Vex Ultrasonic Sensor (US)
Interfacing and Programming
Ultrasonic Sensors

- Generally have a transmitter and receiver.
- Transmits a high-frequency sound.
- Waits to receive echo.
- Calculates distance based on time it took to receive the echo.

\[ d = (v)(t) \quad \text{Round-Trip Distance} \]

\[ d = (v)(t)/2 \quad \text{One-Way Distance} \]

\[ d = \text{distance}, \ v = \text{speed of sound}, \ t = \text{time to receive echo} \]
The Vex Ultrasonic Sensor

**INPUT**
- Sends ultrasonic wave
- Connect to Digital OUTPUT*

**OUTPUT**
- Receives the echo
- Connect to INTERRUPT**

The labeling is a bit counter-intuitive!

*User may have to turn a Digital INPUT into Digital OUTPUT in easyC (See Page 5).
**Any INTERRUPT port may be chosen.
Interfacing Example

INTERRUPT Port #1

ANALOG/DIGITAL Port #7
Check the Vex Controller Configuration

Press F5 to bring up this window.

OUTPUT wire goes to one of the INTERRUPT ports, e.g. Port #1 here.

INPUT wire goes to ANALOG/DIGITAL, e.g. Port #7 here; must configure so that the icon is an arrow going OUT of circle (click the icon until it changes).

Analog signal
Programming The Ultrasonic Sensor

- 4 Steps must be taken to use the sensor:
  1) Declare a variable that will store the data received by the sensor (number of inches.)
  2) Call the StartUltrasonic(x,y) function (once only.)
     - x → INTERRUPT port #
     - y → Digital OUTPUT port #
  3) Include variable = GetUltrasonic(x,y) in a loop in order to poll for values (similar to using a bumper.)
     - Stores the number of inches in “variable”
  4) Use the variable to do something!
Step 1: Declare a Variable

The integer variable called “distance” will be used to store how far away the ultrasonic sensor is from an obstacle in inches.
Step 2: Call the StartUltrasonic() Function

Drag “Ultrasonic” block from menu on left to get this window. This window is used to call StartUltrasonic(), GetUltrasonic(), etc.

OUTPUT wire on INTERRUPT port #1

INPUT wire on Digital OUTPUT port #7

(Choosing “Stop” disables Ultrasonic capability.)
Step 3: Polling for Data

The `GetUltrasonic()` function will need to be inside some sort of loop in order to continuously poll for data, e.g. this infinite loop (while Loop).
Step 3: Polling for Data

After StartUltrasonic() is called, the GetUltrasonic() function can be used in the same manner as GetDigitalInput() for bumpers.

Specify the Interrupt Port and Digital Port numbers (for the OUTPUT an INPUT wires, respectively.)

Retrieve the data to the “distance” variable.
Step 4: Use the Data

GetUltrasonic() stores the number of inches the sensor is from the obstacle to the variable “distance.” The sensor can detect distances between ~3in. to ~115in.

After GetUltrasonic() stores a value in “distance,” the variable may be used for any purpose. Here, a simple message is printed stating the distance to an object on each iteration of the loop.
Step 4: Use the Data (Example)

The sensor detects that the wall is 25 inches away.