



AIRFRAME

INSTALLATION INSTRUCTIONS

Document No. SF2001, Revision C

Revision History

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A	07/17/2020	Added Section 1.4 for TACH2	RVC
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1. Installation Overview

1.1. General Description:

The **S**ureFly **I**gnition **M**odule (SIM) is a magneto replacement for Continental & Lycoming aircraft piston engines.

A SIM is installed onto an engine in accordance with SureFly's engine STC.

Please see www.surefly.aero/engine for information on how to install a SIM onto an engine.

SureFly's airframe STC provides for the installation of a SIM-modified engine (in accordance with SureFly's engine STC) onto an airframe.

These airframe installation instructions detail the steps required to accomplish 2 tasks:

1. Connect a source of battery power from the airframe to a SIM, and
2. Notify the FAA a SIM-modified engine is installed onto an airframe via FAA Form 337.

For information on SureFly's airframe STC please see www.surefly.aero/airframe

1.2. Operation:

Each SIM requires a constant, external supply of 8.5 – 30VDC power to operate.

When turned off (SIM p-lead grounded), a SIM goes into standby and will continuously draw less than 1 milliamp in this mode.

SureFly recommends keeping the airframe battery on a maintenance charger when not in use for extended periods of time (1 month or more).

1.3. Technical References:

The following documents may be referenced during the installation of the SIM:

1. SureFly Airframe Installation Instructions: SF2001 (this document),
2. FAA Advisory Circular 43.13-1b Acceptable Methods, Techniques, and Practices.

Copies of these documents may be found at www.surefly.aero/airframe

1.4. Airframe Tachometer Compatibility:

The SIM outputs a +60VDC pulse on the p-lead (2 pulses per rev. for 4 cylinder and 3 pulses per rev. for 6 cylinder) with a +10VDC offset for a 14V electrical system and a +20VDC offset for a 28V electrical system.

If the tachometer requires a negative-going p-lead signal (Horizon P-1000) or if the tachometer requires a positive going 0-5VDC square wave signal from a previously installed magnetic pickup, the installation will require a SureFly TACH2 Signal Converter.

The following documents are required for the installation of a TACH2:

1. SureFly TACH2 Installation Instructions: SF2002,
2. FAA Advisory Circular 43.13-1b Acceptable Methods, Techniques, and Practices.

Copies of these documents may be found at www.surefly.aero/airframe

For more information on a TACH2 Signal Converter please contact SureFly.

1.5. Airframe Electrical Noise Issues:

The SureFly PC17V Power Conditioner is used to eliminate noise spikes from the airframe input power that may, in some aircraft with a 28V charging system, be large enough to trip a SIM's internal overvoltage protection causing a system reset. Resets of this nature may appear as engine "stumbles" or "rough running". The PC17V Power Conditioner is installed in series between the SIM battery fuse and the SIM power terminal.

The following documents are required for the installation of a PC17V:

1. SureFly PC17V Service Instruction: SI-920,
2. FAA Advisory Circular 43.13-1b Acceptable Methods, Techniques, and Practices.

Copies of these documents may be found at www.surefly.aero/airframe

For more information on a PC17V Power Conditioner please contact SureFly.

2. Step-By-Step Installation Instructions for 1st SIM

2.1. Eligibility Determination:

Before commencing, you as the owner or installer must determine whether the SIM-modified engine is approved for installation on the intended airframe.

FIRST: Determine whether your airframe is listed on SureFly's airframe STC AML. A copy of the AML may be found at www.surefly.aero/airframe

If your specific airframe (entire model designation) is listed on the AML, you may proceed.
If your airframe is NOT listed on the AML, stop now and contact SureFly.

SECOND: Determine whether any previously installed STC's conflict with the installation of the SIM-modified engine onto the airframe. Such might include:

1. FADEC systems,
2. Previously installed electronic ignition systems.

If no conflicting STC's are found, you may proceed.

If any previously installed STC's may conflict with the installation of the SIM-modified engine, stop now and contact SureFly.

2.2. Component List:

The following items are needed to install a single SIM-modified engine onto an airframe:

1. 14AWG(minimum) MIL-Spec (MIL-W-22759 / M22759 / SAE AS22759) wire,
2. Fuse holder with 10A fuse (or other appropriate 10A circuit protection device),
3. Appropriately sized ring terminals,
4. Placard¹,
5. These installation instructions.

SureFly provides a pre-assembled power wire (PN 4&6C601) that you may use for items 1-3 above.

If any documents are missing, you may find copies at www.surefly.aero/airframe

Please contact SureFly if any items are found damaged.

2.3. Preparation:

READ AND UNDERSTAND ALL OF THE INSTRUCTIONS BEFORE BEGINNING INSTALLATION.

Before beginning this installation, install the first SIM onto the engine per the applicable engine STC installation instructions which can be found at www.surefly.aero/engine

2.4. Power Requirements:

1. The first SIM on an engine must be powered directly from the primary aircraft battery, and
2. The primary aircraft battery must be 10-30V and be able to provide a 10A peak current demand to the SIM.

Operating power requirements @ 2700RPM (w/ safety factor added in):

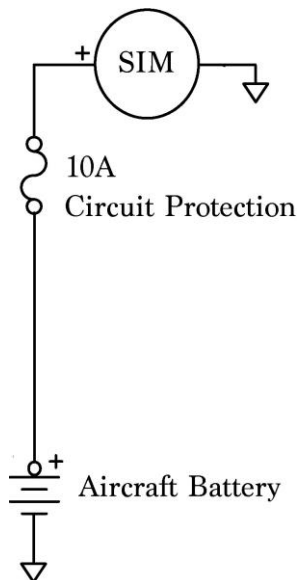
Model:	@ 14VDC	@ 28VDC
SIM4P & SIM4N	1.0A	0.5A
SIM6C & SIM6L	1.5A	0.75A

2.5. Power Wire Requirements:

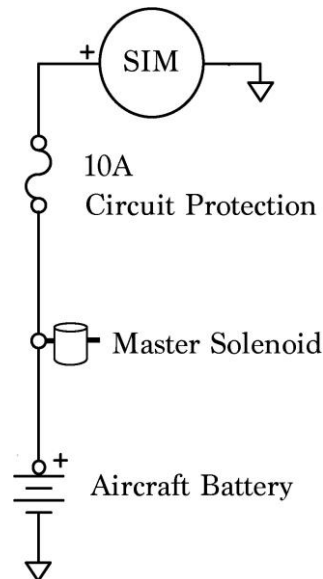
- a) The first SIM power wire must be a minimum of 14AWG,
- b) The first SIM power wire must be MIL-Spec (MIL-W-22759 / M22759 / SAE AS22759),
- c) The first SIM power wire must be circuit protected at 10A.

2.6. Power Wire Circuit:

- a) The first SIM must be permanently connected to either:
 1. Aircraft primary battery (+) terminal, or
 2. Aircraft primary battery input side of the master solenoid.
- b) Circuit diagram:



Normal Installation



Alternate Installation

2.7. Power Wire Routing:

- a) Route the power wire from the airframe battery to the first SIM following the shortest course.
- b) Locate the 10A fuse (or other appropriate 10A circuit protection device) as close to the airframe battery as possible.
- c) Secure the wire along its entire route, protect from chafing and provide strain relief across areas of movement. Guidance for wire routing, chafe protection and strain relief can be found in FAA Advisory Circular 43.13-1b Chapter 11-137 & 11-138
- d) Strip both ends of the power wire and crimp appropriately sized ring terminals onto each end. Do not use solder terminals.

2.8. Install P-Lead Wire:

- a) Install the p-lead wire from the ignition switch onto the first SIM p-lead terminal.
- b) Thread provided nut over first SIM p-lead terminal. Back p-lead base nut with a wrench and torque the nut to 15±2 inch-lbs.
- c) If the p-lead wire is shielded, connect the shield to the p-lead shield (ground) terminal with the provided screw and torque to 15±2 inch-lbs.
- d) **Important Note:** If you are replacing a shower of sparks magneto, install the wire labeled “Advance” onto the P-Lead terminal of the first SIM. Do not use the wire labeled “Retard” – insulate this wire and tie it back.

2.9. Affix the provided Placards:

- a) Affix the provided placard (placard1) to the airframe's instrument panel in view of the pilot:

This aircraft is equipped with an electronic ignition system that requires continuous electrical power.

Do not operate aircraft with low battery voltage or an inoperative charging system.

Placard1

3. Step-By-Step Installation Instructions for 2nd SIM

3.1. Eligibility Determination:

Before commencing, you as the owner or installer must determine whether the SIM-modified engine is approved for installation on the intended airframe.

FIRST: Determine whether your airframe is listed on SureFly's airframe STC AML. A copy of the AML may be found at www.surefly.aero/airframe

If your specific airframe (entire model designation) is listed on the AML, you may proceed.
If your airframe is NOT listed on the AML, stop now and contact SureFly.

SECOND: Determine whether any previously installed STC's conflict with the installation of the SIM-modified engine onto the airframe. Such might include:

1. FADEC systems,

If no conflicting STC's are found, you may proceed.

If any previously installed STC's may conflict with the installation of the SIM-modified engine, stop now and contact SureFly.

THIRD: Determine whether the airframe meets the power requirements listed in section 3.4 of this manual.

If the airframe does not have an FAA approved factory dual electrical system, install an FAA approved battery backup system meeting the requirements of section 3.4 of this manual, and ensure the system complies with all requirements of section 3.4 of this manual before proceeding.

If the airframe has an FAA approved factory dual electrical system, ensure the system complies with all requirements of section 3.4 of this manual before proceeding.

3.2. Component List:

The following items are needed to install a dual SIM-modified engine onto an airframe:

1. 14AWG(minimum) MIL-Spec (MIL-W-22759 / M22759 / SAE AS22759) wire,
2. Fuse holder with 10A fuse (or other appropriate 10A circuit protection device),
3. Appropriately sized ring terminals,
4. These installation instructions.

SureFly provides a pre-assembled power wire (PN 4&6C601) that you may use for items 1-3 above.

If any documents are missing, you may find copies at www.surefly.aero/airframe

Please contact SureFly if any items are found damaged.

3.3. Preparation:

READ AND UNDERSTAND ALL OF THE INSTRUCTIONS BEFORE BEGINNING INSTALLATION.

Before beginning this installation, install the second SIM onto the engine per the applicable engine STC installation instructions which can be found at www.surefly.aero/engine

3.4. Power Requirements:

1. The second SIM on an engine must be powered from a separate battery independent of the primary aircraft battery, and
2. The second battery must be 10-30V with a minimum capacity of 2Ah and be able to provide a 10A peak current demand, and
3. A load analysis must be calculated to ensure the ability of the second battery to operate the second SIM, and all other essential loads connected to it, for a minimum of 60 minutes upon the loss of the primary electrical system, and
4. The aircraft must have a visual means to warn the flight crew of primary electrical system fault, and
5. The instrument panel must be placarded with a warning to prohibit the flight crew from operating the aircraft with low battery voltages or an inoperative charging system, and
6. **For Single Engine Aircraft:** the second battery must be configured in one of the following forms:
 - a. **FAA Approved Backup Battery System:** The backup battery system must be connected to the second SIM in a manner such that the failure of the aircraft primary electrical system would not affect the backup battery system, and vice versa. The following requirements must also be met:
 - i. The backup battery system must provide the flight crew a pre-flight method of ensuring sufficient capacity is available to power the second SIM for a minimum of 60 minutes.
 - ii. The backup battery system must provide an indication to the crew anytime power from non-rechargeable batteries has been used, in which case mandatory replacement is required.
 - iii. The backup battery must be replaced or tested on a periodic basis.
 - iv. Backup battery systems using rechargeable batteries must meet TSO-C173a / RCTA DO-293A for lead acid and ni-cad batteries and be approved for installation in a manner acceptable to the FAA.
 - v. Backup battery systems using rechargeable lithium batteries must meet TSO-C179b / RTCA DO-311A. Lithium battery installation must be approved by STC.
 - vi. Backup battery systems using non-rechargeable lithium batteries must meet TSO C-142b / RTCA DO-227A. Lithium battery installation must be approved by STC.
 - b. **FAA Approved Factory Dual Electrical Systems:** The second SIM must be connected to the second battery on aircraft factory equipped with dual electrical systems and dual batteries. The following requirements must also be met:
 - i. The batteries must be isolated from each other in a means that prevents a failure of one battery effecting the second battery.
 - ii. The second battery must provide the flight crew a pre-flight method of ensuring sufficient capacity is available to power the second SIM for a minimum of 60 minutes.
7. **For Twin Engine Aircraft:** the second SIM of each engine must be connected to a dedicated FAA Approved Backup Battery System (that each conforms to the requirements in Section 3.4 6.a above) for each engine. The second SIM of each engine may not share a second battery or a FAA Approved Backup Battery System.
8. An alternator or generator in an electrical system is not to be considered a source of power for a SIM.

Use the following data for load analysis.

Operating power requirements @ 2700RPM (w/ safety factor added in):

Model:	@ 14VDC	@ 28VDC
SIM4P & SIM4N	1.0A	0.5A
SIM6C & SIM6L	1.5A	0.75A

3.5. Power Wire Requirements:

- The second SIM power wire must be a minimum of 14AWG,
- The second SIM power wire must be MIL-Spec (MIL-W-22759 / M22759 / SAE AS22759),
- The second SIM power wire must be circuit protected at 10A.
- The second SIM must have a dedicated ground wire connecting it to the second battery.

3.6. Power Wire Circuit:

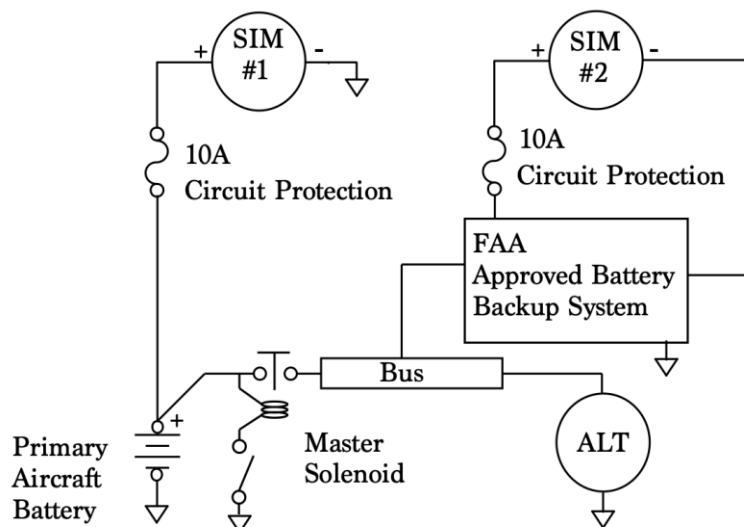
The second SIM must be installed in accordance with one of the following 3 circuits:

a) **FAA Approved Backup Battery System – Single Engine Airframe:**

If the single engine airframe does not have an FAA approved factory dual electrical system, a FAA approved backup battery system must be installed that meets the requirements of section 3.4 of this manual.

The second SIM must be permanently connected (un-switched) to a FAA approved backup battery system.

The second SIM MUST have a dedicated ground wire connected to the FAA approved backup battery system. A metal airframe may be used as the ground path provided separate connections from the SIM and the FAA approved backup battery system are provided.



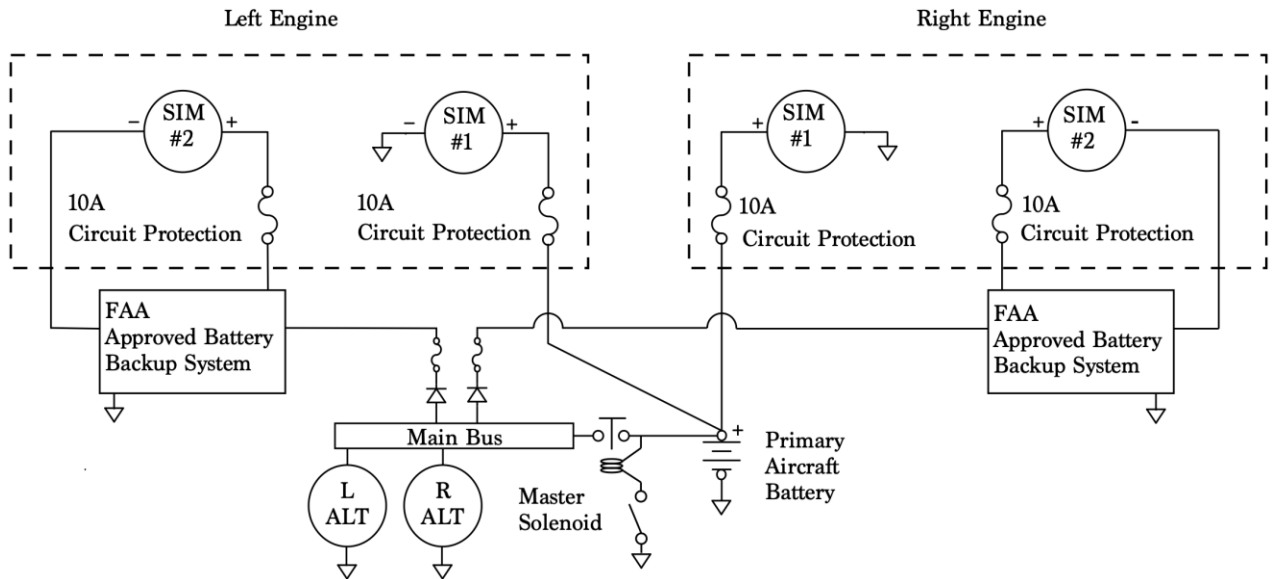
b) **FAA Approved Backup Battery – Twin Engine Airframe:**

FAA approved backup battery systems must be installed that meet the requirements of section 3.4 of this manual.

The second SIM on each engine must be permanently connected (un-switched) to a FAA approved backup battery system.

Each second SIM on each engine must be connected to its own FAA approved backup battery system.

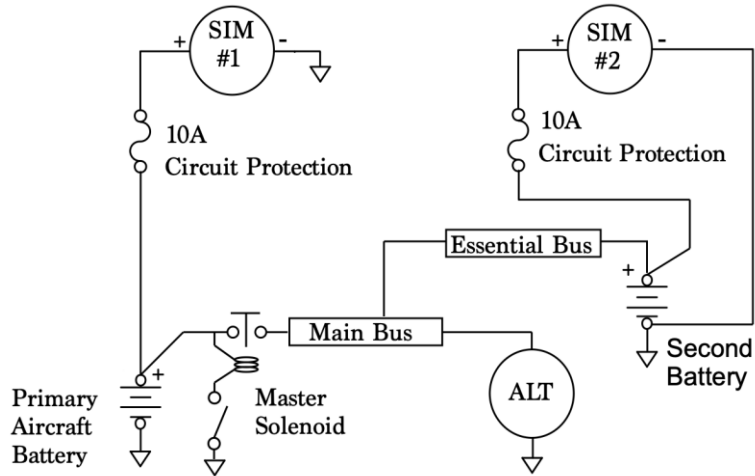
Each second SIM on each engine MUST have a dedicated ground wire connected to the FAA approved backup battery system. A metal airframe may be used as the ground path provided separate connections from the SIM and the FAA approved backup battery system are provided.



c) **FAA Approved Factory Dual Electrical Systems – Single Engine Airframe:**

If the single engine airframe has an FAA approved factory dual electrical system, the second SIM must be permanently connected (un-switched) to the second battery.

The second SIM **MUST** have a dedicated ground wire connected to the second battery. A metal airframe may be used as the ground path provided separate connections from the SIM and the second battery are provided.



3.7. Load Analysis:

A load analysis MUST be calculated before proceeding with the installation of the second SIM. **Do not** proceed with the installation of the second SIM if the load analysis results fail to meet the following criteria:

- a) For a single engine aircraft a load analysis must be calculated to ensure the ability of the second battery to operate the second SIM, and all other essential loads connected to it, for a minimum of 60 minutes upon the loss of the primary electrical system.
- b) For a twin engine aircraft a load analysis must be calculated to ensure the ability of the second battery to power BOTH second SIMs on each engine, and all other essential loads connected to it, for a minimum of 60 minutes upon the loss of the primary electrical system.

Use the following data for load analysis.

Operating power requirements @ 2700RPM (w/ safety factor added in):

Model:	@ 14VDC	@ 28VDC
SIM4P & SIM4N	1.0A	0.5A
SIM6C & SIM6L	1.5A	0.75A

3.8. Power Wire Routing:

- a) Route the power wire from the second battery to the second SIM following the shortest course.
- b) Locate the 10A fuse (or other appropriate 10A circuit protection device) as close to the second battery as possible.
- c) Secure the wire along its entire route, protect from chafing and provide strain relief across areas of movement. Guidance for wire routing, chafe protection and strain relief can be found in FAA Advisory Circular 43.13-1b Chapter 11-137 & 11-138
- d) Strip both ends of the power wire and crimp appropriately sized ring terminals onto each end. Do not use solder terminals.

3.9. Ground Wire Routing:

- a) Route the ground wire from the second battery to the second SIM following the shortest course. A metal airframe may be used as the ground path.
- b) Secure the wire along its entire route, protect from chafing and provide strain relief across areas of movement. Guidance for wire routing, chafe protection and strain relief can be found in FAA Advisory Circular 43.13-1b Chapter 11-137 & 11-138.
- c) Strip both ends of the ground wire and crimp appropriately sized ring terminals onto each end. Do not use solder terminals.

3.10. Install P-Lead Wire:

- a) Install the p-lead wire from the ignition switch onto the second SIM p-lead terminal.
- b) Thread provided nut over second SIM p-lead terminal. Back p-lead base nut with a wrench and torque the nut to 15±2 inch-lbs.
- c) If the p-lead wire is shielded, connect the shield to the p-lead shield (ground) terminal with the provided screw and torque to 15±2 inch-lbs.
- d) **Important Note:** If you are replacing a shower of sparks magneto, install the wire labeled "Advance" onto the P-Lead terminal of the second SIM. Do not use the wire labeled "Retard" – insulate this wire and tie it back.

4. Post-Installation

4.1. Final Inspection:

- a) For the first SIM, visually inspect the following items:
 - 1. Power wire is connected directly to the airframe battery and secure at both ends,
 - 2. Ring terminals are correctly crimped at both ends of the power wire,
 - 3. Power wire is secured, protected from chafing and strain relieved along its entire route,
 - 4. 10A circuit protection device is as close to the airframe battery as possible and secure,
 - 5. Placard described in 2.9 are affixed to the instrument panel in view of the pilot.

- b) For the second SIM, visually inspect the following items:
 - 1. Power wire is connected to a second battery and secure at both ends,
 - 2. Ring terminals are correctly crimped at both ends of the power wire,
 - 3. Power wire is secured, protected from chafing and strain relieved along its entire route,
 - 4. 10A circuit protection device is as close to the second battery as possible and secure,
 - 5. A dedicated ground wire is connected to a second battery and secure at both ends,
 - 6. Ring terminals are correctly crimped at both ends of the ground wire,
 - 7. Ground wire is secured, protected from chafing and strain relieved along its entire route.

4.2. Operational Check:

- a) For the first SIM:
 1. Before initial engine start:
 - a. Turn all master electrical switches **off**.
 - b. Measure the voltage at the airframe battery.
 - c. Measure the voltage at the power terminal of the first SIM.
 - d. The voltage measured at the SIM power terminal must be no less than 0.5Volt less than the voltage measured at the battery.
 2. Start the engine normally using the engine manufacturer's recommended starting procedure,
 - a. Run the engine at 1,800 RPM,
 - b. Turn off all avionics, radios, navigation equipment and any other electrical loads,
 - c. Select the ignition switch to run the engine on only the side the first SIM is installed on (L or R),
 - d. Turn the master electrical switch OFF,
 - e. If the engine stops, the SIM is incorrectly wired. Stop the operational check and check wiring,
 - f. If the engine continues to run, select the ignition switch to run the engine on only the remaining ignition (L or R). If the engine continues to run, the first SIM is correctly wired and you may stop the operational check and proceed.
 3. Contact SureFly if the engine does not run or does not run smoothly on the SIM.
- b) For the second SIM:
 1. Before initial engine start:
 - a. Turn all master electrical switches **off**.
 - b. Arm or turn on the backup battery system.
 - c. Measure the voltage at the second battery.
 - d. Measure the voltage at the power terminal of the second SIM.
 - e. The voltage measured at the SIM power terminal must be no less than 0.5Volt less than the voltage measured at the second battery.
 2. Start the engine normally using the engine manufacturer's recommended starting procedure,
 - a. Run the engine at 1,800 RPM,
 - b. Turn off all avionics, radios, navigation equipment and any other electrical loads,
 - c. Select the ignition switch to run the engine on only the side the second SIM is installed on (L or R),
 - d. Turn the master electrical switch OFF,
 - e. If applicable, isolate the essential bus or second battery from the airframe electrical system as recommended by the manufacturer,
 - f. Ensure there is a visible warning indicating electrical system fault,
 - g. If the engine stops, the SIM is incorrectly wired. Stop the operational check and check wiring,
 - h. If the engine continues to run, select the ignition switch to run the engine on only the remaining ignition (L or R). If the engine continues to run, the second SIM is correctly wired, and you may stop the operational check and proceed.
 3. Contact SureFly if the engine does not run or does not run smoothly on the SIM.
- c) Test for Electromagnetic Interference (EMI) as defined in Appendix A. Report any EMI issues to SureFly.

5. Documentation

5.1. STC Permission Letter:

- a) You must obtain a letter of permission from SureFly Partners, LTD before completing the airframe STC.
- b) Please visit www.surefly.aero/airframe to view and print a copy of SureFly's STC permission letter.

5.2. FAA Form 337:

- a) You must file a FAA Form 337 to notify the FAA of the alternation to the airframe in accordance with SureFly's airframe STC, airframe AML, airframe ICA, AFMS and these Installation Instructions.
- b) Please visit www.surefly.aero/airframe to view and print a copy of SureFly's airframe STC documents.

5.3. Maintenance Log:

- a) You must document the alteration to the airframe in the airframe's maintenance records and/or logbooks.
- b) Please see www.surefly.aero/airframe for an example of a logbook entry.

5.4. ICA:

- a) The Instructions for Continued Airworthiness for the alteration to the airframe may be found at www.surefly.aero/airframe

5.5. AFMS:

- a) The Aircraft Flight Manual Supplement for the alteration to the airframe may be found at www.surefly.aero/airframe
- b) You must complete the AFMS and attached it to the AFM/POH (make sure to note the installation type in Limitations section of the AFMS).

6. Appendix A: Electromagnetic Interference Test

6.1. Alternator / Generator as Installed:

1. Verify that there is no adverse effect on alternator/generator with the SIM operating.
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.
5. Continue to next section.

6.2. All Installed VHF COMM and NAV Radios (record frequencies utilized):

1. Record frequencies where induced audio noise is present (if any).
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.
5. Continue to next section.

VHF COMM Receiver A:			VHF COMM Receiver B:		
118.00 MHz	124.00 MHz	130.00 MHz	118.00 MHz	124.00 MHz	130.00 MHz
119.00 MHz	125.00 MHz	131.00 MHz	119.00 MHz	125.00 MHz	131.00 MHz
120.00 MHz	126.00 MHz	132.00 MHz	120.00 MHz	126.00 MHz	132.00 MHz
121.00 MHz	127.00 MHz	133.00 MHz	121.00 MHz	127.00 MHz	133.00 MHz
122.00 MHz	128.00 MHz	134.00 MHz	122.00 MHz	128.00 MHz	134.00 MHz
123.00 MHz	129.00 MHz	135.00 MHz	123.00 MHz	129.00 MHz	135.00 MHz

6.3. GPS (if installed):

1. Verify that the GPS acquires satellite position with the SIM operating.
2. If satellite acquisition is abnormal, turn the SIM OFF.
3. If abnormal operation goes away, there is likely interference from the SIM.
4. If abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.
5. Continue to next section.

6.4. Engine Monitoring Device (if installed):

1. Verify that there is no adverse effect on engine monitoring device with the SIM operating.
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.
5. Continue to next section.

6.5. Electric Fuel Pump (if installed):

1. Verify that there is no adverse effect on fuel pump with the SIM operating.
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.
5. Continue to next section.

6.6. Hydraulic Pump (if installed):

1. Verify that there is no adverse effect on hydraulic pump with the SIM operating.
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft
5. Continue to next section.

6.7. Flaps If Electric:

1. Verify that there is no adverse effect on flaps with the SIM operating.
2. If interference or abnormal operation is detected, turn the SIM OFF.
3. If interference or abnormal operation goes away, there is likely interference from the SIM.
4. If interference or abnormal operation persists with the SIM OFF, the cause may be interference from other devices or faulty aircraft systems.