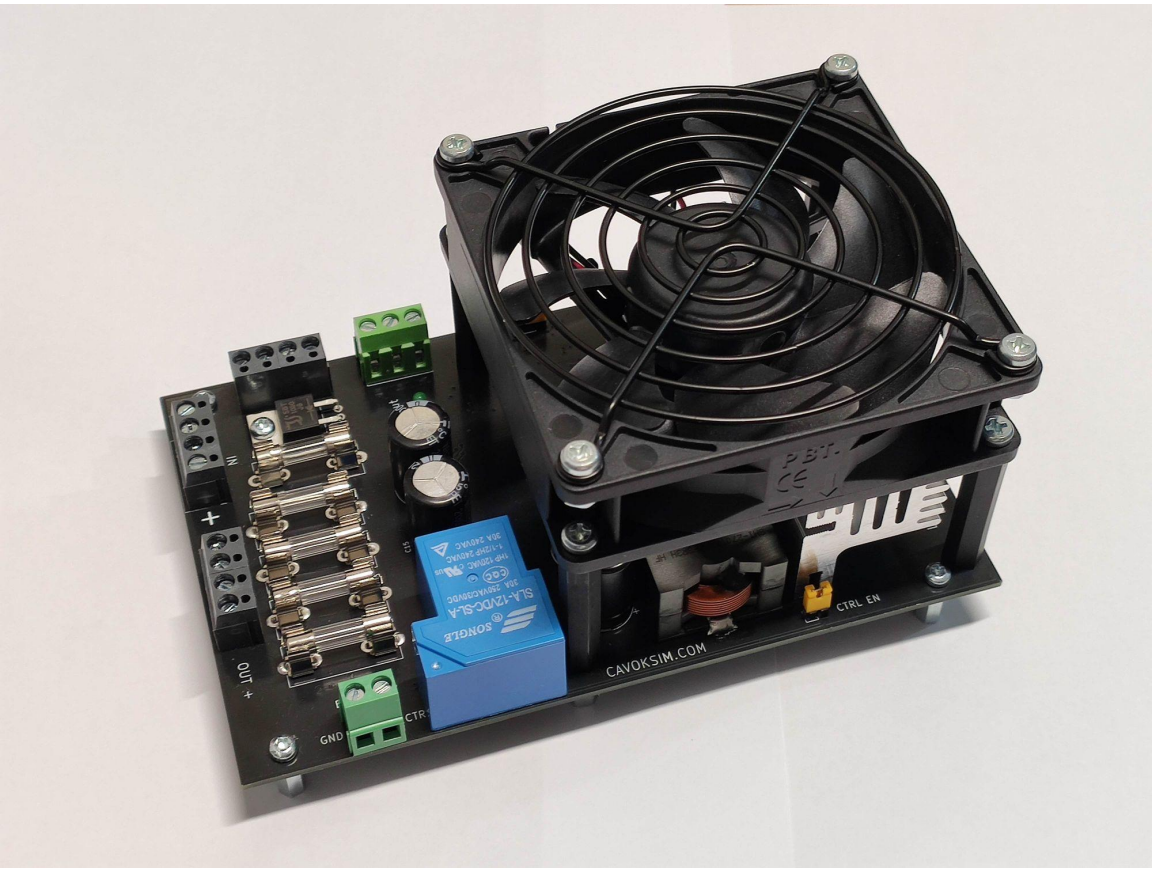
CAVOK Simulations

Lighting Controller
LC-25B



User Manual

Rev 2.1 12/2023

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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.

Important Precautions

- **Protect the LC-25B controller from moisture and high humidity. Moisture can cause malfunctions of the LC-25B. 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-25B 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-25B 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.

The LC-25B controller provides a clean filtered DC output voltage that will not cause any interference with Arinc components.

In its normal backlight mode, the controller provides an output voltage between approx. 1.5V and 5.1V. The output voltage can be changed between these levels with an external potentiometer. The controller can directly be connected to the potentiometers of cockpit dimming control panels.

Alternatively the LC-25B controller can also be used for dimming of Korry type annunciator switches. In this mode, it provides either 3V or 5V output voltage for the DIM and BRIGHT position of the cockpit switch brightness control. It is possible to adjust the output voltage for both BRIGHT and DIM position as required.

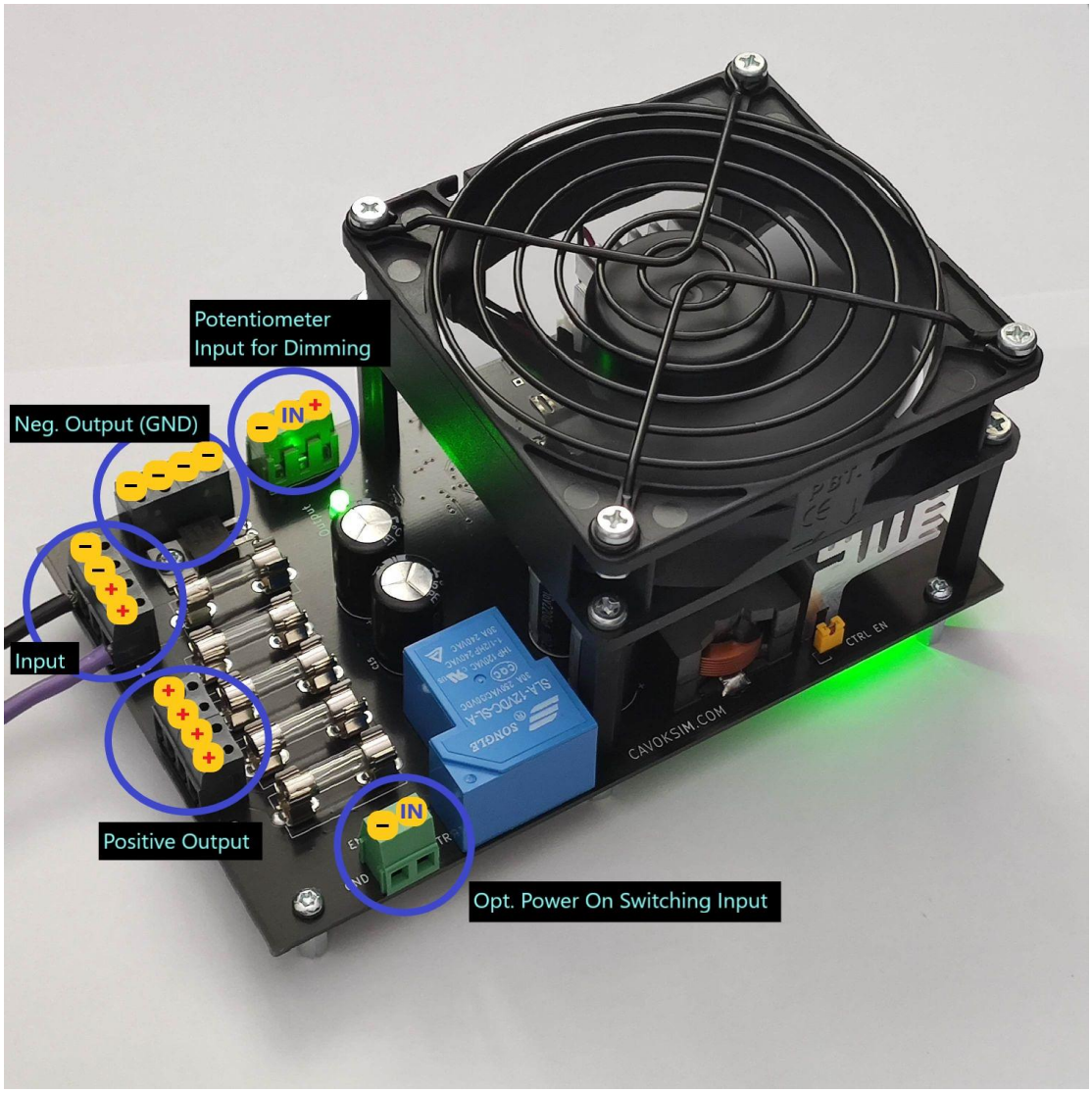
The mode of the controller (Backlight or Annunciator mode) can be selected with jumpers. Both modes can not be used at the same time.

2 Features of the LC-25B controller

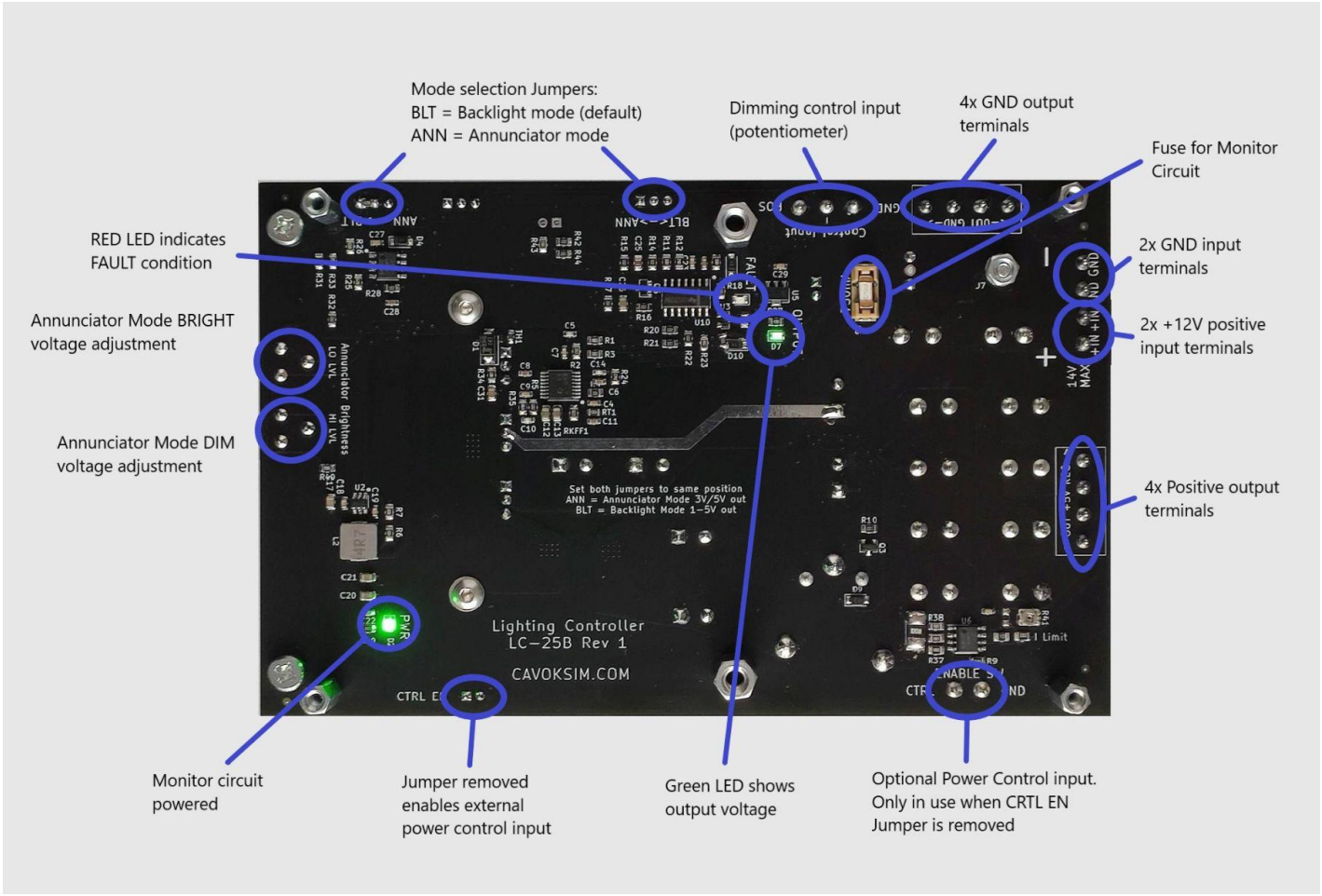
- Modern high efficiency design with high quality components
- Robust design for cool operation and long life
- Large low noise fan
- Protections against reverse input voltage, overload and over temperature
- Independent over voltage protection to protect the connected cockpit panels from damage in case 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

- adjustable output voltage in annunciator mode
- separate low current switching control input to simulate power failures

3 Controller overview



Terminal connectors


Mode selection Jumpers:
BLT = Backlight mode (default)
ANN = Annunciator mode
Dimming control input (potentiometer)
4x GND output terminals
Fuse for Monitor Circuit
RED LED indicates FAULT condition
2x GND input terminals
Annunciator Mode BRIGHT voltage adjustment
2x +12V positive input terminals
Annunciator Mode DIM voltage adjustment
4x Positive output terminals
Set both jumpers to same position
ANN = Annunciator Mode 3V/5V out
BLT = Backlight Mode 1-5V out
Lighting Controller
LC-25B Rev 1
CAVOKSIM.COM
Monitor circuit powered
Jumper removed enables external power control input
Green LED shows output voltage
Optional Power Control input. Only in use when CRTL EN Jumper is removed

Backside

4 Backlight mode

In backlight mode (default mode) the controller output voltage is controlled by an external potentiometer. This potentiometer is 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 control input. The output voltage can then be varied between approximately 1.4V and 5.1V. These are exactly the same voltages as the ones used in the real aircraft.

In this mode a potentiometer has to be connected to the controller. In case that there is no potentiometer connected, the controller switches off and the output voltage is zero.

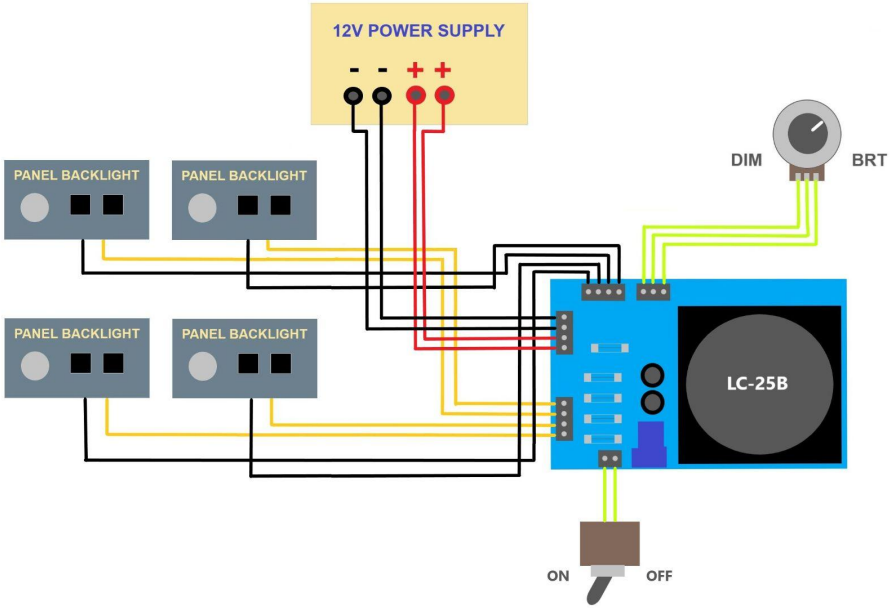


Figure 1- Wiring example for a single controller

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 of the potentiometer.

The ON-OFF switch shown in the diagram is optional. If you want to connect this switch the control input has to be enabled first by removing the yellow jumper labeled ‘CTRL EN’.

If more than one LC-25B controller is controlled by the same potentiometer, wire the “Control Input” and “GND” inputs of the dimming control terminals in parallel (see diagram below). Do not wire the POS control input terminal (red wire) in parallel.

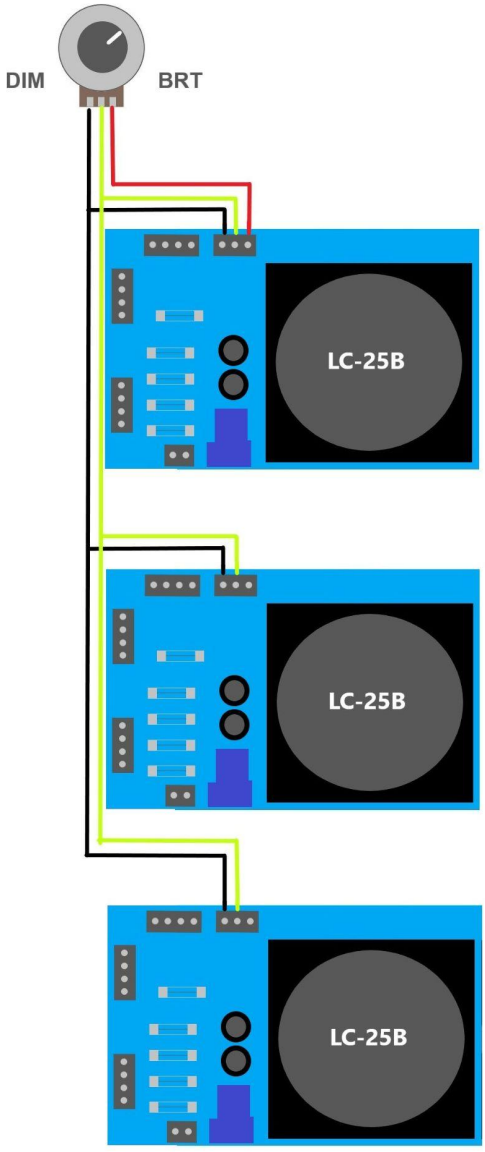


Figure 2- Connecting the same potentiometer to several controllers

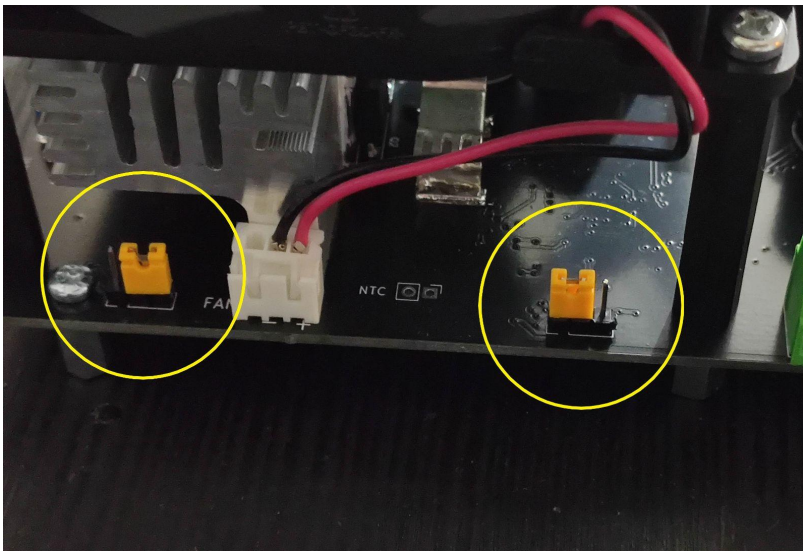
This diagram shows only the wiring of a single potentiometer to multiple controllers for brightness control. For clarity the rest of the wiring is not shown. If multiple controllers share the same potentiometer input, they must also be powered by the same 12V power supply.

5 Annunciator mode

In annunciator mode the output voltage/brightness level can be switched by an external signal to output 2 predefined voltages. The controller can then supply power for panel annunciator lights (“Korry switches”) in DIM and BRIGHT mode.

Activating the Annunciator mode

The default mode of the controller is backlight mode. To switch to annunciator mode 2 jumpers have to be changed from ‘BLT’ to ‘ANN” position. This positions are marked on the backside of the controller board and are shown below:

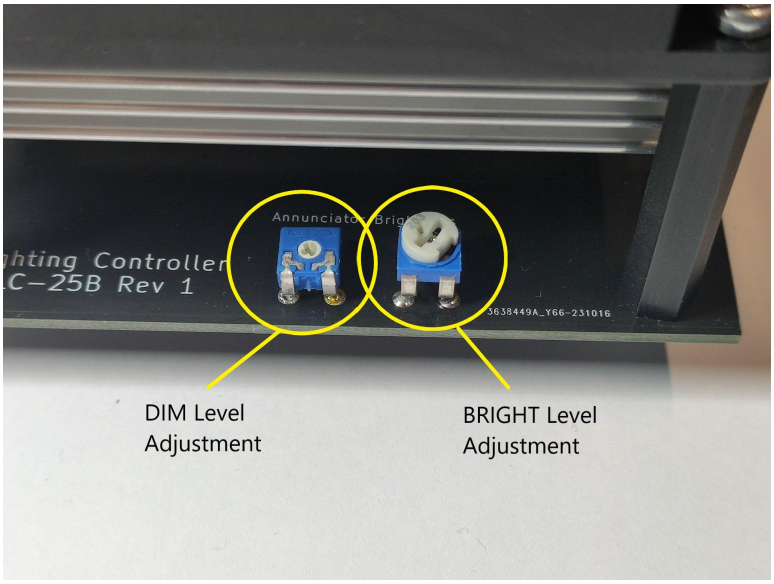


Mode jumpers are shown set to Annunciator mode position.

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

DIM/BRIGHT voltage adjustment

The Controller output voltage can be either approximately 3.3V (Dim position) or 5.0V (Bright position). The voltage for bright and dim level can be adjusted with 2 trim potentiometers by appr. +/-0.4V. Changing the DIM setting will also change the BRIGHT setting. It means that when changing the DIM setting first the BRIGHT must always be readjusted next.



In the real aircraft, the DIM/BRIGHT voltage is fixed at appr. 3.0V and 5.0V. However, 400Hz AC voltage is used, not DC. There are several reasons why it could be desirable to adjust the brightness levels for simulator use:

Modern type LED “Korry” switches produce different brightness levels when supplied with DC voltage compared to AC. Depending on manufacturer and type they can be very dim at 3.0V. It could then be necessary to increase the DIM level voltage. The BRIGHT setting of 5.0V is however designed to make the annunciators readable in bright sunlight in a real aircraft. In a simulator there is no sunlight, so it might be desirable to reduce the BRIGHT setting a little. This also increases the bulb life.

Changing between DIM and BRIGHT level

A switch has to be connected to the dimming control input instead of a potentiometer. This switch will normally be the ANN LT switch of the Airbus overhead panel. When the Control input terminal (labeled on the PCB) is connected to GND, Dim mode is selected. If not, Bright mode is active.

6 Required power supply

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

The LC-25B 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 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.

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

7 Installation

The LC-25B 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-25B can be bolted to an enclosure with M3 and M4 screws. 2 M4 screws are included with the controller.

The output of the LC-25B has low EMI and voltage ripple to minimize interference. However the LC-25B 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-25B 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-25B 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.

8 Load current

The maximum output current will flow when the brightness is set to maximum (5V output voltage). The LC-25B controller is designed for a continuous load of 26A. If the current is increased to above 27A 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-25B 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-25B 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

9 Protections

Protection LED

If the overtemp/overvoltage/overload protection is triggered, the red LED FAULT light will illuminate and the output power will be switched off. To reset the protection, switch the power supply off, wait until the LED is off. Then switch the power back on after an additional 10 seconds.

Overcurrent protection

At approximately 27-28A the overcurrent 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 10 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 of 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.

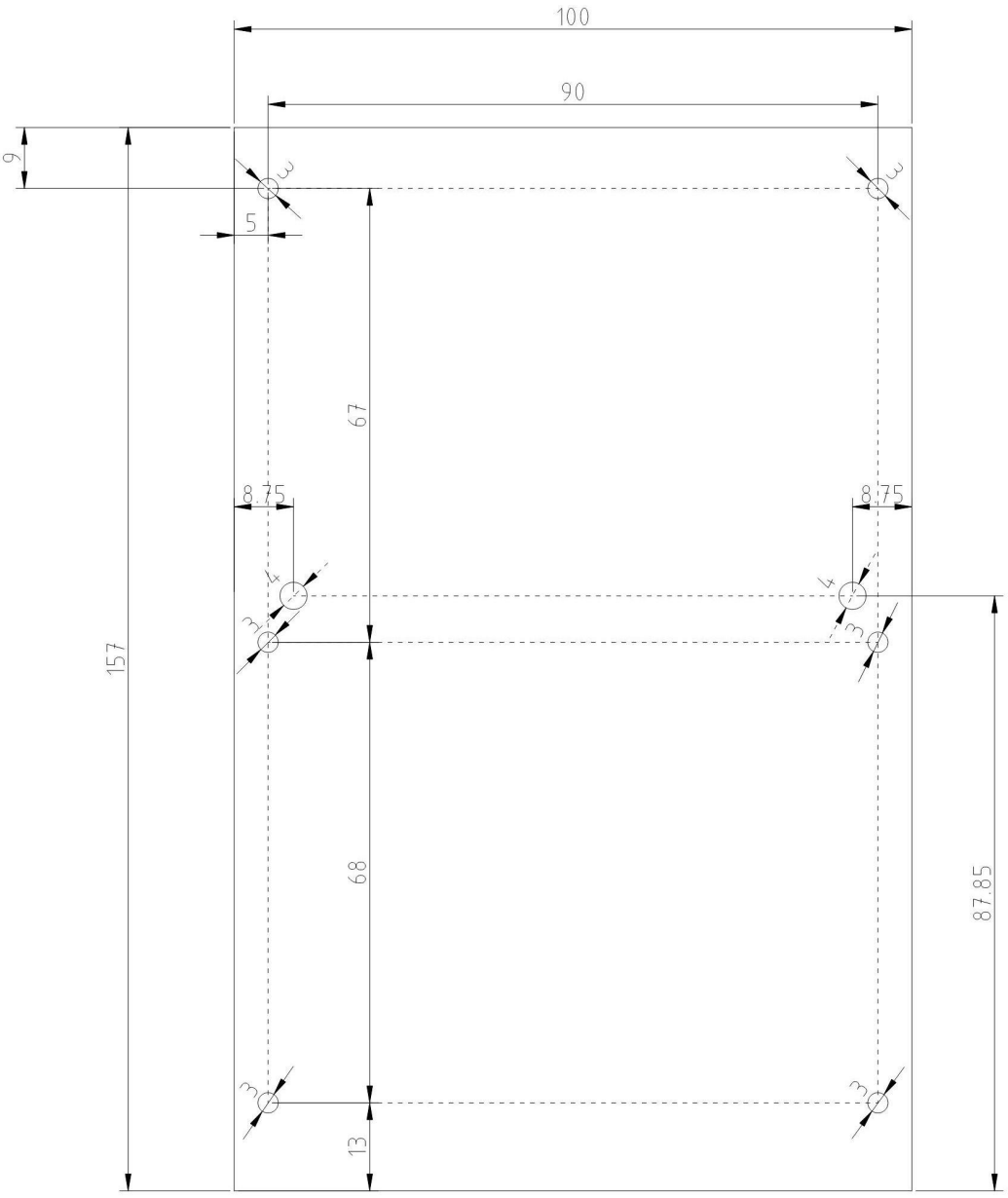
Reverse input polarity protection

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-25B 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.

10 Mounting points technical drawing



11 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	175x100x80mm
Weight	0.5kg
Rated continuous output power:	130W
Rated continuous current:	26A
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**