



ATX LED Consultants Inc  
1108 Lavaca St – STE 110-489  
Austin TX, 78701  
512 377 6052  
<http://atx-led.com>

## Multi Button multi function Wall Switch

AL-WS-8B



### Product Description - wall switch with up to 8 buttons

This wall switch has these applications

- up to 8 individual fixtures can be controlled
- up to 8 groups can be controlled
- up to 8 scenes can be recalled.
- the above can be mixed
- using our ZWD software package – each button can be configured to “trigger” complex actions
- On / Off / Dimming is supported

### On-Add to the Legrand Wattstopper switch

Once the AL-WS-8B has received an address from the DALI bus, each button will send its address when pushed. Press and release to change On -> Off or Off -> On. Press and hold to dim.

### Virtual 3-way supported, Dimming operation

Each button recalls the state of the associated individual address or group. Therefore proper On and Off controls will be sent. Press and hold to dim. Dimming level stored for next use..

### DALI interface for proven reliability, Works with any DALI master

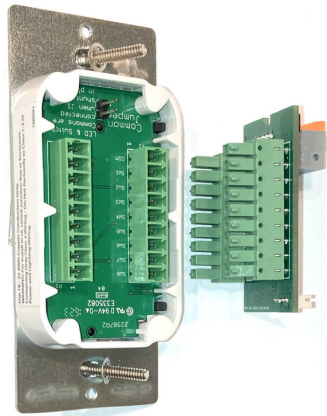
Uses the robust and proven DALI bus for controls Address, Group, Scene assignment is possible with any DALI configuration tool.

### Buy a Legrand LVSW with 1, 2, 3, 4 and 8 buttons, add our AL-WS-8B-DIY

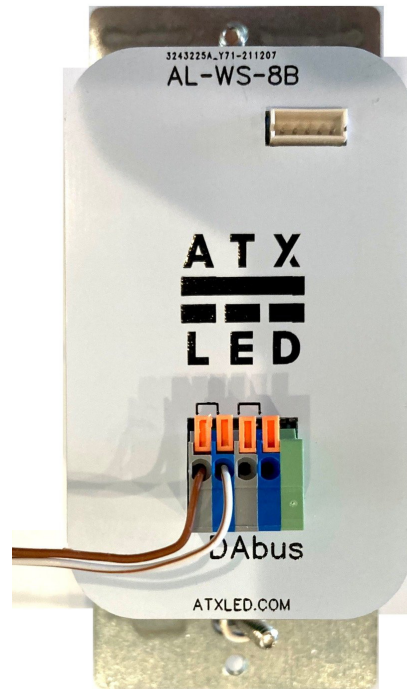
Purchase the LVSW you need online. Google LVSW-102W, LVSW-103W, LVSW-104W, LVSW-108W to rapidly find online resellers. Note, Legrand offers many color and engraving options. Our board attaches to the Legrand device – see next page.

## Specifications with Legrand LVSW

Power requirements	DA pins - DALI bus – 8 ma max ( all LEDs on)
Input Voltage (DALI bus)	14 to 24 volts – ( DALI Bus)
Power consumption	120 milliwatts @ 15 volts (all leds on)
Protection	Reverse protection and static protection on all pins
Static Electricity	Ground Metal plate to protect from Static Discharge – please ground it.
Operating Temperature	0°C ~ 50°C
Size	108H (metal) 70H x 34 D x 42 W mm
Receive Addressing	DALI master assigns the address
Transmit addressing	DALI standard 8 and 16 bits.
DALI BUS interface	DA Bus In and Out – 300 mA max AWG 18-24 gauge wire, spring terminals
Connectors	KF141V type – color coded



Legrand LVSW



AL-WS-8B

## Powering the AL-WS-8B

Power the switch via the DA pins, it needs about 1.5 mA to operate, plus about 2 mA for each LED that is fully on, minimum 13 volts. Connect your powered DALI bus to the DA Gray and Blue pins ( polarity is not significant ). Our implementation allows multiple masters – we use collision detection to avoid conflicts on the bus.

## Buttons on the AL-WS-8B

Each button can be assigned an individual function – see the commands shown below. You can set individual, group, scene or broadcast actions to each button. You can also change the buttons to simply send their On/Off status. By default, the buttons are in scene recall mode, scenes 1 thru 8. When a DALI address is assigned, button 1 will be set to single address transmit – using the same address as the AL-WS-8B itself..

## Display LEDs on the AL-WS-8B

Each LED can be controlled using the DALI address of the button. By default, these LEDs stay on for 4 seconds after a button is pressed, at the brightness of the destination driver.

## Relay option: AL-DA-IO16 ( sml version)

See our AL-DA-IO16 in the structured media enclosure sml© case. This allows a voltage or contact to be monitored, and a relay output to be activated

## DALI Operation – Base Address

Using any DALI master, assign the AL-WS-8B a DALI address. This is not the address of the buttons, this is the address of the module that controls the buttons. At this address the following functions are supported

- Set LED on time in seconds, including always ON
- Set LED brightness including OFF
- Set the operating mode of each button
- Change the address of each button
- reset the device to defaults

The device responds to the provisioning commands from a DALI controller. In order for individual, scenes and group addressable functions to work, a 'short' address [ 0 thru 63 ] needs to be assigned. This can be done by a DALI Master such as the ATX LED Bus. Once a short address is assigned – the device can be understood to operate as nine devices in one. This is only used to write and store configuration commands. A DALI master can write the configuration commands using the DALI write user memory commands.

## DALI Operation – Button Example

Each buttons mode can be can be changed – for example an 8 button switch:

- 1) pairwise example: top left button is broadcast ON (dim up) and next one down is broadcast Off (dim down)
- 2) top right button is ON for address 3, pres to dim up. Button below that is OFF for address 3, press to dim down.
- 3) next row is group 0 ( left ) and short address 1 ( right ). Each will send On/ Off/ Dim to the defined address.
- 4) the bottom two are scene 1 recall (left) and right is scene 6 recall (right), both the undo enabled

## DALI Operation – Simple Button Programming

After the Base address is assigned a Short DALI Address, buttons 1 to 8 are set to generate sequential addresses up from the base address +1. On, Off, and press to dim is supported. If the base is 20, then the top left transmits to SA 21, the bottom right to SA 28. If this is acceptable to you – nothing more needs to be done.

Assigning the base address to a group, will cause the buttons to be programmed to that group number + n. A 4 button switch, with the base set to group 5, will assign button 1 to group 5, 2 to 6, 3 to 7 and 4 to 8.

These individual button functions can be changed on a per button basis – no sequence is required. You can set any individual address, group DALI address or a unique Scene recall function, in any order to any button.

## DALI Operation – values learned from Drivers

At the first time a button is pressed ( after power up, or when the address is changed ) the AL-WS-8B will read the Minimum and Maximum dim levels, the current level, and the group associations from the driver at each address to learn the range for the dimming function. The level at that address is saved for the next dimming action starting point.

## Advanced DALI Operation – paired Button Programming

In 2 button per address mode – Buttons 1, 3, 5, 7 can be assigned as UP only ( with Dim Up only), while buttons 2, 4, 6, 8 can be assigned as Off ( with dim down only). This is called the Pairwise setting.

## Advanced Individual Button Programming

Using memory Bank 0, locations 21 thru 36 addressed by the DALI protocol in the AL-WS-8B, we can assign a function and address to each button and LED. A button has a number between 1 and 8. These can be stand alone, or can be pairwise. If stand alone – each button has a unique destination. If pairwise, then one is On/Up dim and adjacent is Off / Down dim.

### Mode Bits: ( memory bank 0 address 19 + button\*2)

7	6	5	4	3	2	1	0
Momentary	LED Mode A	LED Mode B	Switch Mode	Broadcast	Scene (0-15)	Group (0-15)	Single address
				1 = enable 0 = disable	1 = enable 0 = disable	1 = enable 0 = disable	1 = enable 0 = disable
0			0	Input On / Off sends DALI On / Off ( no dimming)			
0			1	Vacancy Mode -> When input goes from 0->1, ignored: each 1->0 transition delays turn off another 20 seconds of no activity			
1			0	For use with LVSW switches and push buttons, Toggle On/Off, push to dim			
1			1	Odd numbered buttons press to turn ON – hold to dim up. Even numbered buttons press to turn OFF – hold to dim down			
	0	0	Internal LED off				
	0	1	Internal LEDs Individually Dimmable with timeout ( DALI cmd 46 )				
	1	0	Internal LEDs Global Dimmable with timeout ( DALI cmd 46 )				
	1	1	Internal LED On/Off with timeout ( DALI cmd 46 )				

### Address: ( memory bank 0 address 20 + button\*2)

Mode	7	6	5	4	3	2	1	0
Single	0	0	SA5	SA4	SA3	SA2	SA1	SA0
Trigger	0	1	0	0	T3	T2	T1	T0
Group	0	0	0	0	G3	G2	G1	G0
Scene	0	0	0	Undo*	S3	S2	S1	S0
Broadcast	1	0	0	0	Smart	Off Only	On Only	On/Off

'Single' means a button press sends DALI ARC brightness level to Address 0-63. Triggers send a DALI command 171 with data byte = 0-15. Group sends a DALI ARC brightness level to 0-15 groups. Scene recalls prestored scene number 0-15. Undo stores the existing state of every light into Scene 15, so a user can undo a Scene within 6 seconds. Broadcast modes are Off, On, On/Off and Smart. Smart means Off if any lights are on, if all lights are off, send scene #14 recall.

## Virtual 3-Way Operation

The Virtual method listens and maintains sync with devices at same short or group address. This means that each AL-WS-8B will decide using the existing On/Off state of the driver before sending an On/Off command when a button is pressed. The result allows unlimited numbers of switches to dim and control a common light. All ATX LED switches support Virtual 3-way. Scene sync requires version 12 or later.

The level recorded is either the level sent to the short address of the button, or to a group containing that short address. If a scene control on the bus is detected, then the destination address or group will be queried before transmitting the level.

## Push Button vs On/Off mode

Most users should use Push Button Toggle mode. This supports 3-Way and other features.

If you prefer that the buttons are controlled by your DALI master instead of by the logic in the switch – then disable the push button toggle mode – each switch will send a DALI ARC level command of 0 or non-zero for off and On. The non-zero value will be the last ARC level sent to that address. When Push Button mode is disabled (On/Off) mode – the buttons do not control the built in LED outputs directly. these LED outputs respond only to ARC commands from the DALI bus.

## Internal LED timeouts

Each button has an LED. These default to be set to display the brightness of the LED driver at that address. The ON time is programmable, default is 4 seconds – then the LED turns off. Set the DALI command “Fade Time” using the base address to set the ON time. See Brightness for ON/Off/Dim levels.

## Internal LED brightness

There are 4 brightness options in addition to the On time option. The brightness is controlled by PWM to the LED at a rate of 125 Hz with 8 steps. The On time is defined by the DALI Fade Time command.

- The LEDs can be set to be OFF all the time
- Local mode - The brightness of the LED will track the levels sent by the button to the destination address, or by the ARC level sent by a DALI master to the address or group assigned to the button.
- Common mode - ALL LEDs can be set to a common brightness level defined by the level sent to the base address
- The LEDs can be On/Off only without dimming

Note: the LEDs will follow the state of the button inputs in momentary mode only. If the AL-WS-8B-OEM is used in rocker mode – the LEDs will not track the input switches – send level commands to that DALI address to control the outputs.

## Scene Undo Mode

The Scene option supports an undo mode. If a button programmed for Scene undo is pressed, all the light on/off/dim/cct levels will first be saved as scene 15, then the 8B will trigger the requested scene. If the same button is pressed within 5 seconds – Scene 15 ( the previously stored scene) will be set, restoring the lights to the prior setting.

## Smart Broadcast Mode

The Smart mode listens to DALI bus commands and if any light has been turned on, it will send a broadcast off command. If all lights are off, it will send a Scene 14 command. This allows a single button at the front door to turn all lights off on exit, and a preset scene 14 on return. Smart modes need version 12 or later. Smart Mode is numeric 136.

# DALI Commands Supported by the AL-WS-8B at it's own short address

Notes: \* = must be sent twice in 100ms,

ARC	ARC level 0-254		See LED brightness if Global
32	Reset to defaults ( don't change Short Address)		
42	Set all 8 buttons to this Max level		Default 254
43	Set all 8 buttons to this Min level		Default 0
46	Set LED On Time in seconds (See DALI fade time table )		0= Off, 15 = always on
47	Set Vacancy Detection time (DALI fade time table, x 40)		0 to 3600 seconds
128	Set Short Address		
129	Enable Memory Write		
144	Read Status		
145	Ping address	255	
147	Query On/Off of button # from DTRReg2		
149	Query reset state		
150	Query missing short address	255 is missing	
151	Dali Version	1	
152	Read current DTRReg		
153	Query DALI ballast type supported	6	
155	Query power fail status	255 if rebooted	
156	Query DTRReg1		
157	Query DTRReg2		
160	Query ARC Level global LED		
161	Query Max level global LED		
162	Query Min level global LED		
165	Query LED On Time and Vacancy time		Bits 0-3 = Vacancy Bits 4-7 = LED
166	ATX LED HW Type	10	
192	Query Group 0-7 for Global LED control		
193	Query Group 8-15 for Global LED control		
194/5/6	Query Random High/Middle/Low bits		
197	Query Memory Bank address DTR1:DTR		
	Global DALI commands		Hex
256	Terminate		A1
257	Set DTR		A3
258	Initial Addressing Mode		A5
259	Randomize		A7
260	Compare Random Address		A9
261	Withdraw from Random Addressing		AB
264 / 265 266	Set High / Middle / Low Byte		B1
267	Set Short Address if match		B7
268	Query Short Address		B9
269	Query Long Address Match		BB
273 / 274	Set DTRReg1 / DTRReg2		C3
275	Write Data at Memory Bank DTR1:DTR	Send confirm	C7
276	Write Data at Memory Bank DTR1:DTR	no response	C9
40-47	Emulate a Button press – allows SW based regression testing		Individual address only
96-111	Add to Group		For Global LED Control
112-127	Remove from Group		For Global LED Control

## Memory Bank 0

Address	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	722512406476
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	
16	# of buttons	1, 2, 3, 4, or 8
21-36	Button Mode	See table
37-63	User data	

## Memory Bank 1-3

Address	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

Address	Name	Value
3	Up Time	Hours (LSB)
4	Up Time	Hours (MSB)



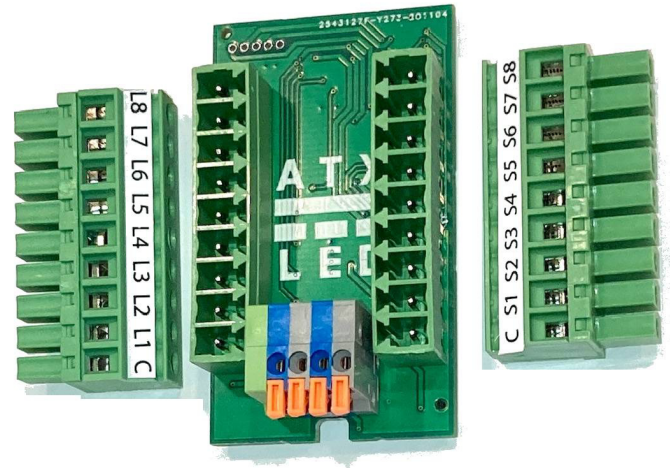
## Advanced individual Button Modes

DALI bus Commands interpreted at addresses/groups assigned to buttons to allow sync'd and expected actions on button presses.

ARC	Copy ARC Level for 3-way processing for Address, Groups, Broadcast	
0	Status LED Off	
1	Status LED UP 8 steps	
2	Status LED Down 8 steps	
3	Status LED UP one step but don't turn on	
4	Status LED Down one step but not off	
5	Status LED Set to MAX level	
6	Status LED Set to Min level	
7	Status LED Down one step and Off if needed	
8	Status LED Up one step or on if needed	
33	Save level in DTReg	
42	Store DTR as new Max Level	
43	Store DTR as new Min Level	
96-111	Add to Group	For 3-way sync
112-127	Remove from Group	For 3-way sync
171	Query presence of AL-WS-8B at this address, report level	
257	Load DTR	

### Ordering part numbers

Model	Number of Buttons
AL-WS-010v	1
AL-WS-2B	2
AL-WS-3B	3
AL-WS-4B	4
AL-WS-8B	8
AL-WS-8B-DIY	8 Module Only bring your own LVSW
AL-DA-Relay8	SML – high current
AL-DA-IO16	SML I/O version



**AL-WS-8B-DIY**  
 Size is 52 x 30 x 28  
 input: contacts  
 output: +12v 2 mA drivers