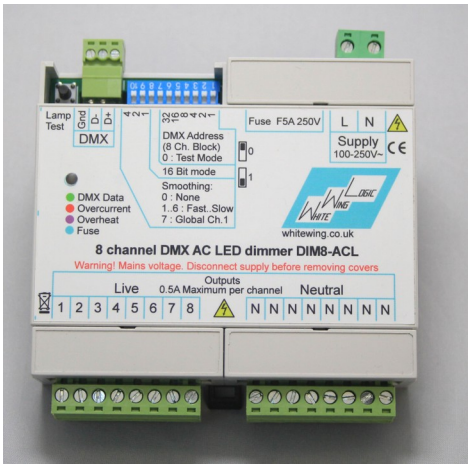
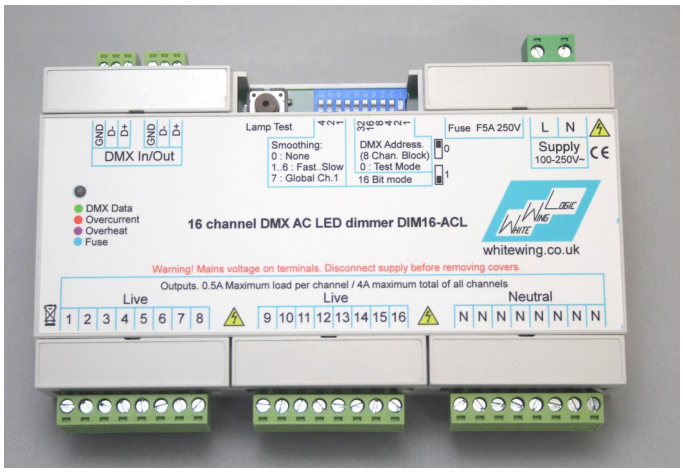
8- & 16- channel DMX AC LED dimmers
DIM16-ACL and DIM8-ACL

Firmware V1.1 4 Feb 2022





Specifications

Model	DIM8-ACL	DIM16-ACL
Supply voltage	100-250VAC. 50Hz (Please enquire for 60Hz)	
No-load power consumption	1W max	
Output current	500mA per channel (115W at 230V)	500mA per channel (115W at 230V) Limited by total device load to 250mA average across all channels
Total load	4Amps (920W at 230V)	
Dimming method	Trailing edge / phase-cut	
Overcurrent trip	5A RMS (7A peak) across all channels	
Overcurrent trip time	<50uS	
Interface	DMX512. Configurable as 8 or 16 bit per channel	
Hardware dimming resolution	10 bit / 1024 steps	
Dimming curve	Linear phase delay with adjustable minimum value. Please enquire for custom curves.	
Internal fuse	5A fast-blow. 5x20mm ceramic (user replaceable)	
Dimensions	106 w x 90 h x 33mm d excluding connectors. 130mm Height including connectors and space for wiring	160 w x 90 h x 33mm d 130mm Height including connectors and space for wiring
Weight	170g	240g

Warning

As mains voltages are involved, the dimmer must be installed and tested by suitably competent persons.
It must be installed inside a suitable enclosure which prevents access to live terminals, and provides fire protection according to local regulations.

Disconnect the mains supply before making or disconnecting any connections.

It is strongly recommended that each dimmer be protected from overcurrent with a suitable circuit breaker in addition to RCD/GFCI (earth leakage) protection to protect against faults with insulation, water ingress or accidental contact.
RCD protection is ESSENTIAL for any installation outdoors or where water ingress is a possibility. For ease of troubleshooting it is recommended to use a separate RCD for each dimmer.

Suitable ratings would be 6 amp 'B' time characteristic for overcurrent and 30mA for the RCD.

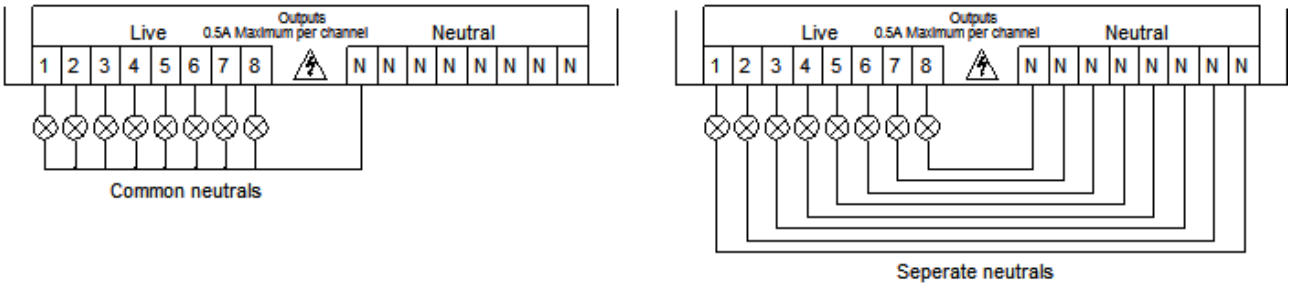
Note that specifically for AC LED tape, which has an integral rectifier, the RCD protection device must be a type A, not type AC. Type A RCBO/RCDs will trip on rectified DC fault currents, which are likely to occur if there is a fault after the rectifier.

For best overall protection and ease of troubleshooting, an individual 6 amp RCBO (combined RCD and overcurrent breaker) on each dimmer provides a compact solution for protection and can be fitted on the same DIN rail alongside the dimmer.
Example device : https://www.tlc-direct.co.uk/Products/BGCRB06A.html

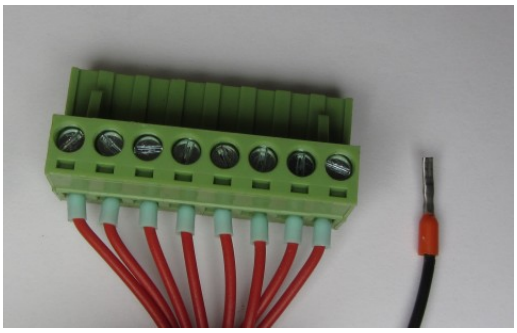
The dimmer must be securely mounted, either using DIN rail, or the keyhole slots on the rear.

Connections

The outputs switch the live side, from the incoming live to the output terminals.
Loads are connected between the Live outputs 1 to 8 or 16 and any neutral terminal. On the 16-channel unit, neutral terminals need to be shared between two loads.
All the neutral terminals are connected together internally, and linked directly to the supply neutral terminal.
Load neutrals may alternatively be connected to an externally-commoned neutral



8-way 5.08mm (0.2”) pitch for the channel outputs.
e.g. Rapid Electronics 21-2845
Note these are also available in 5mm, which will not fit!



2-way 7.62mm (0.3”) pitch for the mains input
e.g. Rapid electronics 21-3451

3-way 3.5mm pitch for the DMX input
e.g. Rapid Electronics 21-3035

It is strongly recommended that bootlace ferrules are used on all connections to avoid issues with stray strands or cable strain due to flexing.
Double-entry ferrules should be used when connecting two wires into a single terminal to provide good strain relief

DMX Input

Input is standard DMX512, via a galvanically isolated DMX interface. RDM is not supported.
It is essential that DMX Ground is used – do not use with a two-wire DMX transmitter.
The DMX line should be terminated at the end furthest from the sending device with a 120 ohm resistor connected between D+ and D-.
The 8-channel unit only has one DMX connector, so for daisychaining, The In and Out cables need to be connected to the same terminal.

8 and 16 bit DMX channel values are supported.
16 bit mode allows finer control, though note that only the uppermost two bits of the fine value are currently used, giving 10 bits (1024 steps) of actual resolution. In 16 bit mode, the MSB/Coarse channel is first, i.e. DMX 1 = channel 1 coarse, DMX 2 = channel 1 fine, DMX 3 = channel 2 coarse etc.
In 8 bit mode, a minimum brightness value may be configured to maximise the control range of the DMX channel value range.
16 bit mode is enabled by setting DIP switch 7 to ON.
Note that all 16 DMX channels used by the dimmer must be sent even if not all output channels are used. i.e. for a single dimmer at address 1, 16 channels must be sent in 8 bit mode, 32 channels in

16 bit mode. For the 8-channel unit, it is still necessary to send values for 16 channels.

Addressing

Addressing is in blocks of 8 channels rather than a DMX channel number. Note that on the 16-channel version, the dimmer occupies two 8-channel blocks, so dimmers should be addressed in steps of two blocks. A full list of DIP switch settings can be found in Appendix 1

Blanking on loss of data

If no DMX data is received for 5 seconds, the outputs will be automatically blanked. This can be disabled via device configuration (see later)

Smoothing

The dimmers incorporate an internal intensity-smoothing function, which can provide significant improvement of the aesthetic appearance of a lighting installation, especially where the source frame rate is low or erratic. It can also be used to “soften” the turn-on of LED lamps to give an appearance more like tungsten lamps.

The smoothing is effectively a crossfade between successive DMX frames, the speed of this crossfade being selectable, either from fixed values via the DIP switch, or by the control system via an extra DMX channel. The latter is controlled globally across all dimmers from DMX channel number 1 (regardless of dimmer address). The crossfade uses the full 10-bit resolution of the hardware.

The best way to determine the optimum smoothing value is visually on the final installation, as it is a very subjective effect, and will be a tradeoff between smoothness and speed of fast changes. It will usually be fairly obvious where the ‘sweet spot’ setting is with some experimentation.

Creative use of smoothing can also simplify the task of content creation and reduce data bandwidth requirements. Content can be simplified as transitions as crude as a simple on/off can become a smooth fade with a suitably high smoothing value.
Reduction of bandwith (by reducing frame rate) can be useful in large installations to reduce overall data processing workload, or where DMX data is passing through an IP network or wireless link, which may have variable bandwidth or latency limitations. For slow-moving content, source frame rates as low as 10 frames per second can produce perfectly fluid results with no visible jerkiness with careful choice of smoothing value.

SW 10..8	Equivalent DMX value in global-ch1 mode	Approximate time for 0-100% fade
10 9 8 0 	0	No smoothing (instant)
1 	192	150mS
2 	214	250mS
3 	240	500mS
4 	245	750mS
5 	251	1.5 Seconds
6	253	3 Seconds
7		Smoothing controlled globally by DMX channel 1 DMX address of dimmer channels in increased by 1 in this mode, i.e. Ch.1 on dimmer 1 is DMX channel 2

Test functions
Inbuilt test functionality allows testing of wiring and fixtures with no data source. Any incoming DMX data will be ignored when in test mode.

1) Channel test mode
This mode is enabled when SW1-7 are all OFF
In this mode, the outputs sequence through 9 or 17 steps for the 8 and 16 channel models respectively.
On entry to test mode (DIP switch change or power on), the steps will sequence continuously once per second. If the button is pressed, auto-stepping will stop and the steps will advance manually on each button press. Any change in any DIP switch setting returns to auto-sequencing.

The current step is indicated by the colour and flash length on the LED :
Steps 1..8 are a short flash of red, green, yellow, blue, magenta, cyan, white, off
Steps 9..16 are a long flash of the same sequence

2) Brightness test mode
This mode is enabled when SW1-6 are OFF and SW7 is ON.
In this mode, all channels cycle from 0 to 100% brightness in 16 steps. Controls are as per channel test mode above.

3) Lamp test
Press and hold the button for >0.25 seconds – all outputs will light at 50% for as long as the button is held.

LED indications :
Dim white : Idle
Green flash : DMX frame received.
Red : Overcurrent condition detected
Magenta : Overheat condition
Cyan : Internal fuse blown
White or yellow flash at startup : firmware version, indicated by number of flashes.
V1.0 = 1 flash, V1.1 = 2 flashes
Yellow indicates that overcurrent detection is disabled (see configuration section later).

Configuration mode
This mode allows for some additional configuration of dimmer operation. The configuration is held in internal nonvolatile memory.

To enter configuration mode , press the button repeatedly and rapidly (approx 4x per second) until the LED colour changes to a slow flash. Note that configuration mode cannot be entered if the dimmer is in test mode (SW1-6 all off)

Once in configuration mode, the LED will blink slowly, the colour indicating the function to be configured. Pressing the button briefly will advance to the next function.
Pressing and holding the button until the LED goes out (approx 4 seconds) activates the selected configuration function.

Configuration mode is exited by changing any DIP switch setting, it will also time out after approx. 30 seconds.

The dimmer outputs continue to operate normally in configuration mode.

LED colour	Configuration function
Red	Reset minimum brightness values to factory default (0-100%)
Green	Set minimum brightness value for **each** channel to current DMX channel value
Yellow	Set minimum brightness value for **all** channels to DMX value of the dimmer's first channel (as configured by DIP switch)
Blue	Set minimum brightness value for all channels to the binary value set on SW1-8 (SW1 = 1. SW2 = 2 … SW7 = 64, SW8=128). Note one of SW1..6 must be on to avoid activating test mode. A value of 0 can be set using the red configuration function.
Magenta	Disable overcurrent cutout. Led will still flash red if overcurrent is detected, but outputs will not be turned off.
Cyan	Enable overcurrent cutout and loss-of-data timeout (factory state)
White	Disable loss-of-data timeout (Firmware V1.1+ only)

<u>Minimum brightness setting modes</u>
Many types of LED bulb have a “dead zone” at the lower end of their brightness range, for example it may be that with a particular bulb type, DMX values below 64 (25%) give no output, and the lamp only starts lighting at its minimum brightness above this.

To maximise the useful control range in 8-bit mode, a minimum value can be set (per channel or globally), and the full range of DMX values scaled to maximise the control range above the minimum.
For example if the minimum is set to 25%, then DMX values 1 to 255 will output 25 to 100%.
DMX 0 always outputs 0%, to avoid unnecessary power draw when lamps are off.

Minimum brightness settings only operate in 8-bit mode, and are ignored by brightness test mode.

There are three ways to set the minimum brightness value, they all set the same value, but use different methods to specify the minimum value, to suit different setups.

The dimmer outputs operate as normal in configuration mode, and will reflect the currently configured minimum brighntess settings.

Examples :
1) to determine and set the required minimum brightness setting for a particular type of LED bulb to be used on all channels :
First ensure that minimum brightness is set to the factory default using the Red config mode.
Adjust the bulb brightness using the first channel of your DMX source so that it is just below the point where the bulb goes out.
Activate the yellow config function.
Check the dimming range, and repeat if necessary.

2) To determine and set the minimum brightness for different bulbs on each channel :
As (1), but set each channel as required, and use the Green config mode.

3) To set minimum brightness to 25%, without using DMX source.
Set SW7 and SW1 on, and all others off (DMX value 65)
Activate the blue config mode

Overcurrent protection

The dimmer continuously measures total load current, and if this exceeds 5 amps RMS (7A peak), will instantly turn off all outputs until the next mains half-cycle. This is intended to protect the dimmer from output short-circuits and excessive inrush current, though may not be able to prevent damage under all fault scenarios.

The LED will flash red briefly if the protection is triggered.

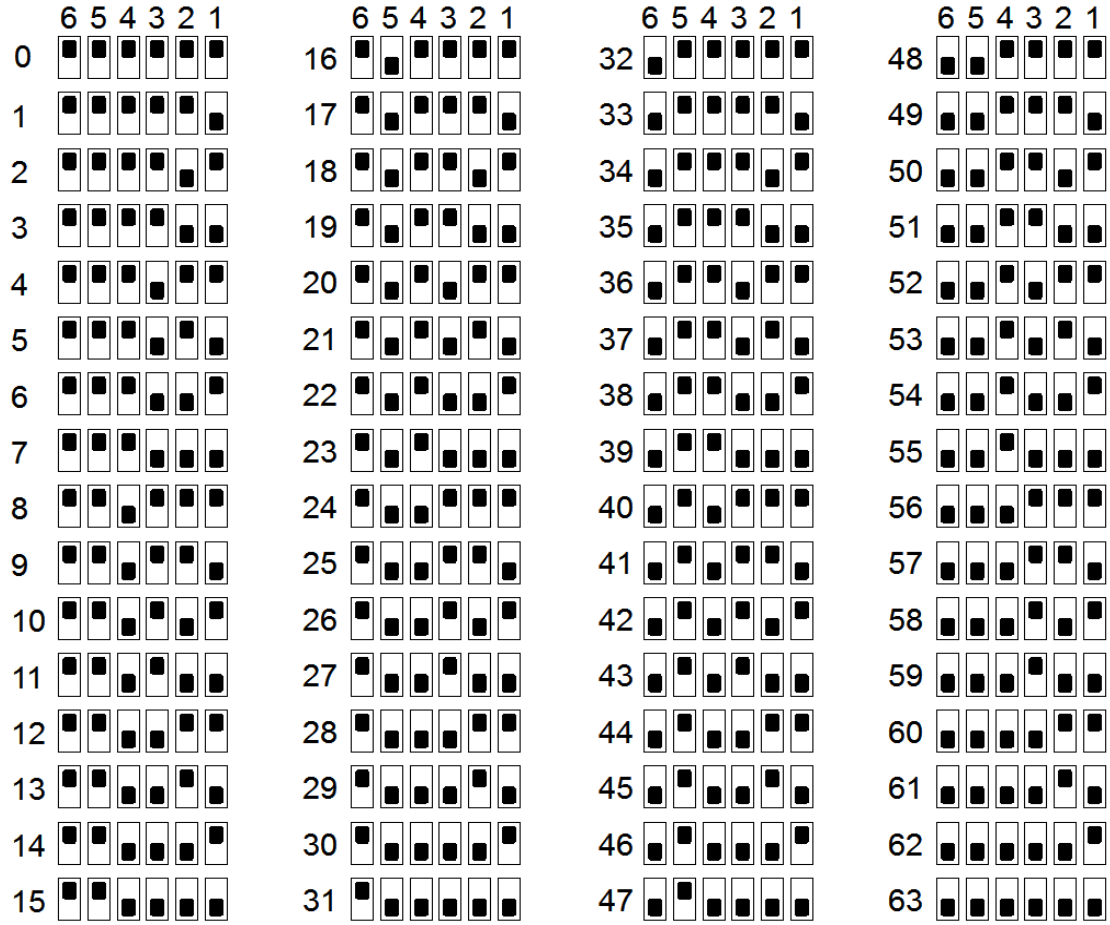
It is possible that loads with high inrush current may trigger the protection briefly if turned on suddenly – if this occurs, it is suggested to use the smoothing function to limit the turn-on rate. If the overcurrent protection causes serious issues then it is possible to disable overcurrent protection using configuration mode, however please contact the manufacturer for advice before doing this.

Appendix 1 – DIP switch address settings

Note both 8 and 16 bit products use the same switch settings, so the 16-channel dimmer would normally use only odd-numbered DIP switch values (in **bold** below) to avoid channels overlapping between dimmers.

DIP switch 1-6 setting	DMX address (8 bit mode) Add 1 for SM=7	DMX address (16 bit mode) Add 1 for SM=7
0	Test mode - channel	Test mode - brightness
1	**1**	**1**
2	9	17
3	**17**	**33**
4	25	49
5	**33**	**65**
6	41	81
7	**49**	**97**
8	57	113
9	**65**	**129**
10	73	145
11	**81**	**161**
12	89	177
13	**97**	**193**
14	105	209
15	**113**	**225**
16	121	241
17	**129**	**257**
18	137	273
19	**145**	**289**
20	153	305
21	**161**	**321**
22	169	337
23	**177**	**353**
24	185	369
25	**193**	**385**
26	201	401
27	**209**	**417**
28	217	433
29	**225**	**449**
30	233	465
31	**241**	**481**
32	249	
33	**257**	
34	265	
35	**273**	
36	281	
37	**289**	
38	297	
39	**305**	
40	313	

41	**321**	
42	329	
43	**337**	
44	345	s
45	**353**	
46	361	
47	**369**	
48	377	
49	**385**	
50	393	
51	**401**	
52	409	
53	**417**	
54	425	
55	**433**	
56	441	
57	**449**	
58	457	
59	**465**	
60	473	
61	**481**	
62	489	
63		



Appendix 2 - Notes on suitable lamp types

Dimmable LED lamps

LED lamps sold as “Dimmable” vary considerably from model to model, and testing will be required to determine suitability for a particular application.
Typical issues that may be seen are :
Flicker or inconsistent lamp-to-lamp brightness at the bottom end
Significant dependence on mains voltage variations , most noticeable at the bottom end
Hysteresis – the power may need to be increased to a certain level before the lamp can be subsequently dimmed below that turn-on brightness.
Delays in turning on.
Most lamps will have a “dead-zone” at the low end, i.e. unlike tungsten lamps, they will not light at all until a certain power is reached.

Mains-voltage LED tape.

This type of LED tape, which has just a rectifier between the mains input and the tape works very well, with a wide dimming range all the way down to zero.

Tungsten filament lamps

Although the dimmer can be used with tungsten lamps, be aware that a common failure mode of these lamps at end of life, or if subjected to mechanical shock is to draw a very high current surge briefly as the filament breaks and an arc is formed across the filament supports. The internal overload protection will typically protect the dimmer but this can't be guaranteed in all situations, and the dimmer's output channel may be damaged.
If tungsten lamps are used, it is strongly recommended to add per-channel fusing using fast blow fuses of no more than twice the lamp's nominal rating.
Another issue with tungsten lamps, particularly halogen types is a high inrush current when a cold filament is first lit. Again, this inrush current could be high enough to cause damage, so it is recommended that the lamps be faded up rather than turned on at full power from zero.
The dimmer's smoothing function may be helpful to ensure a suitably slow turn-on time.

Non-dimmable LED lamps

As you would expect, dimming performance for non-dimmable lamps will be poor to non-existent, but the dimmer can be used for simple on/off control of these lamps.

Incompatible loads

The dimmer is **not** compatible with the following, and erratic operation and/or damage may occur
CFL and fluorescent lamps.
Discharge lamps.
Any inductive load : fans, motors, relays, transformers etc.