





Reed Relays Overview

Product Training Module



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

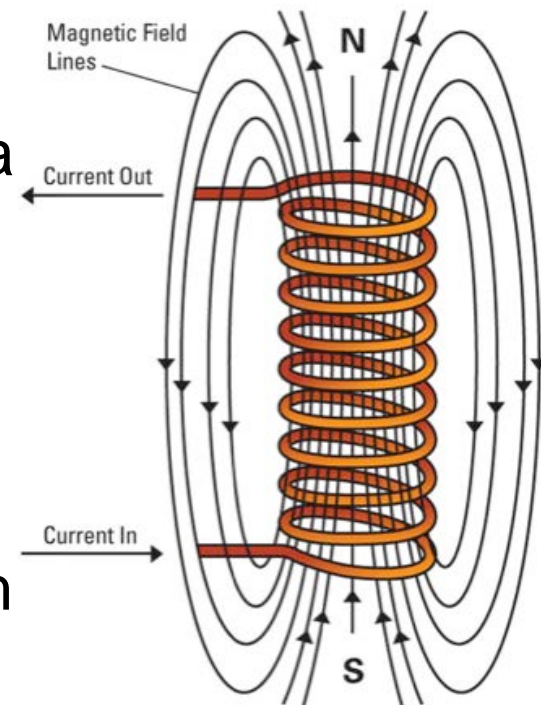
- Made up of many turns of copper insulated wire
- When a current is applied to the coil, a magnetic field is generated
- When energized, its magnetic field operates the contacts

Operation

- The process of closing the reed switch contacts

Deactivation

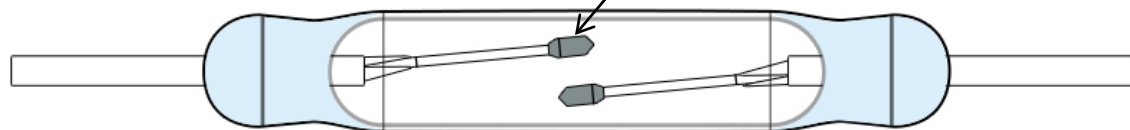
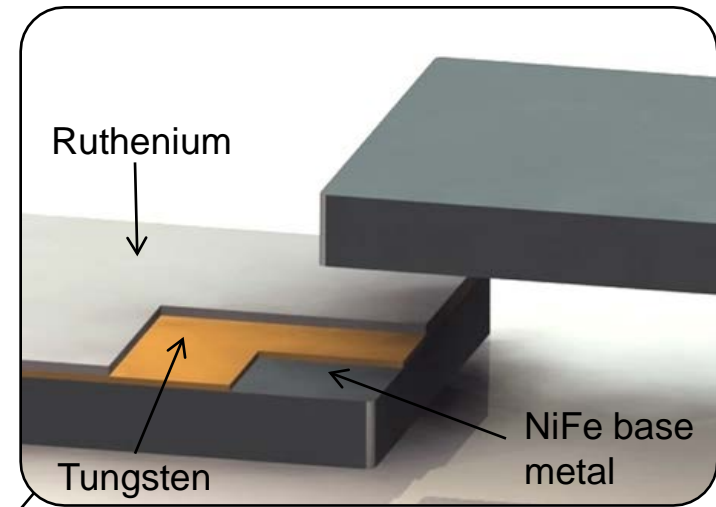
- The process of opening the contacts



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

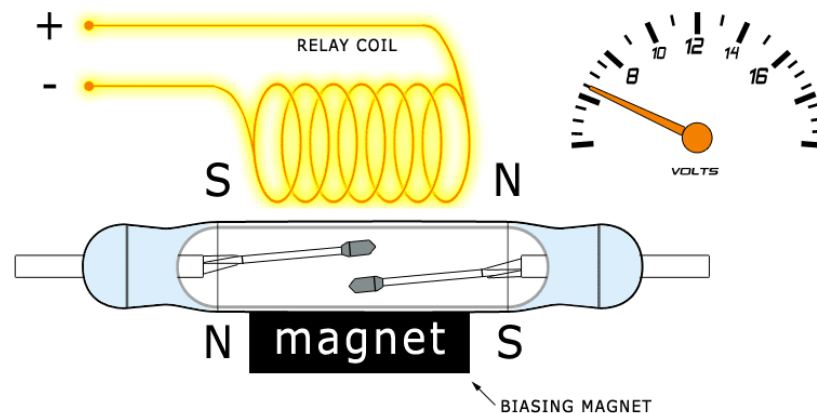
- ▣ Is the resistance across the contacts and/or the resistance between the coil and the contacts

Dynamic contact resistance

- ▣ The method of testing the reed switch dynamically.

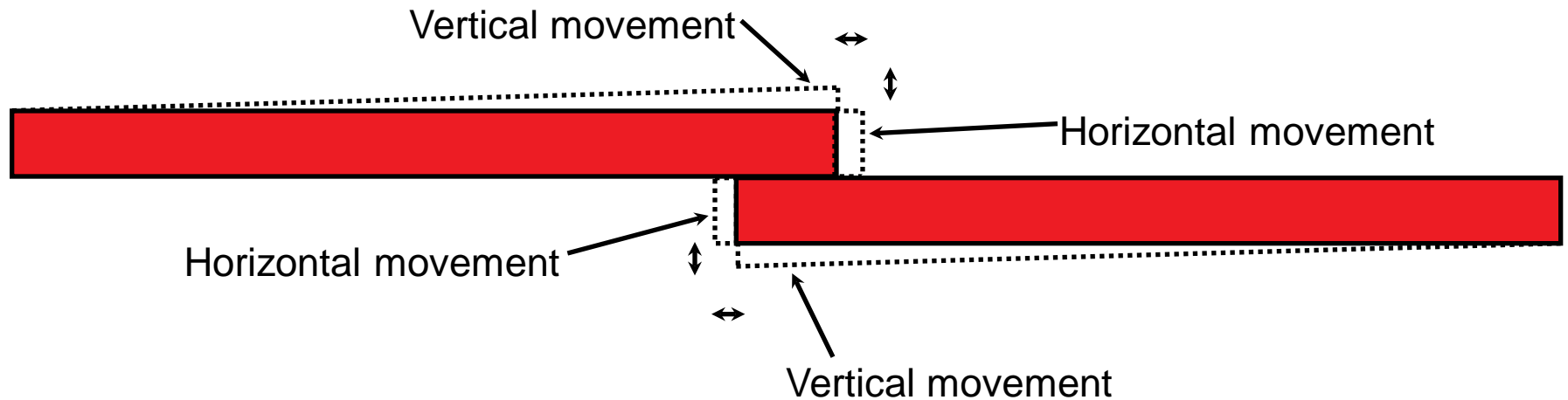
Dynamic Contact Resistance (DCR)

- 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

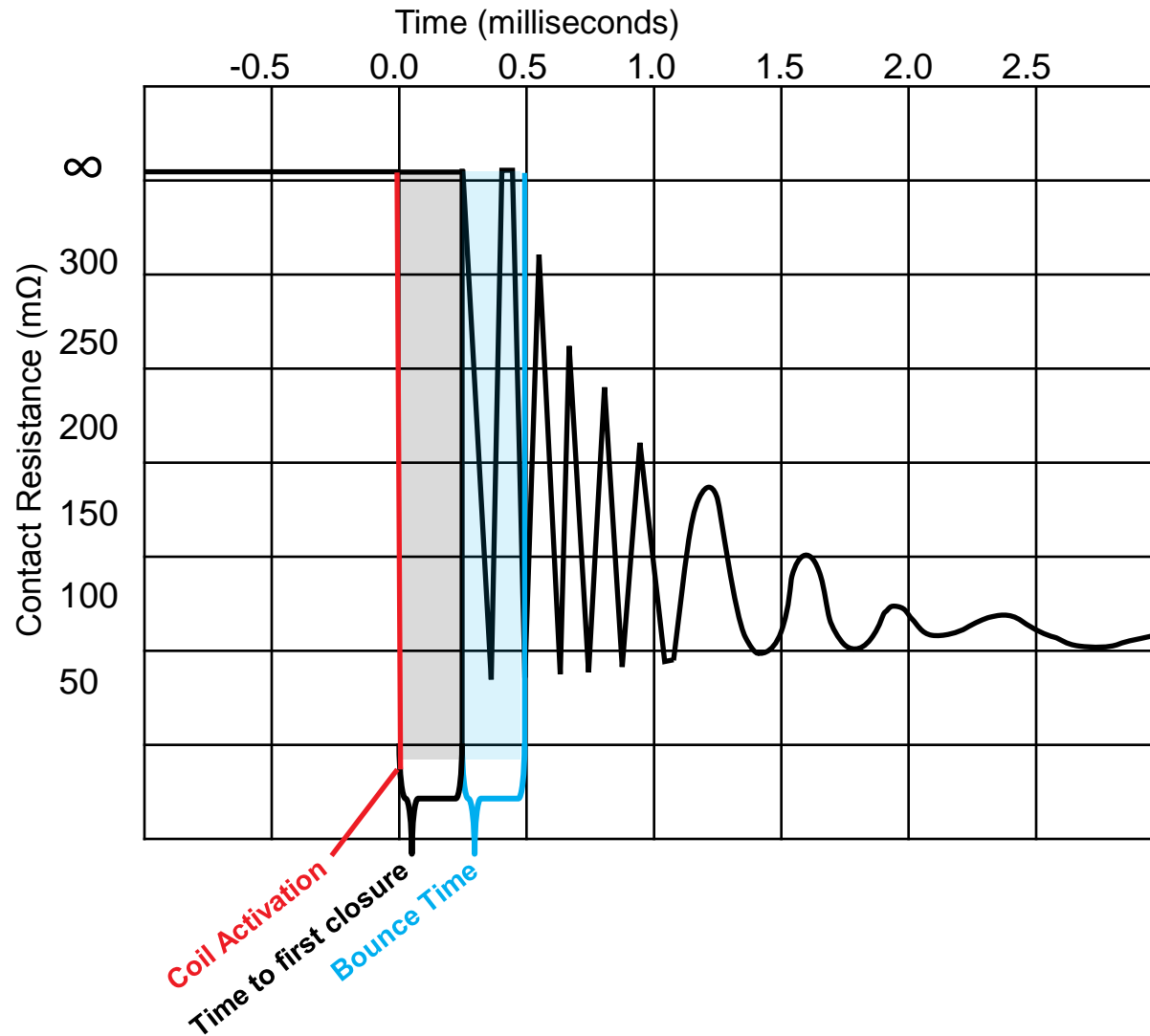
- This movement is occurring in the magnetic field generated by the coil
- When a metal is in motion in a magnetic field a current will be induced in the metal
- This current is a critical part of the measurement of our Dynamic Contact Resistance



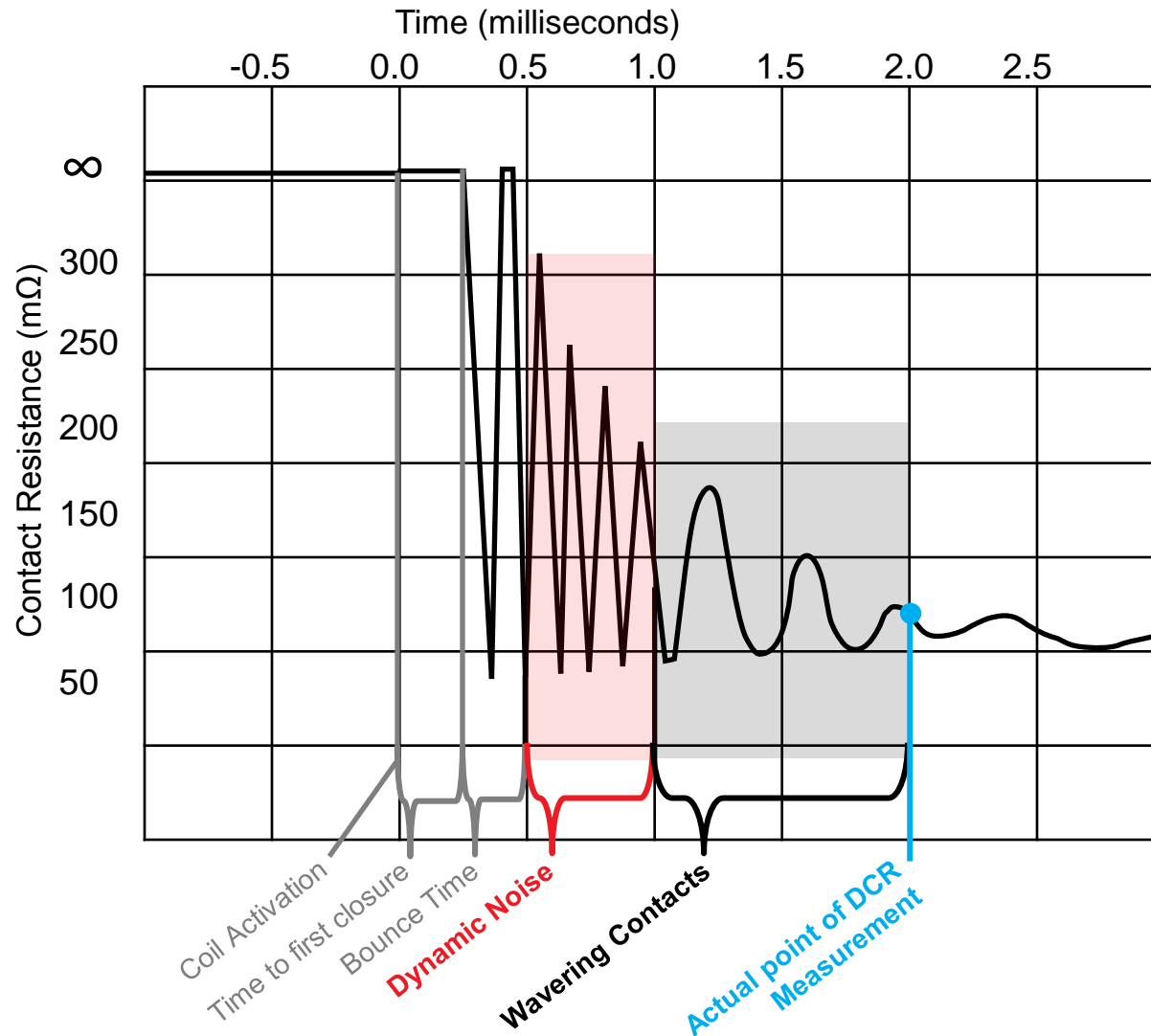
DCR Testing

- 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

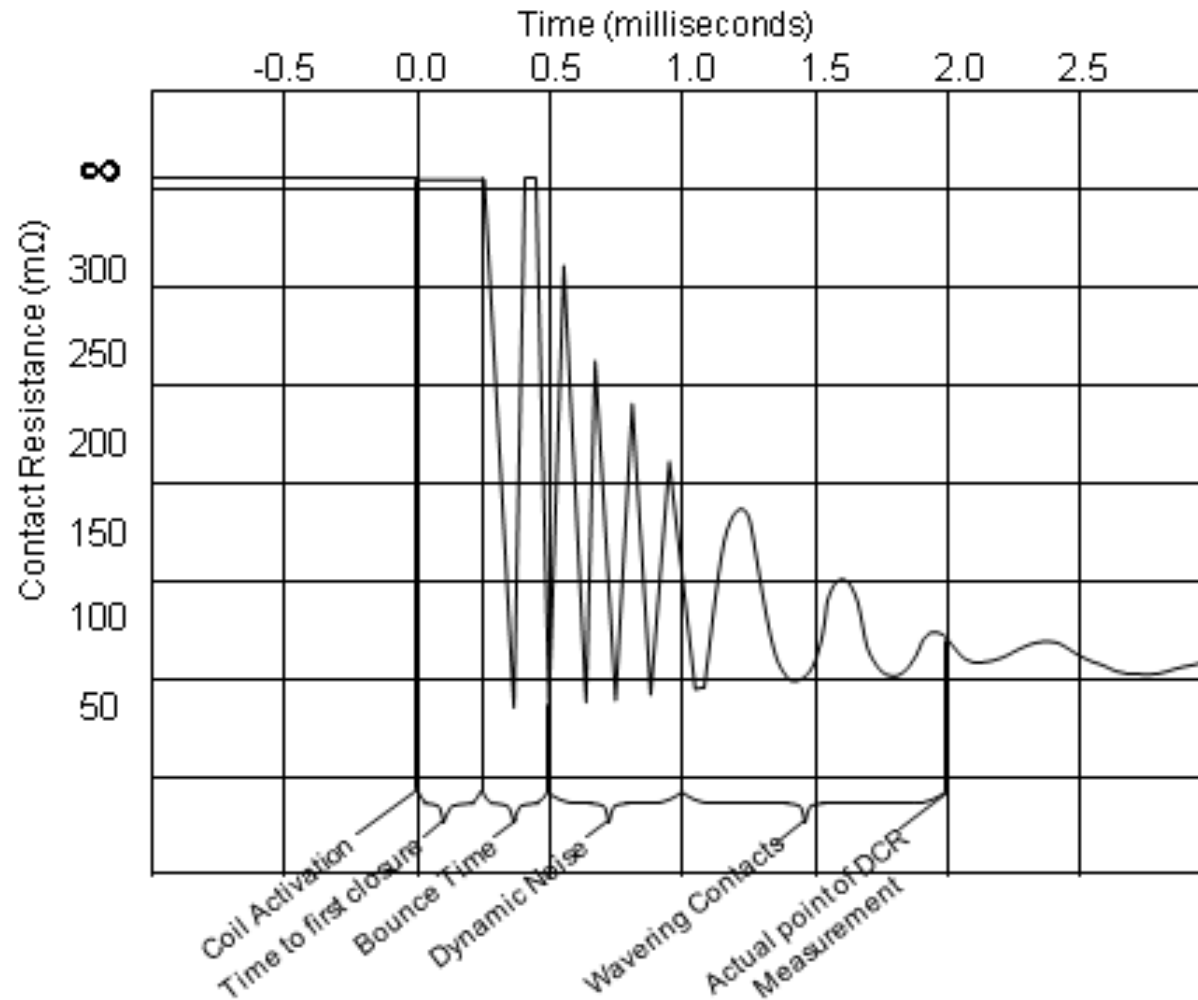
Dynamic Contact Resistance



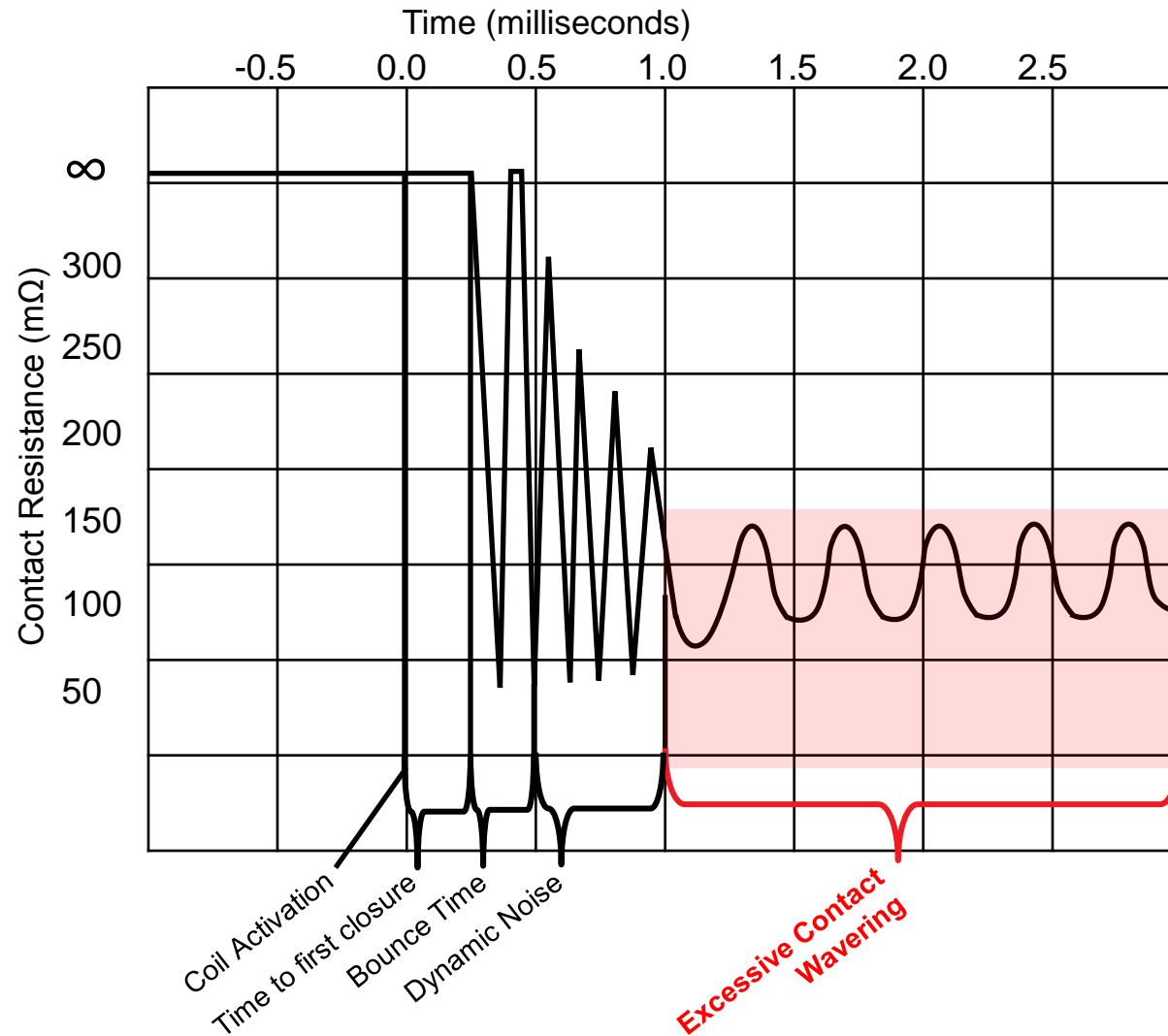
Dynamic Contact Resistance



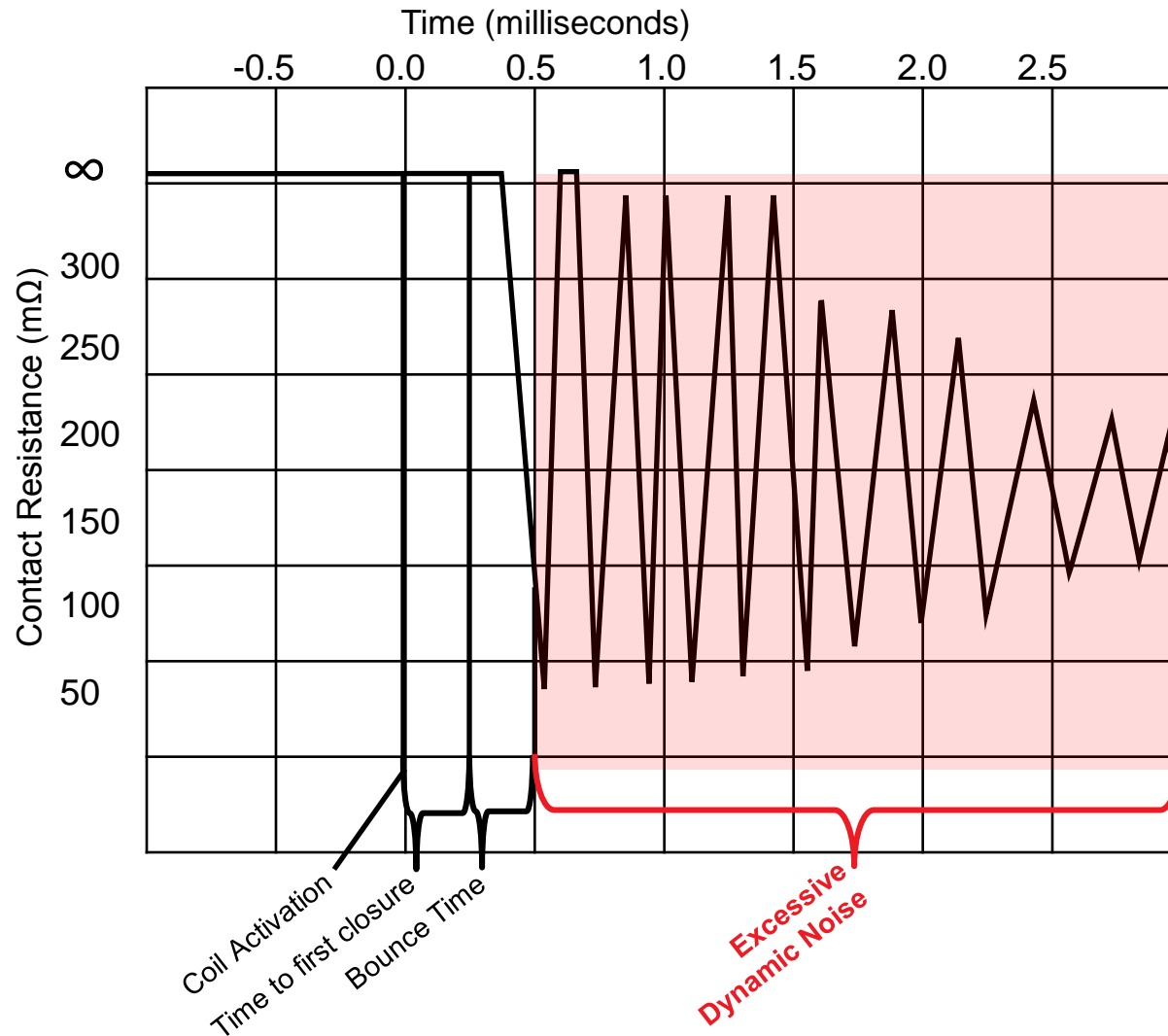
Dynamic Contact Resistance



Excessive Contact Wavering



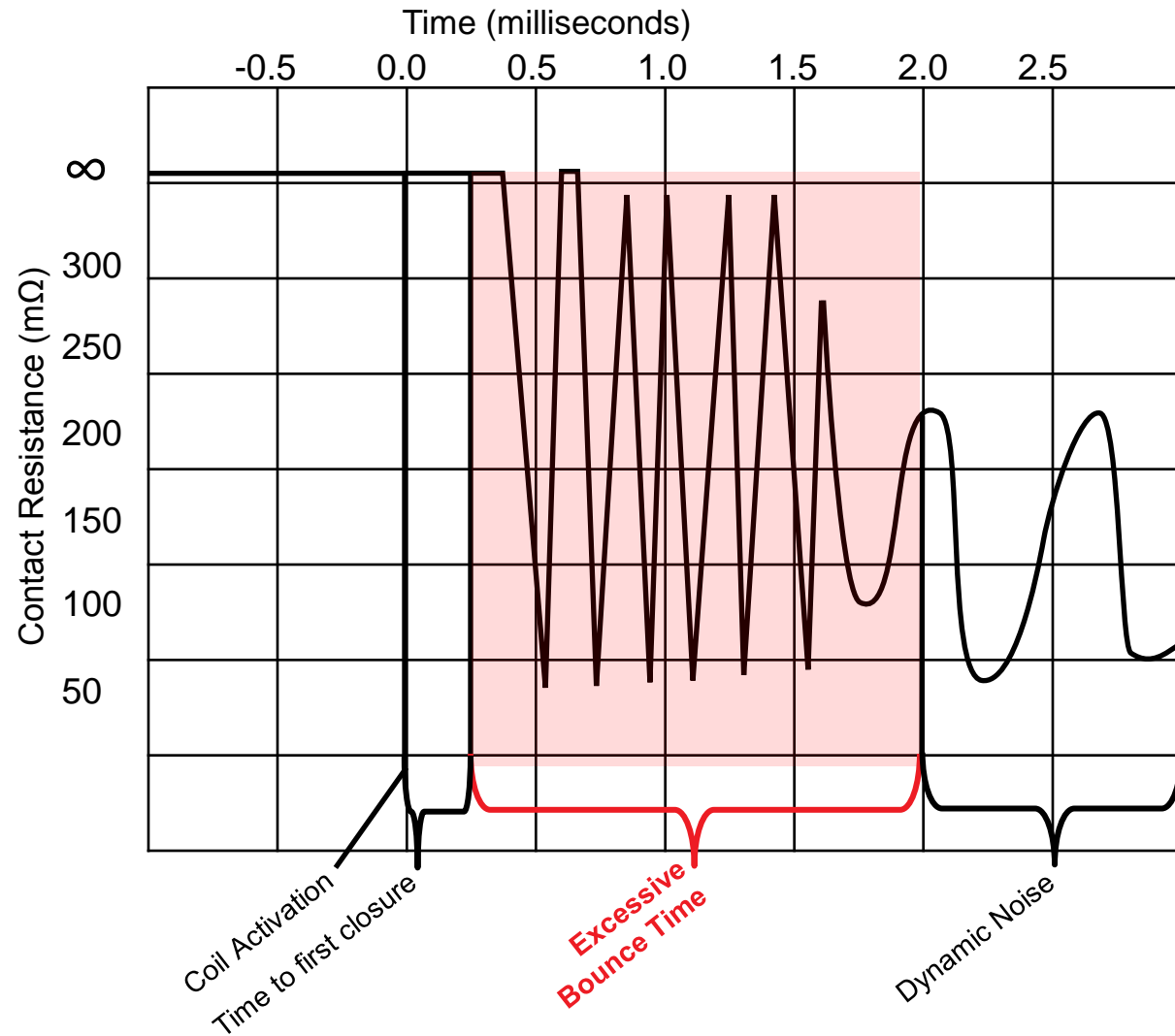
Excessive Dynamic Noise



Coil Activation
Time to first closure
Bounce Time

Excessive
Dynamic Noise

Excessive Bounce Time



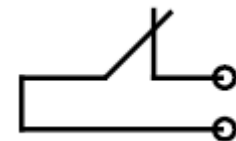
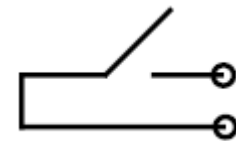


DCR Summary

- 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.

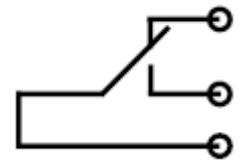
Reed Relay Types

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

- Automotive Diagnostic Test Systems
- Functional PCB tester
- Integrated circuit tester
- Memory and VLSI tester
- Printed circuit board (PCB) tester
- Wafer testers

Characteristics

- High frequency path
- Ability to handle fast digital pulses
- 50 Ω impedance
- High signal isolation > 1 T Ω
- Capacitance < 0.1 pico-farads





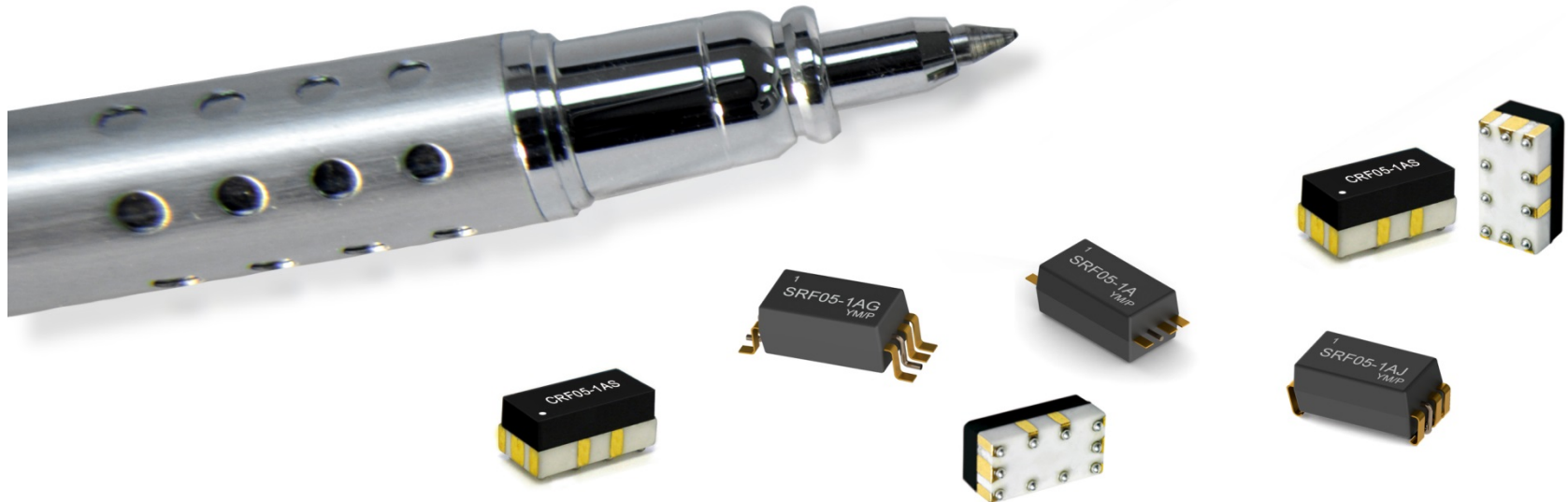
Automated Test Equipment (ATE)

Applications

- Discrete semiconductor testers
- Power component testers

Characteristics

- Very small size
- Surface mount



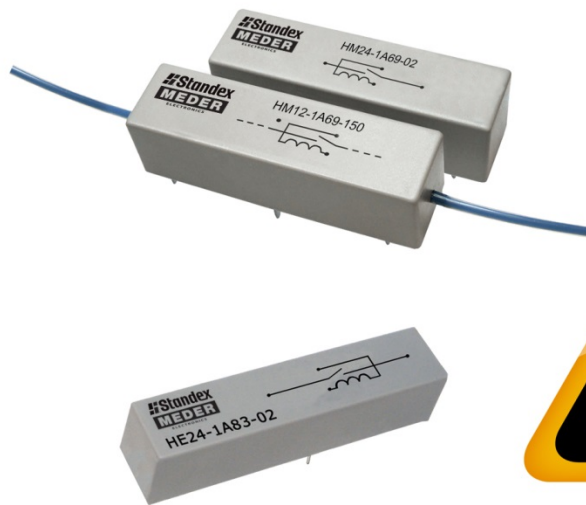
Automated Test Equipment (ATE)

Applications

- Cable testers

Characteristics

- Very high switching voltage > 10kV
- Very high voltage isolation > 15kV
- High pulsed currents > 40 amps



Instrumentation

Applications

- Data acquisition testing
- Electrometers
- Printers
- Medical cauterizing generators
- Medical test systems
- Multimeters
- RF switching and transmitting
- Scanners/Multiplexers

Characteristics

- 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



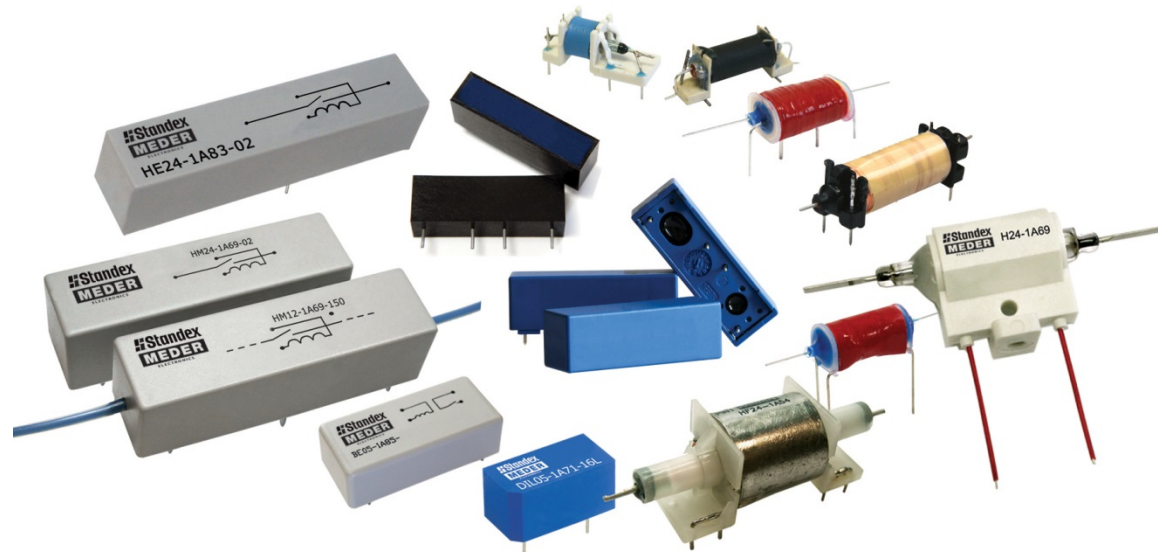
Telecommunications

Applications

- Modems
- AC Line switching and Line sensing
- Pager Transmit/Receive switching
- Cellular antenna switching

Characteristics

- 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

- Security
- Battery powered instrumentation
- Industrial and Robotics
- Explosion proof or intrinsic safety circuit applications

Characteristics

- 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 $> 10 T\Omega$
- Contact resistance typically 50 m Ω





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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