Solid-state and Mechanical Relays

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Overview **Basic Function Types of Relays** • Mechanical • Solid state Design Considerations **Reading the Datasheet Common Uses**





Basic Function Electrically controlled switch Control side and Switched side [2] Can have many different

arrangements







Form Factors



Different methods for different applications





http://www.gigavac.com/apps/schematics.html





Mechanical Relays_[2]

- Reed Type
- Latching
- Time-Delay
- Contactor



http://wiki.pickeringtest.net/file/view/Reed_Relay_Diagram.jpg/211412130/420x261/Reed_Relay_Diagram.jpg



http://upload.wikimedia.org/wikipedia/commons/6/60/ Latching_relay_bistable_permanent_magnet.jpg





Solid State Relays_[3] **Opto-isolators** No moving parts High usage life Limited to lower power ratings **Transistor voltage** drop



Lite-On Technology Corp., "Photocoupler," LTV-357T datasheet, p.2, May 2014. [Online]. Available: http://optoelectronics.liteon.com/ upload/download/DS70-2001-012/S_110_LTV-357T%2020140520.pdf. [Accessed: Apr. 28, 2015].





Design Considerations_[4] Flyback diodes Prevents high current when switching inductive loads (relay coil)

- V = L(di/dt)
- May add hold-up time [1]



http://upload.wikimedia.org/wikipedia/commons/thumb/9/ 92/Flyback_Diode.svg/2000px-Flyback_Diode.svg.png





Contact Considerations

Specs should be fitted closely to application

• Too much arcing can damage relay contacts [1]



http://upload.wikimedia.org/wikipedia/commons/6/6c/Contacts_-_new_and_used.jpg

 Sometimes an arc is necessary to maintain functionality [1]





Contact Wear Prevention

Contact Plating/Alloys

- Silver, Gold-Flashed Silver, Gold Overlay, Silver Nickel, Silver
 Cadmium Oxide, Silver Tin Indium Oxide, Silver Copper Nickel, Gold
 Silver Nickel Alloy, Palladium, Tungsten [1]
- Mercury Wetting [1]
- RC circuit/diode
 - For inductive loads that may draw high current [1]
 - Blowout Magnet
 - Repels arc and shortens arc time [1]





Blowout Magnet Function







Choosing the Right Relay

TSV charger: 30 VDC x 25 A = 750 W Charge Relay Contact Rating: 28 VDC x 30 A = 840 W

 Pack Rating: 22.4 VDC x 650 A = 14,560 W
 AIR Rating: 800 VDC x 350 A = 280,000 W



http://www.evsource.com/images/elec_components/rel ays/Gigavac/gx11.jpg



http://sigma.octopart.com/37524268/image/Omron-MGN1C-DC24.jpg





Choosing the Right Relay

Not as simple as P=I*R

Usually rated at tangent of curve

Load Limit Curve



Tyco Electronics, "Cradle relay N," V23154 datasheet, p. 7, Aug. 2004. [Online]. Available: http://www.farnell. com/datasheets/50789.pdf. [Accessed: Apr. 28, 2015].



Reading the Datasheet

http://www.mouser.com/ds/2/307/MGN_0911-310306.pdf





Common Uses

- Switching large loads with a low-power control circuit
- Galvanic Isolation
- Coaxial Switching
- Control multiple switches with one signal





Galvanic Isolation



TSV BoB Schematic, William Stathis



http://media.digikey.com/Photos/Omron% 20Elect%20Photos/G5T%20SERIES.JPG

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Reference List

- [1] Tyco Electronics, "Relay contact life," application note 13C3236, Dec. 2000. [Online]. Available: http://www.te.com/commerce/DocumentDelivery/DDEController?Action=srchrtrv&DocNm=13C3236_AppNote& DocType=CS&DocLang=EN. [Accessed Apr. 28, 2015].
- K. G. Oliver, Basic Industrial Electricity: A Training and Maintenance Manual, pp. 258-261, CT: Industrial Press, 1991. [E-book] Available: Google Books.
- [3] S. Juds, *Photoelectric Sensors and Controls: Selection and Application*, first ed., pp. 169-171, London: CRC Press, 1988. [E-book] Available: Google Books.
- [4] M. Jouaneh, *Fundamentals of Mechatronics*, SI ed., pp. 37-38, MA: Cengage Learning, 2012. [E-book] Available: Google Books.



