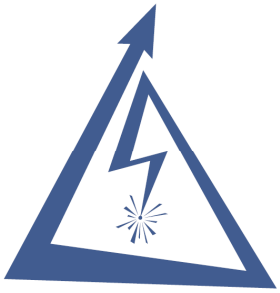

electroair
ELECTRONIC IGNITION SYSTEMS

EIS-61000
Installation Manual

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Revision Log

Rev	Pages Affected	Date of Revision	Description of Revision	Approved by	Date of Approval
00		08/20/2013	Initial Release		
01		10/30/2013	Add receiving and acceptance checking section.	KP	10/30/2013
02		03/18/2014	Added Lycoming engines	KP	03/28/2014
03		07/16/2014	ECO 1116-0051	KP	07/16/2014
04		08/11/2014	ECO 1116-0066	KP	09/11/2014
05		09/30/2014	ECO 1116-0083	KP	11/17/2014
06		12/15/2014	ECO 1116-0103	KP	12/29/2014
07		01/16/2015	ECO 1116-0109	KP	01/16/2015
08		05/19/2015	ECO 1116-0119	KP	05/19/2015
09		11/03/2015	ECO 1116-0130	KP	11/04/2015
10		10/31/2016	ECO 1019-0027	JMS	02/03/2017
11	1,2,8,9,10,12,13,18 ,19,20	03/20/2018	ECO 1019-0051	JMS	
12	2-3, 9-11, 25-28	04/26/2018	ECO 1019-0056	JMS	
13	8-11, 13-14, 20-21	05/17/2019	SA09950CH-A	JMS	07/30/2019
14	2,3, 6, 8-14, 22-25, 29-33	12/18/2020	SA09966CH-A: Electronic Ignition Timing Software Project	JMS	06/10/2021
15	2-3, 7-19, 21-40	02/17/2022	Added Dual EIS Limitations and Requirements and Dual Install Instructions	JMS	
16	10, 12, 15, 24-26, 33	03/28/2022	Added EA-25000	JMS	
17	7-8, 15, 17-18, 30, 34	11/21/2022	ECO 1019-0114	JMS	
18	18, 19, 31, 35	12/14/2022	Updated CSTW, Manifold Pressure, and Tach wire instructions for clarity.	JMS	

Ignition System Technical Discussion

Ignition System Basics

The goal of any ignition system in a four-stroke engine is to start the combustion event so that peak pressure, as a result of combustion, occurs between 10 & 17 degrees after top dead center (ATDC) of the piston travel. This is the generally accepted range and the starting point when talking about ignition systems. From here we work backwards to understand how ignition systems work and what improvements can be made in order to get the most out of the engine.

Dual Magneto System Review

Traditional aircraft engines use a dual, or two, Magneto Ignition System (MIS). Both magnetos are timed to fire at a preset degree before Top Dead Center (TDC). The two magneto system can be made up of a number of combinations: one impulse coupled magneto and one direct drive magneto; two impulse coupled magnetos; or two magnetos that have some kind of "starting help" device like a shower of sparks or "Slick-Start" system. No matter the combination, the magnetos are responsible for supplying energy to the spark plugs causing a "spark" which is used to ignite a fuel/air mixture inside of the cylinder. For decades, this kind of ignition system has been used quite successfully in aircraft engines. Traditional aircraft ignition systems, however, have remained stagnant in technological development and because of their inherent limitations, hand-cuffed the engine's ability to deliver peak performance.

Magnetos have two big limitations: one, they produce a relatively small amount of energy; and two, they can only provide that energy (or spark) at a fixed time point in the crank-shaft rotation. Magnetos typically can provide 12,000V through about 5 degrees of crank rotation at the spark plug – less during the start sequence (6,000-8,000 volts during starting). The fixed time point where the spark occurs means that the magneto cannot adjust the spark event to compensate for variances in fuel/air mixtures. As fuel/air mixtures varies (either because of altitude, air density, fuel density, etc.), the time required to develop peak pressure from combustion also changes. If the ignition event timing doesn't change, then the time where peak pressure occurs MUST change. When this happens, the experience is typically a loss of power.

EIS Overview & Primer

There are two principle differences between a magneto (MIS) and an electronic ignition system (EIS): one, an EIS is able to deliver much higher energy to the spark plug for a long period of time (70,000V through about 20 degrees of crank rotation) at any RPM; and two, an EIS is able to vary the ignition timing based on changes in the fuel/air mixture.

The very large voltage supplied to the spark plugs comes from using larger coils. The EIS's ability to deliver that voltage at any RPM is because the output from the EIS is NOT dependent on engine RPM, but the battery supply. The high energy voltage from the EIS allows for a larger gap in the spark plug – insuring a big, long duration, high quality spark. This spark will then have the ability to ignite typically any kind of fuel/air mixture that passes by the spark plug. This is particularly important for hot-start applications, where the fuel/air mixture is corrupt in some way, caused by the high temperature, poor fuel quality, or any combination thereof.

The ability to vary spark timing is also critical. Any good propulsion engineer will pontificate that the way to develop power out of an engine is directly related to the amount of air that can be put

into the combustion chamber (fuel can always be metered). Aircraft engines battle this problem constantly with changing altitude and poorly designed intake systems. A good way of measuring the amount of air in the combustion chamber is by measuring Manifold Absolute Pressure (MAP). This directly correlates to the amount of air available for combustion. The EIS looks at MAP, and adjusts timing based on this to optimize the location (or degree of crank position) for the spark event to occur. The Electroair EIS uses the vacuum advance curve found in Figure 1 for adjusting timing based on MAP. Some top flow induction engines may use a different curve. The EIS also has an option for no additional advance.

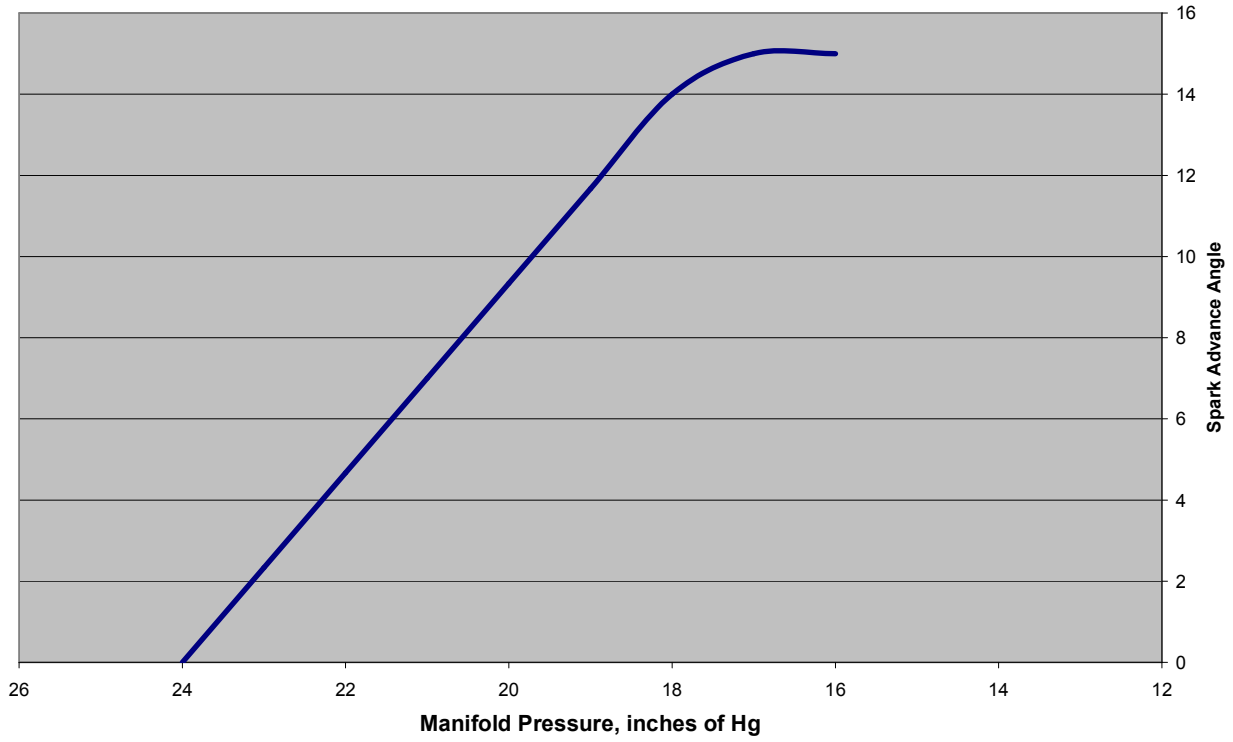


Figure 1: Vacuum Advance Curve

How the Electroair EIS Works

The Electroair EIS fires the spark plugs directly from the coils, not through a distributor. This is accomplished by using multiple coils, each with two spark terminals. The coil terminals are connected to the spark plugs, allowing one cylinder to fire on compression while its companion cylinder fires simultaneously on exhaust. Open spark gaps in the rotor and cap are eliminated, making wear and moisture problems a thing of the past.

What sets the Electroair Electronic Ignition System apart from others is the ability to charge multiple ignition coils at the same time. This increased dwell time means that full spark energy is available over the entire RPM range (up to 9600 RPM at 12 or 24 volts). Unlike capacitive discharge systems that only put out one very short spark, the EIS puts out a full energy, long burning spark at the highest and most critical engine speeds. Long burn times assure effective burning of even rich fuel mixtures.

The EIS Controller includes software, which takes the electrical signal from the crankshaft (or mag timing housing) sensor, identifies top-dead center, and then keeps track of the remaining

rotation. The EIS determines engine speed and computes the spark advance using the settings pre-set at the factory for the engine as a baseline. Settings from the factory are preset for the engine's certified placarded timing. Additionally, the EIS receives engine manifold pressure information and advances the ignition to compensate for altitude and throttle position.

Beyond the synchronization and firing the plugs at the correct advance angle, the EIS also computes the exact dwell time to produce 6 amps of coil current. Coil charging is dynamically measured, so changes in RPM, battery voltage, or temperature are accounted for on every spark. This corrects any errors that are caused by battery voltage or coil temperature changes and insures maximum spark energy.

High Resolution Crankshaft Position Sensor

The EIS uses a single, high resolution, 60-minus-2 tooth crankshaft position trigger wheel. The trigger wheel is either installed in a timing mechanism that is installed in a mag hole (aka Mag Timing Housing or MTH), or a trigger wheel is installed directly on the crankshaft just behind the prop flange. This affords resolution unheard of in any other electronic ignition available today, offering spark accuracy of ¼ degree of crankshaft rotation. This accuracy means the system is ideal for the most demanding engine applications – *that's why the Electroair EIS has accomplished altitude and speed records in the industry.* The Crank Shaft Trigger Wheel (CSTW) can be used in situations where an MTH cannot be installed such as on engines that use single-drive dual magnetos, where only one mag hole is available. If a mag hole is available, the CSTW can still be installed on the crankshaft along with a plate to cover the open mag hole.

In summary, the Electroair EIS delivers more power because:

- Spark timing is precisely controlled under all conditions, including rapid engine acceleration.
- Longer dwell time and better propagation allows the engine to run better on various mixture settings.
- Accurate spark timing allows sustained engine operation closer to desired peak power timing.
- 100% spark energy up to 9600 RPM on 6-cylinder applications (at 12 or 24 volts).
- Longer spark duration!
- Built-in timing program.
- No power draining magnetos to drive.
- No moving parts to wear out or adjust.

Electrical Environmental Limitations

- Radiated Susceptibility – Tested to DO-160G section 20 category T
- Conducted Susceptibility – Tested to DO-160G section 20 category T
- Conducted Emissions – Tested to DO-160G section 21 category B
- Radiated Emissions – Tested to DO-160G section 21 category B
- Lightning – Tested to DO-160G section 22 category A3J3L3

Applicable STCs

The following STCs are applicable for this document.

- SA03286CH
- SE04577CH

DUAL ELECTRONIC IGNITION SYSTEMS LIMITATIONS AND REQUIREMENTS

The electrical power requirements for engines equipped with dual electronic ignition systems will require a separate source of backup electrical power that is independent of the primary source. The separate source of electrical power can take one to the following forms:

- **Backup Battery**: This system is the simplest installation for a single or twin engine aircraft certified with a single or dual batteries and alternator electrical system. For a dual EIS installation on single engine aircraft, only one EIS may be connected to the backup battery. For a dual EIS installation on a twin engine aircraft, one EIS from each engine may be connected to the same backup battery. The backup battery current rating must be greater than the current load of the two EIS. The other EIS on each engine must have separate and independent power sources. Alternatively, for a dual EIS installation on a twin engine aircraft one EIS on each engine may be connected to a separate and independent backup battery. There will be at least three independent power sources for the dual EIS on a twin: the backup battery and two others. No other devices or loads may be connected to the backup battery when it is used as a back-up battery for an EIS. Using a backup battery requires a method of determining the backup battery charge state in order to meet the minimum backup power requirements.
  - **Note:** A backup power source may include a rechargeable battery system that meets TSO-C173a / RTCA DO-293A for Lead acid and Ni-Cad batteries, TSO-C179b / RTCA DO-311A for Lithium batteries, or TSO C-142b / RTCA DO-227A for non-rechargeable lithium batteries. The system must include a state of charge indication available before each flight. A pre-flight indication of battery state of charge must be provided to the crew.
  - **Note:** A backup power source may utilize a non-rechargeable battery that meets TSO-C142b. The non-rechargeable battery must be replaced on a periodic basis that ensures sufficient capacity is available to meet the requirements below. Use of a non-rechargeable battery also requires an indication to the crew anytime power from the backup battery is used in which case mandatory replacement is required.
- **Dual Electrical System**: On aircraft with a dual battery or dual alternator/generator systems with independent primary electrical busses, power from each of the electrical busses can be used when the failure of one electrical system is isolated from the other system.
  - **Note:** Twin-engine applications with dual electrical systems may share a common backup power source, independent of either engine's primary power source, which can provide electrical power after loss of power from both independent electrical systems.
- **Backup Alternator/Generator System**: This system differs from the Dual Electrical System because the backup alternator/generator is not used as a primary source of aircraft electrical power. The backup alternator/generator is used, as an alternate source of electrical power should the primary system fail. These systems are usually attached to either a dedicated or an essential buss and offer reduced current capability when compared to the primary system.

The following must be shown for any backup power supply configuration proposed on any airplane engine installation equipped with a dual EIS.

(1) If any emergency or other procedure recommends or requires the shutoff of any or all electrical systems in flight, such as for smoke in the cabin or loss of a power generation, then a dedicated backup power source must be provided, which is independent of the primary electrical system and automatically available when any electrical system is shutoff in flight. This applies to both single and dual buss systems on single and multi-engine airplanes.
(2) For any one engine on a single or multi-engine airplane, it must take at least two independent power source failures for a LOPC event
(3) For twin-engine airplanes, it must take at least three independent power source failures for a LOPC event in both engines.
(4) For twin-engine installations, the design must continue to meet the powerplant isolation requirements of §23.903(c), including in at least one configuration, an independent power supply for at least one EIS on each engine.

The minimum requirements for the electrical power system are addressed in 14 CFR 23.1309, 23.1351, 23.1353, 23.1357, 23.1359, 23.1361, 23.1365 and 23.1367. The time required in 14 CFR 23.1353(h) is the minimum time for backup electrical power in the event of a failure of primary aircraft electrical power. The backup power does not need to be wholly dedicated to the electronic ignition system since other critical systems may be supplied by the backup electrical power. However, following the loss of the primary power generation system, a minimum of 60 minutes of backup electrical power for the electronic ignition system is highly recommended. Additionally, the inherent redundancy of an independent power source dedicated to the electronic ignition system is also highly recommended when considering an aircraft electrical power failure.

A six-cylinder dual electronic ignition system will consist of two separate Electroair EIS-61000 series kits installed on a single engine or four separate EIS-61000 series kits for dual-EIS on twin engine aircraft (two EISs per engine). For aircraft with a dual, or back-up alternator, one EIS shall be attached directly to the back-up alternator. The load attached to each alternator shall not exceed 80% of the total capacity for the alternator (AC43-13-1B, Chapter 11, Section 11-35), and may need to be adjusted to allow for supplying power to one of the Electroair Electronic Ignition Systems (when dual Electroair systems are installed).

Spark Plug Discussion

The installation manual specifies the recommended gap for the engine application. This gap will be larger than a typical aircraft plug gap because of the higher energy output from the EIS. This is perfectly acceptable with the EIS ignition charging method, since the high load of the cylinder pressure will allow the voltage to be quite high at the electrode; the gap will keep the plug from seeing an over-voltage situation.

The EIS system uses an *inductive* long duration charging method for the coils. Electroair's experience has drawn us to the following guidelines for spark plug selection:

- Select aircraft spark plugs that will work with the EIS. For Lycoming engines, Electroair has found that the REM37BY (or equivalent) plugs work the best because they are easier to gap to the range required and fit the broadest heat range recommended by the engine manufacturers. (Fine wire plugs are also an excellent choice for Lycoming engines). For Continental Engines requiring long reach spark plugs, off-the-shelf fine wire spark plugs will generally be the easiest to adjust the gap. Electroair strongly recommends verifying the heat range for the engine and using the appropriate plugs.
- Electroair manufactures aviation spark plugs that are gapped at the factory to Electroair's recommended wide gap of 0.036 inches. Electroair manufactures both massive electrode and fine wire spark plugs for various applications. The spark plug information can be found on the Electroair website (www.electroair.net). Electroair spark plugs have been FAA approved for use with Electroair's certified EIS-61000 ignition systems. These plugs are only approved for use with Electroair's EIS. Electroair spark plugs should not be used with magnetos.

EIS-61000 Kit Description & Requirements

EIS-61000 Series System Description & Requirements:

1. This EIS kit replaces one magneto on the engine of an aircraft
2. 12V or 24V electrical system capable of 1.25A
3. Manifold pressure line for variable timing
4. Toggle Switch x1, capable of handling 12/24 volts and at least 1.25A(**NOT PROVIDED IN EIS KIT**)
5. 2 amp circuit breaker or fuse x1 (**NOT PROVIDED IN EIS KIT**)
6. 10 amp circuit breaker or fuse x1 (**NOT PROVIDED IN EIS KIT**)

Other items needed:

1. Basic tools and standard aircraft hardware required for mounting EIS controller and coil pack.
2. Electrical tools for cutting, stripping, and terminating various wiring. Also recommended is a good selection of cable ties for harness routing and tie-off.
3. EIS-61000-4M Kit requires Drive Gear and Bushing from removed magneto. See Set-up & Installation of p/n EA-16000 Mag Timing Housing.
4. EIS-61000-6M requires Coupler from removed magneto. See Set-up & Installation of p/n EA-19000 Mag Timing Housing.

EIS-61000 Kit Contents & Optional Parts

EIS-61000-1C Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Crank Shaft Trigger Wheel Kit (EA-11000)
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___Block Off plate (EA-11030)
9. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-1M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (MTH) (EA-10000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-T1C Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Crank Shaft Trigger Wheel Kit (EA-11000)
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___Block Off plate (EA-11030)
9. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-T1M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (MTH) (EA-10000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-5C Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Crank Shaft Trigger Wheel Kit (EA-9000A)
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___Block Off plate (EA-9020)
9. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-T5C Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Crank Shaft Trigger Wheel Kit (EA-9000A)
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___Block Off plate (EA-9020)
9. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-TTT5C Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Crank Shaft Trigger Wheel Kit (EA-9000A)
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___Block Off plate (EA-9020)
9. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-5M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-12000 or EA-25000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-T5M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-12000 or EA-25000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-TTT5M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-12000 or EA-25000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-4M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-16000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-6M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-19000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-T6M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-19000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4196)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000T)
8. ___USB Drive Containing System Documents (Installation Manual)

EIS-61000-7M Kit Contents:

1. ___EIS Controller (EA-21000) with secondary ground wire.
2. ___Coil Pack (EA-8000)
3. ___Coil Plate (EA-8010) + Hardware Kit (EA-8000HW)
4. ___Mag Timing Housing (EA-17000) and hardware kit
5. ___Spark Plug Wires x 3 Bundles (EA-4195)
6. ___Spark Plug RHM/RHB Hardware Kit (EA-4180RHMRHB6)
7. ___Wiring Harness (EA-22000)
8. ___USB Drive Containing System Documents (Installation Manual)

Receiving and Acceptance Checking of EIS Kit

1. Review the packaging before acceptance from the freight carrier. If damaged, refuse the package.
2. Open the package. Components of the EIS kit are inserted into different sections and each component should be handled with care.
3. Review the contents of the package to the content listing on the package.
4. Are all of the materials there?
   a. Yes, proceed to step 5.
   b. No, contact the factory. Have the serial number of the kit available when contacting. (factory 248-674-3433 or sales@electroair.net)
5. Inspect the controller for damage to the aluminum housing. Verify that the placarded controller timing matched the placarded engine timing. If not contact Electroair 248-674-3433 or sales@electroair.net.
6. Inspect the wires for nicks and cracks.
7. Inspect the coil pack and plate for external damage.
8. Inspect the CSTW/MTH for external damage.
9. Are all materials acceptable?
   a. Yes, proceed with installation.
   b. No, contact the factory. Have the serial number of the kit available when contacting. (factory 248-674-3433 or sales@electroair.net)

If possible, store parts in original packaging when not in use. If not possible, wrap parts in cushioning material and place in one location. Review above prior to reinstallation.

For latest copies of documentation, refer to www.electroair.net.

- AML
- AFMS
- ICA
- Installation Manual
- STC

Overview of Six Cylinder EIS Installation

Thank you for purchasing an Electroair Ignition System for your aircraft. Electroair is confident that you will be happy with the performance of the EIS on your aircraft. The next several pages will provide a step-by-step process of installing the EIS on the aircraft. Electroair hopes you will enjoy the experience and that this manual will provide clear direction and guidance through this process. This manual will cover the following general installation steps:

1. General overview and recommendations
2. Removal of old ignition components
3. Set-up & installation of p/n: EA-11000 or EA-9000 CSTW kit, if applicable
4. Set-up & installation of p/n: EA-10000, EA-12000, or EA-17000 MTH kit, if applicable
5. Set-up & installation of p/n: EA-16000 MTH kit, if applicable
6. Set-up & installation of p/n: EA-19000 MTH kit, if applicable
7. Set-up & installation of p/n: EA-25000 MTH kit
8. Installation of p/n: EA-21000 EIS Controller and p/n: EA-8000 Coil Pack
9. Connection of Manifold Pressure Line
10. Installation of p/n: EA-4000 Spark Plug Harness
11. Connection of p/n: EA-22000(T) Wiring Harness
12. Final installation steps

Electroair strongly recommends that reading through this entire installation procedure before installing the EIS on the aircraft. Make sure that any questions are answered before the actual installation. Also, make sure any extra components needed, e.g. cable ties, circuit breakers, switch terminations, etc., are available. Removal of old components and installation of new components is to be completed in compliance with CFR Title 14 Part 43, as applicable, and any Airframe or Engine Manufacturer Maintenance Procedures, as applicable. Above all else, use good common sense and professional judgment. An electronic ignition system is a high voltage device. If an EIS is improperly installed, maintained, or misfired, severe damage could be caused to the EIS, aircraft, the engine, or installer including bodily injury or death.

Please contact Electroair with any questions during this installation process. Good luck and happy flying!!

Electroair

Installation of EIS-61000

1. General Overview and Recommendations:

a. Read through the entire installation instructions before beginning the installation to make sure each step is understood. CALL ELECTROAIR (248-674-3433) if there are any questions or if any items that are unclear.
b. The installation of the EIS could take between 9-20 hours, depending on your skills for working on the engine & ignition systems. It is always advisable to seek help from a professional mechanic. Installation times can vary widely and are very aircraft and installer dependent!
c. This ignition system is designed to be installed by aviation professionals with the appropriate ratings and experience for maintaining General Aviation aircraft.
d. If pre-existing components on the airframe are in the way of or are near the installation locations of the EIS components, Electroair Acquisition Corp. recommends that following the procedures listed below. **NOTE:** When making ANY changes or modifications to the aircraft or aircraft components, make sure all practices are in accordance with CFR Title 14 Part 43.
    i. If the preexisting components can be relocated, move the components to an acceptable location on the airframe where they will not come into contact with the EIS component(s).
    ii. If the preexisting components must come into contact or near the EIS component(s), make sure to protect all components from each other. This could mean, but not limited to, adding anti-chafing material, additional component securing devices, heat shielding material, etc.
e. Always use good safety and work practices. Use appropriate safety equipment (safety glasses, etc.) and precautions. The EIS is a high voltage system and if installed or tested incorrectly can cause substantial damage to both the system and YOU!

2. Removal of Old Ignition Components:

a. Any removed articles that will be re-used should be inspected before re-installation.
b. **Remove cowling. Verify that Master Switch is off and battery is disconnected.**
c. **IMPORTANT:** Determine which magneto will be replaced, either the right or the left.
d. **Remove** ignition harness from the spark plugs associated with the magneto that is being replaced.
e. **Disconnect** the P-lead that is installed on the magneto that is being replaced from the ignition switch.
f. **Remove** the selected magneto; retain the clips holding the magneto in place. **If removing a pressurized magneto, ensure that the pressure line is properly plugged.**
g. **Save** the magneto clips if installing the MTH. Clips will be re-used.
h. **Remove** the selected magneto's ignition harness and selected magneto's P-lead from ignition switch.
i. **Remove** the magneto's P-lead entirely from the aircraft system – a replacement P-lead wire is provided in the EIS wiring harness.
j. **Remove** spark plugs.
k. If using MTH p/n EA-16000, **Remove and save** drive gear and bushing from the magneto being replaced. See Figure 8 for picture of drive gear and bushing.
l. If using MTH p/n EA-19000, **Remove and save** the coupler from the magneto being replaced. See Figure 9 for picture of the coupler.
m. If replacing both magnetos for Dual-EIS Installation, repeat steps a-k.

3. Set-up & Installation of p/n: EA-9000 or EA-11000 CSTW kit:

a. Retrieve p/n: EA-9000 or EA-11000 CSTW kit bag.
b. **Install** the mag hole cover supplied in the EA-9000 or the EA-11000 kit.
c. Access is needed to the crankshaft between the engine case and the prop flange. Remove those components necessary to accomplish this. Refer to engine manufacturer instructions to remove those components necessary to gain access.
d. Clean the crank area just in front of the crank shaft seal. **CAUTION:** The exposed portion of the crank shaft is tin plated. Electroair Acquisition Corp. recommends using a liquid cleaner/degreaser. An abrasive (like sand paper or scotch-brite) will remove the plating. Refer to engine manufacturer's maintenance instructions for proper procedure.
e. **Continental Installations (CSTW/Magnetic Pick-Up Bracket Installation)**

i. Temporarily fit the CSTW on the crank with the trigger wheel (timing teeth) toward the engine case. Slide the CSTW toward the prop flange. (Silver side of the CSTW to the engine case, black side to the propeller). Maintain a minimum distance between the engine case and CSTW of 0.100".

Figure 2: Typical installation of CSTW on a Continental 470 engine. Note: Minimum clearance of 0.650 inches required between front of case and rear of prop studs; contact Electroair Tech Support for additional information.

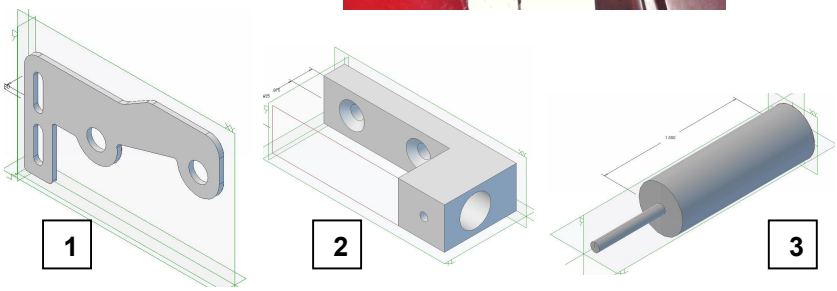


Figure 3: Components that make up the Continental CSTW Sensor Bracket; 1. Pick-Up Bracket (rear-mount alternator; front-mount alternator bracket not shown); 2. Pick-Up Holder; 3. Magnetic Pick-up (Magnetic Sensor)

ii. Temporarily install the pick-up bracket: Remove the first two, forward, top case nuts and install the bracket/pick-up holder assembly (see Figure 3); verify that the center seam of the engine case aligns with the center of the large hole in the Sensor Holder, adjust spacing with flat washers under the bracket if necessary; replace the nuts to a finger tight fit.
iii. Position the CSTW so that the magnetic pick-up (sensor) would be oriented correctly on the timing teeth on the CSTW.
iv. Rotate the CSTW and align the hole in the CSTW with the alignment tool (dowel/rivet assembly). Complete this by inserting the shaft of the pop rivet through the hole in the wood dowel. Place this assembly into the hole of the pick-up holder (dowel/rivet assembly simulates a magnetic pick-up and pop rivet will serve as an alignment pin). Hold it in place.

v. While holding these pieces together, mark the position of the Pick-Up Holder on to the pick-up bracket.

vi. After marking the location of the Pick-Up holder, remove the Pick-Up Bracket and Holder assembly; tighten the fasteners so the pick-up holder is in the correct location on the bracket.

vii. Re-attach completed magnetic Pick-Up Bracket/Holder assembly to the engine using the previous through bolts or nuts and tighten to the recommend torque values found in the engine overhaul specifications.

f. **Lycoming Installations (Magnetic Pick-Up Bracket Installation)**

i. Temporarily fit the CSTW on the crank with the trigger wheel (timing teeth) toward the engine case. Slide the CSTW toward the prop flange (Silver side of the CSTW to the engine case, black side to the propeller). Maintain a minimum distance between the engine case and CSTW of 0.100".

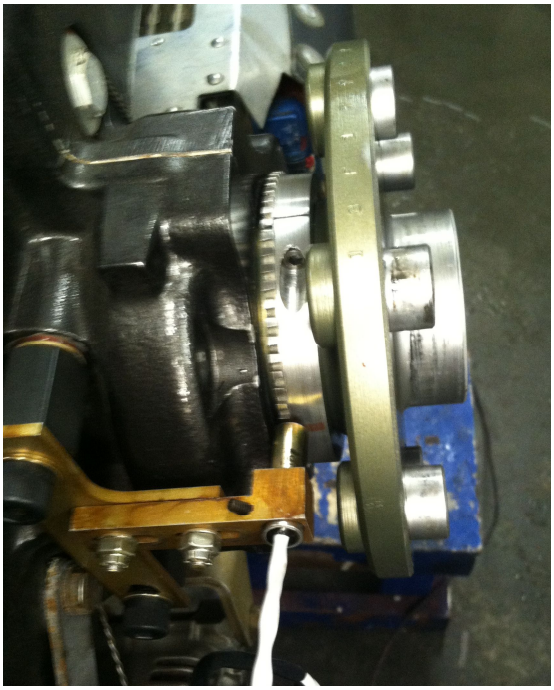
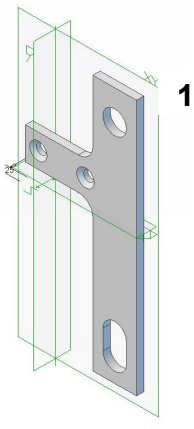
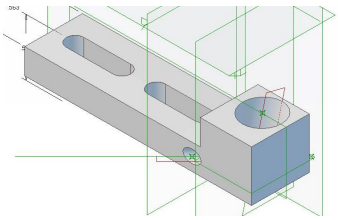


Figure 4: Typical installation of CSTW on a Lycoming 540 engine. Picture shows orientation of trigger wheel and typical bracket location. Please contact Electroair Tech Support if there are any questions about the assembly.





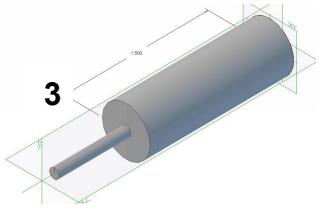


Figure 5: Components that make up the Lycoming CSTW Sensor Bracket; 1. Pick-Up Bracket; 2. Pick-Up Holder; 3. Magnetic Pick-up (Magnetic Sensor); hardware is not shown for clarity.

ii. Temporarily install the pick-up Bracket Stand-Offs: Remove the forward journal bolt nuts and install the Bracket Stand-Offs supplied in the CSTW kit (see Figure 4); torque Stand-Offs to the same value as the nuts that were removed (300 in-lbs, per Lycoming manual).
iii. Install Pick-Up Bracket using supplied socket head cap screws; torque screws to a value of 300 in-lbs. NOTE: Bracket may have to be removed to be able to install Pick-Up Holder; once bracket is in place and will not be removed, safety wire the cap screws in place.
iv. Temporarily install the Sensor Holder on to the Pick-Up Bracket; leave the nuts loose enough so the Sensor Holder can slide back and forth to obtain the correct position.
v. Position the CSTW so that the magnetic pick-up (sensor) would be oriented correctly on the timing teeth on the CSTW.
vi. Rotate the CSTW and align the hole in the CSTW with the alignment tool (dowel/rivet assembly). Complete this by inserting the shaft of the pop rivet through the hole in the wood dowel. Place this assembly into the hole of the Pick-Up Holder (dowel/rivet assembly simulates a magnetic pick-up and pop rivet will serve as an alignment pin). Hold it in place.
vii. While holding these pieces together, mark the position of the Pick-Up Holder on to the Pick-Up Bracket.
viii. After marking the location of the Pick-Up Holder, remove the Pick-Up Bracket and Holder assembly; tighten the fasteners so the Pick-Up Holder is in the correct location on the bracket.
ix. Re-attach completed magnetic Pick-Up Bracket/Holder assembly to the engine (install bracket assembly on stand-offs); tighten fasteners to the recommended torque values found in the engine overhaul specifications. **Verify that screws holding bracket to stand-offs have been secured using safety wire.**

g. **Verify that the master switch is off and battery is disconnected. Verify that the mag switch is off and the mag is properly grounded.**

ALWAYS STAY OUT OF THE PROPOLLER ARC!

h. Rotate the engine until number one cylinder is on Top Dead Center (TDC).
i. Loosen the CSTW and rotate it until the alignment pin (remember the dowel/pop rivet assembly which is still in the pick-up holder) lines up with the hole in the CSTW. The alignment pin can be used to lock the CSTW position. **This should place the trailing edge of the 11th tooth past the two missing teeth** directly under the center of where the magnetic pick-up will go. Reference Figure 6 for sensor alignment and positioning. If this is not correct, return to step “d” or “e” (depending on your engine make) and repeat.

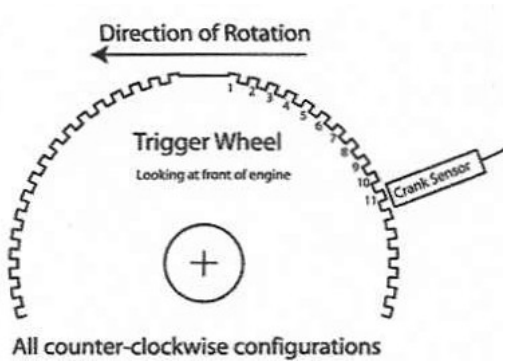


Figure 6: Crank Shaft Trigger Wheel Positioning

j. Remove CSTW and apply Loctite (Loctite # 242) to the crank shaft side of CSTW and to the two socket head cap screws.
k. Carefully replace the collar to the crank shaft and line up using the alignment pin as described in 3i. The alignment pin will help hold the CSTW in position.
l. Torque the cap screws on the CSTW to 20-25 inch-pounds. Be very careful that the gap between the two collar halves remains equal on both sides. If this gap is not held constant, the CSTW will not be concentric around the crank shaft and the timing pick-up will not function properly. **CAUTION:** Do not tighten the CSTW screws to the point that there is no gap between the collar halves. This means that the screws are over torqued, the aluminum collar stretched, and the CSTW will need replacing.
m. Route the magnetic pick-up wire harness up the center of the engine case and then on top of the engine. Use cable ties as necessary to secure routing. **Do not route near spark plug wires. Do not tie wrap to ignition leads.**
n. Remove the dowel/pop rivet assembly from the pick-up holder and install the magnetic pick-up. Using a feeler gauge or equivalent, set the gap to 0.024 inches. Once the gap between the timing teeth and the magnetic pick-up is set, apply a thin coating of Loctite #242 to the set-screws, insert them into the pick-up holder, and tighten them down. Remove the feeler gauge. **NOTE:** The tip of the sensor is a “Chisel Point”; this chisel must be positioned so that it is perpendicular to the plane of the trigger, or so that the chisel is parallel to the line of flight.
o. For Dual EIS installations, a 2nd CSTW will not fit onto the crankshaft. Therefore the 2nd EIS-61000 kit must use a Mag Timing Housing (MTH) or both EIS-61000 kits must use MTHs.

4. Set-up & Installation of p/n: EA-10000, EA-12000, or EA-17000(MTH):

Caution: Disconnect the battery and ALL ignition leads before starting this procedure.

a. **VERIFY MASTER SWITCH IS OFF AND BATTERY IS DISCONNECTED.**
b. Rotate the engine to Top Dead Center (TDC) for cylinder # 1. This done by rotating the prop ***in the direction of proper engine rotation*** until TDC is reached. Verify TDC using the timing marks found on the engine. Typically, the first set is on the fly wheel and the starter; they will line up at TDC; the second set may be another mark on the back-side of fly wheel which lines up with the engine case seam (top or bottom) at TDC. A TIME-RITE™ may also be used. If any of these indications are not correct, repeat this step until they are. ***Always rotate the engine in the direction that it rotates during operation.***
c. Retrieve the MTH and the MTH Hardware Kit.
d. Clean magneto pad on the engine. Install provided gasket from hardware kit onto the MTH.
e. Retrieve the alignment pin from the hardware kit.

If the removed magneto was located between the propeller and the accessory case, use timing hole CW. If the removed magneto was located between the accessory case and the firewall, use timing hole CC. See Figure 7.

Holding the MTH, insert the alignment pin into the appropriate timing cover hole on the back of the MTH (supplied with hardware kit). Slowly turn the gear on the front of the unit until the alignment pin drops into a hole in the internal gear inside the MTH. The MTH is now set to Top Dead Center (TDC) and the MTH shaft should not be able to spin.

Figure 7: Installation of MTH Alignment Pin

f. Install the MTH into the proper magneto hole. Secure the MTH using the mag holding clips referenced in step 2f and secure per engine manufacturer specifications.
g. **If required,** re-index the magneto drive gear to facilitate clearance for the magnetic sensor and the housing. Follow the engine manufacturer's instructions for re-indexing the drive gear.
h. **REMOVE THE ALIGNMENT PIN**. Failure to remove the MTH Alignment Pin may cause damage to the MTH, the engine, or both.
i. The MTH (p/n: EA-10000, EA-12000, or EA-17000) is now installed and timed properly.
j. If installing a 2nd EIS-61000 for dual EIS, repeat step a-i for 2nd MTH.

5. Set-up & Installation of p/n EA-16000 Mag Timing Housing:

a. Retrieve p/n: EA-16000 MTH and the EA-16000 MTH Hardware Kit.
b. Insert woodruff keys into slots on MTH. Insert the faux coupler onto the shaft and align with the woodruff keys.
c. Place the drive gear obtained from the removed magneto onto the coupler. Then insert the bushing obtained from the magneto onto the shaft and drive gear while aligning with woodruff key. See Figure 8 for picture of drive gear and bushing.

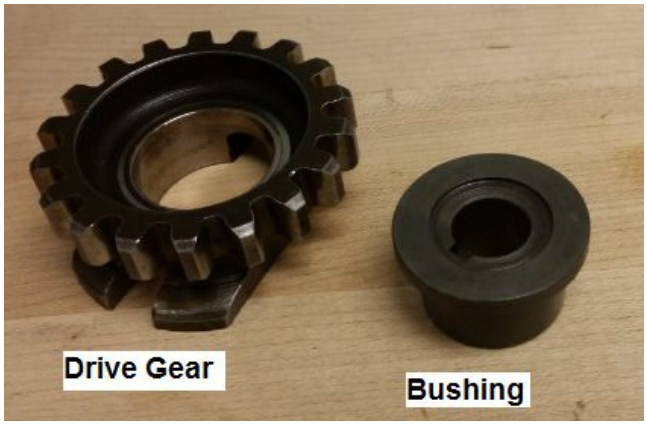


Figure 8: Magneto Drive Gear and Bushing

d. Place washer and castle nut onto the shaft and tighten to 160-190 in-lbs. Install the cotter pin through the castle nut and MTH shaft with the long end of the cotter pin facing away from the MTH. Bend the long end of the cotter pin over the end of the shaft and the short end along the side of the nut.

Caution: Disconnect the battery and ALL ignition leads before starting this procedure.

e. **VERIFY MASTER SWITCH IS OFF AND BATTERY IS DISCONNECTED.**
f. Rotate the engine to Top Dead Center (TDC) for cylinder # 1. This done by rotating the prop ***in the direction of proper engine rotation*** until TDC is reached. Verify TDC using the timing marks found on the engine. Typically, the first set is on the fly wheel and the starter; they will line up at TDC; the second set may be another mark on the back-side of fly wheel which lines up with the engine case seam (top or bottom) at TDC. A TIME-RITE™ may also be used. If any of these indications are not correct, repeat this step until they are. ***Always rotate the engine in the direction that it rotates during operation.***

g. Clean magneto pad on the engine. Install provided gasket from hardware kit on p/n: EA-16000.
h. Retrieve the alignment pin from the hardware kit.

If the removed magneto was located between the propeller and the accessory case, use timing hole CW. If the removed magneto was located between the accessory case and the firewall, use timing hole CC. See Figure 7.

Holding the MTH, insert the alignment pin into the appropriate timing cover hole on the back of the MTH (supplied with hardware kit). Slowly turn the gear on the front of the unit until the alignment pin drops into a hole in the internal gear inside the MTH. The MTH is now set to Top Dead Center (TDC) and the MTH shaft should not be able to spin.

i. Install the MTH into the proper magneto hole. Secure the MTH using the mag holding clips referenced in step 2f and secure per engine manufacturer specifications.
j. **If required,** re-index the magneto drive gear to facilitate clearance for the magnetic sensor and the housing. Follow the engine manufacturer's instructions for re-indexing the drive gear.
k. **REMOVE THE ALIGNMENT PIN**. Failure to remove the MTH Alignment Pin may cause damage to the MTH, the engine, or both.
l. P/N EA-16000 is now installed and timed properly.
m. If installing a 2nd EIS-61000 for dual EIS, repeat step a-l for 2nd MTH.

6. Set-up & Installation of p/n EA-19000 Mag Timing Housing:

a. Retrieve coupler from the magneto being replaced. See Figure 9.
b. Retrieve p/n: EA-19000 MTH and the EA-19000 MTH Hardware Kit.
c. Insert 404 woodruff key into the slot on the shaft of the EA-19000 MTH. Insert the coupler onto the shaft and align with the woodruff key.
d. Place washer and castle nut onto the shaft and tighten to 160-190 in-lbs. Install the cotter pin through the castle nut and MTH shaft with the long end of the cotter pin facing away from the MTH. Bend the long end of the cotter pin over the end of the shaft and the short end along the side of the nut.

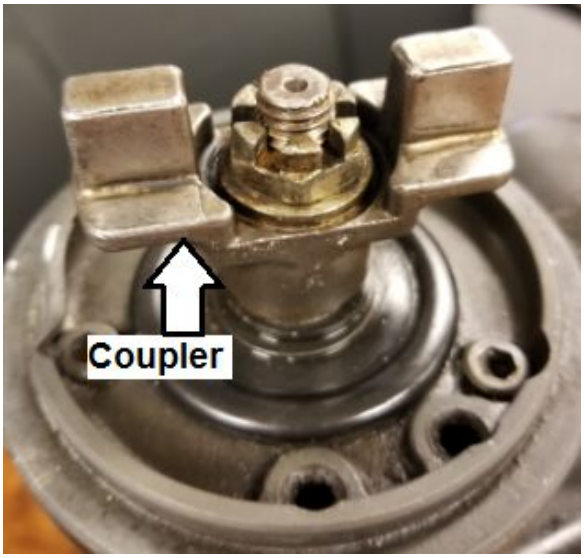


Figure 9: EA-19000 Coupler

Caution: Disconnect the battery and ALL ignition leads before starting this procedure.

e. **VERIFY MASTER SWITCH IS OFF AND BATTERY IS DISCONNECTED.**
f. Rotate the engine to Top Dead Center (TDC) for cylinder # 1. This done by rotating the prop ***in the direction of proper engine rotation*** until TDC is reached. Verify TDC using the timing marks found on the engine. Typically, the first set is on the fly wheel and the starter; they will line up at TDC; the second set may be another mark on the back-side of fly wheel which lines up with the engine case seam (top or bottom) at TDC. A TIME-RITE™ may also be used. If any of these indications are not correct, repeat this step until they are. ***Always rotate the engine in the direction that it rotates during operation.***
g. Clean magneto pad on the engine. Install provided gasket from hardware kit on p/n: EA-19000.
h. Retrieve the alignment pin from the hardware kit.

   If the removed magneto was located between the propeller and the accessory case, use timing hole CW. If the removed magneto was located between the accessory case and the firewall, use timing hole CC. See Figure 7.

   Holding the MTH, insert the alignment pin into the appropriate timing cover hole on the back of the MTH (supplied with hardware kit). Slowly turn the gear on the front of the unit until the alignment pin drops into a hole in the internal gear inside the MTH. The MTH is now set to Top Dead Center (TDC) and the MTH shaft should not be able to spin.
i. Install the MTH into the proper magneto hole. Secure the MTH using the mag holding clips referenced in step 2f and secure per engine manufacturer specifications.
j. **If required,** re-index the magneto drive gear to facilitate clearance for the magnetic sensor and the housing. Follow the engine manufacturer's instructions for re-indexing the drive gear.
k. **REMOVE THE ALIGNMENT PIN**. Failure to remove the MTH Alignment Pin may cause damage to the MTH, the engine, or both.
l. P/N EA-19000 is now installed and timed properly.
m. If installing a 2nd EIS-61000 for dual EIS, repeat step a-l for the 2nd MTH.

7. Set-up & Installation of p/n: EA-25000(MTH):

Caution: Disconnect the battery and ALL ignition leads before starting this procedure.

a. **VERIFY MASTER SWITCH IS OFF AND BATTERY IS DISCONNECTED.**
b. Rotate the engine to Top Dead Center (TDC) for cylinder # 1. This done by rotating the prop ***in the direction of proper engine rotation*** until TDC is reached. Verify TDC using the timing marks found on the engine. Typically, the first set is on the fly wheel and the starter; they will line up at TDC; the second set may be another mark on the back-side of fly wheel which lines up with the engine case seam (top or bottom) at TDC. A TIME-RITE™ may also be used. If any of these indications are not correct, repeat this step until they are. ***Always rotate the engine in the direction that it rotates during operation.***
c. Retrieve the EA-25000 MTH and the MTH Hardware Kit.

d. Clean magneto pad on the engine. Install provided gasket from hardware kit onto the MTH.
e. Retrieve the alignment pin from the hardware kit.

If the removed magneto was a D6LN, use timing hole CC. If the removed magneto was a D6RN, use timing hole CW. See Figure 10.

Holding the MTH, insert the alignment pin into the appropriate timing cover hole on the back of the MTH (supplied with hardware kit). Slowly turn the gear on the front of the unit until the alignment pin drops into a hole in the internal gear inside the MTH. The MTH is now set to Top Dead Center (TDC) and the MTH shaft should not be able to spin.

Figure 10: Installation of MTH Alignment Pin

f. Install the MTH into the magneto hole and connect correctly with the magneto drive gear retainer and cushions. Electroair recommends using new magneto drive cushions. See Figure 11.

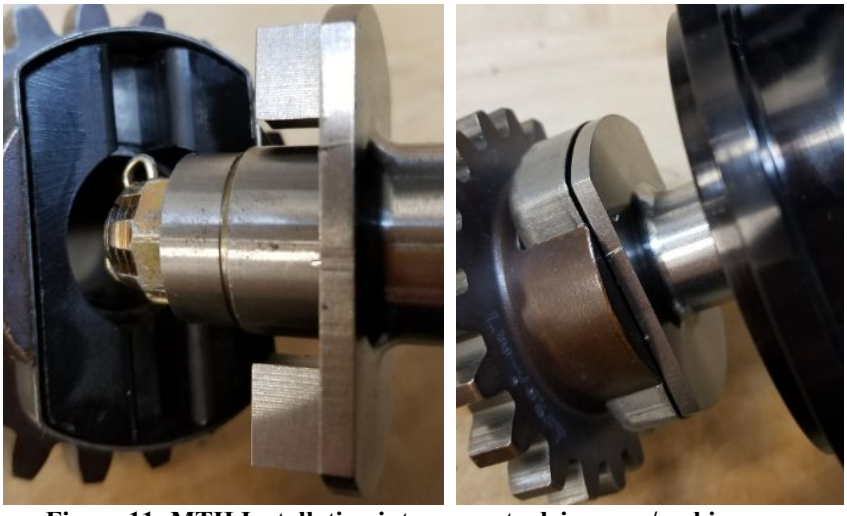


Figure 11: MTH Installation into magneto drive gear/cushions

g. Secure the MTH using the mag holding clips referenced in step 2f and secure per engine manufacturer specifications.
h. **If required,** re-index the magneto drive gear to facilitate clearance for the magnetic sensor and the housing. Follow the engine manufacturer's instructions for re-indexing the drive gear.
i. **REMOVE THE ALIGNMENT PIN**. Failure to remove the MTH Alignment Pin may cause damage to the MTH, the engine, or both.
j. The MTH (p/n: EA-25000) is now installed and timed properly.

8. Installation of p/n: EA-21000 EIS Controller and p/n: EA-8000 Coil Pack:

a. **EA-21000 Installation:** Install p/n EA-21000 EIS Controller where temperatures will not exceed 150°F. Because of this, Electroair requires that the EIS Controller be mounted on the cockpit side of the firewall with the shortest practical distance from the coil pack for the wiring harness runs. Refer to Figure 12 for controller dimensions.

b. Use standard hardware to attach secondary ground wire from the exposed metal mounting hole on the EA-21000 to a competent airframe ground. A standard #6 screw will fit in the mounting hole.

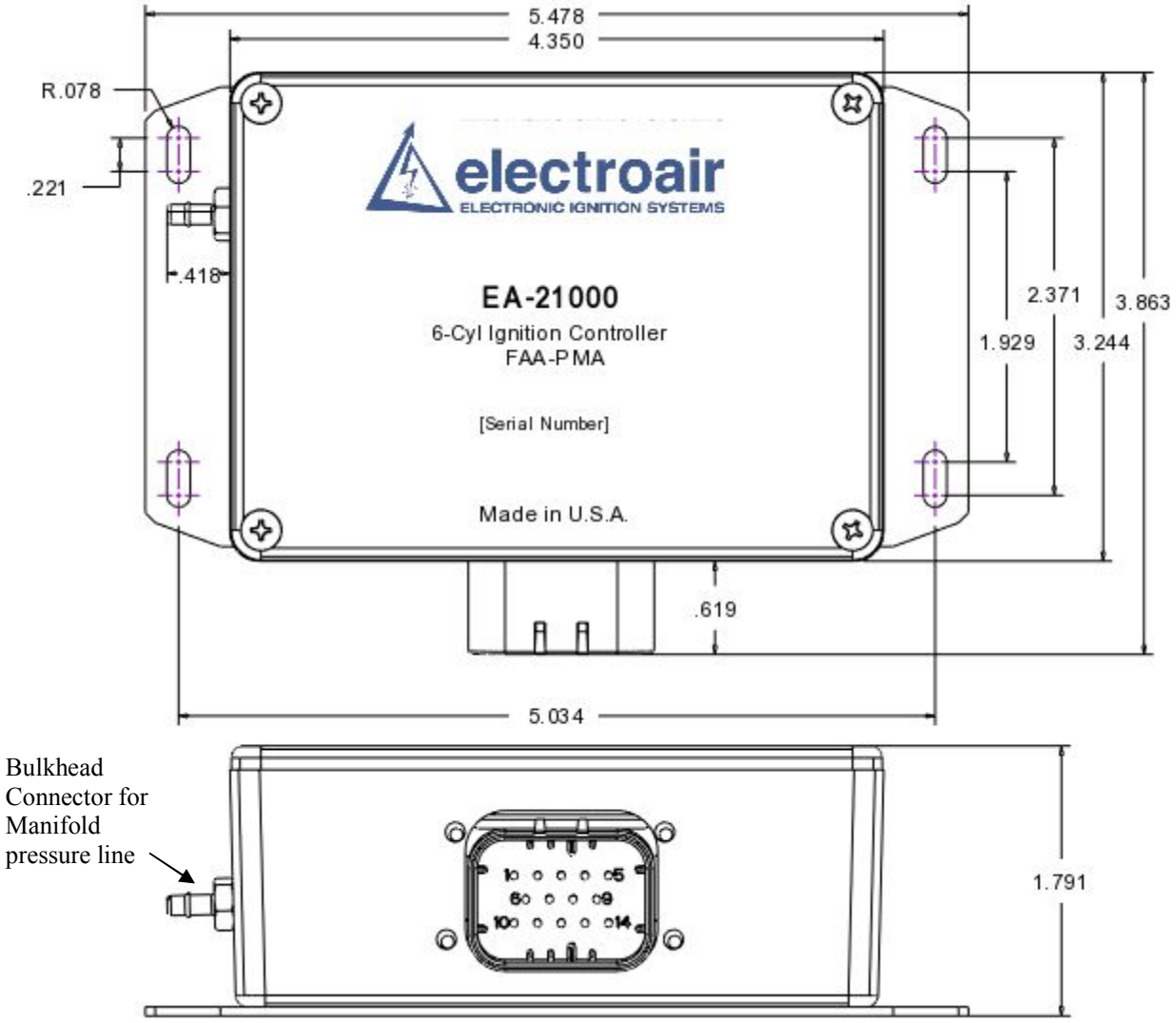


Figure 12: Part Number EA-21000; all dimensions in inches.

c. **EA-8000 Installation:** The Coil Pack is designed to be installed on the engine side of the firewall. Locate the unit in a position to keep the spark plug wires as short as possible and not interfere with other components or create maintenance difficulties in the future. Electroair strongly suggests that the Coil Pack be positioned so that the connector on the coil is facing straight down, but it can be positioned in any orientation that the installation requires. See Figure 13 for the Coil Pack dimensions.

Electroair also suggests that the coil pack and harness be kept some distance away from exhaust pipes and potential exhaust leaks.

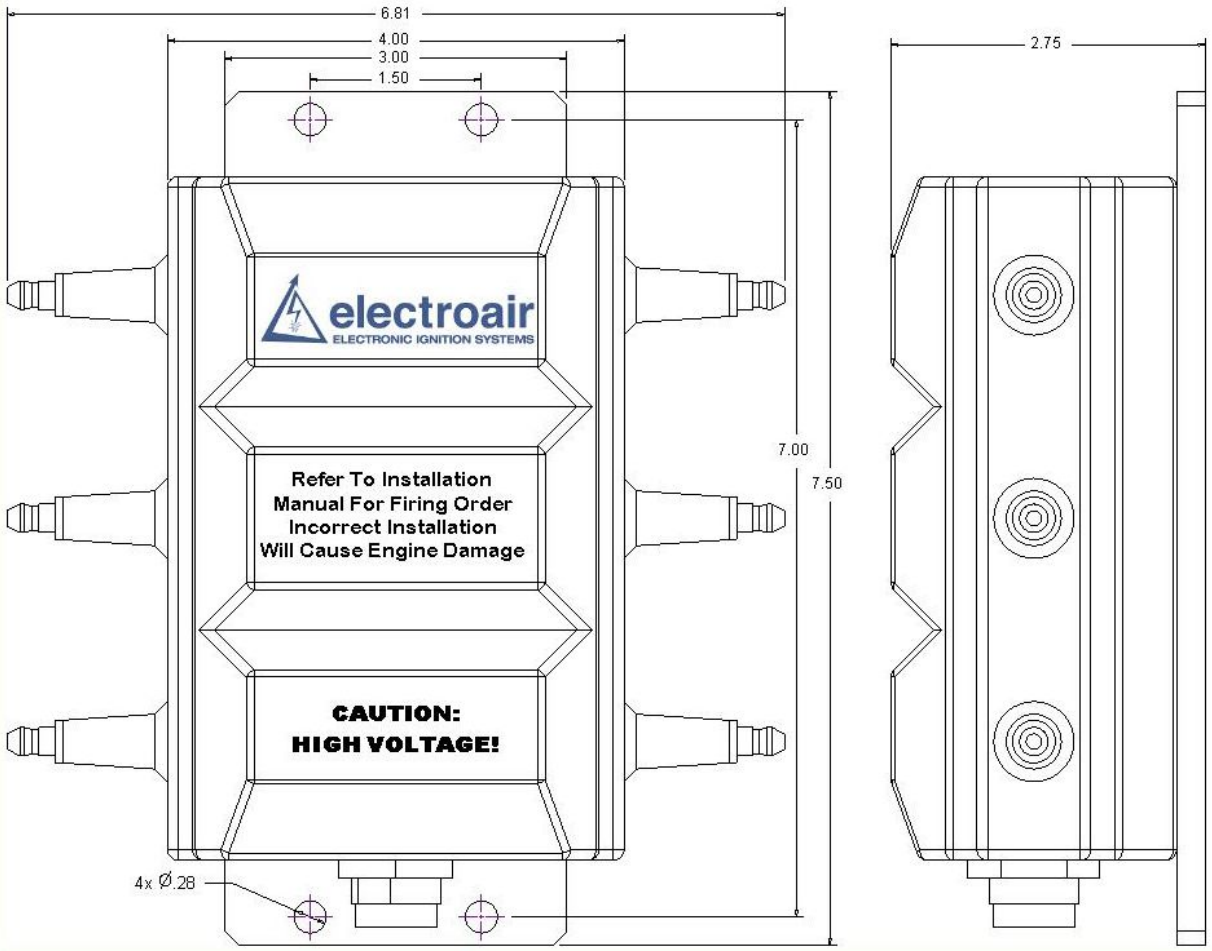


Figure 13: Part Number EA-8000 Dimensions

d. P/N EA-8000 comes with the mounting plate disassembled from the coil pack. This is done so the mounting plate can be used as a guide for easily locating mounting holes on the firewall. When locating the mounting holes on the firewall is completed, install the plate to the coil pack following the procedure below:
   i. Obtain the mounting plate, coil pack, mounting screws (MS24694S50), and Loctite #242 (included in the EIS-61000 kit box).
   ii. Align the clearance holes on the coil plate with the threaded inserts in the coil pack. Make sure that the countersinks, on the plate, are facing outward from the coil.

iii. Apply a small drop of Loctite #242 to each of the coil mounting screws and install plate to coil pack. Make sure the plate is straight and tighten screws (recommended torque value is 12-15 inch pounds).

iv. The black wire that is attached to the mounting plate should be attached to a competent airframe ground.

CAUTION: Prior to any drilling, verify that there is clearance from any components on both sides of the firewall.

CAUTION: Use proper firewall sealing techniques during installation of all components.

e. After all considerations have been made regarding the placement of the controller and the coil pack, drill the mounting holes and install both units using standard AN hardware.
NOTES:

i. To avoid any firewall cracking, place large area washers (AN970) between the firewall and fastening nuts to reinforce these contact points.

ii. For honeycomb firewall installations, consider placing internal screw grommets inside the firewall around the mounting hardware to help prevent damage to the honeycomb structure.

iii. For Dual EIS Installations, consider where two EA-21000 controllers and two EA-8000 coil packs (four of each for twin installations) will be placed. When determining locations, consider that the controllers should be connected to the coil packs from their respective kits.

f. For Dual EIS Installations, repeat steps 8a-8e.

9. Connection of Manifold Pressure Line:

a. Variable timing function using manifold pressure is optional. If variable timing is not desired or unable to be utilized, then the EA-20000 controller must be returned to Electroair for correct configuration. If variable timing is desired, proceed to step b.
b. Verify that a manifold pressure line exists from the engine.
c. If a manifold pressure line does NOT exist, then one needs to be installed in order to use the variable advance feature of the EIS.

    This is Electroair's recommended procedure.

    i. Select an appropriate source for MAP on the engine. For Continental and Lycoming engines, an unused primer port is acceptable source for MAP.
    ii. Remove the plug from the unused primer port. Verify the thread size going into the primer port or other MAP source (typically 1/8" NPT). Select an appropriate fitting (we recommend for a straight nipple AN816-2D; for a 90° nipple, use AN822-2D).
    iii. Fabricate and attach aluminum hardline to the nipple now installed in spare primer port.
    iv. Route hardline to firewall bulkhead fitting (we recommend for a straight fitting AN832-2D).
    v. On the cool side of the firewall, from the bulkhead fitting, route a flexible hose to the controller and attached hose to the EIS controller (EA-20000/EA-21000). We recommend using Stratoflex p/n: 193-2 or Aeroquip p/n: 306-2 flexible hose. Use correct swivel fitting for connection to bulkhead fitting; use standard hose clamps to secure flexible line to EIS controller.
    vi. Check new lines for leaks before proceeding. Correct leaks as necessary.

d. Now connect the manifold pressure line to the bulkhead connector on the EA-21000. Make sure the connection is tight using hose clamps.
e. For Dual EIS, connect the manifold pressure line to the bulkhead connector on both EA-21000 controllers (four for twin), if variable timing is desired for both EISs.
f. If a Manifold Pressure gauge is installed, a "T" can be placed into the manifold pressure line that is feeding the Manifold Pressure gauge.

    1.) The size of the bulkhead connector is 1/8 inch. Recommend Aeroquip 306 or Stratoflex 193 hose with 1/8inch ID.
    2.) The manifold pressure line may be connected with either standard fittings or other appropriate fittings for this application, in accordance with F.A.R 43.13.
    3.) Verify that all connections and lines are tight and secure.

10. Installation of p/n: EA-4000 Spark Plug Harness:

a. Now install the spark plugs that will be connected to the Electronic Ignition System. Electroair recommends use of new aircraft spark plugs. If the old spark plugs are being re-used, make sure spark plugs are clean and gapped 0.028 - 0.036 inches.
   i. ***Electroair Spark Plugs:*** Electroair has approved wide gap aircraft spark plugs for use with the Electroair Electronic Ignition Systems. These spark plugs are manufactured with the wider air gap Electroair recommends be used with the Electronic Ignition Systems. These Electroair spark plugs are not included in the standard EIS kit. These plugs are only approved to be used with the Electroair Electronic Ignition Systems.
   ii. ***Non-Electroair Spark Plugs:*** For all other aircraft spark plugs, Electroair recommends opening the gap of the spark plugs to 0.028 - 0.036 inches. Refer to manufacturer's maintenance instructions on how to adjust gap

CAUTION: Be careful when gapping plugs because the outer electrode can become over-stressed and break. If any problems occur with plug selection, please contact Electroair (sales@electroair.net or 248-674-3433).

b. The kit came with three spark plug wire bundles (six for dual-EIS). Each bundle will make two spark plug wires. **Note:** The EIS Kit comes with RHM spark plug hardware. If REM spark plugs are being used, please contact Electroair for replacement hardware.

CAUTION: Since each assembly makes two spark plug wires, be careful when determining spark plug wire length.

   i. Route the spark plug wire from the coil pack to the correct cylinder (See the ID table at the end of this section for wire orientation) to determine the spark plug wire length. Make sure to keep spark plug wire routings away from exhaust pipes and sensor wires. Wires routed parallel to each other require a minimum of ¼ inch of separation.
   ii. Cut the spark plug wire leaving enough length to go three inches beyond the spark plug.
   iii. Slide the aluminum nut, receptacle, and Viton gasket on the wire. See Figure 14.
   iv. The wire supplied is a spiral core wire with a non-conductive center. Insert the spark plug spring on the outside of the spiral core so that the spring 'tail' makes contact with the spiral core. The spring 'tail' should be felt as it hits the spiral core during the insertion.

CAUTION: Do not install the spring tail directly in the center of the Kevlar fibers as it will not make contact with the spiral core. **OPTIONAL:** ~1/8 inch of the ignition wire insulation may be stripped to expose the spiral core wire to make installing the spring easier.

   v. Verify continuity of the wires prior to install. Blue Wire (p/n EA-4090) resistance is 350 ohms/ft ±10%. Red Wire (p/n EA-4091) resistance is 5700 ohms/ft ±10%.

NOTE: For assistance with Spark Plug Wire Assembly, you can go to http://www.electroair.net/. Under Tech Support and Troubleshooting there is a link to a video that provides a helpful demonstration for Spark Plug Wire Assembly.

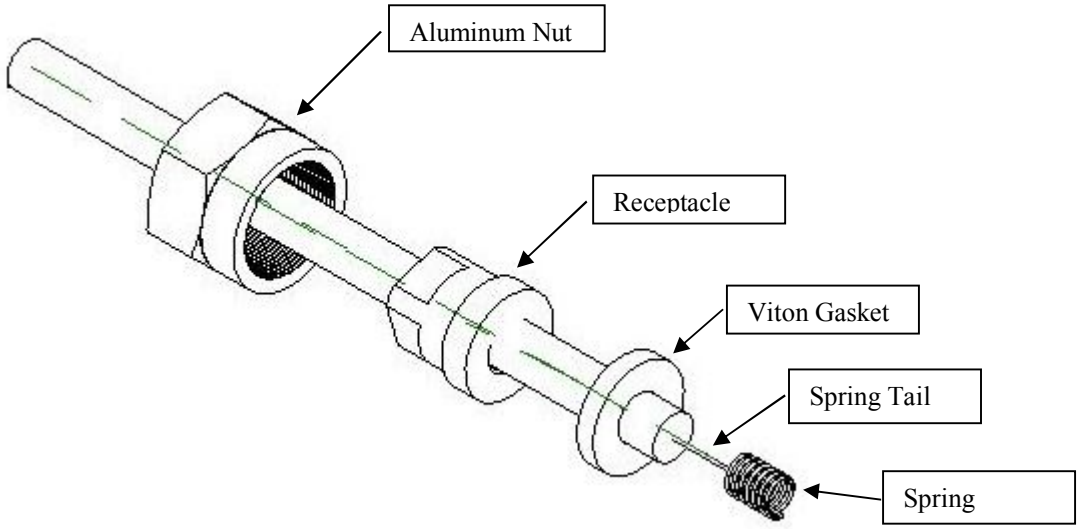


Figure 14: Spark Plug Wire Component Stack Up.

vi. To finish the connection, install the spark plug end of the wire first. This prevents the spark plug wire from twisting as the spark plug nut is tightened.

CAUTION: Do not over-tighten the spark plug nut as this may cause separation of the core of the wire. Torque spark plug nuts to 95 in-lbs.

vii. Repeat steps i through v for each wire

c.

i. Attach the other end of the spark plug wires to the coil pack at their appropriate coil tower. **NOTE:** When inserting the 90° boot over each tower on the coil pack, an audible "SNAP" should be heard when the wire is properly installed onto each tower. If this snap is not heard, remove the boot from the tower and repeat this step until the "SNAP" is heard.

ii. Coil towers are labeled on the coil pack: A, B, & C. Because of the nature of the system, coil towers A will fire, then coil towers B will fire, and then coil towers C will fire.

iii. Install the spark plug wires to cylinders as detailed in the chart below:

Coil Pack	Tower A	Tower A	Tower B	Tower B	Tower C	Tower C
Continental Cylinder #	1	2	5	6	3	4
Lycoming Cylinder #	1	2	3	4	5	6

NOTE: The coil towers should be oriented towards the same side of the engine as the cylinder number – this will make spark plug wire installation easier.

d. For Dual EIS installations, repeat steps 10a-10c for each EIS kit's spark plug wires.

11. Connection of p/n: EA-22000(T) Wiring Harness:

a. **Verify that the master switch is off and battery is disconnected.**
b. The electrical connections that will be made are as follows:
   i. Harness to p/n: EA-21000, EIS Controller
   ii. Harness to p/n: Magnetic Sensor (CSTW or MTH)
   iii. Harness to Tachometer
   iv. Harness to Switched Power & Ground for EIS Controller
   v. Harness to p/n: EA-8000, Coil Pack
   vi. Harness to Ignition Switch (Rotary Switch Only)
c. **For Dual EIS Installation:** Refer to page 8 for Dual EIS Limitations and Requirements for installation. Dual EIS refers to two EIS kits installed independently on one engine.
   i. **Dual Electrical System Option:** Typically, there are two separate electrical busses on aircraft equipped with dual electrical systems. Using this option, wire one EIS to each separate electrical bus (steps 11.k.iv and 11.l.iii). Follow steps 11d through 11n for each EIS (follow steps twice per engine, once for each EIS). Electrical systems must be able to support a 12 volt, 1.5 amp, or 24 volt, 0.8 amp load for one EIS, and 12 volt, 3.0amp or 24 volt, 1.6 amp for two EISs.
   Note: Twin-engine applications with dual electrical systems may share a common backup power source, independent of either engine's primary power source, which can provide electrical power after loss of power from both independent electrical systems
   ii. **Backup Alternator/Generator System Option:** Follow steps 11d through 11n for each EIS (follow steps twice per engine, once for each EIS). Select which EIS will be connected to the backup alternator (only one EIS per engine required). Attach that EIS to the backup alternator directly such that the EIS will continue to be powered by the backup alternator in the event of a primary electrical system failure. Attach the other EIS to the essential bus. Refer to backup alternator installation instructions for direct backup of electrical equipment to alternator. Backup alternator must be able to support a 12 volt, 1.5 amp, or 24 volt, 0.8 amp load for one EIS, and 12 volt, 3.0amp or 24 volt, 1.6 amp for two EISs.
   Note: Form EAF-0526, Backup Alternator Load Analysis, must be completed, reviewed, and accepted before STC Authorization of Dual EIS install.

d. A small hole must be drilled in the fire wall to route wires from the harness to their intended connections. Electroair recommends a 1-inch diameter hole to provide clearance for the wire harnesses. An MS35489-12 grommet can be used along with high temperature silicone sealant to help seal off the firewall hole after the wire harness has been passed through the firewall. For Twin Engine installations, Use the aircraft's existing wire runs as a guide for routing the EA-22000T Twin Engine Wiring Harnesses from the cabin to both wing mounted engines.

CAUTION: Prior to any drilling, verify that there is nothing on the back side of the firewall that could be damaged.

e. ***NOTES:*** The main harness is assembled so it can be installed through tight clearances such as the previously drilled hole in the fire wall. A supply of ring terminals for switches, circuit breakers, and the main Bus Bar is needed. A wiring diagram with pin-out information has been supplied at the end of this section for reference.

CAUTION: Follow these wiring instructions very carefully to insure a correct hook-up of the EIS. Skipping ahead or taking short cuts increases the risk of an incorrect installation and either a poor performing EIS or the possibility of damaging equipment. Prior to turning on bus power, verify the wiring. Please contact Electroair with any questions (sales@electroair.net or 248-674-3433).

CAUTION: Make sure that wires are separated away from the spark plug wires. High voltages going through the spark plug wires can interfere with signals going through sensor and power wires.

f. **Harness to p/n: EA-21000, EIS Controller:**
   i. Connect the wiring harness assembly to the EIS Controller. This is done by inserting the 14-pin female connector (**C1**) into the male header on the Controller. Begin routing the various harness bundles and wires from here.

Figure 15: C1 Connector

g. **Harness to p/n: EA-9000, CSTW Kit (Lycoming engines):**
   i. Route the harness with the square BLACK three pin connector (**C3**) to the connector that is on the magnetic pickup sensor.
   ii. Loop any excess wire and secure with cable ties behind the firewall.

h. **Harness to p/n: EA-11000, CSTW Kit (Continental engines):**
   i. Route the harness with the square BLACK three pin connector (**C3**) to the connector that is on the magnetic pickup sensor.
   ii. Loop any excess wire and secure with cable ties behind the firewall.

i. **Harness to p/n: EA-10000, EA-12000, EA-16000, EA-17000, EA-19000, or EA-25000 MTH Kit:**
   i. Route the harness with the square BLACK three pin connector (**C3**) to the connector that is on the magnetic pickup sensor attached to the MTH.
   ii. Loop any excess wire and secure with cable ties behind the firewall.

j. **Harness to Tachometer:**
   i. The EIS has an optional electronic tach signal available that can be used with an electronic tachometer. If the signal is to be used, follow the next instructions.
   ii. Obtain the black wire, labeled “ELECTROAIR TACHOMETER”, connector **C1**, **PIN 8**.
   iii. The Tachometer output signal is a 12V or 24V (dependent on aircraft system voltage) square wave with three pulses per revolution. **CAUTION:** Verify that the Tachometer or engine monitor system that you are using can receive the above signal before connecting and operating. Incorrect signal types can cause incorrect readings or

potentially damage monitoring systems. Mechanical tachometers will not be able to receive the signal.

iv. Route this BLACK wire to Tachometer or monitor system and install the lead as specified by the equipment manufacturer. Trim and connect this wire appropriately.

v. If you do not intend to use this output, then this bundle should be looped and tied to an appropriate place inside the cockpit for later use.

k. **Harness to Switched Power & Ground for EIS Controller:**

i. Obtain the RED wire that is coming out of the **C1** connector, **PIN 6,** and route this RED wire to the panel for switch termination and circuit breaker termination (fuses may be used as an alternative to the breaker).

ii. Trim and connect the Red wire to a panel mounted switch. Label this panel mounted switch "**EIS Switch**", and proper "**ON/OFF**" orientation. This switch should be a SPST aviation approved switch.

iii. Repeat steps i and ii for Dual EIS Installations.

iv.

1.) **Single EIS Installation:** Connect the panel mounted switch to a 2-amp breaker or fuse. Connect the 2-amp breaker or fuse to Essential Bus Bar. See Figure 17.

2.) **Dual EIS Installation with Dual Electrical System:** Connect each panel mounted switch to a 2-amp breaker or fuse. For one EIS kit, connect the 2-amp breaker or fuse to Essential Bus Bar. For the other EIS, connect the 2-amp breaker or fuse to the other essential bus bar. **Note:** Keep track of what power source is connected to each EIS. See Figure 19.

3.) **Dual EIS Installation with Back-up Alternator:** Connect a panel mounted switch to a 2-amp breaker or fuse. For one EIS kit, connect that 2-amp breaker or fuse to the Essential Bus Bar. For the other EIS, connect the panel mounted switch to two separate current protection diodes. Current will need to flow into the EIS and not the other direction. From one of the diodes, connect to a 2-amp breaker or fuse and then to the essential bus bar. Connect the other diode to another 2-amp breaker or fuse and then to the back-up alternator. Note: Keep track of what power source is connected to each EIS. See Figure 18.

v. Obtain the 16 gauge Black wire, labeled "ELECTROAIR GROUND", that is coming out of the **C1** connector, **PIN 14**.

vi. Trim and connect the Black wire to a competent airframe ground.

vii. ***IMPORTANT:*** For aircraft that are using the "EIS Switch" as the ignition switch for the EIS-61000 and not a Rotary Style Grounding switch, follow these procedures:

1.) Obtain the shielded WHITE wire, labeled "ELECTROAIR KEY SWITCH P-LEAD", connector **C1**, **PIN 10**.

2.) Cut this wire out of the connector and discard. **NOTE:** Be careful not to nick or cut any of the surrounding wires in the connector when cutting out this wire. Cover trimmed wire with appropriate protection.

viii. Repeat steps v through vii for Dual EIS Installation.

l. **Harness to p/n: EA-8000, Coil Pack:**

i. Route the harness with the round BLACK connector (**C2**) to the Coil Pack and connect. See Figure 16 below for how the harness should look. **CAUTION: There is a noise suppressor capacitor in the harness just below Coil Pack Connector (covered by heat shrink). Use extreme caution when routing this harness. DO NOT make sharp bends in the portion of the harness covered by the heat shrink. Make all bends past the heat shrink tube covered portion of the harness. This will prevent damage to the capacitor. Please call Electroair Tech Support if there are any questions.**

Figure 16: Coil Pack Harness Plug

ii. Connect the (**C2**) connector from the harness to the mating connector on the Coil Pack.

iii.

1.) **Single EIS Installation:** Route the unterminated end of the Red wire from the harness through a 10-amp breaker (fuses may be used as an alternative to breakers) to the Essential Bus Bar. Cut to length and install terminals as required. See Figure 17.

2.) **Dual EIS Installation with Dual Electrical System**: For each EIS, route the unterminated end of the Red wire from the harness through a 10-amp breaker (fuses may be used as an alternative to breakers) to the same essential bus the controller in the same EIS kit is connected too. Cut to length and install terminals as required. See Figure 19

3.) **Dual EIS installation with Back-up Alternator:** For one coil pack, route the unterminated end of the Red wire from the harness through a 10-amp breaker (fuses may be used as an alternative to the breaker) to the same essential bus that the controller in the same EIS kit is connected too. Trim and terminate as required. For the other coil pack, route the unterminated end of the Red wire from the harness to two separate current protection diodes. Current will need to flow into the coil pack and not the other direction. From one of the diodes, connect to a 10-amp breaker or fuse and then to the essential bus bar. Connect the other diode to another 10-amp breaker or fuse and then to the back-up alternator. Trim and terminate as required. Note: This coil pack that is connected to the backup alternator should be in the same EIS kit as the controller that is connected to the back-up alternator. See Figure 18.

iv. Loop any excess wire and cable tie or clamp the loop to a convenient location that does not interfere with any components (a location on the inside of the firewall is suggested).

m. **Harness to Ignition Switch (Optional Rotary Switch Connection):**

WARNING: If installed, the P-LEAD wire for the EIS can only be connected to the aircraft's rotary style ignition switch. DO NOT install the EIS P-LEAD wire to any other starting accessory.

i. This installation step is only necessary for aircraft that use a ROTARY STYLE ignition switch. For aircraft that use two separate ignition switches, e.g. rocker or toggle style switches, the "**EIS Switch**" will be the ignition switch for the EIS-61000. For aircraft that use two separate ignition switches, make sure to complete Installation step 12b before starting the engine.

ii. Obtain the shielded WHITE wire, labeled "ELECTROAIR KEY SWITCH P-LEAD", connector **C1**, **PIN 10**.

iii. Trim and connect this shielded wire to the appropriate connection. On the ignition switch, this will be the location that the replaced magneto P-lead was removed from. Use the same methods for connecting a Magneto P-Lead when connecting the EIS P-Lead. ***IMPORTANT:*** Make sure the shield on the EIS P-Lead wire is grounded. Failure to ground this shield can cause the EIS to not operate properly.

n. Figure 22 shows the Wiring Diagram for the EIS-61000. Both EIS kits for a Dual EIS installation will have similar wiring. The only difference between each installed EIS kit will be what essential bus or power source the EIS is connected too. **Note:** Single EIS installation means one EIS installed on an engine. Dual EIS installation means two EISs installed on an engine.

i. **Single EIS installation on one or both (twin) engines**: The connections for C2-Pin 4 and C1-Pin 6 should be to the main essential bus (through 10A and 2A breaker or fuses). See Figure 17.

ii. **Dual EIS installation on one engine with a single electrical system**: Connect C2-Pin 4 and C1-Pin 6 of one EIS to the main essential bus (through 10A and 2A breaker or fuses). Connect C2-Pin 4 and C1-Pin 6 of the 2nd EIS to a backup alternator and the essential bus using current protection diodes (through 10A and 2A breaker or fuses). For twin engine aircraft, if the other engine has one EIS installed, the C2-Pin 4 and C1-Pin 6 connections can be made to either the main essential bus or alternator. See Figure 18.

iii. **Dual EIS Installation on one engine with dual electrical systems**: Connect C2-Pin 4 and C1-Pin 6 of one EIS to one electrical system (through 10A and 2A breaker or fuses). Connect C2-Pin 4 and C1-Pin 6 of the 2nd EIS to the other electrical system (through 10A and 2A breaker or fuses). For twin engine aircraft, if the other engine has one EIS installed, the C2-Pin 4 and C1-Pin 6 connections can be made to either electrical systems. See Figure 19.

iv. **Dual EIS installation on both (twin) engines with a single electrical system**: At least two separate alternators will be needed. Connect C2-Pin 4 and C1-Pin 6 of one EIS from each engine to the electrical system (through 10A and 2A breaker or fuses). Connect C2-Pin 4 and C1-Pin 6 of one EIS on each engine to the separate backup alternators and essential buses using current protection diodes (through 10A and 2A breaker or fuses). See Figure 20.

v. **Dual EIS installation on both (twin) engines with dual electrical systems**: At least one backup alternator or backup electrical system will be needed. Connect C2-Pin 4 and C1-Pin 6 of one EIS from each engine to one electrical system (through 10A and 2A breaker or fuses). Connect C2-Pin 4 and C1-Pin 6 of one EIS on each engine to the backup alternator(s) using current protection diodes, or backup electrical system(s) (through 10A and 2A breaker or fuses). See Figure 21.

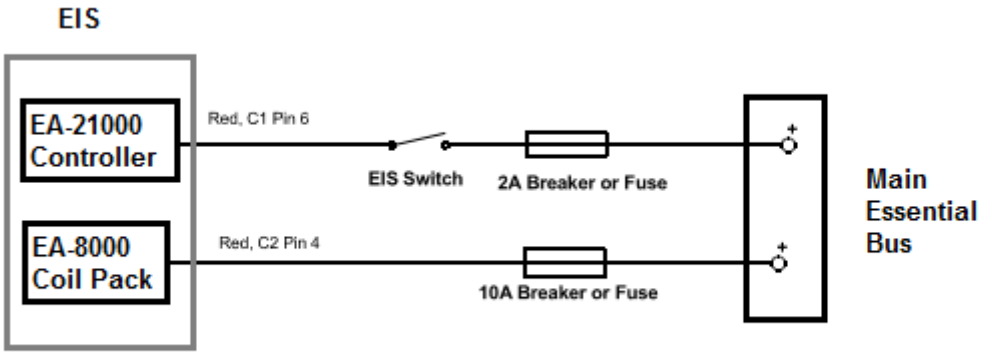


Figure 17: Single Engine, Single EIS Power Connection

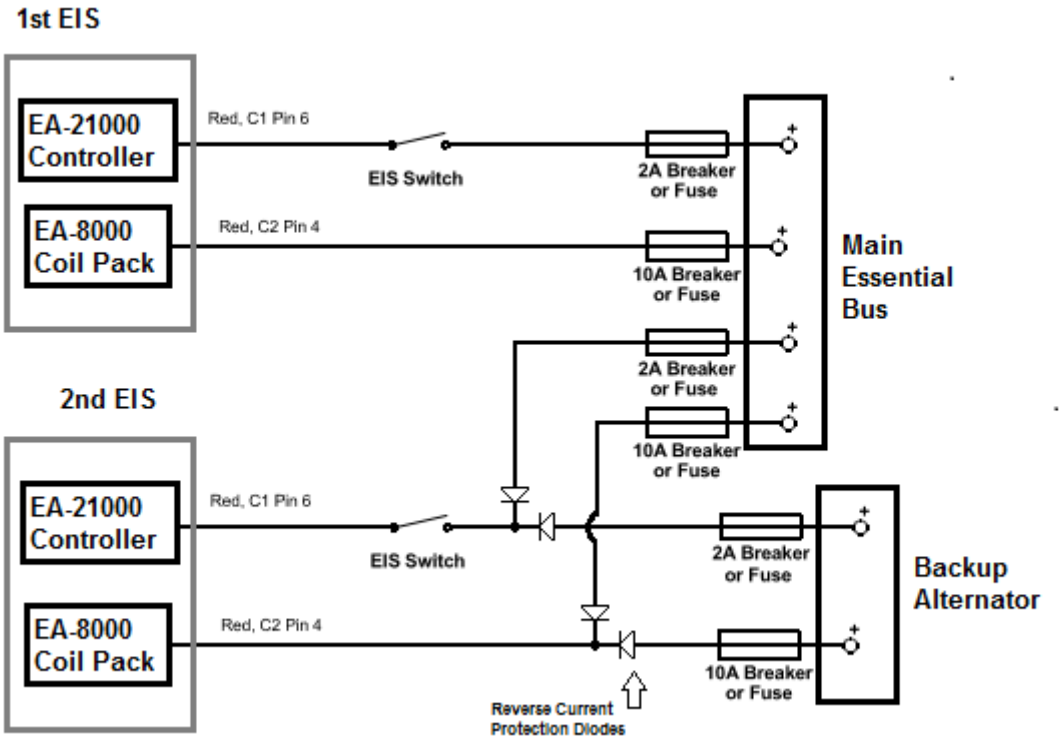


Figure 18: Single Engine, Dual EIS Backup Alternator Connections

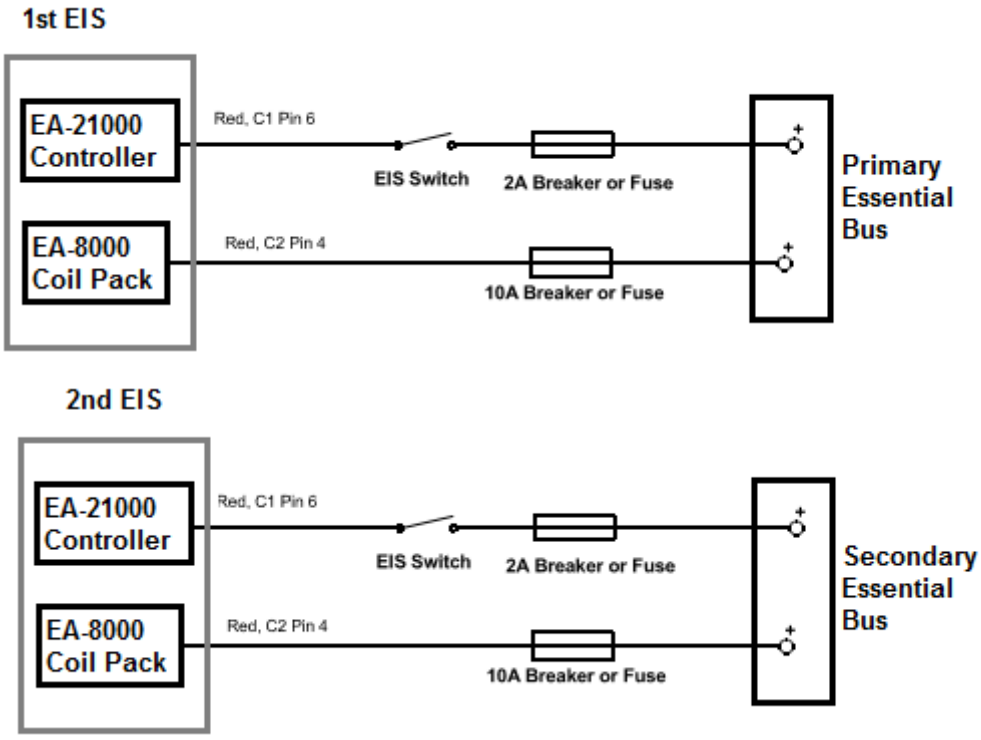


Figure 19: Single Engine, Dual EIS Dual Electrical System Power Connections

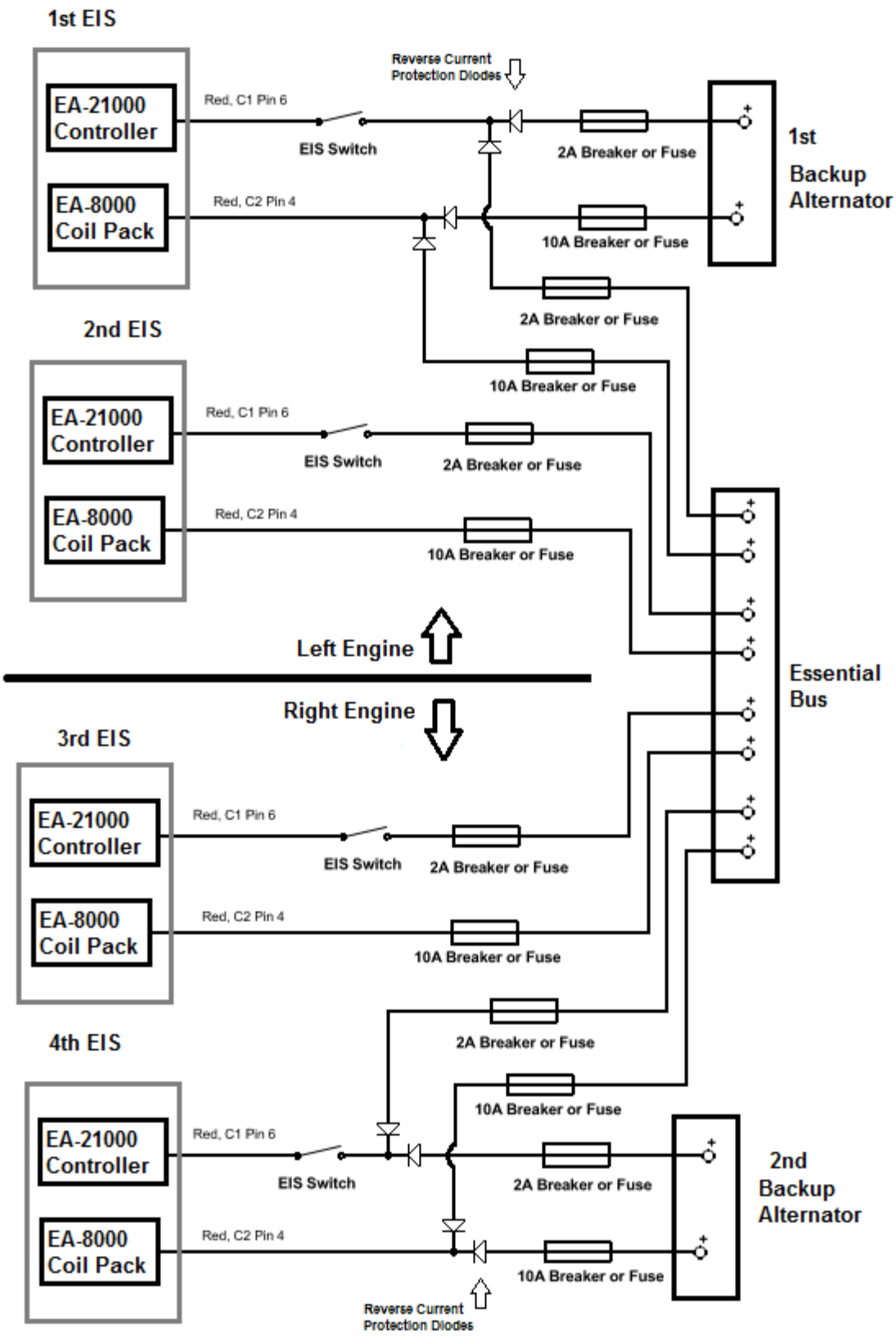


Figure 20: Twin Engine, Dual EIS, Single Electrical System Power Connections

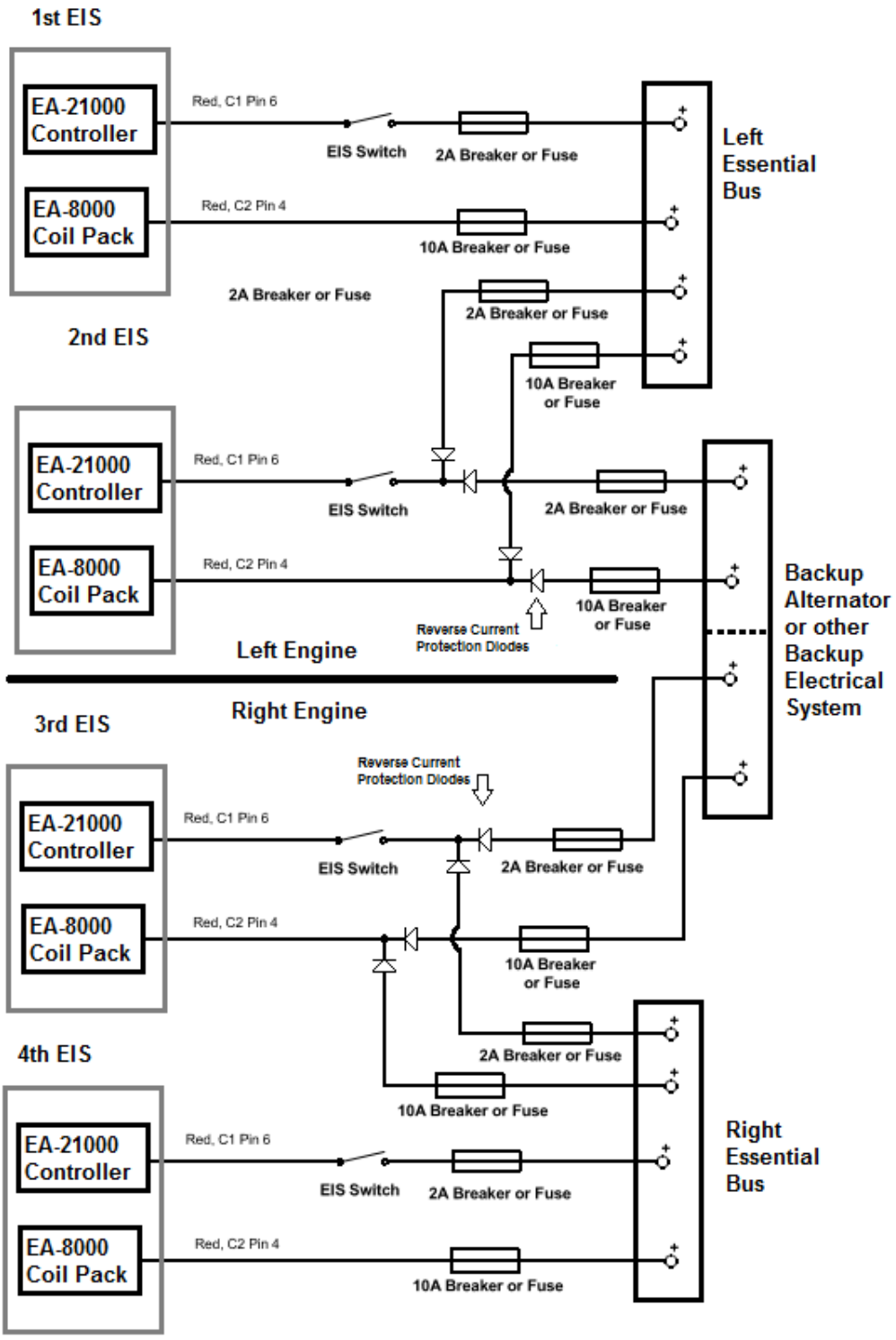


Figure 21: Twin Engine, Dual EIS, Dual Electrical System Power Connections

- Backup power source may be shared or separate if they are independent of either engine's primary power source. See Dual Electronic Ignition Systems Limitations and Requirements section (page 8).

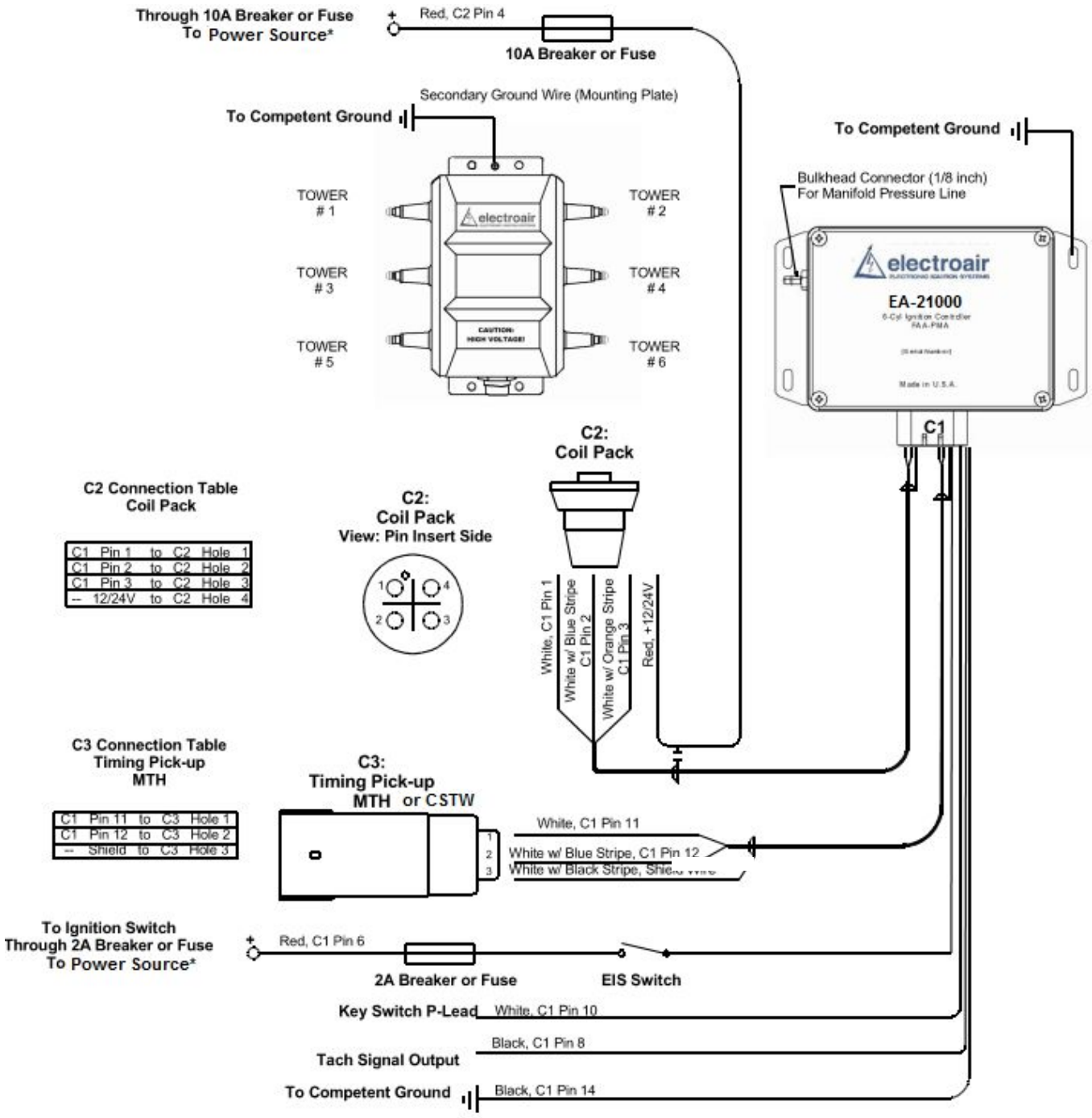


Figure 22: Wiring diagram for a EIS-61000 Series Kit

*Power Source: Refer to step 11n and Figures 17-21

12. Final Installation Steps:

a. Calibration and Timing settings: The unit has been pre-set at the factory to a pre-determined base timing (base timing is always placarded timing for the engine). If the timing placarded on the controller does not match the timing placarded on the engine, please contact Electroair (sales@electroair.net or 248-674-3433). If you feel that the unit is not performing optimally or if base timing needs to be adjusted contact Electroair (sales@electroair.net or 248-674-3433).

b. ***IMPORTANT:*** For aircraft that are using the "EIS Switch" as the ignition switch for the EIS-61000 follow these procedures: Verify that the wire labeled "ELECTROAIR KEY SWITCH P-LEAD", has been cut out of the connector and discarded. **NOTE:** Be careful not to nick or cut any of the surrounding wires in the connector when cutting out this wire.

c. Re-attach and reinstall any connections or components that were removed or loosened during this installation.

d. Secure all new wires, harness, connections and lines to prevent failures due to vibration.

e. Connect battery connections and close any open circuit breakers.

f. Recover all tools that may have been used (you don't want any tools 'floating' around inside the airplane).

g. Review remaining magneto, if pressurized; verify there are no pressure leaks.

   i. Verify the calibrated vent is installed.

   ii. Verify the inline filter, if equipped with a drain, is pointed down for proper drainage of any liquid that may accumulate in the filter.

h. Verify backup power sources are capable of supplying the required load to connected EISs. **Note**: Form EAF-0526, Backup Alternator Load Analysis, must be completed, reviewed, and accepted before STC Authorization of Dual EIS install.

i. Using the Aircraft Flight Manual Supplement, AFMS EIS-61000 Revision 09 or later FAA approved revision, for the EIS, perform a test run-up before flying.

j. Aircraft using multiple EIS systems, should have a way of differentiating between each EIS.

Glossary and Abbreviations:

AD(s) – Airworthiness Directive(s)
AFM – Aircraft Flight Manual
AFMS – Aircraft Flight Manual Supplement
ALS – Aircraft Limitations Section
AML – Approved Model List
APU – Auxiliary Power Unit
BTDC – Before Top Dead Center
CFR – Code of Federal Regulations
CSTW – Crank Shaft Trigger Wheel
EIS – Electronic Ignition System
FAA – Federal Aviation Administration
Ignition Timing – is the process of setting the angle relative to piston position and crankshaft angular velocity that a spark will occur in the combustion chamber near the end of the compression stroke.
LOPC – Loss Of Power Control
MAG – magneto
MAP – Manifold Absolute Pressure
May/Should – an optional requirement
MEL – Minimum Equipment List
MTH – Mag Timing Housing
Must/Shall – a mandatory requirement
RPM – Revolutions per Minute
POH – Pilot's Operating Handbook
STC – Supplemental Type Certificate
TDC – Top Dead Center