

# ZERO ROBOTICS

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## ISS PROGRAMING CHALLENGE

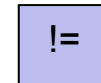
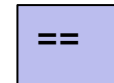
### Conditionals: More Fun with “If-Then” and Logic Operators (Project 5)





- Great job so far! There are a lot of things you already know how to do! In this tutorial and in the following tutorials you will get a chance to start using what you have learned. Some familiar steps will have less detailed instructions. Look at hints or at previous tutorials if you need help, or ask a friend!

- In this tutorial you will:
  - Review: How *your* program controls the SPHERES satellites
  - **Practice** programming with “If\_Then” statements
  - Use the logic operators “==” and “!=”
  - Learn about the “**debug**” feature





- The program inside *your* loop is called **once per second** by the SPHERES control system.

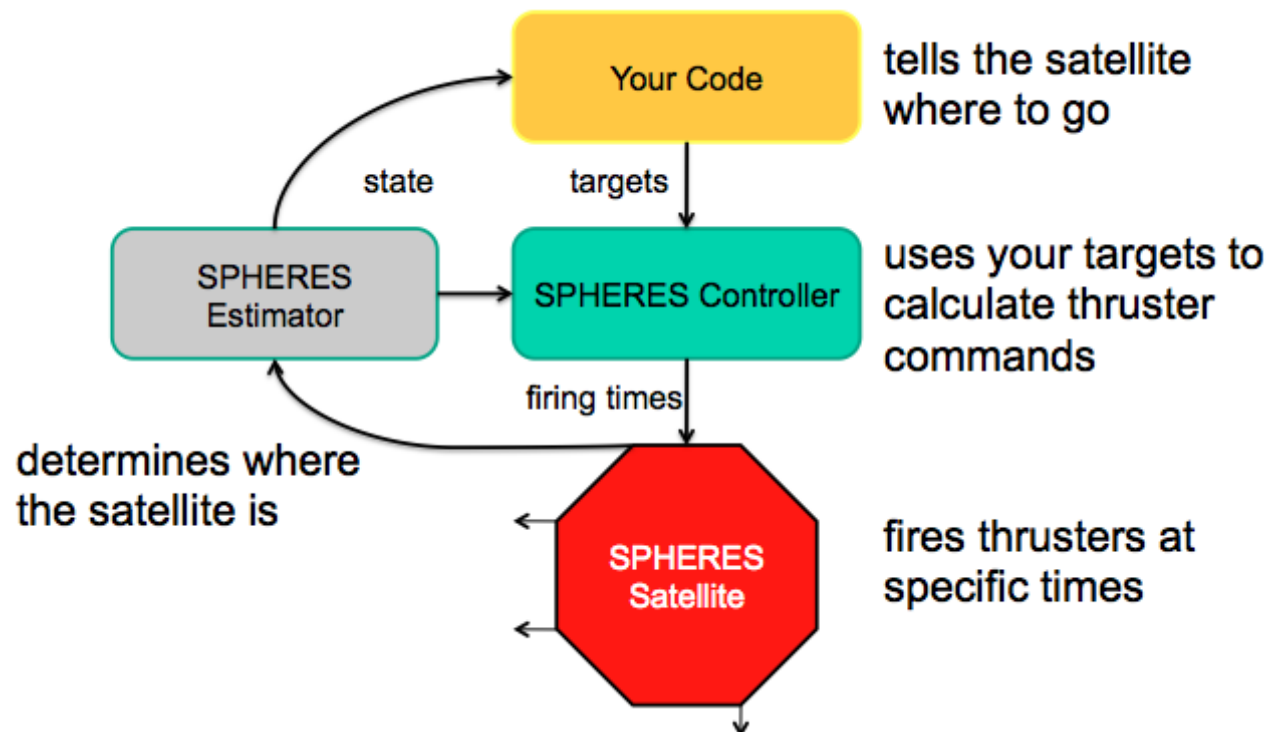
Graphical editor



Text editor

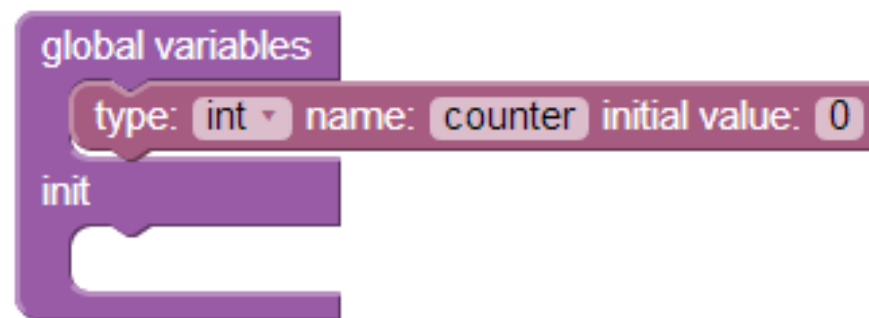
```
1 void loop() {
2 }
```

- During each second:





- Let's create a new **"if-then"** project to learn more about the SPHERES Control System
- Open the IDE
- Select "New Project"
  - Project name: **Project5**
  - Editor: Graphical Editor
  - Game: FreeMode
- Open the **Init** page
- Create a variable (pink block) called "counter"
  - Type: int
  - Name: counter
  - Initial value: 0
- Go back to the **Main** page



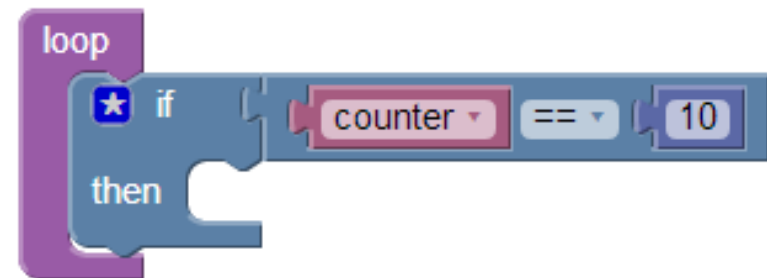
## If-Then with the Logic Operator “==”



- “==” is a Logic operator that means “equals”
- Create the following “if-then” statement in your loop:

**If counter == 10 then . . .**

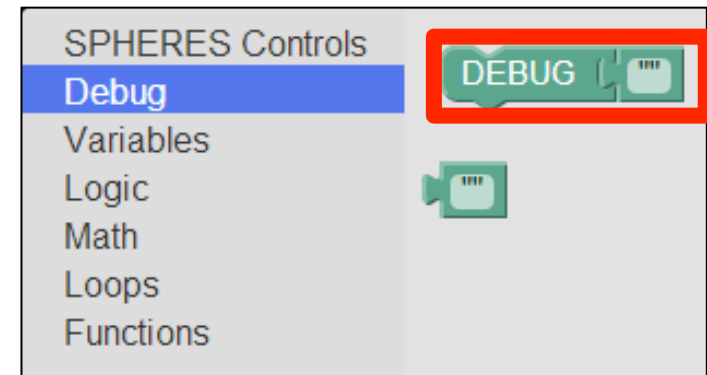
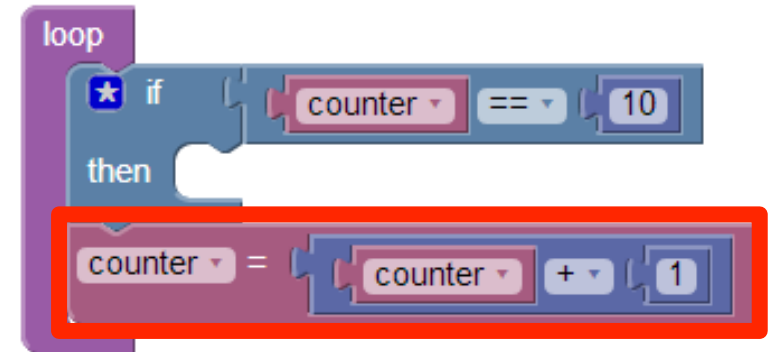
(See example to the right)



- Here are some hints:
  - Drag the “if-then” block from the Logic accordion into the loop
  - Drag the “\_\_==\_\_” block from the Logic accordion to the end of the “if-then”
  - Drag the “--Select--” block from the Variables accordion to the first empty space in the “\_\_==\_\_” block and toggle to **counter**
  - Drag a number from the Math accordion to the second empty space and enter **10**



- Add “counter = counter + 1” **after** the “if-then” statement (see example to the right):
  - Drag the “--Select-- = 0” block from the Variables accordion into the loop **after** the “if-then” block.
  - Toggle to counter on the left side
  - Replace the number with the “\_\_ + \_\_” block from the Math accordion
  - Place a “--Select--” block from the Variable accordion in the first empty space and toggle to counter
  - Place a number (1) in the second space from the Math accordion
- Next add a debug statement, which prints out messages.
  - Find the “DEBUG” block in the Debug accordion



## Adding Debug Statements



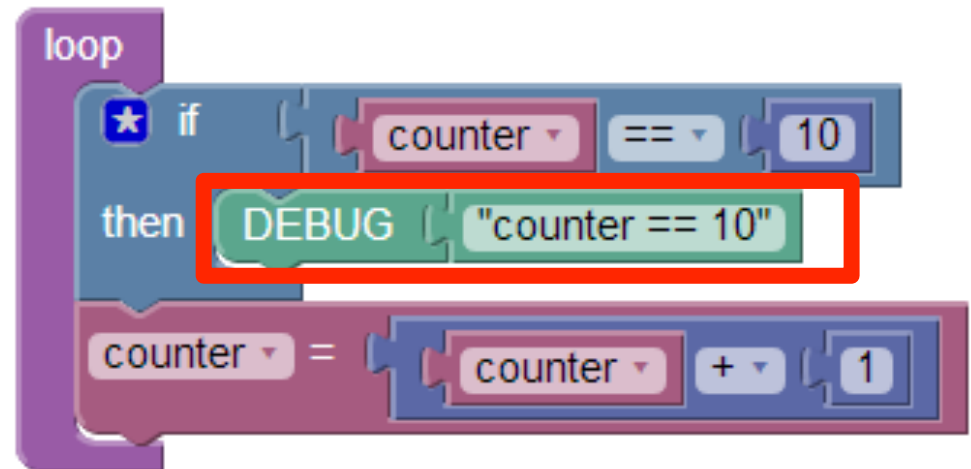
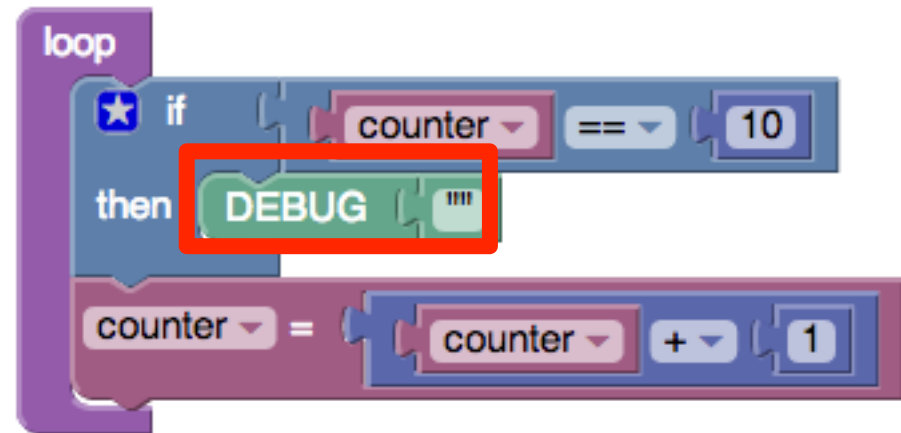
- Drag and Drop the “DEBUG” block into the “if-then” block
- Type in the following message into between the quotation marks in the “DEBUG” block:

“counter == 10”

Notes:

- You will get errors without the quotation marks
- There are no spaces between the equals signs
- You have created the following “if-then” statement:

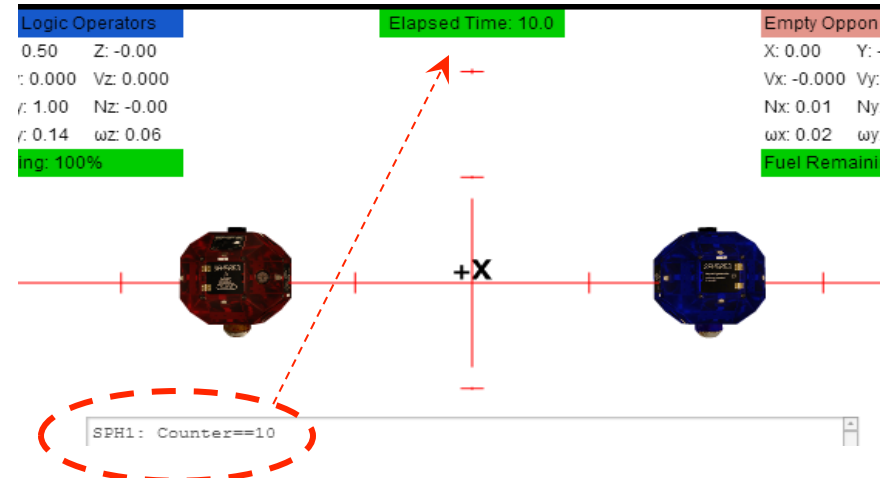
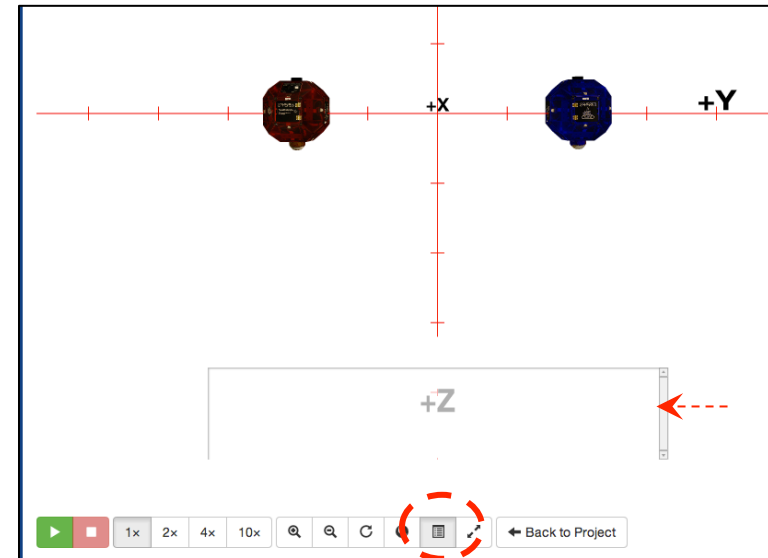
**If counter == 10 then**  
print the debug statement:  
“counter==10”



# Viewing Debug Statements



- Since you have not used any SPHERES controls in your program, the Satellite will not move, instead, watch for your a debug message as follows:
  - Compile, Simulate
    - o Maximum time: 45 seconds
  - **Before** you play your simulation
    - o Be sure a grey console box is present on your screen (Toggle the “show console” icon, if not)
  - Watch for your debug message in this box when you run the simulation
    - o Your debug message for blue SPHERES 1 (SPH1) will appear after 10 seconds (see example)
  - View simulation





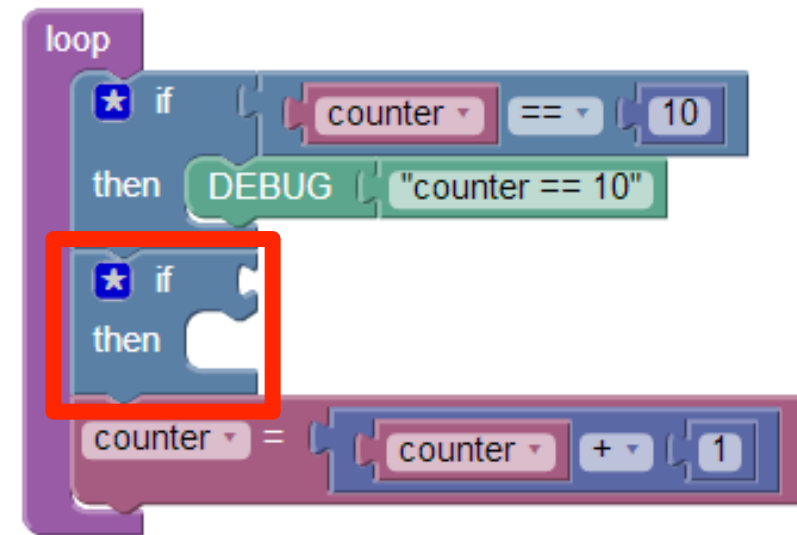
## Adding the logic operator “!=”



- “!=” is a Logic operator that means “not equal”
- What happens if you add the following if-then statement to your loop?

If counter != 10 then....

- To do this:
  - Drag a new “if-then” block from the Logic accordion and insert it into the loop **after** the first “if-then” statement and **before** the “**counter = counter + 1**” block as shown.



## Adding the logic operator “!=” (cont.)

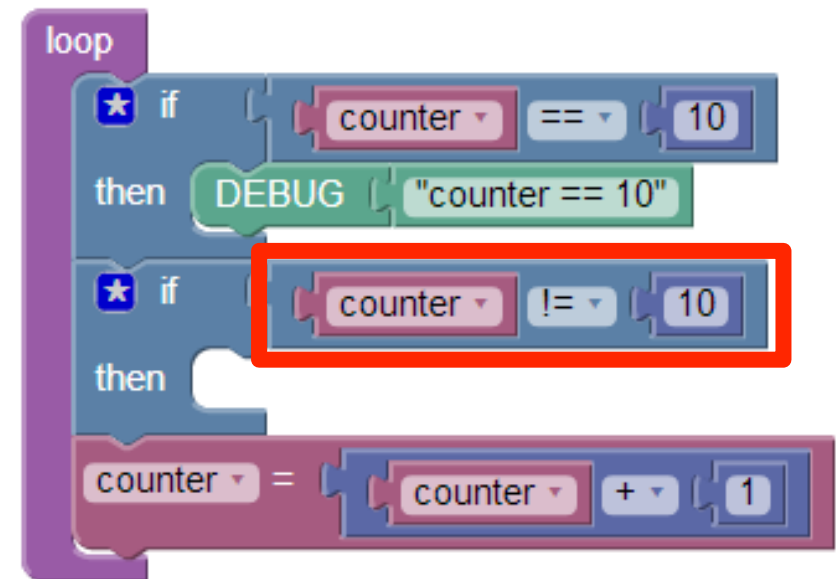


- Change the new “if-then” block statement to:

If counter “!=” 10 then...

(If counter is not equal to 10 then...)

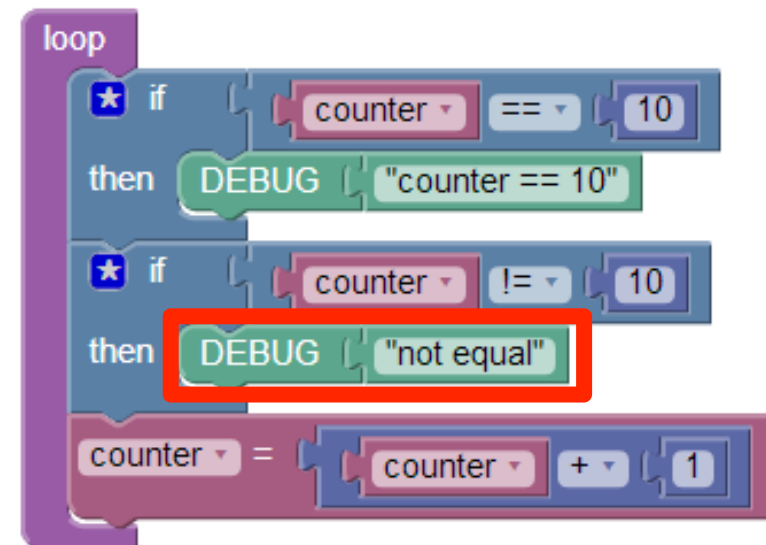
- Drag the “\_\_==\_\_” block from the Logic accordion, and use the dropdown in it to change to !=
- Place a variable block (“--Select--”) from the Variables accordion into the first space and select counter
- Place a number block from the Math accordion into the second space and enter 10



## Adding the logic operator “!=” (cont.)



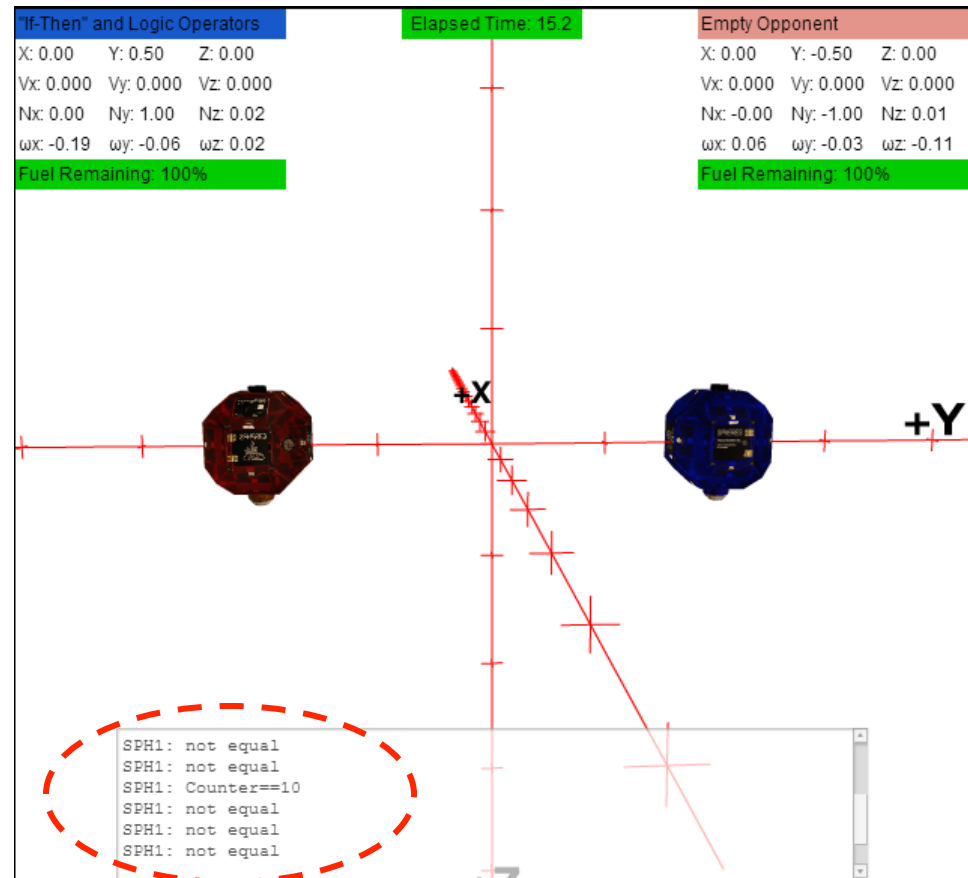
- Drag a “DEBUG” block into the new “if-then” statement
- This time write the message:  
“not equal”  
(don’t forget to use the quotation marks)
- Look at the program you created. What do you expect to happen when you run the simulation? Let’s find out.
- Compile, Simulate
  - Maximum Time: 45 seconds
- **Before** you play your simulation
  - Click the “view console” icon on the bottom of your screen



## Adding the logic operator “!=” (cont.)



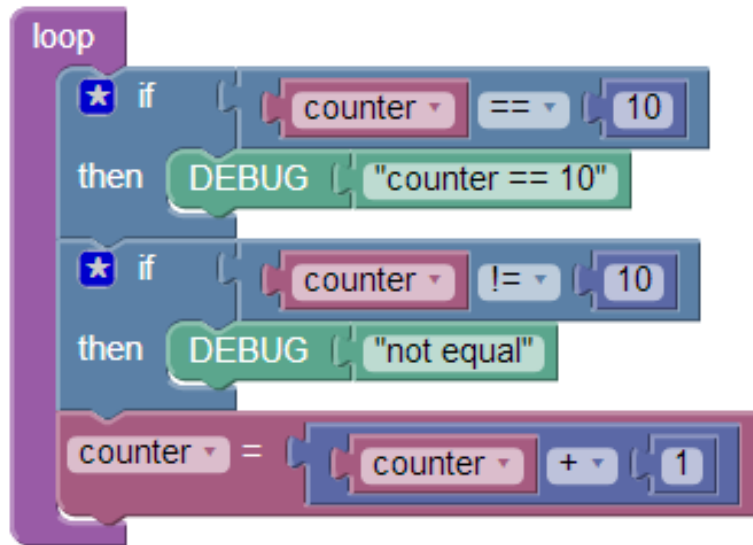
- Remember that your program is being read by the SPHERES Control System every second.
- A “not equal” message was printed each second that the counter did not equal 10 (starting from counter==0)
- A “counter == 10” message was printed for each second that the counter was equal to 10
  - Can you find that message?
- DEBUG statements can help you check if your program is running the way you expect it to run.



## Text Version of Code



Compare:      Your program   -   versus   -   C Code



```

1 void loop() {
2   if (counter == 10) {
3     DEBUG(( "counter == 10" ));
4   }
5   if (counter != 10) {
6     DEBUG(( "not equal" ));
7   }
8   counter = counter + 1;
9 }
  
```



- You can also use the debug statement to print out the value of a variable:

–To do this use the following format inside the DEBUG block:

“text text text **symbol**”, **variable**

–The symbol used depends on the data type:

Data Type	Symbol
int	%d
float	%f

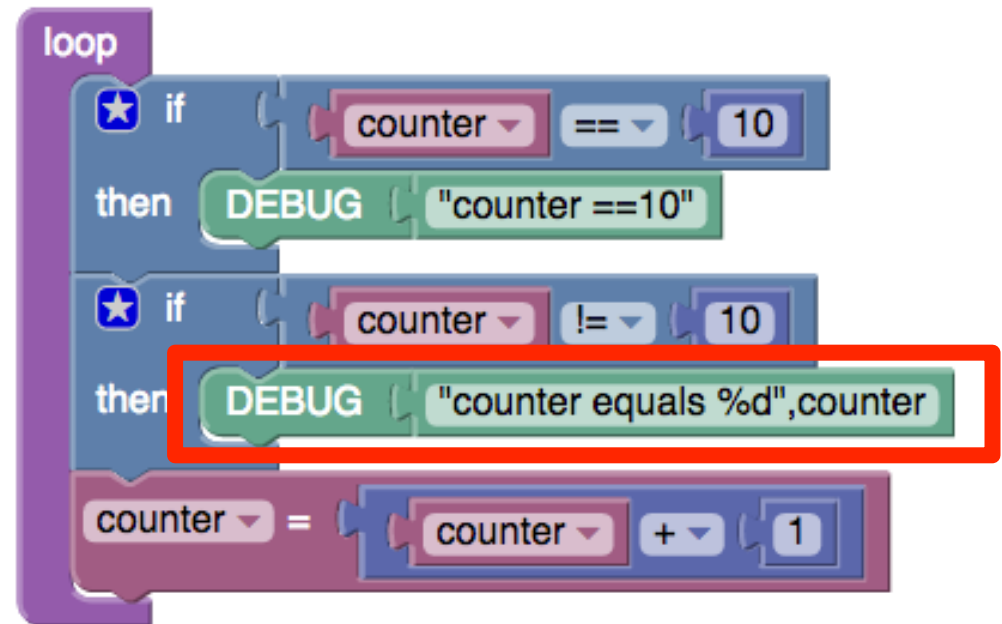
- For example to print out the value of the counter:

–In the DEBUG block write: “counter equals %d”, **counter**

(Use symbol %d since “counter” is an integer (int))



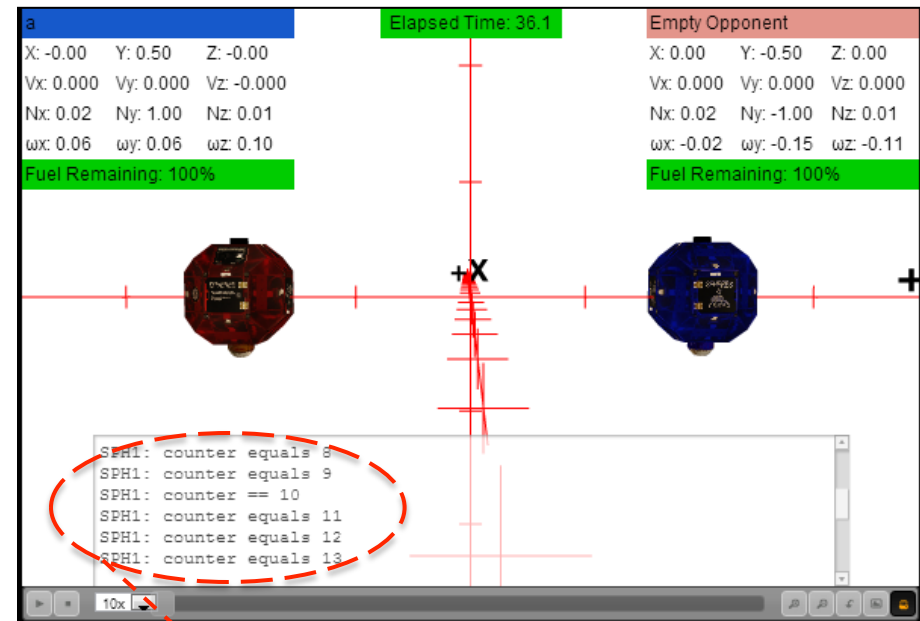
- Change the words in the 2<sup>nd</sup> DEBUG statement to:  
 “counter equals %d”,counter
  - Pay careful attention *to the location of the quotation marks* and *include the comma!*
- Look at the program you created. What do you expect to happen when you run the simulation?
- Let’s find out. Compile, Simulate
  - Maximum Time 45 seconds



## More on Debugging (cont.)



- Remember that your program is being read every second.
- A “**counter equals (number)**” message was printed for each second that the counter did not equal 10 (starting from counter==0)
- A “**counter == 10**” message was printed for each second that the counter was equal to 10
  - Can you find that message?
- DEBUG statements which print variables are also very helpful for checking if your program is running the way you expect it to run.



```

SPH1: counter equals 8
SPH1: counter equals 9
SPH1: counter == 10
SPH1: counter equals 11
SPH1: counter equals 12
SPH1: counter equals 13
    
```





- Congratulations!
- You are becoming a pro at conditional statements!
- You have learned two more logic operators “==” and “!=”
- You wrote a program that shows the SPHERES Control System reads your loop once per second.
- You have learned how to use Debug statements!

