Standex DETECT Electronics

THE UNSEEN STRENGTH: HIGH-VOLTAGE REED RELAYS FOR CRITICAL TESTING

Reed Relays are Key Enablers in Precision, Reliability & Safety

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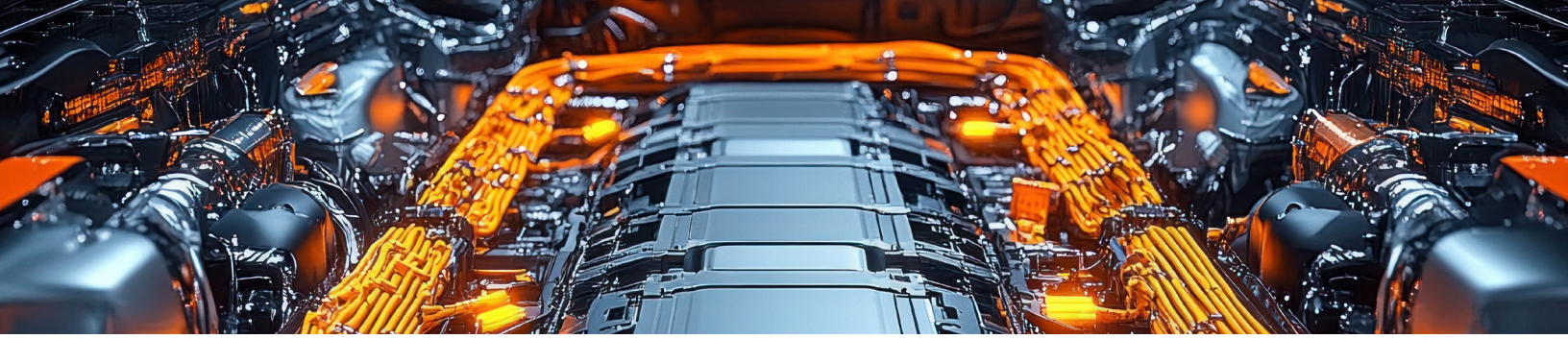
High-Voltage Cable Testers Demands Reliable Switching

High voltage testing is a critical process for ensuring the reliability, safety, and longevity of electronic systems and components. Reed relays are specifically engineered to meet the stringent demands of such applications, offering key characteristics such as very high isolation voltage and insulation resistance—both across the open contacts and between the coil and contact. Furthermore, reed relays provide very low ON resistance, low capacitance and the ability to reliably switch loads ranging from micro to high levels. These capabilities are essential for enabling measurements that span several orders of magnitude, from nanovolts to kilovolts and femtoamps to amps.

Check out the full list of Standex's testing and certifications:

- AEC-Q200
- IEC 60810-4
- IEC 60601-1
- IEC 62109-1/2
- IEC 60664-1
- ISO 6469-3
- IEC 60255-27
- UL listed
- RoHS, REACH



Focus Application: Cable Testers or Electronic Harness Testers

In modern vehicles, especially EVs, cable harnesses carry high-voltage power and signals across complex systems. Even minor defects—like insulation damage or partial breaks—can compromise safety and performance. High-voltage cable testers are essential for detecting such faults and ensuring the reliability of automotive electrical systems.

Designers of these testers frequently implement a matrix of high voltage reed relays to precisely test each wire against all other wires.

1. **High Voltage Testing for Shorts:** Reed relays are critical in applying thousands of volts (e.g., up to 10 kVDC switching and 15 - 20 kVDC standoff voltage across contacts) to identify potential cable shorts. This test method of "each wire to all other wires", also known as "matrix scanning", with high voltage is a standard practice to detect shorts or weak insulation that a low-voltage methods could miss.
2. **High Current Testing for Partial Breaks:** Additionally, these relays can facilitate the application of high current through the wires (e.g., up to 5 amps on a continuous 100% basis, with even higher short-duration pulsed currents possible) to detect partially cut wires, which could otherwise lead to complete breaks and catastrophic failures.

For a particularly challenging test and measurement application that required a compact high voltage relay (5 kV AC / 7kV peak withstand) in a small package for testing insulation characteristics and partial discharge, a unique solution was developed. This involves a new reed relay design **(MRE Series)** with two reed switches internally connected in series, achieving the required performance while maintaining a compact size of 30 mm x 10 mm assembly area. This internal series connection of switches, typically not offered by other suppliers, makes the relay more robust and easier to integrate into designs where the high voltage isolation and creepage distance requirements, together with space constraints is a concern on the circuit board.

Key Features for Cable Testing

1. **High Voltage Capability:** High voltage reed relays can switch up to 10,000 volts and withstand up to 15,000 volts across their contacts. Certain series, such as the H, HE, and HM, can switch up to 10 kVDC and provide up to 20 kVDC isolation. Relays can also hold off 15,000 volts between the switch and the coil.

2. **High Current Capability:** These relays are capable of carrying high currents up to 5 amps continuously (100% duty cycle), with short-duration pulsed currents potentially even higher. For example, the HE/HM series can carry up to 5 Amps continuously and 10 Amps for several milliseconds. Some use cases proved that for the microsecond range the pulsed current can go even up to higher tens or lower hundreds of amperes.

3. **High Insulation Resistance:** They feature high insulation resistance, typically greater than 10^13 Ohms (10 TOhm), customized relay can reach even above 500 TOhm insulation resistance.

4. **Reliability and Longevity:** Reed relay matrices are reliably used in cable testers and are capable of several hundred million operations for cold switching. They operate reliably across a wide temperature range and offer an economical solution for performing switching operations.

5. **Robustness:** Reed relays utilize hermetically sealed reed switches which are further packaged in strong, high-strength resin and plastic, ensuring reliability even when subjected to various environments.

6. **Multiple Configurations:** They are available in various packages and pin configurations, allowing for multiple switches (normally open and normally closed contacts) and high voltage lead wire for 'sky wiring'.

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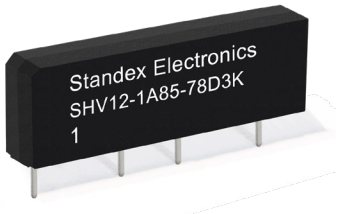
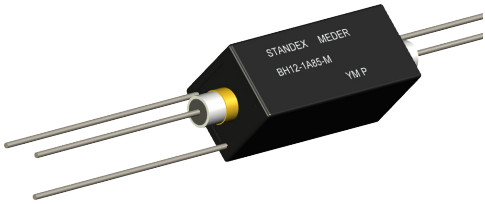
Overall High Voltage Testing Capabilities

Beyond cable testers, reed relays are integral to a wide array of high voltage test and measurement applications, enabling measurements that cover several orders of magnitude, from nanovolts to kilovolts and femtoamps to amps.

1. **Broad Voltage Range:** Switching voltages are available up to 10 kVDC, with breakdown voltages and dielectric strength extending up to 15 kVDC. For instance, the KT Series are surface mount reed relays that switch voltages up to 1.5 kVDC and provide high isolation up to 7 kVDC. The BH series can switch up to 1 kVDC and offers a breakdown voltage of 3 kVDC and low leakage currents across open contacts. The LI, SHV, and BE series provide high breakdown voltage up to 4 kVDC and switching up to 1 kVDC, suitable for closely stacked matrices. The SHV series specifically is ideal for high density assembly while maintain great high voltage performance.
2. **Current Handling:** Reed relays are capable of switching currents up to 3 A and carrying currents up to 5 A continuously, with pulsed currents up to 10 A.
3. **Exceptional Isolation:** They provide perfect isolation between the control and load circuit. High Insulation Resistance can exceed 10^15 Ω. The BH series specifically features high IR up to 10 TOhm (10^13 Ω) across open contacts and contact to coil. The LI and KT series also boast high IR greater than 10^13 Ω. This high insulation resistance results in very low leakage current, typically in the picoamp range.





4. **Low Thermal Offset Voltage:** Critical for precise measurements, special BT relays offer low thermal offset voltage of less than 1µV.

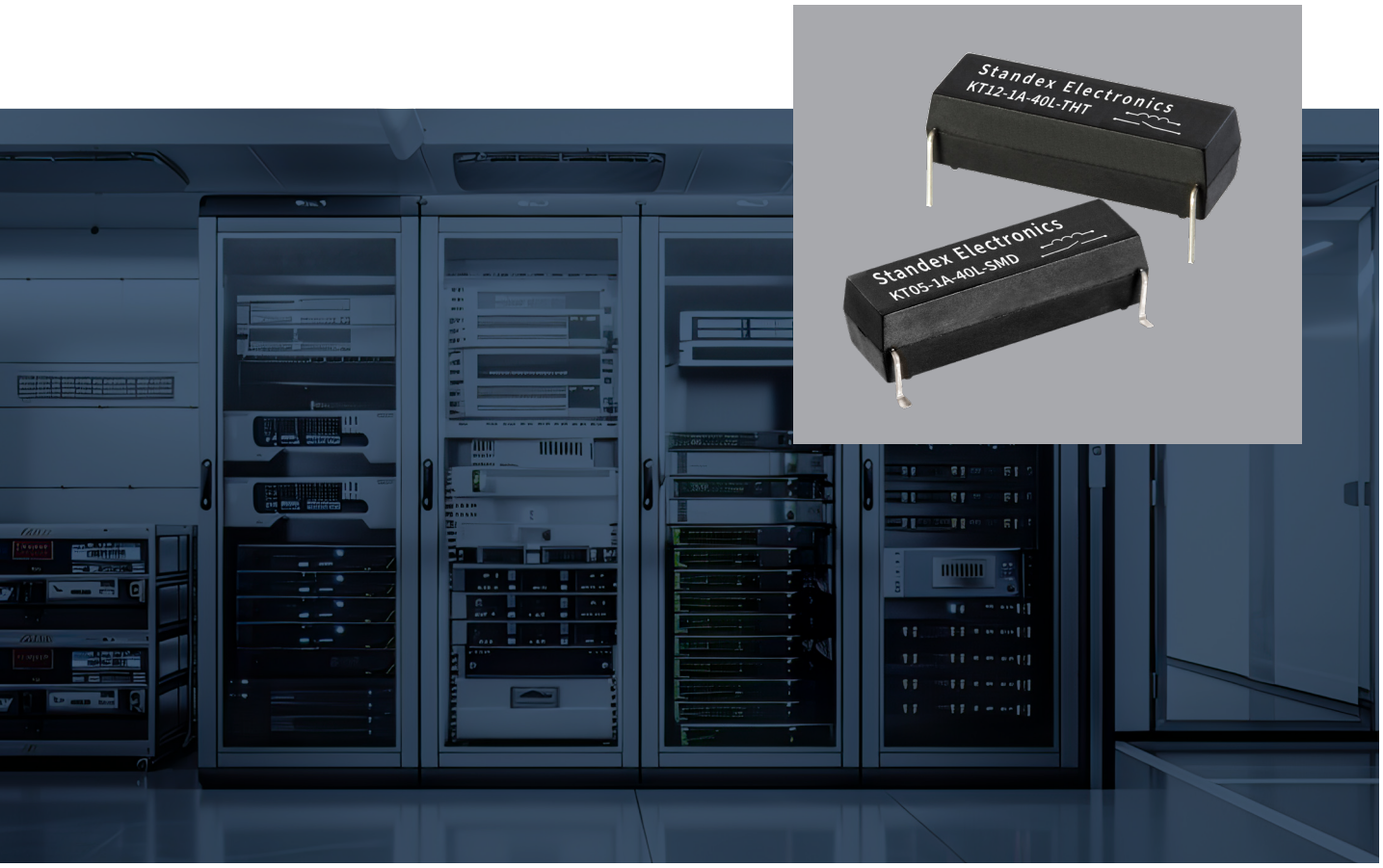
5. **Fast Operation:** Operate times are typically in the 500 µs to 1 ms range.

6. **Hermetically Sealed Switches:** The hermetically sealed switches, often with potted encapsulation or rugged thermoset molding, ensure reliability across a wide temperature range and suitability for various environments, including dusty or potentially explosive atmospheres, by being fundamentally safe.

7. **High-Density Applications:** Many series, including CRR, SIL, MS, UMS, RM, MF, MFS and SHV, are designed for large and closely stacked switching matrices.

8. **Optocouplers:** For specific High Isolation and Intrinsically Safe (ATEX & IECEx) applications, optocouplers are available to galvanically isolate low-voltage devices from high-voltage circuits.

Reed relays offer superior functionality, longevity, and reliability for demanding high voltage test and measurement applications. Their versatility allows for customized solutions to meet unique switching and sensing requirements.



Decades of High-Voltage Testing Expertise

For over 50 years, Standex has partnered closely with customers to develop and refine relay solutions for next-generation high-voltage test systems. These collaborations result in tailored designs that meet exact specifications while maintaining cost-efficiency and reliability through minimal deviation from standard parts.

Standex's high-voltage reed relays are key enablers in advanced test and measurement platforms, where precision, durability, and safety are critical. As testing demands grow more complex, the reliability of high-voltage switching and protection systems becomes increasingly vital.

Standex's Commitment to Innovation

The success of our customer's projects has driven continued innovation at Standex. We are now developing advanced high-voltage reed relays to meet the growing demands of test and measurement applications. These next-generation components are designed to handle higher voltages and currents, enabling more robust and precise testing capabilities across a range of industries.

By partnering with Standex, customers gain not only a reliable solution for today's high-voltage testing needs but also a forward-looking partner committed to advancing switching and control technologies. As your testing requirements evolve, Standex will be ready with cutting-edge solutions to meet new challenges.

To learn more about how Standex Electronics can support your high-voltage test and measurement projects with custom magnetics and sensor solutions, visit **standexdetect.com** or contact our engineering team to discuss your specific application needs.

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