

Landing Height & Gear Safety Controller

User's & Installation guide

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Installing, Using or Operating this device consistent approval of our Limited Warranty & Disclaimers found at the end of this document & our online page

INTRODUCTION

This Controller is a dual function Controller. It combines both a Landing Height System for height callout above ground and a Gear Safety System to prevent the Landing Gear from retracting below a certain airspeed and to offer auto-extend for the Landing Gear once the speed is decreased to set a point.

The Controller comes built-in with a Signal Conditioned, Temperature Compensated and Calibrated Differential Pressure Sensor which hooks to the Pitot/Static tubes of the airplane to collect accurate IAS (Indicated Air Speed) data. It also uses LIDAR range finder module to detect actual height above the runway. It announces airplane height at a certain fixed altitude all the way down to touch down.

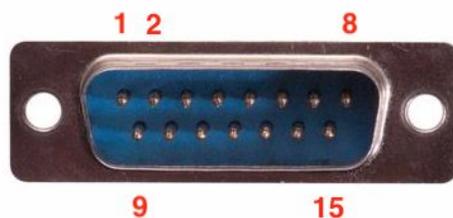
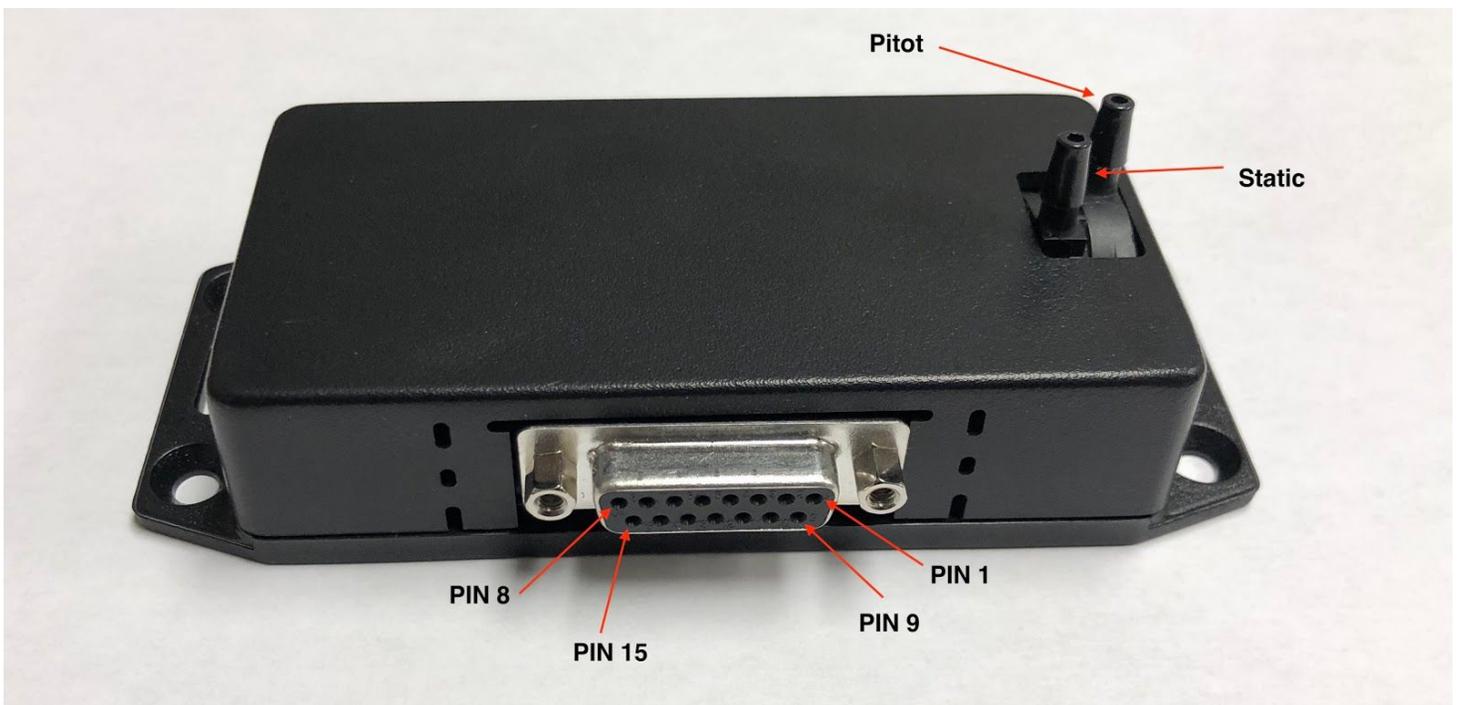
The controller connects to an unused Audio Input Channel to offer Audio Warning for Gear related conditions along with Height Callout during the landing phase of the flight.

The system offers a Wi-Fi interface which offers feedback along with various Settings options for the Gear Safety speed and callout. Any Wi-Fi capable device (phone, tablet, laptops and/or PC) can connect to the controller to complete these functions.

Firmware upgrade and Audio callout modifications are also performed using the Wi-Fi interface.

CONNECTIONS

Refer to the following table for explanation of each PIN and connections.



Looking at DB15 Male Plug/Socket

15-PIN Connector

PIN	FUNCTION
1	No Connection. (Optional LED Output)
2	(Input) LIDAR Blue Wire (Don't use a single twisted pair with PIN 3)
3	(Input) LIDAR Green Wire (Don't use a single twisted pair with PIN 2)
4	(Input) LIDAR Yellow Wire
5	(Input) Gear Up Wire (From Gear Switch)
6	(Output) Gear Up Wire (To Pump UP Pressure Switch)
7	No Connection. Leave empty.
8	(Output)) Gear Down Wire with Series Diode <i>See Note about this connection with Diode in series</i>
9	(Output) Audio (LO) (-ve) Differential Audio output. (Audio LO)
10	(Output) Audio (HI) (+ve) Differential Audio output. (Audio HI)
11	No Connection. Leave empty.
12	(Output) LIDAR Red Wire (+5V) WARNING: Don't mix or swap LIDAR Power (Red) & Return (Black), it will DAMAGE the LIDAR power circuit.
13	(Input) LIDAR Black Wire (LIDAR Return GND) WARNING: Don't mix or swap LIDAR Power (Red) & Return (Black), it will DAMAGE the LIDAR power circuit.
14	(Input) Controller GND
15	(Input) +12V Controller Power

INSTALLATION

The first procedure is to find a suitable location for the LIDAR; it needs a clear, unobstructed view of the grounds below. It can be installed at an angle, make sure no objects including landing gear doors can move, flap in the winds or obstruct the view during landing. Its recommended not to have the LIDAR looking at the ground at an angle more than 30°

An alternative first procedure is to test Audio output to your audio panel to make sure you can hear audio. The Audio output is **Mono differential audio signals**. You can use it on stereo input to your Audio panel by joining both stereo channels to the Audio (+) output of the controller. This is only in the event the Audio Panel requires Audio Hi (Left) and Audio Hi (Right) Channel for Stereo.

It's recommended to select a "Switched" Audio input channel such as NAV2, COM3, ADF and such which is "mixed" with main COM activity. This allows hearing Callout or Gear Warning prompt even when primary COM is active. Your panel will MIX both inputs. Using a "Music" channel or AUX could be "auto-muted" by the Audio Panel when primary COM is active.

For Audio Input Channels that are single-ended (Manual shows only single Audio wire), use +VE wire (Audio Hi Pin 10) and leave PIN 9 unconnected.

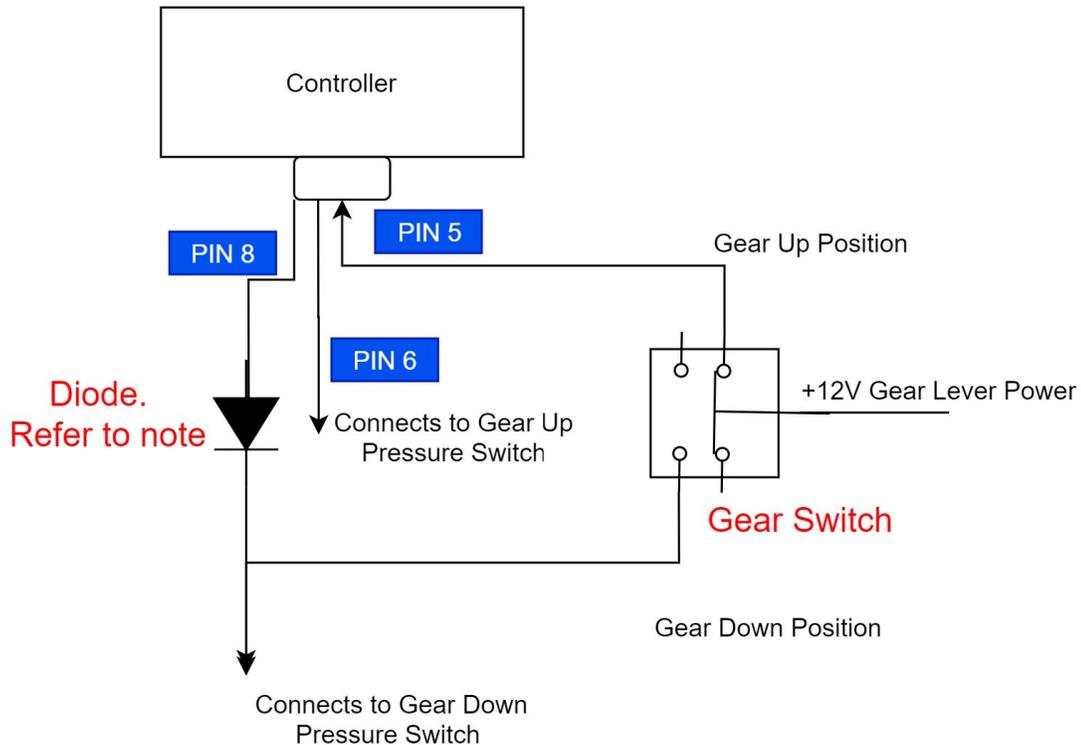
It's best to test the Audio Channel even before connecting the LIDAR or securing LIDAR to its final position and before making any permanent changes to your airframe such as drilling holes. This confirms full operation of Audio before going to the next step of LIDAR mounting position. The controller can be powered without connecting Pitot/Static Tubes and without connecting the LIDAR so Audio test can be performed using Wi-Fi.

Supply the +12v/Gnd connection to the controller and choose a suitable location for the box. The unit is very light and can be secured with a zip tie to any bundle of wires behind the panel. As the unit expects to be connected to Pitot/Static tubes, behind the panel could be the best location to shorten any Pitot/Static tubes extensions.

Gear Safety Wiring

Connect Pitot/Static ports as shown in the main photo above. **Do not mix the tubes, the Static port is not meant to receive positive pressure and may damage the Sensor.** Double check tubes hookup as indicated.

Follow the diagram below to complete the electrical wiring between the Gear Switch & Controller.



The wire connected on the Gear Switch intended for Gear Up Position now ONLY connects to the Controller (PIN 5). Pin 6 is "Controlled" wire which now connects to Gear Up Pressure Switch (or Pressure Controller). The system internally controls providing +12V power to this wire based on the Speed.

Pin 8 (Down Circuit) connects to the same wire which is already connected between the Gear Switch Down Position and Down Pressure Switch (or Pressure Controller). Note a Diode (included) needs to be connected as shown, this is to prevent back current to be received into the Controller Switching Power module when the Gear Switch already mechanically positioned on the Down position.

A standard Schottky Diodes (40V 1A) is included.

Note the polarity of the Diode and connection. A silver bar on the diode indicates the **cathode side**, this side is joined to the wire between Gear Switch Down Position and Down Pressure Switch. The side that does not have a silver bar connects to PIN 8.

The diode can be fully heat shrink as part of the wiring.

Note that the system installed with the 1A included Diode is only suitable for connection to a Pressure Switch (or Pressure Controller) that drives a low-current SSR (Solid State Relay) which requires much less than 1A (1000mA) of current. The standard SSR current requirement is around 20mA or less.



The Controller Switching Power module is capable of switching up to 3.5A, and this can be connected to a Power Switch that drives a mechanical solenoid which normally takes 2.5A. However, the Diode needs to be replaced with a 4A or higher Schottky Diode (not included)

Theory of Operation: When the pilot pushes the Gear Switch to the Up Position; Pin 5 is energized with 12V. At this point, the Controller checks the Speed. If the Speed is above the “Gear Up Set Point”, Controller passes the power to Pin 6. If the Speed started to decrease and reached the “Gear Auto-Extend Set Speed”, the Controller will use the Audio system to warn the user for 10 seconds. At the end of this time, if the Speed is still lower or equal than the “Set Speed”, the Controller removes the power from Pin 6 and apply it to Pin 8. Effectively supplying the Pump Down circuit with power to lower the landing gear. The Pilot should then lower the Switch manually and will be reminded with an Audio message every 10 seconds. The pilot can lower the switch even while the gear is still extending.

Note that for the Auto-Extend feature to be “armed and active”, the speed should have reached 120 kt. If the airplane speed never reached arming speed for auto-extend after take off, this feature is not enabled and the gear will not auto extend.

The system uses the +12V power connected to PIN 5 (From Gear Switch) to provide power to Pin 6 or Pin 8. This is an extra added feature to guarantee that when the Gear Switch is at the Down position, it's impossible for PIN 6 to have +12V even with Controller failure as

the Controller Switching module is passing the power from PIN 5 which is only powered when the Gear Switch is at the Up position.

To be able to operate the gear while on the ground for maintenance and testing; the wires between PIN 5 & 6 need to be manually bypassed.

On existing installations, the same bypass can be used if the controller is installed prior to the bypass wiring. Otherwise, attach a bypass switch so power can reach the High Side pressure switch for ground testing. Remember to remove the bypass.

The best approach for bypassing the speed for ground-testing is to use tubing and blow air into the Pitot to simulate air speed is increasing after the airplane is on jacks. Using a physical bypass switch for ground-testing gives a small chance of this switch being kept bypassed, effectively canceling the ground protection feature of the Controller as the wires are bypassed externally!

LIDAR Wiring

The LIDAR comes with a 6-wire connector. The Orange wire is not needed, this can be cut short and heat shrink so it is not touching any other wires.



A Capacitor (included) needs to be soldered between the Red & Black. See Notes & Recommendations section of this manual.

Wi-Fi SYSTEM

Use your device Wi-Fi Search and look for EI_XXXXXX

The default SSID (Wi-Fi Access Point) is: EI_XXXXXX

The default Wi-Fi Password: 61331970

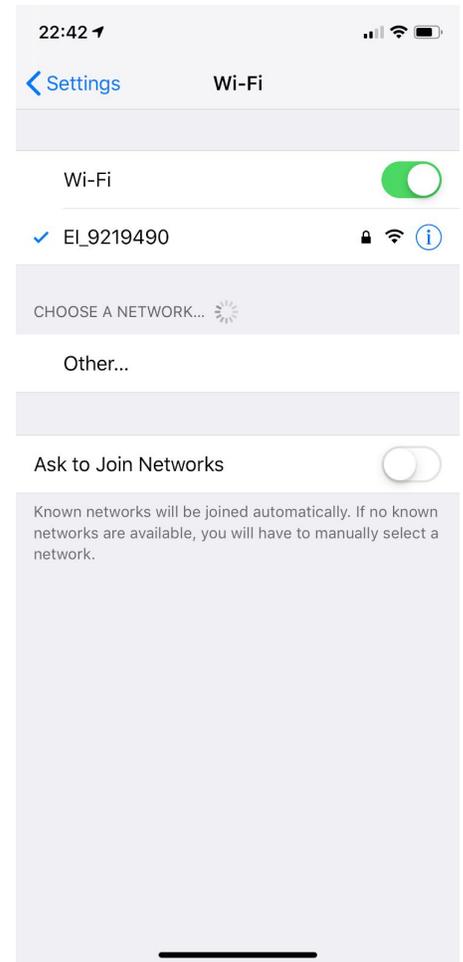
The _XXXXXX is the unique serial number of the unit.

The Wi-Fi System is designed for the Phone screen, but can be used with PCs and Tablets such as iPads. Multiple devices can connect at the same time if required.

Once connected, use your device Browser (Safari / Chrome / others) to connect to the Controller.

Use 192.168.10.1 as the IP in the Browser page. However, if it's easier, any .com or .net can be used. As the Controller is not connected to the internet and it will respond with its own pages on any domain name.

Though it's preferred to use the IP above and press Done or Go and Save the page into your Browser Bookmarks for easy access later on.



22:44 ↖



192.168.10.1



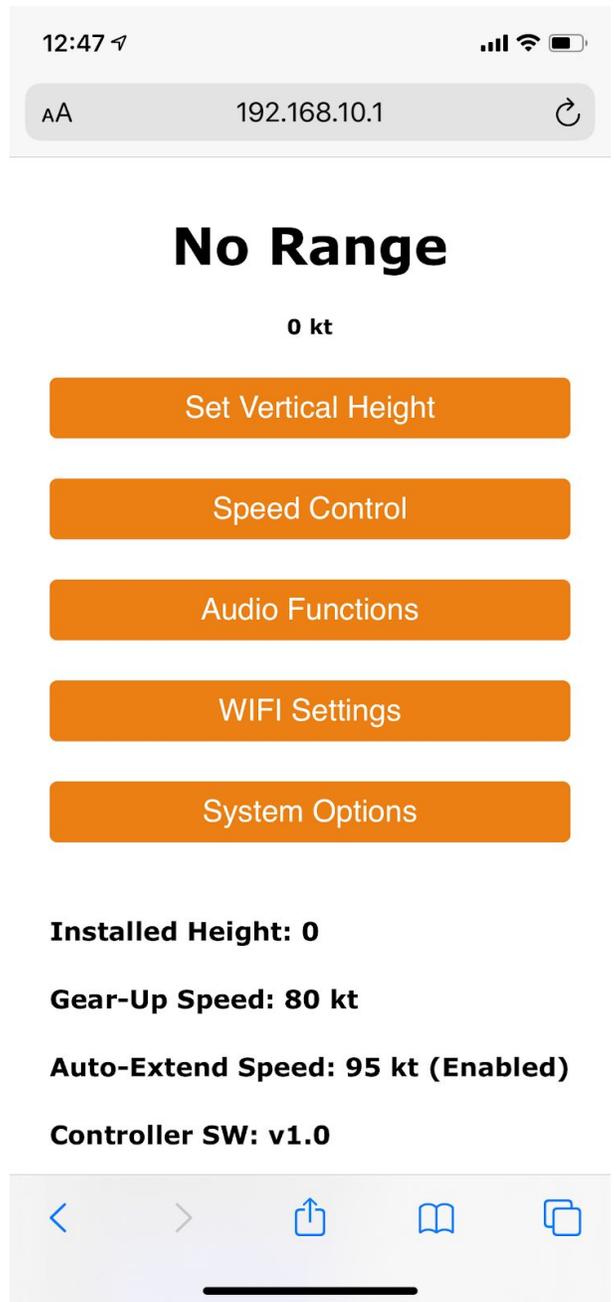
When you first connect, as the Vertical Height is not yet set, the Controller shows the current reading value of the LIDAR. This is the range to ground.

The first button allows setting the Vertical Height. Do not follow the shown value, measure the actual vertical height from the ground exactly below the LIDAR to the back of the LIDAR. +/- 1" is not in issue. This can be adjusted later on to calibrate your Zero announcement with your touch down depending on your flare angle. A higher flare angle means a slightly lower value needs to be set for the vertical height.

The default value of Gear-Up is 80kt. The default value of Auto-Extend Speed is: 95kt. These can be changed in "Speed Control". Setting a value for Auto-Extend to be lower than the Gear-Up speed disabled this feature for those who do not want to activate Auto-Extend.

Audio Testing can be done using "Audio Functions". Changes to Wi-Fi Settings and other System options are also from this page.

Extra explanation and details are included within each page.

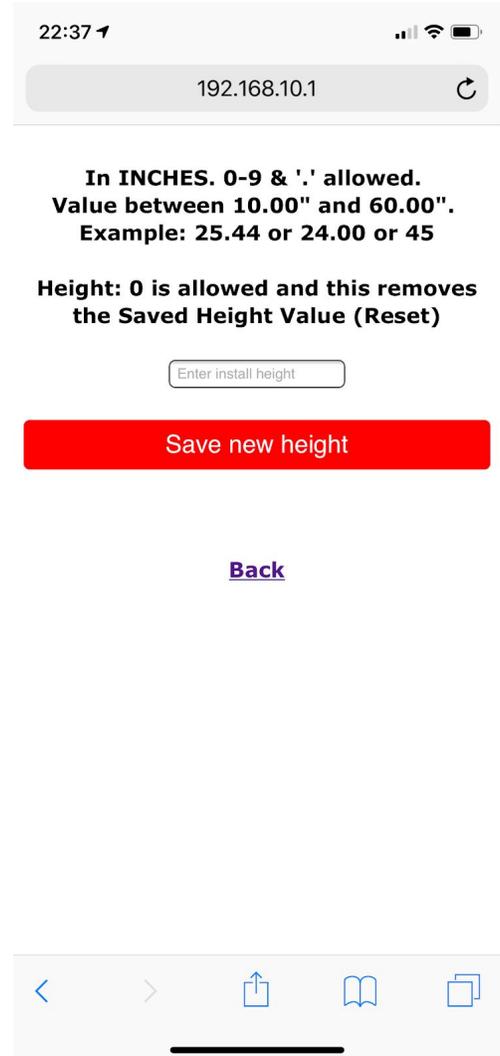


Set Vertical Height

Measure the actual vertical height from the ground exactly below the LIDAR to the back of the LIDAR. +/- 1" is not in issue

Input number in INCHES. Example 25.50

Using 0 will remove any previously Set height and return to show current reading of the LIDAR.



Wi-Fi Settings

You can change the default EI_XXXXXXX Controller network name with any other name such as your Tail-Number. When changed, the system will restart, look for the new name.

For Network names, 4-15 standard A-Z characters are allowed.

For Password change, 8-20 Standard characters with numbers allowed.

Note this is case-sensitive.

When changing the password, please make sure at least one of your devices (phone or iPad) saves the new password and can connect to the unit again without asking for the password. If you forget the new password, the only way to reset it is either by using a device (phone or iPad) that saved the password and reset using this page or by returning the unit back for firmware re-programming. We have no way of knowing your new password if you are unable to connect to the unit.

Additional Notes & Recommendations

- 1) The LIDAR unit will be sent with a Capacitor. This Capacitor needs to be installed. If the LIDAR unit will be installed close to the controller without the need to extend the wires, Notice the polarity of the Capacitor. The Shorter lead (Marked -) on the Capacitor is the GND which is soldered to LIDAR GND (Black wire),. The other Capacitor lead (longer lead) is the +Ve and goes LIDAR RED. Almost in all installation, the LIDAR 6-wire connector needs to be extended. Solder the Capacitor right at where the LIDAR wires ends. So, the extension wires, and the original LIDAR wires along with the Capacitor are all soldered together and heat-shrink. The -ve Capacitor (shorter lead) goes to LIDAR BLACK wire. Other lead to LIDAR RED wire.
- 2) The LIDAR & Controller takes less than 150mA current @ 9V-14.5V. So it does not need its own dedicated circuit breaker. Controller power can be shared with any non-inductive loads (such as LED lights or avionics) but not with any ADS-B Out equipment. A dedicated 1A circuit-breaker is recommended. This circuit breaker can be used as an Override switch, once it's pulled, the Controller is off-line allowing slow-flight or Stalls training to be conducted without Auto-Extend activation. Though it is best to use the Gear Pump Circuit Breaker for such training, as when the Controller is powered-off, the LIDAR call-out is also offline.
- 3) Currents requirements for a Power Switching module depends on if an SSR or Solenoid is being used to power the pump. This current is taken from the Gear Switch +12V Up position. It is recommended that Gear Switch to be powered from the same Pump circuit breaker.
- 4) If the LIDAR does not have a full unobstructed view of the ground surface and some other parts of the plane (such as part of the landing gear) in its view, it may be necessary to do some flight testing before making final holes or drills into the airframe for the final installation point. It's recommended that the system is tested using a dummy access panel cover to attach the LIDAR before the final location is selected and drilled.
- 5) To resolve any audio issues, it's recommended to use shielded 2-core wires for the two audio outputs. The shield itself can be used to connect the Audio Panel GND to Controller GND. In fact, it's also recommended that the Controller GND to be taken directly from the same point as the Audio Panel GND (or Headset GND if the audio is going directly to the headset). This procedure eliminates any ground loop that can affect the audio signal.

- 6) **IMPORTANT** not to mix the Black & Red wires of the LIDAR as it will be immediately damaged and may not be covered by LIDAR manufacturer warranty
- 7) The Audio outputs (PIN 9 & 10) are Differential Audio lines. It's not Audio & GND. If your Audio panel only accepts Single Line for Audio, then use the +ve Audio signal only (PIN 10).
- 8) If a twisted pair wires are going to be used for connection, don't use a single pair for both PIN 2 & 3 (LIDAR Comm lines) as this causes interference within the signal. It is best to use 5 straight wires for all 5 LIDAR connections.

Gear Safety Ground Testing

AIRPLANE MUST BE ON JACKS BEFORE FIRST POWER-UP OF THE CONTROLLER OR AFTER MODIFYING GEAR SWITCH WIRES.

A cross wiring or any error in wiring may cause the high-side Gear Pump to operate when the master switch goes on after modifying the wires from the Gear Switch to the Controller. Airplane **MUST BE ON JACKS** or at least the Gear Pump Circuit Breaker is pulled, or both.

If initial testing is for Audio, then make sure Gear Pump CB is pulled (off) or make sure PIN 5 is NOT CONNECTED to the Controller. Even if PIN 5 is not connected, an external wiring error may lead to the Pump to operate after wires modification.

Test Audio Channel first to make sure the selected Audio Channel input works as expected. Refer to the Wi-Fi section to use for Audio Testing using a phone. Audio Testing can be performed with LIDAR and/or Gear Switch wires (PIN 5) are not connected.

Use your preferred method to increase the airplane airspeed while the airplane is on Jacks. One method is to use a clear tube or similar connected to Pitot port of the airplane and carefully blow into the tube. **Take care not to blow hard.**

The best method is to bend the tube two or three times in your hand and squeeze/push on the tube then slowly blow in the tube while watching the Airspeed Indicator.



This method allows determining the required pressure to blow to get the speed up without damaging any installed sensitive pressure sensors. Squeeze more on the bends to block the tube if you want the speed to stop. Relax your hand slowly for the speed to decrease.

Ground Testing Checklist

- **Testing Power-up with Gear in UP Position:**

- After completing all wiring; (**airplane on jacks**) and before power-up the airplane, place gear switch to UP.
- Make sure Pump CB is IN (ON), check no external bypass is placed.
- Check the dump valve is closed
- Power On Master Switch.

At this point; the gear pump should not start as no power is reaching the pump switch/Controller. Audio Warning is announced. Continue to the next test.

- **Testing Gear UP Set Speed**

- Increase airspeed and when it reaches around 80 kt; gear will start to go up as power is now applied to the pump switch
- Continue increasing the airspeed till it reaches 120 kt or more.
- Continue to the next test

- **Testing Auto-Extend Set Speed**

- Start decreasing speed slowly to reach the Auto-Extend Speed or just below
- Audio Warning will be announced
- Increase Speed so it reaches higher than the Auto-Extend Speed. Audio Warning will stop.
- Decrease Speed again to Auto-Extend Speed and hold it, 10 seconds later after few Warnings, Gear will start to go down.
- 10 seconds later after the gear started to go down, another Audio Warning will be announced if the Gear Switch is still in the UP Position.
- Place the Gear Switch to Down position.

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