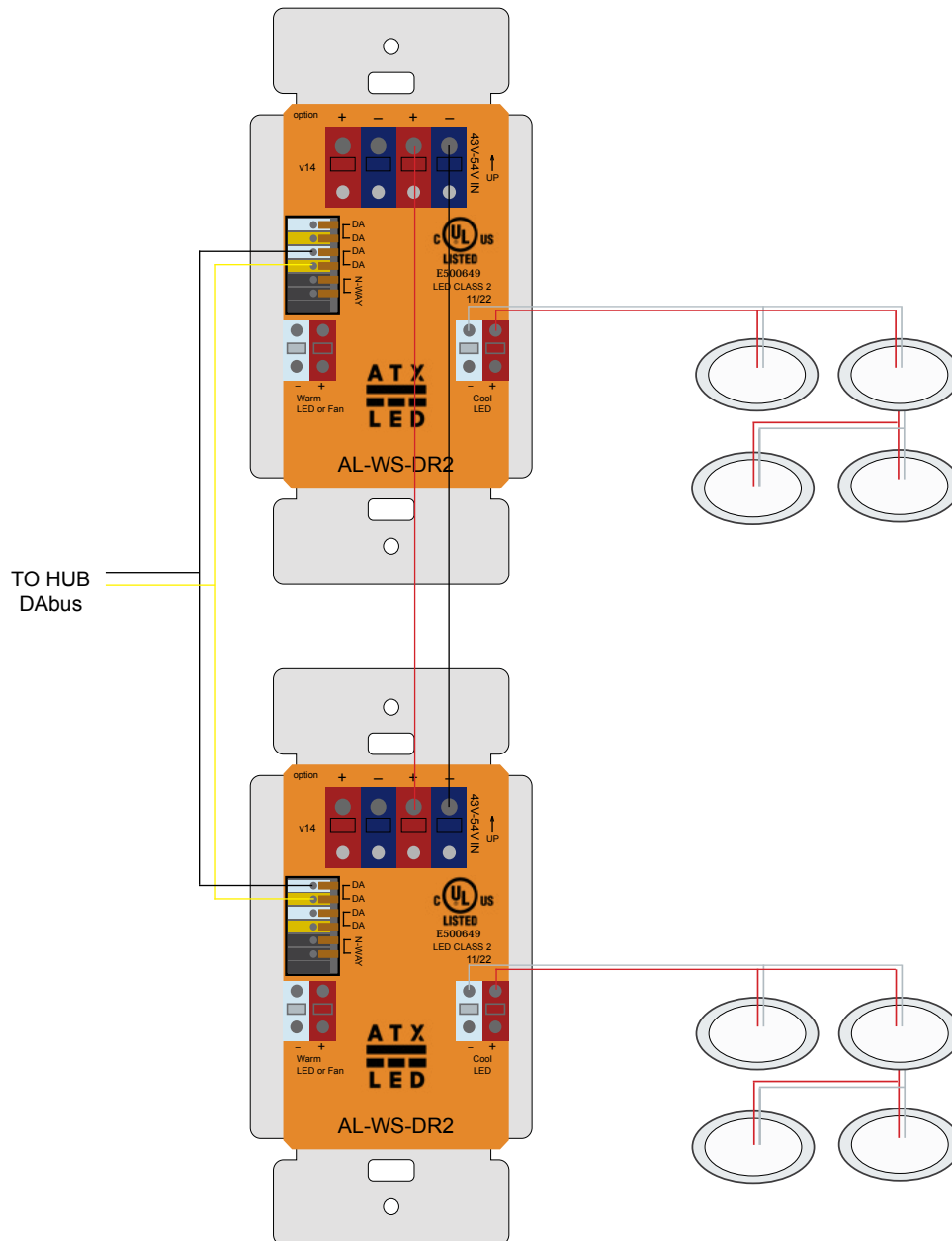


Door jamb switches can be used in the same way. The driver switch will automatically detect it and operate in the appropriate mode.

Tandem Mode (5 to 64 Fixtures) - Synced Multi Switch

Large rooms typically have more than one entry point. A 3-way switch is typically used to allow the lights at each entry point, or door in a hallway, or level in a stairway, to control all the lights. The physical 3-Way switch documented in the previous section handles this very well and at low cost.

In situations where the lighting requirement exceeds the Watts available from one AL-WS-DR2, then Tandem mode is useful. In this mode, two or more DR2 switches operate in unison. The lights can be turned on and off, dimmed or the color changed as one. This mode requires a powered DABus. The AL-WS-DR2 switches are configured either on-site or off-site for Tandem mode, also known as virtual 3-Way. Once configured, the tandem set of AL-WS-DR2 operate together as long as the DABus has power - no internet or hub is required. Thus - any large space can be fully operate by DC lighting, in a low cost and simple setup.



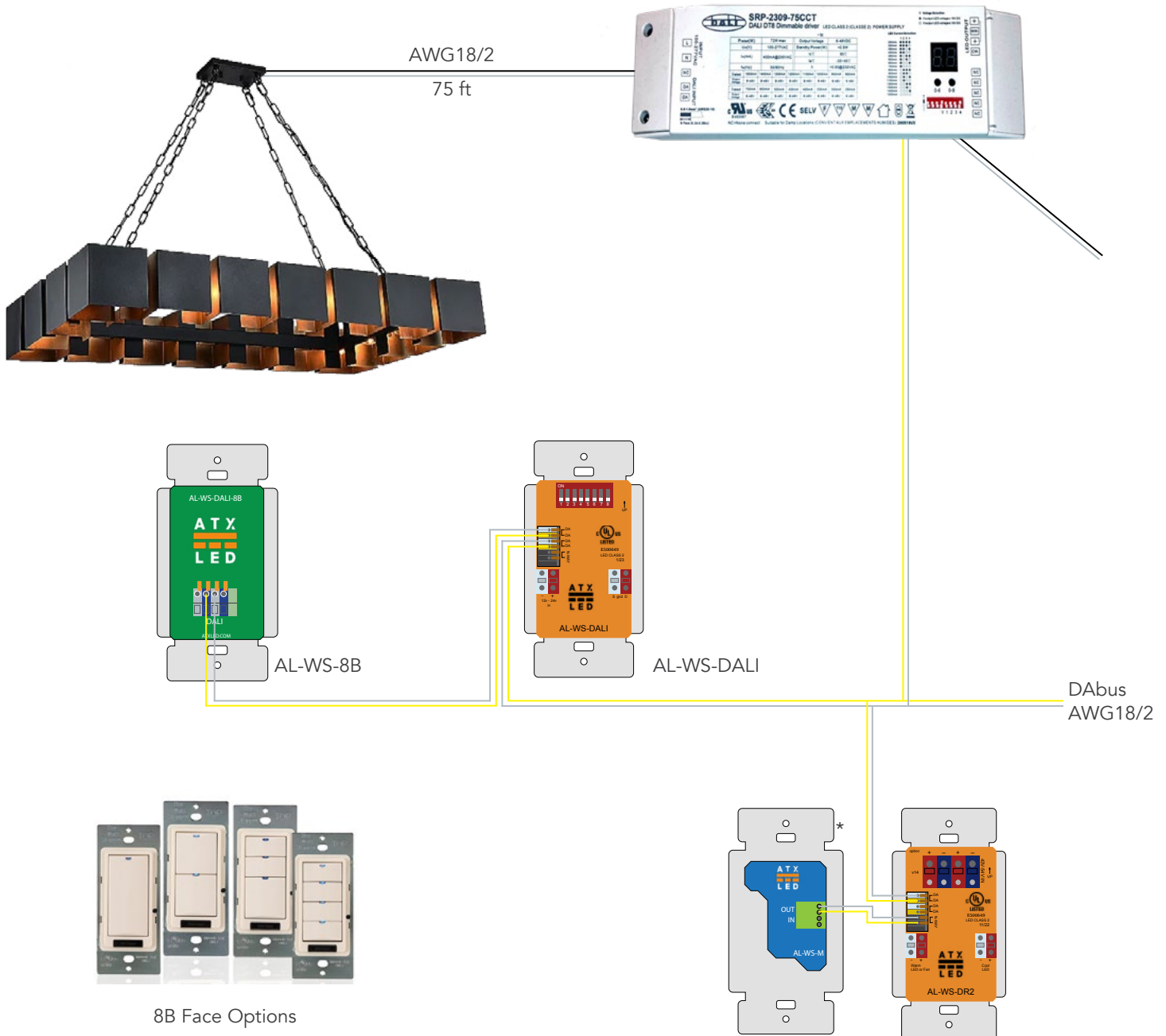
Note: See data sheets for
 - AL-WS-DR2
 - AL-WS-DR2C

Large Chandeliers

For applications with chandeliers with more than 30 watts of E12 or E26 type bulbs, we recommend a centralized driver with up to 75 or 150 watts. The SRP-2305-75CCT and ELG-150-48vDA provide 75 and 150 watts, and are DABus compatible.

These are installed in the central low voltage cabinet, and a home run of 18/2 provides the power. Control is via the DABus with either ATX LED wall switch like the AL-WS-8B (8 button configurable on/off/dimming wall switch), the AL-WS-DALI, any N-way connected switch, or via the ATX LED hub.

The fixture shown in this photo has 18 bulbs of the E12 type. We use the parallel wiring native to this fixture, and power it with the remote DC driver.



* AL-WS-M can control any DALI address.

Other Installation Types

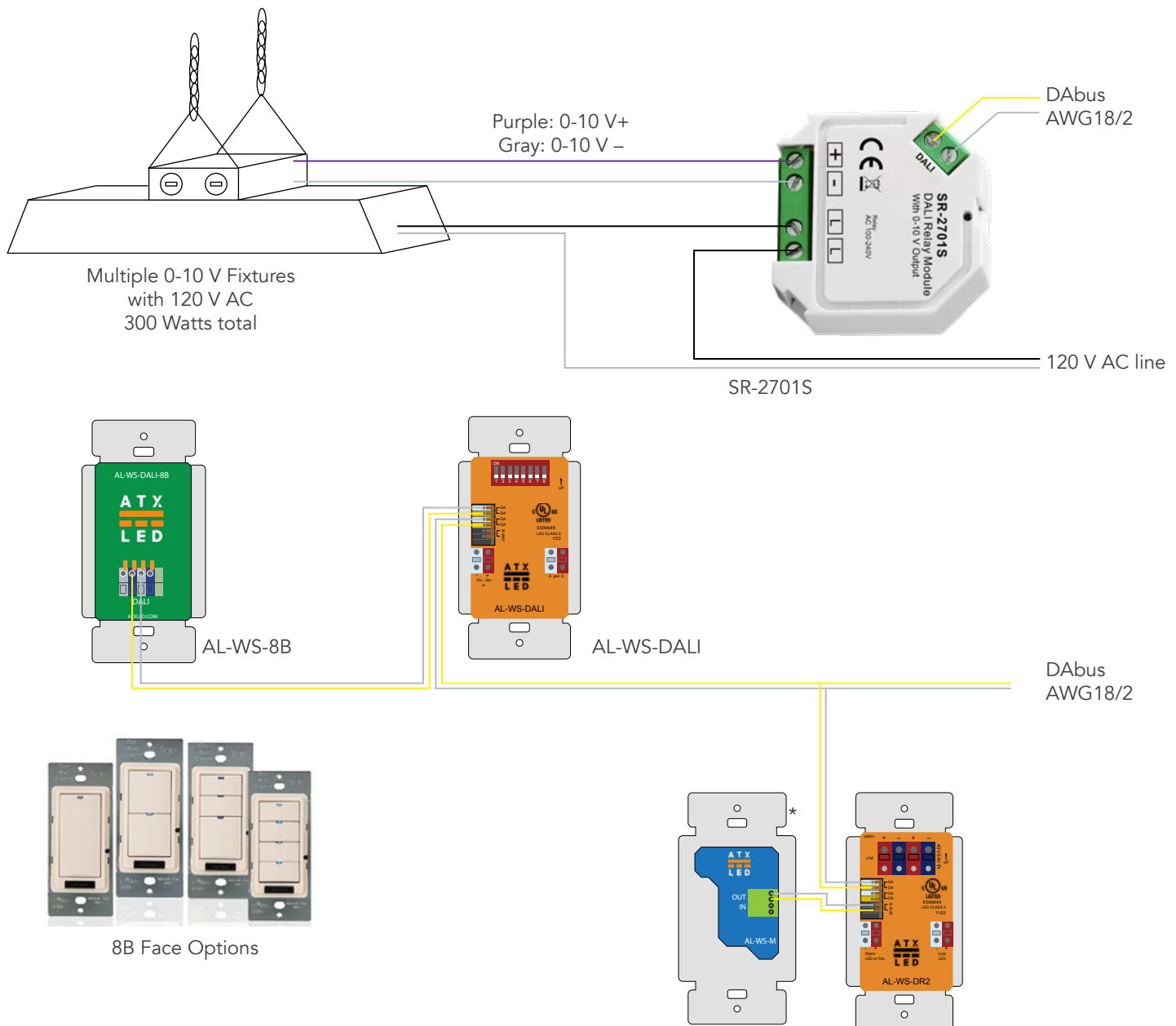
Commercial Applications: 0-10 V Controls

Our DR2 delivers 50 Watts per switch. Some cases, however, call for much more lighting power per switch.

High power lighting products are powered by AC. Manufacturers offer control by 0-10V violet and grey wire pair. This pair is used to control the on/off/dim functions of the lamp.

To interface this type of fixture with the ATX-LED system, simply wire the 120v power as with conventional, but run the violet/grey pair to either the AL-WS-010V or the SR-2701S switch.

Please note that "0-10V" is a classification of dimming method. There are actually two sub-types of "0-10V." One being the "0-10V" and the other being "1-10V." The difference is that with 0-10V fixtures, the switch can only dim the lamp, whereas with a 1-10v fixture the switch can completely shut off the lamp. If 0-10v fixtures are being used, there will have to be a 120v switch to completely shut off the lighting. Therefore, use 1-10V only. With the AL-WS-010V, the SR2701S allows both 120 VAC, 0-10V On/Off, and dimming.



Commercial Applications: DALI Controls of 120 VAC Devices

Our DR2 delivers 50 W per switch, 100 W per home run.

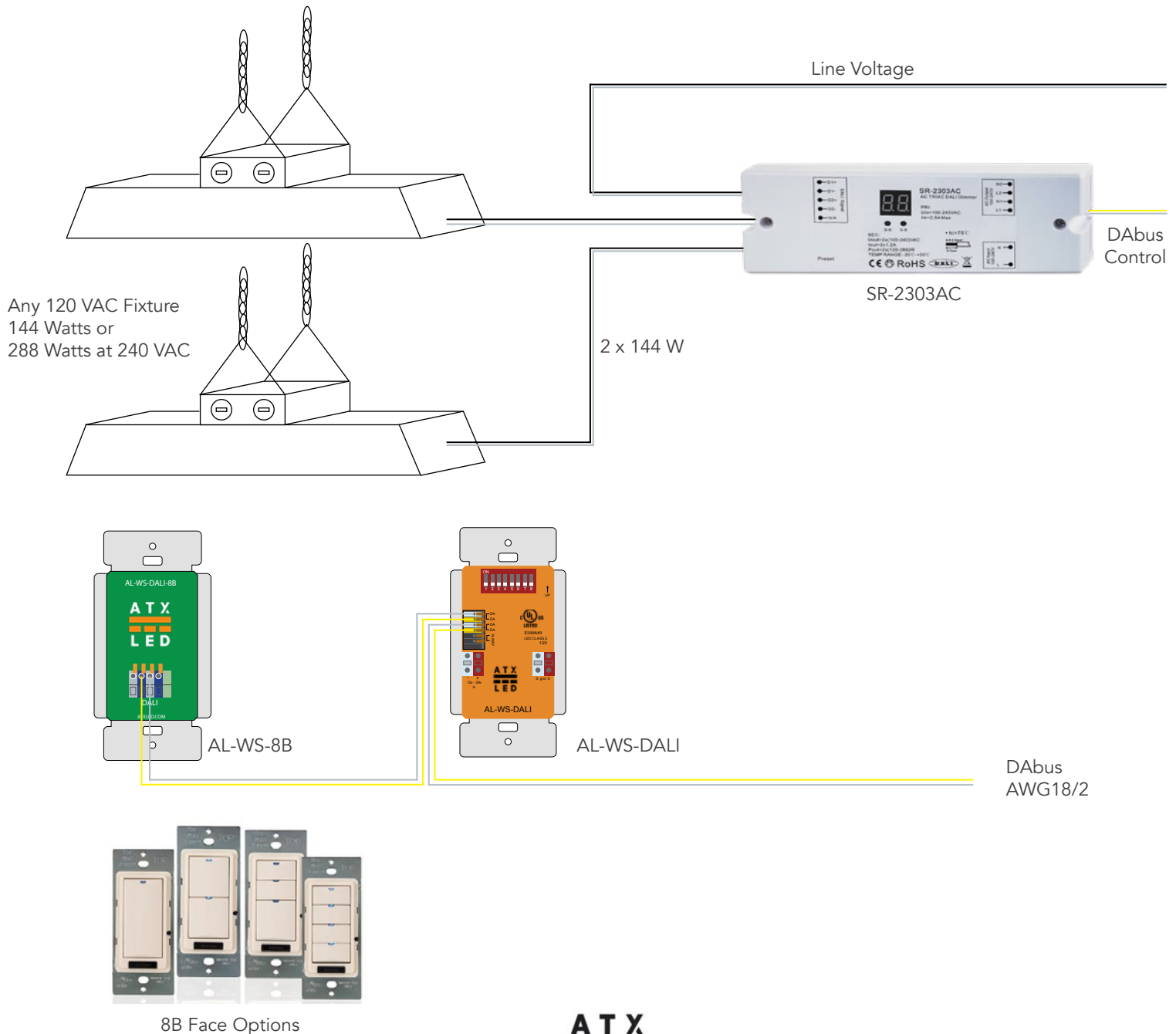
Some cases, however, call for much more lighting power per switch.

High power lighting products are powered with 120 or 240 V AC.

Many manufacturers offer control by a DALI wire pair. This pair is used to control the on/off/dim functions of the lamp, drivers not made by ATX LED. One pair can connect to many fixtures, greatly simplifying the installation.

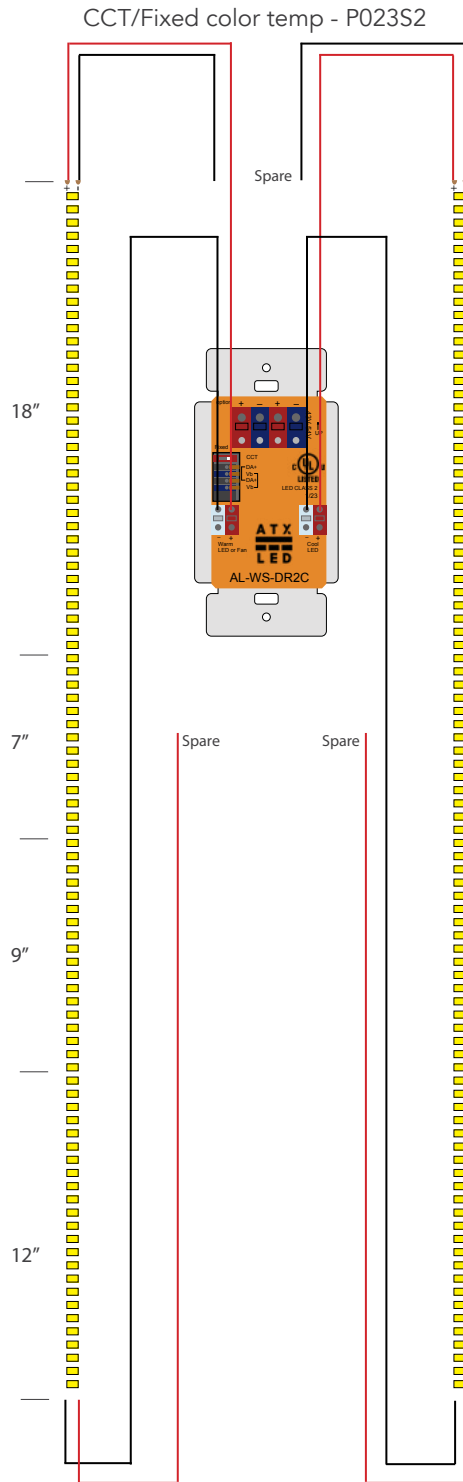
To interface this type of fixture with the ATX-LED system, simply wire the AC power as with conventional, but run the violet/grey DALI pair to the ATX LED DABus and to any of our DABus products, including the AL-WS-8B.

This will enable all smart features like remote dimming, schedule, max and min brightness, scenes and groups.



LED Light Strips

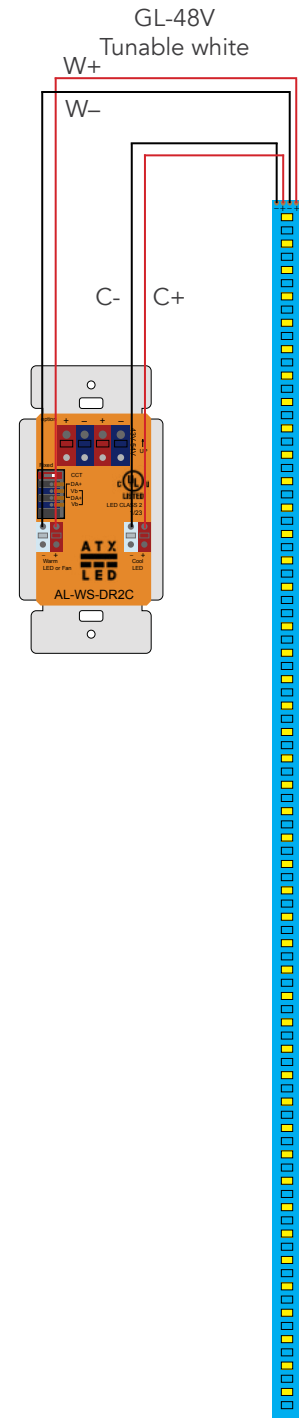
Wire strip lights to any of our DR2 switches in a similar manner to our other LEDs. 24v strip lights are the most common on the market and they work well with DR2s. Take care to follow the wattage rules - 24watts per channel. For fixed color, used up to 8ft or 24 watts on each channel. For Tunable White, use 2 different color temperature strips of your choice and wire it the same way, but with the selector on the switch set to "CCT".



DR2

- **Strip Light Options**
 - A) 2 W/ft, up to 30 ft fixed or 15 ft tunable
 - B) 4 W/ft, up to 15 ft fixed or 7.5 tunable. Use tandem mode for longer runs
 - C) 1.5 W/ft, 24 V - See Application Note
- **SR-2309-75**

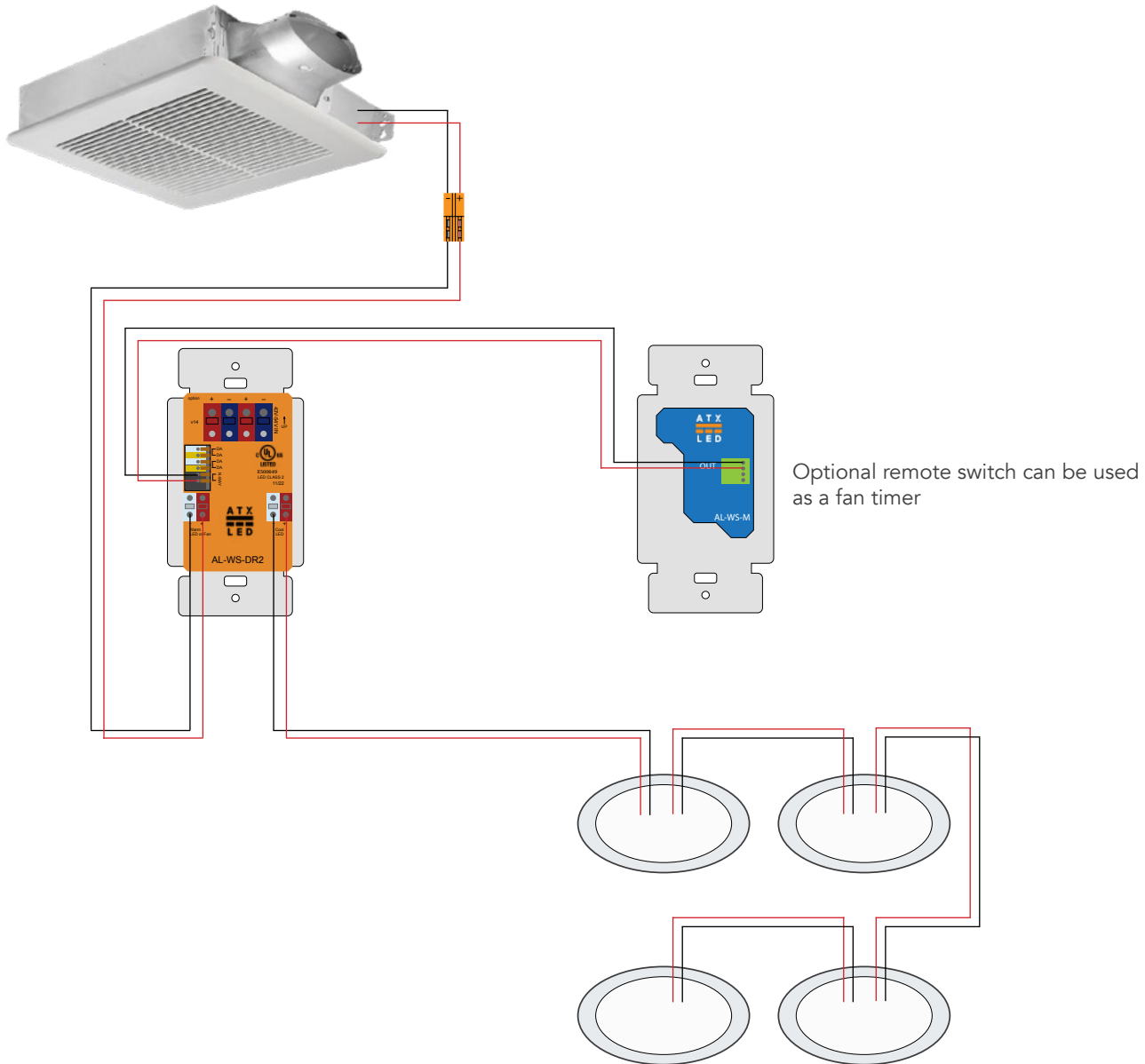
This driver is installed in the low voltage box for strips up to 75 Watts each. Any W/ft model from ATX LED can be used, any length can be used- max wattage is distributed over the length.



Bathroom Lights Plus Fan

The AL-WS-DR2 is used for bathrooms. It has the capability of running a 12 V DC bathroom fan and up to 24 Watts of LEDs. The switch may be used standalone or with a AL-WS-M remote switch.

When the remote switch is used, every time the momentary switch is engaged, the bath fan will run for 5 minutes and an additional 5 minutes will be added for each button press. Press and hold the switch for 4 seconds to cancel the timer and shut off the fan.

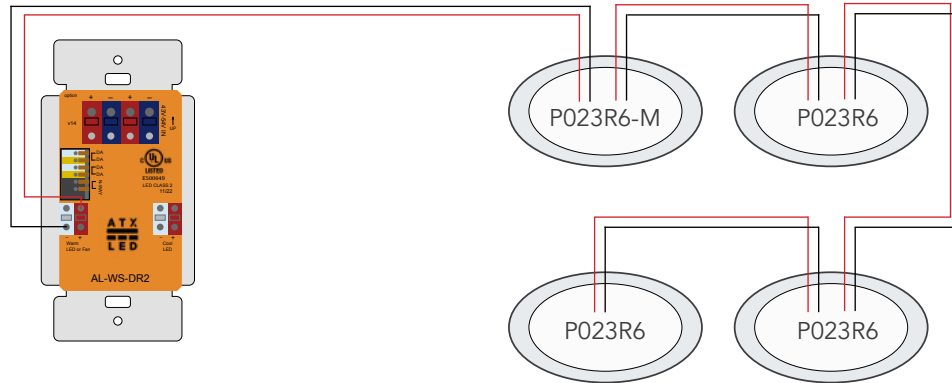


Vacancy/Occupancy for Bathrooms, Utility, Stairs

The P023R6-M fixture is used for bathrooms and other rooms where automatic turn off is a requirement.

It will turn a fixture on with the dimming level desired, and will dim up softly to allow the eyes to adjust. At the end of the occupancy detection, the light will dim down again. The timing and sensitivity can be adjusted. A manual override switch is provided.

The device drives 30 Watts of LEDs of fixed color LEDs directly, and may be used standalone or with a AL-WS-M remote switch for 3-Way controls. It can also be used to control tunable white drivers such as the AL-WS-DR2, and is a fully managed switch within the ATX LED DAbus and controlled by ZWD if desired.



Three Methods of Motion Sensor Wafer

1. 48 V non-dimming (Value)
2. 660 mA dimming
3. 660 mA tunable white

See data sheet for more information.

Digital Addressable Lighting Interface

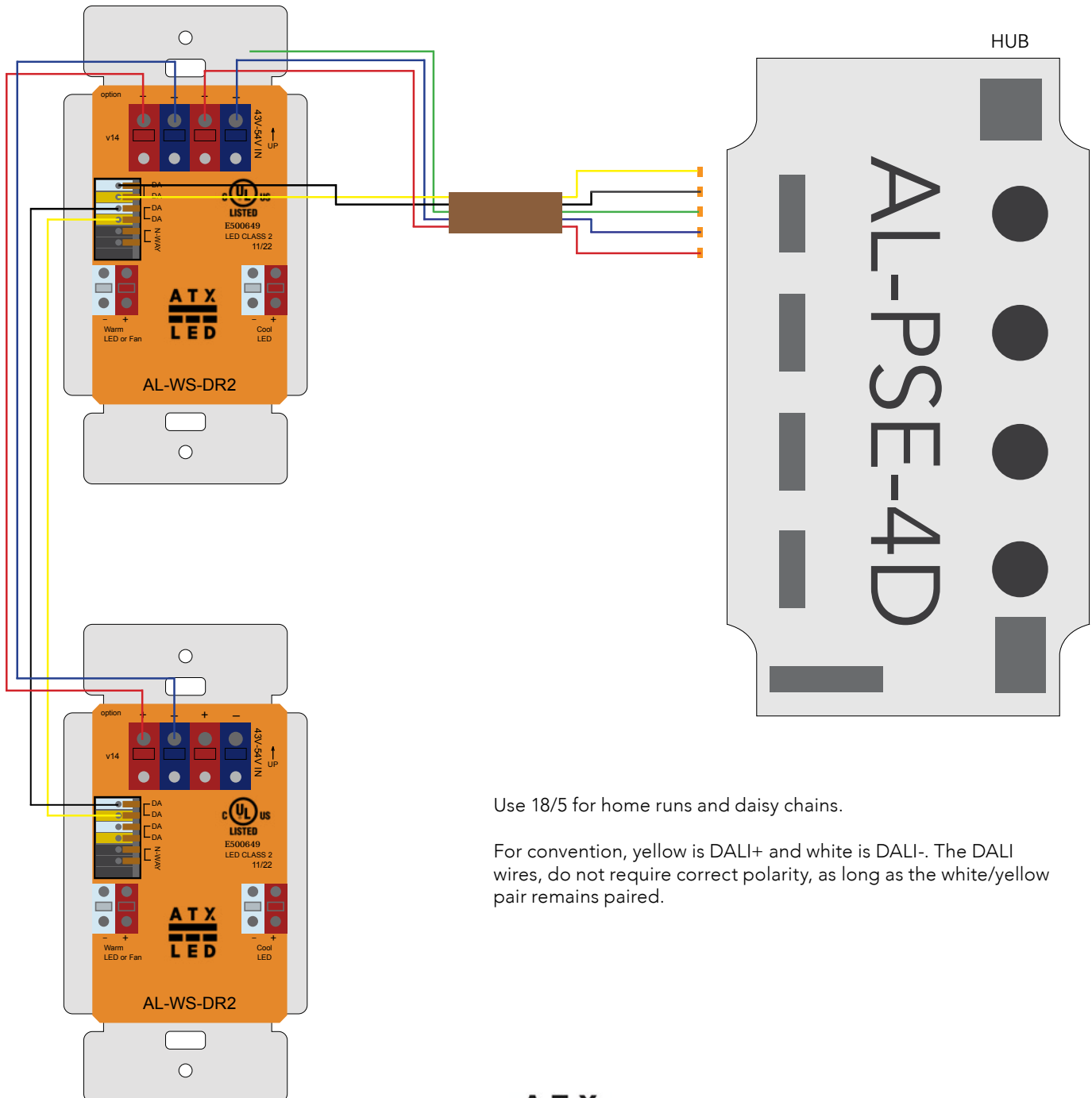
Where the WiFi option allows control of select switches, the DALI™ system allows for whole-home control.

This is the highest-end option for new homes.

The ATX-LED DALI™ system can be compared to Control 4, but much more cost effective.

At the high end, DALI™ works with Crestron and Control 4.

Easier to install than other options because our DALI™ system does not require multiple cat5 terminations.



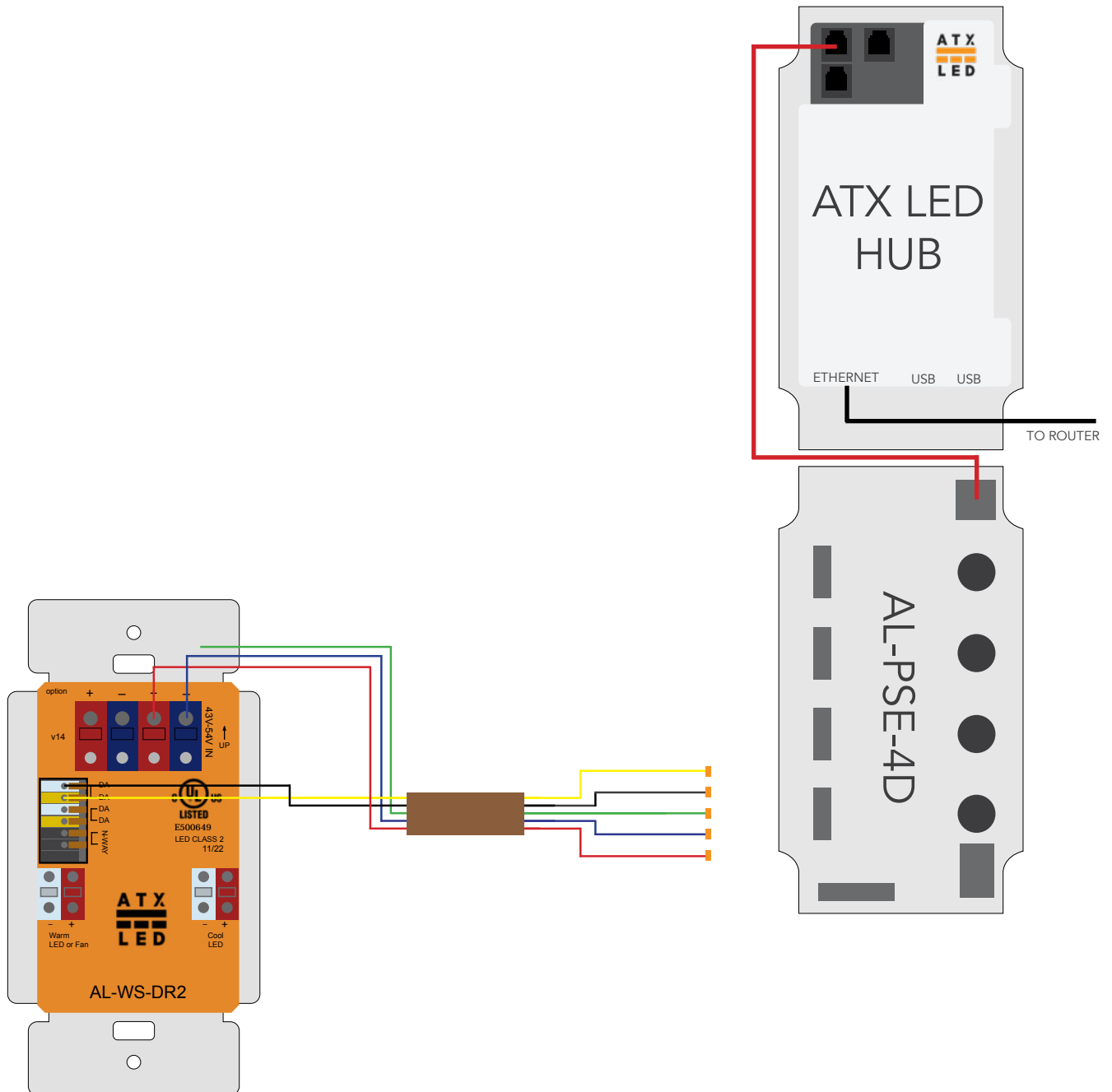
Use 18/5 for home runs and daisy chains.

For convention, yellow is DALI+ and white is DALI-. The DALI wires, do not require correct polarity, as long as the white/yellow pair remains paired.

DALI for App Control

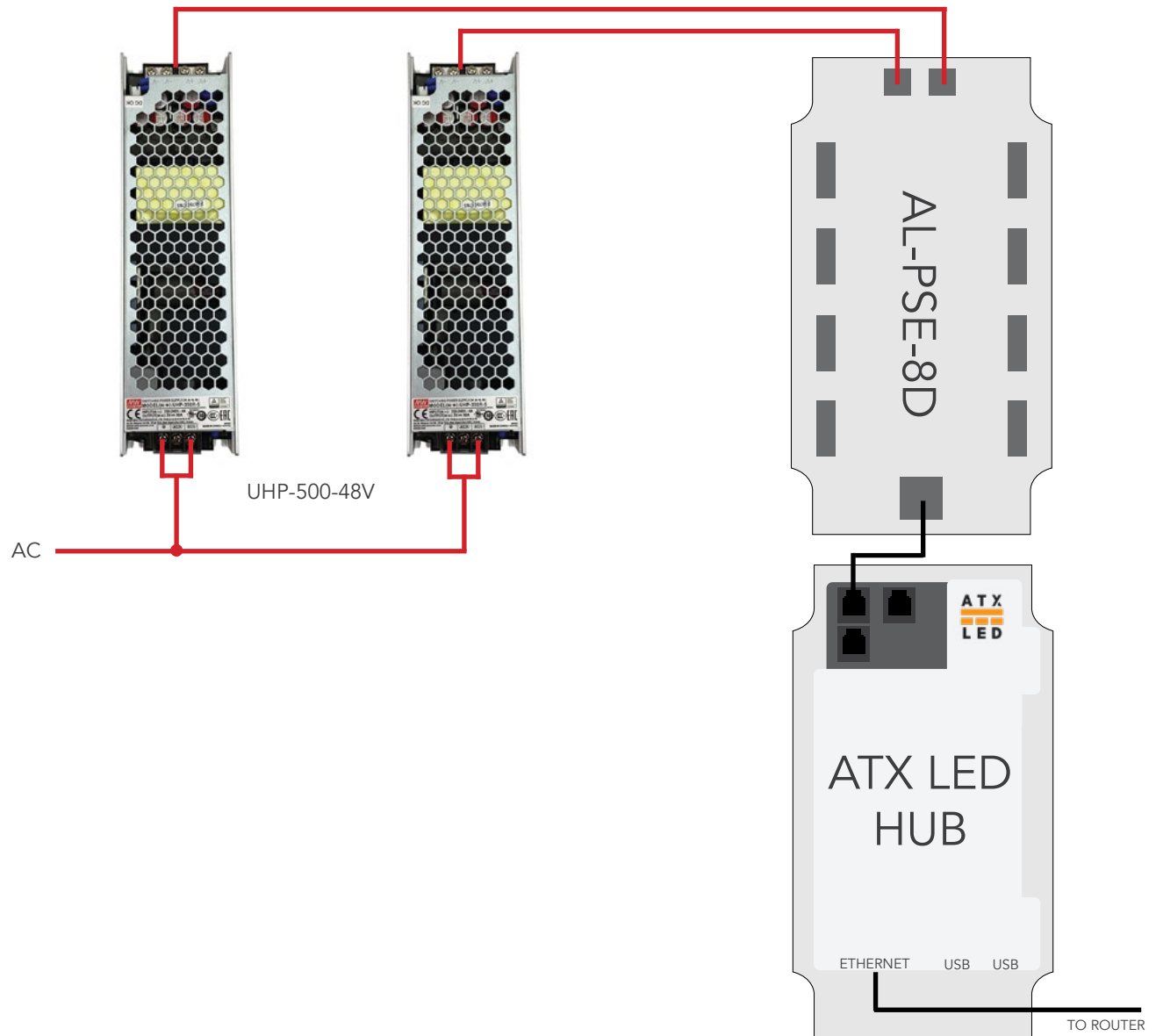
DALI power architecture is similar to that of the standard system, with just a few differences. In this case, we use the AL-PSE-4D as our power distribution board. The "brain" of the system, the AL-DALI-Pi, is connected directly to the AL-PSE-4D via a non-Ethernet RJ-45 jumper connection.

DALI as a DIIA trademark for the IEC62386 standard. For more information, please visit <https://atxled.wiki.zoho.com/public/ZWD-Control-Suite.html>.



Large System with AL-PSE-8D

For systems over 600 Watts, the AL-PSE-8D can be used as shown.



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