Suppose we have an NXT with a light sensor connected on port 3. How do we tell Enchanting this?

1. Click on the “Sensing” palette.
2. Click on the “Configure Sensors” button. A dialog comes up.
3. Find the light sensor configuration block on the left-hand side of the dialog. Drag it to “Sensor Port 3” and drop it there.
4. Choose what sort of light sensor you have.
5. Optionally, give it a descriptive name.
6. Press “OK”.
7. You now have new blocks to use!
Morse Key

Select the Sensing palette, and click on the Configure Sensors button [it is above all the light blue blocks].

Configure a touch sensor, like this:

Make sure that your touch sensor is on port 1 on the actual robot.

Click the button and wait for the program to run on the robot. Press and release the touch sensor. What happens?

What would happen if you changed the note or the duration?

Where could you use or ?

An NXT with a touch sensor connected to port 1.

http://enchanting.robotclub.ab.ca
See how far away something is.

An NXT with an ultrasonic sensor connected to port 4.

From the **Sensing** palette, choose the **Configure Sensors** button.

Configure a ultrasonic sensor.

Make sure the port you configure it for matches the port the real ultrasonic sensor is plugged into!

Click the **GO** and wait for the program to run.

Point the ultrasonic sensor at different objects. What do you see on the screen?

What are the largest and smallest values you see? Are there any gaps where you get no numbers?
Create a sound-level meter.

From the **Sensing** palette, choose the **Configure Sensors** button.

Configure a sound sensor.

Paint a new costume for the sprite -- make it a dot!

Click the and wait for the program to run.

Whisper, talk, sing, shout, or blow on the sound sensor.

**YOU NEED**

An NXT with a sound sensor* connected to port 2.

* Not included in all NXT sets.

**Try This Code**

```
when green旗 clicked
forever
    go to x: 0 y: 23
    point in direction
    map
        sound level from
        sound sensor in decibels
        from: [0, 100]
        to: [90, 90]
    pen down
    move 40 steps
    pen up
    wait 0.01 secs
```

**Enchanting**

http://enchanting.robotclub.ab.ca

**Do It!**

Draw a gauge on the background. Adjust how far the meter moves back and forth.
Differential Drive
(lets your two-wheel robot drive around)

From the palette, choose the button. Configure a differential drive.

The robot needs to know which ports the left and right motors are on so it can steer!

If your robot has two wheels, it is using a differential drive!

The first number embossed on a LEGO tire is the tire’s diameter in millimeters. This tire is 56 mm across.

If you tell the robot to drive forwards and it goes backwards, swap the direction that you’ve configured the motors to drive in the drive type.

The track width is how far apart the wheels are. Measure from a place on the left wheel to that same place on the right wheel. Here, measuring from the left-most point of the left wheel to the left-most point of the right wheel, the track width is about 9.4 cm.

Port A
Right motor
Port C
Left motor

Port A
Port C

9.4 cm

Drives Type

Differential drive
wheel diameter: 56 mm
track width: 9.4 cm
left motor: Port C
right motor: Port A
motors drive in reverse

http://enchanting.robotclub.ab.ca
Drive in a square.

From the Driving palette, choose the button. Configure a differential drive, using the instructions on Card #4. Measure numbers to match your robot.

Click the and wait for the program to run. Unplug the USB cable and place the robot where you want it to start. Press the orange “enter” button on the NXT.

Does the robot “dance” in a square? (Is it configured properly?) Note that you’ll never get 100% accurate motion.

Press the orange “enter” and dark grey “exit” buttons on the NXT to quit the program before plugging it back into the computer.

What other shapes and patterns could you make the robot “dance”? Could you have one robot “dance” a square inside a square being “danced” by another robot, at different speeds?

An NXT with two driving wheels.

http://enchanting.robotclub.ab.ca
Crash Test

Drive into a wall and then stop.

An NXT with two driving wheels and a bumper (touch sensor) on port 1.

YOU NEED

http://enchanting.robotclub.ab.ca

Configure a touch sensor for use as a bumper.

GET READY

as on Card #4.

Configure Drive Type

Configure Sensors

Sensor Port 1

Measures physical contact using a Touch Sensor, named bumper

TRY THIS CODE

When green clicked

Forever

Wait until enter button is pressed and released

Drive up

Wait until bumper is pressed?

Stop

DO IT!

Click the green and wait for the program to run. Unplug the USB cable and place the robot where you want it to start. Press the orange “enter” button on the NXT.

The robot drives until it hits something. Pick it up and press the “enter” button again. It drives until it hits something.

Can you make the robot say something when it hits a wall, such as, “Ouch, my nose” or “Ooof”? Could you draw eyes on it and make it wince?

How would you make the robot explore a room? Try it out!

GO FARTHER
Mexican Wave

Shout “go”, and each robot, in turn, drives forwards, backwards and forwards again.

Configure a sound sensor to listen for the start command.

This works best if you have a whole line up of robots. The delay for each robot is a couple of seconds longer for the one before it in line.

On each robot, click the and wait for the program to run. Unplug the USB cable and place the robot in line.

Then, on a signal, you all shout “go” together, and then, one by one, the robots do the same wave maneuver!

What other displays can you “choreograph”? ("Choreography" is the art of designing of movements, and comes from Greek words meaning “dance writing”).

YOU NEED
1+ NXTs, each with two driving wheels and a sound sensor* on port 2.

* Not included with all NXT sets.

GET READY
Configure Drive Type
Configure Sensors

Sensor Port 2
Measures sound level in decibels
using a Sound Sensor named sound sensor

TRY THIS CODE

DO IT!

You need 1+ NXTs, each with two driving wheels and a sound sensor* on port 2.

* Not included with all NXT sets.

YOU NEED

Enchanting
http://enchanting.robotclub.ab.ca

http://enchanting.robotclub.ab.ca
**Shy Puppy**

Robot follows you around and wants to be close, but not too close!

Too far!

Too close!

Just right!

You need:

An NXT with two driving wheels and an ultrasonic sensor pointing forwards.

![Image of a robot](http://enchanting.robotclub.ab.ca)

Get ready:

Configure an ultrasonic sensor.

Try this code:

Click the 📐 and wait for the program to run. Unplug the USB cable and press the orange “enter” button on the NXT.

Try walking away from the robot. Does it follow? Try going towards it. Does it shy away? Does it ever stand still?

What would happen if you made the robot turn?

What do two or more robots together do?

Add a face to the robot, make it “speak”, or dress it up!
**Sparkline**

Graph a changing value.

**YOU NEED**

An NXT with a light or colour sensor on port 3.

Enchanting 9 [http://enchanting.robotclub.ab.ca](http://enchanting.robotclub.ab.ca)

In Sensing, choose the button. Configure a light or colour sensor, choosing the one you have.

GET READY

TRY THIS CODE

YOU NEED

An NXT with a light or colour sensor on port 3.

Graph a changing value.

**DO IT!**

Click the 🚀 to start. Move the light sensor over different colours and shades. Move it closer and farther from a surface. Point it at a light. Change the angle. What happens?

What happens if you add in the auto-calibration blocks? Try drawing a white line on a black background. Change the lamp colour.

GO FARTHER
Follow That Line!

Follow a line around.

YOU NEED

An NXT with two driving wheels and a light/colour sensor pointing downwards.

Enchanting 10  
http://enchanting.robotclub.ab.ca

GET READY

Configure and name a light or colour sensor, choosing the type that matches your sensor.

TRY THIS CODE

Click the and wait for the program to run. Unplug the USB cable, place the robot on or beside a line, and press the orange “enter” button on the NXT.

Press the dark grey “exit” button to stop the robot.

What happens if you adjust the numbers? Does the line-following course make a difference? Can you follow the edge of a table? Where is the best place to put your light sensor? What would you do with a second or third sensor? Draw eyes and make them look left and right!

DO IT!
Locator

Find a nearby object.

An NXT with two driving wheels and an ultrasonic sensor on port 4.

Locator

Configure an ultrasonic sensor.

GET READY

Click the \( \text{ } \) and wait for the program to run. Unplug the USB cable and press the orange “enter” button on the NXT.

Move an object around in front of the robot. Does it turn to follow it?

How does it work?
How would you do this with two sensors?
Can you make the robot ignore a wall (and anything else as far away as it)?

Try making it scan in a full circle and point at the closest item.

YOU NEED

An NXT with two driving wheels and an ultrasonic sensor on port 4.

Locator

Try this code

Do it!

Locator

http://enchanting.robotclub.ab.ca
THE PLAN

If it has nothing better to do, the robot wanders around. If it sees a foe ahead of it, the robot attacks, trying to push the enemy out of the ring. Most importantly, if it sees the edge, the robot retreats from it, in an effort to stay in the ring.

GET READY

- Driving ➔ Configure Drive Type
- Sensing ➔ Configure Sensors

Configure an ultrasonic sensor and a light/colour sensor.

Create a bunch of costumes for your sprite, using the text tool to display the following words in large letters, “Countdown”, “Wander”, “Attack”, “Retreat” and “Press Button to Start”.

- Variables ➔ Make a variable

Create variables named “next action”, “foe ahead”, and “sees edge”.

YOU NEED

Each competitor needs an NXT with two driving wheels, an ultrasonic sensor, and a light or colour sensor.

http://enchanting.robotclub.ab.ca

SUMO

(card 1 of 2)

Push your opponent out of a ring.

Http://enchanting.robotclub.ab.ca
You’ll make blocks called “Attack”, “Retreat”, “Wander”, and “Startup”.

Click the and wait for the program to run.

Unplug the USB cable and place the robot on the sumo board. When you are told to start your robot, press the orange “enter” button on the NXT.

Can you add other behaviours to the robot, or change some of the existing ones? What could you do to make your sumo robot better?

Would this method of programming work for other robots?