7 Handshaking: Dobot to Microcontroller

NAME: _____   Date: _____   Section: _____

INTRODUCTION

Robotic arms sometimes need to communicate with other machines in a workcell, or factory. This is called **HANDSHAKING** and can be done between different machines, devices and robots. It is a very simple form of communication and is done with simple ones and zeros; or "ons" and "offs".

In this activity you will learn how to make a robot handshake with a simulated machine; a grinder. You will make the robot talk to the grinder to turn it on during an automated grinding operation. Remember, this is CIM, we do not want to keep the grinder running all the time; we need to conserve energy, time, and resources, so the grinder needs to stop, and the robot will then replace the part.
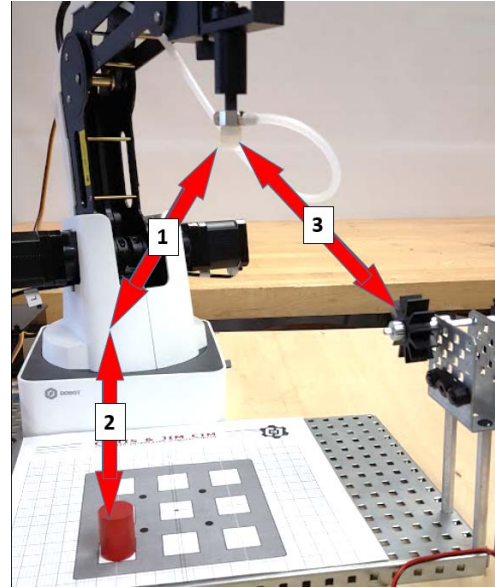
Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS turn it off before making connections or damage to the robot could occur.

KEY VOCABULARY

- Handshake
- Optical Isolator

EQUIPMENT & SUPPLIES

- Robot Magician
- Dobot Field Diagram
- 1" x ¾" cylinders or ¾" cubes

- Servo extension cables
- Dobot Input/Output Manual
- Breadboard/wire/4N25 Optical Isolator and 100 ohm & 4.7K ohm resistors

- VEX, PIC, Arduino may all be used in this activity, but wiring may vary.

- DobotStudio software
- RobotC or other VEX control software
- Pneumatic Gripper or Suction Cup Gripper
- Handshake module
- Normally open digital switch
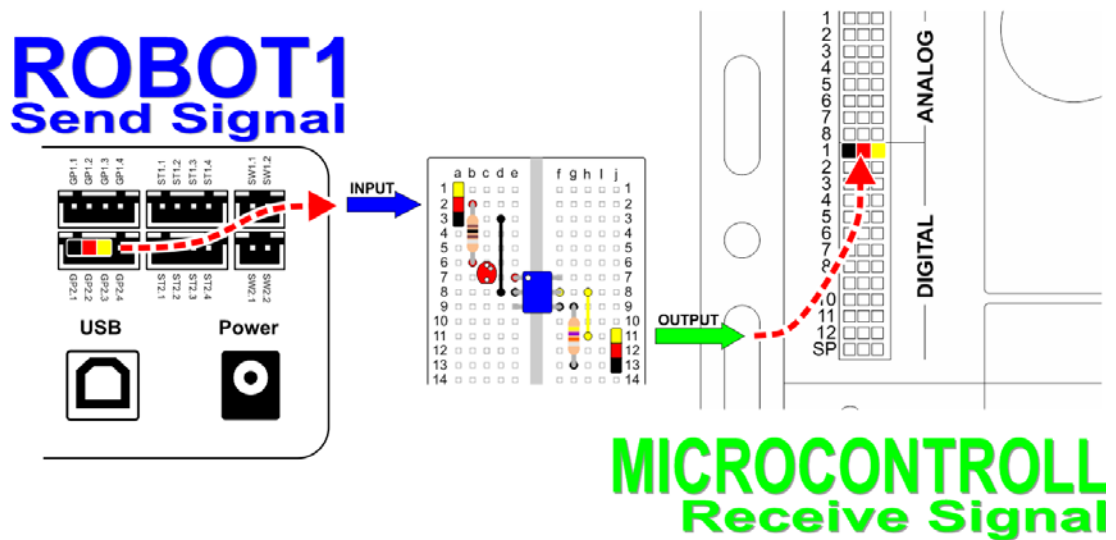- VEX parts: various for building the grinder including a baseplate, motor & controller.
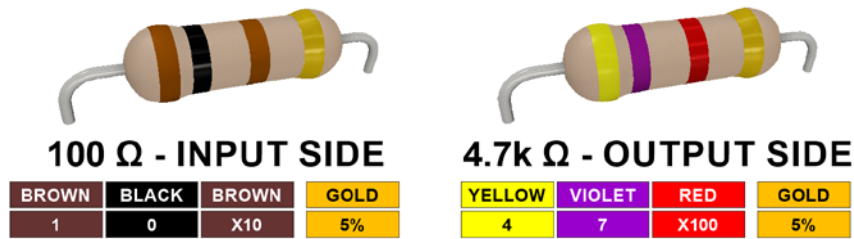
PROCEDURE

Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS turn it off before making connections or damage to the robot could occur. Be sure to ask your instructor if you have any questions.

1. Wire the robot to the VEX Cortex through the handshake controller as shown below. Any other microcontroller, such as an arduino a PIC or a Raspberry Pi may be used as well.
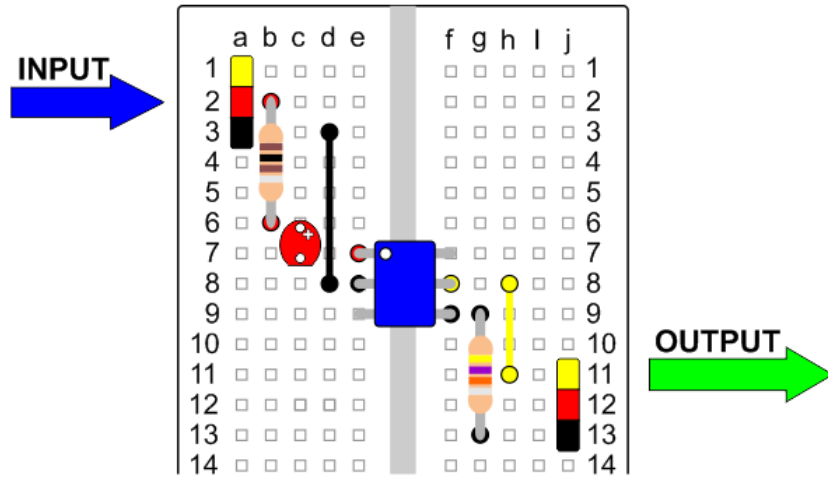

100 Ω - INPUT SIDE			
BROWN	BLACK	BROWN	GOLD
1	0	X10	5%

4.7k Ω - OUTPUT SIDE			
YELLOW	VIOLET	RED	GOLD
4	7	X100	5%

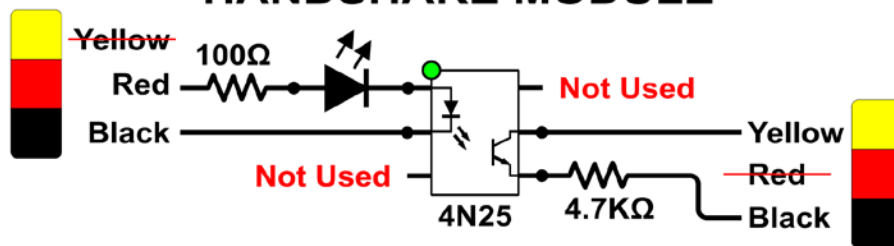Back of the robot: GP2.1 & GP 2.3   Optical Isolator   Cortex: Digital Input

HANDSHAKE MODULE

Connect EIO13 on the back of the robot to the input of the handshake controller, and then wire the output of the handshake controller to digital input #1 on the VEX Cortex. Use servo extensions to do this.

WARNING

Notice that on the **INPUT** to the handshake module you will use the RED and BLACK wires to trigger the Optical Isolator. On the **OUTPUT** side you will use the WHITE and BLACK wires to trigger the input on the VEX Cortex.

If you are not using the handshake module, but some other form of optical isolator, just understand that the signal from the back of the robot is coming from the Black and Red wires from the extension cable.

These correspond to the signal being sent from pins GP2.1 and GP2.2 on the back of the robot.

WARNING

Be sure to consult the Dobot Input/Output manual if you want to use other inputs and outputs, as damage to your robot or your other equipment may result.

2. Wire the *normally open digital switch* as an input as done in previous activities.

HELPFUL TIPS

Use a servo extension cable to attach the VEX limit 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. For more info on how to construct this please refer to the previous activity.
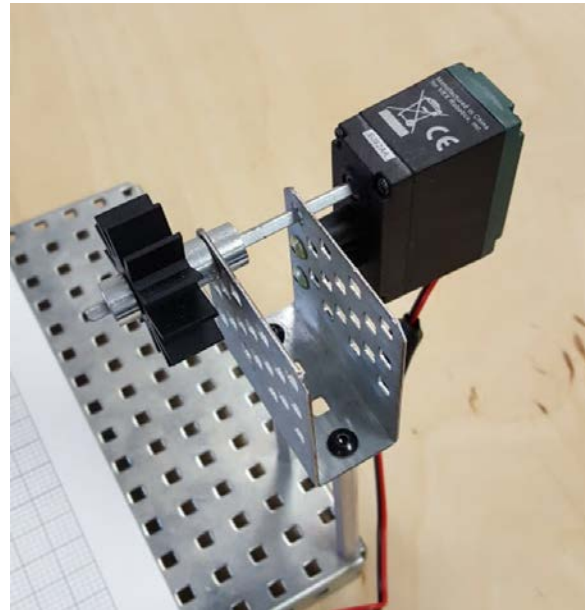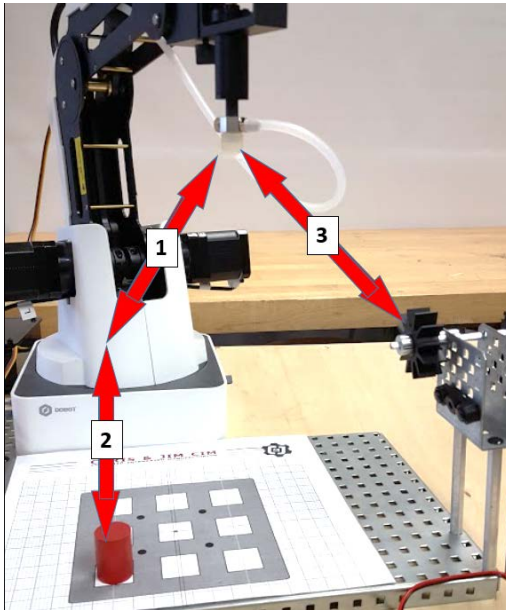
3. Attach the *Air Pump/Vacuum Gripper* kit or the *Pneumatic Gripper* to the robot as done in previous activities.

4. Be sure you are in Pro mode in the DobotStudio software.
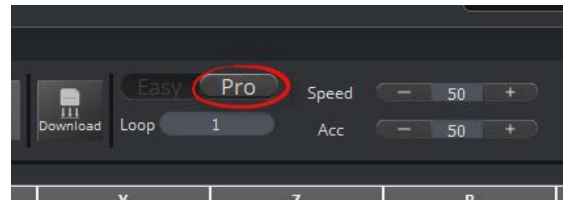
When you re-open this program if you do not switch to Pro mode, it will not use the inputs and outputs!

5. *Set up the Dobot Studio program so that it moves the part through the motions described above.*

6. *Build a simple grinder to simulate a manufacturing process. In this case VEX parts are used to simulate a simple grinder.*

7. Write the RobotC or microcontroller code that will make the robot complete the following tasks:
   a. Send the robot home.
   b. Wait for the limit switch to be hit to start the program.
   c. Continuously do the following, every time the limit switch is hit.
      i. Go get the part from the pallet.
      ii. Bring the part to the grinder.
      iii. Turn on the grinder.
      iv. Complete the grinding operation.
      v. Return the part to the pallet.

VEX Users: *Be sure to set up the input to the VEX Cortex as a **Touch Sensor**, not a **Digital IN**! If you use a **Digital In**, "off" will be "on", and "on" will be "off".*

8. *Write down any notes that you think you may need to make this work:*

9. Once both programs are written, Run the DobotStudio program , and the RobotC or microcontroller program. If written correctly, the robot will wait for the press of the switch, and the RobotC program will wait for an input from the grinder.
   If it does not work correctly, troubleshoot until it does.

10. *If your setup did not work correctly the first time, what did you have to do to make it work?*

CONCLUSION

1. *What would you have to do to make this program run five times without any human intervention? Explain fully.*

2. *What is the order of operations for successfully starting this setup? Which program has to start first? Explain why.*

3. *Which gripper did you choose to complete this activity? Justify your choice*

4. *What's the pseudocode that you used for your microcontroller program? Copy and paste it here.*

5. *In RobotC, If you use a Digital IN, Off will be On, and On will be Off. Explain why this is.*

GOING BEYOND

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

_____ 1. Use a sensor to make this loop multiple times. Make it so the robot goes home after the first cycle and waits for a part to be placed before starting again.

_____ 2. Complete Going Beyond #1 above and make it palletize the product when finished.