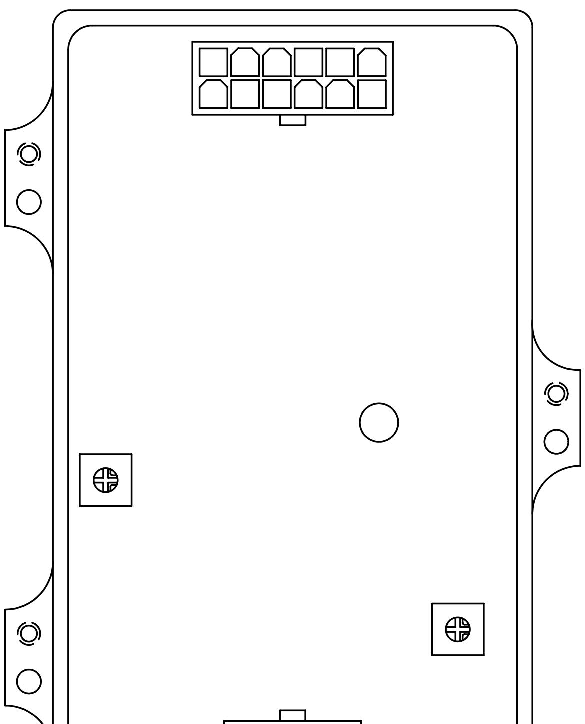
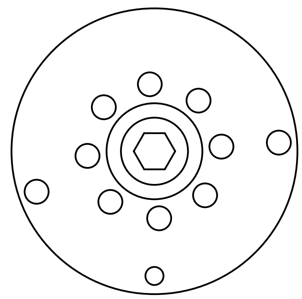
PROBE ENGINEERING, INC.

Installation Instructions

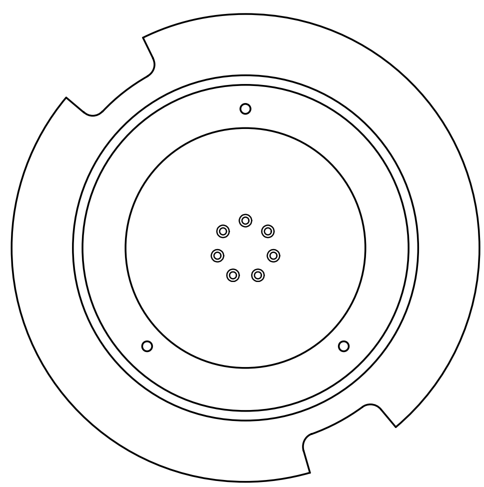
Model XS650-90 Electronic Ignition



Control Module



Trigger Rotor



Sensor Assembly

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Installation Instructions, Model XS650-90
Version 0.1

The Model XS650-90 electronic ignition is designed specifically for Yamaha 650 twin motorcycle engines with crankpin throws re-phased by 90º, so that the normal 360º crankshaft rotation that separates the left cylinder's firing event and the right cylinder's firing event is reduced to 270º.

The XS650-90 ignition system is a single-fire design, using two single-tower coils and firing each cylinder once per 720º of crankshaft rotation (no "wasted spark"). It employs a camshaft-mounted rotor with flying magnets to trigger Hall-effect sensors in a fixed-position pickup assembly, for no-contact, no-wear operation. Spark advance and retard is all-electronic; no centrifugal advancer is used, and the trigger rotor is mounted in a fixed angular relationship to the camshaft.

What should be in the kit:

The Model XS650-90 kit includes the following components:

- Control Module
- Sensor Assembly (with wire harness and connector)
- Trigger Rotor
- Power Cable Harness
- 9V battery connector
- Spare red, black, green, and orange wires (1-foot long each, for optional features)
- Tie-wraps (for organizing the wiring)
- A pair of NGK BPR7ES sparkplugs (the use of resistor-type plugs is required)

What else you will need:

In addition to the usual small hand tools required to get access to the engine's points-plate housing and to remove the fuel tank, side panels, etc., installation will require the following tools and supplies:

- 9V rectangular snap-connect type battery (for setting the static timing)
- Wire cutters/strippers
- Solderless crimp-type connectors, bullet connectors, or solder and shrink tubing
- 3/16" hex wrench (to tighten internal-expander screw in the Trigger Rotor)
- Loctite® "blue" medium-strength thread-locking compound or equivalent
- Xenon-flash timing light

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Before you start:

You will have a new camshaft, ground to match the crankpin phasing of the 90º crank. It is likely that internal advancer rod's bushings and labyrinth seals were removed from the cam before the hard-weld process (1980 and later camshafts did not have bushings and seals installed). If these parts are still in place, or have been reinstalled, the left-hand bushing and seal will have to be removed, as the new magnetic trigger rotor mounts directly to the left-side ID of the camshaft bore, using an internal-expanding collet. The right-side bushing and seal, if present, need not be removed. Instructions on how to do this are included in the **Installation** section. If the left-side bushing and seal are not present, skip those steps.

The installation instructions also cover the removal of the original points plate, condensers, advancer rod, and advancer assembly, none of which may be present on your head by now; presumably, no one building a rephased-crank 650 (or bigger!) twin is working on a stock motorcycle any longer. The instructions are there "just in case" the head still somehow carries the old bits. Skip any steps that don't apply to your buildup.

Installation:

1. Remove the side panels (for general access).

2. Raise and/or remove the seat.

3. Disconnect the battery.

4. Remove the fuel tank.

5. Remove the alternator rotor cover on the left side of the engine.

6. Remove the chromed steel breaker-points cover on the left side of the cylinder head.

7. Remove the chromed steel centrifugal advancer cover on the right side of the cylinder head.

8. Remove the breaker points and their backing plate as a complete assembly from the housing on the left side of the cylinder head.

9. Disconnect the breaker points from the ignition coils.

10. Disconnect the condensers (you don't need them with the solid-state ignition).

11. Remove the nut securing the breaker-points cam to the left end of the advancer shaft (the shaft that runs through the hollow center of the camshaft).

12. Remove the breaker-points cam from the left end of the advancer shaft (it should pull straight off the shaft).

13. Remove the nut on the right end of the advancer shaft that connects the shaft to the advancer mechanism.

14. Remove the advancer shaft and the advancer collar (the collar connects the shaft to the flying weights).

15. Remove the 2 "e-rings" retaining the flying weights on their respective pivots on the advancer mechanism, and remove the weights and springs.

16. There are a seal and a bushing installed in each end of the hollow camshaft. The seal and bushing on the left (points) side of the camshaft must be removed to install the new ignition Trigger Rotor. To remove the seal (it is outermost in the camshaft), thread the 3/8" NPT tap partway into the seal. You can use a tap handle for this if you have one handy; if not, an adjustable end wrench on the drive flats of the tap will work fine. Once the tap has a decent "bite," the seal will usually twist out of the end of the camshaft without much trouble if you simultaneously pull it outward while twisting the tap. If the seal doesn't twist out while tapping, there are two ways to deal with it. The first method is to thread a 3/8" pipe plug (or nipple) into the seal, and press the seal and plug out from the right side of the engine, using the advancer shaft you just removed as a "pusher." A conventional gear puller tool, pulling against the advancer backing plate and pushing on the shaft, makes this easy. The second method is to thread a 3/8" pipe nipple into the seal, and pull it out from the left side.

17. To remove the (inboard) bushing from the left side of the camshaft, again use the 3/8" NPT tap to cut threads into the bushing***. Be careful not to tap so far that you begin cutting threads into the internal shoulder of the camshaft that backs up the bushing***. The bushing is usually a little tighter than the seal, and may need to be pulled out (pipe nipple and spacer) or pushed out (advancer rod and gear puller combination), as described above.

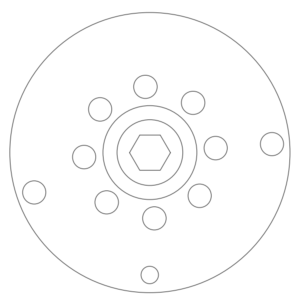
18. Clean up and degrease the camshaft bore where you just removed the seal and bushing. Brake cleaner or electrical-contact cleaner is a good degreaser.

19. Remove the left-cylinder's intake-valve adjustment cover.

20. Now that you've removed most of the small bits that could have fallen down an open sparkplug hole (had there been one), you may choose to remove the plugs to make the following steps of turning over the engine easier. Or, you may choose not to; take your pick. The author has never dropped a screw down a sparkplug hole that still has a plug in it….

21. With a 17mm socket or box-end wrench on the alternator-rotor nut, rotate the crankshaft counterclockwise (the "running" direction) a couple of times, while watching the left intake rocker arm. As the rocker arm is closing (on the compression stroke for the left cylinder), bring the alternator rotor's timing mark to the "full-advance" firing mark on the alternator stator housing. (This is variously given as 38º BTDC for early, points engines, and 40º BTDC for later "transistorized" ignition engines with inductive pickups on the stator housing.)

22. Find the Trigger Rotor in the kit. It looks like this; there is a 1/8" pipe plug screwed into the center of it (the silver goop is moly-grease anti-seize compound):



23. Using your 3/16" hex key, back out (loosen) the pipe plug a couple of turns, to ensure that the internal-expanding collet is at its "free" diameter. Try pushing the trigger rotor into the left end of the camshaft; it should slip in easily, and its shoulder should seat up against the end of the camshaft.

24. If everything looks good, pull the rotor back out, and put a drop of blue (medium-strength) Loctite anaerobic thread locker (or equivalent) into the bore of the cam, spreading it around a bit.

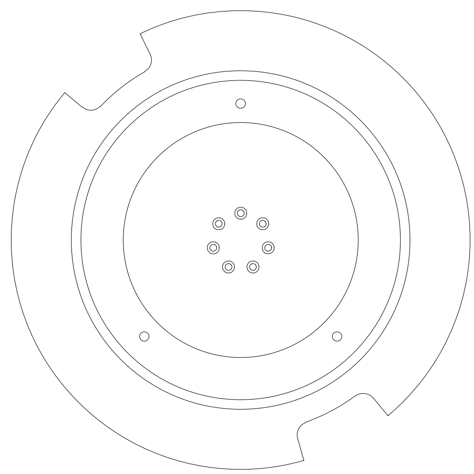
25. Reinstall the trigger rotor, with the 0.094" diameter timing-mark hole (it's got red paint in it) located straight down, at the 6:00 position. Push the rotor inward until its shoulder seats against the end of the cam.

26. Hold the rotor in position (axially and rotationally), and begin tightening the pipe plug, using the 3/16" hex key. As the plug is tightened, the internal collet of the rotor

will expand (it is slotted), and get a grip on the ID of the cam. Don't bother trying to tighten it all the way down just yet; just get it pretty good and snug.

27. Re-check to make sure that you haven't rotated the crankshaft from the "left-cylinder/compression-stroke/full-advance" position, and that the red-dot hole in the trigger rotor is still at the 6:00 position. If either has moved, readjust their positions.

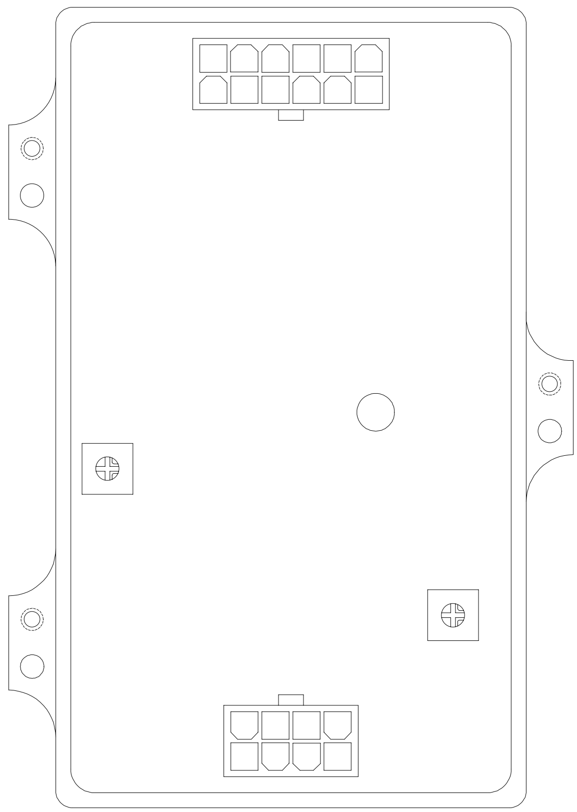
28. Locate the Sensor Assembly in the kit. It looks like this (the seven colored wires are omitted for clarity):



29. Install the sensor assembly into the points housing, over the trigger rotor. The wires will face out, toward you, and the Hall-effect sensors on the central PC board will face inward, toward the rotor. The two cutouts for the mounting screws are asymmetrical (like the original points backing plate) and will only align to the screw holes one way.

30. Center up the sensor assembly's screw-clearance slots on the retaining-screw holes in the housing, and reinstall the two original screws and washers finger-tight.

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



32. There is a 12-pin connector housing at the "top" of the module, 8-pin housing at the "bottom" of the module, two blue potentiometers, and a red LED. Use a piece of string, or wire, or a tie-wrap, and tie up the module temporarily somewhere near the alternator assembly, so that you can see both the alternator stator's timing marks and the module's red LED in your field of view at the same time.

33. The sensor assembly's wire bundle has an 8-pin plug that matches the 8-pin housing in the control module. Plug it in; it is keyed, and only goes one way, which will be obvious. There is a plastic retaining latch that will make a satisfying "click" when the connector goes home.

34. Find the 9V battery connector harness in the kit (it has 9V battery "snap" connector on one end, and a 12-pin plug that matches the housing in the control module on the other), but don't plug it in yet.

35. Snap a fresh 9V battery onto the matching terminals of the connector harness (you do this first, before plugging the harness into the module, so that if you get the battery terminals backward at first, nothing bad can happen).

36. Plug the 9V battery and harness into the 12-pin housing in the control module.

37. Put your 17mm socket or box-end wrench back onto the alternator-rotor nut, and slowly rotate the engine counterclockwise a few turns, while watching the module's red LED. It will alternately illuminate and go dark. The illumination signifies the left-hand coil's "dwell" time, when battery current will be flowing through it (when the installation is complete). The going-dark signifies that the coil current will be stopped, which is the left-cylinder "fire" event. We want to see the LED go dark JUST AS the alternator rotor's timing mark aligns with the full-advance mark on the alternator stator housing. **Yes, this is different from the way we're all used to setting "static timing" on a set of points, in that we're using the full-advance mark, not the idle-timing (retarded) mark, but it is correct for this system.**

38. If the timing's off, start by trying to correct it by rotating the sensor assembly counterclockwise (to retard an over-advanced "fire" point) or clockwise (to advance a retarded "fire" point). Loosen the retaining screws, rotate the housing and gently snug the screws back up, then retry step 37. The timing will change by two degrees at the crank for every 0.021" movement at the edge of the sensor assembly flange.

39. If you're able to get the timing set correctly by repositioning the sensor assembly, mark its position relative to the housing, remove it, and finish tightening down the rotor's collet-expansion pipe plug, taking care not to let the rotor turn in the camshaft bore. If you're NOT able to get the timing set correctly within the adjustment range of the sensor assembly, grab the rotor and give it a little twist to reposition it within the cam; move it counterclockwise if you ran out of sensor adjustment while trying to advance the fire point, and reposition the rotor a bit clockwise in the cam if you ran out of sensor adjustment while trying to retard the fire point.

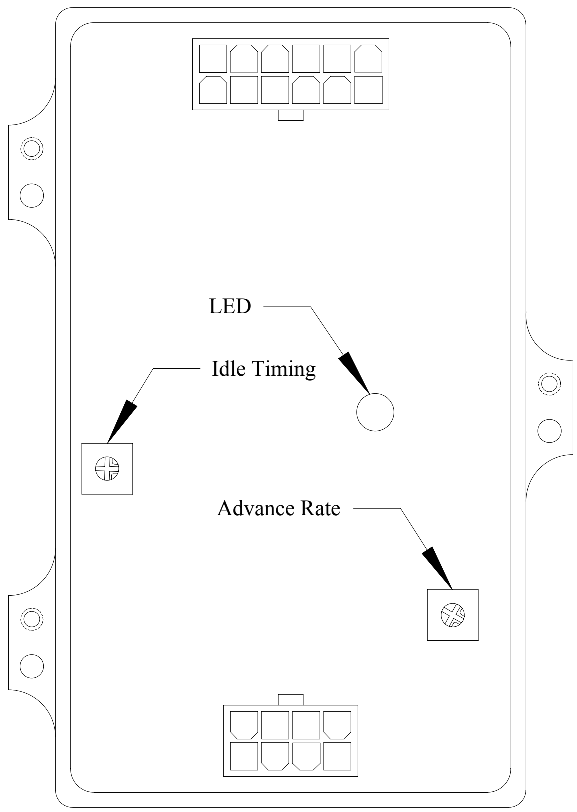
40. Repeat steps 38 and 39 as required until you've got the rotor in position, tightened down, and the sensor assembly set to give you the desired left-cylinder full-advance fire point. It's usually easier than the instructions make it sound. Tighten down the sensor assembly screws, and recheck the timing one more time.

41. Disconnect the 9V battery connector harness from the module.

42. Disconnect the sensor harness from the module.

43. Untie the module from whatever it's been hanging from during the timing-setting steps.

44. Find a place where you'd like to mount the control module. There are two small blue potentiometers visible on the face of the module; one is used to trim in the idle-speed spark advance, and the other adjusts the advance rate of the spark curve. They are identified in the illustration below:



45. When you mount the module, it is handy to have screwdriver access to these potentiometers. The idle-timing potentiometer is pre-set at the factory, but may be varied by those who prefer more or less idle-speed advance than standard. The advance-curve rate is pre-set at the factory to be all-in (full advance) at 3,250 RPM, but is adjustable to be all-in anywhere between 3,000 and 4,000 RPM. Directions on how to adjust both of these controls are included in Appendix 1 of these instructions.

46. The control module should be mounted where it will not be directly exposed to engine heat. Each of the module's three mounting feet has one M3 x 0.5mm tapped-through hole and a 0.125" diameter clearance hole. Each clearance hole will pass an M3 screw, a #4-40 screw, or a 1/8" diameter pop-rivet. Thus, there are several

options available to obtain a secure mount for the module, and the installer should employ his or her preferred method. The module dissipates low power during operation, and will get just warm to the touch. It does not require direct airflow, but should not be mounted in a sealed volume with no airflow at all.

47. Route the sensor assembly's wire bundle to the location of the control module. The sensor assembly 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 wires must be kept well away from the spark-plug leads, so that the electronics won't get confused by radiated spark energy from the high-voltage secondary side of the coil.

48. Look at the12-pin connector at the end of the Power Cable Harness. On the connector's rear surface, where the wires enter, there are (hard-to-see) molded-in numbers showing each wire's position. Numbers 1 through 6 are in the first row (furthest away from the molded "latch"), and 7 through 12 are in the second row. The wires in each position are described in the following table. For the basic system installation, you only have to deal with the six wires shown in **boldface** type:

♦	Position 1:	**Heavy-gauge green wire – goes to chassis ground**
♦	Position 2:	Open (reserved for kill-switch option)
♦	Position 3:	Open (reserved for electronic tach option)
♦	Position 4:	Open (reserved for electronic tach option)
♦	Position 5:	Open (reserved for electronic tach option)
♦	Position 6:	**Heavy-gauge red wire – goes to switched +12 volts**
♦	Position 7:	Open (unused)
♦	Position 8:	**Heavy-gauge green wire – goes to chassis ground**
♦	Position 9:	**Heavy-gauge blue wire – goes to right-cylinder coil**
♦	Position 10:	Open (reserved for electronic tach option)
♦	Position 11:	**Heavy-gauge green wire – goes to chassis ground**
♦	Position 12:	**Heavy-gauge yellow wire – goes to left-cylinder coil**

49. **Important notes** – When routing wires, keep the power cable harness separated from the sensor assembly wires. It is also important to keep all wires away from the high-voltage ignition wires to the spark plugs. We strongly recommended the use of modern, spiral-wound suppression sparkplug wires or carbon-type suppression wires with all electronic ignition systems. The BPR7ES sparkplugs included in the kit are resistor-type plugs, which must be used with electronic ignition. If you are running a different plug type, you must use a resistor-equipped version (for instance, the BR8ES is the resistor-type equivalent to the B8ES).

50. The power cable harness' heavy-gauge green wires (connector positions 1, 8 and 11) must go to a good chassis ground. All the usual notes apply regarding the ground being free of paint and being clean, bright metal. In addition, be cautious of things that look like grounds, but are not; the XS650's battery box is fully rubber-mounted, and is not a chassis ground, no matter how bright you make the bare metal. The ground wires are 12" long as supplied. If you want to make them shorter, you may, but they should not be extended.

51. The power cable harness' heavy-gauge red wire (connector position 6) goes to a switched source of +12 volts. It is recommended that you do <u>not</u> pick this source up directly from the "+" terminals of the coils, as that creates potential electrical noise pickup problems for the control module.

52. The heavy-gauge yellow wire (connector position 12) goes to the minus (-) terminal of the ignition coil for the left cylinder.

53. The heavy-gauge blue wire (connector position 9) goes to the minus (-) terminal of the ignition coil for the right cylinder.

54. The following wiring diagram shows how the system connections should be made. For those not familiar with such diagrams, a "dot" where wires meet signifies that they are connected together electrically, while a "jog" signifies that they are not connected.

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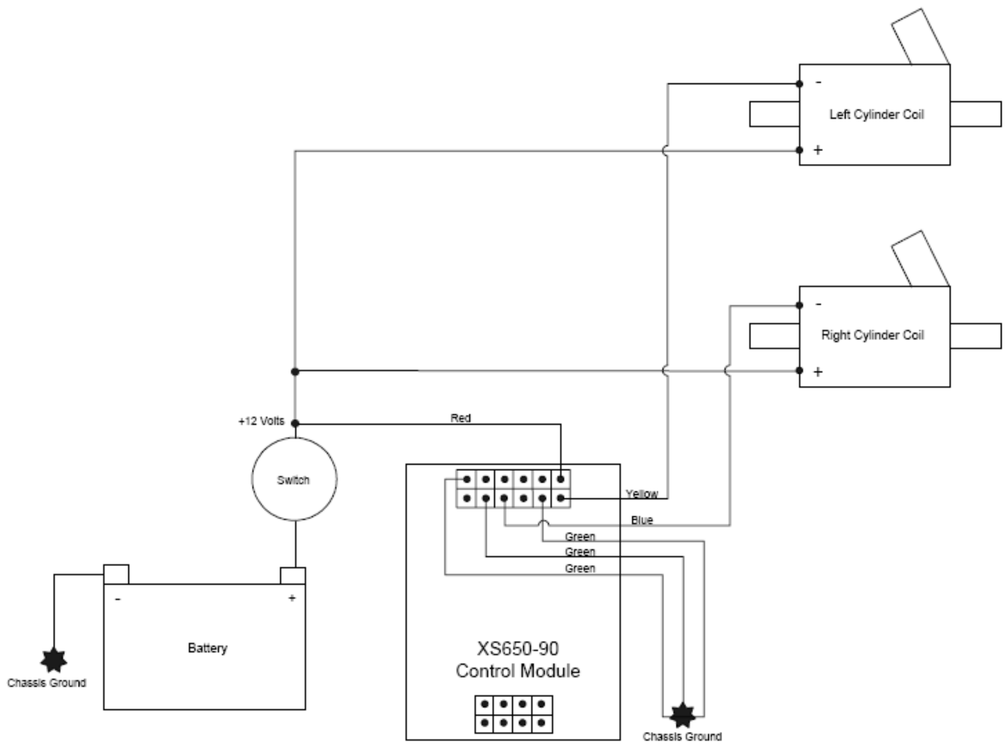


55. Once you've got the coil power wiring, the sensor assembly wire harness, and the power cable harness wiring and routing completed, plug the two connectors into their respective housings on the control module.

56. Reconnect the battery.

57. Before you reinstall the tank, seat, and bodywork, now is a good time to ensure that the basic installation is working properly. You can use the new BPR7ES plugs included in the kit for this test. If you remove or have removed the plugs from the engine, take care that no ignitable mix is blown from the open plug holes onto the test sparkplugs in the next steps.

58. Install the plug wires onto the test sparkplugs. Lay the test sparkplugs on the cylinder head surface so that the metal shells are well grounded.

59. Turn the ignition key to the "on" position.

60. Briefly spin the engine over by foot or by starter motor, while keeping an eye on the spark gaps in the test plugs. The plugs should spark with a slightly staggered, staccato rhythm (thanks to that rephased crank!).

61. If everything looks good, switch the ignition to the "off" position.

62. Disconnect the spark plugs from the plug caps. Install the resistor plugs in the engine, and install the plug caps onto their respective sparkplugs.

63. Reinstall the seat, fuel tank, left intake rocker-arm cover, advancer-housing cover, and any bodywork; open the petcock, and set the choke or enrichener, as required for a cold start.

64. Start the bike.

65. Warm up the engine a little bit, so that it will carburet and idle cleanly.

66. Connect a xenon-flash timing light to the left cylinder's spark plug wire and to the battery (if required; some of us are lucky enough to use the Summit Racing/Flaming River self-powered timing light, and love it).

67. With the timing light shining on the alternator rotor and stator housing timing marks, rev the engine up about 3,500 RPM. As the engine speed rises, you'll see the timing advance toward the full-advance mark; as you approach 3,250 RPM, you'll see the last degree or two of spark lead come in, and thereafter, there will be no further advance. At 3,500 RPM and above, the timing light should "freeze" the alternator rotor's timing mark at the stator housing's full-advance mark, right where you set it using the red LED and the 9V battery during initial setup. If small corrections are needed to get the timing just where you want it, make them now by stopping the engine, rotating the sensor assembly a bit in the appropriate direction, and re-checking with the timing light.

68. Note: the XS650-90 system is delivered with the advance-rate adjustment set for all-in advance at 3,250 RPM; it has an adjustment range from 3,000 RPM to 4,000 RPM all-in. We suggest you begin your tuning using the factory pre-set figure. For those interested in using a more- or less-aggressive advance curve, see the instructions of Appendix 1.

69. Once the full-advance timing is verified, check the idle-speed timing. Let the engine idle at its recommended idle speed (generally around 1,100 to 1,200 RPM), and shine the timing light on the alternator rotor and stator timing marks. You will see the rotor's timing mark "frozen" somewhere n the range of the stator's idle-timing marks.

70. To finalize idle-speed timing, the idle-timing potentiometer on the face of the control module can be used to alter the low-speed timing delay. Turning the potentiometer clockwise increases the timing delay and retards the idle-speed timing; turning the potentiometer counter-clockwise advances the idle-speed timing.

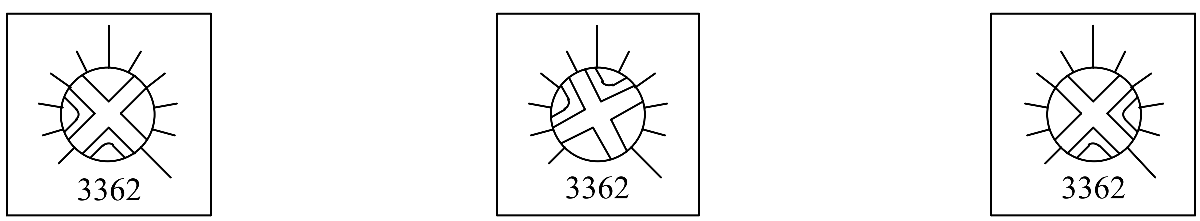
71. When the desired timing has been set and verified, shut off the ignition power, close the petcock, and reinstall the alternator housing cover and points housing cover.

Appendix 1, advance curve options:

The Model XS650-90 system is delivered with the advance-curve rate adjustment potentiometer set for all-in timing at 3,250 RPM. The adjustment range is from 3,000 RPM all-in timing (potentiometer set to its counterclockwise limit) to 4,000 RPM all-in timing (potentiometer set to its clockwise limit). Any intermediate value between the two limits may be obtained.

The following figure illustrates three positions of the advance-curve rate adjustment potentiometer:

3,000 RPM | 3,250 RPM (as delivered) | 4,000 RPM



If you look carefully at the potentiometer, you'll see the markings "3362" along one edge, and engraved position markers around the adjustment screw. The screw has a small relieved area that shows where it is set.

The middle image shows the potentiometer setting as delivered, with the all-in timing set to occur at about 3,250 RPM. The left image shows the screw at its counterclockwise limit, where the all-in timing occurs at 3,000 RPM. The right image shows the adjustment screw at its clockwise limit, where the all-in timing occurs at 4,000 RPM.

If you change the advance rate using the advance-curve adjustment potentiometer, it will also change the idle-speed timing; advancing the all-in timing from 3,250 RPM to 3,000 RPM will make the idle-speed timing advance, and retarding all-in timing from 3,250

RPM to 4,000 RPM will have the opposite effect. So, if the advance-rate potentiometer is changed, the idle-speed timing potentiometer must be readjusted.

Summarizing, here are the relationships between the various timing adjustments of the XS650-90 system:

- Full advance is set by rotating the sensor assembly. Changing the full advance timing will also alter the idle-speed advance, which can then be corrected with the idle-speed advance potentiometer. Changing the full advance point will not affect the advance-curve rate.

- The spark timing at idle is set using the idle-speed advance potentiometer. Changing the idle-speed advance potentiometer setting doesn't affect either the full advance timing or the advance-curve rate.

- The advance-curve adjustment potentiometer changes the engine speed at which full advance is achieved. Changing the advance-curve potentiometer doesn't alter the full-advance timing, but does alter the idle-speed timing, which can then be corrected using the idle-speed advance potentiometer.

Appendix 2, tachometer and kill switch 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 six heavy-gauge wires that came pre-installed in the 12-pin power cable harness connector. The remaining five open positions on the connector housing are associated with the tachometer and kill switch options. Their numbers are:

♦ Position 2:	Kill switch
♦ Position 3:	"4-cylinder" tachometer output (2 pulses per engine revolution)
♦ Position 4:	Return (ground) wire to tachometer (powers tach)
♦ Position 5:	+12V power to tachometer
♦ Position 10:	"2-cylinder" tachometer output (1 pulse per engine revolution)

Positions 3, 4, 5, and 10 are for the system's electronic tachometer drive. You can connect a typical electronic tachometer to the control module, and drive it entirely without having to make any other connection to the bike; the tach will draw both power and RPM signals directly from the module.

The control module's tach outputs make two different "rates" available; **connector position 10** carries the **"2-cylinder"** tachometer output, which gives one signal pulse per crankshaft revolution, exactly the way a 2-cylinder 360º crank engine with a dual-tower coil (waste spark on one cylinder or the other on each rev) would do. An electronic tach for a 4-cylinder bike will generally tie to just one coil; these also usually operate at "2-cylinder" tach rates, since each coil services two cylinders 360 crank degrees out of phase, as described above.

Connector position 3 carries the **"4-cylinder"** tachometer output, which gives two signal pulses per crankshaft revolution, exactly the way a 4-cylinder automotive engine would do. This output gives you the option of tapping into the automotive aftermarket for tachometers. Most of these will have 4-6-8-cylinder selection options; pretty much any automotive tach that can be set to a 4-cylinder calibration will work. We have found aftermarket automotive tachs to be inexpensive, rugged, reliable, and typically more accurate than the average OEM bike tach.

Connector position 5 carries **+12V**, which you can connect to the tachometer to power it (but you don't have to; if you prefer to wire the tach directly into the bike's system, you can). If you use this power lead, it's a VERY GOOD IDEA to put one of those in-line fuse holders into the tach's power lead. A 500mA (one-half ampere) fuse is about right; an Auto-Meter mini-tach, for example, draws only about 150mA with the backlight illumination running.

Connector position 4 is the return (**ground**) wire, which you also connect to the tachometer to power it, if you elect to obtain both tach signal and power from the Control Module.

Typical automotive aftermarket tach wire color codes seem to have become fairly standardized (BUT READ YOUR LITERATURE, AND USE IT AS A GUIDE!). They are:

- +12V power: red lead
- Ground: black lead
- Tachometer RPM input: green lead
- Backlight: white lead (sometimes this is not present, and the red +12V lead powers the lights, too).

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The Model XS650-90 installation kit includes terminated wires that can be inserted into the 12-pin connector housing for tach connection, and they are color-matched to the typical automotive aftermarket pattern. They are:

♦ Position 3:	"4-cylinder" tachometer output (GREEN WIRE)
♦ Position 4:	Return (ground) wire to tachometer (BLACK WIRE)
♦ Position 5:	+12V power to tachometer (RED WIRE)
♦ Position 10:	"2-cylinder" tachometer output (GREEN WIRE)

Since you use EITHER position 3 or position 10 for the tach output, there is only one green accessory wire in the kit. The wires are 12" long; you will have to splice them, as appropriate, to your tachometer leads. The terminals preinstalled onto the ends of the wires insert into the housing from the back end (where the molded-in numbers are, and where the pre-installed 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 to snap them into place (they only go one way) is to use one of the other five wires that are already installed in the connector as a guide. You want to align the heart-shaped "insulation crimp" that bites into the colored part of the wire so that it matches the pre-installed wires.

If you get a wire in the wrong hole, the special remover tool is pricey little bit of sheet metal that is available mail-order from Digi-Key (www.digi-key.com); their part number is **WM9918-ND**. If you do get the wrong color in a hole, it won't make any difference so long as the correct connector location number goes to the correct tachometer input function, but then you won't have color- matching wires (red-to-red, black-to-black), which makes life easier. It'll still work though. By the time it's in your hands, the extraction tool will cost you $30.00 and will not look like a bargain, but there's no other easy way to get a wrongly located terminal out without destroying the connector.

The last option is the Kill Switch:

♦ Position 2:	Kill switch (ORANGE WIRE)

This one's easy. If you install this wire in connector position 2, and the other end of the wire is shorted 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; they continue to operate (the module draws about 100mA). What the kill function does is to inhibit the coil current, so that there can be no spark.

If you wire in an old-fashioned momentary kill button and push it with the engine running, all 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 the sparks are interrupted when the switch is in the “kill” position. You can connect more than one kill switch to the wire from the control module if you want to; the rule is if ANY ONE of the multiple (parallel-connected) switches is in the “kill” position, there will be no spark.

Other details and notes:

- The Model XS650-90 ignition system has two magnets spaced at 165º on the trigger rotor; one magnet initiates a “fire” command from each cylinder’s Hall-effect sensor pickup, and the other magnet initiates a “dwell” command. “Fire” interrupts battery current through the ignition coil’s primary windings, and “dwell” resumes current through the coil, the dwell angle for each cylinder is 390º of crankshaft rotation. At 8,250 crankshaft RPM, this equates to a dwell time of about 7.9 milliseconds, which is long enough to fully “saturate” almost any good-quality coil, giving its maximum available spark energy.

- Hall-effect sensors for the right-cylinder’s “run” and “start” timing events are spaced precisely 135º apart from the left cylinder’s corresponding parts on the sensor assembly PC board; since the camshaft spins at “half time” as compared to the crankshaft, the sensor spacing equates to exactly 270º at the crank. A single electronic advance-retard circuit is shared between left and right cylinders, so that their respective advance curves (that is, timing between idle RPM and the full-advance RPM) are identical. Setting and checking the timing using just the left cylinder automatically sets the right cylinder to the same relative timing, by design.

- For those who wish to use high-performance aftermarket coils, a primary resistance down to 3.0 ohms is permissible. Dynatek’s 3-ohm primary (green), single-tower coils are sold in pairs as part number DC3-1; they are a rugged, reliable, time-tested design. See www.dynaonline.com. for more information. The Dynatek 5-ohm primary (black), single-tower coils are also fine performers, are more than adequate for anything but a full-race, high-compression engine, and will make life easier on your charging system in the bargain. They are sold in pairs as part number DC10-1.

- As previously noted, spiral-core suppression-type sparkplug wire is strongly recommended for use with the electronic ignition. Good quality resistor-core suppression wire is an equally good solution. If you’re running resistor-type plug caps, we suggest you retain those as well, provided they’re in good shape. New 5k ohm NGK caps are available mail order from Mike’s XS and Dennis Kirk in the U.S.

- Coils intended for capacitive-discharge ignition (CDI) systems are generally less than 1 ohm primary resistance, and are incompatible with the Model XS650-90 ignition system. The wrong coils will cause overheating and damage to the control module. Many inexpensive multimeters can't measure accurately down to a few ohms, so be especially careful to know what coil resistance you've really got.

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

For questions and/or assistance, contact:

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