



Module 2, Lesson 2 – Programming the NXT to measure and display sensor signals

Teacher

20 minutes

Purpose of this lesson

- Program the NXT computer.
- Program the NXT to read voltages from a sensor circuit and display on the screen.

In the previous lesson you learned that the NXT contains a potential divider circuit and a voltmeter which can measure the voltage across a thermistor. You also learned that the NXT represents voltages from 0 – 5V as “raw numbers” from 0 – 1023. You then predicted the “raw number” values that the NXT would produce for different temperatures sensed by your thermistor. In this lesson, you will program the NXT to measure and display these numbers. You can then test your predictions by placing the thermistor in water of various temperatures and seeing what the NXT displays.

Materials

Copy of the lesson	Hot water
Computer with Mindstorms software	Ice
1 NXT	1 Thermometer
1 Thermistor circuit (created in the previous lesson)	Graph paper (or Excel)
1 Beaker	

Procedure

Programming the NXT

To program the NXT computer to measure the voltages and display them as “raw numbers” on the NXT screen. We can use any sensor icon to read voltages from sensor port 1. In this lesson, we have used the NXT touch sensor icon, simply as a function to read voltages from the voltmeter built into the NXT.

Before attempting this lesson, you should be familiar with how to set up the NXT, connect it to your PC and write, download and run programs. If you are not familiar, please refer to the Add

on Lesson: **Introduction to the NXT and Mindstorms Software** before continuing with this lesson.

1) Using the Mindstorms software, create a program that will allow the NXT to display temperature readings using a thermistor – see below.

The image shows a Mindstorms software program with several annotated blocks:

- Set sensor block to read from sensor port 1**: Points to the sensor port selection block.
- Infinately repeating loop "keep on repeating anything inside this loop"**: Points to the loop icon.
- Read in raw sensor value 0-1023**: Points to the sensor value block.
- Convert the number into text**: Points to the number-to-text conversion block.
- Display text on screen**: Points to the text display block.
- Remember to set the Display icon to display "text"**: Points to the text icon in the Display block's action menu.

This NXT code means:

- In an infinitely repeating loop:
- Read the raw sensor value (0-1024)
- Convert this number into text
- Display the text on the NXT screen
- Keep on repeating

The **Display** block configuration is shown below:

- Action:** Text
- Display:** Clear
- Text:** Simple Text Mindstorms NXT
- Position:** X: 8, Y: 32
- Line:** 4

Caution: do not use the ready made "temperature sensor" icon that is built in to the NXT programming system. This is designed for use with the LEGO temperature sensor which has different calibration characteristics from the sensor you are building. Therefore the NXT temperature sensor icon may give false temperature readings if you try to use it with your own thermistor.

Temp °C	0	10	20	30	40	50	60	70	80
NXT raw value									

Assessment

Once you have written the above program, run it on the NXT while placing the thermistor into cups of water at various temperatures. Plot a curve of NXT raw value against temperature (measured with your thermometer). Compare this against the curve you predicted (see above). How well do they match?