Standex Electronics

Reed Relays Overview

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Introduction

Purpose

- Explore the Reed Relay technology

Objectives

- Define key terms
- Describe the reed relay's structure and function
- Describe the applications where reed relays are used

Key Terms

Coil

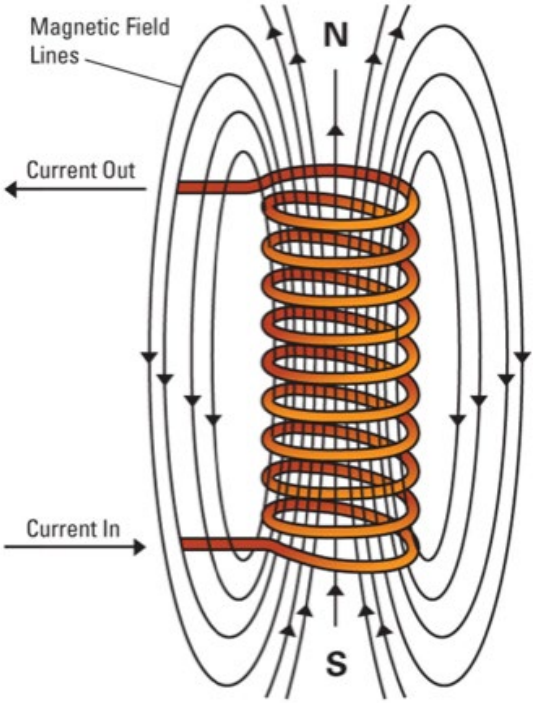
- Many turns of copper insulated wire
- When a current is applied to the coil, a magnetic field is generated
- When energized, its magnetic field operates the contacts

Operation

- The process of closing the reed switch contacts

Deactivation

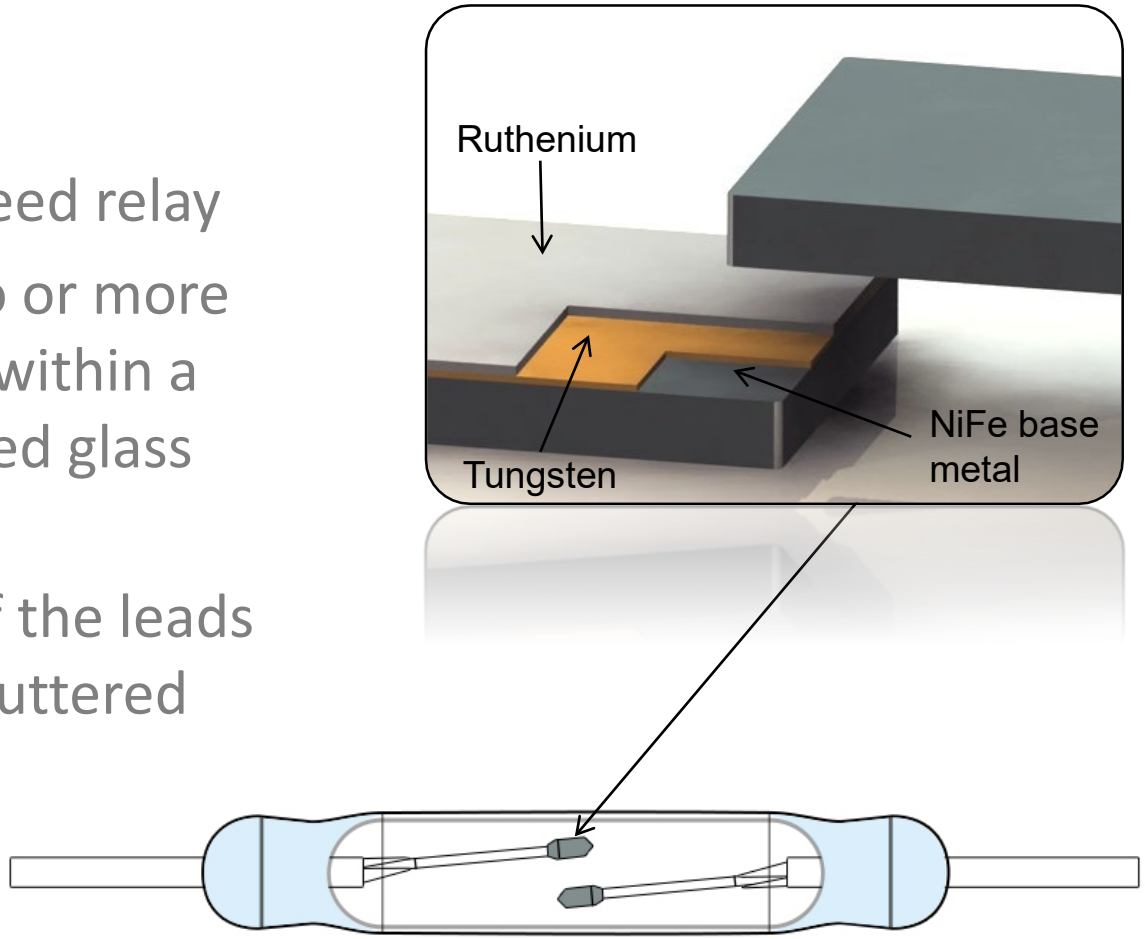
- The process of opening the contacts



Key Terms

The Reed Switch

- The ‘heart’ of a reed relay
- Composed of two or more nickel/iron leads within a hermetically sealed glass envelope.
- The inner ends of the leads have plated or sputtered metallization



Reed Switch

Key Terms

Pull-in and Drop-out voltage

- The pull-in voltage is that point where the contacts close; the dropout voltage is that point where the contacts open

Coil resistance

- The resistance of the copper wire making up the coil.

Hysteresis

- Is the ratio of the drop-out voltage and the pull-in voltage (drop-out/pull-in)

Switching voltage

- The maximum voltage capable of being safely switched

Key Terms

Breakdown voltage

- The minimum voltage which assures no voltage breakdown or arc-over will not occur.

Insulation resistance

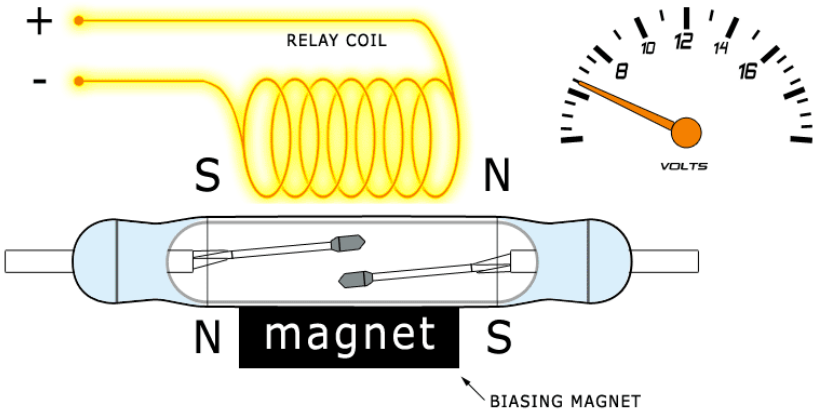
- Is the resistance across the contacts and/or the resistance between the coil and the contacts

Dynamic contact resistance

- The method of testing the reed switch dynamically.

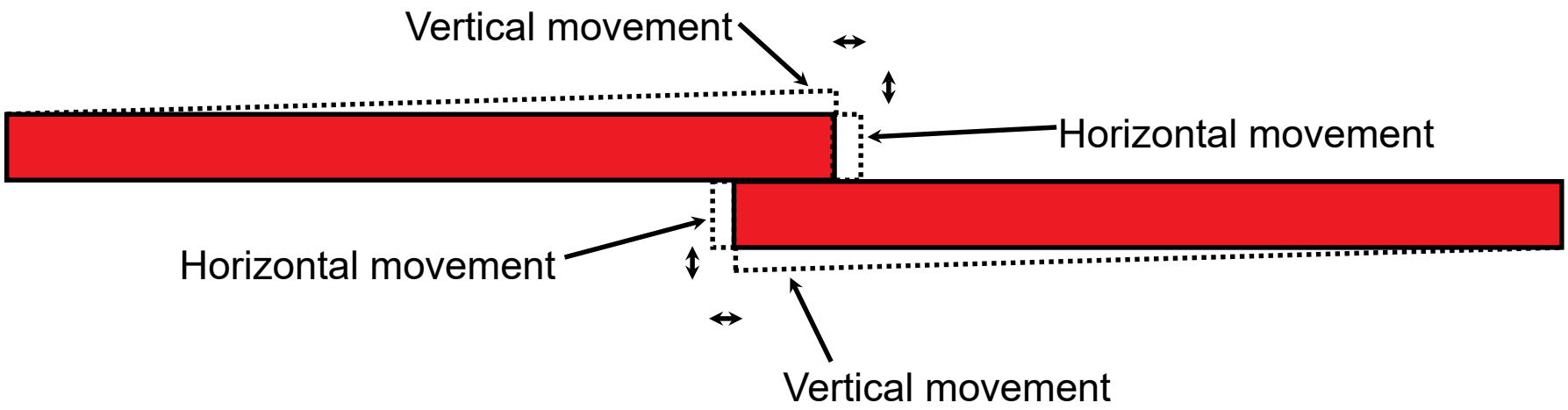
Dynamic Contact Resistance (DCR)

- Contacts are shown in the open state
- When the reed contacts close, they do so with a certain momentum. That momentum makes the reeds vibrate in a simple critically damped harmonic motion
- Critically damped harmonic motion is an important concept in our DCR testing
- The frequency of the harmonic motion is determined from the geometry of the reed switch



Reed Switch Movement After Closure

› Contact movement after closure is shown



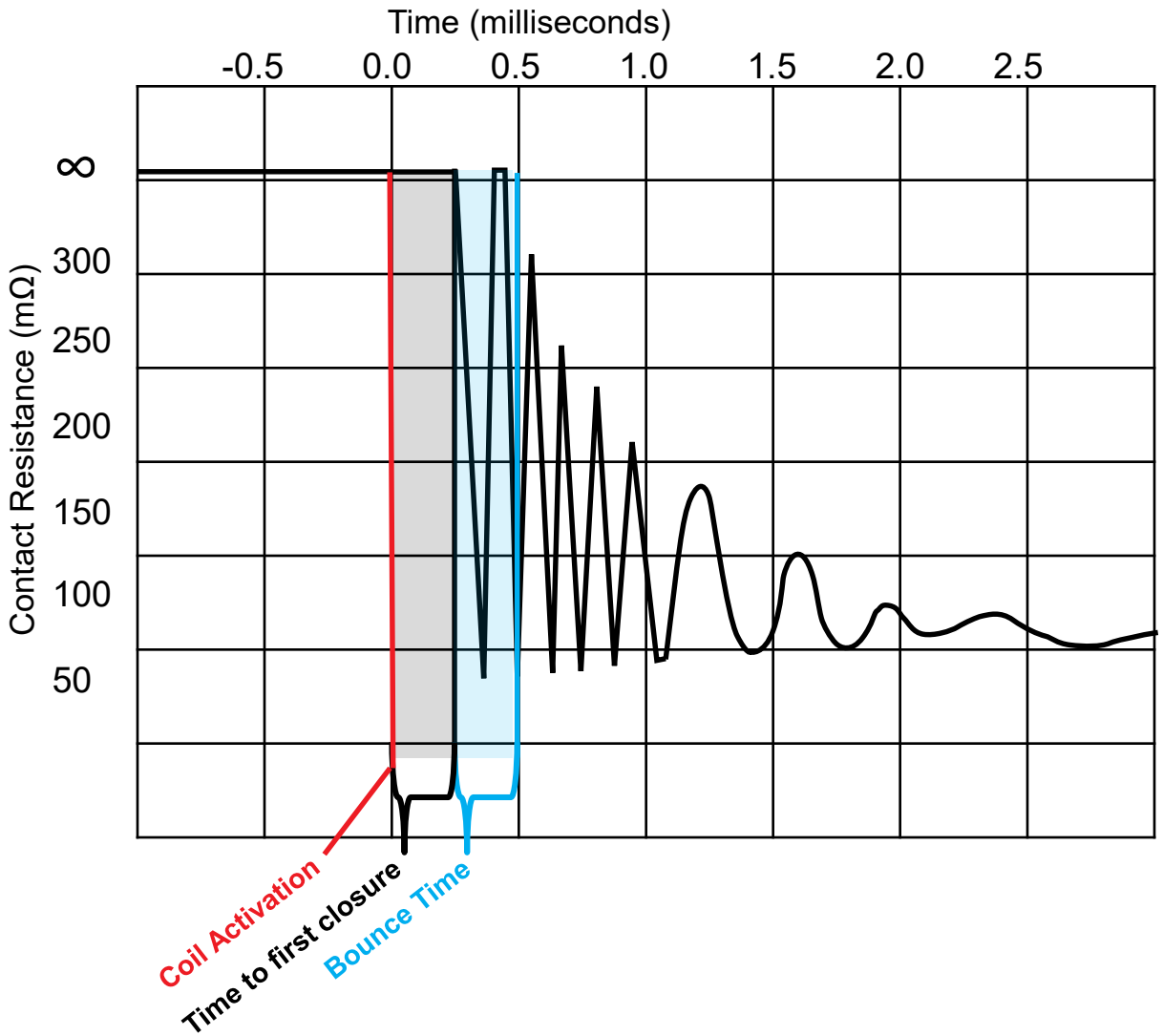
DCR Parameters

- This movement is occurring in the magnetic field generated by the coil
- When a metal is in motion in a magnetic field a current will be induced in the metal
- This current is a critical part of the measurement of our Dynamic Contact Resistance

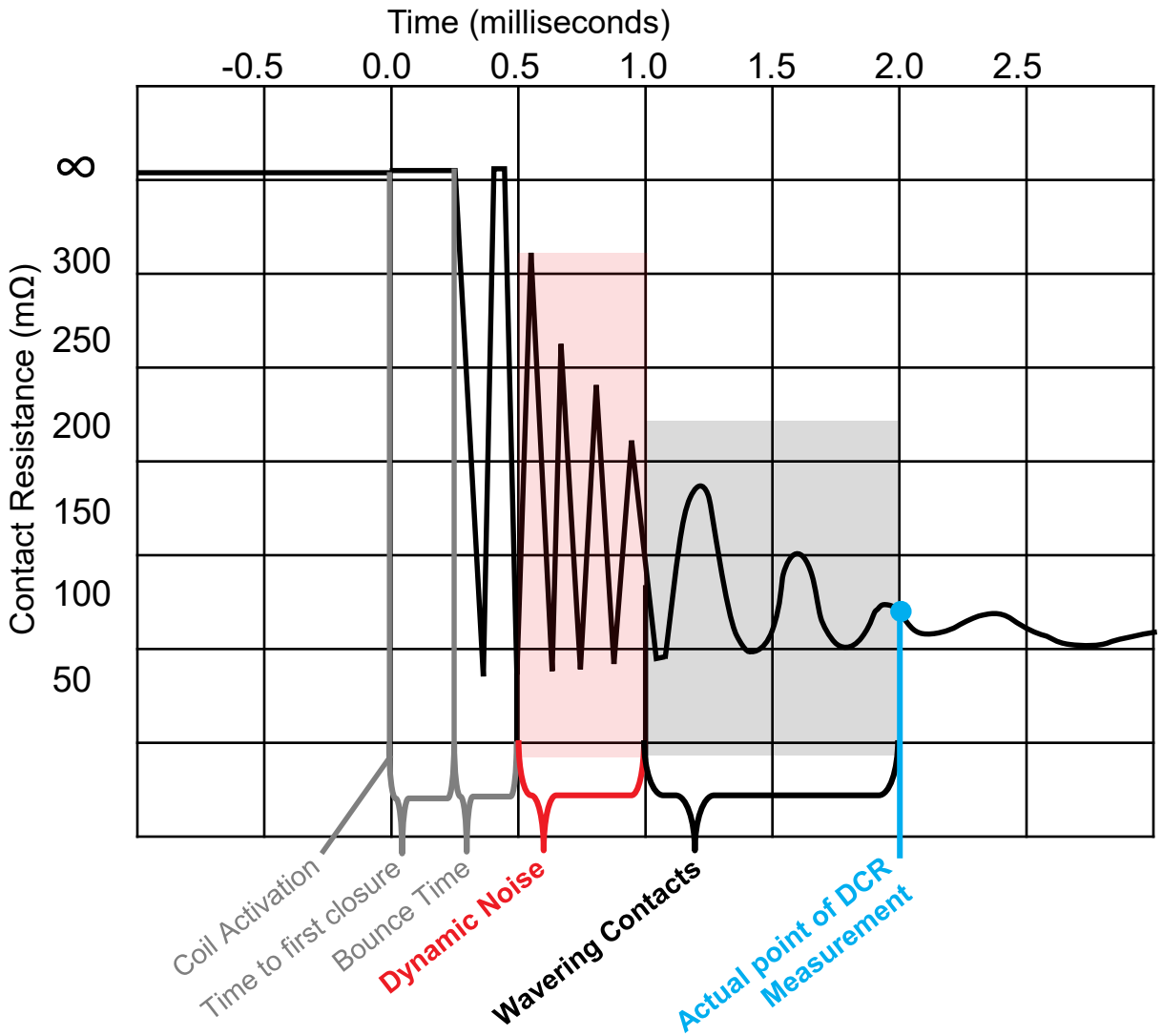
DCR Testing

- Voltage is applied to the coil 100 times per second
- Operating at these speeds the mechanical dynamics are being pushed to their upper limits
- The DCR is like an electrical microscope looking at the mechanical system
- The DCR will expose any flaws in the mechanical system

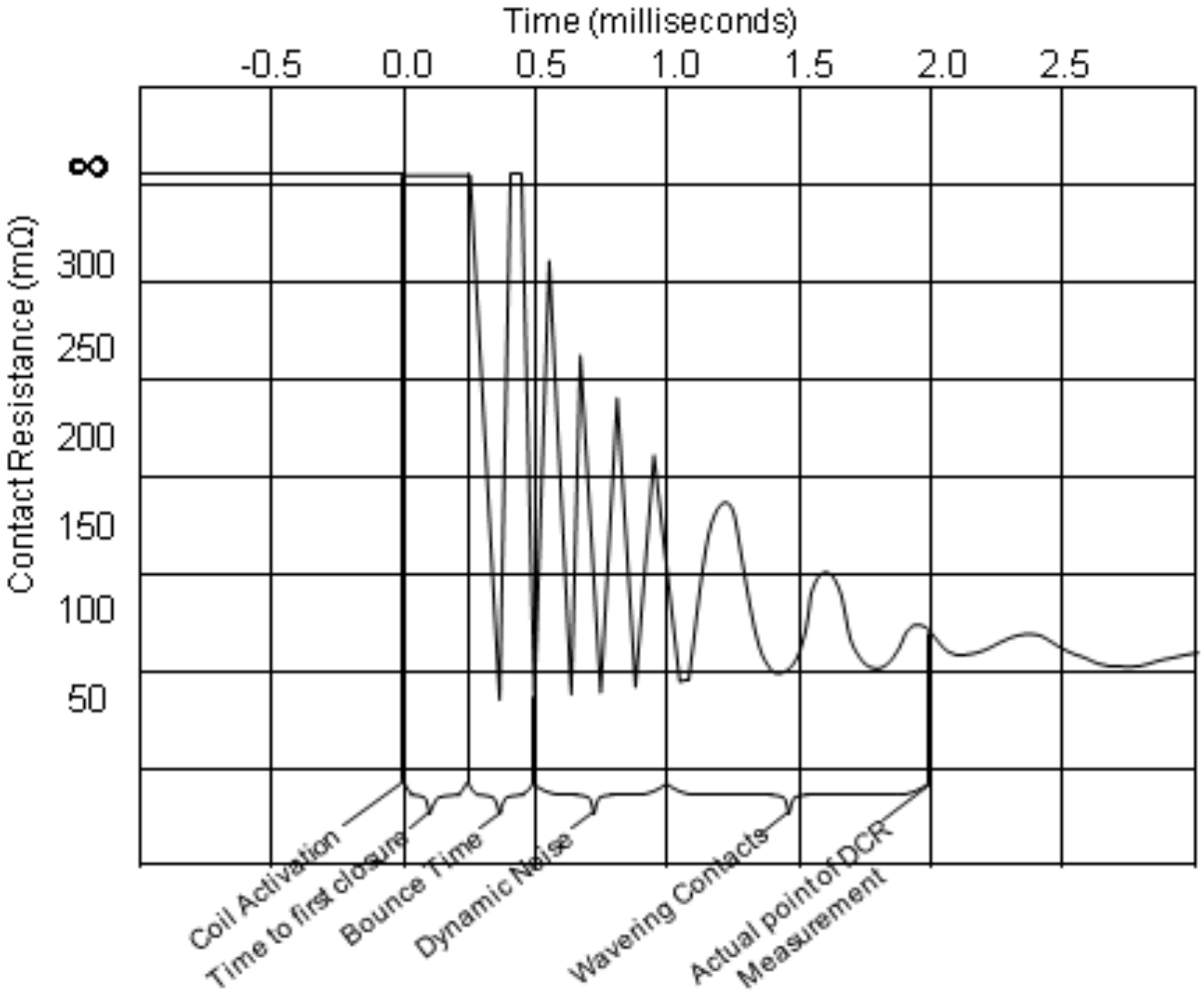
Dynamic Contact Resistance



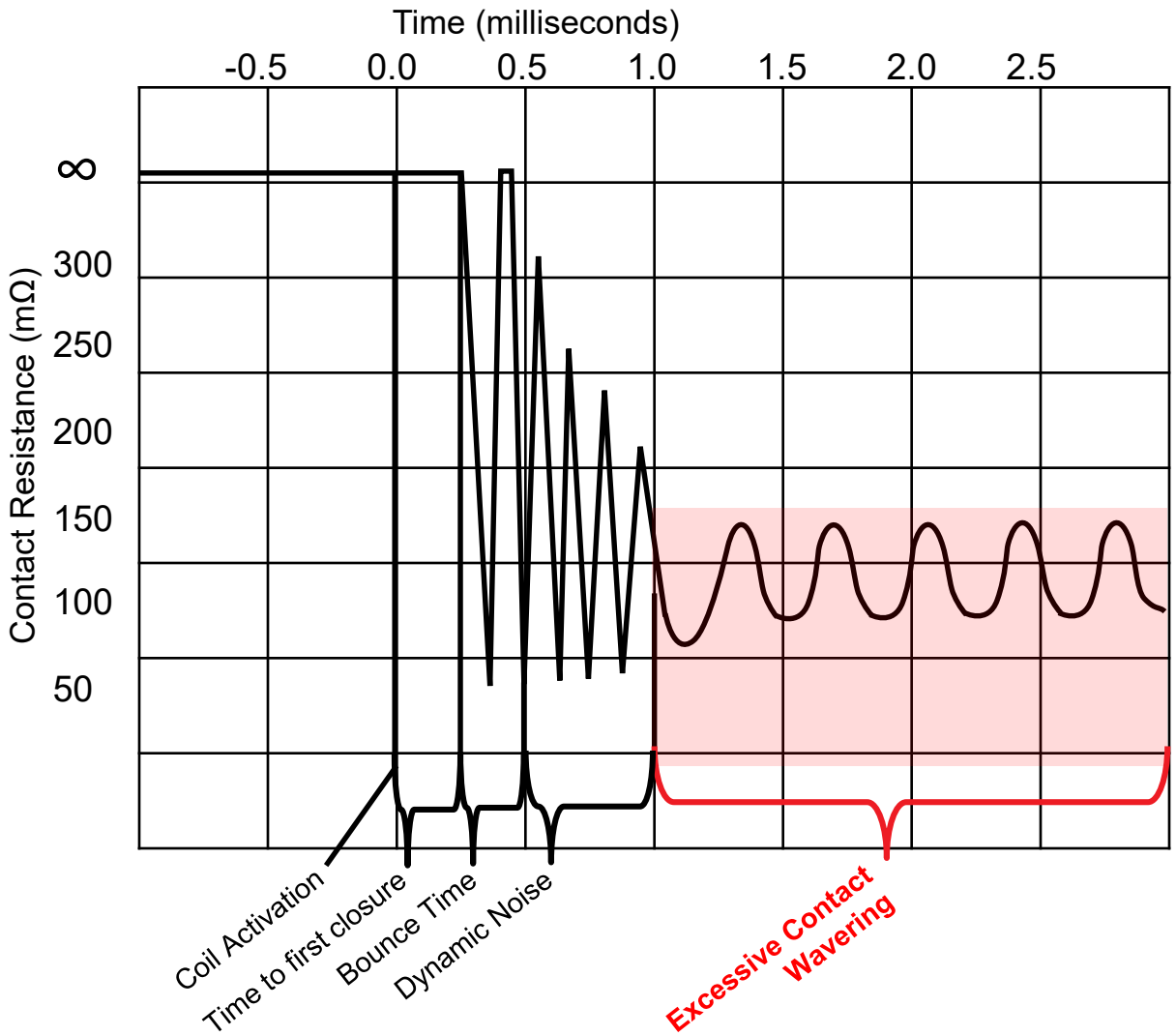
Dynamic Contact Resistance



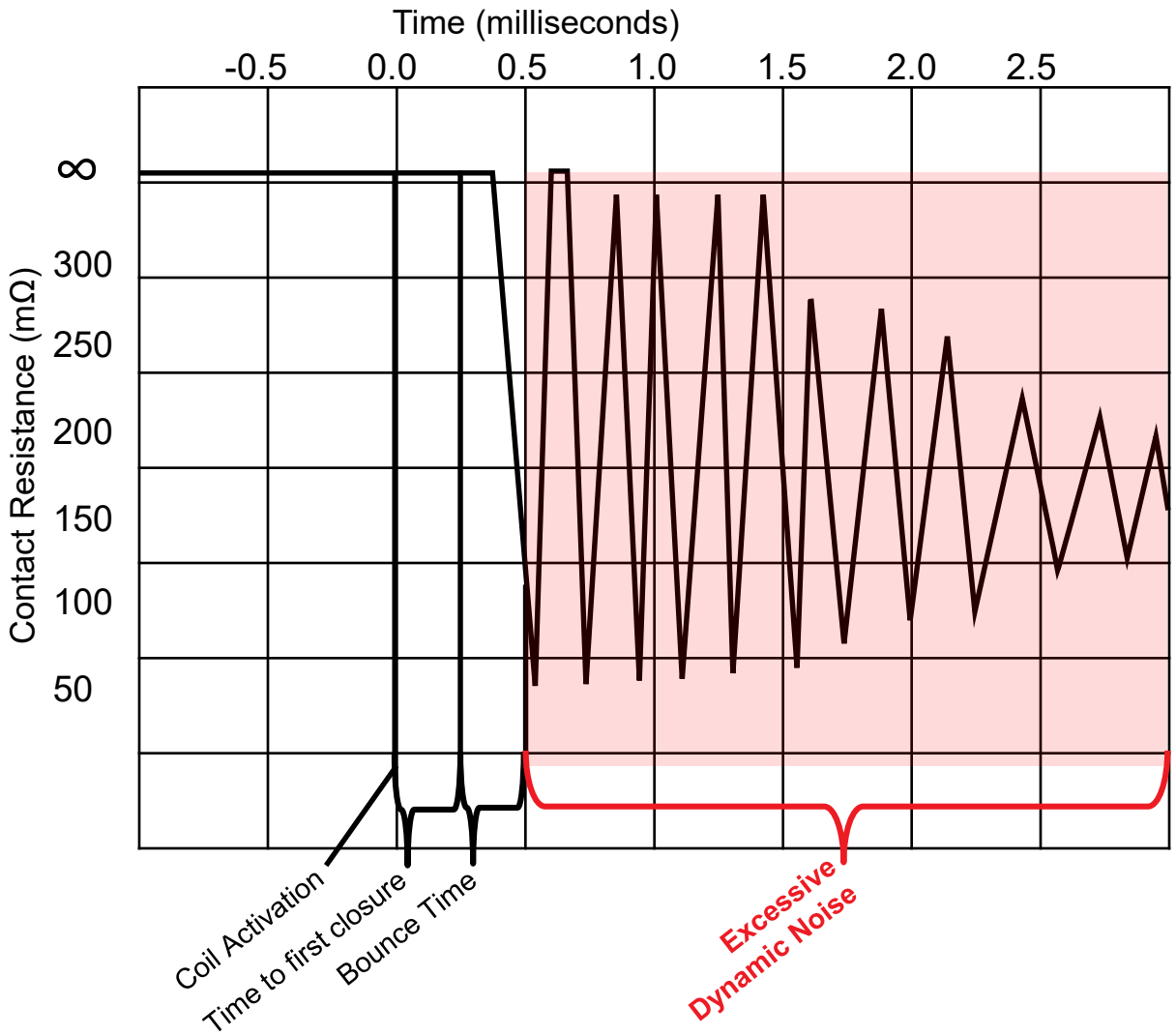
Dynamic Contact Resistance



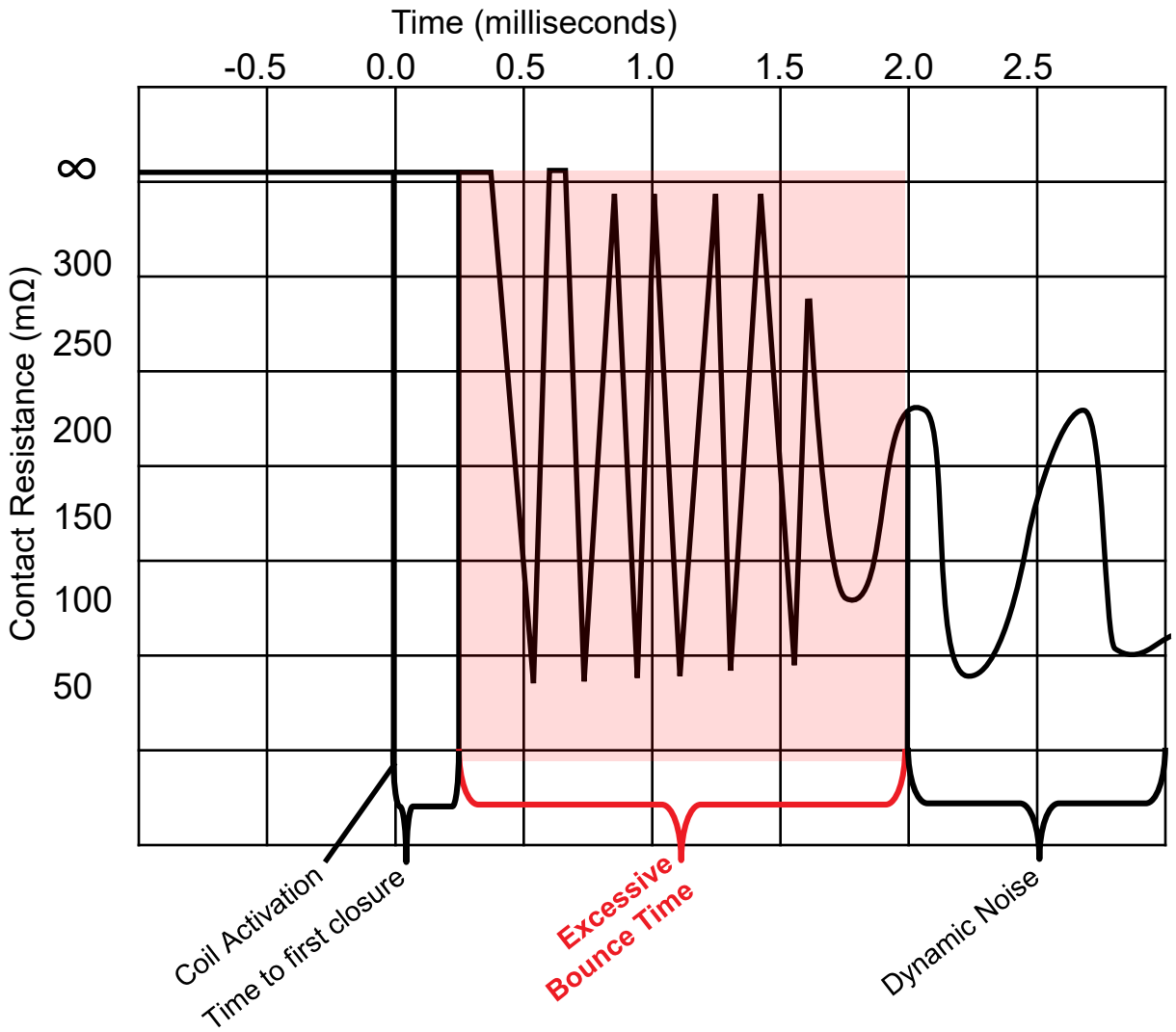
Excessive Contact Wavering



Excessive Dynamic Noise



Excessive Bounce Time

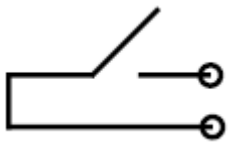


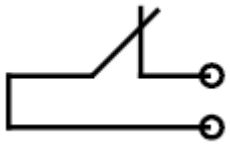
DCR Summary

- Any net force on the reed switch capsule can shorten the life of the reed relay.
- Any slight crack on the glass capsule will drastically reduce life.
- Not testing a reed relay for DCR may result in shortened life in the customer's electronic equipment.

Reed Relay Types

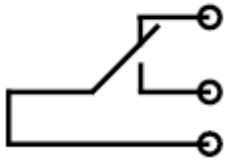
Types	Definition
Contact, Form A	A single pole single throw (SPST) normally open (N.O.) switch
Contact, Form B	A single pole single throw (SPST) normally closed (N.C.) switch





Reed Relay Types

Types	Definition
Contact, Form C	Consists of three reed blades. A normal open contact (NO), A normally closed (NC), and a common contact (C). Also called a single pole double throw (SPDT)
Contact, Form E (Latching Relay)	A relay that maintains its contacts in the last assumed position without coil energization. To change the state of the contacts, the magnetic field must be reversed.



Reed Relays Characteristics

- Capable of switching into the Billions of operations
- The only technology capable of switching zero voltage and current
- Capable of switching up to 15,000 volts

Reed Relays Characteristics

- Only 100 fempto-farads across the open contacts
- Insulation resistance greater than 10 tera-ohms.
- Contact resistance typically 50 milli-ohms

Reed Relays Characteristics

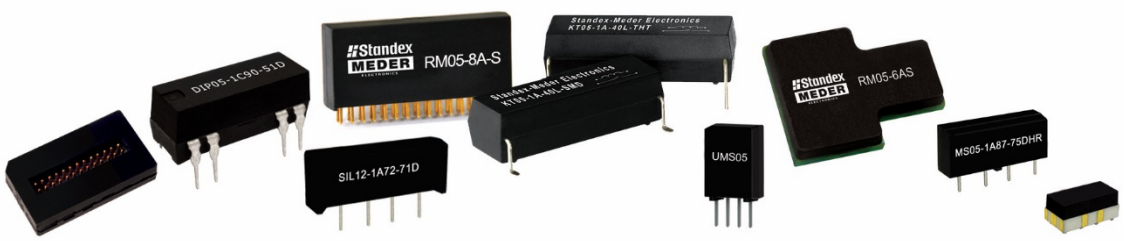
- Very high pulsed currents up to 25 amps possible
- Capable of carrying signals up to 20 GHz
- Capable of operating under 100 micro-seconds
- Capable of operating in temperature extremes from -55°C to 100°C

Reed Relays Characteristics

- Very small sizes as well as surface mounting available
- Large assortment of package sizes
- UL, CSA, VDE, etc. listed reed relays

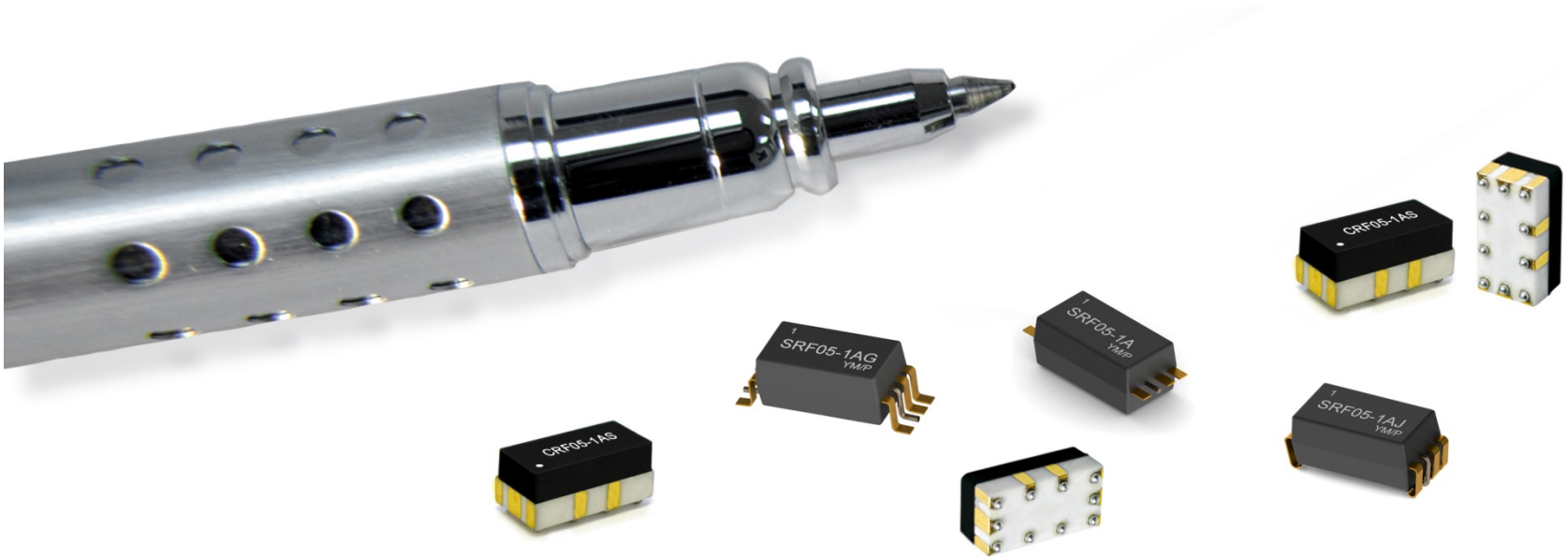
Automated Test Equipment (ATE)

Applications	Characteristics
• Automotive Diagnostic Test Systems • Functional PCB tester • Integrated circuit tester • Memory and VLSI tester • Printed circuit board (PCB) tester • Wafer testers	• High frequency path • Ability to handle fast digital pulses • 50 Ω impedance • High signal isolation > 1 TΩ • Capacitance < 0.1 pico-farads



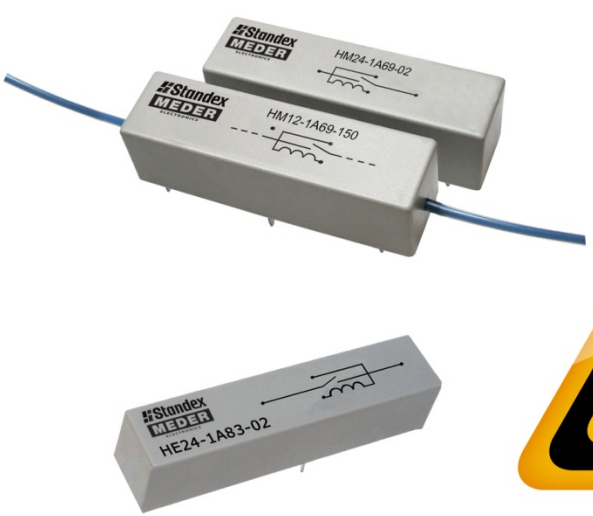
Automated Test Equipment (ATE)

Applications	Characteristics
• Discrete semiconductor testers • Power component testers	• Very small size • Surface mount



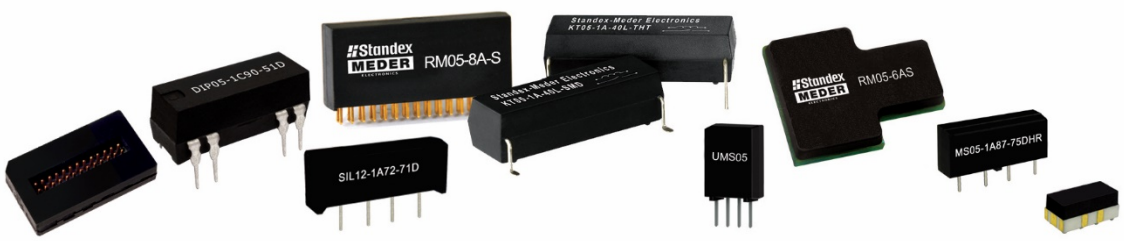
Automated Test Equipment (ATE)

Applications	Characteristics
• Cable testers	• Very high switching voltage > 10kV • Very high voltage isolation > 15kV • High pulsed currents > 40 amps



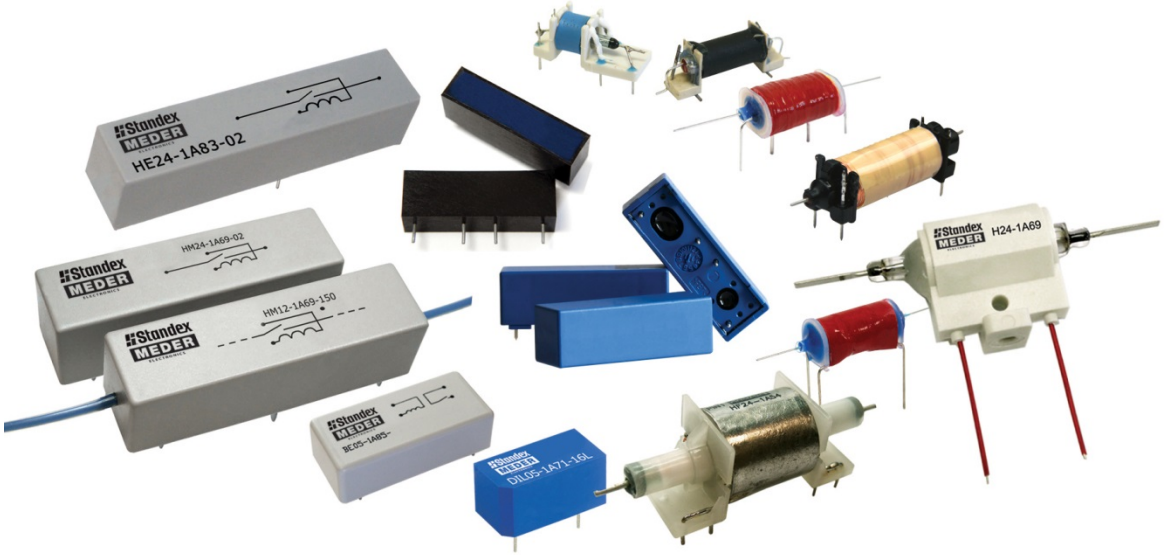
Instrumentation

Applications	Characteristics
• Data acquisition testing • Electrometers • Printers • Medical cauterizing generators • Medical test systems • Multimeters • RF switching and transmitting • Scanners/Multiplexers	• Ability to switch and carry very low voltages < 10 nano-volts • Carry 10 Amps on a continuous basis at 2 MHz • Ability to discern signal levels < 1 pico-amp



Telecommunications

Applications	Characteristics
• Modems • AC Line switching and Line sensing • Pager Transmit/Receive switching • Cellular antenna switching	• Ability to switch millions of operations • Ability to switch the AC Line • Ability to switch digital signals in the 1-5 GHz in transmit/receive circuits



Other Reed Relay Applications

Applications	Characteristics
• Security • Battery powered instrumentation • Industrial and Robotics • Explosion proof or intrinsic safety circuit applications	• Capable of switching into the billions of operations • The only technology capable of switching zero voltage and current • Only 100 fempto-farads across the open contacts • Insulation resistance > 10 TΩ • Contact resistance typically 50 mΩ

Summary

- Hermetically sealed reed relays are used where other technologies simply don’t meet the requirements
- The reed relay’s isolation and ability to handle fast digital pulses
- Proper reed relay dynamic testing insures long life

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