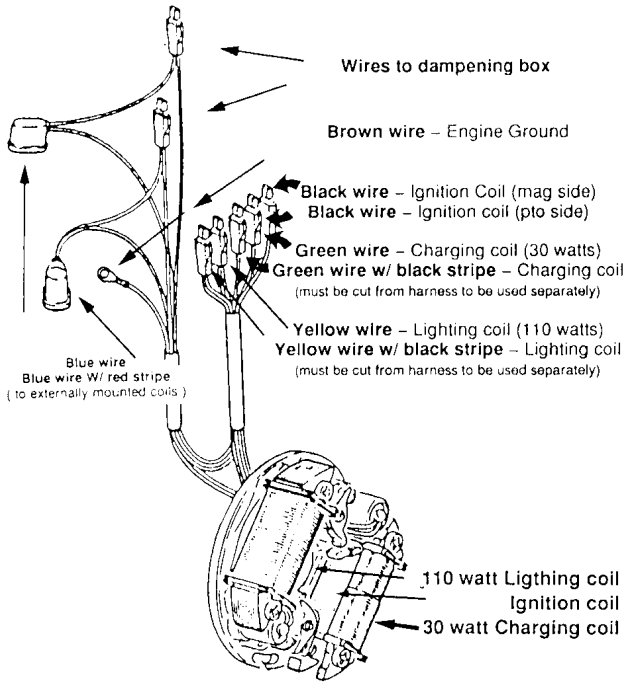
PART - #33

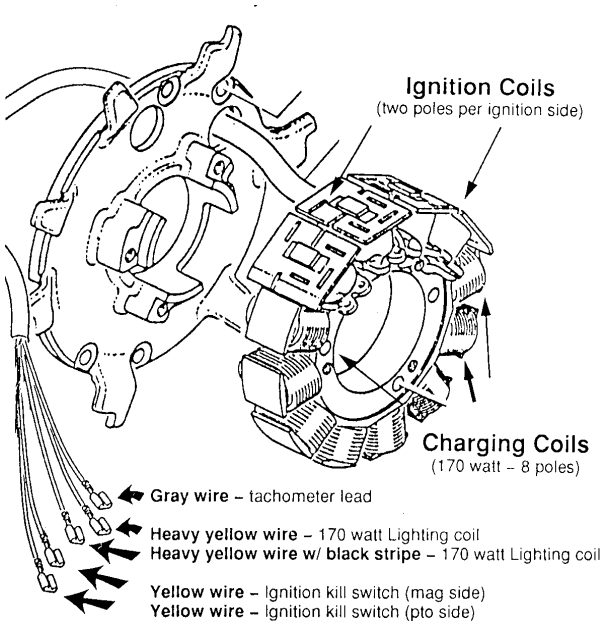
Utilizing Your Engine's Electrical Output

by Mike Stratman

It has been a practice of mine over the years to kind of keep an informal tally of the types or nature of requests for technical assistance. It has come to my attention that an overwhelming number of owner/builders are completely baffled by the options available from the engine's electrical output. Judging from the massive number of blown hourmeters, "will this work to power that" questions, and other generally bizarre experiments being connected to the alternator circuit, the time has come to tackle this subject. Understanding what you have to work with is essential to adapting most any accessory. This month we'll take an in depth look at how to utilize your alternator circuit. We'll explain the different types of systems used by Rotax, the devices made to convert the power to a usable source and what kind of limitations or expectations you should place on the engine's power output.



***Bosch Alternator Systems**; All point ignition Rotax engines are equipped with a "two stage" or a high output (110 watt) lighting coil and a low output (30 watt) charging coil. The lighting coil (two yellow wires) was originally designed for snowmobiles where headlights and other A/C accessories would run directly off the alternator output. The low voltage charging coil (two green wires) was completely separate circuit that could be used for charging a battery for electric starter purposes. The tachometer on snowmobiles usually measured the pulse across the two black wires. This left the other two circuits uninhibited for use with other devices. But this was a bad idea on aircraft motors. If the Tach was to short or fail internally the motor could be killed since grounding these two wires together is how your ignition switch kills the spark! On aircraft motors it is standard practice to connect the tachometer (an entirely different Tach than used on snowmobiles) to one of the two coils. This kind of Tach measures the pulse or wave produced by the coils rather than volts or watts. The pulse is the same on either circuit so the Tach doesn't care which set of wires it's hooked to. It works fine either way. See figure #1 and chart for location of parts and wire color code. Remember, because the output is A/C there is no polarity on the same color wire (i.e. Green - green w/ black stripe).*



***Ducati Alternator Systems:** On all new Rotax 503 and 582 dual ignition engines the power output system is configured dramatically different. Figure #2 shows the 12 pole radial design of the dual ignition system. Two pair of poles are dedicated to each of the separate ignition systems. The remaining 8 poles are part of a continuously wound 170 watt charging coil. You now have only one source for your devices. This limits your capability as we will discuss later. The Tach works off a dedicated wire (gray) so this is no longer a capability problem. The circuit for this type of system requires a different kind of Tach than the Bosch Ignition. Be sure you ask for a Tach for this type of system when ordering. At 170 watts you do have more potential as compared to the 110 plus 30 watt dual output of the Bosch system.*

With either system you must realize that this output has it's shortcomings in it's unaltered form. To put it in layman's terms, it's real quite filthy!! Besides being variable by RPM ranging from 6 to 60 volts complete with random voltage spikes, the wave is inconsistent, and the emission of RF waves disrupting radio communication are all present. We obviously need to clean this up before it can be used for just about anything.

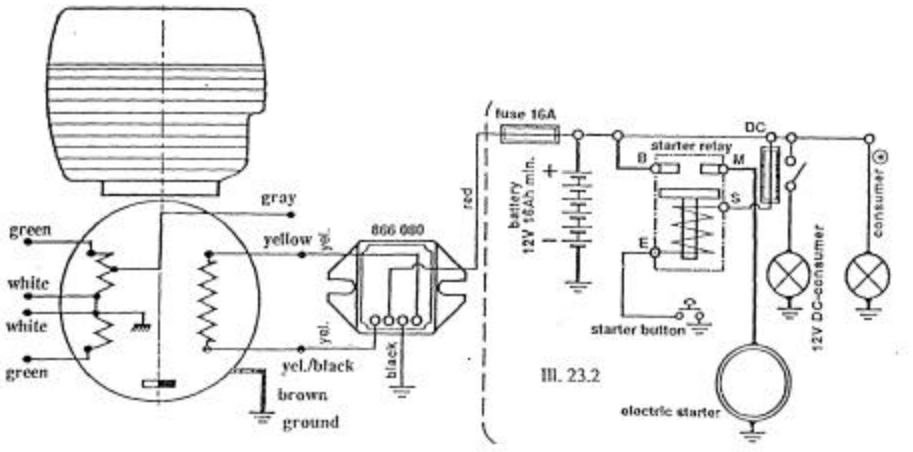


Figure #3 - A typical schematic for using a #9103 single phase regulator to charge a battery and electric start system.

Voltage Regulator / Rectifiers - Single Phase: *CPS # 9103 or Rotax #866-080 is a single phase solid state regulator / rectifier. This simple unit measures just 3" x 2" and weights about 4 oz. and is ideal for charging a battery. Costs runs right around $30. The battery must be a 16-20 amp hour capacity, anything smaller and you risk the chance of overcharging or "cooking" the battery. Once this battery is installed in the system the user can now power a multitude of accessories. Electric starters, nav lights, gauges, interior lights, dashlights, radios, etc. etc. See Figure #3 for typical schematic where a #9103 regulator is used to charge a battery and electric start system.*

Where people get into trouble is when they want to get away without charging a battery. "But I just got an hourmeter and water temp gauge to power". Yes, batteries weight a lot, usually 12 to 20 lbs., but they supply a nice clean steady 12 volts D/C. The #9103 requires a minimum 1 amp load. Without this 1 amp load the circuit will not rectify. In other words, the circuit will continue to put out only A/C voltage and your hourmeter will not function. A 1 amp load is equal to a 12 volt 15 watt incandescent light bulb. Rotax suggests a capacitor of a minimum 2,000 uf / 25 V wired as shown in Figure # . This will satisfy the 1 amp requirement and your #9103 regulator will produce D/C voltage and your hourmeter will function.

Three Phase Regulator #9251: *This solid state unit, Rotax #864-870, measures 4" x 3" and weight 5 oz., slightly larger than the #9103. Costs around $70. Unlike the single phase unit, it will supply D/C voltage without an external 1 amp load. An internal load balancer is part of the circuit. You will also find an extra back-up circuit available. See figure # for the use of a #9251 regulator with an electric start system. Note the extra yellow wire on the regulator. It can exchanged with the other yellow wire in the event of a suspected circuit failure. The unit is also equipped with heat dissipating fins to help cool internal components.*

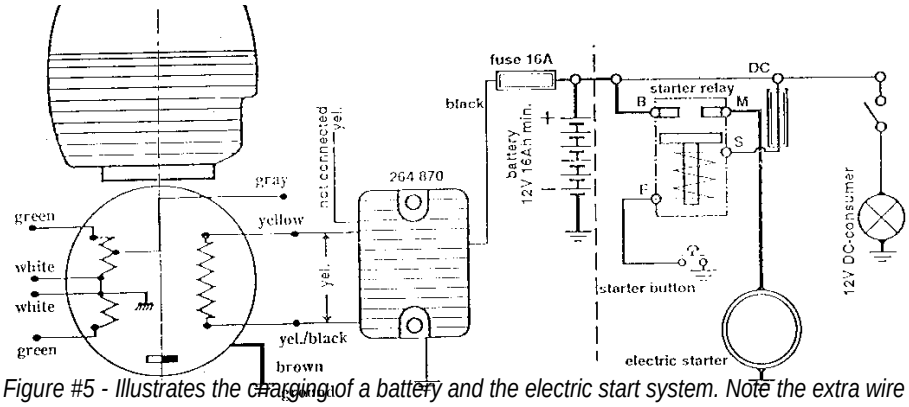


Figure #5 - Illustrates the charging of a battery and the electric start system. Note the extra wire on the regulator is not connect unless desired for back-up.

Hourmeters: *To the best of my knowledge there is currently no hourmeter that will work off A/C voltage only. All hourmeters require from 4 to 40 volts D/C to operate. It says so clearly on the hourmeter instructions. Yet the number of people that will hook them directly to the lighting coil staggers the imagination! This indicates to me they simple do not understand what the engine's lighting coil is producing and hopefully we are taking care of this with part #33. What you do have going for you is the fact that the voltage range that most units will work in is fairly large (4 to 40 volts). Using the #9251 regulator allows you to run an hourmeter with the only drawback being the possibility of not having enough voltage available at idle to get a reading. Any RPM higher than idle and enough D/C voltage will be available. There is some discussion on where or not the 1 amp minimum load required by the #9103 is satisfied by an hourmeter. My suggestion is to use a capacitor or charge a battery as outlined earlier of best results.*

Low Power Amplifier: *Westberg Mfg. makes an inexpensive device called a low power amplifier (Westberg #329-LPA or CPS #4729). This device sells for around $16 and has a circuit that turns A/C into D/C plus has a pre-amp that makes sure your hourmeter reads even at idle. The only draw back here is the device seems to only work with Westberg hourmeters only. Hobbs hourmeters do not work with this device.*

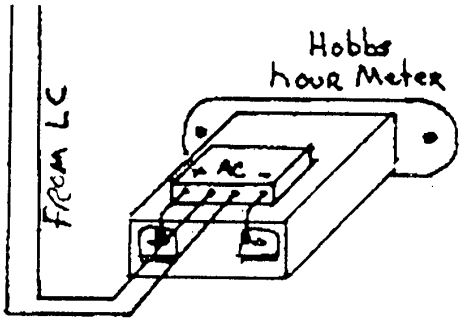


Figure #6 - An inexpensive Hobbs connection using a Radio Shack full wave bridge rectifier. According to my sources this will only work on the "Hobbs" brand hourmeters.

Full Wave Bridge Rectifier: *An interesting piece showed up in the February '92 issue of Ultralight Flying! Magazine suggesting an inexpensive Hobbs connection with a full wave bridge rectifier. Using a Radio Shack part #276-1171, costing around $2, A/C lighting coil voltage is transformed into D/C. Figure #6 shows a simple schematic on this part. Being a little skeptical, I contacted Westberg Mfg. for their comment on what looks like a great short cut to an A/C driven hourmeter. They stated that this type of system would not work with their hourmeters. This leads me to believe that Hobbs hourmeters and Westberg hourmeters are configured differently and should be treated as such. Westberg tells me that an A/C hourmeter is in the works and should be available sometime in the future.*

Strobe Lights*: Strobes are one of the few commonly used devices that connect directly to the A/C output of the engine in it's unaltered form. Because the strobe circuit uses only the voltage to charge a set of capacitors, variable A/C voltage is no problem. Most strobes are configured with a circuit that will only allow the bulb to flash when the capacitors are fully charged. This means at idle the flash interval will be longer but the spark intensity will remain the same. The problem with most strobe lights is they tend to dominate the circuit. Hooking other devices to the same set of alternator wires usually brings compatibility problems. In the case of the new Ducati systems there is only one circuit available, forcing you to make some compromises. The simple schematic shown here illustrates how one strobe manufacturer was able to get around this situation. This was accomplished by a redesign of the strobe's circuit by using only the "spare voltage" the regulator did not use.*

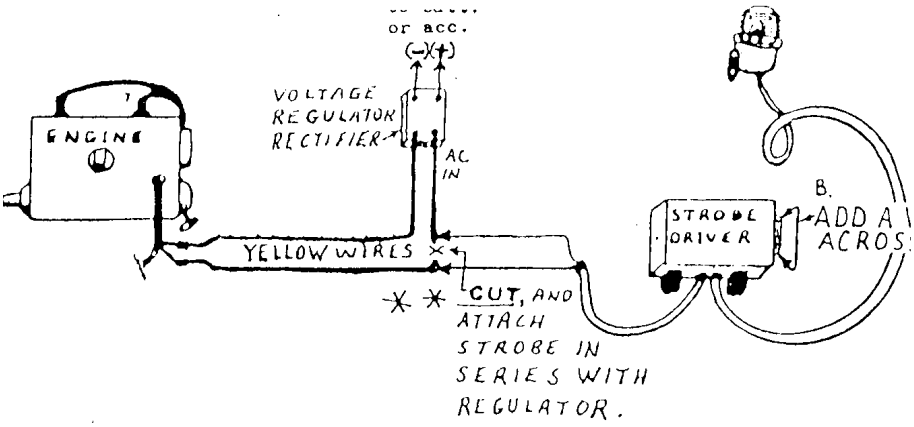


Figure #7 - The uses of more than one device on a single circuit calls for some creativity. With particular circuit will work only with a specially designed strobe circuit.

And there you have it. As you can see, understanding your engine's electrical output capabilities is essential in pre-determining weather or not any given device can be driven by your engine. This approach seems a lot more desirable than the "let's wire it up and see what happens" approach to the electrical system that has been all too common in the past.

Source:Part #33 - Utilizing The Engine's Electrical Output

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