

# ICELED

## *ELECTRO STYLING*

# ZEN

USER GUIDE  
INSTALLATION GUIDE

### **WARNING**

THIS PRODUCT HAS BEEN DELIBERATELY DESIGNED TO CREATE A HIGHLY NOTICEABLE LIGHTING EFFECT THAT WILL TURN HEADS AT CAR SHOWS AND EXHIBITIONS. BECAUSE OF THIS IT IS EXTREMELY IMPORTANT THAT IT IS **NOT USED ON THE PUBLIC HIGHWAY** TO PREVENT THE DISTRACTION OF OTHER ROAD USERS.

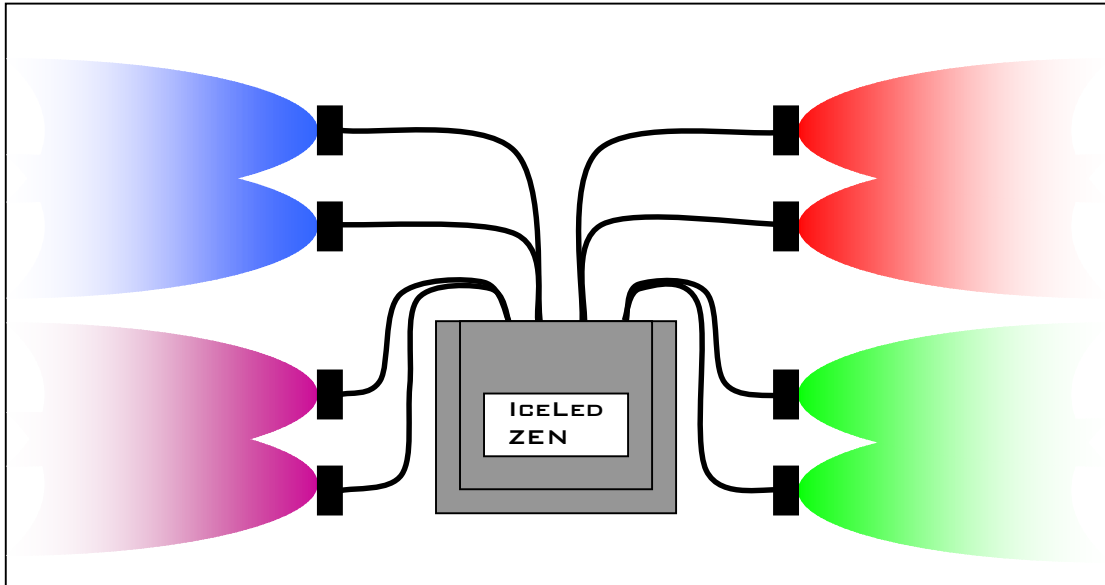
HAVING ISSUED THIS WARNING ICELED LTD. WILL NOT ACCEPT ANY RESPONSIBILITY FOR ISSUES ARISING FROM ANY FAILURE TO COMPLY WITH THIS CLEAR INSTRUCTION.

ICELED LTD. WILL NOT ACCEPT RESPONSIBILITY FOR ANY OTHER ISSUES ARISING FROM IMPROPER USE OR FITTING OF THIS PRODUCT AS THESE MATTERS ARE BEYOND OUR CONTROL.

THIS PRODUCT IS CAPABLE OF PRODUCING STROBOSCOPIC LIGHTING EFFECTS WHEN CONNECTED TO ICELED LIGHT SOURCES.

## Features

ICELED ZEN is a programmable lighting controller that can independently connect and command between one and four zones of interior or exterior ICELED emitters. ZEN allows each Zone to be lit with different colours and intensity levels according to any of 10 user-predefined programs. Simply selecting the appropriate program can quickly make dramatic changes to the entire lighting arrangement.



The four zones may correspond to separate areas - inside a car for example; floor, console, under-dash and roof lights. Some zones may need to be dimmed-out for driving – in which case certain programs can be edited to dim these zones and can be selected whenever required. Not all zones have to be used, ZEN will be equally useful providing control over fewer than four zones. If more than four zones are required, additional ZEN controllers can also be linked together.

## Lighting effects

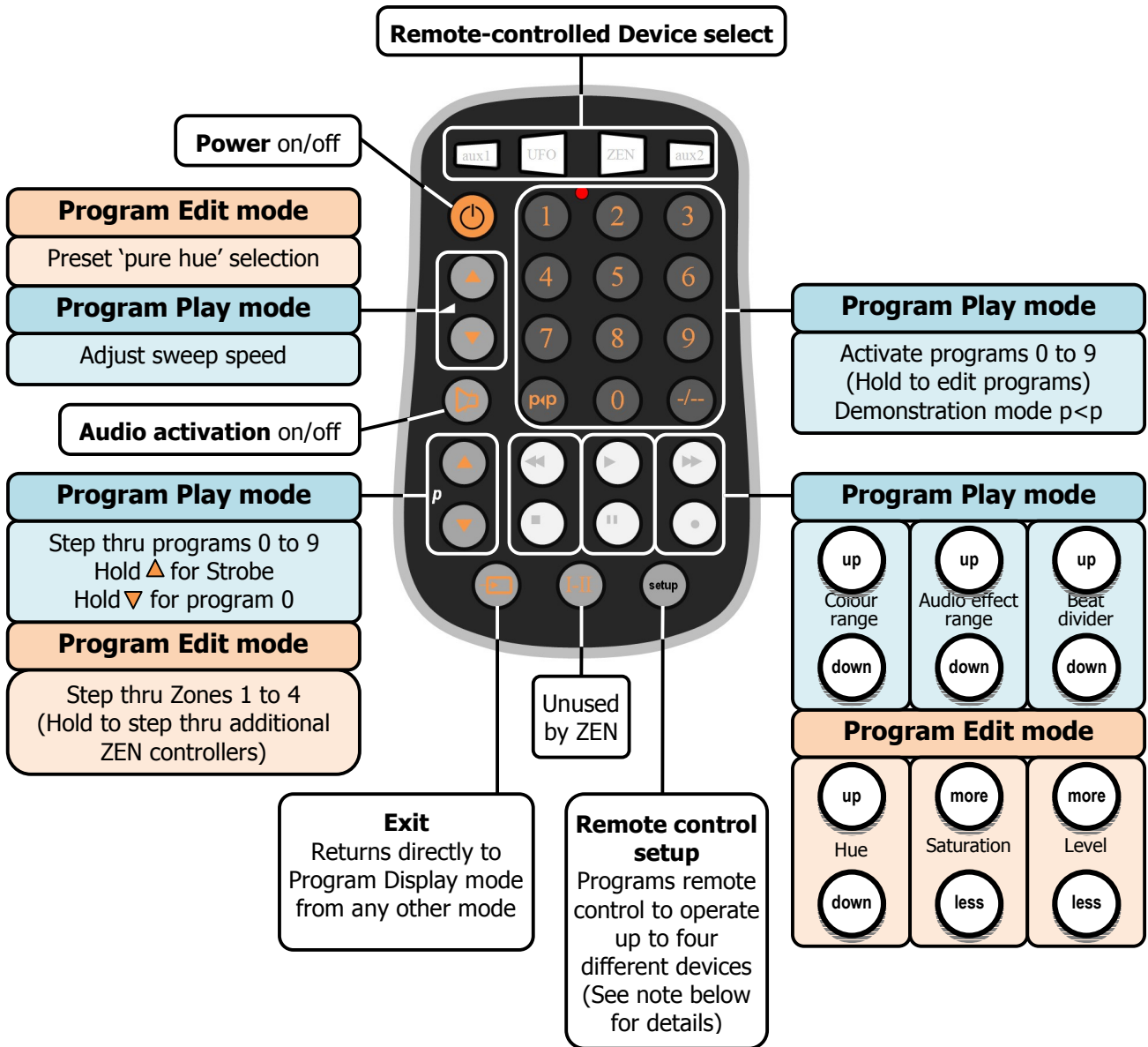
Each of the 10 programs has access to a number of lighting effects that can be applied to individual zones. For example, there is a variable-speed 'sweep' function, which can be used to cycle through a range of colours. Sound reactivity can also be applied to animate the colour or other qualities of the light produced in time with a music beat. A further option allows zones to be synchronised to the ICELED UFO controller when present. A separate 'lightning' program causes all zones to strobe in random sequences.

## Automatic operation

Each ZEN has an Enable input that can be connected to an external circuit (e.g. door switch or sidelights) allowing a preset lighting scheme to be switched-on automatically whenever the external circuit is active. This always selects program 0. The most obvious application is for switching-on interior lighting when doors are opened, however, ZEN may also be useful for controlling external lighting where the colour of each zone can be preset to conform to a particular lighting requirement e.g. white to the front, red to the rear etc. At other times different programs can be selected to override those colours with something more interesting for shows or other off-road meetings.

## Remote Control quick-reference

For your convenience the remote control supplied with ZEN is a “universal” type that can be programmed to operate up to four different devices. In addition to being used to operate ICELED controllers it may therefore also be used to operate common Audio/Visual equipment. As supplied the remote is set to operate ZEN on both of the rightmost device buttons.



**Note** – The remote control device code for ZEN is **0172**  
To assign a particular code to a **device select button** first press the target device button then press and hold the setup button until the indicator lights. Finally enter the four-digit code for your device. The indicator should go straight out. If it flashes twice then the code is not allowed.

## ZEN Terminology

### HSL Colour model

ZEN makes extensive use of the **HSL** colour model to provide easy access to a wide range of attractive colours and effects. This model specifies colour using three components familiar to artists: **Hue**, **Saturation** and intensity **Level**.

Whenever 'colour' is mentioned in this guide, it should always be thought of as being a particular combination of various levels of *hue*, *saturation* and *level* resulting in one of the two million colours that ICELED light sources can produce – including pastel shades, white and even black. The following diagrams should make the role of each component easy to recognise:

**Hue** adjusting the value of *hue* shifts the colour along the visible spectrum e.g. from magenta to blue.



**Saturation** for any given *hue* (e.g. blue in the example below) increasing the amount of *saturation* produces a purer *hue* – or more vivid colour.



**Level** for any given combination of *hue* & *saturation* (e.g. pale blue in the example below) increasing Level boosts the overall amount of light produced.



In the above examples, the full control range is arbitrarily depicted as spanning from 0% to 100%. This represents the lower and upper limits of the remote control range during colour editing operations.

**NOTE** – *Levels* should normally be kept at maximum except for when deliberately dimming-down certain zones or making them completely dark.

Lower *Saturation* settings result in brighter, whiter, colours. However, some effects like the sweep function will be unable to influence colours with very low saturation. To adjust the *Hue* of such colours, first increase the saturation so the hue can be seen.

### Home Colours

In order to establish a particular lighting theme for each program, all zones may be assigned individual 'home' colours in **HSL** format. Home colours provide a starting point for the various effects and are set up in **Program Edit** mode. Each ZEN controller holds a total of 44 home colours.

### ZEN Operating Modes

**Standby** – ready for switch-on with remote control  
**Program Play** – Zones lit according to program  
**Demonstration** – programs played at random  
**Program Edit** – home colour and option definition

## Basic operation

Press the orange power button to turn all Zones on or off. At switch-on the *most recently selected program* will be restored. Alternatively, press any numbered button to activate the corresponding program directly. In either case ZEN enters **Program Play** mode and each Zone shows its own programmed colours.

## Remote display

The remote display normally shows the active program number but will also provide other useful information depending on the mode of operation. A blank display except for small glowing dot indicates that the control unit is in **Standby** mode and power consumption is reduced to a minimum.

## Selecting programs

In addition to the number buttons **0-9** the ▲ and ▼ buttons labelled **p** can be used to step sequentially through each of the 10 preset programs plus the 'Lightning' strobe effect. The strobe effect differs from the other programs in ways that will be described after the general descriptions. Normally a smooth transition will be generated between one program and the next. Once the highest or lowest program has been reached, the buttons will cease to step any further in that direction.

## Program recall

Each program recalls a number of private settings that can be adjusted to generate a unique lighting arrangement. Settings that apply to each individual Zone are preset in **Program Edit** mode while those equally applicable to all zones are adjusted 'live' in **Program Play** mode. The following table summarises the settings recalled whenever a new program is selected.

Setting	Zone 1	Zone 2	Zone 3	Zone 4	Adjusted
<b>Home Colours</b>	HSL	HSL	HSL	HSL	<b>In Program Edit mode</b>
<b>Zone Options</b>	Free UFO Mute Lock	Free UFO Mute Lock	Free UFO Mute Lock	Free UFO Mute Lock	
<b>Sweep speed</b>	Min-max				<b>Live in Program Play mode</b>
<b>Colour Range</b>	Manual, 1-9, unlimited, random				
<b>Audio effect</b>	Level-hue-saturation				
<b>Beat divider</b>	Pattern a-d, 1:1 1:2 1:4				

## Demonstration mode



ZEN can be instructed to make a continuous sequence of random program selections on its own. A new random selection is initiated on each press of the **p<p** button shown left. If an audio trigger is present each new random program will be selected in time with the music.

If ZEN is in **Standby** when this button is pressed it will automatically switch on. Any other button-press immediately cancels **Demonstration** mode and restores manual program selection.



## Live program adjustments

In **Program Play** mode the four vertical pairs of buttons shown right can be used to make immediate changes to the appearance of the lighting performance.

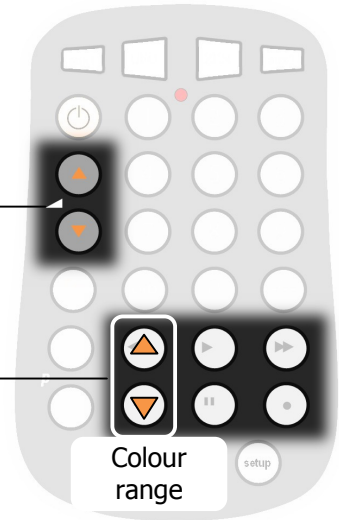
### Colour sweep speed

The rate at which colours are swept around their home settings can be altered from slow to fast using the two 'ramp' buttons. At the lowest setting sweeping is temporarily halted at the colours on display.

**Note** – The Zones will flash to warn whenever high or low adjustment limits have been reached.

### Colour range

The colour sweep can be adjusted to include a wider or narrower range of colours using the leftmost pair of multi-function buttons. If the range is set to zero the 'ramp' buttons shown above will shift the colour manually instead of changing sweep speed.



### Available colour ranges

The Colour range buttons step up and down through the ranges listed below. The selected range applies to all zones.

Remote display	Colour range	Example
[ r ]	Random colours	
[ U ]	Unlimited colours	
[ 9 ]	90% of spectrum	
[ ~ ]	40 – 80%	
[ 3 ]	30%	
[ 2 ]	20%	
[ 1 ]	10%	
[ 0 ]	Manual colour selection ^Home colour	

When selecting a colour range the remote display briefly shows [ L ] followed by a letter or number from the table on the left.

After a few seconds without any changes the display returns to showing the current Program number. *Similar letter/digit sequences are used in many other operations.*

Ranges 1 to 9 restrict the colour sweep to varying percentages of the colour spectrum starting from the home colour. The sweep repeatedly cycles away from, and returns to the hue of the home colour in 10% increments.



**Unlimited** colours sweep through the entire spectrum, while **random** colours are obtained from a 'random walk' around the spectrum.

All zones being swept will be *hue-shifted* relative to their *home colours* set in **Program Edit** mode. This means that if all zones were preset to the same *home colour* they would all continue to track together showing the same sweeping colour. If different *home colours* were preset in each zone then their relative offsets in *hue* will be maintained so that different colours would continue to be shown in each zone.

### Audio activation

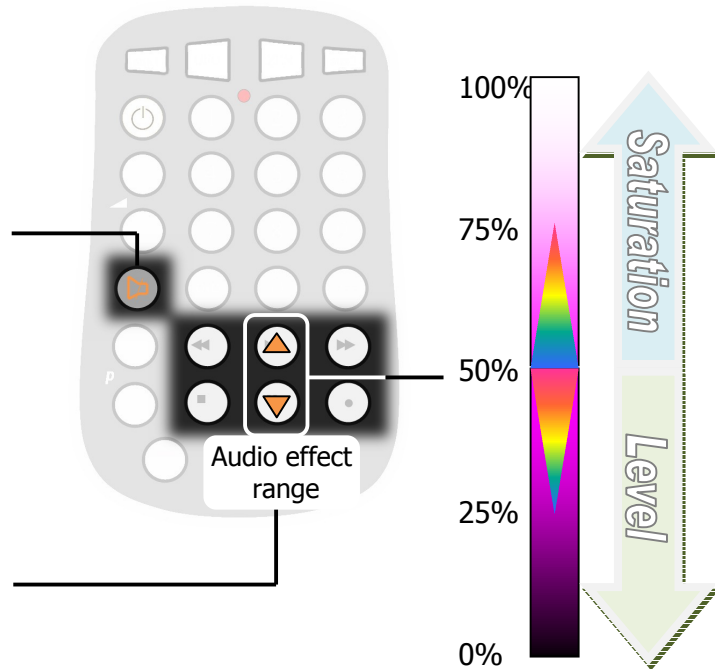


Audio activation is toggled on and off with each alternate press of the loudspeaker button.

The small dot on the remote display lights brightly when audio activation is enabled and blinks in time with the internal beat detector.

### Adjusting the audio effect

If zones are free to respond to sound then the way they do so is determined by the setting of the Audio effect range.



In the top 50% of the range each audio beat reduces the *saturation* of the colour towards white. The saturation effect becomes more pronounced the further towards the maximum limit the setting is taken. At 100% each beat completely de-saturates the colour forcing it to white before settling back to the amount of saturation defined by the *home colour* after the beat. While in this upper control region the remote display shows:



In addition to the saturation effect, around the centre of the range, every beat also steps the *Hue* of each zone by a variable amount. The size of this step varies symmetrically either side of the centre of the range with the 50% position providing the biggest step. This position also coincides with zero change in both *Level* and *Saturation* and is identified with – on the remote display. The step in *Hue* falls off to zero below the 25% and above the 75% points leaving only *Level* or *Saturation* affected by the audio beat.



In the lower 50% of the range the audio beat increases the *Level* of each zone pulsing it to the *home colour* setting before fading back into darkness until the next beat arrives. Increasing the setting gradually raises the minimum *Level* up to a point halfway through the control range at which point no dimming will occur at all. While in this lower control region the remote display shows:

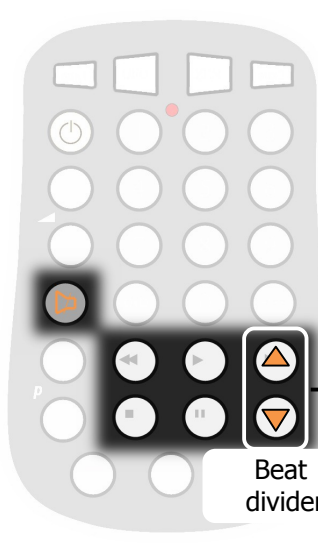


The audio effect can be disabled for individual Zones in **Program Edit** mode. This might be useful for setting up programs having particular zones that are less distracting than others. Disabled zones may still respond to colour sweeping if desired using the options described on page 9.

**Note** – for a given program, the chosen Audio effect applies globally to all zones opting-in for sound activation. Other programs may be configured with different effects to create a variety of lighting schemes each with their own distinct appearance.

### Audio beat divider

The triggering of audio effects can be modified by the beat divider setting. Four different trigger patterns can be selected (a b c d) and each pattern can be set to respond to every beat, every second beat or every fourth beat.



Remote Display	Trigger pattern
d 4	all zones respond simultaneously
d 2	
d 1	
c 4	effects alternate between zones 1&3, 2&4
c 2	
c 1	
b 4	effects alternate between zones 1&2, 3&4
b 2	
b 1	
A 4	each zone responds sequentially
A 2	
A 1	

### Program exceptions

**Program 0** can be activated automatically by an external circuit e.g. a switch operated by an opening car door. This only happens when ZEN is in **Standby** mode so an opening door will not override a program already in use. Switching off the unit with the remote control *when program 0 has been circuit activated* temporarily disables this feature as it suggests that lights are not automatically required. Automatic operation is restored the next time ZEN is switched on using the remote control.

*In the case of being switched-on automatically by opening a car door, program zero will remain on for a short period after the door is closed to provide an interior light delay facility. By sensing the supply voltage, ZEN brings about an early termination of this period when the car engine is started or when leaving the car after a journey.*

### Leaving the vehicle

If a program is active, selecting program 0 rather than switching-off before opening the door and leaving the vehicle provides continuous ambient illumination. Once selected, program zero remains on until the enable input instructs it to switch off. This will be the case once the door has been opened and closed.

### Strobing

In order to prevent inadvertent operation the 'Lightning' strobe effect can only be activated by holding down the **p** ▲ button. The strobe responds to sound activation and to the speed control. When engaged the remote display shows **PL** ('Lightning' strobes). To enter **Program Edit** mode for the strobe hold down the **p** ▲ button while the strobe program is active.

In **Program Play** mode the audio effect buttons control the degree to which all zones strobe together. At the lowest setting zones flash independently in a random sequence. At higher settings zones tend towards flashing together.

## Program Editing mode

Every program recalls its own set of *home colours* – one for each zone. To edit the colours for a particular program **press and hold down the corresponding program button until **E 1** appears on the remote display.**

This puts the controller into **Program Editing** mode for zone 1 and all zones freeze on their *home colours*. In this mode all the buttons shown below assume different functions to those assigned in **Program Play** mode.

### Preset Hues

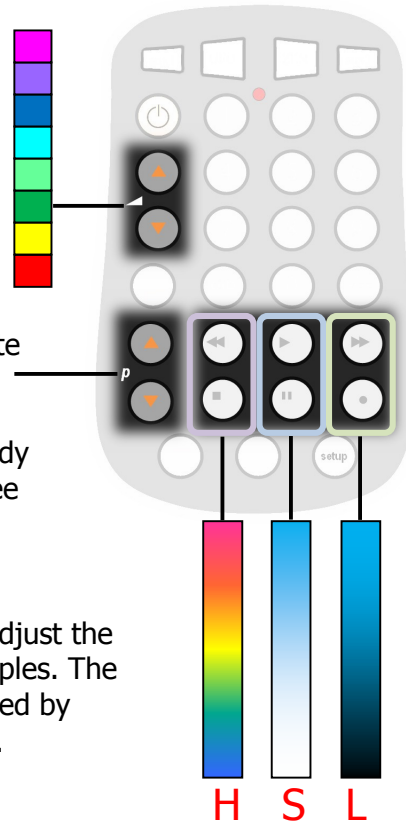
The two 'ramp' buttons quickly step through a selection of pure Hues (Saturation and Level both set to maximum) providing a useful starting point for fine-tuning with the HSL buttons below.

### Zone Selection

The ▲ and ▼ buttons labelled **p** step up and down through each of the four zones to be edited. The remote display shows **E 1** to **E 4** to confirm which zone has been selected and all light sources connected to that zone briefly blink in white to identify themselves as ready for editing. To access zones in any additional ZEN(s) see details on page 13.

### Hue - Saturation - Level

The three pairs of multi-function buttons on the right adjust the individual colour components as illustrated in the examples. The remote display shows which component is being changed by temporarily flashing **H S** or **L** on the remote display.



### Zone options



In addition to the **HSL** colour definition each zone has four private options that determine how the zone reacts to colour changing influences. In **Program Editing** mode the audio key cycles continuously through each of the four available options with each successive press.

A series of blinks from the zone being edited keeps track of the option selected for that particular zone. To select any of the four options shown in the table below, repeatedly press the audio button until the corresponding number of blinks is seen.

Blinks	Option	Description
1	Free	Zone is free to colour sweep and react to sound
2	UFO	As above but will be overridden by UFO if present
3	Mute	Zone is colour swept only (doesn't react to sound)

**Exiting Program Editing mode**



To leave **Program Editing** mode press the **Exit** button shown to the left. **Program Play** is restored with the new home colours and options.

**Factory default settings**

An arbitrary set of 'Factory defaults' are provided to allow the controller to be demonstrated immediately following installation. All programs can be edited to suit individual requirements thereafter. The following table gives an overview of the default settings provided:

Program	Live Program adjustments				Home Colours & Options			
	Sweep speed	Colour range	Audio effect	Beat divider	Zone 1	Zone 2	Zone 3	Zone 4
P L	fast	[ r	n	d 1	Free	Free	Free	Free
P 9	fast	[ r	u	A 4	UFO	UFO	UFO	UFO
P 8	fast	[ r	-	A 2	Free	UFO	UFO	UFO
P 7	medium	[ U	n	b 2	Mute	Mute	UFO	UFO
P 6	medium	[ 7	n	c 2	Free	Free	Free	UFO
P 5	medium	[ 5	u	d 2	Mute	Mute	Free	Free
P 4	slow	[ 3	n	A 1	Free	Free	Free	Free
P 3	slow	[ 2	n	b 1	Free	Free	Free	Free
P 2	slow	[ 1	u	c 1	Free	Free	Free	Free
P 1	manual	[ 0	u	d 1	Free	Free	Free	Free
P 0	manual	[ 0	-	d 1	Lock	Lock	Lock	Lock

*The full set of factory defaults shown above can be restored by holding down the 0 button while in **Program Edit** mode for program 0. After several seconds ZEN will automatically reset itself with the factory defaults in place. This operation overwrites **all** program settings so use with caution.*

## Installation

The complete kit consists of:

- |                            |   |
|----------------------------|---|
| 1 x ECU                    | 1 x Fused supply wire                                     |
| 1 x Remote display         | 1 x Chassis return wire                                   |
| 1 x Remote control handset | 3 x Self-tapping screws for mounting ECU                  |
|                            | 1 x Self-tapping screw and washer for chassis return wire |

### Step 1: Install the ECU

The ECU must not be exposed to moisture or excessive heat so should therefore be located inside the car or luggage bay – not outside or within the engine bay. An ideal location might be somewhere under the dashboard, with a short route to the car battery. The box should be secured to a flat surface using the three short self-tapping screws provided. Ensure that the drilling of these holes will not damage wiring or other equipment on the other side. Care should also be taken not to over-tighten these fixings.

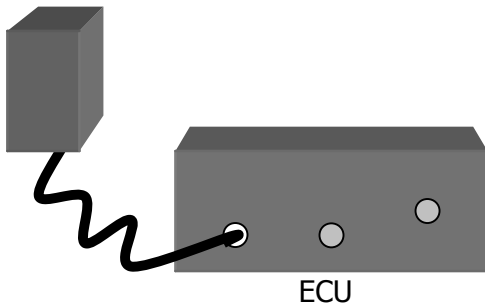
Installation should be carried out in the following sequence after first reading through every step (this will assist in locating everything in the best position).

A fourth hole will be required nearby to attach the chassis return wire. It is not sufficient to use any of the case screws for this connection, as it needs to be fully tightened in order to make a good connection to the metalwork. **Do not connect either of the power wires yet.**

### Step 2: Locate the remote display

The remote display unit plugs into a socket on the rear of the ECU.

Remote display



The display should be positioned where the driver can see it and, as it also receives infrared commands from the remote handset, it should be located at window level to allow the handset to be operated from outside the vehicle.

An ideal place for the remote display might be in the corner of the dashboard where it meets the windscreen.

### Step 4: Wiring the ECU

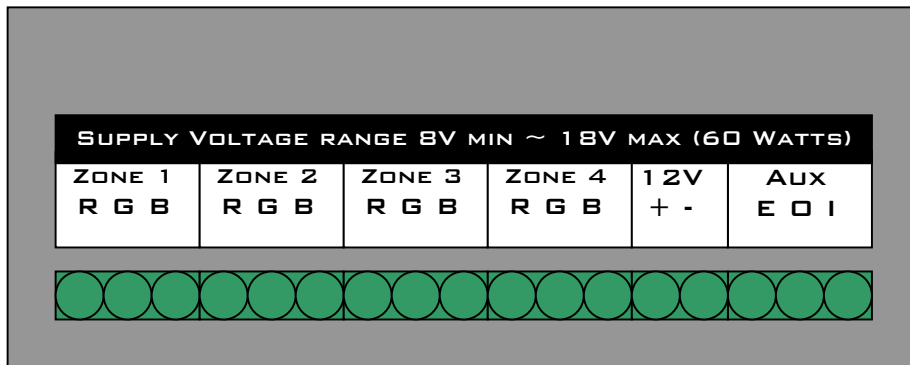
The 3-way connectors terminating the red green and blue wires from the light sources in each zone can be plugged into the appropriate zones. These plugs can be rearranged at any time to reassign the lights to different zones.

**Connections to the 12V supply should be made with the fuse temporarily removed from its holder in the red lead.** The red + wire should be run directly to the vehicle battery if possible, in order to maintain a permanent supply for standby mode. Other power 'pick-up' points may be suitable so long as they provide a constant supply. In either case the fuse holder must be located nearest the supply end so that the fuse can be effective in protecting the wire all the way back to the

ECU. To maintain protection, if this wire is to be shortened at all, it must be cut off at the end furthest from the fuse.

The ring terminal on the end of the short black wire needs to be firmly attached to the vehicles metalwork using the self-tapping screw and serrated washer supplied. **A good contact is essential here.**

If an external enable is to be used it can be connected now. A switch connecting this input to chassis when the door is open or a connection to the sidelight circuit are typical examples of external enables. Any small-gauge wire will be suitable for this connection.



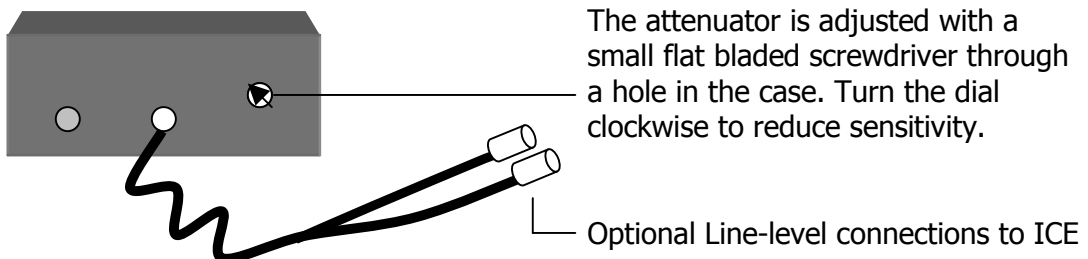
- R Red wire to light source(s)
- G Green wire to light source(s)
- B Blue wire to light source(s)
- + 8-18VDC @ 5A max. (<25mA standby)
- Chassis return
- E External enable (Program 0 selection)
- O Serial output (Expansion output)
- I Serial input (UFO/Expansion input)

**Step 5: Powering-up and testing**

Once the fuse and 12V plug are inserted the remote display should light up showing a version number. After a few seconds the display should clear down to just a standby dot showing that the controller is ready. Press the power button on the remote handset to switch on the zones. If the external enable was active during power-up it will automatically switch to program 0 instead of entering standby mode.

**Adjusting the audio level**

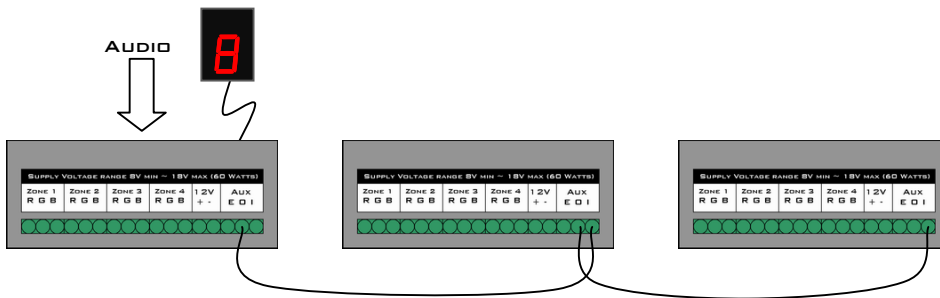
The ECU will automatically adapt to different sound levels over a wide range so no adjustment should be necessary. However a variable attenuator is provided at the rear of the unit if the sound levels are unusually high. This might be required if the patterns do not respond well to the music.



A direct line-level connection can be made to In-Car Entertainment systems using the optional link cable. This automatically disables the internal microphone so ensuring that music alone activates the light show – to the exclusion of all external sounds. The attenuator is still effective when a direct connection is used.

## Expanding the number of zones

Multiple ZENs can be linked together to act like one single controller with extra zones. All that is required is to run a wire from the 'O' terminal of one ZEN to the 'I' terminal of the next. The first controller is the only one that should have a remote display plugged in. Additional controllers take their commands across the expansion link. This is also true of the line-in audio input (if used) – only the first device in the chain needs to be wired to an audio source.



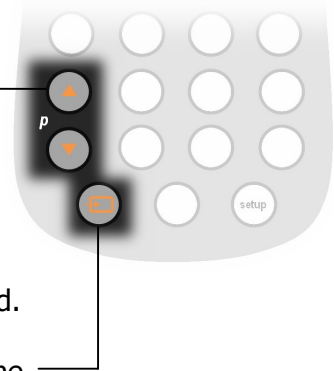
*Each additional controller requires its own connection to the 12VDC supply.*

## Editing expansion zones

In normal operating mode linked controllers all respond to the same program and speed changes. However in order to edit the *home colours* and *options* in zones belonging to expansion controllers it is necessary to step from controller to controller while in **Program Editing** mode.

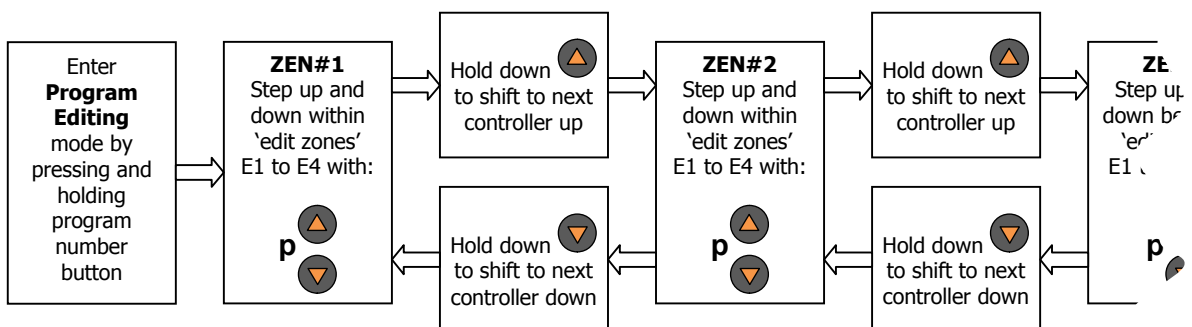
To step from the ZEN at the start of the chain to the next controller up press and hold the zone select up button

When the shift has been made, the first zone of the expansion controller selected will blink identifying the new range of zones that can be edited. At this point the button can be released. Likewise, shifting back down can be accomplished by keeping the down arrow button pressed instead.



Press the **Exit** button to leave Extended editing mode at any time.

The following diagram illustrates how control is passed from controller to controller using the method described above:

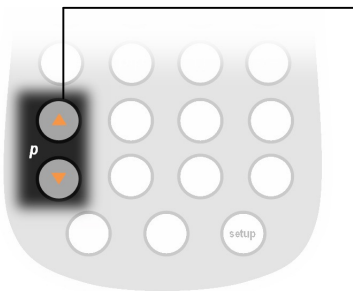




### Expansion zone enable

Each additional ZEN may have its own enable input (E) wired to a separate circuit to automatically switch to program 0. In this case only the four zones associated with that particular controller will be activated. Groups of zones can be 'ganged together' simply by wiring the same enable signal to each controller.


### Enable polarity

The default is for ZEN to switch to program 0 when the enable input is grounded. It is possible to re-program this so that connecting 12Volts to the enable turns it on instead. This might be required if ZEN is to operate automatically from the sidelight circuit for example.



To change polarity, the remote display must be plugged in and either  or  on the remote handset should be pressed **within three seconds** after connecting power to ZEN. The remote display first shows a version number followed by a dot, then either 0 or 1 indicating active low (ground) or active high (12V).

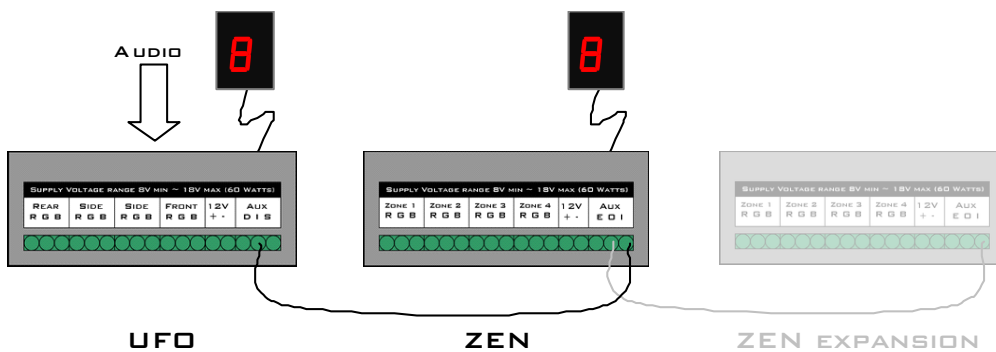
e.g.  version 6, active low.

This can be changed to *active high* by pressing  on the remote control handset within three seconds.

The display will flash back the new setting e.g. .

### Linking-up with UFO

ZEN's expansion input (I) can also be wired to the Interior data terminal (I) on UFO. Doing so allows zones to show the global ICELED colour generated from the underbody pattern. In this case any external audio input **need only** be connected to UFO. The signal is then passed from UFO to ZEN via the link. ZEN still requires its own remote display but may continue to be expanded as described above.



### Temporarily syncing ZEN with UFO operations



When linked-up to UFO, ZEN can be set to obey program changes, sound activation and on/off commands from the UFO remote control. To enable this first press the **Exit** button while ZEN is the selected device. Next, press the device button for UFO on the universal remote and both UFO and ZEN will respond to the same program changes etc together.

Re-select ZEN as the device on the universal remote and operate it normally to cancel synchronised operation.

## Specifications

Nominal supply voltage:	12 Volts DC (1)
Standby current drain:	0.02 Amps
Maximum load current:	5 Amps
Audio sensitivity:	54dB to 102dB
Data input:	Any ICELED controller output

(1) Voltage range of between 8 and 18 Volts. Reverse polarity and over-voltage protection are built in.

## Resources

To see the full ICELED product range visit <http://www.iceled.co.uk> the official ICELED website.

For more suggestions and advice visit <http://iceled.co.uk/area51/> the official ICELED user forums.