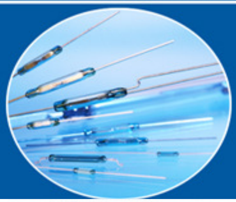
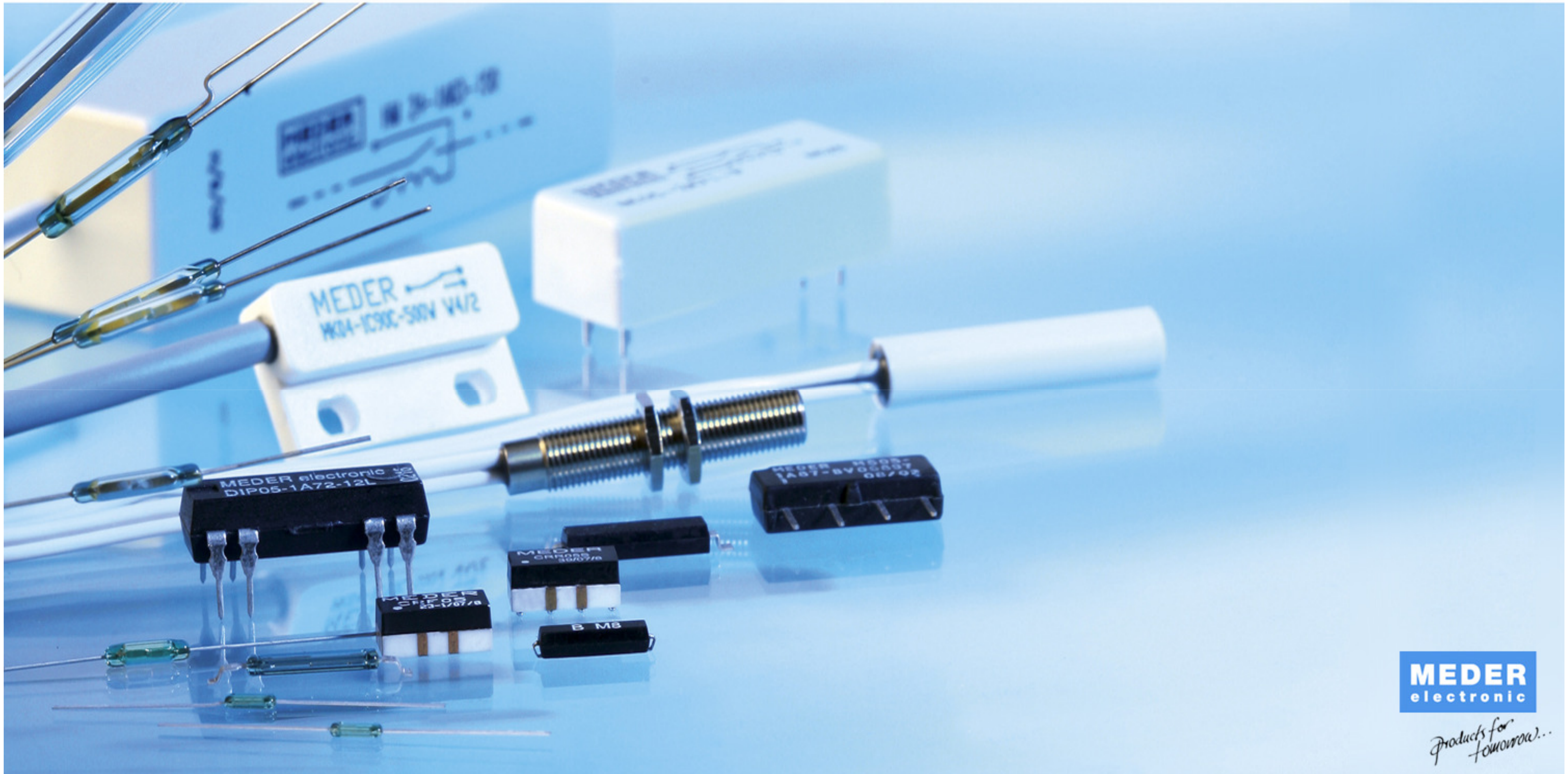
REED SWITCHES REED SENSORS REED RELAYS



MEDER electronic group



Magnets & Magnetic part II

12/03/2009

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Types of Magnets

- Iron (Fe), nickel (Ni), and cobalt (Co) are the most common
    - Less common materials used are chromium (Cr) and manganese (Mn)
- Rare earth types offer very strong fields. Most popular are Neodymium (NdFeB) and Samarium (SmCo)
- There are also a large number of magnets with combined elements (e.g. AlNiCo)

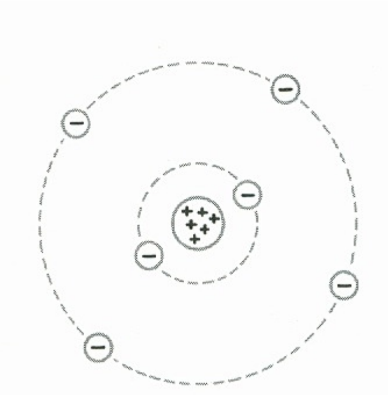
Types of Magnets

- By combining different elements and bringing them to the liquidus state than rapidly cooling them down we can produce a vast assortment of magnets, all of which will have a varied set of properties

Material	Curie Temp. (K)	Curie Temp. (℃)	Curie Temp. (℉)
Co	1388	1115	2039
Fe	1043	770	1418
$FeOFe_2O_3$	858	858	1085
$NiOFe_2O_3$	858	585	1085
$CuOFe_2O_3$	728	455	851
$MgOFe_2O_3$	713	440	824
MnBi	630	357	674
Ni	627	354	669
MnSb	587	314	597
$MnOFe_2O_3$	573	300	571
$Y_3Fe_5O_{12}$	560	287	548
CrO_2	386	113	235
MnAs	318	45	113
Dy	88	-185	-301
EuO	69	-204	-335

Where does the energy come from?

- A magnet gets its energy from the electrons spinning around the nucleus of an atom. Some atoms have more rings and the electrons are further away from the nucleus. The electrons that are further away from the nucleus spin faster than those nearer the nucleus.



Stacking Magnets

- Stacking magnets in series will essentially extend the magnetic field
- If two 100mT magnets are stacked in series, the overall magnetic field may be 150mT. As you increase the number of stacked magnets, there will be less and less of an increased magnetic strength

Stacking magnets

Stacking Magnets

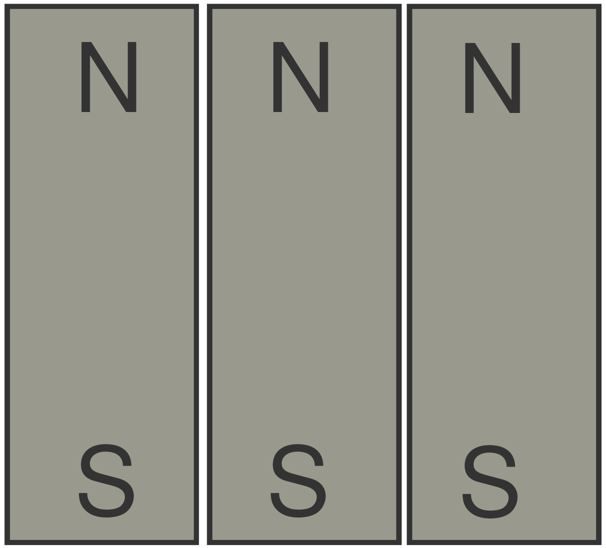
- The ideal length of a magnet depends upon the magnet type. Below is a chart containing magnets and their ideal length to diameter ratios

Magnet type	Ratio (Length to Diameter)
AlNiCo 5	5 to 1
AlNiCo 8	3 to1
Ferrite (Ceramic)	1 to 1
Rare Earth (SmCo and NdFeB)	1 to 1

- Knowing these ratios will give one a clue on how much more magnetic field strength will be gained by stacking magnets

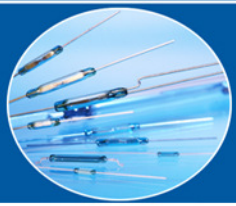
Magnets in Parallel

- Magnets in parallel will create a larger or broader magnetic field influence. However, using 100mT magnets the net magnet field will stay at the same level



Effects of a strong magnetic field on a reed

- No adverse effect at all
- Once the reed blades are magnetically saturated, any increased field will have no effect



Effects of a strong magnetic field on a reed

- MEDER performed the following experiments

Subjected the following reeds to an AT varying from 20 AT up to 1000 AT (or 10 to 500 gauss at 50Hz)	ORD211 (5 each)			ORD311 (5 each)			ORD324 (5 each)			ORD2210 (5 each)		
Operate Time in µs (and the drive where an increase in field strength resulted in no reduction in operate time) and overdrive	Op T µs	AT	O/D %	Op T µs	AT	O/D %	Op T µs	AT	O/D %	Op T µs	AT	O/D %
	124	312	1500	70	208	1000	200	208	1000	200	208	1000
Change in AT before testing vs after testing	Negligible AT change			Negligible AT change			Negligible AT change			Negligible AT change		
Subjected Similar switches of the same type above to repeated closures and openings and had tested them for AT before and after testing	Negligible AT change			Negligible AT change			Negligible AT change			Negligible AT change		

MEDER electronic
Products for tomorrow...

- **End of part II**

Content of part III:

- Basic Reed Switch Construction
- Reed Switch Handling Precautions