

Name: \_\_\_\_\_

Arr: \_\_\_\_\_

# Messing Around with Sensors and Switches Worksheet

Record the digital output values and other observations of all the sensors mentioned and covered in Volume Two.


You may want to review the following sections in the textbooks:

- Voltage divider board (VDB) theory & analytics (*Chapter 21* on pp 808 – 812)
- Pull-up resistor and VDB theory (*Chapter 21* on pp 819 – 821)

### Sensors Covered in the Textbook

- **2-axis Joystick** (*Chapter 21* on page 798; *Chapter 22* Challenge Problem with button on page 878)

x: _____	x: _____	x: _____	Button not depressed: _____ Button depressed: _____
y: _____	y: _____	y: _____	
x: _____	x: _____	x: _____	
y: _____	y: _____	y: _____	
x: _____	x: _____	x: _____	
y: _____	y: _____	y: _____	



- **8-Button Board using Pull-up Resistors** (*Chapter 22* on pp 859 – 862)

<b>Using Internal Pull-up Resistors</b>	
Button(s) not depressed: _____	Button(s) depressed: _____

- **Battery Level Meter (VDB/Fixed Resistor or Commercial Plug-in Meter)** (*Chapter 21* on pp 813 – 814)

<b>Robot Battery Pack Voltage</b>	
Current: _____ V	Post Charging: _____ V

- **Hygrometer** (*Chapter 21* on pp 787 – 793)

<b>Soil Conditions</b>		
Dry: _____	Damp: _____	Wet: _____

- **IR (Flame) Detector (passive IR)** (*Chapter 21* on pp 794-795)

<b>Readings of Various IR Sources at Various Distances and Look-Angles</b>		
<b>Candle (Distance)</b> Near: _____ ( _____ cm) Mid: _____ ( _____ cm) Far: _____ ( _____ cm)	<b>Incandescent Bulb (Distance)</b> Near: _____ ( _____ cm) Mid: _____ ( _____ cm) Far: _____ ( _____ cm)	<b>Sun (Look-Angle)</b> Direct: _____ (0°) Close: _____ ( _____ °) Far: _____ ( _____ °)

- IR Line Sensor (active IR) (Chapter 21 on pp 787 – 794)

Line Colors (Left Sensor)	Line Colors (Right Sensor)
White: _____	White: _____
Light Gray: _____	Light Gray: _____
Dark Gray: _____	Dark Gray: _____
Black: _____	Black: _____

- Magnetic Field (Hall-Effect) Sensor (Chapter 21 on pp 799 – 803; and curve fitting on pp 807 – 808)

No Magnetic Field Present: \_\_\_\_\_

**Hall-Effect Readings of a Weak Magnetic Field at Various Distances and Incidence Angles**

North Pole (Distance)	South Pole (Distance)	North Pole (Incidence Angle)	South Pole (Incidence Angle)
Near: _____ ( _____ cm)	Near: _____ ( _____ cm)	Perpendicular: _____ (90°)	Perpendicular: _____ (90°)
Mid: _____ ( _____ cm)	Mid: _____ ( _____ cm)	Angled: _____ (45°)	Angled: _____ (45°)
Far: _____ ( _____ cm)	Far: _____ ( _____ cm)	Parallel: _____ (0°)	Parallel: _____ (0°)

**Hall-Effect Readings of a Strong Magnetic Field at Various Distances and Incidence Angles**

North Pole (Distance)	South Pole (Distance)	North Pole (Incidence Angle)	South Pole (Incidence Angle)
Near: _____ ( _____ cm)	Near: _____ ( _____ cm)	Perpendicular: _____ (90°)	Perpendicular: _____ (90°)
Mid: _____ ( _____ cm)	Mid: _____ ( _____ cm)	Angled: _____ (45°)	Angled: _____ (45°)
Far: _____ ( _____ cm)	Far: _____ ( _____ cm)	Parallel: _____ (0°)	Parallel: _____ (0°)

- Pushbutton (NO) (Chapter 22 on pp 854 – 857; and using pull-up resistor on pp 858 – 859)

Using External Resistor or VDB	Using Internal Pull-up Resistor
Button not depressed: _____	Button not depressed: _____
Button depressed: _____	Button depressed: _____

- Sharp IR Ranger (Chapter 20 on pp 749 – 758; and curve fitting on pp 771 – 774)

**Readings of a Large, Flat, Opaque Object at Various Distances and Look-Angles**

Distance (Range: 6-80cm)	Look-Angle
Near: _____ ( _____ cm)	0°: _____ (Direct)
Mid: _____ ( _____ cm)	15°: _____ (Small Angle)
Far: _____ ( _____ cm)	45°: _____ (Mid Angle)
Infinite: _____ (∞ cm)	60°: _____ (Large Angle)

**Readings of a \_\_\_\_\_ Object at Various Distances and Look-Angles**

Distance (Range: 6-80cm)	Look-Angle
Near: _____ ( _____ cm)	0°: _____ (Direct)
Mid: _____ ( _____ cm)	15°: _____ (Small Angle)
Far: _____ ( _____ cm)	45°: _____ (Mid Angle)
Infinite: _____ (∞ cm)	60°: _____ (Large Angle)

- SR04 Ultrasonic Ranger (Chapter 22 on pp 835 – 845)

**Readings of a Large, Flat, Opaque Object at Various Distances and Look-Angles**

Distance (Range: 2-400cm)	Look-Angle
Near: _____ ( _____ cm)	0°: _____ (Direct)
Mid: _____ ( _____ cm)	15°: _____ (Small Angle)
Far: _____ ( _____ cm)	45°: _____ (Mid Angle)
Infinite: _____ (∞ cm)	60°: _____ (Large Angle)

**Readings of a \_\_\_\_\_ Object at Various Distances and Look-Angles**

Distance (Range: 2-400cm)	Look-Angle
Near: _____ ( _____ cm)	0°: _____ (Direct)
Mid: _____ ( _____ cm)	15°: _____ (Small Angle)
Far: _____ ( _____ cm)	45°: _____ (Mid Angle)
Infinite: _____ (∞ cm)	60°: _____ (Large Angle)

- Switch (SPST) (Chapter 22 on pp 863 – 864)

Using External Resistor or VDB	Using Internal Pull-up Resistor
Switch open: _____	Switch open: _____
Switch closed: _____	Switch closed: _____

*You may need to check state of the switch (open or closed) with a DMM on the continuity or resistance setting.*

- VDB/Flexion (Chapter 21 on page 797)

No bend: _____	<b>Bend Up</b>	<b>Bend Down</b>
	“Small” bend: _____	“Small” bend: _____
	“Medium” bend: _____	“Medium” bend: _____
	“Big” bend: _____	“Big” bend: _____

- VDB/Force (Chapter 21 on page 797)

“Small” force: \_\_\_\_\_      “Medium” force: \_\_\_\_\_      “Big” force: \_\_\_\_\_

- VDB/Photoresistor (Chapter 21 on pp 787 – 793; curve fitting on pp 804 – 805; and with pull-up resistor on pp 819 – 821)

Bright light: _____ (raw)      _____ (lux)
Ambient light: _____ (raw)      _____ (lux)
Dim light: _____ (raw)      _____ (lux)
No light: _____ (raw)      _____ (lux)

- VDB/Potentiometer (Chapter 21 on page 797)

Full counterclockwise: \_\_\_\_\_      ¼ turn: \_\_\_\_\_      ½ turn: \_\_\_\_\_      ¾ turn: \_\_\_\_\_      Full clockwise: \_\_\_\_\_

- **VDB/Thermistor** (*Chapter 21* on page 796; and curve fitting on pp 815 – 818)

Cold temperature: \_\_\_\_\_ (raw)    \_\_\_\_\_ (K)    \_\_\_\_\_ (° C)    \_\_\_\_\_ (° F)

Cool temperature: \_\_\_\_\_ (raw)    \_\_\_\_\_ (K)    \_\_\_\_\_ (° C)    \_\_\_\_\_ (° F)

Ambient temperature: \_\_\_\_\_ (raw)    \_\_\_\_\_ (K)    \_\_\_\_\_ (° C)    \_\_\_\_\_ (° F)

Warm temperature: \_\_\_\_\_ (raw)    \_\_\_\_\_ (K)    \_\_\_\_\_ (° C)    \_\_\_\_\_ (° F)

High temperature: \_\_\_\_\_ (raw)    \_\_\_\_\_ (K)    \_\_\_\_\_ (° C)    \_\_\_\_\_ (° F)

- **Whisker (Bumper) Switch Using Internal Pull-up Resistor** (*Chapter 22* on pp 866 – 868)

**Left & Right Whisker**

Switch open: \_\_\_\_\_      Switch closed: \_\_\_\_\_

**Some Other Sensors *Mentioned* in the Textbook**

- Color (*Chapter 21* on page 787)
- Humidity (*Chapter 21* on page 787)
- Microphone (*Chapter 21* on page 787)

**Some of the Sensors NOT *Mentioned* in the Textbook**

- Battery-Level Meter/Voltmeter
- Carbon Monoxide (CO)
- Compass
- Conductivity
- Electric Current
- Frequency of Sound
- GPS
- IR Remote Board
- Tilt Switch (Mercury Switch)
- Turbidity
- Vision (Pixicam)