

ENDURALAST

EDL4



450w Charging System Upgrade Installation Guide

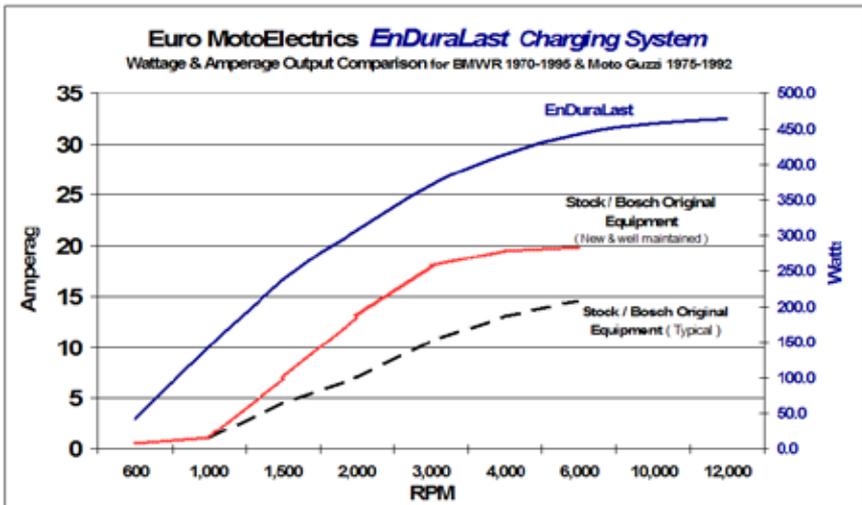
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EDL4 Alternator Kit Performance

29 Amps / 400 Watts @ 5000 RPM (450 Watts Total Max Rating)
25 Amps / 350 Watts @ 3000 RPM
20 Amps / 280 Watts @ 2000 RPM

- Increases power output by up to 80% over the stock Bosch system.
- Stable voltage production under all load conditions.
- Electronic voltage regulator/rectifier combination, replaces diode board rectifier & voltage regulator.
- High-tech permanent magnet rotor will never over-heat or short out.
- Brushless design eliminates worn out brush holder, rotor slip rings, and carbon brushes.
- Eliminates the *no charge* due to burnt out generator light, while retaining its function.
- Works with all BMW Airhead applications between 1970-1995, bolts right on and wires up simply.
- Designed and manufactured to modern OEM specifications.



Theory of Operation

The original BOSCH alternator system used on BMW's and select Moto Guzzi's of the same era was designed in the late 1960's. The system is based on energizing the rotor with electricity from the diode board, through the generator light and voltage regulator. Once the rotor is electrically charged and spins inside the wire windings of the stator, AC current is generated and sent to the Diode board, or "Rectifier" to rectify or correct the AC current to DC current so it can be used to charge the battery. The Rectifier uses Diodes which are like electrical gate keepers, to change the electricity from AC to DC.

The EnDuraLast EDL 4 Alternator Kit is a significant upgrade to the original charging system. The major components are manufactured in Italy and the custom modifications done in the USA to the highest standards under ISO certifications.

It's beauty is in its simplicity. No longer is the complex wiring from the diode board, generator light, voltage regulator and brushes needed to energize the rotor because now the rotor is permanently magnetized. The brushless, permanent magnet rotor spins inside the stator and AC current is generated in the stator wire windings. The stator is very robust. Failures are rare, caused by excessive heat or physical impact damage.

The Regulator / Rectifier (R/R) then converts the AC current to DC current to charge the battery sending it via the RED wire. The BLACK wire on the R/R is the voltage sensing wire. The voltage supplied here from your bikes battery tells the R/R what to do. Once the battery no longer needs voltage it shunts the surplus to ground. It is a shunting style R/R. It is therefor extremely important the R/R has a solid connection from it's case to vehicle ground.

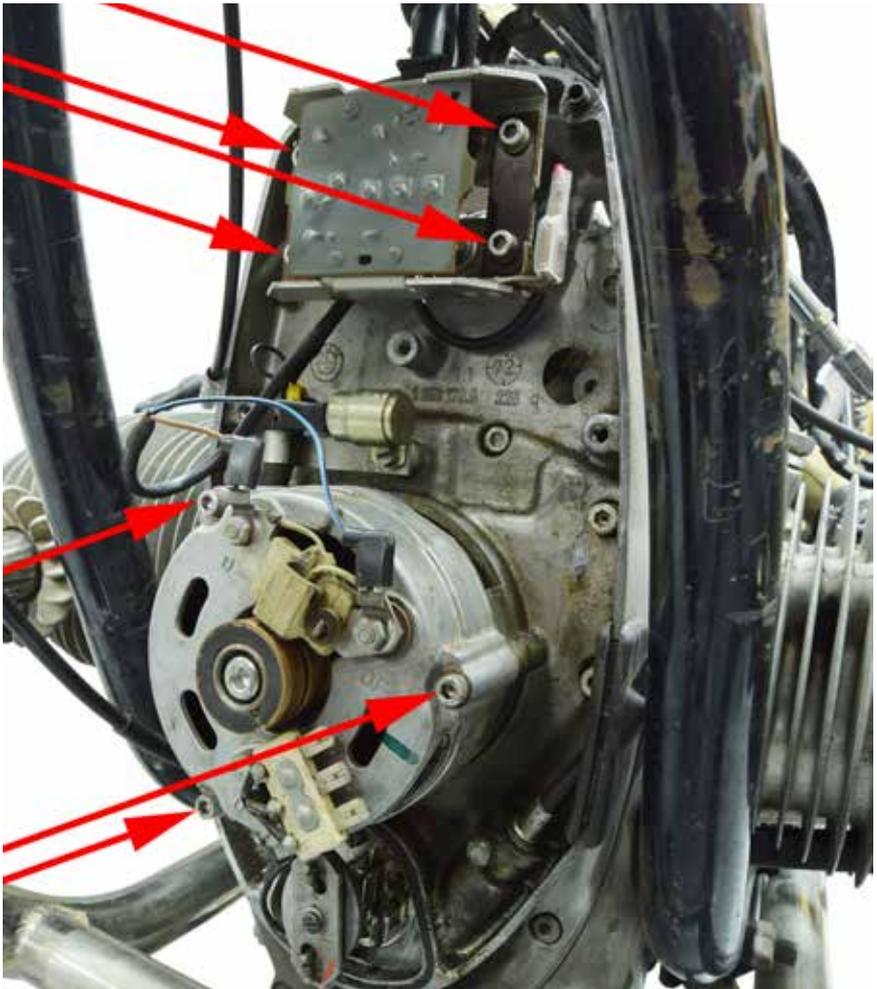
This alternator system can be envisioned as a stand alone system that will interact electrically with your bike at two points. It reads the battery voltage via the BLACK wire, and depending on the information provided to it, will deliver available voltage via the RED wire to the battery. All other electrical systems on your motorcycle including ignition are not impacted by this upgrade.

Remove the Existing Charging Components

Disconnect the battery and place it on a charger so it is fully charged when the project is complete. Remove any fairings, fuel tank, front engine cover, starter cover, and oil cooler to access the engine front and top.

- Remove the 4 fasteners that secure the diode board.
- Remove the diode board and disconnect all wires.
- Remove the 3 fasteners that secure the alternator cover to the timing cover.

Disconnect all the electrical connectors from the alternator cover and remove the harness and stator as one unit.

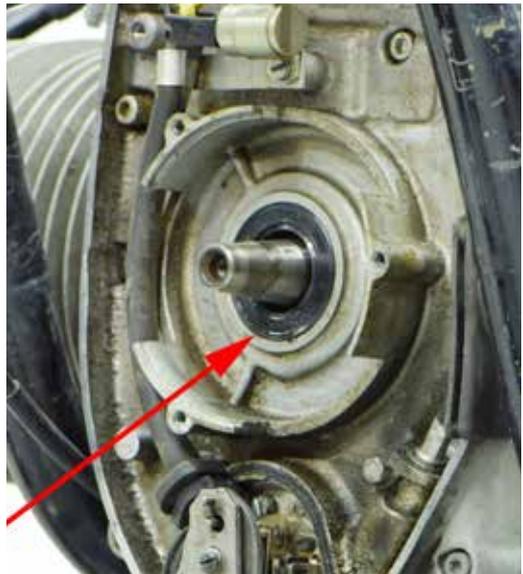


Remove the alternator rotor bolt.
Place rotor removal tool into the
rotor and tighten the tool.



Gently tapping the rotor with a rubber mallet after tightening the removal tool can assist in releasing the rotor from the crankshaft. The rotor can “pop” off the end of the crankshaft, so be prepared! You may need to put the transmission in gear to keep the engine from turning over during this process.

Once the rotor is removed it is time to inspect the oil seal on the crankshaft. A replacement is included in the kit as this is the best time to replace it. Note the orientation and depth so you do not drive it in too far.



Removing the Front Engine Harness

There have been a few harness variations over the years. All the necessary wires to replace this harness are included in this kit.



Once you free the grommet from the top of the engine cover, follow the wires up to the voltage regulator. Unplug the 3 pin connector from the voltage regulator and remove it, replacing the screws back into the frame.

Take note of the remaining electrical connections made by this harness. Once you are doing the electrical installation you will see what connections are required.

The front of your engine should look as pictured below:



Assemble the Rotor and Stator

This is an exploded view of the alternator components that will be assembled under the front engine cover.



Mount the Rotor

Now we are going to start assembly of our new high output alternator beginning with the rotor. Inspect and clean the nose of the crankshaft. Remove all remaining oil with alcohol and a clean cloth. Clean the inside of the alternator rotor of any remaining oil from the manufacturing process. *(The new rotor has a protective cap. Take care not to damage the lip of the arbor when removing it. You can easily blow it off with compressed air)* Now that both surfaces are clean and prepared, slide the new rotor onto the crankshaft. To confirm a clean interface, grasp the rotor and try turning it. If the rotor slips on the crankshaft, remove and clean it again.

Secure the rotor in place with the included rotor bolt and lock washer with a torque setting of 14 foot pounds / 19 Newton meters.



Mount the Stator

There are three stator rings included in the kit. One outer ring that is smooth and 2 inner rings with different sizes for the mounting lip. With the included caliper measure the inner stator rings as shown to distinguish between the 105mm and 107mm inner rings.



Measure the groove on the engine where the inner stator frame fits to determine which inner ring to install.



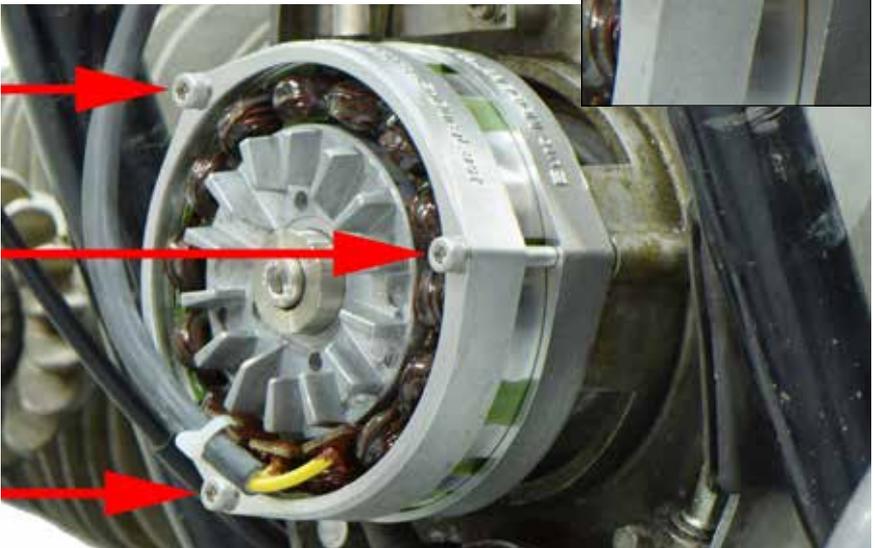
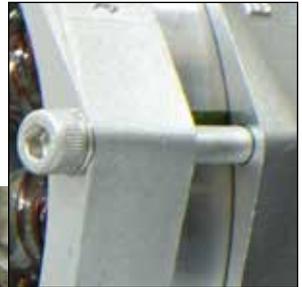
The seating of the inner stator frame into the timing chain cover machined groove is precise and tight! If there is ANY side to side movement or play in fitment, then you have selected the wrong inner ring.



Fit the stator and outer ring. Take note of the cutouts on the stator body to allow the mounting bolts to pass through. Note the stator wires are approximately in the 6:00 position.

Fit the outer stator ring aligning the screw holes and secure the entire assembly with the bolts and lock washers included.

Take great care not to over tighten as you can strip the threads on your aluminum timing chain cover. It may be easier to install the stator with both rings as one pre-assembled unit.



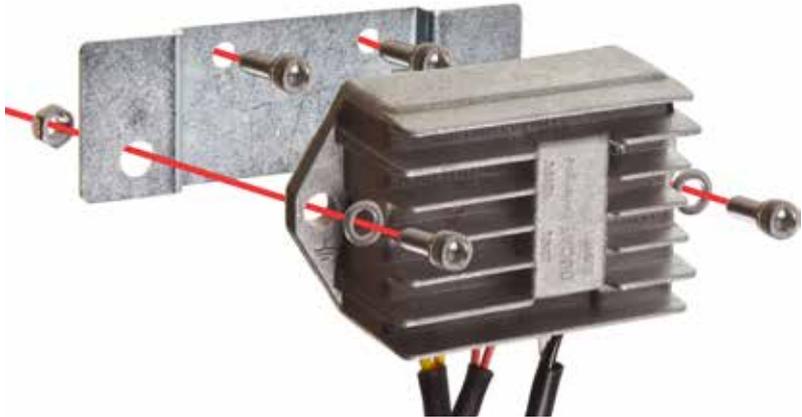
Mount the Regulator Rectifier

There are many possible locations to secure the R/R. Possible solutions are as follows, however it is up to you to determine the most viable solution.

Early BMW models have the voltage regulator mounted as shown here.



A mounting bracket is included that will allow you to mount the R/R in the original location. Assemble as illustrated below. It is tricky to secure everything in such a tight area, the use of a needle nose pliers is recommended.



When mounted it will look like this.



Later BMW models have the voltage regulator mounted as shown here.



For these models, further back on the center frame is a reasonable location to mount the R/R as shown. Start by relocating the relays to the opposite side of the mounting bracket to clear room for the R/R. Drill out the existing screw hole to the rear to accept the mounting bolt.



Measure forward 92mm on center and drill the second hole.



Mount the R/R to the underside of the bracket with the included hardware. Note the R/R case is its ground connection, and for it to function properly and for its longevity, a solid ground connection is required. You may find it advantageous to install the additional ground strap included to ensure a proper ground connection.

When mounted it will look like this.



There are many other locations to mount the R/R in addition to the previous options provided.

You can certainly use your mechanical creativity! Pictured to the right are a few locations our customers have had success with and may work for you too.



In some custom applications it is mounted on the front of the bike where you would often find a horn. This location is great as it will receive ample cooling and air flow.



Note when you are mounting the R/R, the case is its ground connection, so if you mount it on rubber bumpers for example, you will want to use the included ground wire. A poor ground connection can cause premature failure of the R/R. It is always a good idea to add your own additional ground strap to ensure the systems longevity.



One location that is **NOT** recommended is **UNDER** the front engine cover, where the original diode board is located. Per the manufacturer (Ducati Energia) this R/R is not to exceed 194°F/ 90°C. The operating temperature here has been measured at 215°F/ 102°C. Do not cut or modify the R/R housing as it will more than likely cause damage.

Install Electrical Wiring

There are many evolutions of the BMW Airhead since 1970, with changes to the electrical system. The electrical installation portion of this guide is broken into these variations. The variations of the front engine harness distinguishes the installation variations. The wires included with this kit accommodates all installation variations.

If you are unsure of your exact model you can enter your Vehicle Identification Number (VIN) in a website such as www.realoem.com to find the original manufactured month, year, and model.

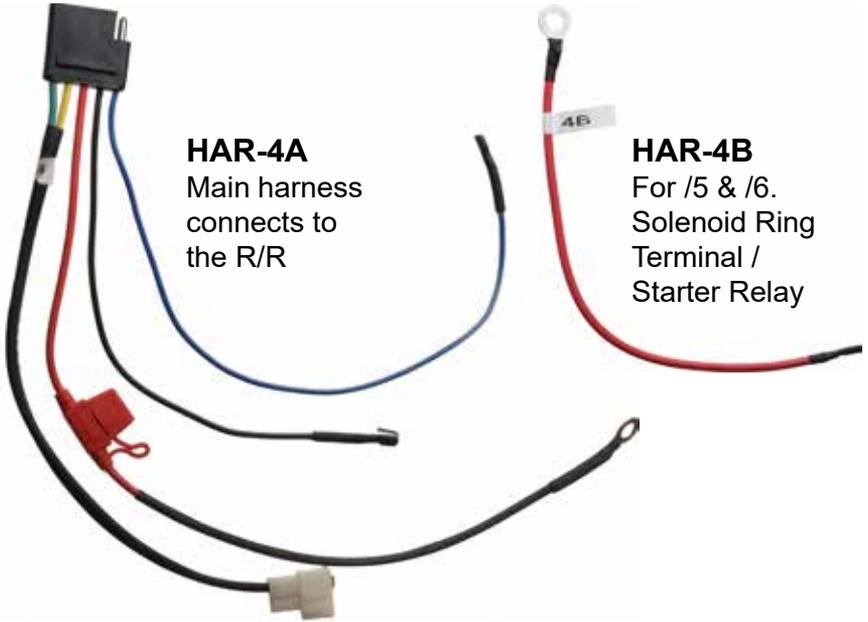
This kit eliminates most of the need for cutting, stripping, crimping and soldering most wires. One variation that could not be accounted for on all models is the generator light terminal which has two variations.

Some modifications or additional wiring may be needed depending on your specific installation.

It is possible that your particular bike may have been modified and many not look exactly as described. You must use your judgment or contact a professional installer for assistance.



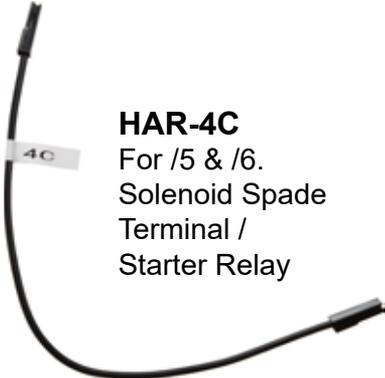
Contents of HAR-4 Packet



HAR-4A
Main harness
connects to
the R/R



HAR-4B
For /5 & /6.
Solenoid Ring
Terminal /
Starter Relay



HAR-4C
For /5 & /6.
Solenoid Spade
Terminal /
Starter Relay



HAR-4D
For contact
points ignition.
Ignition Condenser /
Coil Negative



HAR-4E
For /7 & Later Models.
Solenoid Spade Terminal /
Starter Relay



HAR-4F
Additional Ground
wire for R/R
*Optional but
recommended*

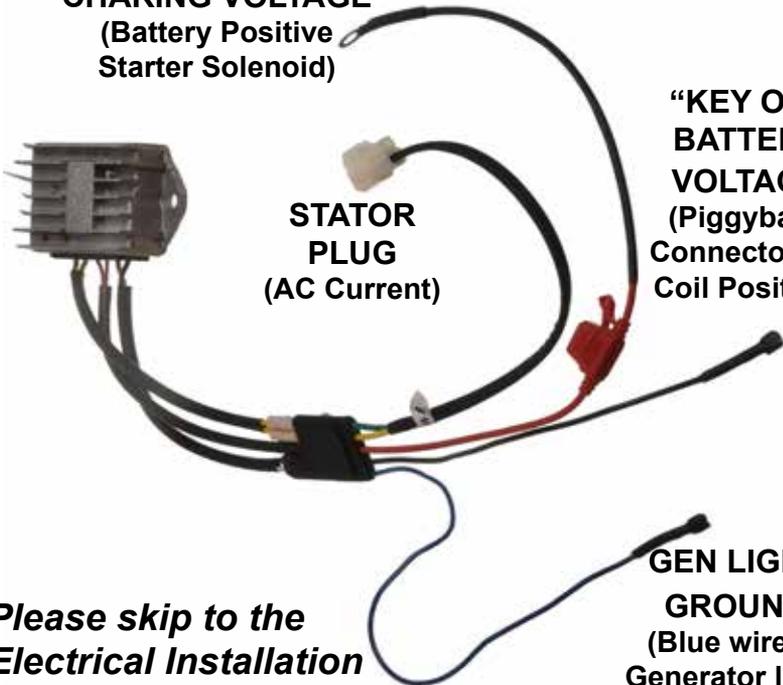
The main harness HAR-4A connects to the R/R as shown below. Lay the R/R and HAR-4A on a table and connect the cable as shown below.

Note the Black & White can only connect to the Black & Blue by virtue of the plug shape. Red to Red in the middle. Yellow & Yellow to Yellow & Green (the order doesn't matter on the two Yellow as they are both AC current from the Stator.)



All of the terminals on HAR-4A are shown below, with their connection and function.

CHARGING VOLTAGE
(Battery Positive
Starter Solenoid)



**“KEY ON”
BATTERY
VOLTAGE**
(Piggyback
Connector for
Coil Positive)

**GEN LIGHT
GROUND**
(Blue wire to
Generator light)
*Not required to
function*

***Please skip to the
Electrical Installation
section appropriate for
your particular bike.***

The use of this alternator is more complex when used on a BMW /5 series motorcycle because of the specific wiring architecture. It can be done with a starter relay modification.

The wires you will be using include **HAR-4A, 4B, 4C, 4D**. You will need to produce one wire not included, and a replacement 12 volt 50 amp SPST starter relay. Everything that will be required is detailed in the following steps for you.

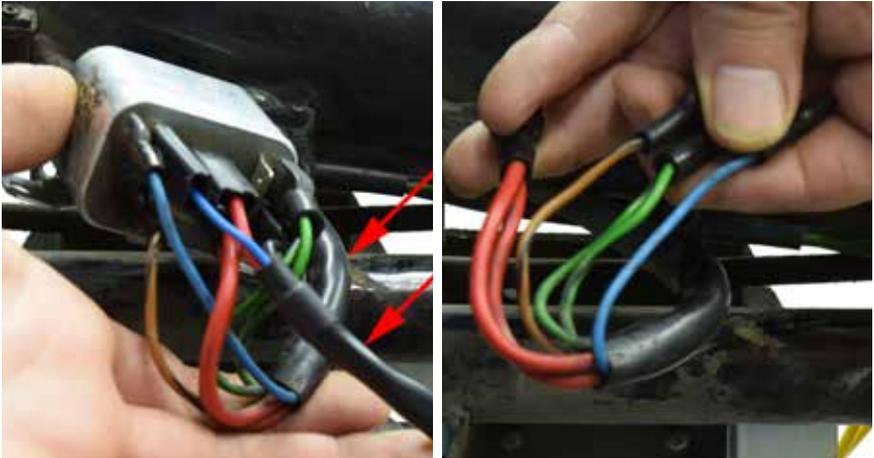
The /5 series uses a starter relay referred to as a “Cricket” relay. This relay is a safety feature on the motorcycle, and is located on the front left side of the center frame under the tank. The relay will prevent the starter from engaging while the engine is running. Because the starter button is the same as the turn indicator switch, it is easy enough to press the button while using the turn indicators, especially when wearing appropriate riding gloves.

The relay (BMW # 12 41 1 350 775 with **SR9570** found on the front) identifies the engine is running via the BLUE D+ wire. This is part of the rotor “Energizing Circuit”. This circuit is removed and is not replaced as part of this new alternator upgrade.



Unfortunately now the starter relay has no way of knowing if the vehicle is running, and will not start the bike. To restore the starter relay function to the bike, a new starter relay needs to be wired in. In doing so remember, the safety feature of starter lock out will be removed! This modification should not be taken lightly as your safety is paramount to our company and your loved one's.

To install the EDL4 the starter relay will be replaced. Start by freeing the starter relay removing the two screws holding the ears to the bike. Keep these fasteners as we will reuse them. Identify the two harnesses that lead to the starter relay. Both are identified in the image below with red arrows. One will be the front engine harness which was removed earlier. The second will be part of the main chassis harness. Unplug the wires from the main harness which will be **RED, BLUE, BROWN, & GREEN.**

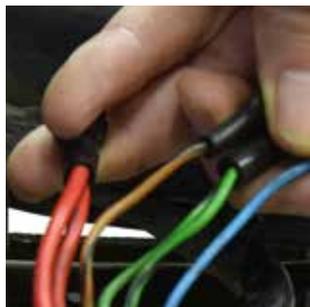


New Relay Installation



You now need to source a 12 volt 50 amp SPST relay. You can either purchase it from EME part # **REL-SPST50A**, or source from an auto parts supplier. It will have 4 pins numbered **30, 85, 86, 87.**

*Not all relays have the same placement and orientation of the pins so you **MUST** confirm the terminal numbers on the specific relay you use and match with these specifications.*



You will need to make a wire to connect the double red wire from the chassis harness to battery voltage. *It will match HAR-4B however needs a male spade terminal instead of female.* This wire runs from the **starter solenoid positive terminal**, to the **double red wire** from the chassis harness. This wire supplies voltage to power the bike.



Run **HAR-4B** from the new starter relay terminal **30** to the **starter solenoid positive terminal**. This will provide power to the starter relay.



Connect the main harness **BROWN** to **86** and **GREEN** to **85** on the replacement relay.



Run **HAR-4C** from the **starter solenoid spade terminal** to the new starter relay terminal **87**. This will trigger your starter to engage when you press your starter button.



Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the ignition wire removed that was part of the front engine harness.



The relay will now look like this and can be secured with one of the original relay mounting screws to the frame as shown.

HAR-4A will complete the remaining electrical connections as detailed below:

Plug the regulator rectifier terminals into the harness plug as shown on page 15.



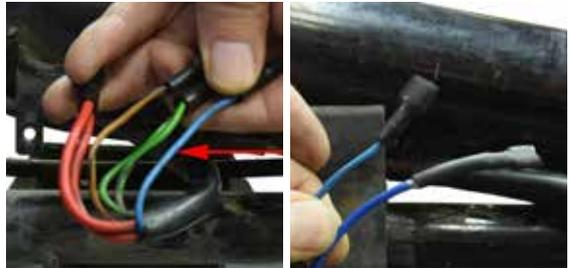
Connect the **WHITE PLUG** with yellow / green wires to the **WHITE PLUG** from the stator.



Connect the ring terminal **RED** wire to the **starter solenoid positive** Terminal. This is the same terminal that the battery positive cable connects to.

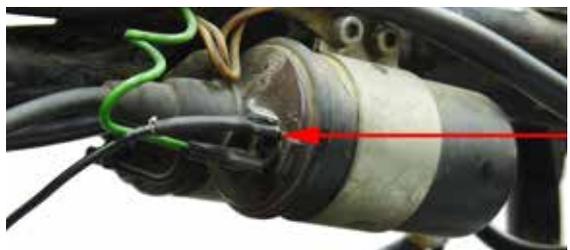


Connect the **BLUE** wire to the **BLUE** wire previously connected to the starter relay, coming out of the main chassis harness. This wire is connected to the generator light in the headlight.



You will need to change the HAR-4A blue wire terminal from a female, to a male terminal to make this connection.

Connect the **BLACK** wire (with piggyback terminal) to the **coil positive** terminal. Use the piggyback to reconnect any wire (typically GREEN) that was removed to make this connection if needed. *Stock coils should have open terminals.*



The wires you will be using include **HAR-4A, 4C, 4D.**

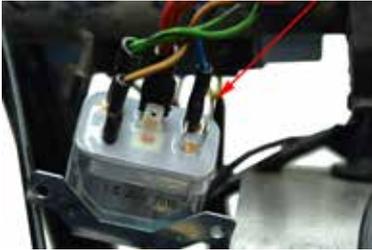
The /6 starter relay BMW # 61 31 1 357 104 and the **SR9572**

found on the front looks very much like the relay used on /5's.

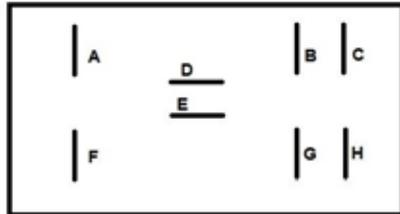
However it is VERY different. Now the D+ BLUE wires connected to the relay serve no function in the relay, it is simply a junction.

Perhaps designed this way so BMW would not have to produce a new wiring harness when it moved away from the "Cricket" relay.

Because of this, installation is much easier.



Bottom of Relay 61 31 1 357 104

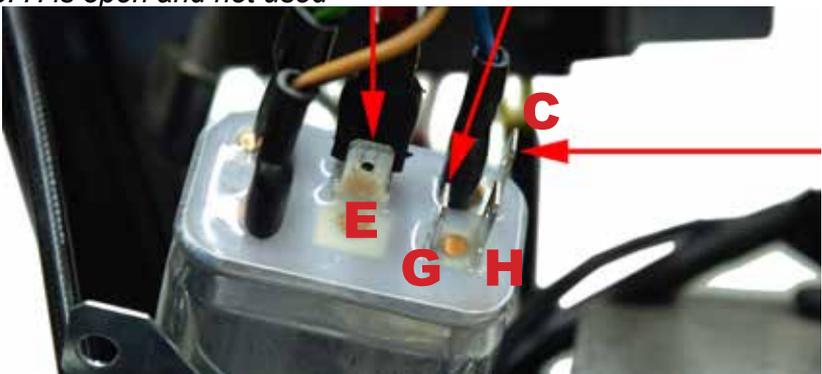


Side closest to bike when installed

Detach the starter relay by removing the two screws holding the ears to the frame. Now you can comfortably access the terminals underneath it. *Keep the screws handy as you will reinstall the relay at the end.* Identify the terminals on the starter relay, disconnected when removing the front engine harness:

- BLUE** wire from terminal **C**.
- RED** wire from terminal **E**.
- BLACK** wire going to terminal **G**.

note: H is open and not used





Install **HAR-4C** between the starter relay terminal **G** to the starter **solenoid spade terminal**. This is what will trigger your starter to engage when you press your starter button.



Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the original ignition wire removed with the front engine harness.

HAR-4A will complete the remaining electrical connections as detailed:

Plug the regulator rectifier terminals into the harness plug as shown on page 15.



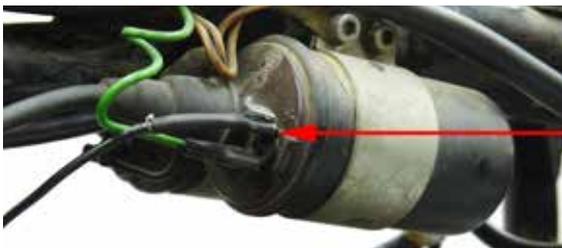
Connect the **WHITE PLUG** with yellow / green wires to the **WHITE PLUG** from the stator.



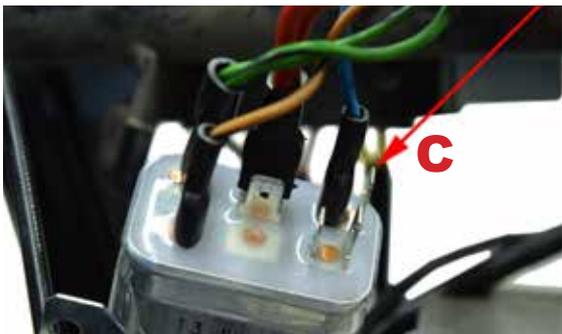
Connect the ring terminal **RED** wire to the **starter solenoid positive** Terminal. This is the same terminal that the battery positive cable connects to.



Connect the **BLACK** wire (with piggyback terminal) to the **coil positive** terminal. Use the piggyback to reconnect any wire (typically **GREEN**) that was removed to make this connection if needed. *Stock coils should have open terminals.*



Connect the **BLUE** wire from **HAR-4A** to the starter relay terminal **C** that was just revealed. This will restore the generator light function on your instrument cluster.



Now you can fasten your starter relay back onto the frame.

Airhead Models Up To 09/1978

HAR-4A will complete the remaining electrical connections as detailed below:

Plug the regulator rectifier terminals into the harness plug as shown on page 15.



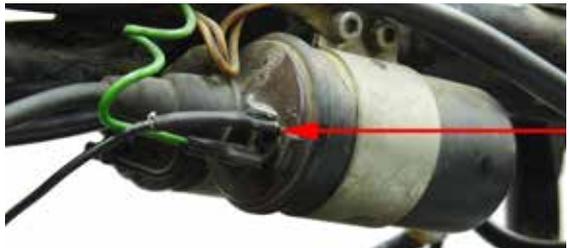
Connect the **WHITE PLUG** with yellow / green wires to the **WHITE PLUG** from the stator.



Connect the ring terminal **RED** wire to the **Starter Solenoid Positive Terminal**. This is the same terminal that the battery positive cable connects to.



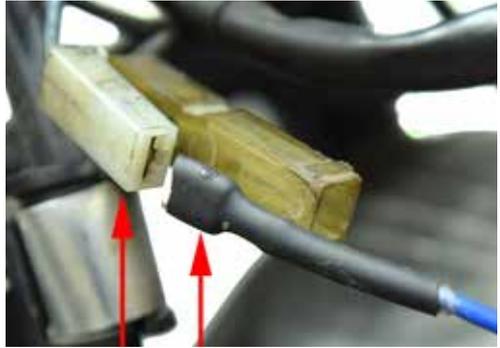
Connect the **BLACK** wire (with piggyback terminal) to the **coil positive** terminal. Use the piggyback to reconnect any wire (typically **GREEN**) that was removed to make this connection if needed. *Stock coils should have open terminals.*



Identify the two remaining connections from the front engine harness, which should terminate into two white plugs shown here.



The **BLUE** wire from **HAR-4A** goes to the **BLUE** wire in the white plug. You will have to change this terminal from a Female to a Male terminal on the HAR-4A with the terminal provided in the kit. This wire is connected to the generator light in the instrument cluster.



Run **HAR-4E** from the **Starter Solenoid Spade Terminal** to the **BLACK** wire in the white plug as shown. If your model does *not* have this plug, you will replace it with the bare connector into the relay block replacing the trigger wire for the starter. This wire will trigger the starter when the start button is pressed and replaces the original wire when you removed the engine harness.



Run **HAR-4D** from the ignition **condenser** to the **coil negative** (terminal #1). This replaces the original ignition wire when you removed the front engine harness.

Airhead Models After 09/1978

HAR-4A will make the remaining electrical connections, and are all detailed below:

Plug the regulator rectifier terminals into the harness plug as shown on page 15.



Connect the **WHITE PLUG** with yellow / green wires to the **WHITE PLUG** from the stator.



Connect the ring terminal **RED** wire to the **Starter Solenoid Positive Terminal**. This is the same terminal that the battery positive cable connects to.

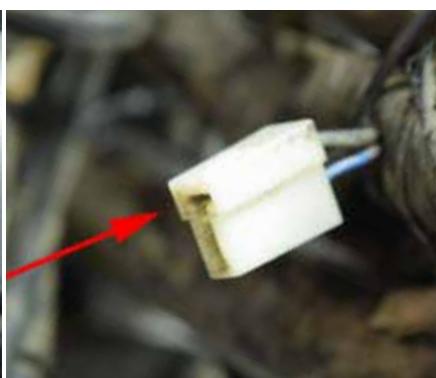


Identify the white plug shown below. It will have one **BLACK** and one **BLUE** wire entering it from the front engine harness.



This connector can be problematic to disconnect. Take care when working with plastic connectors that are aged and brittle.

The **BLUE** wire from **HAR-4A** goes to the **BLUE** wire in the white plug. You will have to change this terminal from a Female to a Male terminal on the harness with the terminal provided in the kit. This wire is connected to the generator light in the headlight.

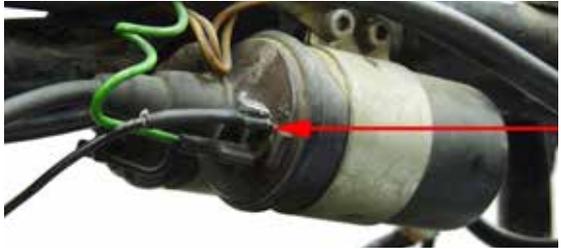


Run **HAR-4E** from the **starter solenoid spade terminal** to the **BLACK** wire in the plug as shown. This wire will trigger the starter when the start button is pressed and replaces the original wire removed with the engine harness.

Early models have a pair of single tower coils (one on each side of the frame.)

Connect the BLACK wire with piggyback terminal to the coil positive terminal. If needed, use the piggyback to reconnect any wire (typically GREEN) if one was removed to make this connection.

Stock coils should have open terminals.



Later models have a single coil with two towers located towards the front on the right side. Connect the GREEN wire to the piggyback terminal and reconnect to the coil positive post.

Originally these coils electrical connections used ring terminals. Later they changed to spade terminals. If your coil has the original ring terminals, you will need to make a minor modification to accommodate this.



Some airheads have been modified with aftermarket coils or converted to dual spark. If so refer to the function of the terminals and wire appropriately.

Final Reassembly

To ensure ease of future service, we highly recommend that all fasteners be thoroughly cleaned and that a good quality anti-seize paste be used during reassembly of parts. With the ignition switch still off and transmission in gear turn rear wheel while you watch the rotor to ensure that it runs true and straight inline with the stator without touching. Review all work done during the installation process. Ensure that all components are mounted correctly and securely. Check all wiring to make sure that the components are connected properly and that wires are routed appropriately to avoid pinching, binding, rubbing and are secured with the included cable ties. With the EnDuraLast charging system installed there is no longer any risk of shorting out electrical components when removing/installing the engine front cover. Therefore you no longer need to worry about disconnecting the battery before working with the front cover. Reinstall the front engine cover, starter cover, fuel tank, and all remaining components removed to restore the bike to operating condition. Reinstall the battery, and clean the terminals to ensure a solid connection to the battery cables.

Start the motorcycle. While the engine is running, connect the voltmeter across the battery terminals to check for charging voltage. Watch for voltage at the battery terminals to increase with RPM's.

After confirming correct operation of your new charging system, verify everything is reassembled properly and it is safe to ride.

Variations

A popular modification to Airheads is adding a spark plug to each head (Dual Spark) conversion. If this is done on your model, the coil configuration will look different from original and what is shown here. All that is needed is to note the coil positive and negative and connect your configuration to match the directions when identifying coil positive and coil negative.

Aftermarket ignition systems are also a popular modification. You may not have the original contact point, condenser configuration. If so reconnect the original ignition system as originally installed. The ignition system has no impact on the charging system other than some wires may be included in a shared harness assembly.

Trouble Shooting

If there is continuous high voltage (over 15 volts) the issue is a faulty ground or voltage lower than actual battery voltage supplied to the BLACK wire on the R/R. The black “voltage sensing” lead must be supplied a true and accurate key ON battery voltage; if not, the voltage regulator will automatically compensate for the lower voltage being sensed and produce constant and / or intermittent higher voltage. If the black wire is connected directly to the battery it will always be energized and be a parasitic draw on the battery.

With this new alternator, there are 4 possible failures.

1. The rotor is permanently magnetized, failure is rare.
2. The stator is very robust, failure is also rare, You can test for continuity between the two yellow leads on the stator, and verify there is no continuity to ground.
3. The R/R is the most susceptible component for failure. Each one is computer tested at the factory to ISO standards prior to shipping. The reason why this regulator would fail is because of heat. It is not to exceed 90°C / 194°F. Excessive heat is caused in 3 ways;
 - A. The battery used is aged and sulfated to the point it will not accept a charge. This added resistance presented to the R/R will cause it to heat up, much like a light bulb heats up.
 - B. The normal heat generated by the R/R cannot be dissipated because of it's physical location. Never mount this R/R under the front engine cover on a BMW where the original diode board was installed. Besides the engine heat, it will not receive adequate air flow to stay cool.
 - C. The R/R ground connection is not solid or intermittent. This is a case of resistance to ground needs to be as low as possible. A solid ground strap is a great preventative measure to ensure the R/R can shunt to ground safely.
4. The battery is aged or sulfated and not able to accept a charge. We recommend having a load test performed to your battery at the start of every season. This system is very reliable however it cannot over compensate for an aged or sulfated battery.

Do not overload the system! Although you will have dramatically increased your power & amperage output, you must still observe the laws of physics and electromagnetism. Please review the wattage demands of all additional accessories before installation and use. To increase the reliability of the charging system, there should be a 10-20% buffer margin between demand and output capacity at your engine operating speed. (Refer to the charge system output chart on page 2) Total power demand should NEVER exceed the power capacity of the system.

IMPORTANT INFORMATION ABOUT BATTERY HEALTH:

The vehicle must have a good, fully charged battery for the electrical system to operate properly !

- Battery voltage reading MUST be 12.6 Volts or higher.
- If your battery is over 3 years old, it should be replaced.
- If your battery has been discharged 3 times or more, it is sulfated and MUST be replaced !

A sulfate damaged battery will not;

1. Accept a charge and may damage your charging system.
2. Provide sufficient voltage and / or current to turn the starter motor.

Make sure the positive and negative cables are free of corrosion, and have clean tight fit.

Battery Voltage	State of Charge / Battery Condition	Recommended Action
12.7 V	100 %	Battery Good
12.6 V	90%	Battery Good
12.4 V	75 %	Charge Battery
12.2 V	50 %	Replace Battery
12.0 V	25 %	Replace Battery
11.9 V or less	Discharged	Replace Battery

Due to older battery high internal battery resistance the charging system has to work harder. While good batteries absorb voltage spikes, older and/or defective batteries may produce voltage spikes that can cause damage to the voltage regulator and / or rectifier, etc. This would create a high voltage and / or low voltage output and may cause the charging system to ultimately fail.



Complete your setup with the EnDuraLast crank mounted ignition system! Specifically designed for this EDL 4 alternator utilizing a custom pickup configuration using a HALL sensor and full digital advance curve derived from the crank shaft RPM's. Preprogrammed advance curves for stock or dual spark modified configurations.



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