

CBR2 Exploration

Connect the CBR 2™ to the handheld with the USB cable. A *Vernier DataQuest™* application page will automatically open and the CBR 2™ will begin measuring the position of the closest object.

The motion detector sends out an ultrasonic pulse and then measures how long it takes for that pulse to return after bouncing off the closest object. When the CBR 2™ motion detector sends out a pulse, the pulse hits the object, bounces back, and is received by the CBR 2™ motion detector. If an object is closer than 15 centimeters (about six inches), consecutive pulses may overlap and be misidentified by the CBR 2™ motion detector. The plot would be inaccurate, so position the CBR 2™ motion detector at least 15 centimeters away from the object.

As the pulse travels through the air, it loses its strength. After about 12 meters (6 meters on the trip to the object and 6 meters on the trip back to the CBR 2™ motion detector), the return echo may be too weak to be reliably detected by the CBR 2™ motion detector. This limits the typical reliably effective distance from the CBR 2™ motion detector to the object to less than 6 meters (about 20 feet).

The path of the CBR 2™ motion detector beam is not a narrow, pencil-like beam, but fans out in all directions up to 15° from center in a 30° cone-shaped beam. To avoid interference from other objects in the vicinity, try to establish a *clear zone* in the path of the CBR 2™ motion detector beam. This helps ensure that objects other than the target do not get recorded by the CBR 2™ motion detector. It is best to hold the CBR 2 so that it points toward a smooth surface like the wall or door. When using more than one CBR 2™ motion detector in a room, one group should complete a sample before the next group begins their sample.

The walker should be standing approximately two meters from the motion detector. The walker should walk slowly toward the motion detector at a constant velocity. The calculator operator should click the green **Start** button in the lower left corner of the screen.

Graphs for position versus time and velocity versus time are created and displayed on the same screen. To display only the position versus time graph, press **Menu > Graph > Show Graph > Graph 1**.

1. Continue to explore so that each person has an opportunity to walk to generate graphs:
 - of a line with a positive slope
 - of a line with a greater positive slope
 - of a line with a slope of zero
 - of a line with a negative slope
 - of a line with a more negative slope
2. What generalizations can you make about how you walked related to the graphs generated?
3. What letters of the alphabet can you “graph”?
4. Have one person secretly make a graph for the rest of the group to describe her/his “moves.”