ELECTRO EXPLOSIVE DEVICE TESTING
MEASURING RF-INDUCED BRIDGEWIRE CURRENTS
IN WEAPONS SYSTEMS

APPLICATION NOTE

The Problem

An electroexplosive device (EED) used in the detonation of explosives must be proven safe and reliable under exposure to an electronmagnetic environment (EME).

The three main problems facing a person testing EEDs within a weapons system are:

1. It is usually beyond the capability of the test system to produce the worst case EME. Therefore, the instrumentation must be capable of measuring currents in the bridgewire well below the maximum allowable (maximum no-fire) EED current.

2. Placing the sensor in the EED should not alter the system being tested.

3. Sensor performance should not be altered by the EME.

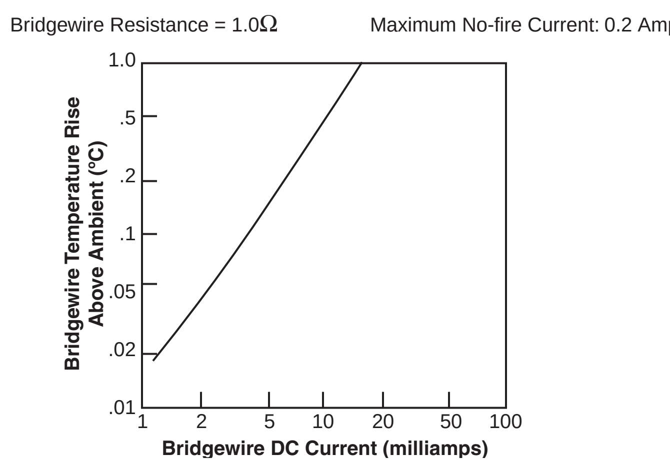
Previously, the standard method of measuring induced bridgewire currents has been to use a thermocouple to sense the temperature rise of the bridgewire caused by the induced current. This electrical technique suffers from the above concerns and limitations.

The Solution

Because of the above concerns, various ordnance and weapons systems companies have recently begun using Luxtron's Fluoroptic® temperature sensing system to measure RF-induced bridgewire currents in EED's. The electrically inert fiberoptic probe neither effects the EME susceptibility of a system under test nor is the measurement effected by the EME. Also, the probes have a negligible thermal conductivity. The Fluoroptic® temperature sensing system has a relatively broad dynamic range, thus, safety validation of critical EEDs is possible with a radiation power much lower than the real environment.

Two methods are used to sense temperatures with the Luxtron system. One method is to use a soft-tipped surface temperature probe (phosphor on probe tip) in direct contact with the bridgewire. The second method is to coat the bridgewire with the phosphor and to point the open end of an optical fiber at the bridgewire to view its entire coated length. (For more information on these two methods, see Tech Notes TN 86-6, TN 86-7, and TN 86-8).

The Luxtron system can easily sense less than 100 microwatts of power dissipation in an EED bridgewire. One user was able to measure down to 7 microwatts by using the bridgewire contact method and packing the EED with an inert material with thermal properties similar to those of the charge. This method more accurately simulates the thermal characteristics of a real EED. In recent experiments at Luxtron, power levels approaching 1 microwatt have been measured (see Figure).



LOG-LOG Plot of Bridgewire Current Vs. Temperature Rise.

Reference

M.W. Shores, "Improved Technique for Measuring Induced Bridgewire Current," Symposium Record, International Symposium on Electromagnetic Compatability, IEEE, pp. 37-42, (1986).

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