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Utility Power Monitor Alerts Users When To Power Up and Power Down An Engine/Generator Set

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I live in a subdivision near Annapolis, Maryland. Many of the houses appear to have been constructed by a few developers. I am unaware whether the county had an active zoning enforcement department during their construction. However, the houses have some noticeable deficiencies. One that becomes apparent when a heavy rainstorm occurs is that the cellar walls leak.

During a hurricane several years ago, the electrical power failed and therefore the sump pump could not function. We remained without electrical power for five days, during which time my cellar acquired a foot of water. I then proceeded to "lock the barn door after the horse ran away" by purchasing and installing an engine/generator set (EGS). Naturally, my main objective in buying an EGS was to provide backup power for the sump pump so that I could avoid a flooded cellar in the future. But I also needed a backup source of power for several other pieces of equipment such as:

- the well pump—to enable flushing the toilet, washing body and clothes,
- the refrigerator—to prevent food in the refrigerator and freezer from spoiling,
- a microwave oven—since one can live without a stove if the microwave is functioning, and
- my home office—its computer, fax machine and lights.

During the daytime, it is usually apparent that the electricity source has failed. However, during sleeping hours, failure of the electricity source may go unnoticed. This can result in water in the cellar, inability to flush the toilets, melting of food in the freezer, etc.

With that in mind, I decided to design a monitor that would generate a sound when the electrical power failed, thus hopefully awakening me so that I could manually start the EGS. This device would plug into an electrical outlet that is not "backed-up." Typically, if you purchase an EGS that does not have the capacity to protect the entire house, you will have some outlets that will not be "hot" from the EGS. So there would be a suitable outlet available for the monitor.

Before delving into the design of the monitor, a few words about the EGS are in order. A common power rating for an EGS is 5,000 W. A unit with this rating won't power everything in a typical household, but it will back-up the critical appliances. Due to the competitive nature of manufacturing EGSs, the price of a 5,000-W unit today is approximately the same as it was several years ago but many contemporary units are now sold with electrical starters for the same price as their predecessors. I noticed a 5,500-W EGS (pull start) from Harbor Freight Tools for $469, an attractive price.

Although higher-power EGS units may incorporate circuitry for automatic start up and shutdown, this is not an option on the lower-power (5,000-W) EGS units that I have I seen in the marketplace. Nor have I seen any units in this range with any type of utility power monitor built-in. So there does seem to be a requirement for a standalone monitor of the type being described here.

The need for this monitor is not only in alerting the EGS user when to start up the EGS. In developing this monitor, I also considered the need to power down the EGS. For instance, after starting the EGS at night, you may desire to return to bed. If utility electricity again becomes available overnight, it would be desirable to know this so that you may deactivate the EGS. Deactivating the EGS would save gasoline, engine wear and eliminate the engine sound. Therefore, I decided that a second desirable feature for the monitor would be to generate a sound when the utility power returns.

With these goals in mind, I developed the monitor shown in Fig 1. In this figure, the piezoelectric buzzer that sounds the alarm is visible on the right side of the front panel, and a toggle switch that turns the unit on or off is visible on the left. Throwing the switch to the "Utility Power On" position prepares the monitor to sound the

alarm when utility power fails. Setting the switch to "Utility Power Off" prepares the monitor to alert the user when the power returns.

Fig. 1. Throwing a switch on the front panel activates the monitor so that it will generate a sound when utility power fails and also when the power returns.

Fig. 2 is the circuit schematic. Note, a plug-in relay was selected, but a relay with solder contacts may be substituted. Given the simplicity of the circuit, there was no need to design a pc board. The circuit was simply constructed on two prototyping boards, also referred to as solderable bread boards (Fig. 3.)

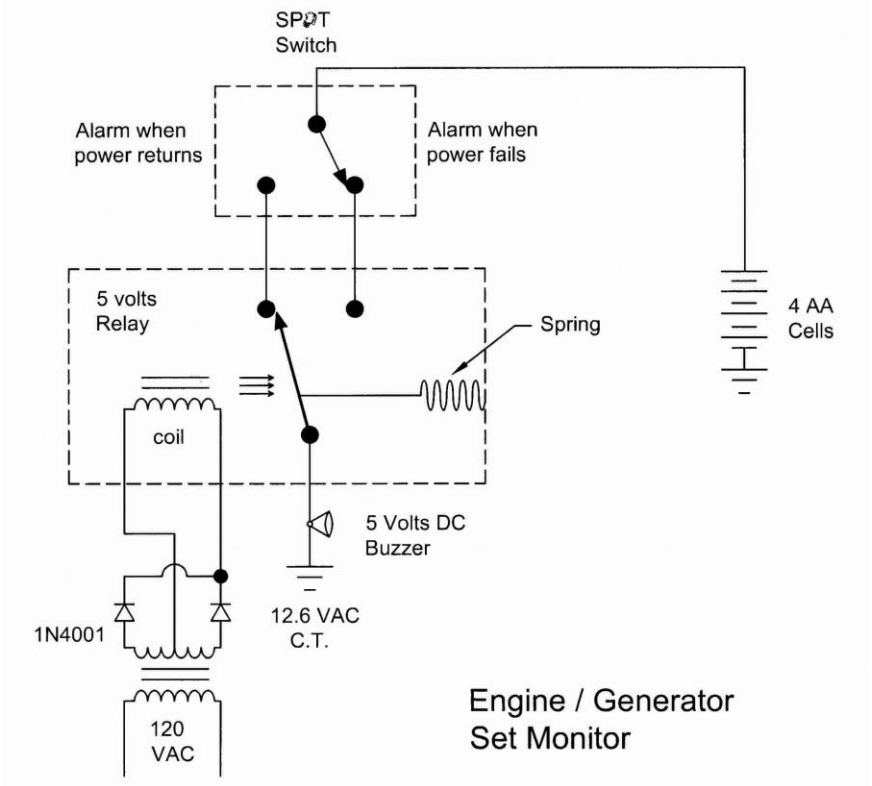

Fig. 2. Schematic of engine/generator set monitor.

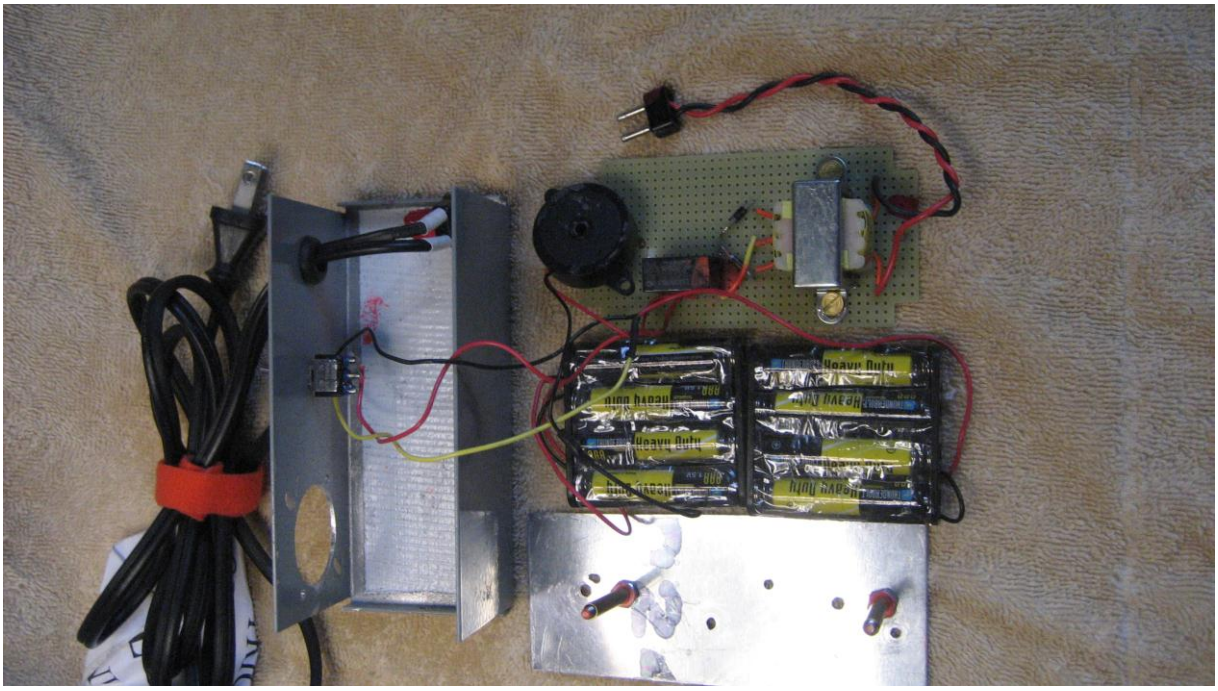

Fig. 3. Internal construction of engine/generator set monitor.

A list of the components used to build this monitor are given in the table. All materials were purchased from a single nationwide electronics distributor, Mouser Electronics. Some other nationwide electronics distributors that may have all of the same or equivalent parts are Digi-Key, Jameco, All Electronics, Newark Electronics, etc.

Table. Parts list for engine/generator set.

Item Description	**Item Part Number**
MILL-MAX 14-pin IC socket	123-13-314-41-0010
Mountain switch	1055-TA1130B-EVX
Omron low signal relay	G6E-134P-ST-US-DC5
Mallory Sonalert buzzer	PL-27N26WQ
Keystone AAA battery holder, 2 pieces	2482
BPS prototyping boards	854-PR1590B
Xicon power transformer, 120 to 12.6 V at 60 mA	41PG006
Bud enclosure, 5 x 2.25 x 2.25 inches	563-CU-3004A
Rubber grommet, 1/2 inch	Various
Batteries (8)	AAA Alkaline
Tubing for spacers, 3/16 inch	K&S Metals
120-V line cord	Various
Rectifier diodes, 2 pieces	1N4001 or 2,3,4
Wire, 24-gauge single and multi-strand	Various

Acknowledgment: Thank you to Oscar Ramsey, who kindly constructed and tested the breadboard and final assembly, and to Colin White, who drew the electrical schematic.

Editor's Note: An abridged version of this article recently appeared in Electrical Contractor Magazine. However, that article omitted various details such as the bill of materials for this project.

About The Author

William J. Rynone, Ph.D, P.E. is the president of Rynone Engineering (REI), which provides consulting for electronics and aviation-related projects. Specifically, this firm provides technical document writing and support for a wide range of professional projects including user and repair manuals for all types of mechanical, technical, scientific, and electronics devices and applications. REI also handles patent disclosures, related documents, and all manner of professional presentations. Prior to his work as a consultant, Rynone held engineering positions with companies such as Burroughs Corp., Dumont Laboratories, and Lockheed Electronics. He has also taught electrical engineering at the U.S. Naval Academy and Johns Hopkins University. Furthermore, Rynone has written extensively on numerous circuit design and aviation topics. He can be reached at 410-263-0794.