



## 4 Using Digital Inputs

NAME: \_\_\_\_\_ Date: \_\_\_\_\_ Section: \_\_\_\_\_

### INTRODUCTION

Robotic arms need to be able to communicate with an operator so that you can tell it when to begin or end an operation. We can do this very easily with an input connected to the arm. This input can be something as simple as digital on/off switch.

In this activity, you will perform a pick and place with a robot arm using the air pump kit and a vacuum gripper or mechanical gripper. You will make the robot wait for an input on a switch before it starts, and eventually you will make the robot repeat this five times. Here is what you want your robot to do:

- Wait for the operator to hit the start switch
- Go home
- Pick up the object
- Place the object in another spot
- Return home
- Operator moves the part back to the start
- Repeat



*Suction cup gripper attached to the rotational servo.*



**Remember:** We always go to a position above the pick or place point first so that the robot places the object straight down, with no friction or interference. This will increase accuracy!

### KEY VOCABULARY

- TCP
- Loop
- Pull Down Resistor
- Normally Open
- Suction
- Vacuum
- Digital
- Normally Closed



## EQUIPMENT & SUPPLIES

- Dobot Magician
- Dobot Field Diagram
- ¾ inch wooden cylinders
- Servo extension cables
- Electrical tape
- Suction cup gripper
- Suction Cup or Mechanical Gripper
- DobotStudio software
- Digital Switch
- Jumper wire
- 3 prong male header pin
- Resistor 4.7KΩ to 15KΩ

## PROCEDURE



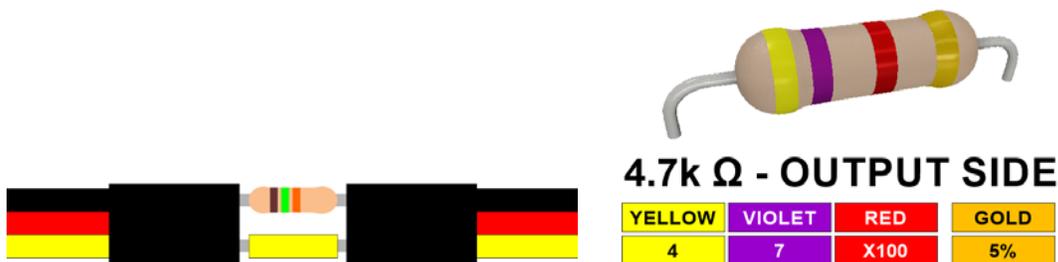
**WARNING**



**Power OFF**

**Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS shutdown the Dobot before making connections or damage to the robot could occur.**

1. Attach the *Suction Cup or Mechanical Gripper* as done in previous activities to the *rotational servo* and then attach it to the robot and plug in the wires as shown below.
2. Add the switch as an input. *Be sure to turn off power to the Dobot before continuing!*
3. Install a **PULL DOWN RESISTOR** on the ground side of the servo extension cable. The pull-down resistor will insure a well-defined logical level in our logic circuit. This resistor will help eliminate possible float values and will pull the input pin to a logical low state in all conditions. The pull-down resistor can have any value from 4.7KΩ to 15KΩ. The larger the resistance, the slower the input pins response will be to voltage in milliseconds.
4. **One way to do this is shown below. Be sure to complete this portion of the activity the way that your instructor taught you.**



**4.7k Ω - OUTPUT SIDE**

### Parts List

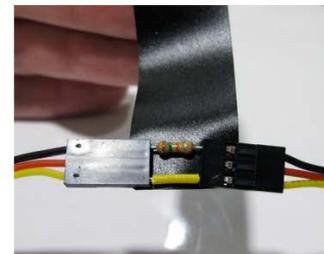
2 Servo Extension Cables  
1 Male Header Pins - 3 Prong  
1 Short Jumper Wire  
1 Resistor 4.7kΩ to 15kΩ  
1 Digital Switch  
Electrical Tape or Heat Shrink

### 1. Install Resistor & Jumper Wire

The Resistor needs to be installed on the ground side to work as a pull down resistor.

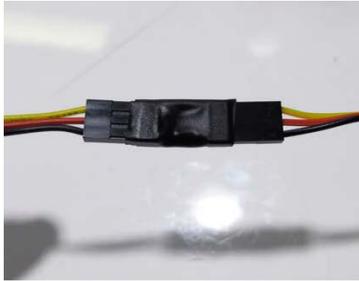
### 2. Secure the Components.

Wrap the resistor and jumper wire with electrical tap or heat shrink to ensure they will not come apart



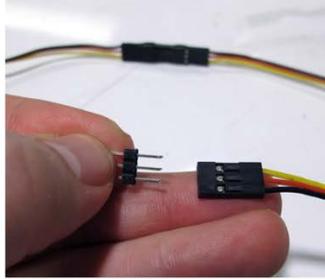
### 3. Ensure Connection

Lightly tug on the assembly to ensure the connection is stable



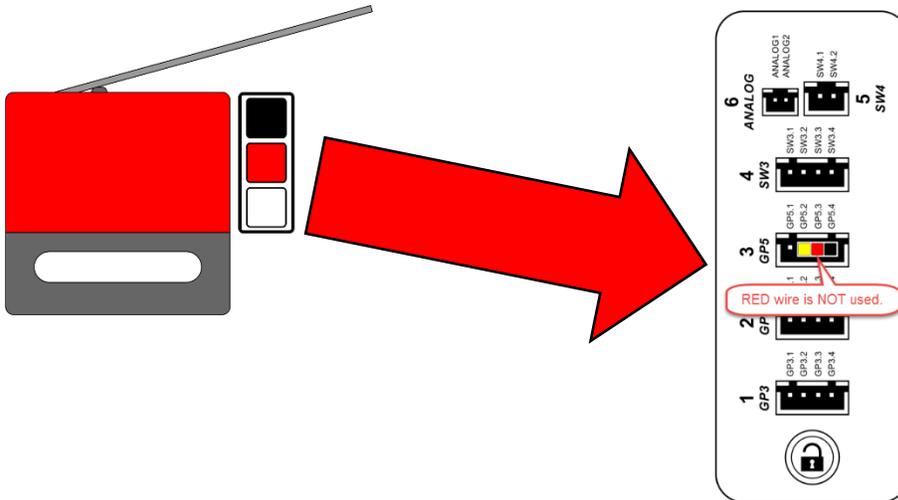
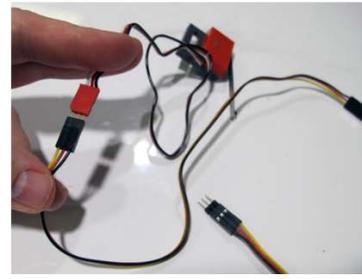
### 4. Install Male Header Pin

Install a 3 prong male header pin on one end of the servo extension cable. This end will go into the bread board.



### 5. Install Digital Switch

Install a digital switch to the opposite end of the servo extension cable.



Use the wire you made above to attach the switch to GP5 as shown in the diagram above. Always be sure the black wire on the extension cable matches the black wire on the switch.



5. Open Dobot Studio software, connect and home the robot, and be sure the *Suction Cup* is chosen



6. Now open the *Teach and Playback* module and perform a pick and place with a wooden cylinder as you did in a previous activity. The only difference is that this time you will use the Suction Cup to pick and place the object. Be sure to use “above” positions. Save your program when finished. You may even be able to use a program you have already written and just touch up the points.

**Be sure to have your instructor check when completed.**



- Be sure to turn on/off the suction when necessary

SuctionCup	
SuctionCupOff	EI
SuctionCupOff	
SuctionCupOn	
SuctionCupOn	
SuctionCupOn	
SuctionCupOn	

- Be sure to add EIO5 as an Input on the first line of the program. This will ensure that when you hit the switch (Turn it on) the robot will start the rest of the program.



*You must be in Pro Mode to do this!*

Trigger_ID	Condition	Value
EIO5_Input	=	1
Cup		

- Hit the *Play* button to run your program and see what happens.

*10. Did it work the first time? If not, what did you have to change to make it work?*

- Now let's make the robot do this five times, as you did in the last activity.  
***Be sure to have your instructor check when completed.***

- Be sure to save your work when done.



## CONCLUSION

1. *What is the purpose of the resistor in the wire that you made at the beginning of the procedure?*
2. *What might happen if you did not use this resistor?*
3. *What does it mean that the switch is DIGITAL?*
4. *What type of operation could this be simulating?*
5. *Is the switch you used Normally open, or Normally closed? How do you know?*
6. *If you used a normally open switch*

## GOING BEYOND

***Finished early? Try some of the actions below. When finished, show your instructor and have them initial on the line.***

- \_\_\_\_\_
1. Look in the inputs and outputs manual and find another open input you might be able to use. Check with your instructor to be sure you choose an appropriate one, and then make the robot move the object to another predefined position when you hit that switch.
- \_\_\_\_\_
2. Can you use something else as an input to the robot to make it do something? Check with your instructor and try something else.
- \_\_\_\_\_
3. Wire a microcontroller to be an input for the robot.



Ask your instructor about what to use for this activity.

