Discrete Position Sensing

- Mechanical
- Optical
- Magnetic

Mechanical Sensing -<u>Microswitch</u>



Microswitch Operation



Microswitch Actuators



Optical Sensing

- LED's and Photodiodes
- Transmissive/Reflective
- Modulated/Unmodulated
- Light-on/Dark-on
- Fiber optic

Transmissive & Reflective Sensors



Beam Pattern and Reflectance



RELATIVE REFLECTIVITY TABLE		
<u>Material</u> Kadak white	Reflectivity (%)	Excess Gain Required
test card	90%	1
White paper	80%	1.1
Masking tape	75%	1.2
Beer foam	70%	1.3
Clear Plastic*	40%	2.3
Rough wood pal (clean)	let 20%	4.5
Black neoprene	4%	22.5
Natural alunni- num, unfinished	* 140%	0.6
Stainless steel, microfinish	400%	0.2
Black anodized aluminum*	50%	1.8
*NOTE: For materials with shiny or glossy surfaces, the reflectivity		

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*NOTE: For materials with shiny or glossy surfaces, the reflectivity figure represents the maximum light return, with the sensor beam *exactly perpendicular* to the material surface

Specular Reflection



Modulation

- "Chop" LED on and off at many kHz rate
- Bandpass filter after photodiode at the same frequency as chopping
- Threshold circuit after BPF generates on/off output

Magnetic Position Sensors

- Reed switches (sense permanent magnet)
- Inductive proximity sensors (eddy current)
- Hall Sensors (sense permanent magnet)

Inductive Proximity Sensor



Inductive Proximity Sensors





Hall Sensors





- Hall effect:
 - constant voltage forces a constant current in semiconductor sheet
 - magnetic field flux lines perpendicular to current cause proportional voltage across sheet.
 - discovered by E.F.Hall in 1879
- Linear sensor needs voltage regulator and amplifier
- Switch also needs threshold circuit, with hysteresis

Hall Switch

- Magnet motion
 - head-on

CENTERLINE

MOTION

ALNICO 8, 0.212"D x 0.187"

DISTANCE D (INCHES)

TE40-0.05

800

600

400

9.95 0.10 0.15 0.20 0.25 0.30 0.35

- bypass or slide-by
- Total effective air gap (TEAG)
- Sensitivity, Hysteresis, & Temperature



Sinking/Sourcing

- The tag indicates that the LOAD (PLC input) has a +DC common
 - this is a sinking output
 - Sinking output => sourcing input





Sinking/Sourcing

 Photosensor – comes in either NPN (sinking) or PNP (sourcing)



Emitters Cabled Hookup



Receivers with NPN Outputs Cabled Hookup



Receivers with PNP Outputs Cabled Hookup



Terminal Blocks





