

Name: _____

Arr: _____

Messing Around with Sensors and Switches Worksheet

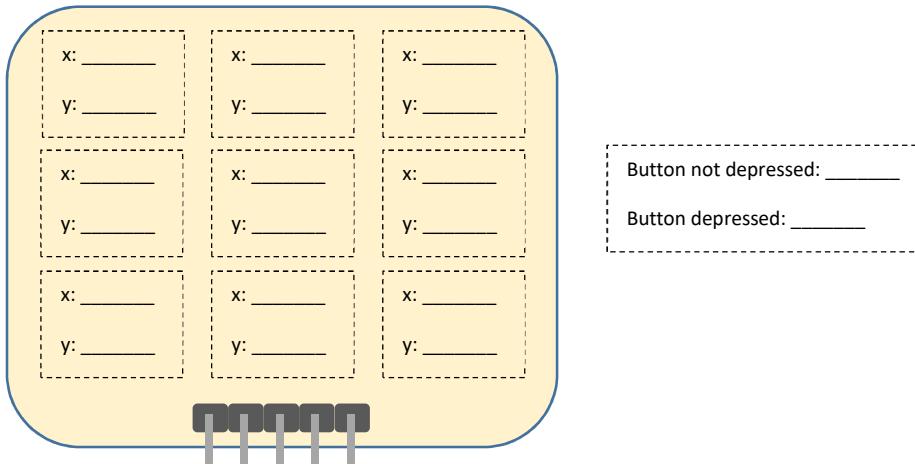
Record the digital output values and other observations of all the sensors mentioned and covered in Volume Two.

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)



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

Using Internal Pull-up Resistors	
Button(s) not depressed: _____	Button(s) depressed: _____

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

Robot Battery Pack Voltage	
Current: _____ V	Post Charging: _____ V

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

Soil Conditions		
Dry: _____	Damp: _____	Wet: _____

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

Readings of Various IR Sources at Various Distances and Look-Angles		
Candle (Distance)	Incandescent Bulb (Distance)	Sun (Look-Angle)
Near: _____ (_____ cm)	Near: _____ (_____ cm)	Direct: _____ (0°)
Mid: _____ (_____ cm)	Mid: _____ (_____ cm)	Close: _____ (_____ °)
Far: _____ (_____ cm)	Far: _____ (_____ cm)	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) Near: _____ (_____ cm) Mid: _____ (_____ cm) Far: _____ (_____ cm)	South Pole (Distance) Near: _____ (_____ cm) Mid: _____ (_____ cm) Far: _____ (_____ cm)	North Pole (Incidence Angle) Perpendicular: _____ (90°) Angled: _____ (45 °) Parallel: _____ (0 °)	South Pole (Incidence Angle) Perpendicular: _____ (90°) Angled: _____ (45 °) Parallel: _____ (0 °)
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Hall-Effect Readings of a Strong Magnetic Field at Various Distances and Incidence Angles

North Pole (Distance) Near: _____ (_____ cm) Mid: _____ (_____ cm) Far: _____ (_____ cm)	South Pole (Distance) Near: _____ (_____ cm) Mid: _____ (_____ cm) Far: _____ (_____ cm)	North Pole (Incidence Angle) Perpendicular: _____ (90°) Angled: _____ (45 °) Parallel: _____ (0 °)	South Pole (Incidence Angle) Perpendicular: _____ (90°) Angled: _____ (45 °) Parallel: _____ (0 °)
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- **Pushbutton (NO)** (*Chapter 22* on pp 854 – 857; and using pull-up resistor on pp 858 – 859)

Using External Resistor or VDB Button not depressed: _____ Button depressed: _____	Using Internal Pull-up Resistor Button not depressed: _____ Button depressed: _____
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- **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) Near: _____ (_____ cm) Mid: _____ (_____ cm) Far: _____ (_____ cm) Infinite: _____ (∞ cm)	Look-Angle 0°: _____ (Direct) 15°: _____ (Small Angle) 45°: _____ (Mid Angle) 60°: _____ (Large Angle)
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Readings of a _____ Object at Various Distances and Look-Angles

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

Switch open: _____
Switch closed: _____

Using Internal Pull-up Resistor

Switch open: _____
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: _____

Bend Up

“Small” bend: _____
“Medium” bend: _____
“Big” bend: _____

Bend Down

“Small” bend: _____
“Medium” 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: _____ $\frac{1}{4}$ turn: _____ $\frac{1}{2}$ turn: _____ $\frac{3}{4}$ turn: _____ Full clockwise: _____

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

Cold temperature:	<input type="text"/>	(raw)	<input type="text"/>	(K)	<input type="text"/>	(° C)	<input type="text"/>	(° F)
Cool temperature:	<input type="text"/>	(raw)	<input type="text"/>	(K)	<input type="text"/>	(° C)	<input type="text"/>	(° F)
Ambient temperature:	<input type="text"/>	(raw)	<input type="text"/>	(K)	<input type="text"/>	(° C)	<input type="text"/>	(° F)
Warm temperature:	<input type="text"/>	(raw)	<input type="text"/>	(K)	<input type="text"/>	(° C)	<input type="text"/>	(° F)
High temperature:	<input type="text"/>	(raw)	<input type="text"/>	(K)	<input type="text"/>	(° C)	<input type="text"/>	(° F)

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

Left & Right Whisker	
Switch open:	<input type="text"/>
Switch closed:	<input type="text"/>

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)