

**electroair**  
Direct Fire Ignition Systems

***EIS-41000 Installation Manual***

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# ***Ignition System Technical Discussion***

## ***Dual Magneto System Review***

On a traditional dual magneto system, both magnetos are timed to fire at a preset degree before Top Dead Center (TDC). When starting the engine, the ignition switch grounds the 'P' lead to the right magneto, stopping it from firing. Meanwhile, the left magneto with the impulse coupling can still fire. The impulse coupling causes the magneto to fire at TDC, and will continue to fire at TDC until the engine reaches about 200 RPM. At this time, the impulse coupling disengages and the magneto falls back to firing at 25 degrees before TDC. Once the ignition switch is released from the start position, the right magneto also begins to fire. From now on, no matter what the RPM, power setting, or altitude the engine spark timing will remain at 25 degrees before TDC.

At any altitude, a cylinder on the intake stroke draws in fuel and air. At lower altitudes, on the compression stroke (as the piston moves up) at 25 degrees before the piston reaches the top of the cylinder (TDC), the spark plug fires lighting the air/fuel mixture. The objective is to reach the peak pressure point (as a result of igniting the air/fuel mixture) by the time the piston reaches 11 degrees past TDC.

As altitude increases, thinner air reduces the oxygen available for the proper fuel-air mixture creating more space between the air/fuel molecules. When the spark plug fires at 25 degrees before TDC, the thinner air/fuel mixture will burn slower. Therefore, the peak pressure point occurs much later than 11 degrees past TDC, and hence there is a loss in power. By advancing the timing based on RPM and atmospheric conditions, the peak pressure point can be maintained much closer to 11 degrees after TDC. This can only be done with an electronic ignition system and is best done with an ***Electroair Ignition System (EIS)***!

## ***EIS Overview & Primer***

Before discussing the detailed mechanics of how the EIS works, we should overview the benefits and general operation of the EIS. The EIS differs from standard magneto systems in one very significant way: ***TIMING***. In a magneto, timing is permanently set; the EIS adjusts timing (or spark advance) based on RPM and manifold pressure. This ability to adjust the spark advance allows the EIS to determine the optimum timing setting which produces the most power with the least fuel.

$$\text{EIS Spark Advance (Timing)} = \text{Mechanical Advance} \\ + \text{RPM Advance} + \text{Vacuum Advance}$$

The mechanical advance is set during the installation of the EIS timing housing or crankshaft sensor. This setting is usually zero degrees of TDC.

The final component for the total amount of timing comes from the vacuum advance, or Manifold Pressure Sensor. The manifold pressure is sensed and calculated in to the total spark advance. These two measurements are used together to determine the most efficient timing setting for the engine. The MAP Sensor will add a maximum of 15° of advance to the total Spark Advance. Refer to the following Vacuum Advance Curve Chart, fig. 1:

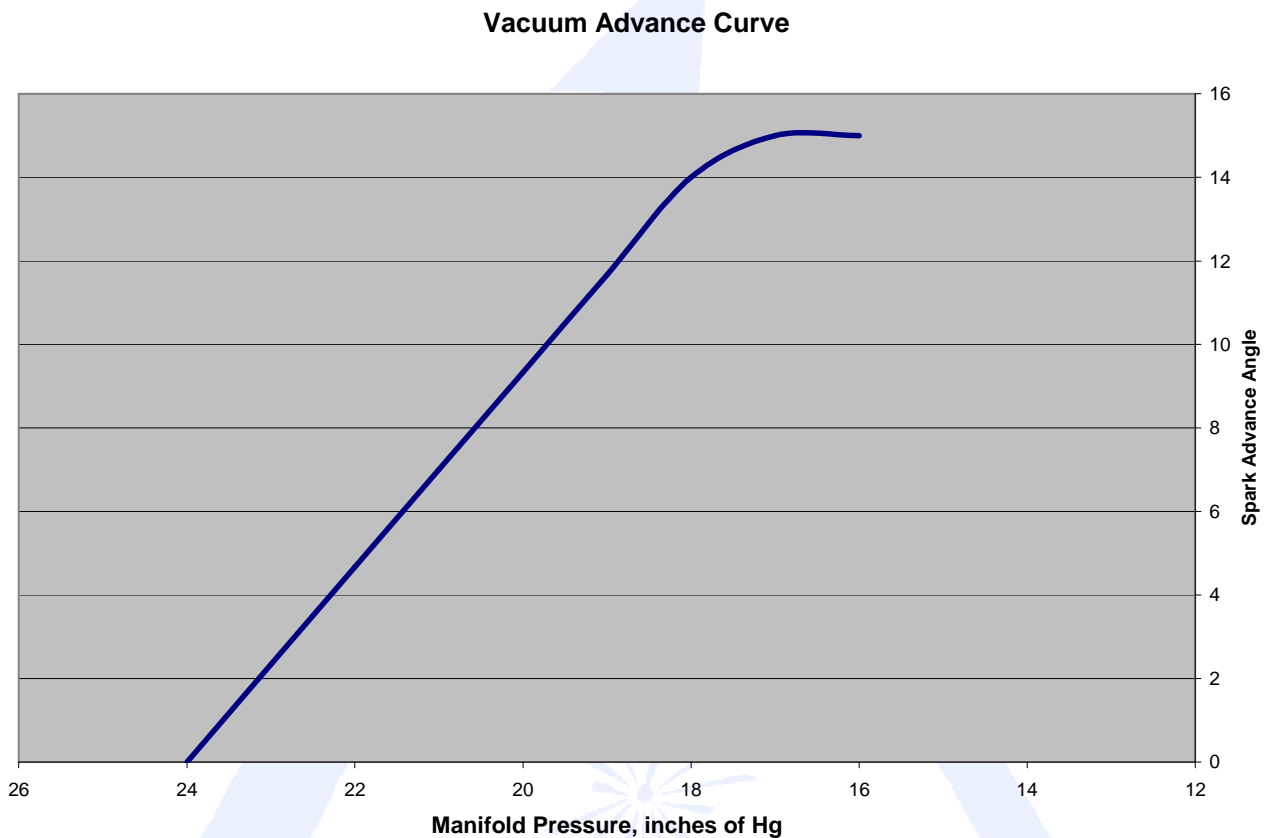


Figure 1

If the MAP Sensor (manifold absolute pressure or vacuum) option is not installed, then the vacuum advance value in the above equation would be zero. Without the MAP sensor installed, the advance remains zero up to the 250 RPM. At 250 RPM, it advances to 7 degrees BTDC, and then at 400 RPM, the unit advances to the spark advance setting for your engine (this is set at the factory) and will remain at that setting for operation.

## ***EIS/Direct Fire Ignition Technical Discussion***

### **How Direct Fire Ignition Works**

A "Direct Fire" ignition fires the spark plugs directly from the coils and not through a distributor cap and rotor. 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 Ignition System (EIS) apart 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 volts). Unlike capacitive discharge systems that only put out one very short spark, the EIS puts out a full energy, long burning spark at your highest and most critical engine speeds. Long burn times assure effective burning of even lean fuel mixtures.

The brain of the EIS includes dual digital microprocessors using patented spark algorithms, 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 your engine as a base-line. Settings from the factory are for stock engines; however they can be modified to 'tweak' more power for racing applications. 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 9 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 Single-Crankshaft-Sensor Decoding**

The EIS uses a single, high resolution, 60-minus-2 tooth crank trigger wheel. 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 it has set altitude and speed records.*

In summary, your Electroair EIS delivers more power because:

- Spark timing is precisely controlled under all conditions, including rapid engine acceleration.

- Longer dwell time and a better flame front allow the engine to run better on lean and lean of peak mixture settings.
- Accurate spark timing allows sustained engine operation closer to peak power timing.
- 100% spark energy up to 9600 RPM on 6 cylinder and 12,000 RPM on 4 cylinder applications (at 12 volts).
- Long, 2000 microsecond (typical) spark duration (represents approximately 20 degrees)!
- Built-in timing computer
- No power draining magnetos to drive
- No moving parts to wear out or replace
- Built-in timing monitor lets you measure the advance with a voltmeter
- Options include: backup sensor, Tach output and remote timing control

## Spark Plug Selection

As was previously stated, spark plugs are generally more important to spark quality than spark plug wires. Most spark plugs exhibit failure when exposed to a large load. Failure usually consists of either intermittent sparking or arc-over. Arc-over is when the spark occurs between the spark plug wire and the engine block, instead of at the plug tip. Arc over is exacerbated by the use of low-quality wires, or wires that have cuts in the insulation.

The load at which a spark plug fails is different for all spark plugs. With the EIS's charging circuit, the more load you put on an engine, the more voltage will be applied to the plug. This is a beneficial situation: for a high compression engine, the voltage at the plug will be inherently higher (since there is more load). The detriment is that spark plugs and wires are only rated to a certain voltage (30-40,000 volts is typical), and can begin to "blow out" at around 40,000 volts. If that voltage is exceeded by a large amount for a long enough length of time, the spark plugs will either blow out, break down or arc to somewhere other than the electrode (often through the insulator directly to the engine block).

Your installation manual specifies the recommended gap for your 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 our 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 bottom line is this: the EIS system uses an *inductive* (long duration charge at battery voltage) charging method for the coils, which is completely different than the *capacitive* (short duration charge at higher-than-battery voltage) charging method used by other manufacturers. What may work well for these systems may not work well for ours. Our experience has drawn us to the following guidelines for spark plug application:

- All aircraft spark plugs will work with the EIS. We have 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 manufacturer. We strongly recommend that you verify the heat range for your engine and use the appropriate plug.

## **Low Voltage Operation with Permanent Magnet-Type Starters**

There has been much discussion regarding the newer style, lightweight starters that use permanent magnets as the basis of their technology. To understand some of the issues, we must first understand one basic design characteristic of a permanent magnet lightweight starter: it needs a lot of power to get started! Since most permanent magnetic starters are derivatives of small automobile engine starters, their motors are first found in automobile chassis where batteries are substantially larger than typical light aircraft batteries and hence, have more available power. When these designs were adapted to aircraft, they failed to take into account the smaller batteries typically associated with light aircraft (25 amp-hour batteries and smaller). Permanent magnet starters typically draw between 30%-40% more energy than their larger, older style counterparts that they typically replace. This has left the entire aircraft electrical system, including the electronic ignition system, competing with the starter at the beginning of the flight cycle for power.

Most electronic ignition systems, Electroair's included, require a minimum amount of power available in order to operate correctly. In the case of the Electroair EIS, the minimum system voltage required is 8V. If the system voltage falls below that value for any length of time, the EIS will not function properly and can potentially cause the engine to 'kick-back'. This event can happen during the start-up of an aircraft engine using a permanent magnet starter if, for instance, the battery is not a peak charge. It is strongly recommended that an operator of one of these starters with an EIS always keep a full charge on their battery. Other suggestions that have come from some starter manufacturers include adding a dual battery to support the starting requirements. Electroair also supports the idea of a dual battery system, in particular, for potential emergency situations. This solution, however, has to be balanced with what the original weight considerations of the aircraft were in the first place.

One other alternative which has the benefits of a lightweight starter and does not have the draw backs of permanent magnet type starter is to use a series wound starter. Such an example is the starter built by B & C Specialty Products of Newton, KS. The B & C starter uses a series wound motor as the drive unit and draws much less power than a permanent magnet starter and is less susceptible to problems inherent to permanent magnet starters – like hot starts. A hot engine reduces the effectiveness of a permanent magnet starter. The B & C Starter has been used very successfully with electronic ignition systems. Of course, good battery condition and good grounding are vitally important for trouble free operation.

Another remaining solution to the low voltage problem associated with permanent magnet starters is to remain with the old style, Prestolite or Delco starter. These are heavier, obviously, than their counterparts, but there have not been significant problems reported about their operation with an electronic ignition system.

Please contact Electroair technical support if you are experiencing any starting problems. There are several solutions available.

## ***EIS-41000 Kit Contents & Requirements***

### ***System Requirements:***

1. 12V or 24V electrical system
2. Manifold pressure line for tapping into for the MAP sensor.
3. A desire to increase power and improve fuel efficiency!

### ***Kit Contents:***

1. \_\_\_ EIS Controller (EA-1000)
2. \_\_\_ Coil Pack (EA-2000)
3. \_\_\_ MAG Timing Housing (EA-3000)
4. \_\_\_ MAP Sensor (EA-5000)
5. \_\_\_ Spark Plug Wires w/ termination hardware (EA-4000)
6. \_\_\_ Controller Wire Harness (EA-6000)
7. \_\_\_ 0.5ml bottle of Loctite 242 (packed with Coil Pack)
8. \_\_\_ Installation Manual

### ***Other items you will need:***

1. If you are replacing a Bendix Magneto, you will need the Slick-type mag holders to mount the EA-3000. They are available directly from Electroair as p/n EA-015.
2. A toggle switch for powering EIS and 2amp & 10amp circuit breakers.
3. Basic tools and standard aircraft hardware required for mounting EIS controller, coil pack, and MAP sensor.
4. Electrical tools for cutting, stripping and terminating various wiring. Also recommended is a good selection of cable ties for harness routing and tie-off.

## **Overview of EIS-41000 Installation**

Thank you for purchasing an Electroair Ignition System for your aircraft. We are confident that you will be happy with the performance of your EIS on your aircraft. The next several pages will take you step-by-step through the process of installing your EIS on your aircraft. We hope you will enjoy the experience and that this manual will provide you with 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 and installation of the Mag Timing Housing
4. Installation of the EIS Controller and Coil Pack
5. Installation of the MAP Sensor
6. Spark Plug Harness
7. Wiring
8. Final installation steps
9. Options

We strongly recommend that you read through this entire installation procedure before installing your new EIS on your aircraft. Make sure that any questions you might have are answered before the actual installation. Also, make sure any extra components that you might need, e.g. cable ties, circuit breakers, switch terminations, etc., are all available. Removal of old components and installation of new components is to be completed in compliance with FAR 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 or miss-fired, you could cause severe damage to the EIS, your aircraft, or even yourself.

Please contact us if you have any questions during this installation process. Good luck and happy flying!!

Electroair

## ***Installation of EIS***

### **1. General overview and recommendations**

- a. Read through the entire installation instructions before beginning the installation to make sure you understand each step. **CALL US** if you have any questions or if there are any items that are unclear.
- b. The installation of the EIS should take between 6 - 10 hours, depending on your skill set for working on the engine & ignition system.
- c. Review your own skill set. This ignition system is designed to be installed by aviation professionals with the appropriate ratings and experience for maintaining General Aviation aircraft.
- d. When installing all EIS-41000 components, if preexisting components on the airframe are in the way of or are in close proximity to the installation locations follow these 3 measures.
  - 1) When making **ANY** changes or modifications to the aircraft or aircraft components, make sure all practices are in accordance with AC43.13-2B.
  - 2) 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-41000 component(s). If moving the preexisting components is not an option, refer to measure #3.
  - 3) If the preexisting components must come into contact or close proximity to the EIS-41000 component(s), make sure to protect all components from the other components. 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 (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. Remove cowling. Verify that Master Switch is off and battery is disconnected.
- b. **IMPORTANT:** Verify that the right hand magneto is a direct drive type (not impulse coupled type) magneto. For Lycoming engines, the direct drive type magneto will have gear p/n: 61163 installed on the drive shaft. This gear will be reused to install p/n: EA-3000 Mag Timing Housing. If your engine uses two impulse coupled magnetos, the right hand magneto position will need to be reconfigured to accept a direct drive type magneto (spacer removed, shorter studs installed, correct gear available, etc.). Consult the engine manufacturer's maintenance manual for the correct procedure to complete this conversion before proceeding. Electroair p/n: EA-3000 is not compatible with an impulse-coupled magneto gear set-up.

- c. Remove ignition harness from spark plugs associated with the right hand magneto. These are typically the right-hand lower and the left hand upper spark plugs
- d. Disconnect the P-Lead from the right hand magneto.
- e. Remove the right hand magneto, right hand ignition harness, and right hand P-lead from key switch. Retain the magneto hold down clips; they will be used to install the Mag Timing Housing (MTH, p/n: EA-3000).
- f. Remove the magneto drive gear, Lycoming p/n: 61163, from the magneto. Be careful not to damage the gear. We recommend using a standard gear puller. Retain gear for installation on p/n: EA-3000, Mag Time Housing.
- g. Remove spark plugs if new plugs are going to be used (recommended) with the electronic ignition system.

### 3. Set-up & Installation of p/n: EA-3000 Mag Timing Housing (MTH)

- a. Retrieve p/n: EA-3000; remove nut, cotter pin, and washer and set aside.
- b. Place the magneto gear on the Mag Timing Housing shaft. Be sure to align the Woodruff (half-moon shape) key with the slot in the gear.
- c. Install the washer and nut and tighten to the same torque value as recommended by the magneto manufacturer (Bendix or Slick). Install the cotter pin with the long end of the cotter pin facing you. Bend the long end of the cotter pin over the end of the shaft and the short end along the side of the nut.
- d. Holding the MTH, insert the alignment pin in the alignment hole on the back cover (pin supplied with unit). Slowly turn the gear on the front of the unit until the alignment pin drops into a second hole inside the MTH. The MTH is now set to Top Dead Center (TDC). See the picture below for example. Leave the alignment pin in the MTH and ready the engine for the MTH installation (next steps). See Figure 3.1



Figure 3.1: Installation of MTH Alignment Pin

- e. Clean magneto pad. Install new gasket on p/n: EA-3000.
- f. **VERIFY MASTER SWITCH IS OFF AND BATTERY IS DISCONNECTED.**
- g. Rotate the engine to Top Dead Center (TDC). This done by rotating the prop *in the direction of the engine rotation* until TDC is reached. At TDC, the impulse coupler on the left magneto should click. 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 at TDC. If any of these indications are not correct, repeat this step until they are. **Always rotate the engine in the direction that it normally turns.**

- h. Install the MTH into the right magneto hole. Secure the MTH using the mag holding clips referenced in step 2.e and secure per engine manufacturer specifications.
- i. **Remove the alignment pin.** Failure to remove the MTH Alignment Pin may cause damage to the MTH, the engine, or both. P/N EA-3000 is now installed and timed properly.

#### 4. Installation of p/n: EA-1000 EIS Controller and p/n: EA-2000 Coil Pack

- a. **EA-1000 Installation:** Install p/n EA-1000 EIS Controller where temperatures will not exceed 150F. Because of this, we recommend 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. Reference Figure 4.1 for controller dimensions.

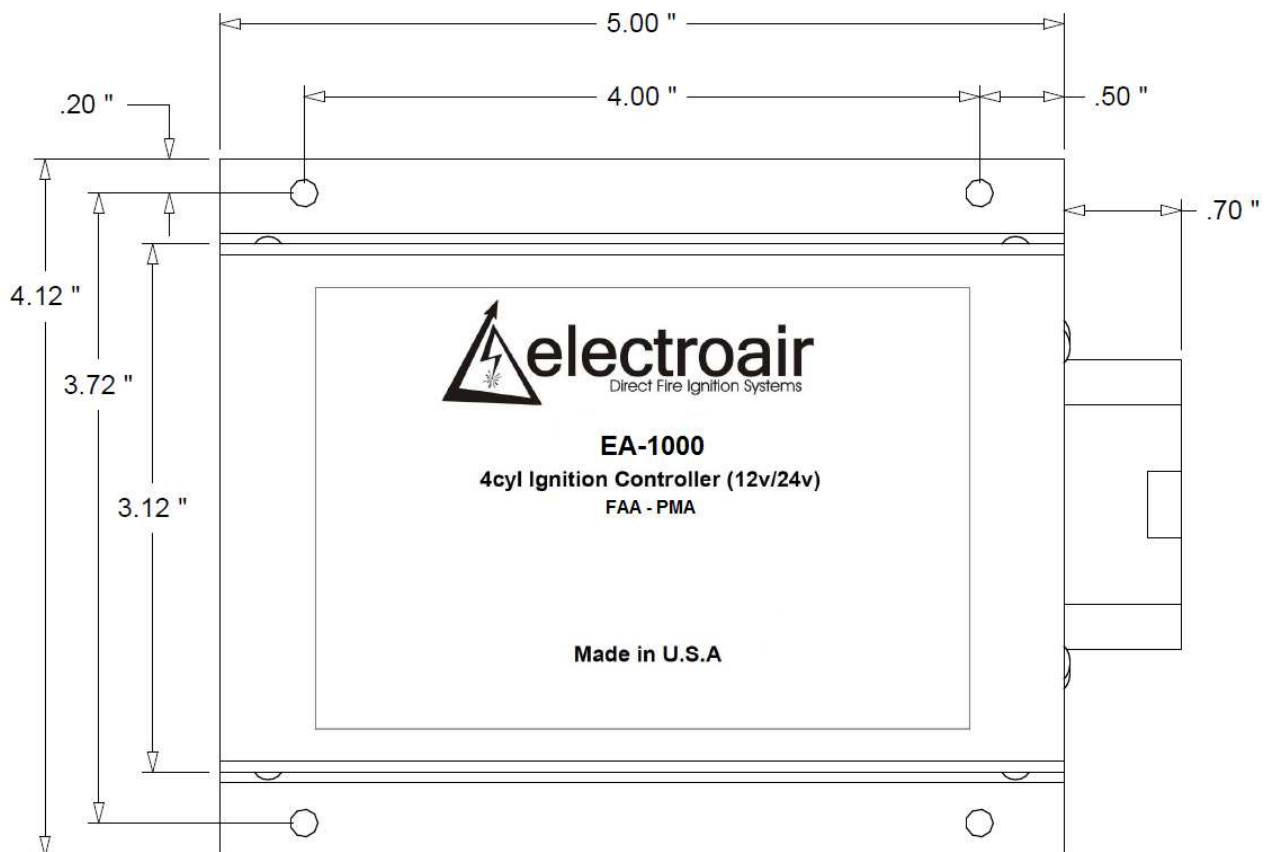


Figure 4.1: p/n: EA-1000 overall and hole dimensions

- c. **EA-2000 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 can be positioned in any orientation if the installation requires alternate positioning. See figure 4.2 for the Coil Pack Dimensions.

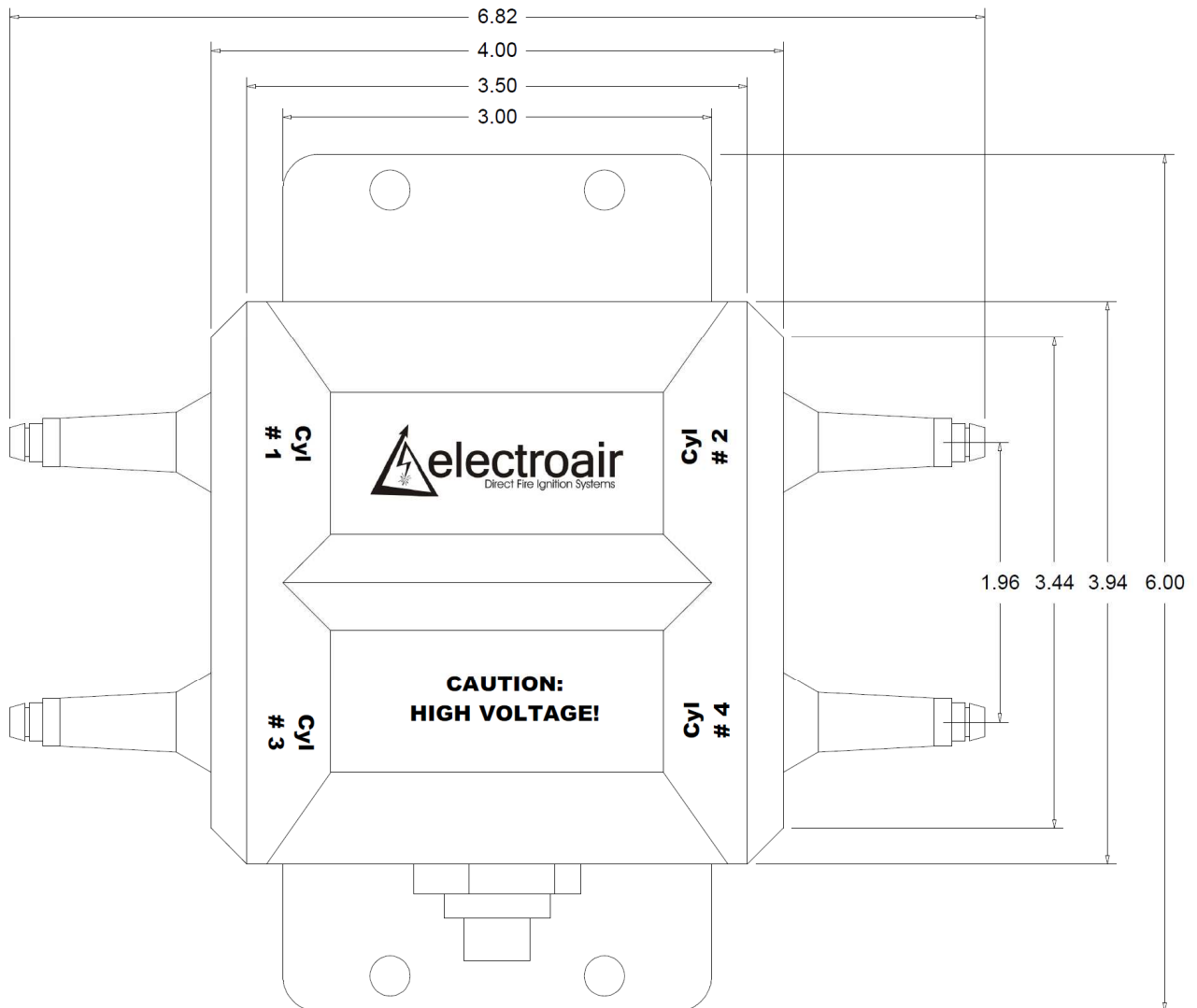


Figure 4.2: p/n EA-2000 Dimensions

- d. P/N EA-2000 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, reinstall the plate to the coil pack following the procedure below:

1. Obtain the mounting plate, coil pack, six mounting screws (MS24694S50), and Loctite #242 (included in the EIS-41000 kit box).
2. Align the six clearance holes on the coil plate so that they line up with the six threaded inserts on the coils. Make sure that the countersink, on the plate, is facing outward.
3. Apply a small drop of Loctite #242 to each of the coil mounting screws and install plate to coil pack. Make sure that that plate is straight and tighten screws (recommended torque value is 12-15 inch pounds).

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

- 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:**
  - 1) To avoid any firewall cracking, place large washers between the firewall and fastening nuts to reinforce these contact points.
  - 2) For honeycomb firewall installations, consider placing internal screw grommets inside the firewall around the mounting hardware to help prevent damage to the honeycomb structure.

#### **5. Installation of p/n: EA-5000 MAP Sensor and connection of manifold pressure line**

- a. Verify that a manifold pressure line exists for a Manifold Pressure gauge.
- b. If a manifold pressure line does not exist, then you will need to install one in order to use p/n: EA-5000. **NOTE:** Use of p/n EA-5000 is optional. Leaving p/n: EA-5000 out of the system will simply cause the system to remain at a constant spark advance and not adjust spark timing for various manifold pressure readings, or altitude. This will reduce your fuel efficiency and the overall performance of the ignition system, but will not harm any engine components.
- c. Locate an appropriate location for the MAP Sensor (preferably on the cool side of the firewall). Keep in mind all of the considerations that were mentioned in Step 4.b. Also, the location should insure that the manifold pressure hose going to the MAP Sensor should be as short as practical.
- d. Mount the MAP Sensor using standard AN type hardware.
  - 1) Mounting holes are sized for #6 fasteners. Use AN machine screws and either locking nuts or lock washers/plain nuts for installation.
  - 2) Connect secondary ground to MAP Sensor. A secondary ground wire should be connected to the MAP Sensor where indicated (observe that paint has been removed from the bottom side of the MAP Sensor case, showing the connection point).
- e. Now connect the manifold pressure line to the MAP Sensor. Make sure the connection is tight.
  - 1) **CAUTION:** Be careful not to apply too much force to the MAP Sensor hose when connecting it to the manifold pressure line. Improper forcing of the hose can cause internal damage to the MAP Sensor.
  - 2) If a Manifold Pressure gauge is installed, you can 'tee' into the manifold pressure line that is feeding the Manifold Pressure gauge.

1. The hose coming from the MAP Sensor is MIL-H-5593 type hose commonly used in vacuum line installation (either Aeroquip 306 or Stratoflex 193). This size is -3 or 3/16"ID.
  2. You may connect to your manifold pressure line with either standard fittings or other appropriate fittings for this application.
  3. Verify that all connections and lines are tight and secure.
- 3) If a Manifold Pressure gauge is not installed and you have created a new manifold pressure line, connect that new line directly to the hose coming from p/n: EA-5000 using standard fittings. The hose coming from the MAP Sensor is MIL-H-5593 type hose commonly used in vacuum line installation (either Aeroquip 306 or Stratoflex 193). This size is -3 or 3/16"ID.

## 6. Spark Plug Selection & EA-4000 Spark Plug Wire Harness Hook-up

- a. You can now install the spark plugs that will be connected to Electronic Ignition System.
  - 1) We recommend that you use new, aircraft spark plugs with the massive electrodes. If you are re-using the old spark plugs, make sure that they are clean.
  - 2) Gap the spark plugs to 0.030"-0.035". For Lycoming engines, we suggest using the REM37BY (or UREM37BY) spark plug because they are the easiest to gap. Check the engine application data to verify that these plugs can be used in your engine. **CAUTION:** Be careful when not using an REM37BY (UREM37BY) plug when gapping, because the outer electrode can become over-stressed and break. If you have any problems with plug selection, please give us a call.
- b. Your kit came with spark plug wire assemblies. Each assembly will make two spark plug wires. **CAUTION:** Since each assembly makes two spark plug wires, be careful when determining spark plug wire length.
  - 1) Route the spark plug wire from the coil pack to the correct cylinder (See Coil Pack label for wire orientation) to determine the spark plug wire length. Make sure to keep spark plug wire routings away from exhaust pipes. Wires routed parallel to each other require a minimum of 1/4" of separation.
  - 2) Cut the spark plug wire leaving enough length to go three inches beyond the spark plug.
  - 3) Slide the aluminum nut, receptacle, washer, and gasket on the wire. Approximately one inch of wire should extend past the gasket. See Figure 6.1 for the correct component stack-up.
  - 4) The wire supplied is a spiral core wire with a non-conductive center (Kevlar fibers). Insert the spark plug spring on the inside of the spiral core so that the spring 'tail' makes contact with the spiral core. You should feel the spring 'tail' 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:**

you may strip ~1/8" of the ignition wire insulation to expose the spiral core wire to make installing the spring easier.

5) See Figure 6.1 for an example:

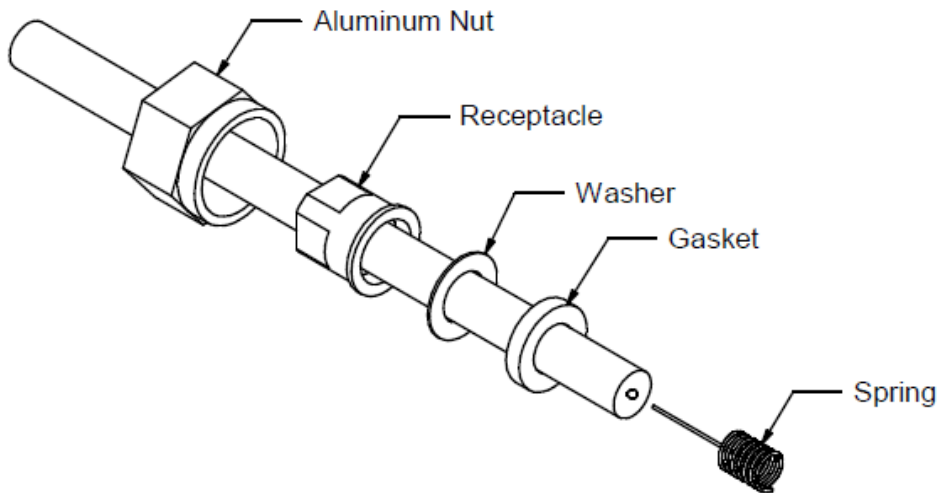


Figure 6.1 Spark plug wire components

- 6) To finish the connection, install the spark plug end 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. Tighten the spark plug nut to a torque value of 95 in-lb
- 7) Attach the other end of the spark plug wires to the coil pack at their appropriate coil tower.
- 8) Coil towers are numbered on the coil pack: 1, 2, 3, & 4. Because of the nature of the system, coil towers 1 & 2 will fire simultaneously and then coil towers 3 & 4 will fire simultaneously.
- 9) For Lycoming engines, hook-up the spark plug wires according to the following chart:

Coil Tower #	Tower 1	Tower 2	Tower 3	Tower 4
Cylinder #	1	2	3	4

- 10) The coil towers should be oriented towards the same side of the engine as the cylinders – this should make spark plug wire hook-up easier.

## 7. Connection of p/n EA-6000 Wiring Harness Hook-Up

- 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-1000, EIS Controller
  - ii. Harness, Bundle #1 to p/n: EA-5000, MAP Sensor
  - iii. Harness, Bundle #2 to p/n: EA-3000, Mag Timing Housing (MTH)

- iv. Harness, Bundle #3 to p/n: EA-2000, Coil Pack
  - v. Harness, Bundle #4, Switched Power & Ground for EIS Controller
  - vi. P-Lead, Bundle #5
  - vii. Tachometer Signal, Bundle #6
- c. A small hole must be installed in the fire wall to route wires from the harness to their intended connections. We recommend a 1" diameter hole be drilled to provide clearance for the wire harnesses. A grommet, suggested p/n: MS35489-12, can be used to help seal off the firewall hole after the wire harness has been passed through the firewall.

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

- d. **NOTES:** The main harness is assembled so it can be installed through tight clearances such as a hole in the fire wall. You will need to supply terminations for switches, circuit breakers, and the bus bar. The main harness has been tied off into six separate bundles. Each bundle is labeled 1, 2, 3, 4, 5, or 6. We will work with each harness bundle separately. 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 your 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. Please call us if you have any questions.
- e. **EA-1000 Controller:** Connect the wiring harness assembly to the EIS Controller. You will begin routing the various harness bundles from here.
- f. **Bundle #1, EA-5000 Map Sensor:** Route harness bundle #1 to the MAP Sensor from the controller.
- 1) Route harness to MAP Sensor.
  - 2) Connect bundle #1 to the MAP Sensor; loop any extra wire and secure with cable ties.
    - 1. Attached to the connector end of bundle #1 is a loose white and black striped wire. Route this wire to a ground source.
- g. **Bundle #2, EA-3000 MTH:** Route harness bundle #2 to the Sensor that is installed in the MTH.
- 1) From the already installed MTH, will be a wire harness terminated with a black, three-way connector. See Figure 7.1 below. Route bundle #2 to this three-way connector.



Figure 7.1: MTH with correctly terminated sensor

- 2) Connect bundle #2 to the connector from the MTH. Verify that the connection is secure.
  - 3) Loop any excess wire and secure with cable ties.
- h. **Bundle #3, EA-2000 Coil Pack:** Route harness bundle #3 to the Coil Pack.
- 1) Bundle #3 is terminated with a cannon plug type connector. See Figure 7.2 below for how the harness should look.

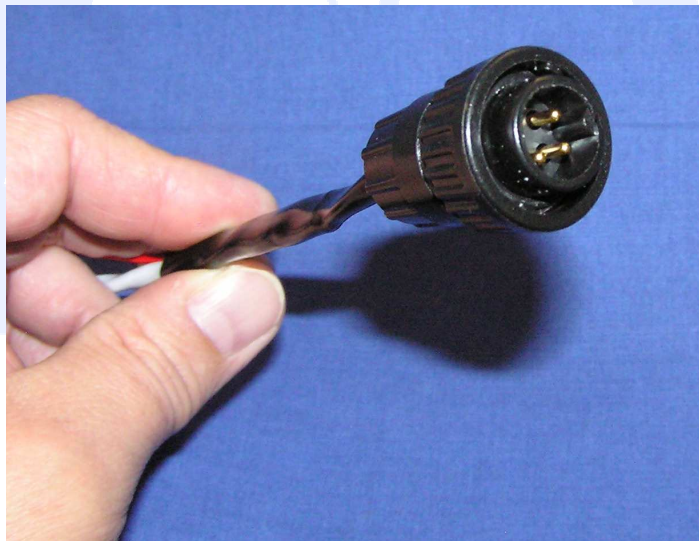


Figure 7.2: Coil Pack Harness Plug

- 2) Connect the four-way connector to the mating connector on the Coil Pack.
  - 3) Route the 'Red' wire through a 10 amp breaker to the Essential Bus Bar. Trim and terminate as required.
  - 4) 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).
- i. **Bundle #4, Toggle Switch Set-Up:** Route harness bundle #4 to Essential Bus Bar for switch termination and ground connection.
- 1) Trim & Terminate the Black wire to the bus ground.
  - 2) Trim & Terminate the Red wire to a panel mounted switch that is protected with a two amp breaker. **Do Not Use a Breaker Switch.** Label panel mounted switch "EIS Switch", and proper "ON/OFF" orientation. This switch should be a SPST switch.
  - 3) Connect the two amp breaker to Essential Bus Bar.
- j. **Bundle #5, P-Lead:** Route harness bundle #5 to the key switch for termination.
- 1) Trim and Terminate the P-Lead to the "R" position side of the key switch. Use the same methods for terminating a Magneto P-Lead when terminating the EIS P-Lead.
    1. Make sure the shield on the P-Lead wire is grounded.
- k. **Bundle #6 Tachometer Lead:** Bundle #6 contains the lead for the Tachometer output of the system (single black 22 gauge wire). 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. Alternatively, bundle #5 can be trimmed out of the harness connector if this option will never be used. If you plan on using this output, follow the instructions below.
1. The Tach output signal is a 12V or 24V (dependent on aircraft system voltage) square wave with two 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.
  2. Route lead to Tachometer or monitor system and install the lead as specified by the equipment manufacturer.
    - a. Loop any excess wire and cable tie or clamp the loop to a convenient location that does not interfere with any components

Configuration Information:  
 Cylinders: 4 Coil Firing Order: Back - Front  
 Coils fire every 180 degrees  
 TDC Tooth:11

**C2 Connection Table  
 Coil Pack**

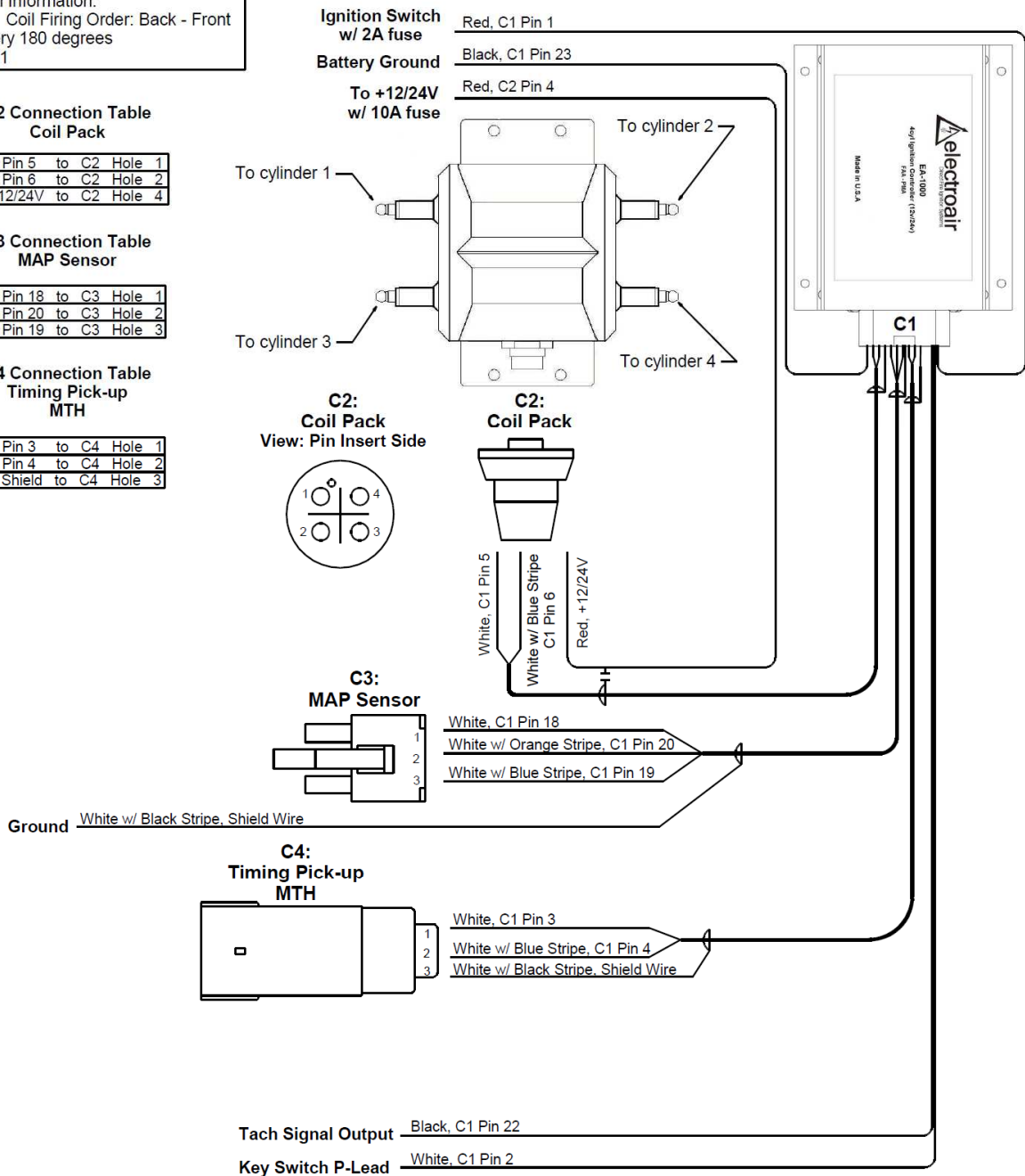
C1 Pin 5	to C2 Hole 1
C1 Pin 6	to C2 Hole 2
--	12/24V to C2 Hole 4

**C3 Connection Table  
 MAP Sensor**

C1 Pin 18	to C3 Hole 1
C1 Pin 20	to C3 Hole 2
C1 Pin 19	to C3 Hole 3

**C4 Connection Table  
 Timing Pick-up  
 MTH**

C1 Pin 3	to C4 Hole 1
C1 Pin 4	to C4 Hole 2
--	Shield to C4 Hole 3



## 4-Cylinder Lycoming Electrical Overview

## **8. Final Installation Steps**

- a. Calibration and Timing settings: Your unit has been pre-set at the factory for a base timing of 25 deg BTDC (base timing is always placarded timing for the engine). Please contact us if you feel that your unit is not performing optimally, or if that base timing needs to be adjusted.
- b. Re-attach and reinstall any connections or components that were removed or loosened during this installation.
- c. Secure all new wires, harness, connections and lines to prevent failures due to vibration.
- d. Connect battery connections and close any open circuit breakers.
- e. Recover all tools that may have been used (you don't want any tools 'floating' around inside the airplane).
- f. Proceed to the operational section and perform a test run-up before flying.

## **9. Installation Options available from Electroair**

- a. MTH Holders: You may use Slick p/n: K-3328
- b. Other options will be announced when available.

