Technique	Incorporate modular, fault tolerant power switching devices in new system designs and system upgrades. Specify application in system/ equipment specifications, requirements documents, and design policies and practices.

MODULAR AUTOMATED POWER SWITCHING DEVICE

Use modular, automated, fault tolerant power switching devices to enhance maintenance procedures

Benefits	Miniaturizing of conventional electronic components and assembling them in convenient groupings provides the following benefits: • More efficient base of maintenance can be achieved. • Logistics support requirements (materials, parts, etc.) are reduced by stocking modules as opposed to piece parts. • Keeping modules at lowest level of maintenance (throw-away) will minimize the requirements for sophisticated test equipment and highly skilled technicians. • Modular design will result in improved fault detection by isolating the problem at the module level instead of at the piece part level. • Module design can be sized to accommodate various loads. • Sealed modules provide increased environmental protection.
Key Words	Power, Switching, Modular
Application Experience	National Space Transportation System
Technical Rationale	Incorporation of the technique will achieve the goal of avoiding high maintenance costs from premature failure of hardware due to moisture or sand intrusion and other severe environmental conditions. Shuttle program operations around the world have shown that this switchover device has been extremely reliable even under conditions that are normally detrimental to electrical equipment.
Contact Center	Kennedy Space Center (KSC)

Modular Automated Power Switching Device
Technique OPS-10

This technique recommends providing modular, single-fault tolerant, power switching devices that enhance ease of maintenance and expedite system restoration.

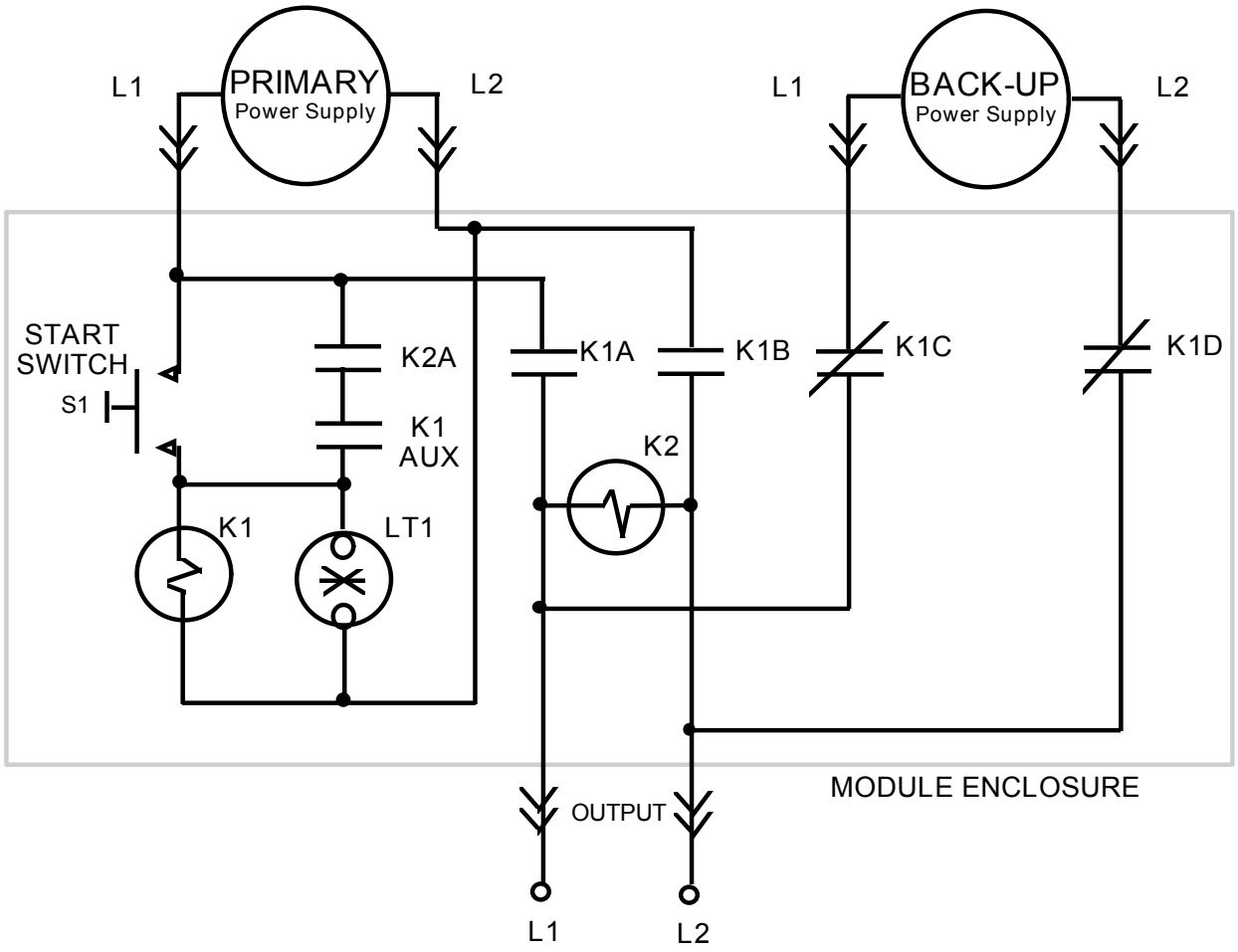
Application
The design of lighted visual Landing Aids presently installed at several Space Shuttle landing sites around the world specified that the Ball/Bar lights for the Inner Glideslope must be powered by a primary and backup power source with automatic switchover in the event of primary source failure. The Reliability/Maintainability Engineers had to ensure the system would not prematurely fail and that the switchover mechanism was relatively inexpensive, self-contained, and easy to install/maintain. As a result of this effort, the modularized automated power switching device was developed and implemented (see Figure 1).

Failure to utilize this technique could result in excessive cost if commercial Automatic Transfer Switches are utilized instead. The Ball/Bar light system is critical to Shuttle landing operations. These systems must be up and operational prior to a Launch Commit decision. Failure prior to launch could result in a very costly delay to the Shuttle program.

References

1. NSTS 07700, Vol. X, Space Shuttle Flight & Ground System Specification, Rev. J, June 14, 1990.

2. KSC Drawing No. 80K52361, Automatic Transfer Switch Wiring Diagram for Ball/Bar Lights.



- IF K1A OR K1B FAILS OPEN - K2 DROPS OUT CAUSING THE BACK-UP POWER SUPPLY TO COME ON LINE.
- IF THE PRIMARY POWER SUPPLY FAILS - K2 DROPS OUT CAUSING THE BACK-UP POWER SUPPLY TO COME ON LINE.
- S1 IS USED TO SUPPLY THE PRIMARY LINES AND IS ALSO USED TO BY-PASS K2A & K1 AUX TO ACTIVATE AND LOCK ON K1.

Figure 1. Modularized Automatic Power Source Switching Device