



### Hugh's HandBuilt CDI Install Tech and Instructions:

This article will assume that you have removed all of your existing charging system and ignition from your XS650. If you have not done so, go ahead and make that happen.

We will focus on this being a CUSTOM Install, as we are not focusing on how to wire it into your existing wiring harness, or how to mix/match plugs and such from the OEM harness.

The CDI is a standalone system, providing charging and ignition. We will provide a diagram on how to wire your system in 2 manners. Pick the system that best suits your install:

1. Using OEM style "on-off" switch, or other "on-off" switch that utilizes switched Hot (+) power to turn on and off the ignition system. This setup works best for those keeping OEM Style switches, and a battery - but will also work without a battery (headlight will need to be "off" when kick starting however, for most effective use)
2. Custom Install, with a much simpler harness and diagram, which will utilize a "Kill" Switch, which can be a momentary ground switch, or a toggle, etc.. which will make contact with ground (-) on the chassis to turn off the ignition. This setup works best for those running batteryless, and who would prefer less wiring/hardware for a simpler install.

You will need the following tools:

19mm Socket (3/8" Drive)

3/8" Ratchet or Impact Gun

Metric Allen Wrenches

Double Crimp Pliers

Soldering Iron, Flux, Solder, etc..

Miscellaneous Zip Ties

Paint Marker or other Permanent Marker

Spark Plug Gapping Tool

Needle Nose Pliers

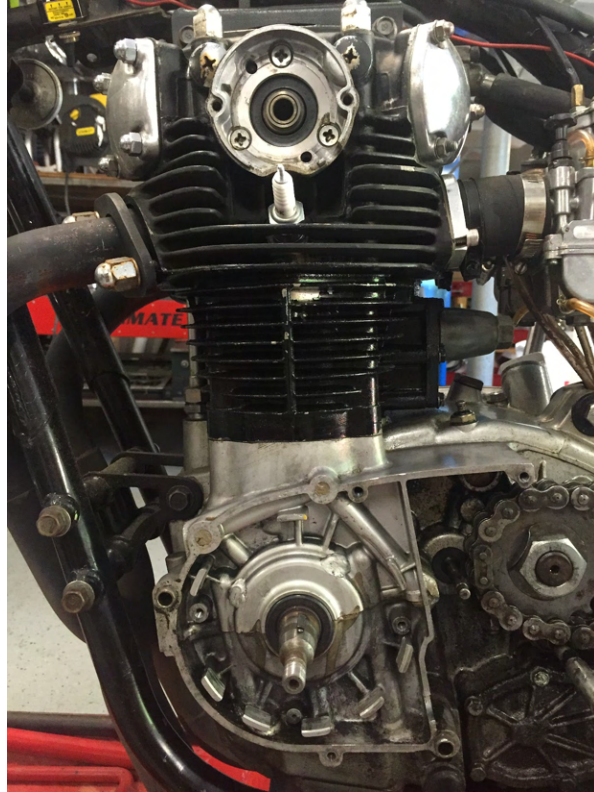
This install article is going to be "loose" - meaning that we are not going to show you where or how to mount your coil, CDI Box, Relay, etc... Those things are up to you the end user. We will love any feedback you may have of course, and in the future may create custom mounts that can be purchased separately. Your accessories (lights, horn, signals, gauges, etc..) will be wired dependant upon your build. We recommend each accessory gets its own individual fuse, One for the Headlight, one for the Brake Light, one for the Running Light, etc... There are some great wiring diagrams on XS650.com - get involved over there and find something that suits your needs. And keep in mind, the more accessories you use, the more likely it is you will need a battery to help power them at low RPM.

**PLEASE READ THE ENTIRE SET OF INSTRUCTIONS BEFORE INSTALL!** I spent about 9 hours installing, photographing and writing these, so that you won't have any questions at all - so do yourself the favor, and read them over. I know they seem long, but it's mostly pictures.

\*The above pic references most of the items you'll have in your kit, may change a small bit in appearance in the future\*

***Set Engine to Top Dead Center (TDC)*** using the factory timing marks before removing the OEM Charging System (Need a puller for the factory charging rotor? Check my store, I got em!)

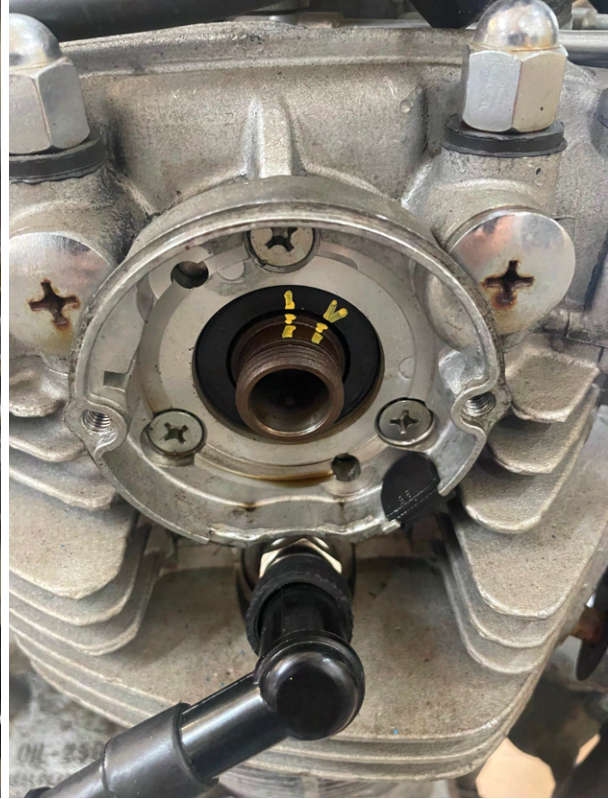
Start with the Charging System removed, this our 1975 Test Mule XS650 - she gets beat down, so don't expect show bike pretty on this one - she's a runner, and mostly she gets abused testing all of our HHB Goodies... You'll note that we have already removed the Points system as well.



\*Note, your hardware kit may be slightly different, as we have evolved the mounting systems, and done more pre-installing of small parts for you. Don't sweat any difference...

You'll want to set the engine to TDC. If you don't know how, it's in your XS650 Manual. Pro-Tip, TDC can be eyeballed using a flashlight through the Spark Plug hole. And you can double check that the "Pin" hole that indexes the original Mechanical Advance Unit on the right side of the camshaft is vertical (12:00 or 6:00, doesn't matter which) when at TDC until the keyway on the crankshaft is facing "up" - You can also find TDC using the original charging system components, and set TDC before removing those parts.

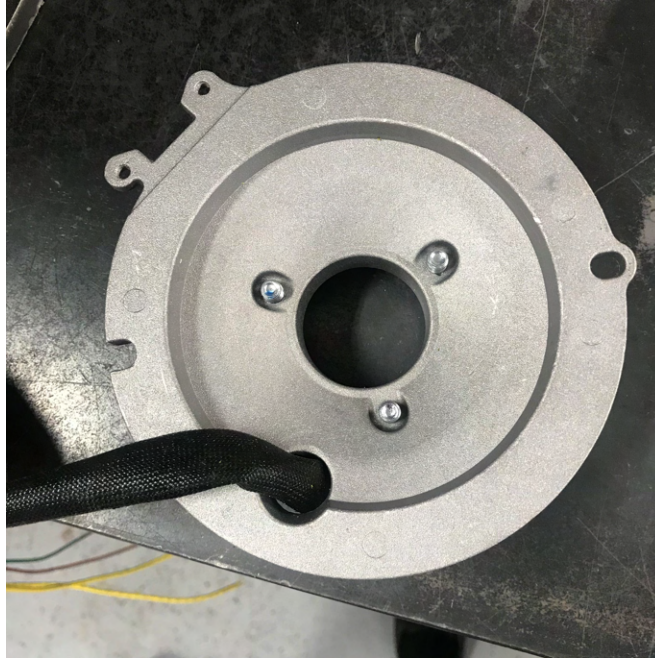
**Also make sure you have removed the Woodruff key from the crankshaft, you will NOT be using a woodruff key on the new CDI Kit / Install**



Once you have TDC, I like to make some reference marks using yellow paint on the engine cases. 2 marks on the crank, and 2 on the cam help keep things a bit more accurate. (see above) - This way you can always reference TDC quickly when removing the kit, changing timing, etc.



Remove the Dowel Pin from the Crank Cases, if still present. (As shown removed above)  
Loosely Install the Pickup on the CDI Plate, using the M4 Screws Provided Don't Fully Tighten  
the pickup just yet. The Stator has been pre-installed on the backing plate for you, and the  
wiring has been pre routed to the back of the mount.



Take note of this location on your engine cases (marked with yellow paint as shown) - this is  
where you want the wiring to run.



Do a loose install of the mounting plate with the pickup wiring run one of the two ways shown. You can run the pickup wiring behind the mount, or to the right of it nicely tucked away. Not all cases were cast identical of the years, so pick the method which works best for you. Mostly, you need to make sure ALL wiring is free from moving parts, and not being pinched.



\*Pickup wiring tucked behind the mount as shown above



\*Pickup wiring routed to the right of the mount, tucked nicely against the cases.

Once you are happy with the wiring and its routing, fasten the Stator and Backing plate to the cases with the M6x16 Hardware Provided. Torque to 6ft Lbs. ALWAYS use blue thread locker on this hardware.

Install the Wiring Grommet - you may need to trim some of the protective sheathing to get it just right, we send it out a bit long.



\*This grommet protects your wiring from chafing after installing the side cover, take your time to install it nicely in the factory notch on the cases.

Take time to properly route the stator and pickup wires away from where the rotor will be spinning. Some stators will have more "slack" in the wires than others, so making them taught would be wise, and secure as needed with a zip tie. You can slip some of the protective wire covering over these as well.

Now I typically slip the protective sleeving onto the wiring again, and route all of the wires to the location I want to mount my CDI, Relay, and Regulator. I won't be going into all that detail here, you can get creative if you need to. Should you need to extend any wires, make sure to use the same color patterns and solder ALL connections along with heat shrink on the joint to protect it. Any custom extensions to the wiring MUST be properly soldered and protected to avoid voiding the warranty of course.

So once you have decided how long your wires need to be, you can trim them down as needed to be all the same length. I often bunch up the protective sleeve a bit, and zip tie it, just to make things easier.

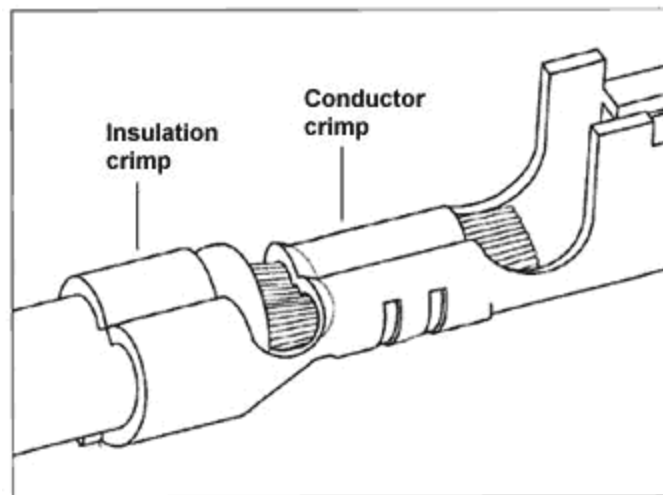


Grab the bag of electrical connectors. Yours may or may not have everything in this one pictured, but you get the idea.



Here is where I get picky (and you should too!) - while I would prefer everyone install this system using the proper crimping pliers, I know that some will not. IF for some reason you have a system failure and your system is returned with poor connections, we will not be able to honor any potential warranty claims. Proper connections are a must, and on a vibration happy XS650, take time to do this properly. Read this paragraph again.....

If you do not have pliers that can make crimps that look like this, then see if you can find some (I am hoping to carry some on my website soon, but RMStator sells a nice set Part# RM100002)



Here are the pliers I use, RMStator Part# RM100002 - these work really really well. I have also taken the time to write on the side which the wire goes, as these do both crimps at the same time, and that larger side is where the wire goes.



\*IF you are unable to source a set of proper pliers, or create proper crimps, we will also allow soldered connections if made properly. Please still make an effort to properly crimp the insulation crimp and the conductor crimp before soldering. However, a set of pliers like this will come in handy on more than just this, as you are likely rewiring your whole motorcycle at this point. Money well spent.

Ok, back to the project at hand... I know, these instructions are intense! I promise the install is much easier than these instructions make it out to be, I just like being thorough - and you deserve as such...

So now, onto the Yellow Wires from the Stator. These are your charging wires. You'll want to trim back the wire just a bit, using good sharp wire strippers. Don't over overboard, you only need a small amount of wire showing.



Now, you will need the FEMALE Bullet Connectors from the wiring kit, and the matching rubber sleeves that go with them. *\*Color and style may vary slightly, but you get the idea...*



Make sure to slip the rubber sleeves over the wire BEFORE installing the female connectors. Or you'll be cussing later (not even all that much later, usually just as soon as you make the "perfect" crimp - or at least it works that way for me)



And then crimp the terminal onto the wiring. I'll take a quick moment to say that you do have to position the terminal properly in the crimping pliers first, it takes a quick moment to get used to, but once you have it down, you'll wonder how you ever lived without them!

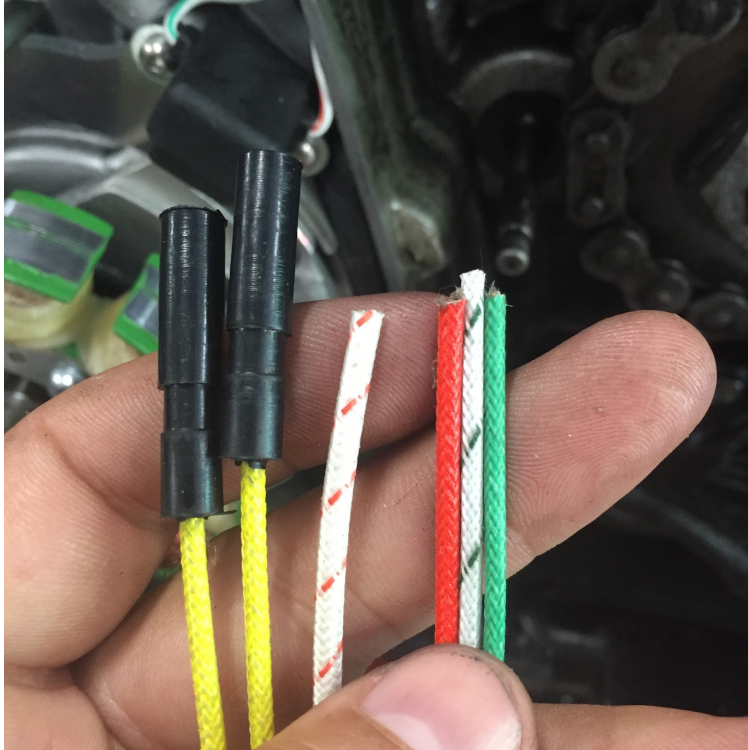


If you notice, you don't want to damage the actual "bullet" part of the connector - it sticks out of the pliers as seen above. You may have to pre-bend the tabs on the terminals a bend by hand as well in order to get the terminal to sit nicely in the pliers before final crimping.

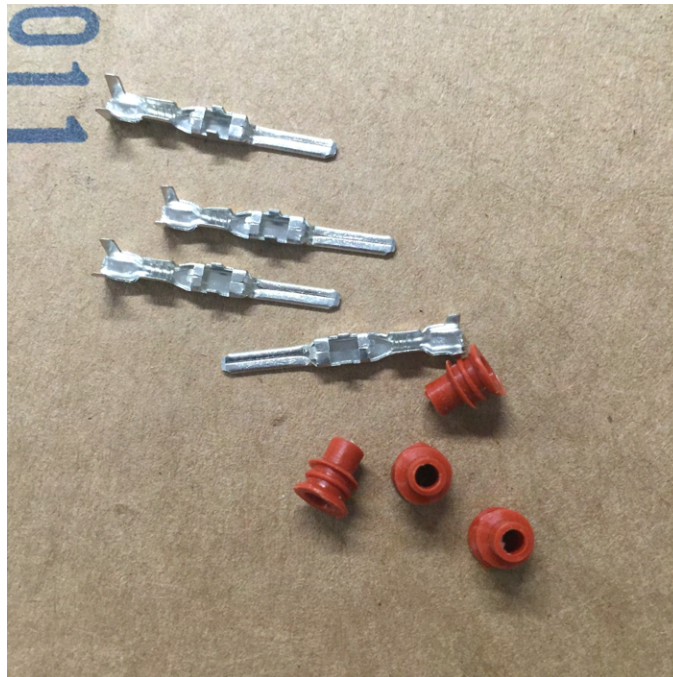
You should have 2 crimps that look like this... If not, think about adding a small bit of solder just to be double sure. You'll notice that I left too much wire exposed when I cut my insulation off, but I did trim it back after the crimp and re-worked these just to be more thorough in my install.



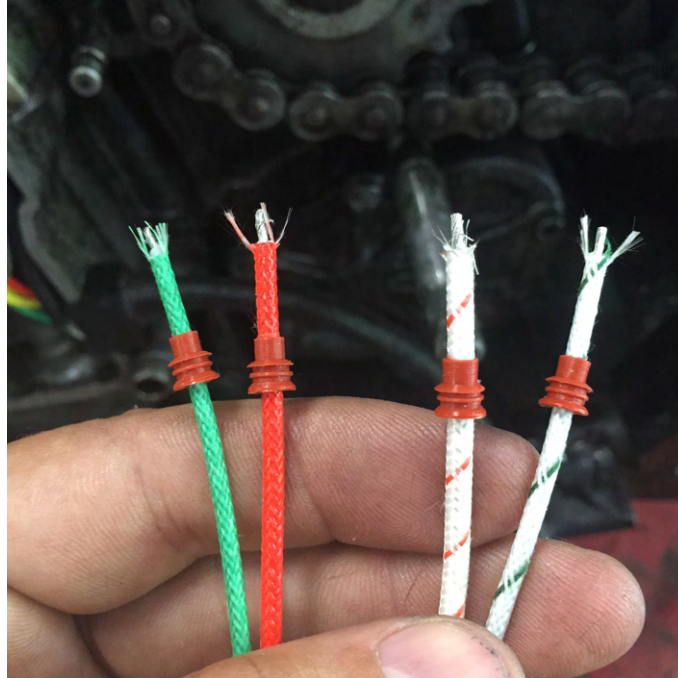
Now onto the other wires coming from the stator. Trim the back and prep them for crimping.



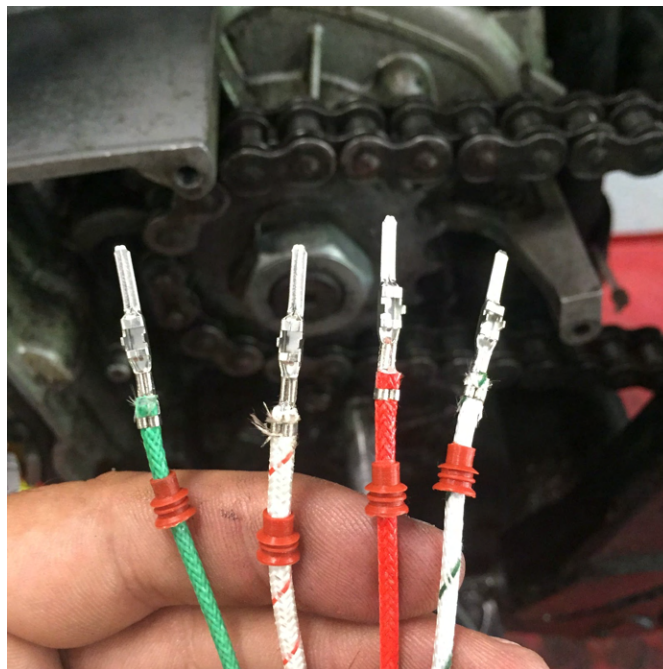
Find the Male Terminals and rubber boots as shown below.



Slip the rubber boots onto the wiring as shown.

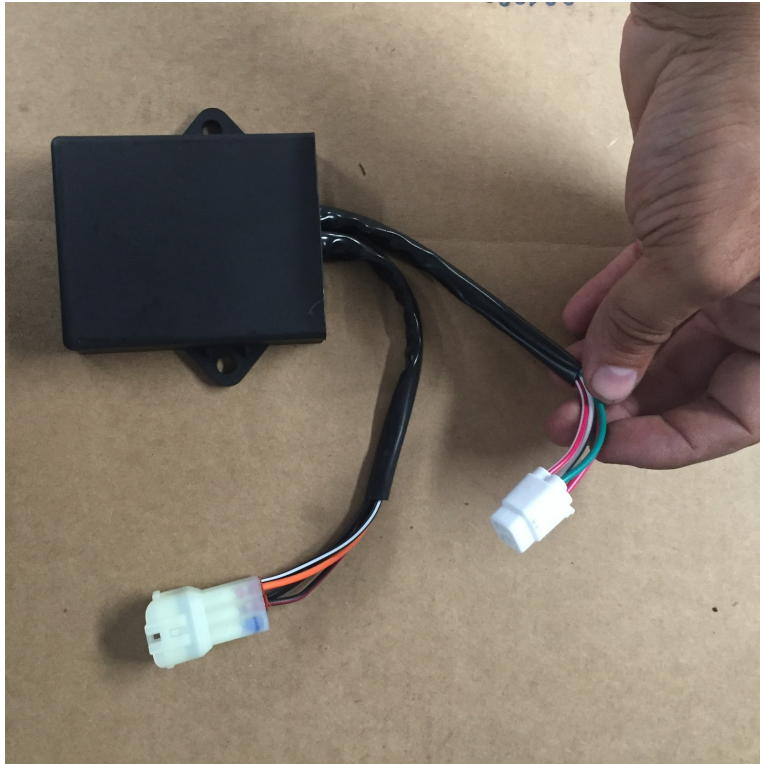


And then crimp the male terminals to each wire.



And of course, if you aren't confident in your crimps, add a touch of solder as well. With these pliers, I'm finding no need to solder these connections - they retain the terminals very well. IF you can tug on a terminal and it is loose or comes off, you'll need to up your wiring game - reliable bikes have good wiring.

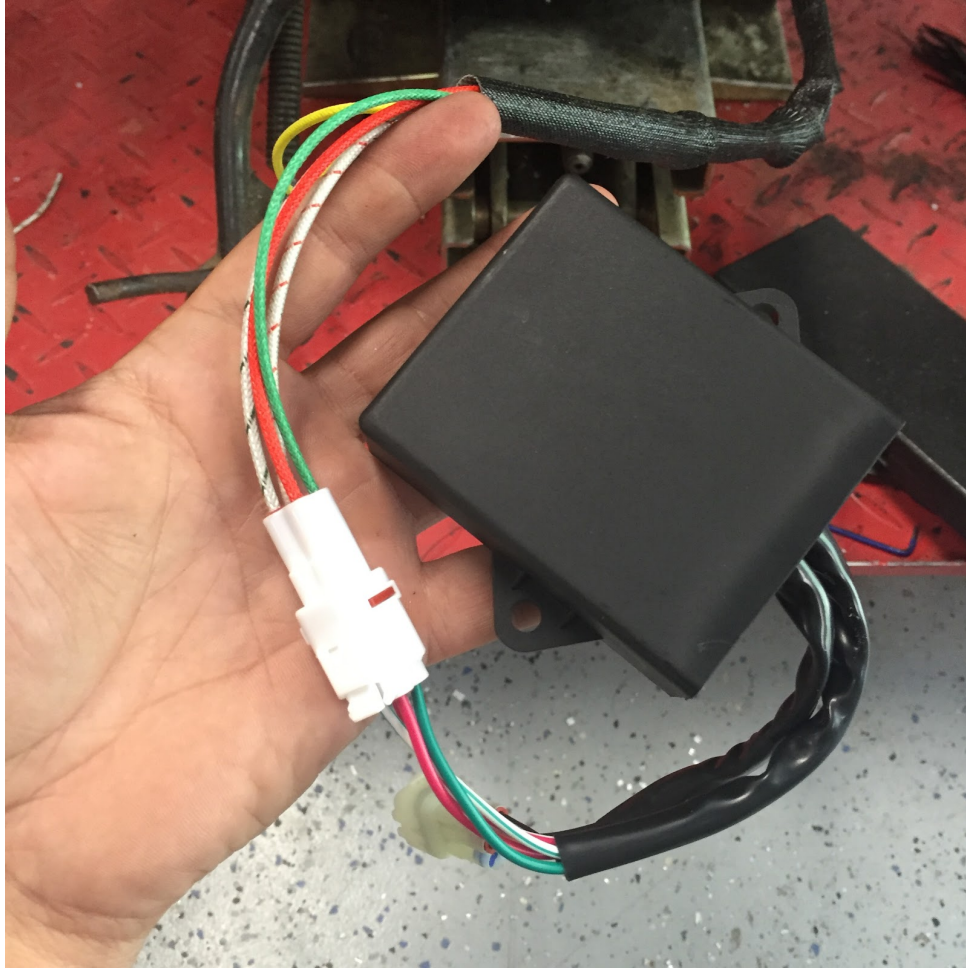
Onto the CDI Box! This is where you start feeling accomplished. Seriously, like almost all of the hard work is done at this point. So if you wanna, go grab a cold one and relax a bit... These machines are a blast to own and work on, if you aren't having fun while doing both - then something is way wrong - always take time to enjoy these moments... There is nothing quite like spending time alone in the shop with your XS650.



You will find in the wiring kit the female plastic plug that matches this 4 terminal plug coming from the CDI (the one I'm holding)

The wires from the Stator are color coded to match the wires on the CDI - so match up the male terminals you just crimped, and they will "click" into the plastic female housing - it will look like this when you are done..





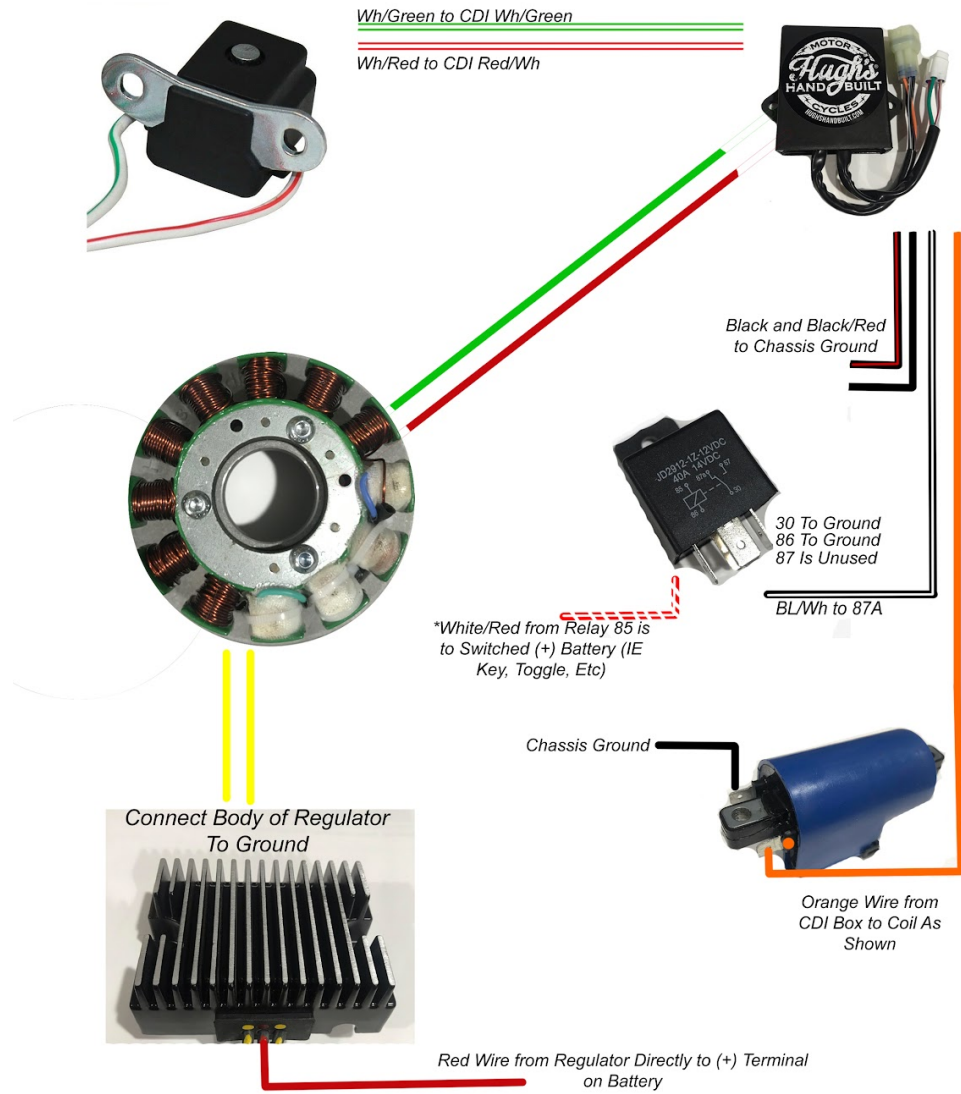
Red to Red, Green to Green, White with a Green Stripe to White with a Green Stripe, you put your left foot in, you put your left foot out, you do the.... Wait, you got this right?

The CDI Kit is sent out with a wiring harness pre-made for you, for folks using a Battery and a (+) switched power source to turn the ignition on/off (Like a keyed switch, OEM Switch, etc) - and it is mostly plug and play from here.

For those of you running kick only, you can modify this harness, delete the relay, and run a (-) Kill Switch (Like an old dirtbike, you'll be grounding out a wire to "Kill" the ignition) - if you doubt your ability to do a solid job, find a friend who can - skipping out on proper wiring work is 99% of the reasons these systems don't work to their best ability. Always make proper grounds, heat shrink as needed, etc...

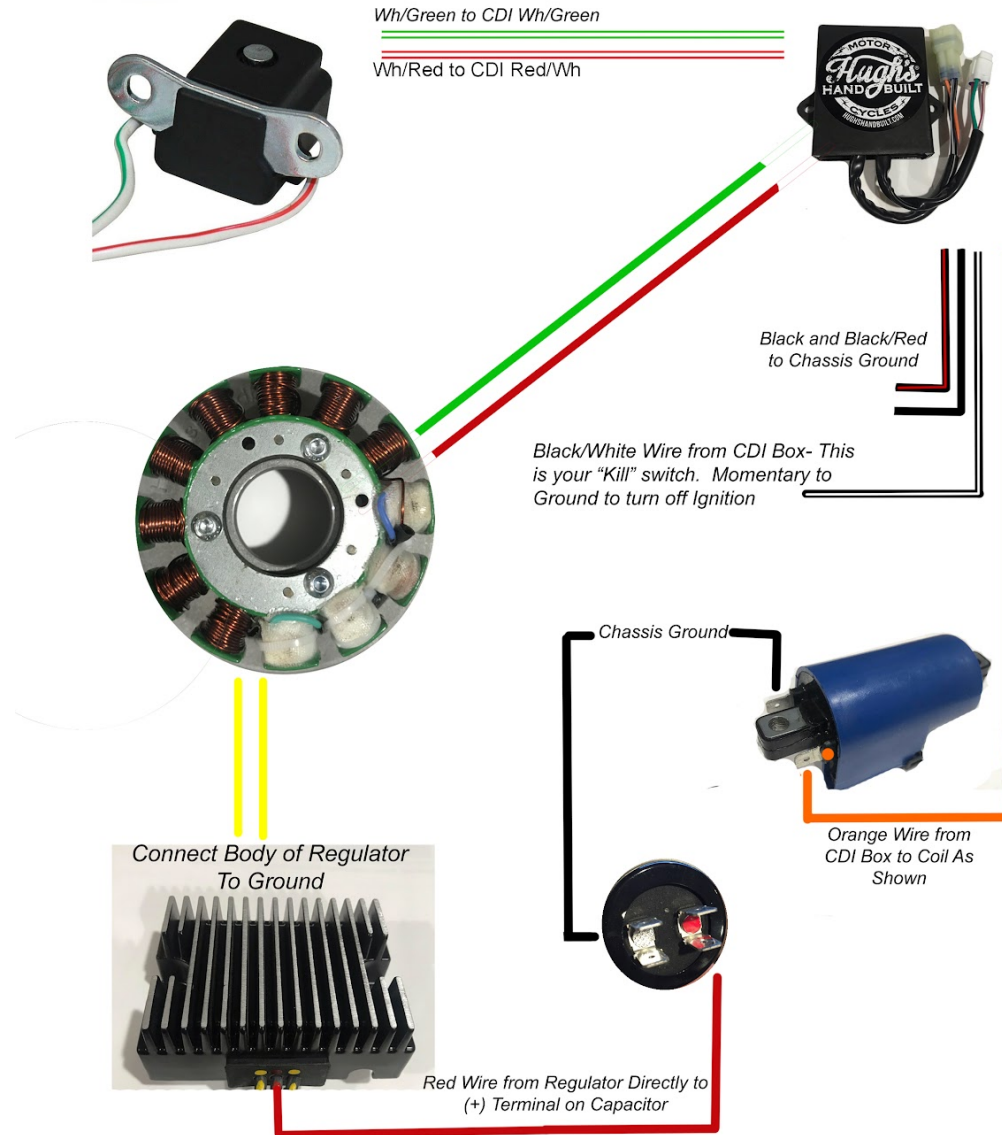
Refer to these wiring diagrams as needed for your install:

### CDI Wiring Diagram for use with 12V battery and a Positive "On/Off" Switch



*\*Any Deviations From This Wiring Diagram Void Warranty of this CDI System*

## CDI Wiring Diagram for use with Capacitor



*\*Any Deviations From This Wiring Diagram Void Warranty of this CDI System*

Wiring on this end is really really easy... Grab your CDI Coil (yes, you must use the supplied coil with our system, your OEM coil or other aftermarket coil will likely not work)



I have labeled "OR" for Orange on this coil, you will use this reference when wiring your system, although it may not be labeled when you open your package of course.

Thats it! Your coil is wired and ready for fire!

Onto the Regulator Install!

Your Hugh's HandBuilt CDI System has been upgraded to a MOSFET regulator. This is a great upgrade to our system. Voltage control and heat dissipation is far improved.

The MOSFET Regulator does NOT have a ground wire (-), **so you will need to make sure that the regulator body is grounded to the frame of the motorcycle.** This can be done through the mounting holes to a custom bracket, or with a wire from the body directly to the frame. Fenders, Swingarms, Battery Boxes, etc.. are typically not good grounds. Please ground directly to the frame/chassis.

There are 3 black wires on the Regulator. The Middle wire is the Positive (+) wire, and this will be the feed to your battery/capacitor/etc.

The outer 2 wires are to be connected to the Yellow Stator Wires. We will label these with a paint pen for you such as below:



Crimp/Solder (as needed) the male terminals to the yellow wires - follow the wiring diagram for the remaining wire as per your application.

Gather the flywheel, the last 3 M4x4 bolts, the last 3 M4 Star Washers, and the large nut and washer... You'll also want the timing tab of course.



Install the timing tab onto the Flywheel using the M4 Hardware and Lockwashers. You want the timing tab to be centered in the slots for now. **You will later come back and add locktite to this hardware once you have finalized your timing**, for now just make sure it is snug.

Slip the flywheel on the crank (as shown below)



**Making sure you are still at TDC** (We have a great article on our website for that, and plenty of resources online are available, so we won't go over that here) - you will now set the Ignition Gap. This is the gap BETWEEN the Magnetic Pickup, and the edge of the timing tab itself. This gap should be  $\frac{5}{8}$ " of an inch, or 16mm if you are using the metric system.



The yellow "dot" circled in black represents the Magnetic Pickup on the bottom of the Pickup itself. Just for reference, since it's hard to show in pics otherwise

Keep the flywheel from moving, and tighten that sucker down. I'm not gonna lie, I use the old Cordless Impact for this task. It makes things SOOO much easier, and keeps things from moving around while tightening them. Make sure to hold the flywheel tight while doing this of course





**Double Check TDC using the marks you put on the cam**, in case anything moved a bit. Now you need to install your Timing Sticker on the side cover, and make a corresponding mark at TDC on the flywheel. This cover has had a sticker for a few years now, so we are just reusing it. I use a straight edge from the center of the crank bolt to the TDC mark, so my line is nice and straight. \*Note, i remove the cover, and then use the same straight edge to extend the paint mark onto the Gold part of the flywheel too.



Now you can remove the cover and set it aside.

Now you can use the Brass Feeler Gauge to set the gap between the Pickup Coil and the Timing Tab.



The only tricky part here is that you want to have at least .015" gap at the **front and the back** of the timing tab. IF the timing tab isn't the same front and back, gently tweak it with a screwdriver or other tool until it is. Once you are happy that you have .015-.020" gap on the leading and following edge of the timing tab, lock down the M4 Screws on the Pickup Coil - gently... We'll come back to a few of these steps after final timing has been set.

**\*IF YOU SKIP THIS STEP, you run the risk of the timing tab making contact with the pickup and destroying one or both of these components. Take your time.**



Tweak tab as needed.



Snug Pickup Hardware Gently.

Now you need to install the spark plugs, we gap our NGK Plugs at .040" with this system. With all your components installed, and the plug wires hooked up - you are now ready to fire the bike!

Providing that your carburetors are in good clean shape (I swear, if you folks hit me up with engine issues, and have NOT cleaned, rebuilt or replaced your carbs with new prior to this point - please do so now, it will save a TON of aggravation on both of our parts - seriously, work with me here...)

Get your engine fired up, and idling without the chokes (or enrichers) on, and check your timing with a timing light while the side cover is installed, and the timing sticker installed.. If you are a bit advanced, you can slide the timing tab clockwise on the flywheel to bring it back to spec, and if you are too retarded, you can slide the timing tab counter clockwise to do so.

IF you cannot get the proper timing using the slots on the Timing Tab, you may need to remove the flywheel and index it as needed.

**Once you are happy with your final timing, remove one M4 Screw at a time from the timing tab, Install the Provided Star Washers, and use Blue Locktite to hold it in place.**

Repeat until all 3 are set. Do the same with the Pickup Coil hardware, one at a time, verifying clearance with the feeler gauge before final torque.

You are now DONE!

## **MORE DETAILS ABOUT YOUR CDI SYSTEM:**

Your CDI system should be nearly ½ a kick to fire up a well tuned and properly running engine. The spark on a CDI is VERY hot, but a bit shorter in duration, so it is less tolerable of a “Lean” tune. So if you are rocking some stock carbs, with pods and open pipes, and haven’t rejetted or tuned your carbs for those mods, you may find the CDI less tolerant of your setup. This is a good thing, it will force you to get a proper tune, and lean isn’t as “mean” as we used to think, its mostly mean to pistons and valves... So fix your tune.

If you are using the Relay system, and just can’t get spark, or are unsure of spark, with your key switch “ON” - unplug 87a from the relay, and try again to fire the engine. If it fires this way, and you plug it back in while running and the bike stops running, then you know you have an issue with 12V (+) power supply from your ignition switch or otherwise.

The CDI System is self powered as an ignition. It will run your bike without any 12V source at all, as it gets its power from source coils on the Stator. Should you ever break down, have a bad battery (Batteries HATE vibration by the way, so isolate your battery if you haven’t already)

you can ride the bike home without lights and other accessories. It's not recommended to ride for long however as the stator will still be trying to generate power.

We have dyno tuned this ignition and found the engine does not need nearly as much advance as the old mechanical advance unit provided. **If you are not seeing full "Advance" on the timing sticker with a timing light, don't fret** - we've pulled about 3 degrees of timing for more reliable riding and the same power output.

This system is much simpler designed than current ignitions on the market. If you happen to leave a battery and key "On" all night, the system will still be ok. It will even kick start back to life without issue. Other systems will melt a coil or fry a circuit board. Not so much with this system.

The CDI has NO rev limiter, proceed into the stratosphere of RPM's with caution!

We use only NGK Spark Plugs in all of our bikes, gapped at .040" - any changes from this can cause erratic firing - use the proper plug for the job.

Your system is warranted against defects for 1 full year from purchase date, original owner only. IF you bum up the install, we'll still work with you - you know how we do, we stand behind you folks.

If you have any complaints, compliments or other suggestions, please let me know. If you have all praise, let everyone else know!

If you were overly happy with this purchase, feel free to mail me a cold brew of your favorite choice. We always dig sharing with you folks, and #buyhughabrew is the best compliment we can get.

*Hugh Owings*  
*Hugh's HandBuilt*

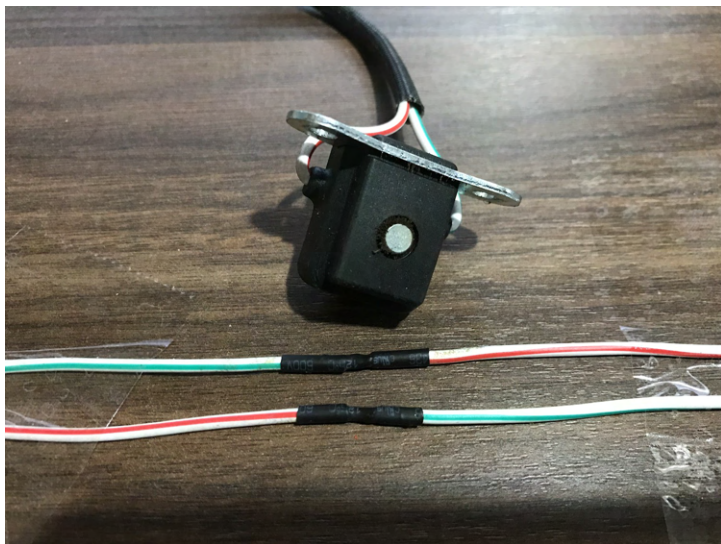
Find us on Facebook, or Tag us on Instagram - we'd love to hear from you!

## ***TIMING NOTE!***

Timing: Using a Timing Light, verify your system is firing at “Fire” on the timing sticker. If it is firing at “TDC” you may need to reverse your leads on the pickup wiring.

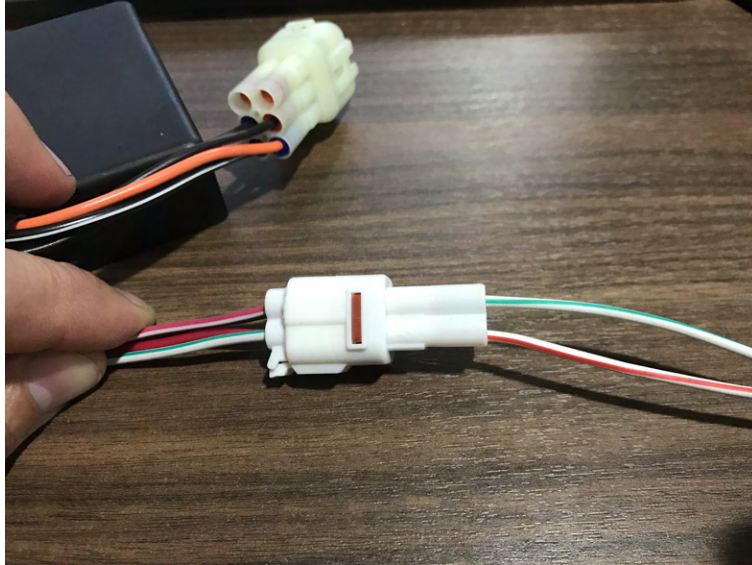
When using a timing light, if the timing does NOT advance with throttle input, you may need to swap the wires as listed below on the Pickup Unit. We had some pickups come to us with the wire colors reversed, but don't fret, you can just repin them at the connector if the above symptoms cause you issue.

IF your engine kicks back, timing may be too far advanced - or you have a really rich starting circuit (carburetor issue).



## ***TIMING ADJUSTMENT***

IF you find yourself unable to set base timing to your satisfaction with the adjustability of the timing tab, you can remove the Key from the crankshaft, and rotate the entire flywheel assembly until satisfactory timing is achieved. This is useful for race bikes, turbo applications, etc as well. Just make sure you really tighten down the flywheel nut once you have set your desired base timing. A few “Ugga Duggas” from your favorite impact gun will do the trick.



\*Re-pin Wires at this connector as needed should you have issues with firing at TDC or not advancing. Always always always verify your timing with a proper timing light.

## HOW TO TEST COMPONENTS:

### Ignition Coil:

Primary Resistance (between 2 wire terminals on coil): 0.5-0.7 ohms

Secondary Resistance (between 2 spark plug cap ends): 6.3k ohms

\*this system's really not very picky. Any resistance around there says the coil is good.

\*\* Spark Plug Wires ARE replaceable on this coil, remove the black clip, and the wires can be unscrewed from the coil.

### ***IF only getting spark on one cylinder:***

Set Meter to 20k Range on Ohms. Measure resistance between one of the spark plug caps/wires and one of the wire harness spade terminals on the coil. Should be OL or Open Circuit at any resistance range. If you see a #, 3-10L Ohms or so, the coil is shorted internally.

### Stator:

Source coil: Green to Red Wires: 22 Ohms

Charging Coil: Yellow to Yellow Wires: .7-1.0 Ohms

**Pickup Coil:**

White/Green to White/Red: 115 ohms

**Relay:**

Relays are pretty simple, but occasionally can get dirt, corrosion or moisture in them causing issues. If the bike will run with 87A Disconnected, then you have an issue with the Relay, or the Positive Sourced "On" switch from the battery. Relays can be opened and cleaned/inspected, and are available at most auto parts stores on the cheap.

**Warranty Issues:**

IF you have done a proper job of installing the system, and you find something has failed - please do all of the test above BEFORE contacting us. This will speed up your troubleshooting, and save everyone some time. 99% of the failures we see come from poor install, lack of thread locker on hardware, rushed wiring, and poor grounds. Take your time with the install, you'll be glad ya did.

IF a component tests bad - email us, we'll take care of ya from there.

Hugh