Let there be lights.

Probably one of the first changes that anyone wants to do to a bike used for Long Distance Duty is to augment the headlights. There are several ways to do this but in essence you can:

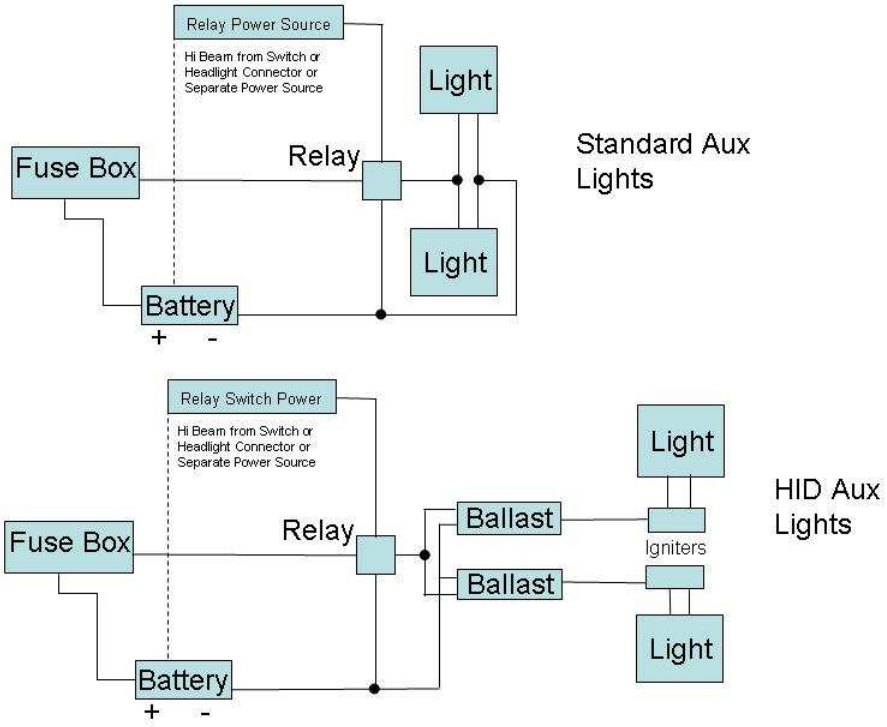
1. Upgrade the Existing Headlights with larger output bulbs.
2. Add Separate Standard Auxilliary Lights
3. Convert the Existing Headlights to High Intensity Discharge (HID) Lights.
4. Add HID Auxilliary Lights

I'm not going to argue about the virtues of any of these solutions. Just suffice it to say I've tried them all and the last two bikes I've outfitted got HID Low Beam only Conversions in the existing headlights and a set of Phillips HID (PHID) driving lights.

I do want to comment on putting larger output bulbs in your existing headlights. What you want to do is make sure the existing wire harness can carry the additional load. Go back to the Post about making an electrical circuit and see how to select the proper wire gauge for a circuit. Use that information to ensure that your existing wire can handle the larger output bulbs. If not there are headlight wire harnesses available from Electrical Connection (link available in the post about electrical components vendors) that can be installed to beef up the wire and protect your harness. Installing one of these is essentially the same as adding standard auxiliary lights without the need to mount the light.

What I want to demonstrate here is the installation of a system because the process is similar regardless of the type of solution you choose. As mentioned, just putting in bigger bulbs may require a new harness and that is similar to putting in a standard auxiliary light system. Putting in an HID conversion or Auxilliary HID lights is also a similar process with the only difference being how to mount the lights themselves.

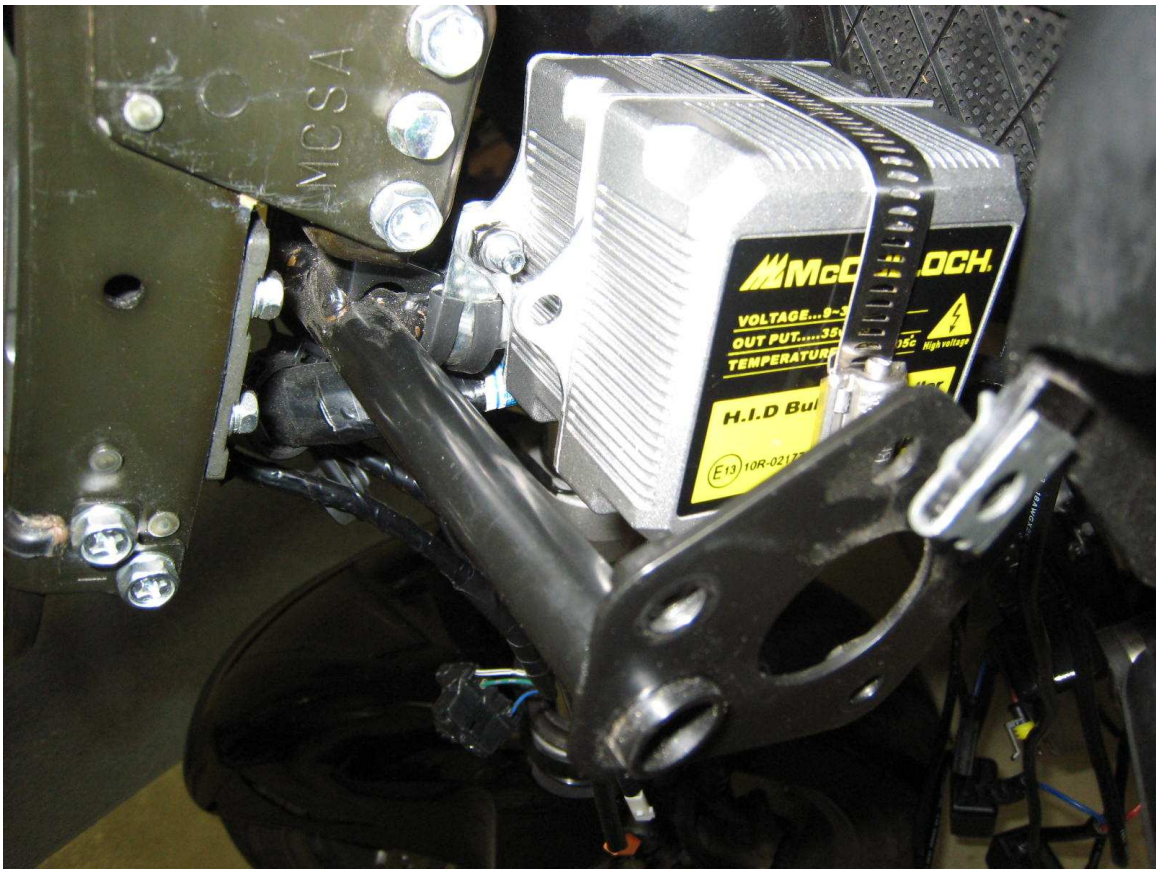
When doing electrical work it is always good to work with a diagram of what you are doing. They do not have to use exact electrical diagramming terms and symbols (mine do not) but you need to understand them to work from. For a set of Auxilliary lights the basic diagram is as follows:



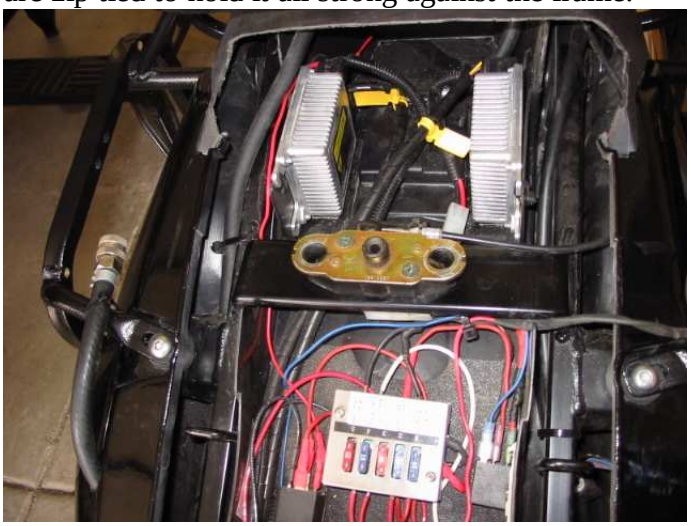
You can see that both systems are controlled by a switch (of some sort) which powers a relay where the power passes through. I like to use the Existing High Beam switch to control the relay. That way I keep my handlebars clean and am using an OEM (Original Equipment Manufacturer) switch. I normally do this by going to the headlight connector and determining which lead is the high beam power lead. I then tap into that by cutting the wire and crimping on a splice (see prior post about adding a fuse box relay)

After the relay is where the difference is. In a standard system the power lead out of the relay goes directly to the lights (Note: Many systems use a separate Relay for each Auxiliary Light if they have a high electrical draw, e.g. 110W) while on the HID systems the power is run to the Ballasts. The ballasts will have leads that deliver their output to the Igniters for the HID lights. This is where there is a difference.

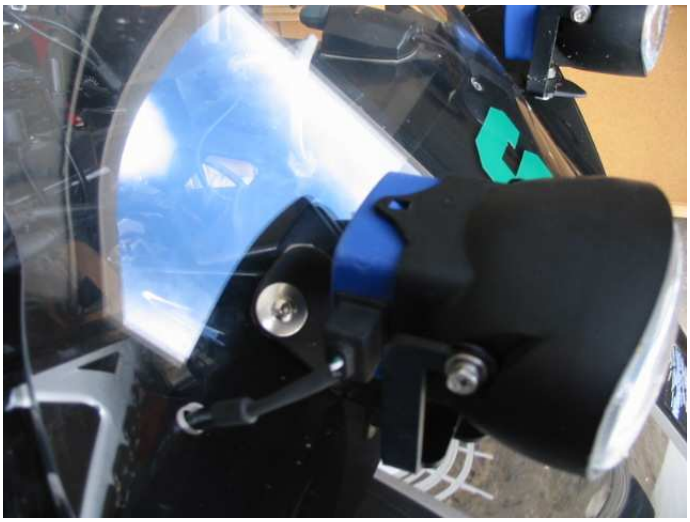
On the PHIDs the igniter is part of the light itself as it is on some of the other newer HID auxiliary lights (called third generation HID Lights). On older version lights and on Headlight Conversion kits the igniter is a separate box (usually about 3" X 3" X 2" deep). The part of the harness (that comes with the lights) between the Ballasts and the Igniters can be altered (shortened or lengthened). The lead coming from the Igniter to the light (or bulb in a conversion) CANNOT be altered. That makes it difficult to locate separate igniters on many bikes because of the set length of those leads. This is why I prefer the PHIDs or what are called Third Generation HID lights.



Here are the HID Conversion Ballasts on my ST1300. They are located on the left side of the forward end of the bike behind the speaker grill. Many people zip tie these in place but you will notice the bolt on the left side of the inside ballast. That firmly attaches the ballasts to the frame of the bike using a rubber coated clamp (found in the hardware section of a good Ace store). The outboard Ballast is attached to the inside one with trim tape them the two are held fast together with a large steel clamp that you see (found in the plumbing section of the hardware store). The bottom tangs on the Ballasts are zip tied to hold it all strong against the frame.



Here are the PHID ballasts on my Vstrom. I extended the harness between these and the PHIDS themselves so I could locate them in the rear of the bike underneath the seat.



Here is a close shot of the PHID. Notice the blue box on the rear of the light. This is the built in igniter. Nice because it saves you from having to put these on your bike anywhere.

A sample installation – HID Headlight Conversion

Now that we have some basics lets walk through an installation. I will use pictures from a couple of different installations but emphasize the systems on my Vstrom which is complex and consist of two systems, a low beam only headlight conversion and PHID auxiliary lights.

One thing that is a real sore point on the Vstrom is the electrical generating capacity of the bike. It is something like 380 watts of which there is only about 100 watts left in reserve for rider use. That is good enough for running a Gerbing jacket but nothing else - and I would usually unplug one of the headlights on my stock 2002 Vstrom when using my Gerbing. Otherwise I use a Widder vest with chaps that is more like 60 watts.

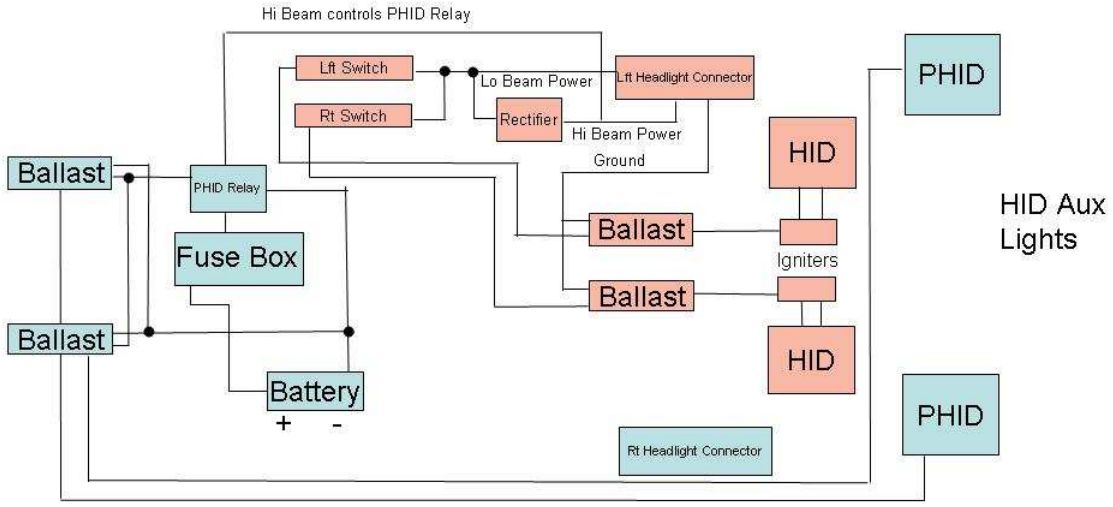
That means on those cold nights I had a choice - see the deer and freeze, or don't see as much and be warmer. I had equipped the bike with Phillips HID third generation lights which are absolutely awesome and only draw 70 watts for two. That helped out until I needed some real warmth for me, so the real drawback was the drain from the 55/60 H4's that are standard on the Vstrom and added nothing to my vision once the PHID's were ignited. That had to change...

My solution would be expensive but I felt it would work. The Vstrom has terrific headlight reflectors and H4 bulbs. This is the similar to the FJR and Dale Wilson, aka Warchild over on the FJR and Blackbird communities had pioneered an HID replacement for the OEM bulbs in these bikes. Information for this system and directions for modification can be found here:

http://www.fjrtech.com/getdbitem.cfm?item=49

I got into the self administered group buy from the FJRTech site, for the Low Beam HID replacements for the bikes original reflectors. This was the best $200 I've spent in a long time. I decided that the combination of the PHID's and the low beams would be excellent as opposed to the more complex Hi/Low beam HID bulb (Rube Golberg comes to mind) option that is available on the FJR site and not recommended. The FJR tech article above describes in great detail the logic behind using a low beam only unit, the installation and the difficulty in wiring (using the OEM Hi/Low Beam Switch).

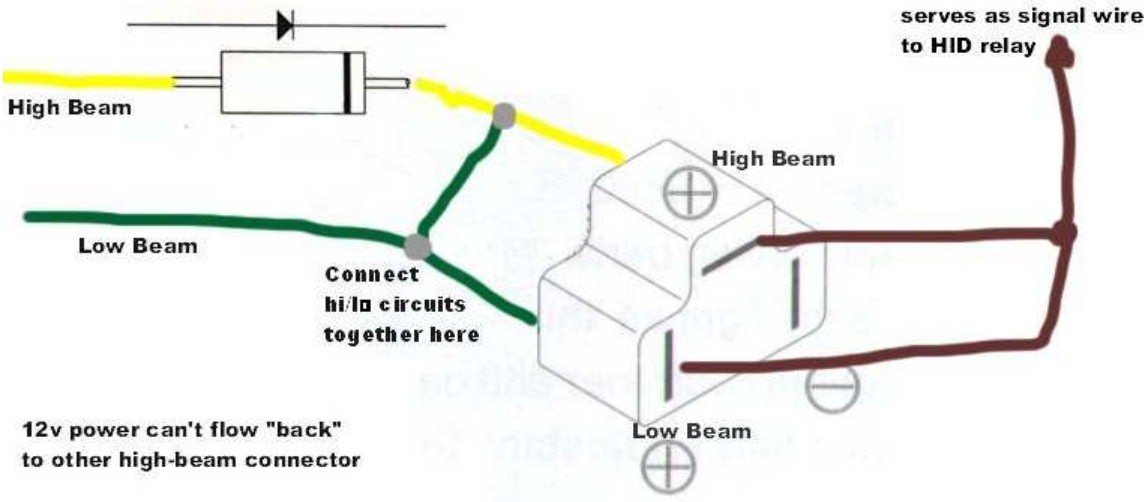
When doing a complex installation I like to start with a drawing to work out my electrical connections and what goes where. For the Vstrom that diagram looks like this:



The light blue is the system for the PHID auxiliary lights while the rose color is the system for the HID headlight low beam only conversion. Notice that there is no relay for the Headlight Conversions and I use power directly from the left side H4 OEM connector. I also use that connector ground for the ground in the system. I sized the wire and felt it was capable of handling the 70 watt draw from the two bulbs and I in essence use the relay that is already built into the bike for the headlights by using the power and ground from the H4 and the switch already on the bike for Hi/Low.

As Warchild said in his tech article, a problem exists with the wiring of the Low Beam HID's when using the OEM high beam switch to light off the PHID's because you are

wiring the high beam and low beam output from the H4 connector together so the low beam only conversion is powered always whether you set the OEM switch to Low or High Beam. To solve the issue (low beam power feeding back to the high beam circuit leaving the PHID's lit at all times) he suggests using a one way Diode in the circuit. My solution, since I had purchased high amp switches (to control on/off of each headlight individually) and planned on running the actual headlight power through those switches to power the bike lights without a relay, was to use a rectifer instead of a Diode which could handle the higher loads easily. Warchild's circuit looks like this:



You can see my rectifier in the circuit diagram for my Vstrom. I route the high beam power through it before I connect the high beam wire to the low beam (creating a constant on power connection for the low beam only HID Conversions). You will also notice that after I connect the two wires to get constant power to the lights all the time, I then run it through the separate on/off switches for the headlights that are wired in parallel (parallel means power goes to each equally and one switch has no impact on the other). Now, each light can be on or off with it's own switch and when the switch is on, it will be on whether I have low or High Beam selected on the

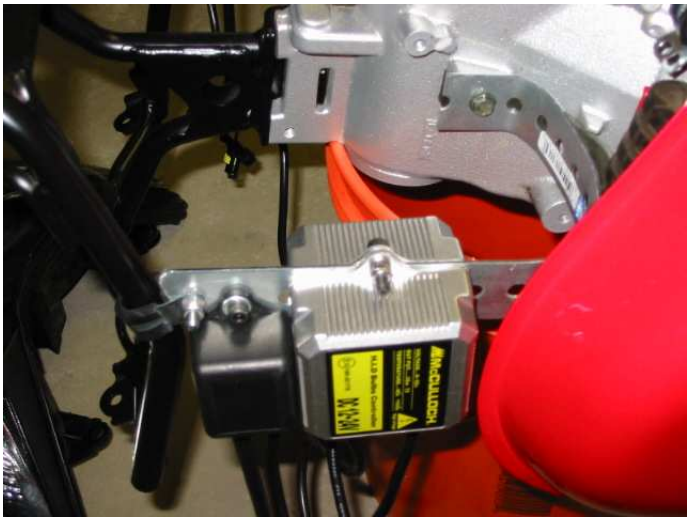
Here is a rectifier. These are really four diodes in use to "rectify" a power flow from DC power to AC. A little known fact is that you can use two of the leads as a high load Diode. When looking at this particular Rectifier (HVCA KRPC2501) there are two connectors, one marked with a + and the other a ~. The proper wiring is to run the input from the ~ to the + and then out. That will allow the flow of electricity to only flow one way (from C to the +).

The signal from the High Beam that was to be used to power the relay for the PHIDS (when the High Beam is selected on the OEM switch) was spliced in after the H4 connector and prior to the rectifier on the high beam wire. This means that power from the low beam circuit could not run back through the rectified high beam wire turning on the PHID relay when the low beam is selected on the OEM switch. The relay would ONLY go on when the High Beam was selected and power came from the H4 connector.

This sounds complex but it essentially:
High Beam Power from H4 - - - Splice to PHID Relay - - - Connect the ~ lead on the rectifier - - - Connect a output wire to the + on the rectifier - - - Tie the end of that lead into the Low beam power from H4 connector and run that to the switches.

The conversion kit from McCulloch included a pre made wiring harness from ballast to igniter to bulb. The distances were very short on the order of 12 to 18 inches which meant I had to locate the ballasts and igniters in the front end of the motorcycle. While the

Vstrom is very roomy under the side panels there is NOTHING to attach too. I decided to make my own bracket that would follow the inside contour of the side panesl and allow structure for me. I made it from 2 inch wide predrilled 1/8 metal strips. I attached the rear of the bracket to the bolts that hold the gas tank forward mounts and used some insulated clamps to attach the front end of the brackets to the cowling frame. This turned out to be a pretty sweet farkle to the bike (one of my best innovations). You can see the two ballasts were bolted to the right frame and each igniter was attached at the forward end of the bracket on their respective sides.

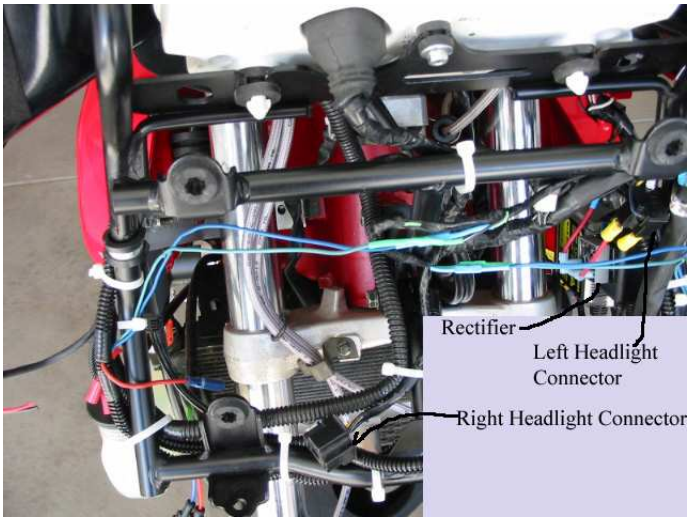


Notice the Igniter for the left Headlight is mounted to the metal strip right in front of the two ballasts. The places it very close to the headlight so the harness will reach. The right igniter is located on the metal strap on the other (right) side next to the right headlight.

I used the left light socket and first split the high beam line and ran one lead back to the PHID relay and the other through the rectifier so that when the high beam was energized it would activate the PHID's. On the exit side of the rectifier I connected the high and low beam wires together and then ran it to the two separate switches in parallel so I could control the left and right beams separately.

The Vstrom (like many motorcycles) powers up the lights when the key is turned on. Once the starter is deployed all energy is sucked down by the starter and if the HID's are not warmed up enough they will be doused by the starvation of electricity and will not start up again without the switches being cycled - a serious problem. The separate switches allow me to turn the lights off when starting the bike and use all energy for the start-up process and after the electrical system has recovered I can energize the lights (yes, I have forgotten to turn my lights on before). It also lets me select both or either of the lights to employ and further save 35 watts from one light being out for use on heated gear. The output from the switches is sent to the ballasts to power them along with the ground from the H4. This is just an easy electrical connection to the ballasts with the supplied connectors with pigtails (one positive for power and one for ground).

You can see some of the connections below in this picture. See the leads coming out of the H4 connector and notice the one going to the rectifier and then the lead coming out the other side of the rectifier.

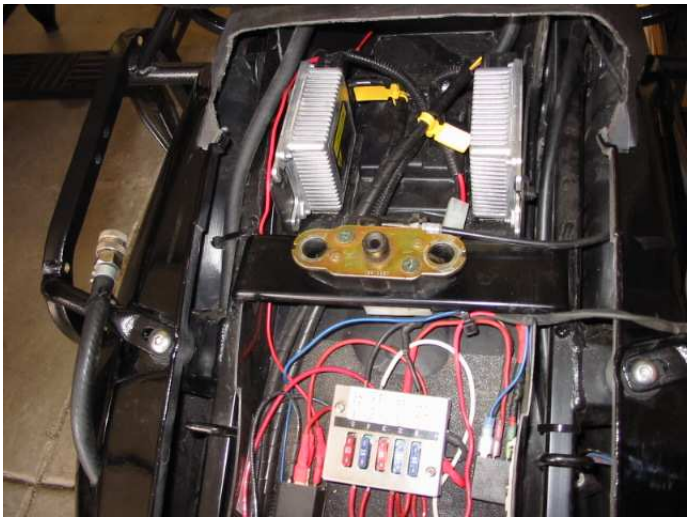


In the next picture you can see the two switches on my cowling panel. Even better, they have a red light on each switch so I can tell if they are on or off. Please notice the Datel volt meter forward of the switches. This reads volts (in 10ths) on the system and is run on a direct circuit from the battery.

To complete the installation of the headlight conversion all I had to do was install the H4 replacement HID capsules (a direct plug and play into the headlights) and connect the plugs from the Igniters.

A sample installation – PHIDs (Phillips HID's)

This motorcycle is a reconstruction project from a crash I had in 2005. I had the ballasts for the PHID's in the rear of the motorcycle before, and that was where they were going again. The igniter for the PHID's is attached to the light itself (see the blue box on the back of the light in the close up up above) so the ballasts can be placed anywhere on the bike. I had previously extended that harness (you can do this from all the lessons I have given in prior posts – it is only three wires) and used it again to wire the PHID's and place the ballasts in the rear as shown here.



Notice just to the right of the fuse box the relay that is there with the four wires coming out of it. That is the relay that has"

1. Control power coming from the Hi beam circuit (blue wire).

2. Power in from the Fuse Box.
3. Power out to the Ballasts behind it.
4. Ground over to the fuse box which has a grounding block on the aft side.

Wiring this is as demonstrated before in prior posts (see adding a fuse panel).

You can see the loomed wires coming out of the rear of the ballasts and heading forward on the motorcycle. This is the Ballast output to the igniters. This wire was loomed and then routed alongside the right side of the frame and forward to the PHID lights.

All the aux lights I have seen on Vstroms are located outside the silhouette of the motorcycle mounted either on a rail sticking out of the front, or are located on crash bars intended to protect the plastic of the bike. That means if the bike is dropped the first thing that will hit is the $600 PHID's! Now, I hate to admit it but I DROP MY MOTORCYCLE ON A REGULAR BASIS. I accept this as fact. Part of rallying and adventure riding is that you will be on uneven soft surfaces in difficult conditions (It is a rallymasters duty to do so).

That solution was just not acceptable. On the prior design I mounted the lights on a special designed bracket that I made to be held by the windscreen bolt which then layed flush on the front cowling of the bike and was then stuck there with automobile trim tape (that same Damn Tuff Stuff). Yes my lights were destroyed in the accident but the whole front end of the motorcycle was destroyed as it cartwheeled off the road - no design could have protected those lights in that incident. I will also say that when I found parts of the cowling, the bracket I designed had been flattened BUT IT WAS STILL STUCK TO THE COWLING by the trim tape.

That was exactly what I decided to do again and you can see the result in the close up picture of the PHID above. The only problem was that the new Windstrom windshield covered that cowling. I needed to mount the lights (in the same manner) but directly to the Windstrom. To do this I made new brackets and mounted the lights up above the OEM Headlights. This solution keeps the lights inside the silhouette of the motorcycle when it is dropped on either side and better yet provides an awe inspiring amount of light

because of the higher mounting. One thing is for sure, these lights cannot be used with oncoming traffic.

The PHID's were located high up on the motorcycle. Yes – it is over 42 inches high and I could easily be pinched for using illegal lights but in 60,000 miles I have never had that problem. The key is to use them judiciously and only when you really need them.

If you go back to the close up picture you will see that I routed the wires up through the cowling and exited into the cockpit area on either side of the instrument panel. I had to drill holes in the plastic cowl to accomplish this. Then the wires were routed through the edges of the windscreen with holes carefully drilled using a forstner bit
http://www.wisegeek.com/what-is-a-forstner-bit.htm
so that I did not crack the fragile plastic..

I also cut the three wire harness from the ballasts up towards the front of the bike and used three separate Bullett connectors on each wire going to the lights. The reason for this was so I could pass those sleeker bullett connectors through the small holes I drilled in the plastic parts to install and remove the lights when I wanted to.

The PHIDs used to come with the connectors only on one side of the light. To get the wires to be symmetrical on your bike (so both were not going into the left side of the light housing) you would have to disassemble the light from the igniters and dremel out a notch in the housing to reverse one of the igniters. Dale (Warchild) Wilson used to have an instruction on performing that alteration but the most recent set that I received came with symmetrical connections already so that I could place the lights so both connectors face the center of the bike or both faced outward from the bike, whichever configuration fit my installation best.

I have already had the opportunity to test this system in about 50,000 miles of riding and rallying and it works like a charm. The Low Beam HIDs are awesome and the PHID's are really only needed as a high beam flash. To do that I usually run with only the right low beam energized and the PHID's lit. That way they are warmed up and I can douse them to oncoming traffic or for traffic I'm overtaking and the single Low Beam HID still provides plenty of light. With that configuration I have been able to run a Gerbing Jacket, Gloves (or heated grips) and I am only marginal when running the leg chaps. If I need those (high 20's and low 30's for extended periods) then I can run without the PHID's and use both low beams if I choose. There is a tremendous amount of light with those two low beams but because the PHID's are not warmed up I cannot use them to flash.

The reason for this is because when the PHID's are initially lit they draw a tremendous amount of energy (similar to the starter) for the first 15 to 30 seconds and it may douse the headlights if I am running all the other electrical gear on the Vstrom as the generating system dips below 12 volts. It is too close to take the chance of dousing my headlights (which will happen if the system voltage drops below 12 volts).

This was one of the most sophisticated alterations to the rally bike that I made and is the

reason why this post is so long and embellished.