



Glider

Landing Gear

Warning Systems

Explanations, Guidance, and Animation

Updated: February 12, 2024

Please Note

This presentation may have been updated with new information, changes, and/or corrections.

Be sure to visit my presentation web site and download the latest version of this document. It could make an important difference to your work!

<http://aviation.derosaweb.net/presentations>

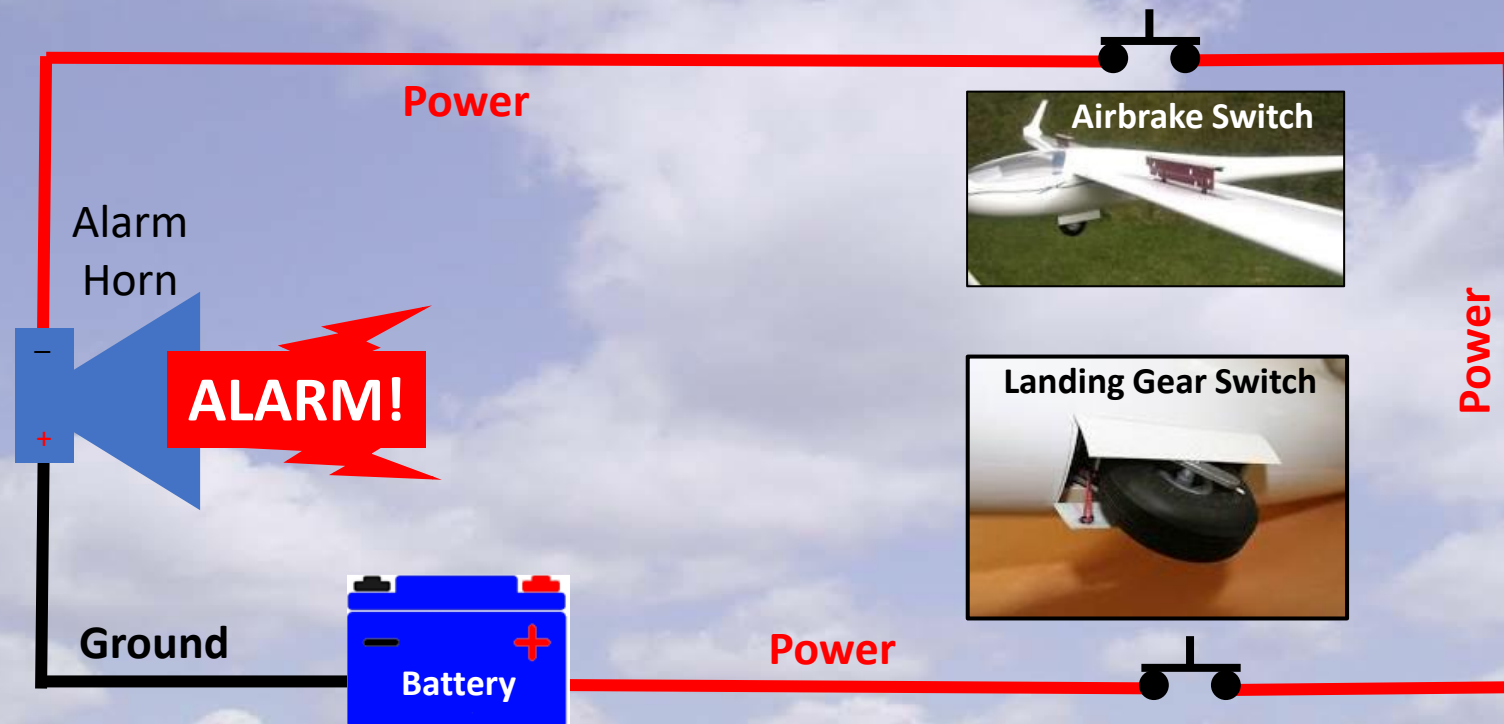
Thank you, John (OHM Ω)

2nd Please Note

There is no single universal answer on how to implement a landing gear warning system in a particular glider. This is due to gliders having many different linkage designs to **raise/lower** landing gear and to **open/close** airbrakes. Hopefully, this presentation will provide enough information and pointers to help you design, install, and test a landing gear warning system for your glider.

Basics of a Gear Warning System

- The electrical circuit for a landing gear warning system is very simple indeed.
- The circuit consists of only a battery, some wires, two switches, and an alarm horn. See the circuit diagram below.
- For each phase of flight (launch, airborne and landing) the two switches (gear and airbrake) are either **ON** (closed) or **OFF** (open).
- If **both** switches are **ON** (closed) then an alarm will sound.



Learning How Landing Gear Warning Systems Work

- **The Basics** - If the landing gear is retracted and the airbrakes are open at the same time an **alarm must sound**
- **The Specifics** - The position of the switches are very important such that;
 1. When the gear is retracted - even a small amount this will cause the associated **power switch to close** and to **“arm” the system***
 2. When the airbrakes are opened - even a small amount this will cause the associated **power switch to close** and to **“arm” the system***
- If both #1 and #2 above are true (gear is up and airbrakes are open) then both warning switches are **“armed”** (closed) therefore the **alarm will sound**

*What does **“arm the system”** mean? To **“arm”** something is to initialize a control system to make it ready for action but **not make able** to take that action yet. Usually this is to prevent accidentally triggering an event.

Example – During a NASA missile launch the button launch is not **armed** until just before launch. Only at the last moment the button is connected to power (**armed**) and only then pushing the launch button will work.

Learning More About Landing Gear Warning Systems

There are Typically Two Types of Switches Used in Gear Warning Systems

Mechanical (Micro) switches



Magnetic switches



Magnetic switches **are preferred** because;

- Safety – To activate the magnetic switch the magnet does not need to touch each other. Thus, by not touching control linkages reduces the possible of linkage interference/damage and/or switch damage
- Nearly any magnet, large or small, will work to activate the magnetic switch
- The magnetic switch will last through many more millions of on/off cycles versus a mechanical switch
- The magnetic switch can be easily mounted (epoxy in place is typical)
- The magnet can be mounted in various ways;
 - Steel linkages: the magnet will attach itself (can permanently glue later)
 - Aluminum linkages: taped in place (can permanently glue later)
 - Either mounting method allows for easily movement of the magnets to test the warning system's functionality

* See <https://www.youtube.com/watch?v=R--m0NDROj8&t=338s> for an aviation related safety take on the use of mechanical micro-switches.

Learning More About Landing Gear Warning Systems

There are Two General Types of Magnetic Switches

Magnetic “Reed”



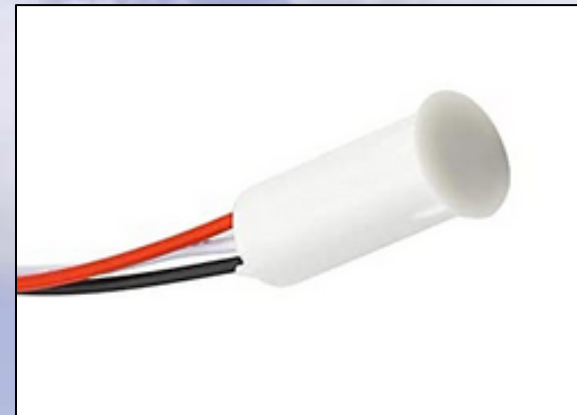
Magnetic “Hall-Effect”



- **Magnetic “Reed” Switches**
 - This is an electro-mechanical switch
 - Uses a pair of magnetizable, flexible, metal reeds whose end portions are separated by a small gap
 - https://en.wikipedia.org/wiki/Reed_switch
- **Magnetic “Hall-Effect” Switches (Sensors)**
 - Less prone to mechanical failure due to no wear on physical parts
 - https://en.wikipedia.org/wiki/Hall_effect_sensor

Learning More About Landing Gear Warning Systems

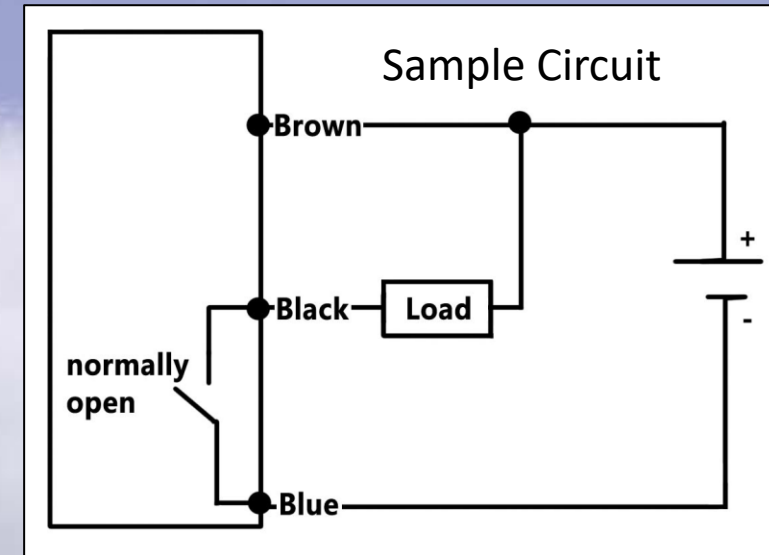
Examples of Various Common Magnetic (Reed) Switches



See https://en.wikipedia.org/wiki/Reed_switch

Learning More About Landing Gear Warning Systems

Examples of Various Common Magnetic “Hall-Effect” Switches



See https://en.wikipedia.org/wiki/Hall_effect_sensor

Learning More About Landing Gear Warning Systems

There are Two Common Types of Switch Contacts

- **Normally Open (N.O.) Magnetic Switch**

- When a **magnetic N.O. switch** is near a magnet, electricity will flow through the wires (turned on)
- When a **magnetic N.O. switch** is not near a magnet, electricity will not flow through the wires. (turned off)

- **Normally Closed (N.C.) Magnetic Switch**

- When a **magnetic N.C. switch** is near a magnet, electricity will not flow through the wires. (turned off)
- When a **magnetic N.C. switch** is not near a magnet, electricity will flow through the wires. (turned on)



Magnetic “Reed” Switch



Magnetic “Hall-Effect” Switch

For Gear Warning systems two switches will be required (air brake and landing gear).
For your particular glider’s situation you may need one of each type of switch,
or two switches of a particular type.

Implementing a Landing Gear Warning System

Complete the Final Mounting of Alarm Horn, Wiring & Switches

- **Alarm Horn**

- There are many 12Vdc alarm piezoelectric horns available on the internet.
- Get an alarm that is **LOUD!** The **Mallory Sonalert** brand of audible alarms is the best IMHO.

Amazon link to Mallory Sonalerts → <https://www.amazon.com/s?k=sonalert>

- Typical mounting position of the horn is hidden behind the instrument panel.
- Wiring & Battery Connections
 - Use only Tefzel type wiring
 - See <http://aviation.derosaweb.net/presentations/#wiring> for more details.
- Magnetic Switches
 - Secure mounting of the magnetic switch and magnet is critical.
 - A high quality epoxy is the best option. West Systems brand is recommended.



ANIMATION of a Sailplane Landing Gear Warning System

A Sailplane Landing Gear Warning PowerPoint Animation

Which Demonstrates The ...

- ... 3 Phases of flight (Take Off, Airborne, Landing)
- ... Actuations of airbrake and gear control linkage
- ... Positions of gear warning alarm switches on/off

Click to continue to the Animation →

Animation of a Sailplane Landing Gear Warning System

The following animation is of a sample gear warning system. The mounting, placement, and type of magnetic switches and associated magnets for your glider may be different than shown. Review the other slides in this presentation to help to implement your landing gear warning system.

Click here to continue to the Animation →

Important Notes for OLDER VERSIONS of PowerPoint

The included animation in this presentation has **NOT** been tested with versions of PowerPoint prior to 2004 and you may experience issues. An option is for you to download & view the available MP4 version of this presentation.

See <http://aviation.derosaweb.net/presentations/#gearwarning>

Click here to continue to the Animation →

Animation of a Sailplane Landing Gear Warning System

Phase 3: Landing
Landing Gear Up!
Airbrakes Open!
Alarm Sounds!



Click to Sequence

Airbrake Control Lever

← Open

Magnet

Closed →

N.C.
Magnetic
Switch

Switch Off

Power

Power

Animation is shown using normally closed (N.C.) magnetic switches

Power

Alarm
Horn

ALARM!

Ground

Landing Gear Down



Gear Control Lever

Magnet

Up

Magnet

Down →

N.C.
Magnetic
Switch

Switch Off

Power

Power

Battery

A green rectangular button with a dark green play icon (a triangle pointing right) in the center. The text "Click Here to Repeat Animation" is written in white, centered over the button.

Click Here to
Repeat
Animation

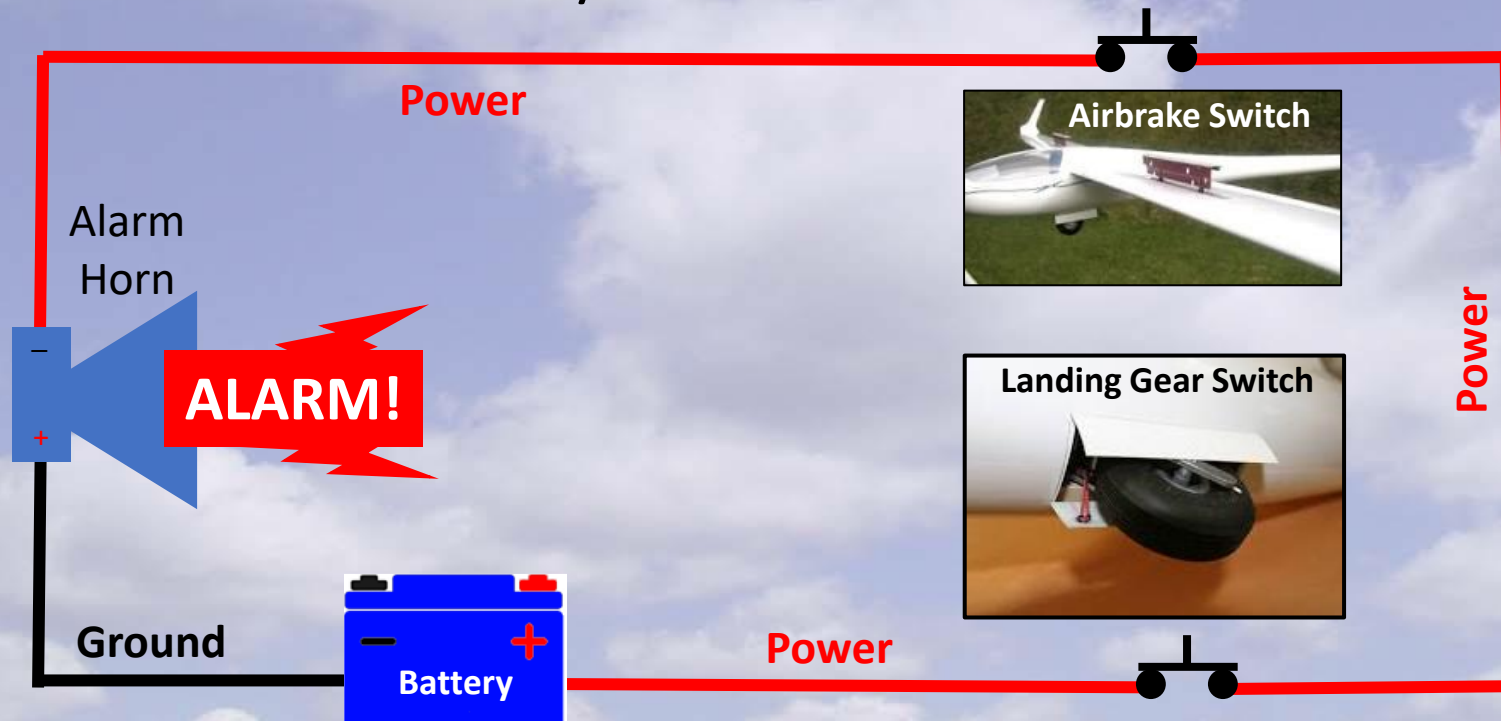
A dark blue rectangular button with a dark blue play icon (a triangle pointing right) in the center. The text "Click Here to Learn More" is written in white, centered over the button.

Click Here to
Learn
More

Implementing a Landing Gear Warning System

Becoming Familiar with How the Gear Warning System Works

- Temporarily connect the magnetic switches to a battery and the alarm horn* as shown in the simple wiring diagram below
- Move magnets near/away from the magnetic switches to turn them on/off and see how this turns on/off the alarm horn.



Implementing a Landing Gear Warning System

Trial Installation of the Gear Warning System

- Gain access to the gear and airbrake linkages by removing access panels as needed. Typically, these locations are nearest to the handles of the airbrake and gear levers along the sides of the cockpit.
- Determine how the gear and airbrake linkages move as the handles are push/pulled. The portion moving is where the magnets should be temporarily mounted* so that they move back and forth on the linkage and will actuate/deactivate a nearby magnetic switch.
- Temporarily mount* the magnetic switches so that when the handles+magnets move they come close enough to the magnetic switch to activate it (within approx. 1/8" or 3mm).
 - You may find that a more powerful rare-earth magnet is needed in your particular glider
- Temporarily wire the switches to the battery and alarm horn per the previous slide.

* Double sided tape should work well during testing

Implementing a Landing Gear Warning System

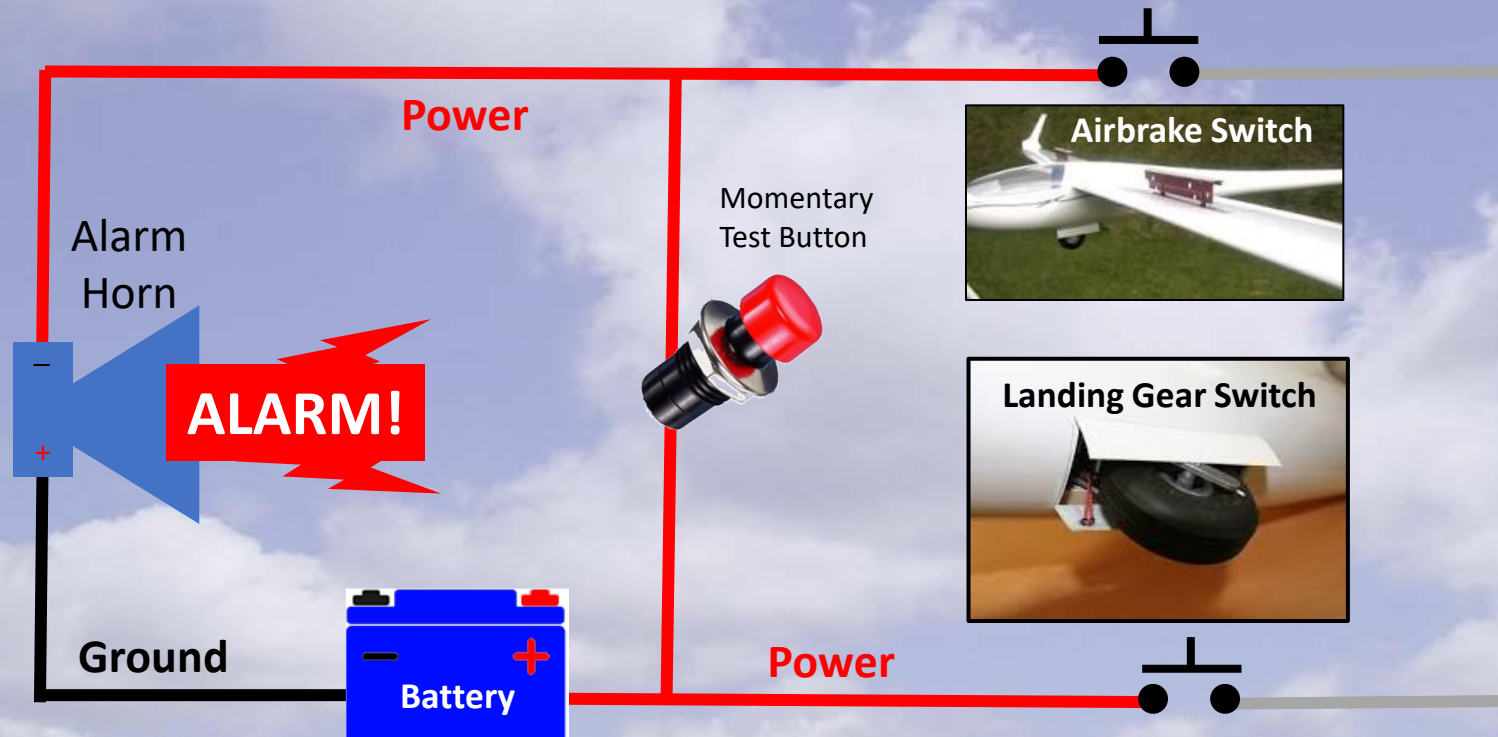
Testing the Trial Gear Warning System

- Place the fuselage on a cradle to allow the gear to be easily raised and lowered
- Fully assemble the glider (wings, etc) for correct linkage movement
- Test sequence;
 1. Lower the gear and move the airbrakes to both open & closed positions
The alarm horn should not sound
 2. Raise the gear and close the airbrakes
The alarm horn should not sound
 3. Raise the gear and open the airbrakes
The alarm horn MUST SOUND
- Adjustments if needed
 - Type of switch used (normally open or normally closed)
 - Wiring of switches to the battery and/or alarm horn.
 - Positions of the switches and/or magnets
 - Retest until correct.

Implementing a Landing Gear Warning System


Adding a Landing Gear Alarm Test Button

- It is always best to test the system by opening the airbrakes while cycling the landing gear. However, you may want to add a momentary type test button that bypasses both of the magnetic switches for testing purposes.





Click Here to
Repeat
Animation



Click Here to
End
Presentation

See My Other Presentations

- Glider Electrical Wiring
- Transceiver Troubleshooting
- Oxygen Systems
- Working with Glider Air Lines
- Trailer Wiring & LED Lighting
- Trailer Chains
- Soaring Pilot Relief Systems
- Battery Testing
- Emergency Location Devices
- Survival Kits
- Spar Alignment Tool
- L'Hotellier Fittings
- Carbon Fiber Panels
- IGC Filename Decoding
- Blanik L-23 Strut Work
- Removing Painted Lettering
- Open Glider Network
- Instrument Knob Extensions
- Landing Gear Warning Systems

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