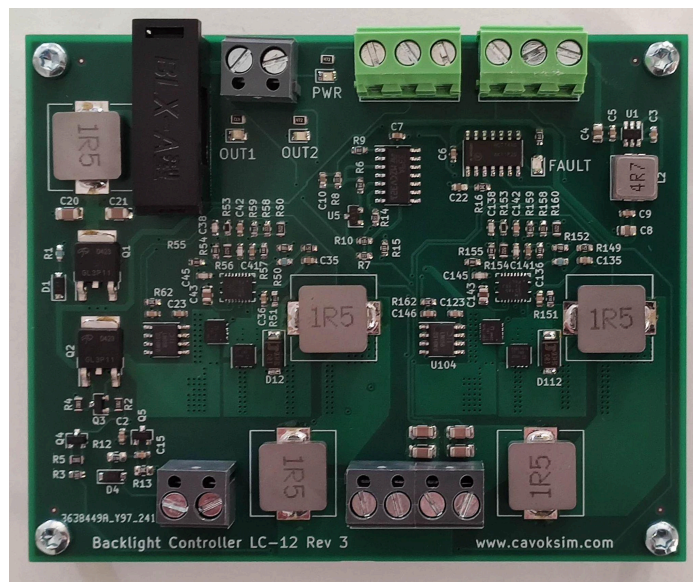




Lighting Controller LC-12



User Manual

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- Please read this manual carefully before installing your product
- Please follow all Precautions to safely install your product. When these guidelines are not followed the product or the aircraft component to be interfaced might be damaged. This damage will then not be covered by warranty.
- This product has multiple safety functions to prevent damage to connected equipment in case of a malfunction. However the use of this product is at the risk of the customer. Cavoksim Ltd. will not be responsible for any damages that might be caused by the use of this product.

Important Precautions

- **Protect the LC-12 controller from moisture and high humidity. Moisture can cause malfunctions of the LC-12. Do not touch any metal parts of components or solder joints of the controller while it is switched on.**
- **Take extra care when connecting the main supply voltage to the board. Applying a voltage that is too high or has reversed polarity or applying the voltage to the wrong board terminals can damage the board. Do not connect or disconnect input power to the board while the power is switched on.**
- **Keep the LC-12 controller away from metal objects or conductive surfaces that might touch the boards and create short circuits with exposed solder joints and components of the boards. Install the controller in a protective enclosure.**
- **There are small SMD components on the backside of the controller board that can be easily mechanically damaged. Handle the controller board with care.**
- **When installing the controller in an enclosure make sure that there is sufficient space on all sides of the controller to allow unrestricted airflow and cooling.**

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1 Introduction

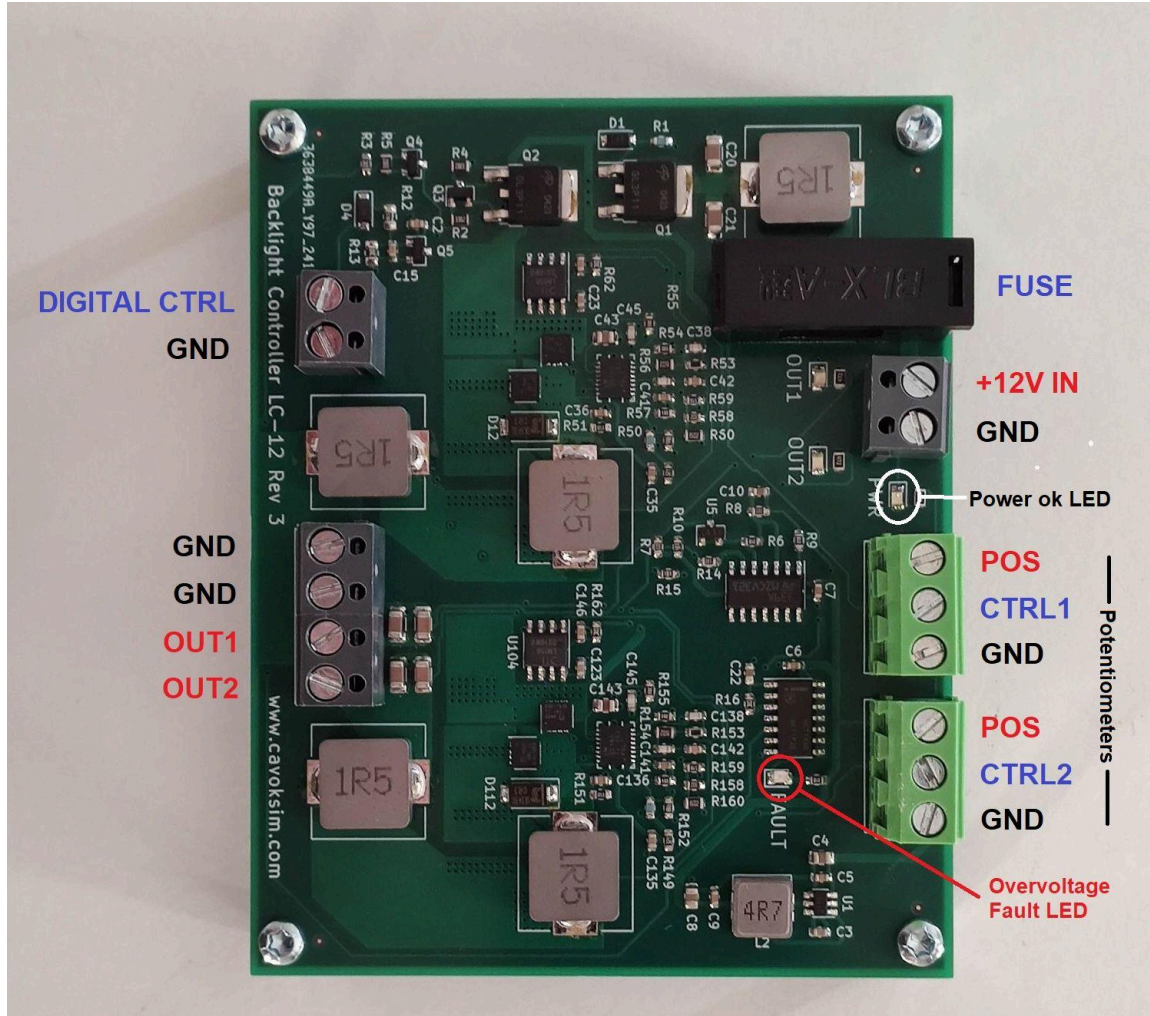
The LC-12 controller is a lighting dimmer that provides variable DC voltages between 0.2V and 5.1V to the backlight of Cockpit panels from an 12V input source. The LC-12 has two separate voltage outputs which are rated for 6A each and can individually be controlled. That makes it ideal for A320 FCU backlighting.

The LC-12 controller provides a high quality low EMI filtered DC output voltage that will not cause any interference with Arinc components. The output voltage can be changed with an external potentiometer. The controller can directly be connected to the potentiometers of cockpit dimming control panels.

2 Features of the LC-12 controller

- High efficiency modern Texas Instruments converter chips
- Robust design for cool operation and long life
- Efficiency more than 90% for low losses and cool operation.
- Silent operation. No fan cooling required
- Protections against reverse input voltage, overload and over temperature
- Dedicated voltage protection circuit to protect the connected cockpit panels from damage in case of a malfunction of a main voltage converter
- 2x6A rated continuous output current capacity
- Filtered low noise DC output to avoid interference problems
- Fully compatible with Airbus panel dimming control potentiometers
- Digital power On/Off control input compatible with microcontrollers

3 Controller overview



Board overview

4 Quickstart guide

Connect a 12V supply to the LC-12. Check the correct polarity according to the diagram and the printing on the back of the LC-12 board. Verify that the polarity is correct. Do not switch the supply power on until the board is fully connected.

The output voltage of each of the 2 channels is controlled by external potentiometers. These potentiometers are usually installed in an Airbus cockpit panel. The standard value for these potentiometers is 470 Ohm. Other potentiometers between 470 Ohm and 10k can also be connected to the CTRL inputs. The output voltage can then be varied between approximately 0.2V and 5.1V. These are the same voltages as the ones used in real aircraft.

Connect 2 potentiometers to the CTRL1 and CTRL2 inputs. The CTRL input terminal has to be connected to the wiper contact of the potentiometers. The other 2 potentiometer contacts have to be connected to the GND and POS terminals. If the polarity of the contacts is reversed, the brightness will increase when turning the potentiometer counterclockwise instead of clockwise. In this case just reverse the connection of POS and GND.

Do not leave potentiometer CTRL inputs unconnected.

If you don't have the potentiometers yet and just want to test the board, connect the CTRL terminals to the POS terminals. This will cause a full brightness output. If you use only one of the 2 outputs, connect the CTRL input of the unused channel to GND.

The load is connected to GND and OUT1/2. The maximum rated current per channel is 6A. It is recommended to use AWG14/2.5mm² wires to minimize the voltage loss. The wires should not be longer than necessary.

The Digital shutdown CTRL input can stay unconnected if not required.

After switching the supply voltage on the green PWR LED should illuminate. The Green OU1 and OUT2 will vary in brightness depending on the output voltage of the respective channel.

5 Required power supply

The LC-12 controller is designed to be supplied from a 12V power supply. The input voltage range can be between 11.7V and 14V.

The LC-12 controller has an efficiency of approximately 90% at the rated power output of 2x30W. Therefore the minimum rated input power must be 70W for full load.

In real life, there should be some additional margin because the overload protection of the power supply might trigger early and also the advertised power output of cheap consumer power supplies is often only the short term peak maximum output. The maximum continuous load is usually only 80% of the advertised rating.

Therefore a minimum input power supply of 100W per LC-12 controller is recommended.

6 Installation

The LC-12 controller should be installed in a protective enclosure. Ensure sufficient ventilation and check that the temperature inside the enclosure does not exceed 35°C.

The LC-12 can be bolted to an enclosure with M3 screws.

The output of the LC-12 has low EMI and voltage ripple to minimize interference. However the LC-12 itself is a high frequency switch mode power supply that generates a large amount of EMI in its close proximity. To protect your avionics from interference, keep as much distance as feasible between the LC-12 and any sensitive avionics, Arinc 429 connection wires and Arinc 429 interface boards. A minimum distance of 1.5m is recommended.

The EMI emission of the LC-12 can be greatly reduced by installing the controller in a metal enclosure and grounding that enclosure (to the same ground used by the controllers power supply). However, openings for ventilation are required. The cooling airflow from and towards the cooling fan should be unrestricted on all sides. Make sure that any metal enclosure is not touching any conductive parts of the controller.

7 Load current

The maximum output current will be reached when the brightness is set to maximum (5.1V output voltage). The LC-12 controller is designed for a continuous load of 2x 6A. If the current is increased to about 7A on a channel the overcurrent protection becomes active and switches the output off.

In case of short circuit a separate short circuit protection will be triggered and switches the power off within a few microseconds to protect the power transistors from damage.

To make sure that the controller is not overloaded, it is recommended to measure the current to each connected panel separately with an ammeter at full brightness during installation.

Because of the high current AWG14 or 2.5mm² size wires are recommended for the outputs with a wire length of less than 3m. Thinner and/or longer wires will work too, but because of their higher resistance they will be heating up slightly and there will be a voltage drop along the wires. That means that the full voltage will not reach the panels anymore and they can not illuminate with maximum brightness.

If the LC-12 is used for the Airbus K217 FCU, the combined load for both channels is less than 5A which is significantly lower than the maximum allowed current.

8 Digital control input

The LC-12 can be switched Off by applying a positive digital signal to the SHUTDOWN SIGNAL CTRL input. This can be useful to simulate lighting power failures controlled by the simulator software.

This input signal can be in the range of 3V-5V and is therefore compatible with both 3V and 5V logic chips. The input can be directly connected to a microcontroller output. There is no driver circuit necessary.

9 Protections

Overvoltage Protection

The controller has a separate voltage monitor circuit that is independent of the main voltage regulators. If an overvoltage of more than 5.6V is detected on either channel, the overvoltage protection is triggered. The red LED FAULT light will illuminate and the output power of both channels will be switched off immediately. To reset the protection, switch the power supply off and back on after a few seconds. Triggering this protection is not normal. If it happens repeatedly the board might be defective.

Overcurrent protection

At approximately 7A the overcurrent protection of a channel is triggered. Output power is switched off. To reset, remove the load of the channel.

Short circuit protection

This protection removes power immediately in case of a short circuit to protect the power transistors.

Overtemperature protection

The board has integrated over temperature protection that will switch the output off when an abnormal high internal temperature is detected. However, operating the board at high temperature for a prolonged time will reduce its lifespan. Ensure sufficient cooling and do not overload the board.

Reverse input polarity protection

The board has an advanced reverse polarity protection using MOSFET. Reverse polarity should not damage the board or blow the fuse. However, this is not guaranteed to prevent damage to the controller in all cases. Therefore make sure the power supply is correctly wired to the LC-12 before switching it on.

Fuses

The LC-12 has a 7 Amp F7A glass fuse

10 Technical Specifications*

Converter type:	2 Texas Instruments synchronous buck converters
Converter efficiency:	>90%
Switching frequency:	750kHz
Input voltage:	12V nominal, range 11.7V-14V DC
Output voltage range:	0.2V-5.1V DC
Output voltage ripple (at rated load):	<10mV
Max. environment temp:	35°C
Min. input power supply rating:	100W recommended for rated load
Dimensions	100x80x30mm
Weight	0.1kg
Rated continuous output power:	60W
Rated continuous current:	2x 6A
Fuses:	1x 5x20mm glass fuse F7A for input

*** all given specifications are typical values and can change without prior notice**