

EXPERIMENTAL GEAR ALERT

INSTALLATION MANUAL For AMPHIBIAN AIRCRAFT

P/N 2080

SPECIFICATION IM-2080

REV. 1

March 25, 2012

JDG

Approved

Aircraft Components, Inc.
www.flyingsafer.com

For Experimental Category Aircraft Only. Not FAA Approved

I. INTRODUCTION

This manual provides information for installing and operating the P/N 2080 Gear Alert Landing Gear Warning System on an experimental amphibian aircraft. All installation work should be performed in accordance with this manual and applicable sections of AC 43.13 - 1B.

II. SYSTEM DESCRIPTION

The Gear Alert System is an electronic device that provides the pilot with an easily recognizable audible voice warning if he attempts to make a landing with the landing gear in the wrong position for either a water landing, or a runway landing. The system consists of three subassemblies, an electronic module which is mounted inside the aircraft, and two push type yellow illuminating switches (switch-lights)



that mount on the instrument panel. One switch-light is labeled for water landings and the other switch-light for runway landings. The unit is interconnected to existing or user-provided landing gear position indicating lights, a user-provided landing flap position switch, the pitot system and the aircraft audio panel, VHF transceiver or pilot headset jack. Audible voice warnings are heard in the pilot headset and through the small internal Gear Alert speaker.

Unlike other gear warning systems, the Gear Alert system does not false alert (such as when flaps are selected or raised on the ground or during takeoff.) The Gear Alert system only becomes active after the airspeed has increased above a user-settable activation speed (initially factory preset to activate at approximately 60 mph when airborne.)

Landing flap (20 or greater) is the preferred initiator of the Gear Alert landing sequence of audio and visual interrogations, warnings and confirmations. This provides ample time to react to warnings with the aircraft still some distance from touchdown. Unlike other systems that rely only on flap position, if for any reason landing flap is not selected the Gear Alert will initiate its landing sequence at the activation speed.

Rather than using lights, tones or voice confirmations that can be ignored or cancelled by a distracted pilot the Gear Alert system requires the pilot to actively indicate his desired type of landing and then provides a voice prompt of either an unsafe condition or the type of safe landing selected (in a unique male or female voice.)

WARNING: THE GEAR ALERT IS AN ADVISORY SYSTEM ONLY. IT SHOULD NOT BE UTILIZED AS THE PRIMARY MEANS OF DETERMINING LANDING GEAR POSITION THE PILOT SHOULD CONTINUE TO UTILIZE THE NORMAL OPERATING PROCEDURES, CHECKLISTS, LIGHTS, INDICATORS, ETC. AS THE PRIMARY INDICATION OF LANDING GEAR POSITION.

III. SYSTEM OPERATION

In the air or on the ground, momentarily pushing either switch initiates a self-test sequence. The system responds with: “TEST OK”.

During takeoff, when the aircraft has exceeded 60 mph (or as determined by the installer) for more than thirty seconds, the system becomes active. This is indicated by both switch-lights lighting up for six seconds. The thirty second buffer provides ample time to raise the flaps above 20 degrees. If the pilot remains at landing flap (20 degrees or greater) beyond the thirty seconds, the Gear Alert will initiate the landing sequence interrogation. To cancel the landing sequence, simply raise the flaps out of the landing position. Cancellation of the landing sequence is indicated by both switch-lights illuminating for six seconds.

During takeoff if the gear is not fully retracted the system will provide a short warning “RAISE GEAR.... RAISE GEAR. The warning stops after the one repetition.

During cruise flight if the pilot wishes to perform stalls or slow flight maneuvers (below the activation speed), the Gear Alert system can be temporarily disengaged by pushing and holding either switch-light for 2 seconds. The system responds with: “TEST OK” and the switch-lights will slowly alternate on and off while the system is disengaged. Momentarily pushing either switch-light will extinguish the lights and reengage the Gear Alert system.

During approach when the pilot selects landing flap, after a 5 second delay the Gear Alert system begins its landing sequence by flashing both switch-lights in unison and with a repeated interrogation: “SELECT LANDING, SELECT LANDING...”

This interrogation continues until the pilot pushes either the water landing or the runway landing switch-light. The system then checks to determine if the landing gear is in the proper position for the type of landing selected. If the gear is up and the water landing switch-light is pressed the system responds in a female voice: “WATER LANDING, OK”. If the landing gear is down and the runway landing switch-light is pressed a male voice states: “RUNWAY LANDING, OK”. If the gear is in the wrong position or asymmetric the system responds repeatedly in a female voice: “CHECK LANDING GEAR, CHECK LANDING GEAR”.

If the check landing gear interrogation was the result of an incorrect switch-light selection the pilot can push the correct switch-light and will hear the appropriate “----- LANDING, OK” response.

If the check landing gear interrogation resulted from an incorrect gear position the pilot can correct the gear position and will hear the appropriate “----- LANDING, OK” response.

If the interrogation was due to an asymmetric gear problem the landing sequence can be cancelled by raising the flaps out of the landing position. Landing sequence interrogations and responses can be cancelled at any time by raising the flaps out of the landing position. Cancellation of the landing sequence is indicated by both switches illuminating for six seconds.

During approach if landing flap has not been selected and the aircraft slows below the activation speed for at least 2 seconds, the Gear Alert system will begin its landing sequence: “SELECT LANDING, SELECT LANDING...”

Pilot action and system responses are identical to the landing flap initiated sequence (above) except where the pilot wishes to cancel the landing sequence.

If the aircraft is below the activation speed and flaps are in the landing position, then to cancel the landing sequence the pilot must accelerate above the activation speed for a minimum of 5 seconds and raise the flaps out of the landing position.

If the aircraft is below the activation speed without landing flap the pilot must simply accelerate above the activation speed for a minimum of 5 seconds.

Cancellation of the landing sequence is indicated by both switches lighting up for six seconds. At this point if a gear problem necessitates terminating ACI gear alerts simply push and hold either of the ACI switch-lights for two seconds to disengage the system.

During a missed approach or touch and go after the landing sequence has been completed with “----- LANDING, OK” the aircraft will normally have slowed below the activation speed (60 mph) and the system will then revert to the normal takeoff mode, activating again when the aircraft has exceeded the activation speed for thirty seconds.

However, a missed approach could occur with landing flap selected, landing sequence completed (-----LANDING, OK) and where the aircraft never slows below the activation speed (60 mph.) In this situation, the Gear Alert system will re-activate when either the flaps are raised out of the landing position or the gear position is changed (indicated by both switch-lights illuminating for six seconds.)

IV. APPLICABILITY

This system is **not FAA approved**. It is intended for installation on Experimental category amphibian aircraft only. The aircraft must have the following minimum requirements for an installation.

1. 12 Volt DC power.

2. One or two gear up and gear down position indicating lights, where the gear position or limit switches supply power to turn the indicating lights on. (Contact the ACI if the Gear Alert must be configured for use with gear position or limit switches that provide a ground for the gear position lights.)

3. Although the system can be operated without a landing flap position switch it has been found with the that a landing flap position input will provide ample time prior to the flare to respond to the “select landing” interrogation. The landing flap position switch must supply a constant ground for the module input whenever a predetermined flap angle is exceeded. One way of achieving this is to fabricate a cam that continuously closes a switch whenever the flaps exceed a predetermined angle.



The ACI “*e-Flaps*” Flap Controller also provides a constant ground for the 2080 Gear Alert when flaps are in the landing position.

4. An audio panel, intercom (or VHF transceiver) with an un-switched audio input or a headset jack for the pilot.

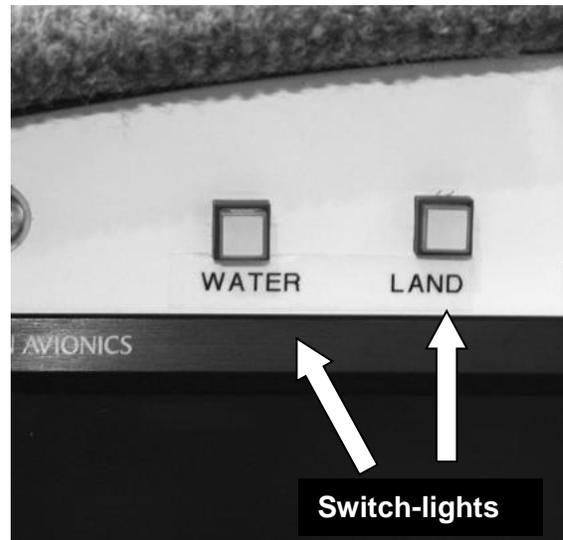
V. COMPONENT INSTALLATION

1. Locate a place to mount the electronic module that permits access to the speed and volume adjusting screws and will allow the 3/16-inch dia. tubing on the unit convenient access to the pitot pressure line that attaches to the airspeed indicator. Drill 4 mounting holes and attach the unit to the aircraft with the hardware provided.

2. The Gear Alert system “T” into the aircraft Pitot pressure line that goes to the airspeed indicator. Locate the tubing that runs to the pressure side of the airspeed indicator. Cut the line, and install a “T” fitting. Attach the 3/16 tubing to the side connection of the “T”. Note: Minimum bend radius in the tubing should be 1 inch to prevent flattening the tube.

3. Locate a position on the instrument panel where the 2 switch-lights can be installed. Ideally, the switch-lights should be close to the gear switch or near other warning lights in the pilot’s line of sight. They can be arranged either horizontally, or vertically.

4. Install the switch-lights and suitable labels. **NOTE!** The switches have unique colored wiring. One switch is wired for water landings and the other for runway landings.



VI. ELECTRICAL CONNECTIONS

Refer to wiring schematic FIG A for the installation as defined in Applicability Section IV.

NOTE: It is important that the system power and ground be isolated as much as possible from current surges and EMI noise. In some cases, having a non-bundled dedicated ground, power source and line noise filter may be required for reliable operation.

1. The Gear Alert system is internally protected. A 3-amp breaker or fuse will adequately protect the wiring provided with the unit. Attach the RED wire (Pin 1) to the 12v aircraft power buss.

2. Attach the BLACK wire (Pin 3) to a good aircraft ground point.

Wire Color	Pin	Function
violet	8	water switch
green	4	water switch
orange	11	water switch
gray	9	land switch
yellow	5	land switch
orange	11	land switch

3. Wire the two switch-lights as shown on the schematic. The color codes on the pre-wired switch-light match the colors of the main cable assembly.

4. The WHITE wire (Pin 10) provides a 600-ohm audio output. In order to provide a voice warning to the pilot's headset the audio output must be wired to the aircraft audio system in a way that the pilot cannot accidentally turn it off. If the aircraft has an audio panel, intercom or transceiver that has an un-switched audio input, the Gear Alert audio output should be connected to this point. If more than one service uses this same audio input a 500-ohm resistor should be wired in series with each service. If the aircraft avionics do not have an un-switched input, then the WHITE wire can be hooked directly to the pilot's headset jack using a.

Wire Color	Pin	Function
black	3	ground
red	1	12v power
white	10	audio
blue	6	up light
white/blue	13	up light
brown	7	down light
white/brown	15	down light
white/black	2	flaps
short violet	14	speed adj.

5. The system interconnects to the gear up and to the gear down indicating lights. One side of the light will have power or ground continuously, while the other will change as the gear goes up and down. The wires must be attached to side of the position lights that changes voltage.

If you have two gear lights for each position attach the BLUE wire (Pin 6) and WHITE/BLUE wire (Pin 13) to the positive side of the "Up" position lights. Attach the BROWN wire (Pin 7) and WHITE/BROWN (Pin 15) to the positive side of the "Down" position lights.

6. If you are installing LED's rather than incandescent bulbs for your gear position lights verify that the LED's have a resistor in series, or add a resistor (560 ohm, ¼ watt) with each LED. (If you have already been using the LED's with 12 volts they will already have these resistors incorporated.)

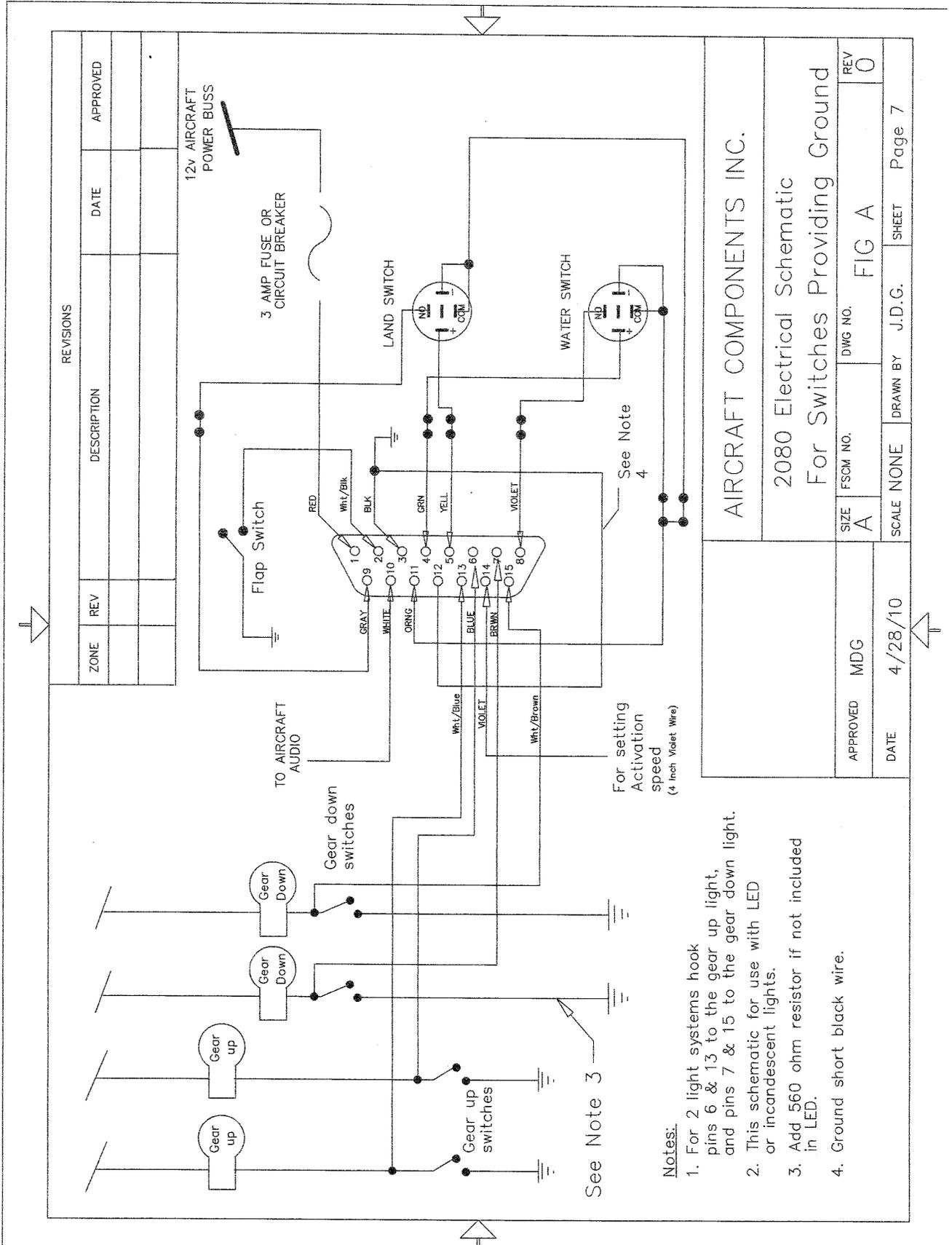
7. If there is electrical dimming of gear position lights you must use a dimming circuit on the ground side of the lights. (Do not vary the voltage to dim the lights.)

8. The landing flap position switch (or *e-Flaps* controller) should be connected to the WHITE/BLACK wire (Pin 2) on the connector. Whenever the flap is set for landing (flap 20 degrees or greater) this switch must ground Pin 2 continuously. After the installation is complete and the system powered up, select landing flap (close the flap position switch) and test the WHITE/BLACK wire connection with a digital voltmeter. The voltage should read no greater than **0.7** volts.

9. Attach the gray DB-15 connector to the electronic module and secure it with its mounting screws.

10. Leave the SHORT VIOLET wire available for adjusting the activation speed setting.

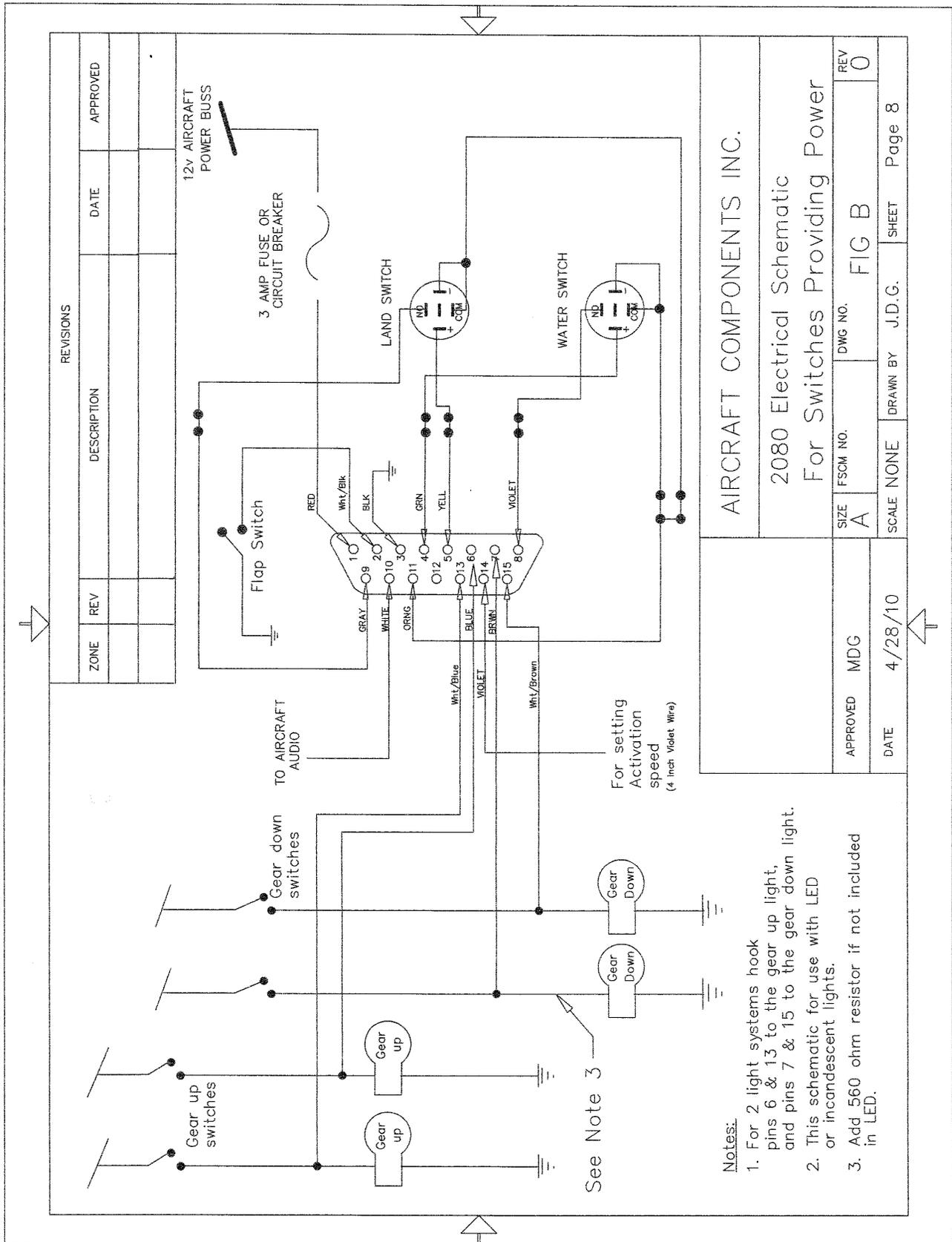
11. Cover any bare connections, bundle and secure all Gear Alert system wiring.



REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

AIRCRAFT COMPONENTS INC.		SIZE	FSCM NO.	DWG NO.	REV
2080 Electrical Schematic		A		FIG A	0
For Switches Providing Ground		SCALE	NONE	DRAWN BY	J.D.G.
APPROVED		MDG	DATE	4/28/10	SHEET
DATE		4/28/10	SCALE	NONE	PAGE 7

- Notes:**
1. For 2 light systems hook pins 6 & 13 to the gear up light, and pins 7 & 15 to the gear down light.
 2. This schematic for use with LED or incandescent lights.
 3. Add .560 ohm resistor if not included in LED.
 4. Ground short black wire.

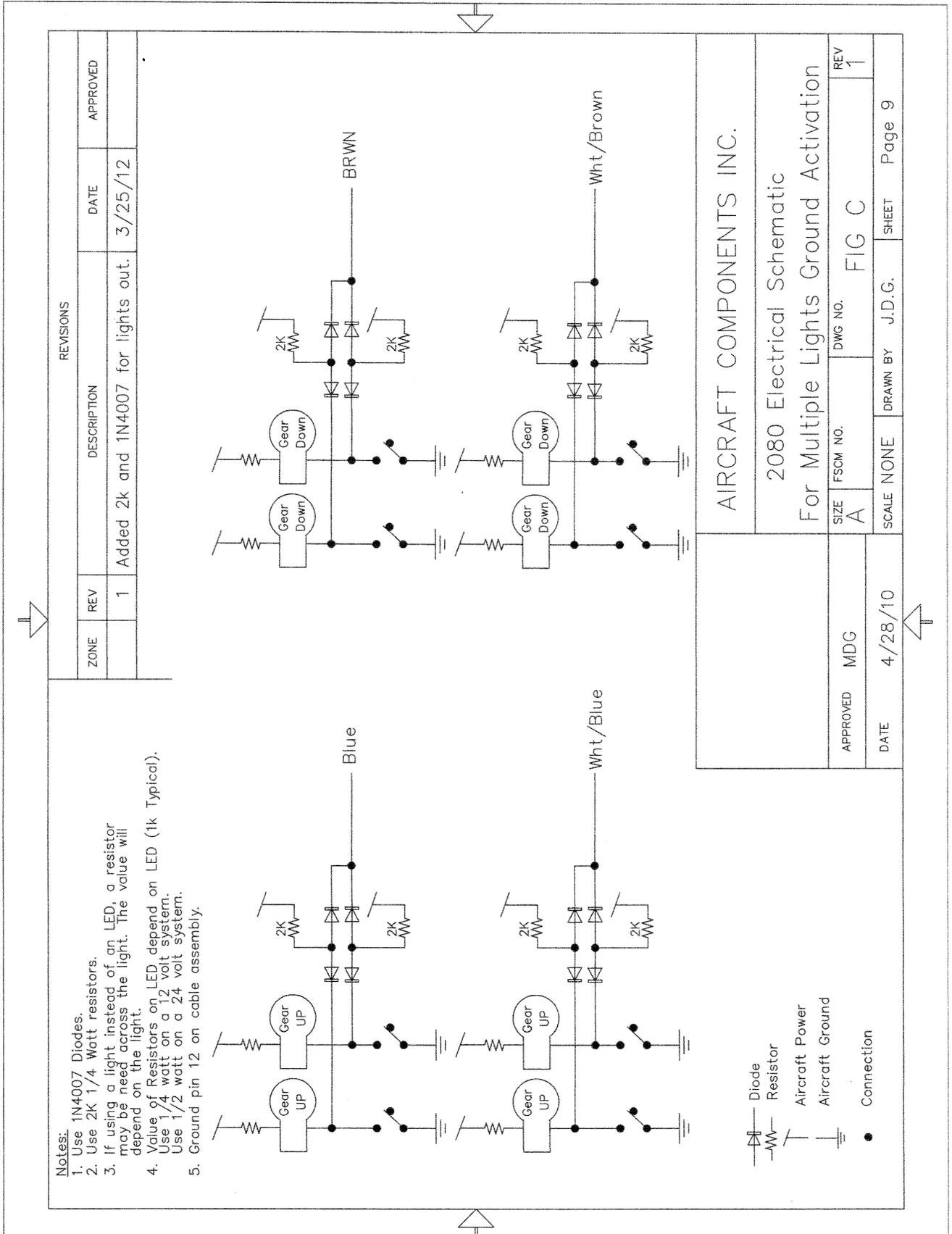


REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

AIRCRAFT COMPONENTS INC.
 2080 Electrical Schematic
 For Switches Providing Power

APPROVED	MDC	DATE	4/28/10
SIZE	A	FSCM NO.	
SCALE	NONE	DWG NO.	FIG B
DRAWN BY	J.D.G.	SHEET	Page 8

- Notes:
1. For 2 light systems hook pins 6 & 13 to the gear up light, and pins 7 & 15 to the gear down light.
 2. This schematic for use with LED or incandescent lights.
 3. Add 560 ohm resistor if not included in LED.



Notes:

1. Use 1N4007 Diodes.
2. Use 2K 1/4 Watt resistors.
3. If using a light instead of an LED, a resistor may be need across the light. The value will depend on the light.
4. Value of Resistors on LED depend on LED (1k Typical). Use 1/4 watt on a 12 volt system. Use 1/2 watt on a 24 volt system.
5. Ground pin 12 on cable assembly.

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ZONE	REV	DESCRIPTION	DATE	APPROVED
	1	Added 2k and 1N4007 for lights out.	3/25/12	

AIRCRAFT COMPONENTS INC.

2080 Electrical Schematic

For Multiple Lights Ground Activation

APPROVED	MDG	SIZE	FSCM NO.	DWG NO.	FIG C	REV	1
DATE	4/28/10	SCALE	NONE	DRAWN BY	J.D.G.	SHEET	Page 9

VII. SYSTEM ADJUSTMENTS

1. The speed at which the system will activate when landing can be adjusted by turning the speed adjusting screw through a hole on the front panel of the electronic module. (This hole is furthest away from the DB-15 connector.) The speed can be set between 40 mph and 90 mph. For it is suggested that the speed be set to activate at 60 mph when airborne.

NOTE: Some Aircraft have a low static pressure region in the cockpit that will cause the Gear Alert module to “see” a higher airspeed than as indicated on an aircraft with a properly corrected static pressure system. This could cause the system to activate below the desired activation speed. Therefore, as a calibration starting point we set a speed setting that is about 10 mph faster than the desired activation speed and then flight test the system. (The system has been preset to 70 mph at the factory to cause activation at approximately 60 mph when airborne.)

If this speed is not suitable the installer must determine an airspeed that is less than the aircraft's lowest cruise speed but higher than any speed encountered at the beginning of the flare, and set the activation to this speed. This adjustment is accomplished as follows: There is a SHORT VIOLET wire (Pin 14) in the cable assembly. Attach a digital volt meter between this wire and aircraft ground. Refer to the separate factory-calibrated sheet of voltage vs. speed that came with your unit. With power applied to the system, insert a small screwdriver through the hole in the electronic module, and turn the speed control until you read the voltage on the meter that corresponds to the desired speed setting. The new speed setting will not be active until the system is turned off and back on.

Once you have set the speed setting (see Note above) it should be ground tested and then flight tested to confirm calibration with the aircraft's ASI.

NOTE: When calibrating the system, it is useful to have a length of appropriate tubing from the Pitot tube to the cockpit area so that you can gently pressurize the system by mouth while watching the ASI, Gear Alert system switch-lights and listening to the electronic module's speaker. **DO NOT OVER PRESURIZE.** When above the activation speed seal the tube with your tongue. If the speed drops go looking for leaks! There is a brief delay between the time the system recognizes the activation speed and when it actually starts the warning sequence. (This delay was incorporated to minimize false triggering.) Remember, you should set the speed setting on the ground approximately 10 mph higher than the desired activation speed and the system must be powered down after each adjustment.

Once any final adjustments have been made, insulate and secure the end of the SHORT VIOLET wire.

2. The headset volume can be adjusted by turning the volume potentiometer through a hole in the front of the electronic module closest to the DB-15 connector. Turning the pot (counter clockwise) increases the volume output to the aircraft audio system (not the module speaker.)

Speed setting table for P/N 2080 Gear Warning System

The following are the voltage readings for settings for the activation speed.

Activation Speed, MPH	Pressure, (inch Water)	Voltage, (volts)
45	.996	1.37
50	1.229	1.56
60	1.77	2.05
70	2.41	2.61
80	3.15	3.25
90	4.0	4.0

NOTE: These are approximate values, the actual setting may vary. The actual setting will depend on things such as the static pressure variation in your aircraft, the Pitot pressure errors etc.

VIII. SYSTEM CHECKOUT AND OPERATION

A. Ground Test

1. Power up the Gear Alert system. The voice must not sound. The amber switch-lights must not illuminate. Individually turn on the various electrical devices in the aircraft. Any false trigger of the Gear Alert at any time constitutes failure of this test. If any electronic device in the aircraft does not operate correctly, turn off the Gear Alert and determine if it is the cause. The test fails if the system affects the operation of any electronic device in the aircraft, or if any electronic device in the aircraft affects the operation of the Gear Alert.

2. Push either switch-light and release it. The voice message “TEST OK” must be heard in the pilot’s headset, and through the built-in speaker. If the test message fails to function or the volume is inadequate, this constitutes failure of the test. Repeat this test by pushing the other switch-light. The headset volume can be adjusted by turning the volume potentiometer in the electronic module.

3. Push either switch-light and hold it for about 2 seconds then release it. The test message “TEST OK” should be heard, and when your finger is released, the amber lights in both switch-lights will flash alternately indicating that the system is disengaged. Pushing either switch-light again will turn the lights off and re-engage the system. If the test voice does not function, or the amber lights fail to blink, or the system does not re-engage, the test has failed.

B. Flight Test

Failure of any of the following flight tests constitutes system failure.

1. **Gear Warning** - Perform a normal takeoff, raise the flaps above the landing configuration but leave the gear down. When the aircraft has exceeded the activation speed for more than thirty seconds the system should activate (both switch-lights illuminate for six seconds).

The voice warning “RAISE GEAR...RAISE GEAR” should be heard at an adequate volume level in the pilot’s headset, and through the built-in speaker. The voice warning will cease after the one repetition.

2. **False Trigger** - Fly the aircraft at different cruise speeds from maximum cruise speed to just above activation speed. Tests should include flight with power changes, climbs, steep turns, etc. Any false triggering of the Gear Alert system at any time constitutes failure of the test.

3. **System Test** - With the aircraft flying above the activation speed, push either switch-light and release it. The voice message “TEST OK” should be heard at an adequate volume level in the pilot’s headset, and through the built-in speaker. Repeat by pushing the other switch-light.

4. **System Disengage** - Push and hold a switch-light for about 2 seconds. The voice message “TEST OK” will play. When your finger is released, the switch-lights will flash alternately indicating that the system is disengaged. Push either switch-light again. This should extinguish the alternating lights and re-engage the system (both switch-lights light up for 6 seconds.)

5. **Gear up Flap Activation** - With the landing gear retracted and the speed above the activation speed, select landing flap. After a 5 second delay both switch-lights will begin flashing and the voice message “SELECT LANDING ...” will be heard continuously in the pilot’s headset and through the built-in speaker (the “landing interrogation”). Push the switch-light marked for water landing. Both switch-lights will stop flashing, the switch-light marked for water landing will light up and a female voice message “WATER LANDING, OK” must be heard.

Raise the flaps above the landing position, and then repeat this test, except this time push the switch-light marked for runway landing. The voice message “CHECK LANDING GEAR, CHECK LANDING GEAR” must be heard. (The voice will continue until the gear is extended, the flap is raised above the landing position or the water landing switch-light is pushed.)

6. **Gear down Flap Activation** - With the landing gear down and the speed above the activation speed, select landing flap. After the landing interrogation push the runway landing switch-light. The switch-lights will stop flashing, the runway landing switch-light will light up and a male voice message “RUNWAY LANDING, OK” must be heard.

Raise the flaps above the landing position, and then repeat this test, except this time push the water landing switch-light. The voice message “CHECK LANDING GEAR, CHECK LANDING GEAR” must be heard. (The voice will continue until the gear is raised, the flap is raised above the landing position or the runway landing switch-light is pushed.)

7. **Gear up Speed Activation** - With the landing gear retracted, flap above the landing position and speed above the activation speed, slow the aircraft to below the activation speed. After the landing interrogation push the water landing switch-light. The switch-lights will stop flashing, the water landing switch-light will light up and a female voice message “WATER LANDING, OK” must be heard.

Accelerate the aircraft above the activation speed until both switch-lights light up and then repeat this test, except this time push the runway landing switch-light. The voice message “CHECK LANDING GEAR, CHECK LANDING GEAR” must be heard. (The voice will continue until the gear is lowered, the speed is increased above the activation speed for 5 seconds or the water landing switch-light is pushed.)

8. **Gear down Speed Activation** - Commence this test with the landing gear retracted, flap above the landing position and speed above the activation speed. Lower the landing gear, don’t touch the flaps and, slow the aircraft to below the activation speed. After the landing interrogation push the runway landing switch-light. The switch-lights will stop flashing, the runway landing switch-light will light up and a male voice message “RUNWAY LANDING, OK” must be heard.

Raise the gear and accelerate the aircraft above the activation speed until both switch-lights light up. Now lower the gear and repeat this test, except this time push the water landing switch-light. The voice message “CHECK LANDING GEAR, CHECK LANDING GEAR” must be heard.

(The voice will continue until the gear is raised or the speed is increased above the activation speed for 5 seconds or the runway landing switch-light is pushed.

9. **Electrical Interference** - Individually turn on the various electrical devices in the aircraft. As each device is activated, verify that its operation is not affected by the Gear Alert system, and that the system does not false trigger as the various electrical devices are turned on.

IX. DOCUMENTATION

1. The installer is responsible for making all logbook entries, revising weight and balance, and other documentation as required.
2. System weight is 0.7 lb.

X. MATERIALS

The following materials are included in the Gear Alert assembly. Check all parts before beginning the installation.

1. (1) Electronic Module Assembly P/N 2080-2-1
2. (1) Cable Assembly P/N 2080-3
3. (1) Installation Manual
4. (1) Installation Kit P/N 2080-10

The following are some of the materials that must be supplied by the user.

1. (1) "T" Fitting (for the size of pitot static tubing used in the aircraft.)
2. (1) adapter to connect the unit's 3/16" tubing to aircraft pitot static tubing.
3. (1) 3-amp fuse or circuit breaker (5-amp maximum.)