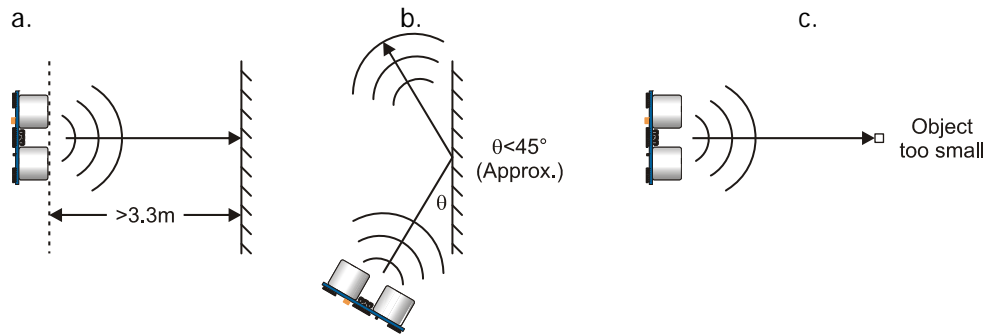


## Practical Considerations for Use

### Object Positioning

The PING))) sensor cannot accurately measure the distance to an object that: a) is more than 3 meters away, b) that has its reflective surface at a shallow angle so that sound will not be reflected back towards the sensor, or c) is too small to reflect enough sound back to the sensor. In addition, if your PING))) sensor is mounted low on your device, you may detect sound reflecting off of the floor.



### Target Object Material

In addition, objects that absorb sound or have a soft or irregular surface, such as a stuffed animal, may not reflect enough sound to be detected accurately. The PING))) sensor will detect the surface of water, however it is not rated for outdoor use or continual use in a wet environment. Condensation on its transducers may affect performance and lifespan of the device.

### Air Temperature

Temperature has an effect on the speed of sound in air that is measurable by the PING))) sensor. If the temperature ( $^{\circ}\text{C}$ ) is known, the formula is:

$$C_{\text{air}} = 331.5 + (0.6 \times T_c) \text{ m/s}$$

The percent error over the sensor's operating range of 0 to 70  $^{\circ}\text{C}$  is significant, in the magnitude of 11 to 12 percent. The use of conversion constants to account for air temperature may be incorporated into your program (as is the case in the example BS2 program given in the Example Programs section below). Percent error and conversion constant calculations are introduced in Chapter 2 of *Smart Sensors and Applications*, a Stamps in Class text available for download from the 28029 product page at [www.parallax.com](http://www.parallax.com).

## Test Data

The test data on the following pages is based on the PING))) sensor, tested in the Parallax lab, while connected to a BASIC Stamp microcontroller module. The test surface was a linoleum floor, so the sensor was elevated to minimize floor reflections in the data. All tests were conducted at room temperature, indoors, in a protected environment. The target was always centered at the same elevation as the PING))) sensor.

### Test 1

Sensor Elevation: 40 in. (101.6 cm)  
Target: 3.5 in. (8.9 cm) diameter cylinder, 4 ft. (121.9 cm) tall – vertical orientation

