



ELECTROMECHANICAL TRIM TAB SYSTEMS

Automatic Leveling Control Manual



Linear Devices Corporation
dba Lectrotab
11126 Air Park Road, Suite G
Ashland, VA 23005

www.lectrotab.com
Phone: 804-368-8428
Fax: 804-368-8438

Table of Contents

- Introduction.....3
- Safety.....3
- How Do Trim Tabs Work.....4
- Operational Overview.....5
- Display Panel Installation.....6
- Wiring Connections.....7
- Display Control Calibration ALC-1.....8
- Display Settings/Operation.....9
- Troubleshooting.....10
- Specifications.....10

Introduction

Lectrotab introduces an automatic leveling control system to maintain the boat on a level plane and ensure a comfortable ride. If sea conditions change, adjustments in boat speed occur, or passengers move about the boat, the automatic leveling control system utilizes built in sensors to correct the attitude of the boat to maintain the proper level. The control incorporates advanced programming to correctly level boats 20 foot or larger.

The Lectrotab automatic leveling control (ALC) design advantages and features include:

- Improved fuel efficiency and faster speeds
- Internal GPS (does not require connection to GPS antenna)
- Actuators connect directly to display (ALC-1 for single actuator system does not require a control box)
- Faster planing at slower speeds
- Automatic correction of bow high conditions or listing
- Automatic tab retraction once boat is docked or optional connection to ignition key switched off
- Automatic corrections while turning are ignored
- Completely sealed and waterproof display
- Automatic dimming of display LED indicators in darkness and brighten in sun light
- Operates on 10 to 30 Volts DC
- 2 Year Warranty
- CE Approved (Compliance with EMC regulations)

Safety

- Failure to follow all instructions listed in this manual may result in equipment failure or serious injury.
- If using trim tabs for the first time, follow the Operation section of this manual to familiarize yourself with the feel and response of your trim tab system.
- Never deploy tabs in a following sea. Keep tabs fully retracted in a following sea.
- Never deploy tabs quickly at high speeds or above cruising speeds. This may cause the boat to turn quickly and become unstable and difficult to control.
- Stay alert, watch what you are doing and use common sense when operating your trim tab system.
- Do not use the trim tab system when under the influence of drugs, alcohol or medication. A moment of inattention while operating the trim tab system may result in serious injury.

How Do Trim Tabs Work

Boaters will enjoy many performance and efficiency benefits by adding Lectrotab trim tabs. Lectrotab trim tabs improve fuel efficiency, increase boat speed, accelerate shallow water planing, eliminate porpoising, and enhance the overall boating experience with a more comfortable ride.

- **Improved Fuel Efficiency and Faster Speeds**

Most importantly, the trim tabs may be adjusted to optimize speed and fuel efficiency. Typically, the bow rides high causing the stern to drag in the water at cruising or lower speeds. A boat owner will attempt to correct this problem by trimming his outdrive down to bring the bow down. This adjustment is extremely inefficient and reduces boat speed and increases fuel consumption, because trimming of the outdrive pushes water down to allow the transom to rise and bow to lower. In this scenario, the outdrive is not only propelling the boat forward but it is also pushing the bow down. The most efficient way to operate the boat is to adjust the tabs to maximize boat speed and level. The outdrive may then be adjusted so the prop shaft is parallel to the water to maximize the thrust to push the boat forward.

- **Faster Planing**

For shallow water starts, trim tabs allow the boat to get up on plane faster. Faster planing can be accomplished by lowering the tabs to the fully deployed position. As the boat achieves plane, trim tabs may be raised until the boat is level.

- **Porpoising**

Occasionally, an uneven load distribution or certain speeds will cause the boat to “porpoise”. This problem can easily be corrected by deploying both trim tabs simultaneously a few degrees until the “porpoising” stops.

- **Boat Leveling**

Every boat owner has experienced passengers or equipment moved to one side of the boat, which causes the boat to lean to one side and leads to difficulty in handling the boat as well as an uncomfortable ride. Adding trim tabs to a boat corrects this problem by deploying the tab on the same side as the boat is leaning towards which levels the boat for a more comfortable ride.

- **Head Sea**

Rough sea conditions can also be better managed with trim tabs. Typically in a head sea, the boat speed must be reduced causing the bow to ride high. The waves will pound and beat the boat bottom for an extremely uncomfortable and slow ride. Trim tabs can be deployed to level the boat out and allow the hull to cut through the waves for a smoother and more efficient ride.

- **A Beam Sea or Wind**

A beam sea or wind can lead to a wet ride. To greatly reduce or eliminate the spray caused by waves or wind hitting the boat side, the windward side trim tab may be deployed to raise the windward side of the boat. Also retracting the leeward trim tab side may help.

Operational Overview

- **Theory of operation:**

As loads shift in a boat or as sea and wind conditions change, trim tabs are an important enhancement for a boat to maintain a level boat and comfortable ride. The Lectrotab auto leveling control (ALC) will automatically sense changes in lateral or roll (port and starboard) and longitudinal (fore and aft) position and adjust the tabs to bring the boat level. When sea or wind conditions change, course changes, or passengers move around the boat, the ALC will automatically adjust the tabs to maintain a proper boat level, eliminating the need for constant trim tab adjustments from the helmsman.

- **Control disabled while turning or off plane:**

The auto leveling control is designed with built-in gyros to sense when a boat is turning and disables the control while in a turn or below planing speeds to prevent automatic corrections. The ALC automatically reverts back to Auto mode once a steady course is sensed or boat is on plane again. The AUTO indicator will flash while the boat is in a turn or below planing speeds.

- **Control configured for 20 foot or larger boats:**

The auto leveling control system may be configured for boats larger than 20 feet to effectively maintain the correct boat level. For vessels over 50' please contact Lectrotab for correct matching of ALC control to actuators and tabs.

- **Control adapts to varying sea conditions:**

In calm seas, a list condition is corrected faster than in rough seas. This allows for faster tab reaction when needed and avoids unnecessary tab adjustments in rough seas, which could cause a roll in high waves.

- **LED Position indicators:**

The display will show tab adjustments by lighting LED's downward for tab deployment and upward for tab retraction. While automatically adjusting the tabs, the LED indicator, adjacent to the one lit up, will flash to show adjustment direction.

- **Automatic and Manual modes:**

The auto leveling control may be switched from automatic to manual mode by pressing the AUTO button. The AUTO LED remains lit in automatic mode. In manual mode, the AUTO LED goes off. The top and bottom buttons can be pressed to manually control bow down and bow up respectively, and the left and right buttons can be pressed to manually correct boat listing or roll to bring the port side down (starboard side up) or starboard side down (port side up), respectively. The AUTO LED indicator flashes to indicate the boat is turning or is off plane, and the automatic control is disabled during this time.

- **Adjusting Gain for faster response time:**

The gain on the ALC can be adjusted for a faster response time to correct listing from starboard or port sides in the automatic mode. Review ALC programming section of this manual.

- **Automatic Tab Retraction:**

The trim tabs will automatically retract when the control senses the boat is off plane for a few minutes. Another option is to connect terminal 7 to the ignition key run position to automatically retract the tabs when the key is switched to OFF. Using this option only allows the tabs to retract when the key is switched to OFF.

Display Panel Installation ALC-1

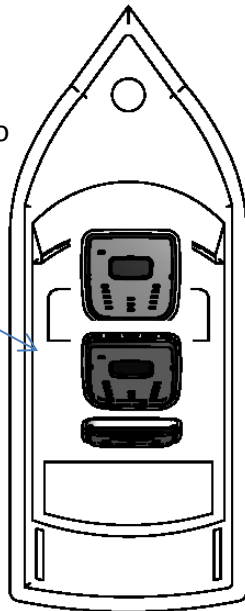
For ALC-1 (single actuator, single station display only)

- **Mounting Display Panel:**

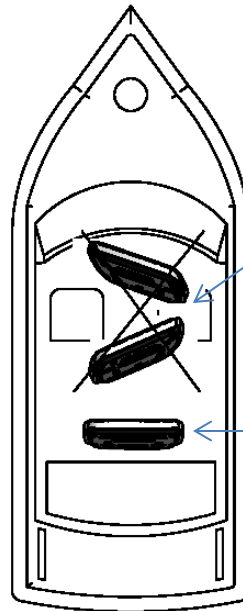
1. The ALC incorporates sensors that measure the boat's movement. The ALC display panel must be mounted on a flat surface which is perpendicular to a straight plane from stern to bow with the rear of display facing the bow in a vertical mounting or top of display facing bow in a flat mounting. The display may be mounted at angles between upright to a flat surface as shown below in the left diagram. The display should not be rotated at angles left to right as shown below in the right diagram top two configurations.
2. Locate the display panel at the helm where it is convenient to access and view the LED indicators.
3. The mounting hole diagram has two 3/16" (4.5mm) holes and one 2" (50mm) as shown below for the two mounting studs and display connector.
4. Mount the display with the washers and nuts provided.

Important: For retrofit installations, always disconnect the wires from the original control panel before connecting to the ACL. Switch off the main dc circuit breaker before starting the connection.

Mounting Display:
Correct position for mounting ALC display panel is from flat to vertical at any angles in between as shown.

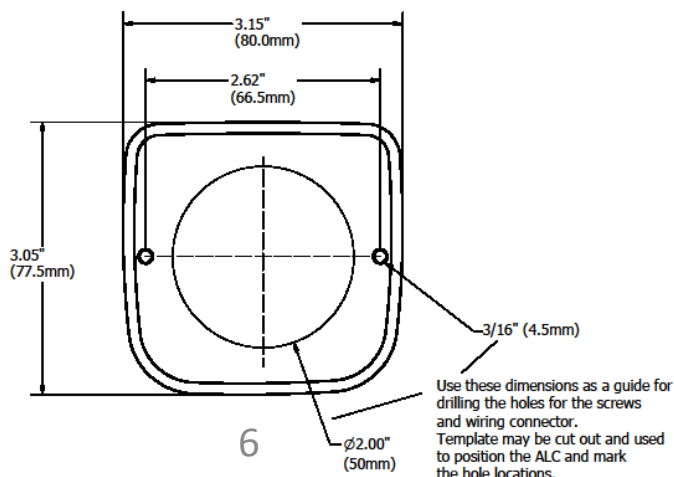


Incorrect Mounting: Do not mount ALC at angles as shown in top two configurations.



Correct Mounting

Do not use this example as a mounting template cutout (dimensional reference only). Display kit will include actual size template to use as a cutout.

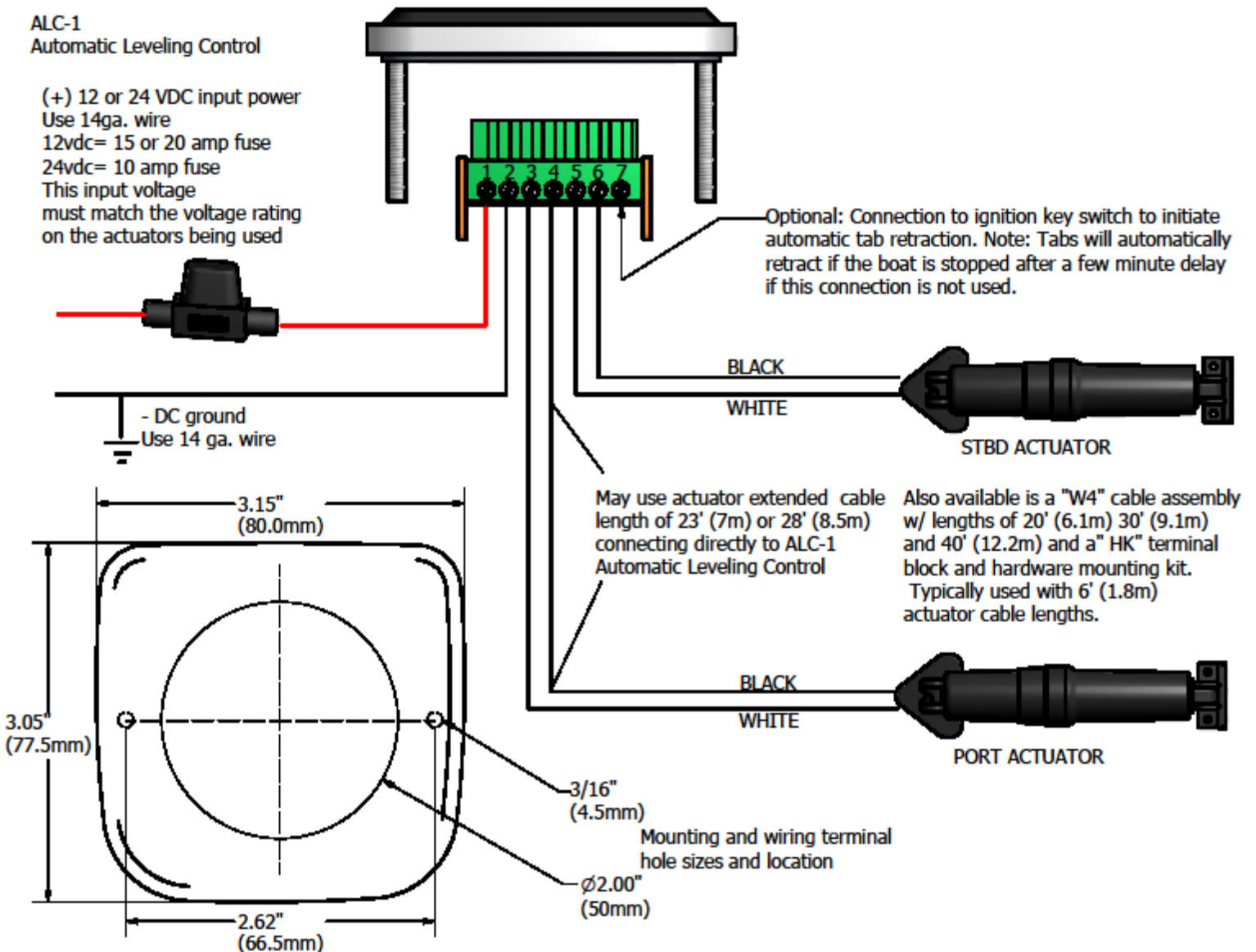


Wiring Connections ACL-1

For ALC-1 (single actuator, single station display only)

- **Wiring Display Panel:**

1. Refer to wiring diagram as shown below for the ACL-1 wiring connections.
2. The red (+12vdc or +24vdc) wire from the boat's fuse panel and black battery negative wires should be a minimum size of 14 AWG (2.5mm²).
3. **Important:** DC voltage source connected to ACL switch must match actuator voltage (first letter in actuator serial A, C or S =12vdc, B or D = 24vdc).
4. Optional: Terminal 7 may be connected to ignition key run position to automatically retract the tabs when key is switched to OFF. The tabs will automatically retract if this option is not used after the control senses the boat is off plane for a few minutes.



Display Control Calibration ALC-1

(Single actuator, Single station)

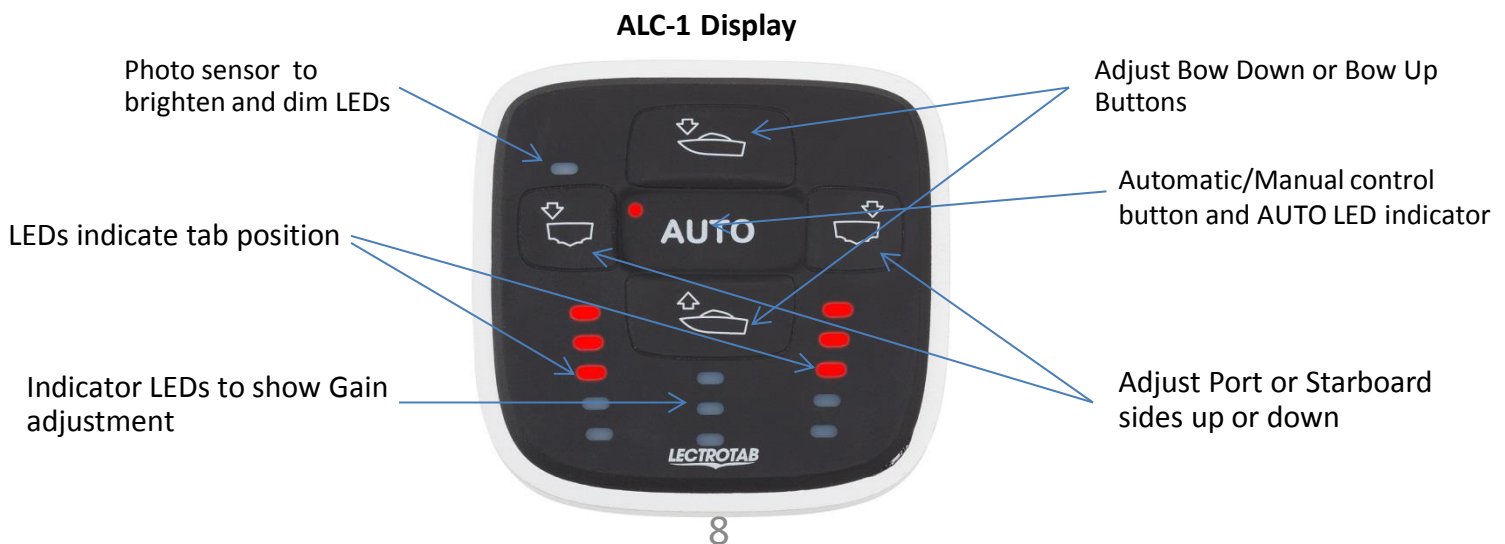
- **Calibrating the Display:**

For the automatic leveling system to function properly, the trim tab type, position and electrical current draw must be known. This information is automatically acquired and stored in memory during calibration.

1. Turn battery selector switch ON to apply supply voltage to ALC-1 display. If optional terminal 7 is used, turn the ignition key to the run position to activate the control.
2. The AUTO indicator should be blinking to indicate the device needs calibrating.
3. Press and hold the Bow Down (top button) and Bow Up (bottom button) simultaneously for 12 seconds while the control calibrates by running the trim tabs to the fully retracted and deployed positions. The calibration may take up to 60 seconds and should not be interrupted.
4. Once calibration is completed, the AUTO LED indicator will stop blinking. The port and starboard tab level LED indicators will now be lit. The port tab indicators will be shown on the left bar and starboard on the right bar.

- **Verify Connection and Operation:**

1. **IMPORTANT!** After calibration, verify the connection by pressing the buttons one by one and observing the trim tabs.
2. Press and hold the top button "Bow Down". Both trim tabs should deploy downwards.
3. Press and hold the bottom button "Bow Up". Both trim tabs should retract upwards.
4. If the tab or tabs are moving in the opposite direction as described, switch the two actuator wires from the actuator that moves in the wrong direction (move 3 to position 4 and 4 to position 3 for port actuator) at the 7 pin plug, and switch 5 and 6 in the same manner for the starboard actuator and repeat the testing process.
5. Press the left button "Port Down" and the port trim tab should retract upwards, and the starboard trim tab should deploy downwards.
6. Press the right button "Starboard Down" and the starboard trim tab should retract upwards, and the port trim tab should deploy downwards.
7. If the wrong tab is moving as described in step 5 and 6, exchange wires 3 and 4 with 5 and 6 at the green 7 pin plug and repeat the testing process.



ALC-1 Display Settings and Operation

- **Automatic Control Setting and Operation:**

After the installation, calibration and verification have been completed, take the boat for a test drive and store the correct level or attitude as described below.

1. Operate the boat at a typical cruising speed (not maximum speed). Manually adjust the trim tabs until the desired boat level or attitude is attained.
2. Once the proper attitude is achieved, at a typical cruising speed, press and hold the AUTO button for 4 seconds. Now, the desired attitude is stored in permanent memory. The indicator LED to the left of the AUTO text is lit, and the auto leveling control is set in automatic mode.
3. **Fine Adjustment:** In AUTO mode, the desired attitude can be fine tuned by pressing any of the four buttons. Pressing the “Starboard Down” button once sets the boat .5 degrees to starboard. Pressing the top “Bow Down” button once sets the bow down .5 degrees and so on as the other buttons are pressed. Once the fine adjustments are complete, press and hold the AUTO button for 4 seconds to set into permanent memory to overwrite the previous setting.
4. As the boat is operated at slower speeds or turned, the automatic control is suspended, and the AUTO indicator begins blinking. The auto function is temporarily interrupted to avoid deploying the tabs at slow speeds or in turns. ALC reverts back to AUTO mode at speeds above planing and once a turn is completed.
5. Press the AUTO button to switch between Automatic and Manual modes.
6. **Display Shut Down:** When the boat is stopped and not in use for some time, the ALC will automatically shut down to minimize the current draw from the battery to prevent depleting the boat’s battery.
7. **Automatic Tab Retraction:** The trim tabs will automatically retract when the control senses the boat is off plane or stopped for a few minutes. Another option is to connect terminal 7 to the ignition key run position to automatically retract the tabs when the key is switched to OFF. This option only allows the tabs to retract when the key is switched to OFF.

- **Adjusting Gain:**

1. The gain determines how fast the auto leveling control corrects a list condition. It can be adjusted in three steps. As a rule of thumb, boats longer than 35 feet may use setting 1 or 2 while boats below 35 feet may use settings 2 or 3 (setting 1 (top LED) = slower response, Setting 2 (middle LED) = medium, setting 3 (bottom LED) = fast response).
2. Adjust the gain by pressing and holding the Port button (left) and Starboard button (right) for 4 seconds until one of the Gain indicators (middle 3 LEDs) begin flashing.
3. Press the top “Bow Down” or bottom “Bow Up” to adjust the setting.
4. The 3 LED indicators at the bottom middle show the 3 gain settings starting with gain setting #1 on top, #2 in the middle and gain setting #3 on the bottom. (setting 1 (top LED) = slower response, Setting 2 (middle LED) = medium, setting 3 (bottom LED) = fast response).
5. Now press the left “Port” and right “Starboard” buttons at the same time for 4 seconds to store this setting in permanent memory.

ALC-1 Troubleshooting

- Error Code:**

If the ALC control senses a fault, an LED indicator will show a quick repetitive flash. See display below for flashing LED error code.

Quick flashing LED indicates trim tab actuators are not connected properly (see wiring diagram)

Quick flashing LED indicates short circuit on supply connection 1 and 2

Quick flashing LED indicates short circuit to ground



Quick flashing LED indicates incorrect mounting angle (see display mounting instructions)

- LEDs do not light:**

- 1) If boat is off plane or stopped for several minutes, the ALC display enters a normal power off mode to prevent discharging the battery. Operating the boat and pressing the display buttons will bring the display back to fully operational mode.
- 2) If optional terminal 7 (green plug) is used and connected to the ignition key switch, turn key switch to ON and make sure battery selector switch is turned on.
- 3) Measure voltage at terminal 1 (green plug) (+12 or +24vdc) and terminal 2 (battery negative) for proper voltage (see wiring diagram). Replace fuse or repair poor connection if battery voltage is not measured at terminals 1 and 2.

Specifications

Model Number	Display Color	Number of Stations	Actuators per tab plate	Overall Width	Overall Height/ Thickness	Mounting Hole Cutout (Diameter)	DC Voltage	Fuse Size Power Input (1 Actuator per Tab)	Fuse Size Power Input (2 Actuators per Tab)
ALC-1	Black	1	1	3.15"/ 80mm	3.0"(77mm)/.. 437"(11mm)	2"/50mm	12/24	12vdc = 15 amp 24vdc = 10amp	N/A
ALC-2D	Black	1 or 2	2	3.15"/ 80mm	3.0"(77mm)/.. 437"(11mm)	2"/50mm	12/24	N/A	12vdc = 30amp 24vdc = 20amp
ALC-1D	Black	1 or 2	1	3.15"/ 80mm	3.0"(77mm)/.. 437"(11mm)	2"/50mm	12/24	12vdc = 15 amp 24vdc = 10amp	N/A