Lighting Controller
LC-25

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.

Precautions

- **Protect the LC-25 controller from moisture.**
- **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-25 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.**

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1 Introduction

The LC-25 controller is a lighting dimmer that provides a regulated DC voltage of approximately 1V to 5V to the backlight of Cockpit panels from an 12V input source.

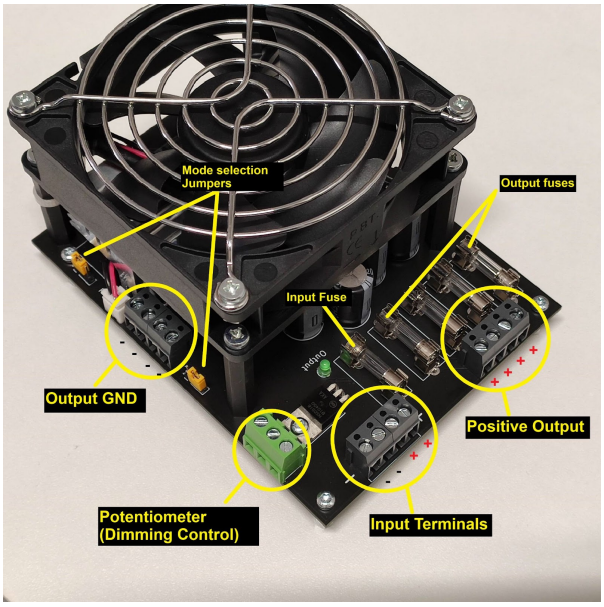
Simple PWM dimmer boards have often been used in home simulators for this purpose. Apart from not providing any protections, these boards have caused many problems due to the high amount of electromagnetic noise and interference that they generate. PWM noise can especially interfere with Arinc 429 communication of cockpit devices. The LC-25 controller on the other hand provides a clean filtered DC output voltage that will not cause any interference with Arinc components.

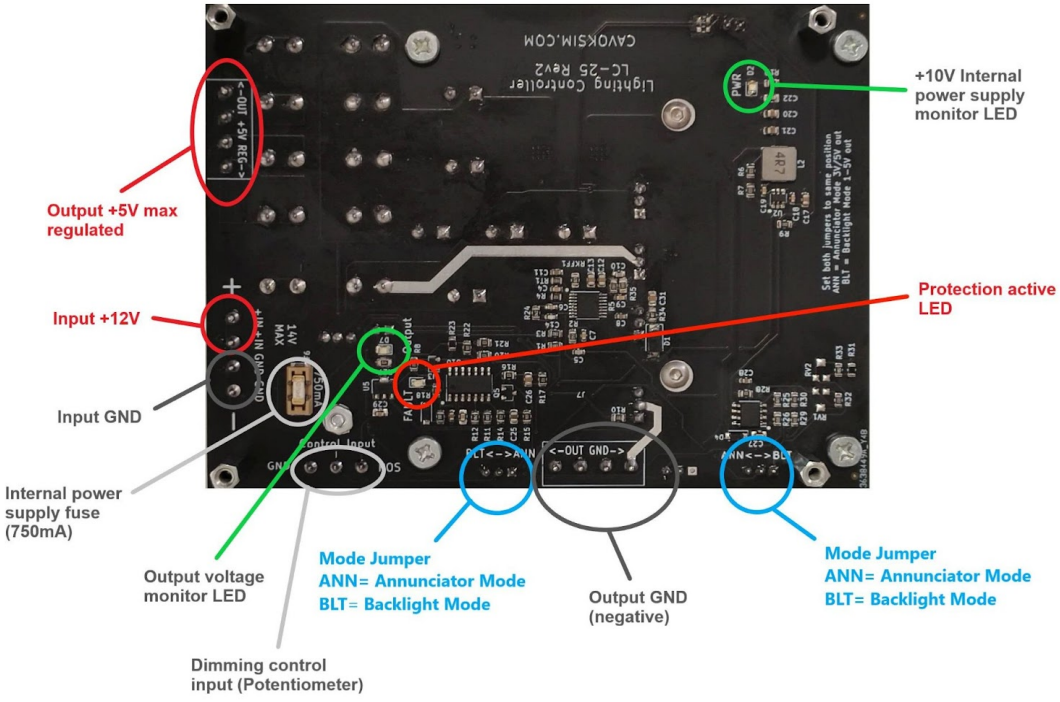
Alternatively the LC-25 controller can also be used to power Korry type panels switches. In this mode, it provides either 3V or 5V fixed output voltage for the DIM and BRIGHT position. The mode of the controller (Backlight or Korry mode) can be selected with jumpers. Both modes can not be used at the same time.

2 Features of the LC-25 controller

- Modern high efficiency design with high quality components
- Robust design for cool operation and long life
- Large low noise fan
- Protections against reverse input voltage, overload and over temperature
- Independent over voltage protection to protect the connected cockpit panels from damage in case of a malfunction of the main controller
- 26A rated continuous output current capacity
- Filtered low noise DC output to avoid interference problems
- Soft Start function to extend bulb life
- Fully compatible with Airbus panel dimming control potentiometers

3 Controller overview





4 Controller wiring diagrams

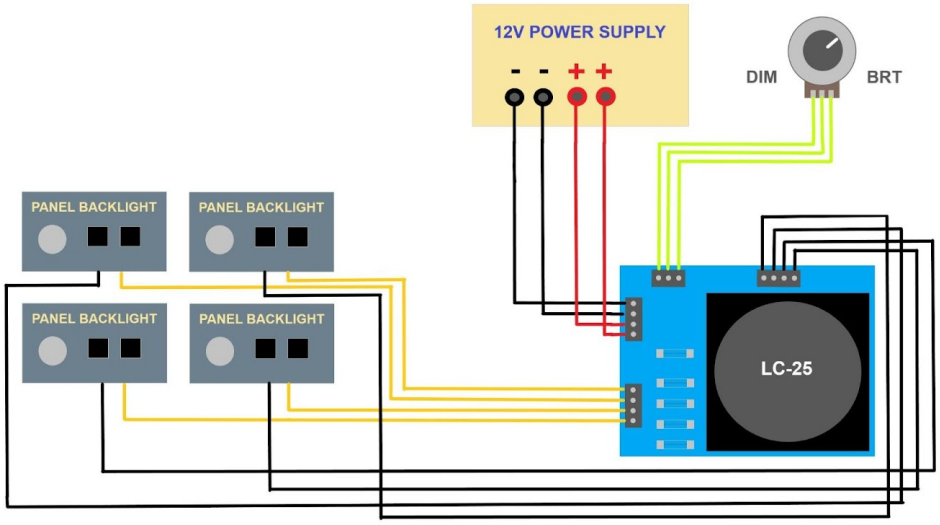


Figure 1- Wiring example for a single controller

The number and connections of the panels in this wiring diagram are just an example. More panels can be wired in parallel to any output as long as the current per out terminal is below 8A and the total current per controller is not greater than 26A. All terminals of the outputs are wired in parallel on the controller. Therefore any panel can be connected to any output terminal as long as the currents are within limits.

If the direction is reversed when turning the potentiometer (lights brighter when turning counterclockwise instead of clockwise), swap the POS and GND connections to the potentiometer.

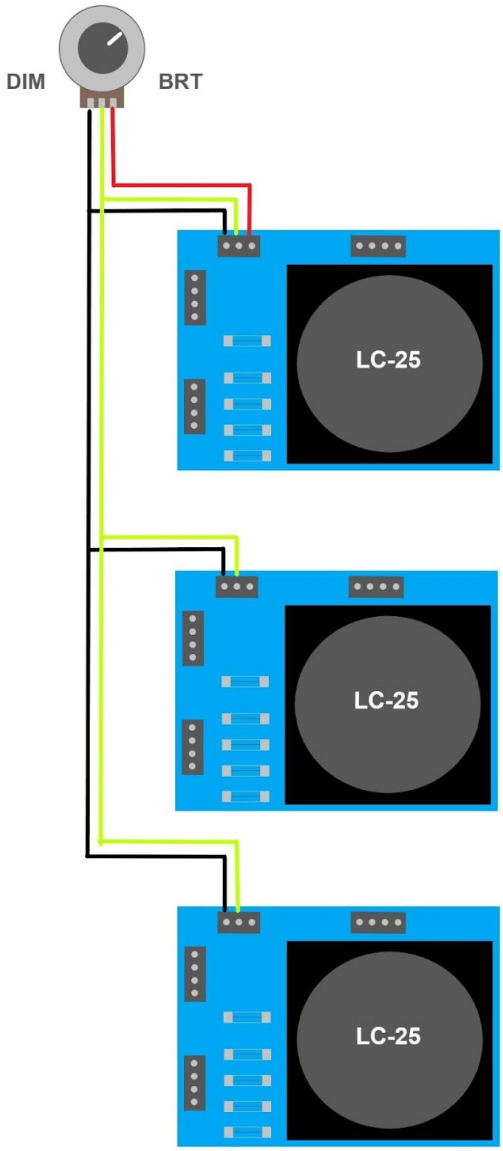


Figure 2- Connecting the same potentiometer to several controllers

This diagram shows only the wiring of a single potentiometer to multiple controllers for brightness control. For clarity the rest of the wiring is not shown. If multiple controllers share the same potentiometer input, they must also be powered by the same 12V power supply.

Mode Jumpers

The LC-25 controller can operate in two brightness control modes that can be selected by jumpers:

Backlight Mode (BLT):
The Controller output voltage is controlled by an external potentiometer. This potentiometer is usually installed in the Airbus panel. The standard value for these potentiometers is 470 Ohm. Other potentiometers between 470 Ohm and 1k can also be connected to the control input. The voltage will be varied between approximately 1.4V and 5.1V. These are exactly the same voltages as the ones used in the real aircraft. If more than one LC-25 controller is controlled by the same potentiometer, wire the “Control Input” and “GND” inputs of the dimming control terminals in parallel (see Chapter 4 Figure 2). Do not wire the POS control input terminal in parallel.

Annunciator Mode (ANN):
The Controller output voltage can be either 3V (Dim position) or 5V (Bright position). A switch has to be connected to the dimming control input instead of a potentiometer. When the Control input terminal (labeled on the PCB) is connected to GND, Dim mode is selected. If not, Bright mode is active.

Both Jumpers always have to be in the same position, meaning if jumper1 is set to BLT, jumper 2 has to be set to BLT too. Mixing of modes is not possible.

Protection LED

If the overtemp/overvoltage/overload protection is triggered, the LED FAULT light will illuminate red and the output power will be switched off. To reset the protection, switch the power supply off, wait until the red LED is off. Then switch the power back on after an additional 5 seconds.

5 Required power supply

The LC-25 controller is designed to be supplied from a 12V power supply. The input voltage range can be between 11.7V and 14V.

The LC-25 controller has an efficiency of approximately 80% at the rated power output of 130W. Therefore the minimum rated input power must be 162W per controller.

In real life, there should be some 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.

A320 series cockpit panels use almost exclusively incandescent light bulbs for backlight and require a substantial amount of power for the whole cockpit.

Therefore a minimum input power supply of 200W per LC-25 controller is recommended. To power the backlight of a full A320 cockpit at least 3 LC-25 controllers and a minimum 600W 12V power supply is recommended.

6 Installation

The LC-25 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-25 can be bolted to an enclosure with M3 screws. The 4 mounting standoffs are arranged in a rectangular shape of the size 90mm x 112mm.

The output of the LC-25 has low EMI and voltage ripple to minimize interference. However the LC-25 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-25 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-25 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. Make sure that any metal enclosure is not touching any conductive parts of the controller.

7 Load current

The maximum output current will flow when the brightness is set to maximum (5V output voltage). The LC-25 controller is designed for a continuous load of 26A. The maximum load is 28A. If the current is increased to 30A 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. Then add up all connected load currents and check that the sum does not exceed 26A per controller.

The LC-25 controller has 4 separate output terminals with separate fuses. The purpose of the 4 terminals is to distribute the high output current to 4 separate wires and to reduce the load of individual wires and terminals. The load should be distributed as evenly as possible to each of the 4 outputs. Each of the 4 outputs is protected by a 10A fuse. The purpose of the fuses is to protect the connected wires from overheating and fire in case of a short circuit.

Light bulbs have a significantly (10 times!) lower resistance and higher current flow when they are switched off and cold. Connecting an additional light panel to the controller while it is already switched on can trigger the overcurrent protection due to the low cold state resistance of the additional panel. It is therefore not recommended to connect load to the LC-25 while it is powered on.

Do not connect more than 10A of load to a single output terminal.

Because of the high current AWG14 or 2.0mm² 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. The maximum input current is around 15A. Recommended size for the input wires is 4x AWG16 or 2x AWG 14.

Here are some examples of the approximate backlight current for A320 cockpit panels at maximum brightness for your reference:

Flight control unit (FCU) type K217AB:	4.6A
Electric control panel 35VU:	3.9A
Right Wiper/Cargo/Ventilation panel 22VU:	2.5A

8 Protections

Overcurrent protection
At approximately 30A the overload protection is triggered. Output power is switched off and the red FAULT LED on the back of the controller illuminates. To reset, remove the overload condition and then switch the power off for at least 5 seconds.

Short circuit protection
This protection removes power immediately in case of a short circuit to protect the power transistors. Once the short circuit is removed, output power is switched back on automatically after a 5 second delay.

Overtemperature protection
The temperature of the power transistors is monitored. If the transistors overheat, the FAULT light illuminates and output power is switched off. This protection might not prevent overheat damage in all cases. Therefore ensure sufficient airflow for cooling the device.

Overvoltage protection
The controller has a separate voltage monitor circuit that is independent of the main voltage regulator. In case that the output voltage increases to 6V the protection triggers and switches the output off to protect the connected cockpit panels from damage. To reset the protection the power has to be removed for at least 5 seconds.

Reverse input polarity protection
In case that the input voltage has the wrong polarity, the board protection will short circuit the input. This in turn will either trigger the over current protection of the power supply and switch it off or it will blow the 25A input fuse of the LC-25 board. In both cases the controller will be protected from damage. This is only a “last line of defense” protection. It is not guaranteed that it can prevent damage to the controller in all cases. Therefore make sure the power supply is correctly wired before switching it on.

Fuses
The controller has a F25A glass fuse for the input and four F10A glass fuses for the outputs.

IMPORTANT:
The output GND of the controller is switched and not directly connected to the input GND. The overvoltage/overload/overtemperature protection works by disconnecting the output GND to interrupt the output current flow. The output positive side stays connected. That means it is important to connect the light panels to the switched GND according to the wiring diagram.

9 Technical Specifications*

Converter type:	Synchronous buck converter
Switching frequency:	132kHz typical
Input voltage:	12V nominal, range 11.7V-14V DC
Output voltage range:	1.4V-5.1V DC typical
Output voltage ripple (at rated load):	<50mV
Max. environment temp:	35°C
Min. input power supply rating:	200W recommended
Dimensions	130x100x80mm
Weight	0.4kg
Rated continuous output power:	130W
Rated continuous current:	26A
Max. output power:	150W
Max. current:	30A
Fuses:	1x 5x20mm glass fuse F25A for input
	4x 5x20mm glass fuse F10A for outputs

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