Tech Basics: What Electricity Does in Every Electrical System.

By Gerald Cooper & Femi G. Ibitayo

What does electricity do in every electrical system?

After looking at Ohm's Law and the relationship between Voltage, Current, and Resistance let's jump right into our study of electrical systems with two general statements that provide a starting point in simplifying the concepts. I call these Cooper's E-rules.

E-Rule number one:

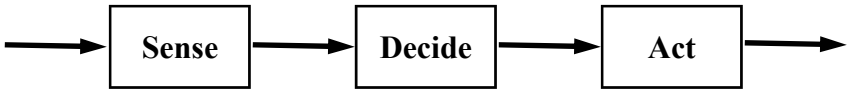
All electrical systems either manipulate information or do work, or do both.

Regardless of the actual complexity of the system, everything that the system does will fall into one of these two categories---**information or work**.

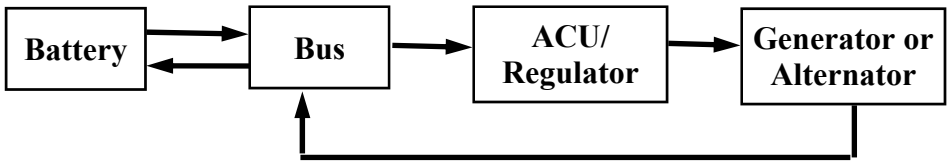
E-Rule number two:

All electrical systems are organized in a similar fashion: They Sense, Decide, and **Act.**

Any system can be divided into three basic elements of organization: The elements are **Sense, Decide,** and **Act.**



These concepts also apply to Aircraft Electrical Charging Systems (AECS) in a similar fashion. The regulator SENSES the bus voltage DECIDES if it is high or low then tells the generator or alternator to ACT to increase or decrease it's output to the bus.



AECS is not rocket science. It takes only a little thought to reason through the symptoms of the problem, then with a few voltage and resistance measurements to base your analysis on and confirm your conclusions, the problem is solved. Sounds simple, Huh? Well it may not always be as simple as described above, but there is nothing mysterious about charging systems that with a little thought and a little investigation into how they work, anyone can become proficient in servicing them. A good understanding of the relationships in Ohm's Law will give you a head start in understanding the reaction that Voltage, Current and Resistance has on electrical circuits, and for this discussion aircraft charging systems in particular. So exercise your brain just a little and master the principles of Ohms Law.

ZEFTRONICS' AECS seminars held in Longview, Texas is one way to get out of dreading the Aircraft Electrical Charging System problems and get on path of AECS expertise. ZEFTRONICS provides Electrical Charging Systems Solutions.

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E-Rule number one and the AECS.
All electrical systems either manipulate information or do work, or do both.

In the typical Aircraft Electrical Charging System (AECS), closing the Battery switch informs the battery relay to close (act, do work). The closed relay contacts allow the current from the battery to flow to the bus and all the electrical devices dependent on the battery for operation. Closing the Alt switch informs the ACU to pass current to the alternator's field. The ACU passed current acts on the field to excite (or inform) a rotating alternator to produce enough electrical power to act on the battery to charge it and also carry all other electrical loads previously carried by the battery. This way, all electrical systems either manipulate information or do work, or do both.

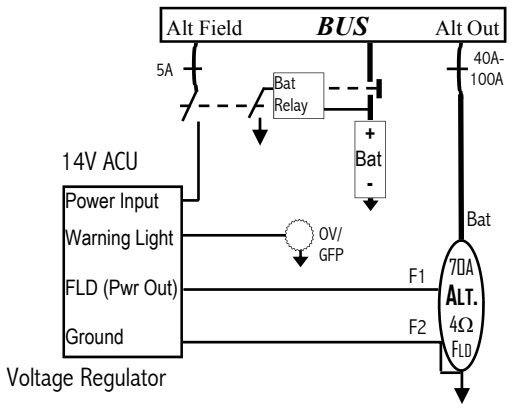
E-Rule number two and the AECS.
All electrical systems or components are organized to Sense, Decide, and or Act**.**

In the typical AECS, the battery relay **senses** the closing of the Battery switch. It **decides** to close its contacts to allow (or **act**) current to flow from the battery to the system.
The ACU senses the bus voltage through a closed Alt switch. Based on the sensed bus voltage, the ACU decides to increase or decrease the alternator field current.

The alternator senses each additional load (radios, pitot heat, etc) switched on the bus and decides to support it. The increase in load drops the bus voltage. A drop in the bus voltage causes the ACU to increase the field current in order to enable the alternator to support the added load and keep the bus voltage at a fixed level. The reverse is also true. Removing a system load causes the bus voltage to increase. With an increase in the bus voltage, the ACU decreases the field current to keep the bus voltage at a fixed level. This feedback setup is common to all AECS in operation.

This inter-dependence or inter-relationship demonstrates the basic set up of all electrical systems whether complex or simple. That is why a good grasp of the two fundamental E-rules is crucial to the success of all personnel or persons dealing AECS problems or projects.

Typical AECS



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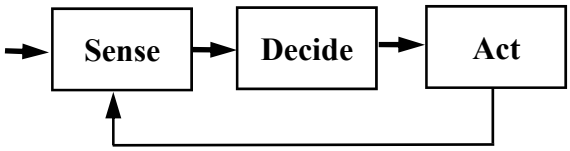

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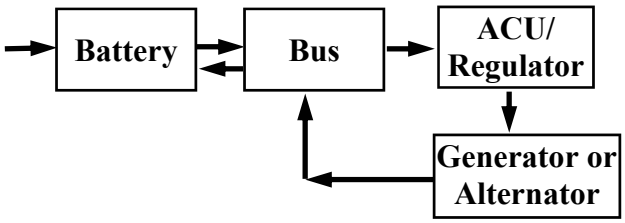

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