Austin Led Consultants

DMX and Led power over ethernet

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AL-PWS-DR1

Decorator style
PoE for LEDs
28 watts 660 mA CCR
Switch / Dimmer / Driver
3-Way and DALI

Product Description - AL-PWS-DR1 wall switch

This switch operates just like any standard residential light switch – however it takes 24-50v DC instead of 120VAC, and directly drives up to 24 watts of LEDs. This Decorator style switch in a standard residential style outline fits into any home, looks like any switch . In many areas PoE is permitted for installations without a licensed electrician. No complicated controller is required yet it can be controlled by App, or Cloud automation.

Stand alone it operates as a simple switch for 24 watts of LED's. Software configurable for 300, 360, 660 mA LEDs with up to 24 watts total. Use AWG CAT-5e or CAT-6 cable to bring 48v (or 24 to 50 volts) from a central power supply over to the switches, then use AWG 18 to connect to your LEDs – standard CAT-5e crimper is used wire to this device. Simple DC connectors connect to the LEDs.

For 3-way operation – a simple CAT-5e wire link for 2, 3, or an unlimited numbers of switches to control this devices LED's. Any single pole switch found at Home Depot can be used to add a 3-Way remote switch, or the RH-253 or AL-PWS-DS momentary switch can be used for an unlimited number of switch points.

An integrated simple momentary switch is used for On/Off and brightness. With the standard format of the Decorator switch - now for low voltage applications – any casual user requires no training, no App to use this switch. Perfect, flicker free dimming from off to 1 to 100%. No network setup is required. Temperature feedback assures excellent dimming.

To enable Home / Business automation – the AL-PWS-DR1 includes a DALI bus port for App and voice control. Use the AL-DR1-Pi to for home automation and to connect to Alexa or Google home voice control. The DALI protocol is supported, with automatic addressing. RJ45 feed thru for Power and control to allow Daisy Chain installations. Up to 4 switches can share one home run.

Specifications

Power source and DALI	RJ45 power mode B, DALI pins 1,2 N-Way pins 4,5
LED constant current output	700 mA max current, programmable Spring loaded connectors
Input voltage range	24v to 50 volts
Standby power consumption	50 milliwatts
Conversion efficiency	Over 95%
Protection	Reverse protection and static protection
3-Way control	Dual 3-way inputs – compatible with the AL-PWS-SW momentary 3-way switch
Operating Temperature	0°C ~ 50°C
Size	115 x 46 x 50 mm
Dimming	1 to 100 % Current control
FCC and interference	All outputs are RF filtered for minimal interference
Maximum output voltage	Input minus 4 volts
Minimum output voltage	6 volts, minimum current self calibrating*
Hot Swap	Yes – can unplug and connect LEDs with power applied.
DALI interface Individual, group and scene support	DALI standard interface via RJ45 connector pins 1 and 2 are tied together,
LED / PIR / Fan output	Compatible with LEDs, Fans and PIR LEDs

Wiring the AL-PWS-DR1

See https://wiki.atxled.com/ for more examples

Key parts of a AL-PWS-DR1 installation

		ATX LED installation	Conventional 120vac
Power Supply	48v with total wattage needed	20 cents/watt	$5 breaker
AL-DPOE-8	8 port injector with PoE and DALI	$40 / home	
CAT-5e	Copper (not CCA) Cable to the switches	$0.10 / ft	Romex $0.50 / ft
AL-PWS-DR1	Dimmer / Driver	$80 retail	$40 Smart dimmer
3-Way switch	Low cost remote switch	$2 plus cat-5	$2 plus Romex
Alarm Contact	Turns light on if door open	$1	$40 plus labor
AWG18	Wire to the LEDs	$0.15 / ft	Romex $0.50/ft
P023R6-660	LED lights	$15 retail	Can+Trim+LED
Labor		Low Voltage	Electrician

Default Operation – stand alone

By default – the AL-PWS-DR1 operates stand alone – no controller or master is required. Connect the dual LED output to your LED's. Up to 5 660mA LEDs can be attached without any additional hardware. For 300mA LEDs - our AL-LED-Doubler allows perfect balancing of 4 LEDs. See https://atxled.com/How2 for wiring suggestions. No other wires are required.

Hardware 3-Way Operation

N-Way wire input connection

The two N-Way inputs have 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. Other options are enabled by the DALI 35 command – see below

3-Way Operation without configuration

If you need 3-Way switching please use a standard simple 2 or 3 way switch connected to either N-Way input – both are the same. Simply connect a simple On/ Off switch between the pins 3 and 6 of the RJ45 connector. 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.

Push Button Operation

With the Push Button method – a switch like the RH-253 switch can be used. Each momentary action on the N-Way pin will toggle the light on / off. At power on – the AL-PWS-DR1 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-PWS-DR1 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-PWS-DR1 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. If the DALI bus is configured – DALI dim commands will be transmitted.

Door Jam Operation

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

Software Controlled Operation

Default DALI Operation

By default – the AL-PWS-DR1 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-PWS-DR1. 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 a AL-DALI-PI or DALI-100 or similar provisioning tool to assign short and group addresses.

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.

Software 3-Way Operation

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 – several modes are available. A DALI command 35 with the following values will select these advanced features

0	THREE WAY	Default
5	PIR Detect	If the LED voltage drops (PIR LED triggered) then transmit a DALI command on address or Group +1
6	FAN	Output is for a FAN – turn the FAN on and keep on for YY Hold time
8	NIGHT	PIR signal (active High) on N-way pin turns the LED ON at min Level, sends ON command to bus. FADE time to Max dim is adjustable
10	Timer	Same as FAN – intervals are 4x longer

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.

Fan control

Intended for bathroom fans, if the B output is a light, and the light switch is turned on locally and stays on, then the A output will be turned on for the Hold-ON duration. The delay before turn on is set by the DALI command 51, then once on, the on time is set by the DALI command 52. If the light stays on, the fan stays on past the Hold-On time

DALI	Function	Set DTR value before these commands	Scale
50	Fan Idle	Sets the speed of the fan when it is 'off' – can set a low level	20-200
51	Delay before ON	∞, 7, 10, 14, 20, 28, 40, 56, 80, 113, 160, 226, 320, 452, 640, 900 Seconds	0 = ∞ 15=900
52	Hold-ON	∞, ½ , ¾, 1, 1 ½ , 2, 3, 4, 5, 8, 10, 15, 20, 30, 40, 60 Minutes	0 = ∞ 15=60
53	Fan Operate	Sets the speed of the fan when it is 'on'	50-254

∞ means never. The A output can also be controlled by a simple contact switch connected to the N-Way input. The N-Way switch overrides the timers. Note: Set mode 35 to FAN to set Delay and Hold. Set mode 35 to 0 to set lamp fade rates – then change to Fan mode to set Delay and Hold

Powering the AL-PWS-DR1

Power the switch via either RJ45 input connector, 48 or 50 volts is recommended, 24 and 56 volts are allowed. No Data connection is required. You can feed from the input to the output up to 24 watts total. After power up – the first time the switch is set to minimum Dim there will be a learning 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 power to the switch is cycled.

Recommended ETL listed LED's

Table 1 – Direct to LED method

LED rated watts	Model	Size inches	LED rated mA	Max Count	Total power output Watts	Wiring method
6	P023R6-6	4	660 mA	4	24	Series
6	P023R6	4	360 mA	2	12	Series
12	P023R11	6	360 mA	1	12	One per side
6	ATX-A60	E26	660 mA	4	24	Series
6	ATX-C35	E12	660 mA	4	24	Series
3	B01A6HJJLRY	3	300 mA	4	13	Series

Table 2 – using the AL-LED-Doubler current Mirror with 300 mA LEDs

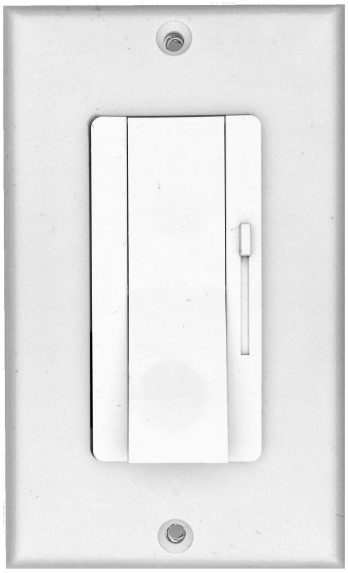
LED rated watts	Model	Size Inches	LED rated mA	Max Count	Total power needed	Wiring method
1	B01FVRQVK4	2	300 mA	27	27 watts	4 in series, 4 chains
3	B01A6HJJLRY	3	300 mA	8	25 watts	4 in series, 4 chains
6	P023R6	4	360 mA	4	25 watts	2 in series, 4 chains
12	P023R11	6	360 mA	2	25 watts	2 chains

AL-LED-Doubler

The AL-LED-Doubler device accepts a 0 to 700 ma input, and outputs two 0-350 ma lines. The two lines are matched in current – assuring long life of the LED's regardless of temperature differences, different line lengths, or different manufacturers. Dimming is perfect down to low current levels. In the case of a mismatched LED type, wiring or LED fault, – the AL-Doubler indicates the problem and helps identify the cause.

See http://atxled.com/pdf

DALI bus products from ATX LED Consultants

		
Injector for 8 home runs	Wall Switch 0-10v Driver with DALI	Alexa to DALI interface AL-DR1-Pi

Typical Compatible standard DALI products

		
120 VAC DALI LED driver	DALI Wall Switch	DC-DC Dali driver expansion option

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
	42	Store DTR as new Max Level,	
	43	Store DTR as new Min Level	
	44	Store DTR as 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	
A	49	Set UPS mode and use DTR as temporary Max Level Min to 254	255 = reset
	50	Set Fan slow speed idle	
	51	Store DTR as Fan Delay time	
	52	Store DTR as Fan Hold time	
	53	Store DTR as Fan Operating Speed	
	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 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
	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	Active
0	THREE_WAY (Default)	N-Way On/Off
1	PUSHBUTTON (N-Way push on, push off)	N-Way = 1->0
2	DUAL_SWITCH (two outputs share the DIM level, with individual switch controls)	N-Way On/Off
3	Dimming PIR mode (B output it always ON, but dimmable)	Always
4	Full ON PIR mode (B output is always ON, full power)	Always
5		
6	Fan mode - delay FAN on, then hold (B output)	Delay time
7	Hotel Mode – turns all lights off – intended for door key pocket	N-Way = 1
8	PIR dim mode – turns the B output to minimum DIM	N-Way = 1
9	PIR timer mode – turns both LEDs on for N seconds	N-Way = 0->1

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	722512407176
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	
16	Second Short address	
17	Group Address Mode	
16-63	Storage	User Defined

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 (DTR1 = 4)

DTR register	Name	Value
3	Up Time	Hours / 256
4	Up Time	Hours (8 years max)
5	On Time	Hours / 256
6	On Time	Hours (8 years max)
7	Power Used	Dim level * Hours
8	Power Used	(Dim level * Hours) /256
9	Instantaneous current	mA / 10
10	Instantaneous LED voltage	Volts * 10
11	UPS mode	Power limited output level 20-254