CONTROL FREAK
Making light work

DALI to 0-10V Converter V2
2 Outputs DALI Type 5

User Manual

Issue: December 2018

Description

The DALI to 0-10V Converter is a DIN mount 0-10V controller with the following characteristics:

- Sinks or sources current automatically (50mA maximum)
- Supports DALI broadcast, addressing, groups and all standard DALI settings
- UL94V0 material 4 pole DIN mount case
- Removable 12-way terminals top and bottom for easy wiring, 250VAC rated
- 2 address/2 output

DC Supply

For the 0-10V Converter to work it needs to be powered with a 24vdc (>360mA) source. This supply is connected to the 0-10V Converter supply input screw down terminals marked 24DC IN + & - (although the converter is not polarity sensitive). When DC supply is present, the "DC OK" status led will illuminate. NOTE: Power supplies are available from Creative Lighting; when selecting a power supply, ensure it complies with all statutory requirements including EN55015 and meets the required values as outlined above.

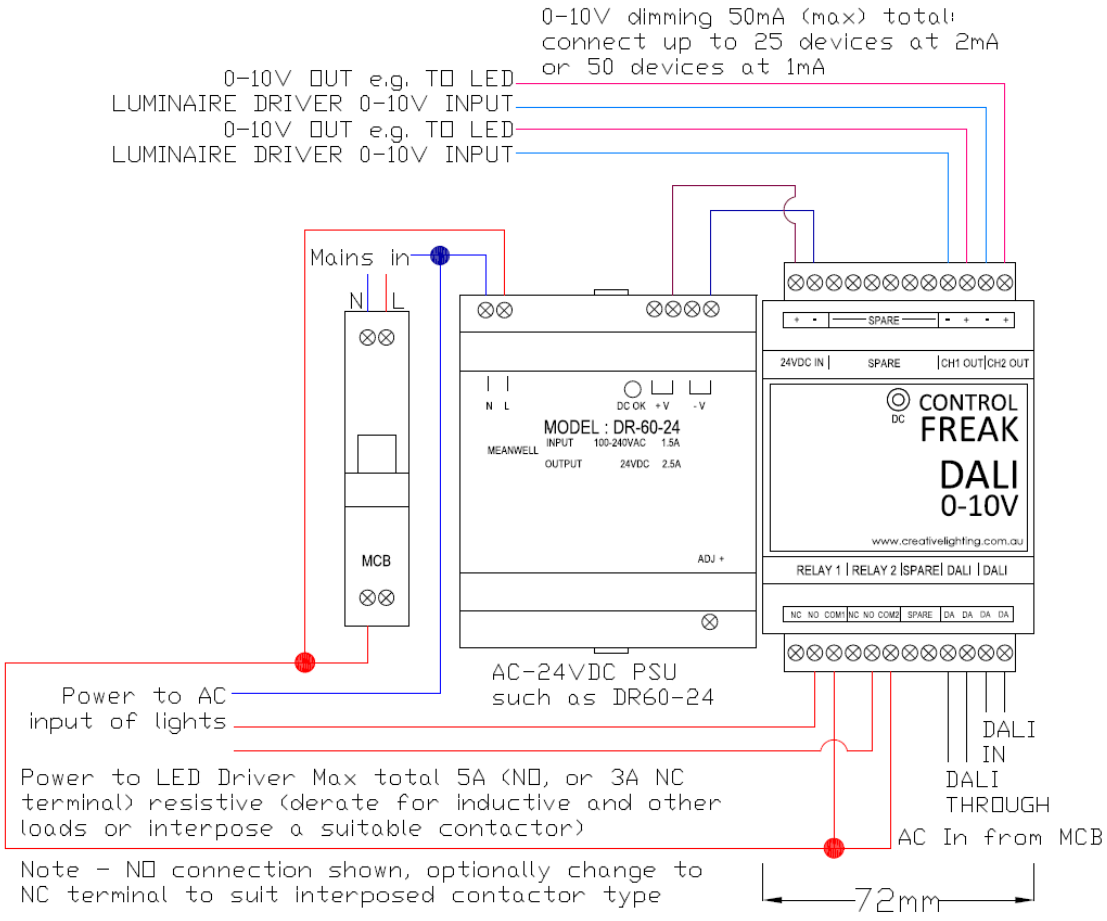

Figure 1. Example wiring diagram

0-10V Connection

Connect the 0-10V line of the 0-10V devices (e.g. the lights to be controlled) to **one** of the 0-10V channel outputs on the Converter.

Connect the 0-10V connection from the Converter to the 0-10V input of the 0-10V devices. NOTE that unlike DALI, **0-10V is polarity sensitive** and must be connected accordingly.

The Converter contains two (2) SPDT relays, each allowing for normally open (NO) and normally closed (NC) configurations. The relays are commonly used to allow 0-10V lights to be turned off; 0-10VAs not all 0-10V devices will dim down to off with the 0-10V signal, an internal relay is used to disconnect power to them when an off command is received via DALI. This connection is not required if the connected 0-10V devices can dim to down to

NOTE: Voltage measured under no load. Results may vary slightly under different load conditions.

off. A normally closed (NC) contact is also given which operates in opposite to the normally open (NO) input. This is provided for specialty cases and isn't needed during normal use.

The DALI to 0-10V Converter can sink or source 50mA of current on the 0-10V line. Typical 0-10V devices use 1mA each with a typical maximum current draw of 2mA per device. The maximum number of 0-10V devices then varies between 25 to 50 devices depending on their current requirements. As 0-10V systems do not support addressing, all connected devices will be controlled together. The range of 0-10V output is from 70mV to 9.48V (devices typically reach their min and max before this).

Relay loads

Contact form	**SPDT**
Rated load (NC – Normally Closed)	**5A at 250VAC at 40°C**
(NO – Normally Open)	**3A at 250VAC at 40°C**
Contact Material	**AgSnO2**
Minimum recommended load	**100mA, 5VDC**

Table 1. Datasheet values for Relay Loads –loads close to or above the ratings require an interposed relay between the convertor relay control output and the load

DALI Connection

The DALI line wires are connected in the screw terminals at the bottom right of the enclosure. NOTE: DALI is not polarity-sensitive. The DALI standard requires cables to be sized for not more than 2VDC voltage drop.

The Converter contains two (2) 0-10V control line outputs, and two (2) SPDT relays. Accordingly, it will take up two (2) DALI addresses on a DALI line, one address per channel and relay (channel 1 and relay 1 are controlled from the same address, likewise for channel 2 and relay 2). It supports all the standard DALI commands and settings such as broadcast, addressing, groups, scenes, fade times, etc.

The DALI to 0-10V Converter will directly translate DALI arc levels to 0-10V values. To do so, it won't follow the DALI logarithmic dimming curve by default and will instead provide a linear output. This default behaviour can be changed with a suitable DALI tool such as the Control Freak ADDICT. See the table below for example conversions:

DALI Arc Level	% of DALI Maximum (254)	0-10V Value	% of 0-10V Maximum (9.48VDC)
64	~25%	2.36V	25%
127	50%	4.69V	~50%
191	~75%	7.07V	~75%

Table 2. Linear (default) translation of DALI arc values to 0-10V values

DALI Device Type 5 Support

The DALI 0-10V complies with DALI version 2 functionality and implements two standard DALI devices. The 0-10V reacts to all DALI Type 5 Commands including operating mode and dimming curve selection. To receive DALI levels and commands, the DALI terminals for the relevant DALI line should be connected to a DALI line that also connects to a DALI power supply unit and one or more DALI controllers. For more information on the DALI protocol, refer to the DALI Standard documentation available from the I.E.C.

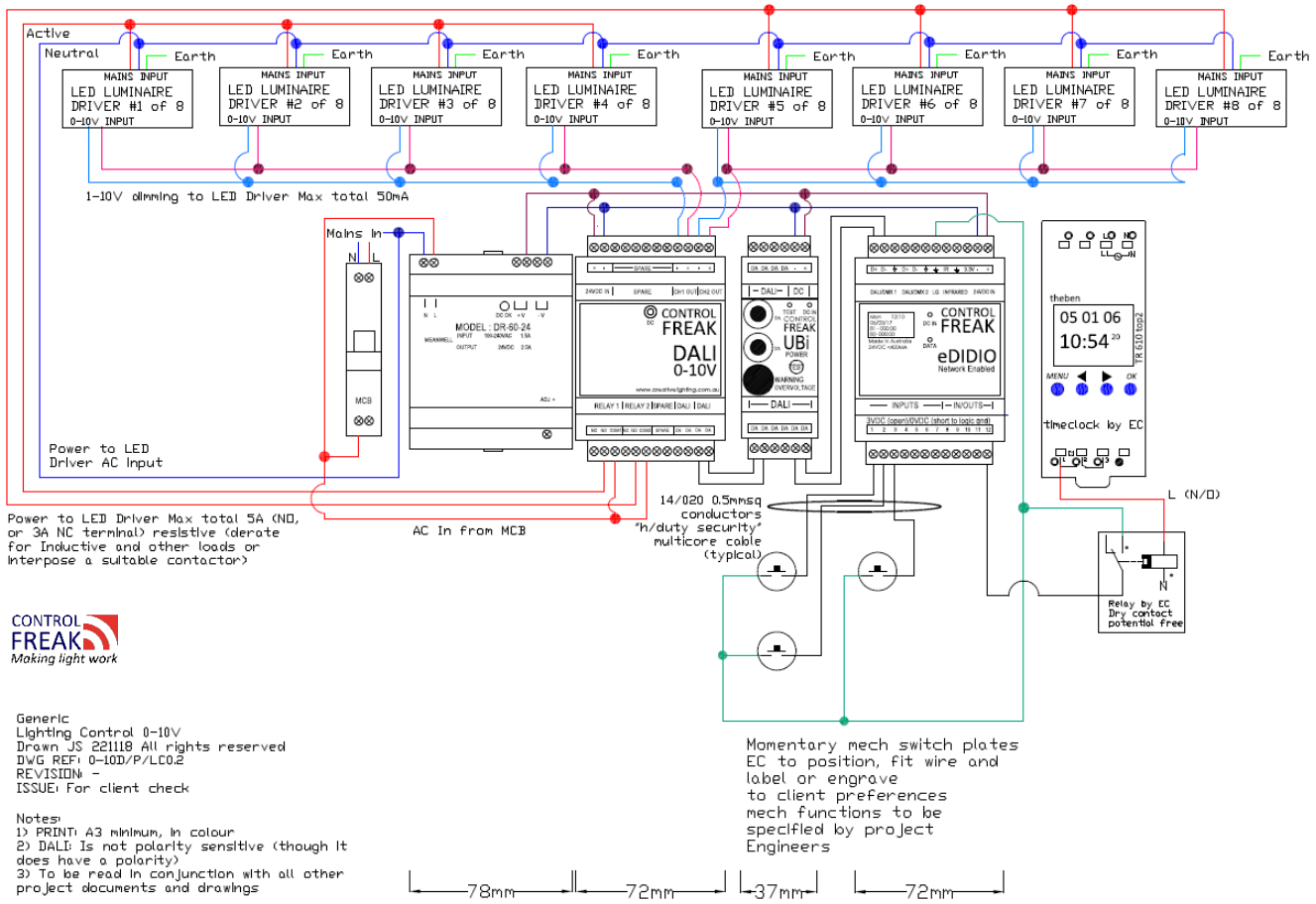

Figure 2. Example wiring diagram showing convertor with DALI control system and peripherals

DALI Fade Time

The DALI fade time allows for the device to set (per channel) a fade time based on DALI Fade Times.
Note: A DALI fade time will only be used with Direct Arc Level Commands; a MAX, MIN or OFF command will use the devices instant fade.

Fade time Setting	Min fade time (s)	Nominal fade time (s)	Max fade time (s)
0	Uses Extended Fade Time – see Extended **Fade Times**		
1	0.6	0.7	0.8
2	0.9	1.0	1.1
3	1.3	1.4	1.6
4	1.8	2.0	2.2
5	2.5	2.8	3.1
6	3.6	4.0	4.4
7	5.1	5.7	6.2
8	7.2	8.0	8.8
9	10.2	11.3	12.4
10	14.4	16.0	17.6
11	20.4	22.6	24.9
12	28.8	32.0	35.2
13	40.7	45.3	49.8
14	57.6	64.0	70.4
15	81.5	90.5	99.6

Table 3. DALI Fade Times

Extended Fade Times

If the fade time of 0 is selected, then the device will use the extended fade rate to calculate the desired fade. The value that is sent to the device is calculated using the equation (1), where AAAA is the base value, (between 1 and 16) and YYY is the fade time multiplier. The multipliers are shown in **Error! Reference source not found.**.

$$0YYYAAAAb \quad (1)$$

Multiplier (YYY)	Multiplication Factor		
	Minimum	Nominal	Maximum
000b	0ms	0ms	0ms
001b	95ms	100ms	105ms
010b	0.95s	1s	1.05s
011b	9.5s	10s	10.5s
100b	0.95 min	1 min	1.05 min

Table 4. Extended DALI Fade Times

Example: If you want to set a fade rate of 6 minutes then you would calculate it as shown below;

AAAA = 6 = 0101 (binary)
YYY = 100 (binary)
Byte to send = 0YYYAAAA = 01000101 = 69 (Dec) = 0x45 (Hex)

This fade rate allows for fades between 100ms to 16 minutes.

Dimming Curve

The DALI 0-10V allows for the selection of an appropriate dimming curve; logarithmic or linear. The default mode is linear, due to the nature of the 0-10V. The dimming curve can be selected through the device type 5 extended command 229, where a value of 0 represents logarithmic, and a value of 1 represents linear. The difference between the curves are shown in Figure 3. Log and Linear Dimming Curves.

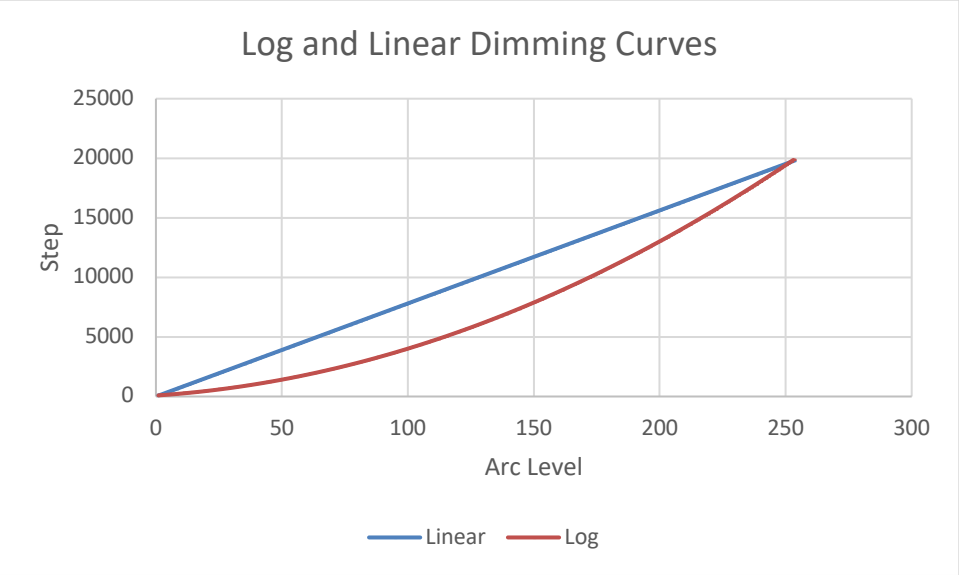

Figure 3. Log and Linear Dimming Curves

0-10V vs 1-10V Operation

The DALI 0-10V can be selected to operate in 1-10V mode if required. The off value will still trigger the relay, however the minimum will be 1V. This mode can be selected by sending Device Type 5 Command 224. To set the 0-10V back into its default 0-10V mode, the Device Type 5 Command 225 can be used.

Physical Minimum Selection

The DALI Device type 5 allows for the physical minimum to be set. The physical minimum works differently for logarithmic and linear modes.

When the device is in logarithmic mode, the physical minimum selection will dictate when to cut off power to the 0-10V output. If the physical minimum is set to 10%, then any arc level below 10% will be reduced to 0 and the relay will turn off.

In linear mode, the output is defined by the following equations.

$$V_{out} = 10\left(\frac{n - P_{min}}{254 - P_{min}}\right) \quad \text{[volts] for 0–10 V linear mode}$$

$$V_{out} = 1 + 9\left(\frac{n - P_{min}}{254 - P_{min}}\right) \quad \text{[volts] for 1–10 V linear mode}$$

The output will still be from 0-10V or 1-10V, however the arc level required to produce this voltage changes.

Summary

The DALI 0-10V is designed for Type 5 and follows as per the Standard the commands in **Error! Reference source not found.**. The expected responses are outlined, as well as the supported features of type 5.

Command Number	Name	Supported	Response
224	Set output Range to 1-10V	YES	No Response
225	Set output Range to 0-10V	YES	No Response
226	Switch on internal pull-up	NO	No Response
227	Switch off internal pull-up	NO	No Response
228	Store DTR as physical minimum	YES	No Response
229	Select Dimming Curve	YES	No Response
230	Reset converter Settings	YES	No Response
231-237	Reserved		No Response
238	Query Dimming Curve	YES	0 or 1
239	Query Output Level	YES	0-255, 0.04V to 10V
240	Query Features	YES	0b00011001
241	Query Failure Status	YES	0b00000000
242	Query Converter Status	YES	Bit 0 – 0-10V, Bit 2 Log/Lin
243-254	Reserved		No Response
255	Query Extended version Number	YES	0x01
272	Enable Device Type 5	SPECIAL	No Response

Table 5. Type 5 Commands

In order to send a Type 5 command, the Enable Device Type 5 command must be sent first, and then the desired command. The Type 5 command must also be repeated within 100ms in order for it to be successfully read. The 'Enable Device Type 5' command must be sent before every type 5 command, it does not enable it indefinitely.

Miscellaneous

The 0-10V Convertor contains a memory bank that contains information such as UID, DALI version, Hardware version and software version. This information is all available through reading the memory bank through DALI.

REGISTRATION – DALI to 0-10V Converter V2

Please complete this form and fax to 07 32828700 to register for manufacturer's warranty.

Name of project _____

Location of project_____

Brief description of project _____

_____

Purchaser Name _____

Purchaser Company _____

Contact Details – Email _____

Contact Details – Telephone _____

Date of Purchase _____

Purchased from_____

_____

CAD

Creative Lighting can also provide scalable CAD drawings and blocks of the DALI convertor and other products.

Range

All the products we make are under our registered Control Freak brand:

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SLAMMO DALI DMX512 DSI and RDM to PWM
eDIDIO Ethernet and LLI to DALI and DMX Scene Controllers, Group Controllers, Sequencers, Translators for DALI and DMX
LIDA DALI AC controllers for Contactors/relays, Fans and HID loads
ADDICT tools for DALI, DMX and RDM with optional wireless
UBi patented DALI Test Power and Distribution DIN mount devices
DMX512 Splitter Repeaters
Universal Lead sets 600VAC + rated
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Warranty

Congratulations on acquiring this genuine Control Freak® product ("the goods") which is guaranteed to the purchaser for a period of 24 months from the date of original purchase from Creative Lighting and its authorized agents and resellers.
Under normal use and for applications for which this product was designed, this Control Freak® product and all component electronics are warranted to be free of defects in material and workmanship.
In the unlikely event that the goods prove to be defective, Creative Lighting will decide either to repair or to replace the defective components. Before that can happen, the goods must first be returned to Creative Lighting at the purchaser's cost.

Australia only: If we determine that the goods are defective, we will not only repair or replace the defective components at no cost to the purchaser; we will also pay the cost to return them to the purchaser by our standard freight method, with any cost to reinstall the goods borne by the purchaser. This Guarantee specifically excludes faults which arise as a result of alteration, tampering, misuse, abuse, accident, vandalism, negligence, improper installation, or the use of other manufacturer's products in combination with the goods except where such use of other manufacturers' goods is authorized by us. All other warranties inclusive of any warranties of merchantability or fitness for any particular purpose whether expressed or implied are hereby expressly negatived to the fullest extent permissible by law. Under no circumstances will Creative Lighting be liable for reinstallation or freight except in the case of freight within Australia. In no event shall the manufacturer be liable for consequential damages.
This Guarantee constitutes the sole and exclusive remedy to the purchaser for proven defects.