



# Introduction to Engineering Lab - ECE 101

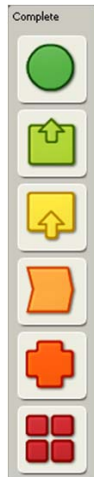
The complete palette using data hubs and data wires

October 12, 2015

# The complete palette

## The complete palette

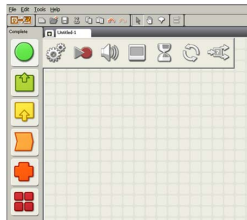
- So far, you've used only the Common Palette (for most blocks so far) and the Custom Palette (for the My Blocks).
- This palette contains all blocks that can be used in an NXT program, except for the My Blocks that you create yourself.
- Each colored icon on the Complete Palette represents a certain type of block in the categories Common, Action, Sensor, Flow, Data, and Advanced blocks.



# The complete palette

## The common palette

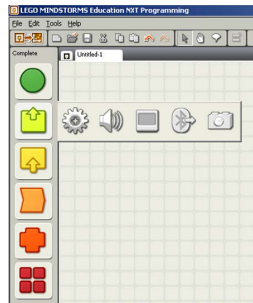
- Common blocks are the blocks from the Common Palette.
- Common blocks are just a collection of frequently used blocks.
- The seven common palette blocks are:
  - Move
  - Record/Play
  - Sound
  - Display
  - Wait for
  - Loop
  - Switch



# The complete palette

## The action palette

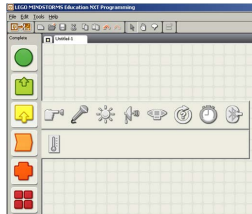
- Most of this can be accessed through the common palette, although there are slight differences
- The five action palette blocks are:
  - Motor
  - Sound
  - Display
  - Send message
  - Lamp



# The complete palette

## Sensor palette

- Sensor blocks (colored yellow) are blocks to read values from sensors for use in your programs. These blocks differ from the blocks that you've used so far to poll sensors, such as the orange Wait block.
- The sensor blocks are:
  - Touch sensor
  - Sound sensor
  - Light sensor
  - Distance sensor
  - NXT buttons
  - etc
- All of these are used as data sources for other parts of your program

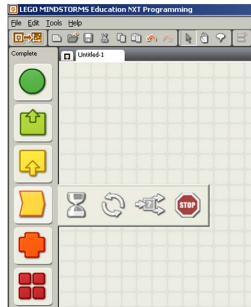




# The complete palette

## Flow palette

- Used to change a programs flow. For instance, some blocks may need to be repeated (with a Loop block), or a decision may need to be made (with a Switch block).
- The flow blocks are:
  - Wait
  - Loop
  - Switch
  - Stop program
- The stop program block can be used any where in the program to end the whole program

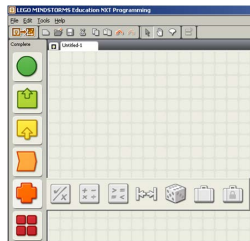




# The complete palette

## Data palette

- The data blocks are:
  - Logic
  - Math
  - Compare
  - Range
  - Random
  - Variable (read and write)
  - Constant
- Each block has its own function, but they all process values carried by data wires and generate new values based on the input values.

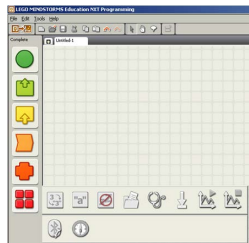




# The complete palette

## Advanced palette

- The advanced blocks are:
  - Number to text
  - Text
  - Keep alive
  - File access
  - Calibrate sensor
  - etc
- We'll talk about it more next time







## Data hubs and data wires

### Data hubs and data wires

- You'll learn how to use data hubs and data wires to create more advanced programs for your robots.
- So far, you configured each programming block by entering the desired settings in the Configuration Panel.
- By using data hubs and data wires blocks can configure each other.
  - For example, one block can instruct a motor block to run a motor at a certain power level





## Data hubs and data wires

### Using data plugs: input and output

- The hubs contain two types of plugs: output plugs (on the right side) and input plugs (on the left side).
- Output plugs carry out a value and pass it to a data wire.
  - For example, the Distance plug on the Ultrasonic Sensor block carries out the measured distance value.
- Input plugs retrieve the value from the data wire and pass it to the block it connects to so that the value can be used to reconfigure one of the blocks settings.

### When using blocks with data wires, what happens to the settings you configured in the Configuration Panel?

- As a general rule, the data wire input overrides the setting specified in the Configuration Panel, and the setting in the Configuration Panel is ignored.
- All other settings that do not conflict with a data wire are in effect, as specified in the Configuration Panel.



# Data hubs and data wires

## Data wire types

- Data wires carry information between blocks.
- There are three types of data wires: Number, Logic, and Text data wires.
- Each type of data wire carries a specific type of information (numerical, logic, or text values), and each type has its own color.

## The number data wire (yellow)

- Carries numeric information that may include whole numbers (such as 0, 15, or 1427), numbers with decimals (such as 0.1 or 73.14), and negative numbers (such as -14 or -31.47).
- Examples of information carried by Number data wires are Ultrasonic Sensor readings and loop counts.



## Data hubs and data wires

### The logic data wire (green)

- Carries only two values: true or false.
- These wires are often used to define settings of a block that can have only two values.
- For example, a motor will spin forward when a Logic data wire with the value true is connected to the Direction plug of a Motor block. Consequently, it spins backward when the Logic data wire value is false.

### The text data wire (orange)

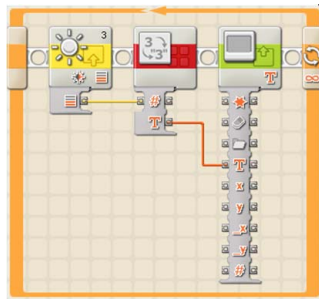
- Carries text between blocks to, for example, the data hub of a Display block so that it appears on the NXT screen.
- This text can be a word, like Hello, as well as sentences like My name is John.
- The broken data wire: The broken data wire (gray) carries no information.



## Data hubs and data wires

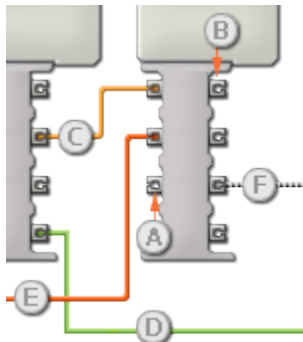
### Display Block: Showing values from a sensor

- Here we take a LIGHT SENSOR block (found under the Complete Palette)
- Connect it to a NUMBER TO TEXT block
  - Note that, you cannot use the Display block to display values from Number data wires. Therefore, you'll have to convert the numeric sensor reading into something that the Display block does accept: text.
- Connect that to a DISPLAY blocks Text data terminal
- You have to tell the Display block that you want to display TEXT and which line you want to display it on



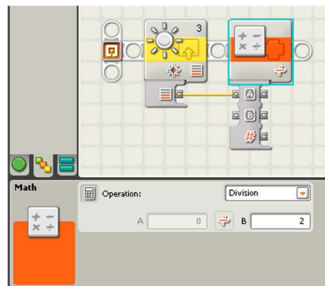
## Multiple data wire connections

- You can use multiple input plugs on a single block to reconfigure more than just one setting of a block with a data wire.
- In the same way, you can use multiple output plugs on a single block.
- You can also use a single output plug to send information to more than one block



## The Math block

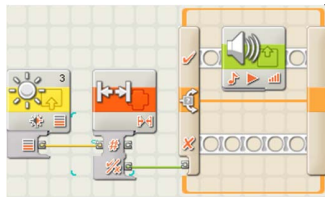
- The math block allows us to do the following:
  - Addition, Subtraction, Multiplication, Division, Absolute Value, Square Root
- Values can be put in at the program OR taken from other blocks in the program (sensors, counts, variables, etc)
- *Shown on the right:* The value of the light sensor is being divided by 2, then the value would be available on the outside of the Math block by connecting to the # data terminal





## The Range and the Switch block

- You can use the **Range Block** to select a course of action if a value falls within a certain range.
- It doesn't do anything by itself and must be paired with two things
  - An input number and
  - An output logic value (true/false)
- A **Switch block** can also make decisions about values when a data wire is connected to the Switch block.
  - To do this: set the control parameter on its configuration panel to Value







## Data hubs and data wires

### Switches and flat view

- Switches can have Flat View disabled, and each condition for the switch will then have a tab at the top of the block
- Toggle the tabs to see the different sections of code inside the block sections
- Enables you to connect blocks inside and outside the switch

