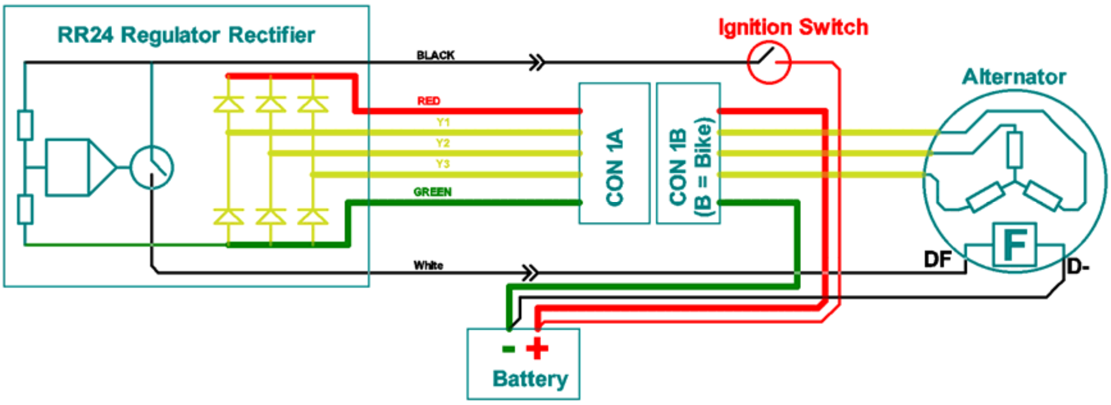
Trouble Shooting Battery Charging Problems on Bikes with “High Side Switching” Alternator Regulator type RR24.



Orientation: A GENERATOR is basically a coil of copper wire on an iron former, in which a permanent magnet is rotated. This creates an alternating current in the coil. Often 3 coils are connected together as shown above to make up a “3phase star” configuration. Useful electric current flows from the 3 wires into the Regulator Rectifier on the bike, which converts that 3phase AC to DC for charging the battery. Lights and other stuff on the bike takes current from the battery, the generator and RR keep the battery correctly charged up whenever the engine is running.

An ALTERNATOR is an advanced device similar to a generator, but containing NO permanent magnets. Instead, alternators make use of a revolving ELECTROMAGNET, often called the ROTOR. The rotor is electrically connected by brushes and slip rings (it has to spin round without tangling up). The REGULATOR continually measures the battery voltage and *adjusts the current through the electromagnet* so that the alternator generates exactly enough power to keep the battery nicely charged whatever the bike’s demands for electricity are.

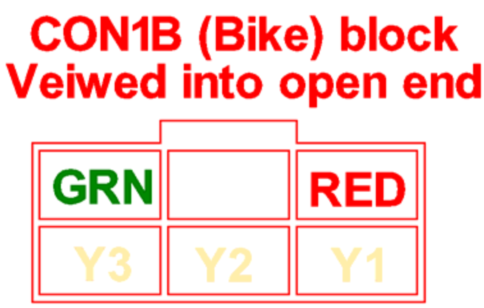
There 2 possible wiring circuits for controlling the rotor current. Clearly, no more than one of these can be right for your bike. The one shown here (*high side switched circuit*) has one end of the rotor (D-) connected to battery -ve; the other end (DF) is fed +ve controlled current through the RR. The other possibility would be a *low side switched circuit* in which one end of the rotor (DF) would be connected to Battery +ve and the RR would control the current coming out of the other end (D-) through to the battery -ve. It is essential that you know which type of circuit your bike has. Wrongly connecting up the opposite type of RR for the particular bike circuit you’ve got can result in much amusing smoke and colourful language, also it will invalidate all warranties.

Please bear in mind that it is not so unusual to have *more than one problem at the same time* on a bike charging system. The following procedure will find most, including multiple problems.

Start here: ***Everything is connected up, battery fails to charge.***

First Shot: ***Check continuity of the charging circuit between the RR and the battery.***

Good tool to make up is a 55Watt headlamp bulb with 500mm flying leads and ¼” male fastons. Unplug the 6 way block connector between the new RR and the bike wire harness. Briefly connect the bulbtool between the 2 female receptacles in the CON1B block connected to Battery -ve & Battery +ve (RED & GRN in the CON1B



sketch). The bulb should light up to full power, indicating that the bike wiring between the battery & the CON1B block is good for a current of 4 or 5 Amps. If bulbtool only lights dimly, maybe the battery is flat, maybe the wire harness has too much resistance. A tiny resistance of less than ¼ of an Ohm is certainly big enough to cause major charging problems, but it won't even show up using a normal multimeter. If you suspect there may be a problem here, try popping the GRN & RED fastons from CON1B block and running an extra pair of HEAVY wires (use 2.5mm house wire and 2 x female fastons) from the back of the CON1B block, outside the bike, directly to ring tags under the battery terminal bolts. This effectively bypasses the wire harness and fuse box etc. This is the most common "insoluble" problem we see.

Second Shot: ***Static-check the alternator is ok.***
Completely disconnect the RR from the bike. Use a multimeter to check the following readings *at the CON1B connector*: Stator resistance between any 2 of 3 yellow wires should be around 0.75Ohms, and should be the same for any combination of 2 probes on 3 yellow wires. This is actually too low a resistance for a standard meter to register as good, but sometimes a high reading can show a fault. Also check the ISOLATION between any yellow wire and the frame ground, there should be no conduction, any resistance less than around 10kOhms here indicates a phase to frame insulation failure, often indicates a possible short circuit when engine gets hot. The ROTOR resistance should be in region of 4 Ohms cold, 6 or 7 Ohms hot. Shorted turns in the rotor are a common failure mode, sometimes indicated by a LOW resistance reading. Again, 4 Ohms is too low to register correctly on a standard multimeter, though please do try. Better way to measure the rotor resistance is to set the multimeter to AMPS DC range and stick one prong into the female faston from the IGN SWITCH (black in the wiring diagram above), stick the other prong into the female faston from the alternator DF terminal (White in the wiring diagram above) and briefly turn on the IGN SWITCH. The meter should show a current of maximum about 3Amps DC. Ohms' law says 12Volts divided by 3Amps = 4 Ohms resistance. Turn off the key, else your battery will go even flatter. If more than 3Amps, you've got a partly shorted rotor winding.

Third Shot: ***Dynamic test the alternator is ok.***
This test will use the bike engine to drive the alternator at full power into the battery, no regulation at all. This test can only be done safely if the first 2 tests have shown that the charging circuit wiring is good and that the rotor resistance is good. Do not proceed without first proving the first 2 tests are good. Remove the meter from the black & white female fastons. Make up a short wire link with 2 male fastons. Use this test link to short together the black wire and the white wire on the bike. When the IGN SWITCH is turned on this will drive the full battery voltage into the rotor coil. Set the multimeter to measure DCVOLTS and connect straight across the battery terminals. Plug in CON1 / CON1B to enable the rectifier part of the RR to work, leave the black wire and white wire from the RR hanging disconnected and safely taped up. Start up the engine but DO NOT REV UP. The meter across the battery should quickly rise to about 14Volts or higher, switch off soon, everything will be overloading.

Fourth shot: ***The real stator winding test.***
Having exhausted the easy options, there remains only the stator winding that might be defective. It's pretty hard to test. We need to keep the wiring tricks from the Third Shot test still connected to energise the rotor, but we need to test the power output from each phase pair in turn using the bulbtool while the engine is running. Pull the CON1 blocks apart, and start the engine. Probing inside the CON1B block with the multimeter set to VOLTS AC should show about 9VAC to 14VAC between any 2 pairs from any 3 yellow wires at about 1050RPM idle speed. Check them all, *they must all measure to the same value*. Next use the bulbtool across all 3 possible combinations of 2 test wires in 3 holes. The bulb brightness *must be the same for all 3 connection pairs*. Any imbalance indicates a fault on 1 or more of the 3 phases. Revving up the engine much above idle will pop the bulbtool. Turn off the ignition switch soon, rotor will be getting hot, battery will be getting flatter.