What to look for in relays for space applications

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 When NASA’s Curiosity rover made a perfect landing in Gale Crater of Mars, it was 150 million miles from the nearest repairman. Every component has to operate reliably to support the vehicle’s expected operation life of 98 weeks—or one Martian year. Specifying a relay for space obviously involves finding a compact, lightweight device that meets electrical needs.

In selecting relays for space applications, it is important to evaluate how well the device will perform in such harsh environments. Temperature extremes are perhaps the first thing that comes to mind, but temperatures are not the only environmental challenges. The ability to operate in a vacuum, to withstand radiation levels, and to handle different atmospheres are important. Launches of space vehicles present mechanical stresses from vibration and acceleration that must also be factored into the selection process.

Ability to operate in a vacuum. While relays used in space applications are typically hermetically sealed, seals occasionally leak – or are only good for so many years – a concern on a mission with a long life. Relays that rely on oxide layers, which become unstable in a vacuum, will become unreliable if the seals leak.

Cleanroom manufacturing. Even minute particle contamination must be avoided during manufacturing to avoid any inconsistency in relay operation. The relay should be expected to operate perfectly every time. For this reason, rigorous cleaning, handling, and storage processes are imposed in order to confirm that space relay materials, components and subassemblies are fully protected throughout the manufacturing process.

Environmental stress screening. Testing of relays for space applications is typically far more involved than testing for terrestrial uses. Tests such as vibration, temperature cycling and thermal shock, and the like are similar except they typically last longer, with more cycles. Such testing may also include an extended temperature range to reflect the temperature extremes of space. The intention is to

stress-test the device to a greater degree than required for ground or aerospace needs.

Consult with the relay supplier about the types and extent of testing that may be appropriate for your application. The application environment will differ between a communication satellite and the Mars rover, for instance. What's more, the number of operating cycles for the relay may be significantly different depending on its application. For example, a relay used to separate a satellite from the launch vehicle may only need to operate once. A relay that is used in power processing or conditioning, on the other hand, may be required to operate thousands of cycles.

Relays suited to space applications are available with the same forms and ratings as terrestrial relays. The difference lies in choosing those designed, qualified, and manufactured to meet the rigors of a space application.