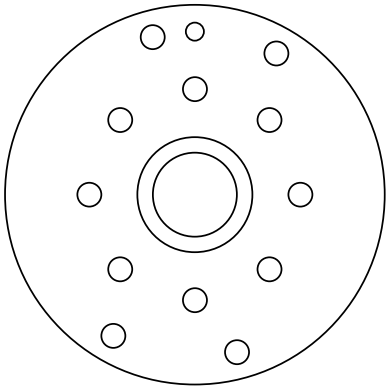
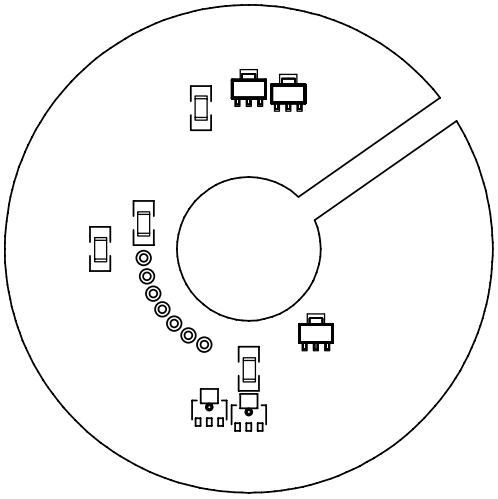
PROBE ENGINEERING, INC.

Installation Instructions

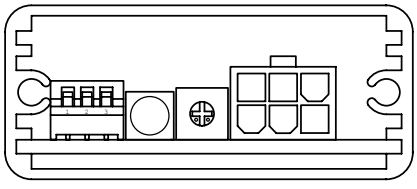
Model FS-10EL Ignition System



Trigger Rotor



Pickup Plate



Control Module

PROBE ENGINEERING, INC.

Installation Instructions, Model FS10-EL

Version 6.1

The Model FS10-EL electronic ignition is designed for 1960s through 1970s Honda Models CB160, CL160, CB175, CL175, and SL175, all with derivatives of Honda's early ("sloper") or later ("upright") twin-cylinder engine with a 360º crankshaft .

The Model FS10-EL is a dual-fire ignition system that fires both spark plugs simultaneously once per crankshaft revolution, using a dual-tower ignition coil. The "L"-suffix version is based on the earlier Model FS-10E product, but incorporates a user-adjustable rev-limiter circuit. When the rev limit is reached, each cylinder fires on every-other power stroke, cutting power in half and preventing engine over-speeding without accumulating excessive unburned fuel in the cylinders.

The system will work with the OEM coil, but for superior performance, an aftermarket coil between 3 ohms and 5 ohms primary resistance should be used. For racing, a 3-ohm coil will give hotter spark at sustained maximum RPM.

Note: Known good resistor-type spark plug caps and/or resistor-type plugs MUST be used with the FS10-EL ignition system. 30-year-old OEM resistor caps are usually shot; the best insurance is a pair of new NGK resistor plug caps, widely available from parts retailers for a few dollars each.

What should be in the kit:

The Model FS10-EL kit includes the following components:

- Control Module
- Trigger Rotor (with spacer shim for CB160 use pre-installed)
- Pickup Plate (with shielded leads and 6-pin connector)
- Power Cable Harness (with 5-pin connector)
- Rubber-faced flat washers (2 each, for retaining the Pickup Plate)
- M5 hardened washer, 15mm diameter by 3.5mm thick (for Rotor retaining bolt)
- Self-adhesive Velcro for mounting the Control Module
- Spare white and orange wires (1-foot long each, for optional features)

What else you will need:

In addition to the usual small hand tools required to get access to the engine's breaker-points assembly, the installation will require the following tools and supplies:

- Wire cutters/strippers
- Solderless crimp-type connectors, bullet connectors, or solder and shrink tubing
- Loctite® "blue" medium-strength thread-locking compound or equivalent
- A drain pan to catch oil from the "wet" area around the alternator rotor

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Installation Instructions, Model FS10-EL

Version 6.1

Installation:

1. Remove the side panels, if applicable (for general access).

2. Remove the seat.

3. Disconnect the battery.

4. Remove the fuel tank.

5. Place a drain pan beneath the alternator rotor cover and remove the cover (the alternator area on these bikes is "wet;" there is no left-side crankshaft seal).

6. Remove the breaker points cover.

7. Remove the bolt and washer that secure the centrifugal advancer mechanism and put them aside (they will be reused to retain the electronic ignition's Trigger Rotor).

8. Remove the two screws and washers that retain the points backing plate and put them aside (the screws will be reused to retain the electronic ignition's Pickup Plate).

9. Remove the breaker points and backing plate as an assembly.

10. Disconnect the breaker points lead wire from the ignition coil.

11. Disconnect and remove the condenser.

12. Remove the advancer mechanism from the quill on the end of the camshaft.

13. Clean any gross rust or debris from the cam-end quill and from the seating surface (shoulder) at the end of the quill.

14. Rotate the crankshaft so that the 3mm diameter locating dowel at the base (shoulder end) of the quill is at the 12:00 position. If you have any question about the dowel being firmly retained, remove it, degrease the dowel and its bore, and reinstall it with medium-strength (blue) Loctite or equivalent thread-locking compound.

15. **For CB/CL160 engines**: The 160 engines have a camshaft quill that is 10mm diameter, versus the 175 engines' 11mm quill diameter; the two engines' camshafts are otherwise similar. The trigger rotor has a bore ID machined to fit over the 175's 11mm quill. So that the same ignition kit can be used for either engine, the rotor is delivered with a spacer shim installed in its bore, which reduce the ID to match the smaller quill of the 160 engine. If you're installing the rotor onto a 160 cam,

carefully slip the rotor over the quill, taking care not to disturb the spacer shim. Align the notch in the rotor's hub with the 3mm locating dowel at the 12:00 position (there is a 0.094" through-hole in the rotor's face that aligns with the notch in the hub, so that you can tell where you are). Seat the hub end firmly against the shoulder at the base of the quill.

16. **For CB/CL/SL175 engines**: The 175 engines have a camshaft quill that is 11mm diameter, versus the 160 engines' 10mm quill diameter; the two engines' camshafts are otherwise similar. The trigger rotor has a bore ID machined to fit over the 175's 11mm quill. So that the same ignition kit can be used for either engine, the rotor is delivered with a spacer shim installed in its bore, which reduce the ID to match the smaller quill of the 160 engine. If you're installing the rotor onto a 175 cam, first use a pointed object to tease the shim out of the rotor bore. With the shim removed, slip the rotor over the quill, aligning the notch in the hub with the 3mm locating dowel at the 12:00 position. (There is a 0.094" through-hole in the rotor's face that aligns with the notch in the hub, so that you can tell where you are.) Seat the hub firmly against the shoulder at the base of the quill.

17. Install the M5 hardened washer from the ignition kit between the hex head of the original advancer retaining bolt and the original flat washer (the OEM flat washer is 17mm diameter, and the new, hardened washer is 15mm diameter). Use these to bolt the trigger rotor in place. Apply medium-strength (Loctite "blue" or equivalent) anaerobic thread locker on the retaining bolt threads.

18. Slip the pickup plate over the trigger rotor (the plate's center hole is large enough to clear the retaining bolt and washers), with the electrical components facing in toward the rotor and the wires facing out toward you. Note that the words "Probe Engineering, Inc." are etched in copper across the top of the plate's outward-facing side.

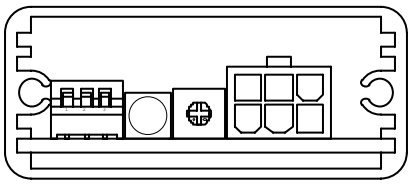
19. Install the two rubber-faced washers provided in the kit onto your original points-plate retaining screws, with the washers' metal faces against the screw heads. The compliant rubber face of the washers provides a way of taking up the small "step" clearance between the thickness of the pickup plate and the depth of the recess into which it locates (the original points-plate recess). Loosely thread the screws and washers into the retaining holes in the left cam-box housing. **NOTE: CB175-series engines are threaded for standard M5 by 0.8mm pitch screws in this location, and CB160-series engines are threaded for the non-standard M5 by 1.0mm "coarse" pitch screws. If you don't have the original screws, make sure to obtain the correct thread for your application.**

20. Align the words “Probe Engineering, Inc.” on the pickup plate parallel with the plane of the head gasket (horizontally for 175 engines, and angled for 160 “sloper” engines), and lightly tighten the screws to retain the plate.

21. There is a flatted grommet on the pickup plate’s lead wires. Seat the grommet in the lead-out hole at the lower right of the points housing. Leave a little play in the wires so that the plate can be rotated later to finalize the timing, and be sure that none of the plate’s wires are in contact with the trigger rotor, the retaining bolt and/or washers, or sharp edges of the housing.

22. Route the wires from the pickup plate out over the cylinder head, similar to how the original points wires were routed.

23. Locate the Control Module in the kit. It looks like this:



24. There is a 6-pin connector toward the right side of the module, a three-position DIP switch toward the left side, and a red LED and blue potentiometer between the two. There is also a 5-pin connector (not shown in the line drawing) at the end of a short wire bundle coming out the module.

25. Find a place where you’d like to mount the control module. The module’s potentiometer can be used to make small trim adjustments to the idle-speed spark advance, which is independent of the full-advance timing. It is preset for your bike at the factory, and will usually not require adjustment unless you elect to run significantly more or less full-advance timing than Honda’s original specifications. If the blue potentiometer is accessible when the module is in place, it will make this adjustment easier.

26. The control module is delivered with Velcro fastening material. The “loop” side is attached to the module; the “hook” side has an aggressive “peel-and-stick” adhesive, for attaching to a clean, flat surface on the bike. The module dissipates low power, and will get warm to the touch during operation. It does not require aggressive airflow, but should not be mounted in a sealed volume with no airflow at all. Don’t mount the module so that it’s “upside-down;” if it hangs from the Velcro so that gravity wants to pull it straight off, gravity (and vibration) will eventually succeed in doing just that.

27. Route the pickup plate assembly's wire bundle to the location of the control module. The pickup plate wires are insulated using high-temperature Teflon, and have a tinned-copper braided shield surrounding them; the wires can be routed pretty much anywhere (except to an exhaust pipe!) without major temperature concerns. **However, the pickup wires must be kept well away from the spark-plug leads, so that the electronics won't get confused or damaged by spark-energy "pickup" from the high-voltage coil leads.**

28. The pickup assembly's wire bundle has a 6-pin plug that matches the module's 6-pin connector housing. Plug them together; they are keyed, so that they only fit one way. The retaining latch that will "click" when the connectors are fully mated.

29. There is a 5-pin connector on the Power Cable Harness. On the connector's rear surface (where the wires enter), molded-in numbers show each wire's position, 1 through 5. The wires in each position are as follows. You only have to deal with the three wires shown in boldface type:

♦ **Position 1:**	**Heavy-gauge red wire – goes to switched +12 volts**
♦ **Position 2:**	**Heavy-gauge green wire – goes to chassis ground**
♦ **Position 3:**	**Heavy-gauge yellow wire – goes to ignition coil**
♦ Position 4:	Open position – for optional kill switch connection
♦ Position 5**:**	Open position – for optional tachometer output

30. The power cable harness' heavy-gauge green wire (connector position 2) must go to a good chassis ground. A "good ground" means three things; it must have a low-resistance path to the battery's negative (-) terminal, it must have low-resistance path to the metal of the main chassis, and it must have a low-resistance path to the cylinder-head. If these three things are not well-connected together electrically, you will have problems. The ground wire is 12" long as supplied. If you want to make it shorter, you may, but it should not be extended. The chassis ground must be free of paint and be clean, bright metal.

31. The red wire (connector position 1) goes to a switched source of +12 volts from the battery. You can pick this up from the wire supplying +12 volts to the ignition coil's primary terminal.

32. The yellow wire (connector position 3) goes to one primary terminal of the ignition coil (the other primary terminal of the coil is connected to +12 volts).

33. Figure 1 shows how the power wiring should look when you're done. The pickup plate and its wires are left out of the diagram for clarity – only the wires that the installer is responsible for connecting are shown. If you are unfamiliar with wiring diagrams, wires that have a "dot" at their intersection are electrically connected to one another, while a "jog" signifies that they are not connected.

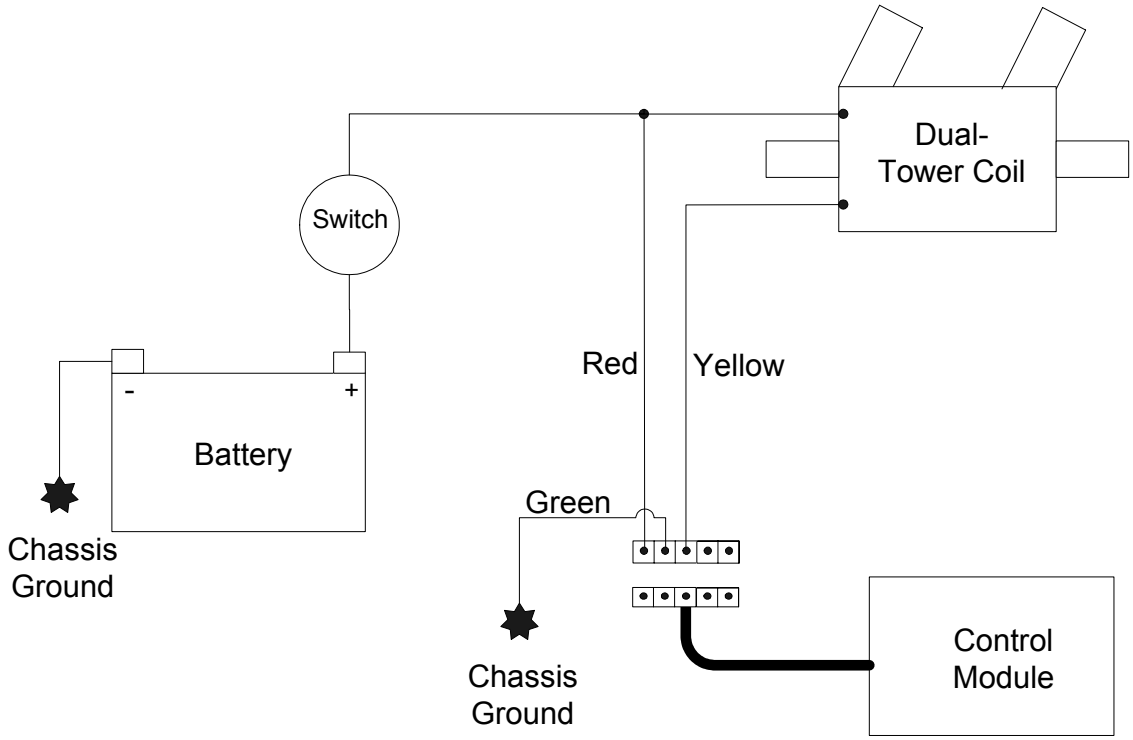


Figure 1

34. Plug the 5-pin connector into the control module's matching connector. It's keyed, so it only goes one way, and it will be obvious. Make sure the connector is pushed home until the retaining latch "clicks,"

35. Take a deep breath, clear your head, and double-check your wiring.

36. Reconnect the battery.

37. Disconnect the spark plug caps and remove the spark plugs. Reinstall the plug caps onto the plugs, and lay the metal base of the plugs down so they make electrical contact with the cylinder head surface. **Make sure that the spark plugs are well away from the empty spark plug holes in the head, and that the carburetors and cylinders are "dry" (no fuel), so that you will not ignite fuel vapor with the sparks you are about to create at the plug gaps.**

38. Turn the ignition power switch to the "on" position.

39. Using a socket or box end wrench on the alternator rotor's retaining nut, rotate the crankshaft slowly counterclockwise while watching the timing marks.

40. As you rotate the engine, the red LED on the control module will alternately illuminate and go dark. Lighting up signifies that the Hall-effect "run" sensor is in the "dwell" mode; where coil current will be passing through the coil when the bike is running.

41. Exactly when the LED goes dark at the end of the dwell mode is when the spark plugs will fire **at the full-advance point**. Note that unlike the OEM points-type setup, for which factory-type "static" timing is usually done at the full-retard position, the electronic ignition's timing LED changes state at the *full-advance* timing point.

42. The factory full-advance timing location is marked on the alternator rotor by an engraved line located counterclockwise (on the rotor face) from the "T" and "F" marks. The timing is correct when the LED goes dark just as the timing pointer aligns to this full-advance mark.

43. Full-advance timing is adjusted by rotating the pickup plate. If adjustment is required, loosen the two retaining screws and rotate the plate to obtain correct full-advance timing. Rotating the plate clockwise advances the timing, and rotating it counterclockwise retards the timing. For every 0.022" of movement at the edge of the pickup plate, the timing will change by 2° of angle at the crankshaft.

44. When you've got the full-advance timing set, tighten the two pickup plate hold-down screws. To make the washers' rubber facing deform enough to make up the small "step" between plate and recess, you will have to tighten the screws firmly.

45. Switch ignition power to the "off" position.

46. Disconnect the spark plugs from the plug caps, reinstall the plugs in the engine, and reinstall the plug caps onto the plugs.

47. Reinstall the seat, any side panels, and the fuel tank; open the petcock, and set the choke or enrichener, as required for a cold start.

48. Loosely reinstall the alternator cover; you are about to start and warm up the engine, and this will minimize the oil-fling mess from the "wet" alternator cavity.

49. Start the engine and warm it up a little bit, so that it will carburet cleanly. Stop the engine.

50. Connect a xenon-flash timing light to a plug wire, and connect the timing light to the battery, if required.

51. With the engine stopped, remove the alternator cover again, and restart the engine. Watch out for oil fling.

52. With the timing light operating, rev the engine up to about 3,500 RPM. The timing light should "freeze" the alternator rotor's timing indicator at the full-advance mark. If small corrections are needed to get the timing spot-on, make them now.

53. Once the full-advance timing is verified, check the idle-speed timing. Let the engine idle at between 1,000 RPM and 1,200 RPM, and shine the timing light on the alternator rotor. The small blue potentiometer on the face of the control module can be used to finalize the low-speed timing; turning the potentiometer clockwise increases the timing delay and retards the timing; turning the potentiometer counter-clockwise advances the timing.

54. When the timing has been set and verified, shut off the ignition power, close the petcock, reinstall the alternator rotor cover and points housing cover, and top up the oil level.

Appendix 1; setting the rev limiter

The three toggles of the module's DIP switch allow the user to set the rev limiter to one of eight combinational settings. In ascending order, these are:

Rev Limit	Switch 1	Switch 2	Switch 3
RPM	Position	Position	Position
10,500	Down	Down	Down
11,000	Down	Down	Up
11,500	Down	Up	Down
12,000	Down	Up	Up
12,500	Up	Down	Down
13,000	Up	Down	Up
13,500	Up	Up	Down
None (limiter off)	Up	Up	Up

The as-delivered DIP switch setting is with all three toggles in the "down" position, with the rev limit set to 10,500 RPM. The toggles are numbered from one to three (from left to right); the numbers are visible on the switch housing.

When the engine reaches the set rev limit, each cylinder fires on every other power stroke (that is, every four crankshaft rotations, instead of every two crankshaft rotations, as is normal for a four-stroke engine). The resulting "stutter" sound and feel will alert the rider that the rev limit has been reached, at the same time reducing engine power by half to prevent over-revving. As soon as engine speed is reduced below the limit, normal ignition firing resumes.

Setting all three toggles to the "up" position disables the rev limiter and allows unrestricted engine RPM.

Appendix 2; kill switch and tachometer options

As noted in the wiring table earlier in this document, there are tachometer and kill switch options available. If you've completed the basic ignition system installation, you've already dealt with the three wires that came pre-installed in the 5-pin power cable harness connector. The two remaining connector positions are associated with the tachometer and kill switch options. Their numbers are:

- Position 4: Kill switch
- Position 5: Tachometer output

The FS10-EL installation kit includes one white and one orange wire that can be inserted into the 5-pin connector housing to make the kill switch and tachometer connections.

The terminals are preinstalled onto the ends of the wires; these may be inserted into the connector housing from the back (where the molded-in numbers are, and where the existing red, green, and yellow wires are sticking out). The terminals "snap" into place and are then permanently retained; you can feel and hear them "click" when they go all the way home. The simplest way to see how the terminals must be oriented for insertion (they only go one way) is to use one of the other wires already installed in the connector as a guide.

The first option is the kill switch; this one's easy. If you install the kit's accessory white wire in connector position 4, and short the other end of the wire to chassis ground, the plugs will stop sparking for as long as the electrical connection is made. The kill function does NOT disable the ignition's control module or tachometer output; they continue to operate (the module alone draws only about 85 milliamperes). The kill function shuts off the coil current, so that there can be no spark.

If you wire in an old-fashioned momentary kill button (the kind with a single wire that shorts to the handlebar when activated) and push it with the engine running, both cylinders will stop firing for as long as you hold down the button. You can also use a toggle-type switch to ground, so that spark is interrupted when the switch is in the "kill" position.

The second option is the "digital" tachometer output signal (orange wire, connector position 5). The tachometer output is configured to give one signal pulse per crankshaft revolution; this is a common Japanese bike electronic-tachometer format for 4-cylinder bikes.

Electronic tachometers will generally have either three or four wires. The three-wire versions have the following connections:

- +12V
- Ground
- Signal Input

Four-wire tachometers have an additional dedicated lead for the internal backlight.

Color coding for these wires varies from manufacturer to manufacturer, so you will have to determine which is which according to your tachometer's documentation. The orange tachometer output wire of the ignition module would connect to the Signal Input wire of the tachometer.

Other details and notes:

- The FS10-EL system has an auto-shutoff feature that turns off the coil current if the engine is not started within 30 seconds of the key switch being turned on (or if the engine has been stopped for any reason with the ignition powered). This prevents draining the battery or damaging the coil and module if the system is accidentally left energized. Once "timed out," the module will automatically restore coil current when crank rotation is detected; you don't have to cycle the power to re-boot the system.

- Recheck ignition timing after each periodic cam chain adjustment. Since the ignition is driven from the end of the cam, a stretched chain will retard the ignition.

For questions and/or assistance, contact:
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