



# Wireless Embedded Systems and Networking

## Lab Day 2: Part 1: Add your own external sensors

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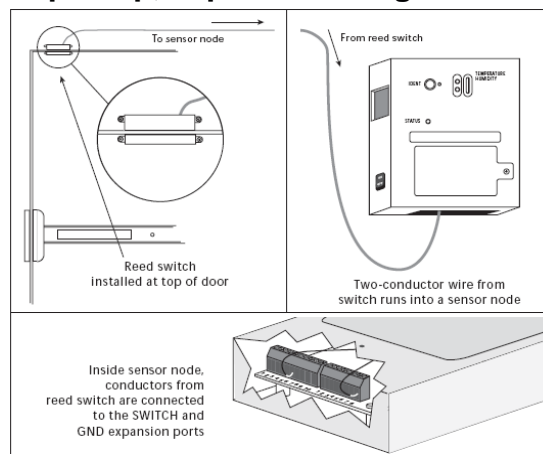
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## Magnetic Reed Sensor

- Study the resistance of the magnetic reed sensor open and closed.
- Discuss pull up, expected voltage and current.

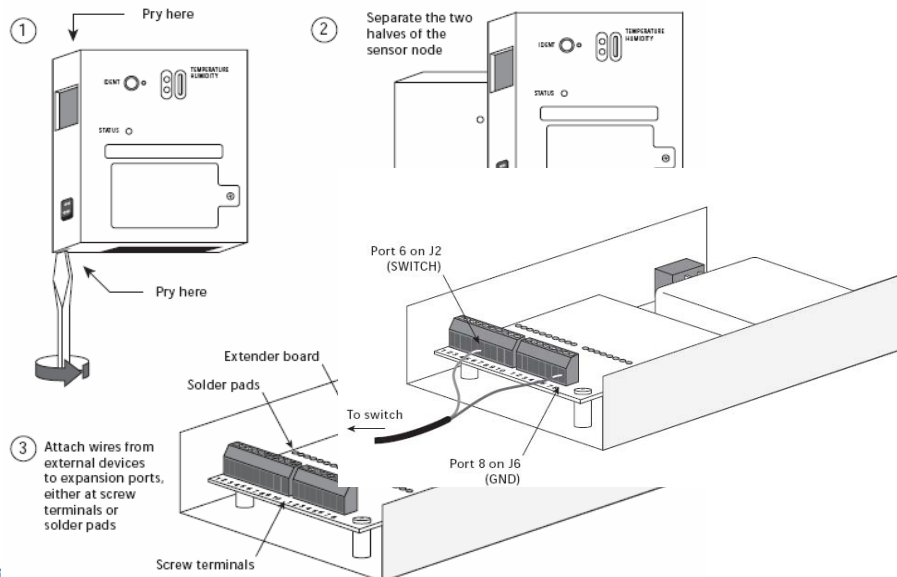


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## Connecting sensors to expansion port



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## Configuring Switch Port.

- Enable Device.



- Name the states.



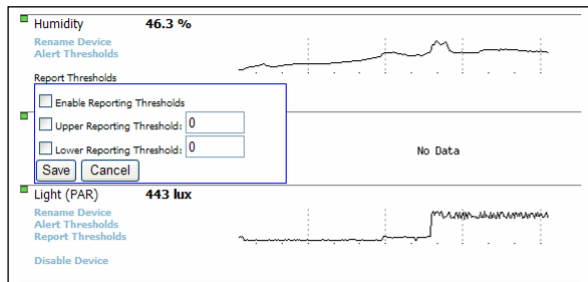
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## Interrupt vs. Sampling

- Discuss interrupt versus sampling.
- Exercise 2-1: set the alarm on humidity.



## Using RTD

- Exercise 2-2: Study the resistance of the RTD in ice water versus room temperature versus tea.

	Ice Water	Room Temperature	Tea
Resistance of RTD			
Temperature			

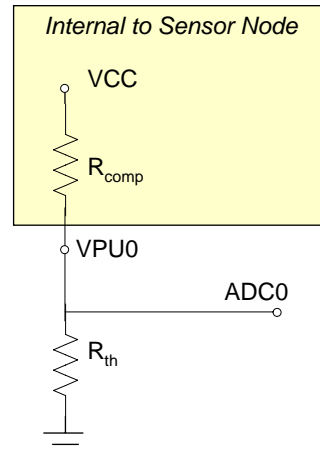
## Concept of resistive sensors.

- Discuss voltage divider, reference voltage. Mapping readings to engineering units.

$$V_{ADC0} = \frac{R_{comp}}{R_{comp} + R_{th}} VCC \text{ (if } V_{VPU0} = VCC)$$

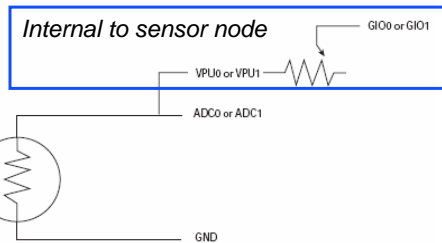
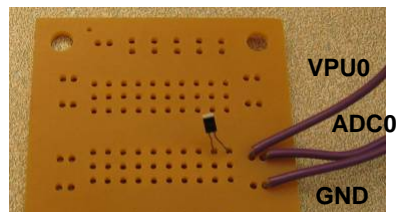
$$V_{ADC0} = 0 \text{ (if } V_{VPU0} = 0)$$

- Exercise 2-3: What value  $R_{comp}$  should be set to?
- For a Primer Pack node,  $V_{ADC0}$  is between 0 to 4095 (12-bits).

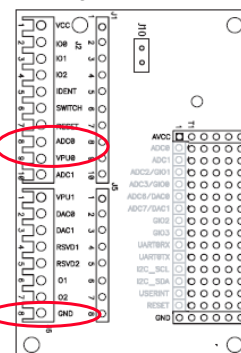


## Attach RTD to ADC port

- Connect one end to ADCx, the other to GND.
- Try with your own node.



Wiring to sensor node



## Configure ADC port, resistor, reference



Node 00173b000fecb28f

Group:

Description:

Edit Node Information

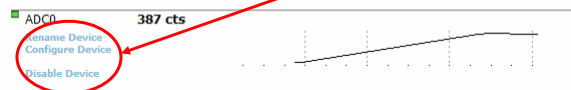
Last Heard: 5:11:16 pm

Sensing and Control Node Management

Sample Period (in seconds): 300 [edit]

Last Sample: 5:11:16 pm Request New Sample Now

Sensor Value 15 minutes 1 hour 6 hours 1 day



Periodic Read:

Power:  Off  When Sampling  On

Resistance: 10216 ohm

Warmup: 0 ms

Reference:  Vcc  1.5V  2.5V

Save Cancel

1. Enable Port to Use.
2. Configure Each Port.



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## Measurement using a sensor node



- Conduct same measurements using a sensor node.
  - Measure temperature using the RTD connected to a node.
  - Try both in ice water versus in room temperature.
- Compare results to expectations.



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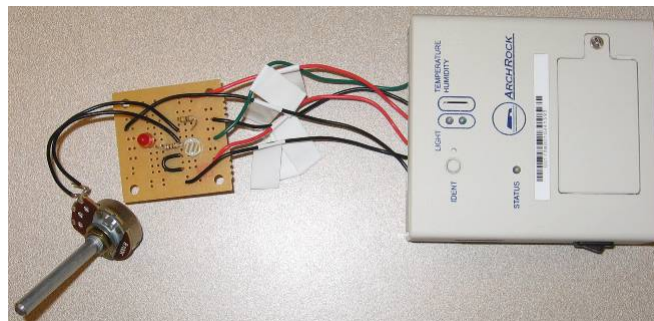
## Conversion

- Pull data into excel using the data export facility and do the conversions.

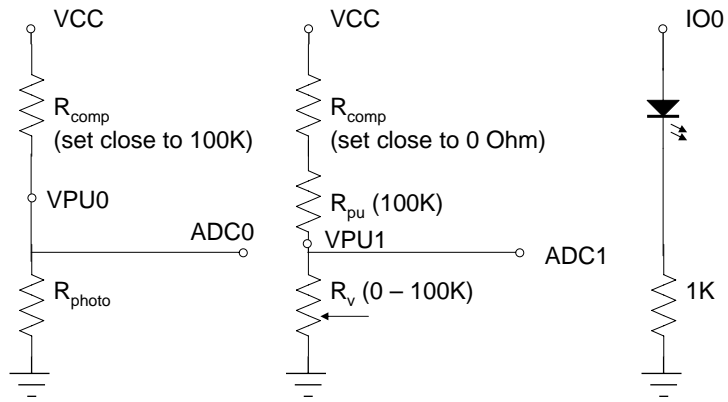
	Raw Reading	Temperature
Point 1		
Point 2		
Point 3		
Point 4		
Point 5		

## A Sample Sensor Board

- Resistive sensor: photo resistor
- Voltage sensor: voltage divider with variable resistor
- Actuator: LED



# Sample Sensor Board



$R_{comp}$ : Programmable Potentiometer in Primer Pack Sensor Node



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