6 Handshaking: Dobot to Dobot

NAME: _____   Date: _____   Section: _____

INTRODUCTION

Robotic arms need to communicate with other robots in a work cell, 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 another robot. Robot 1 will pass a part into another robot's work envelope and then send a signal and go to a safe position. The other robot will then receive the signal, get the part, and place it somewhere else.

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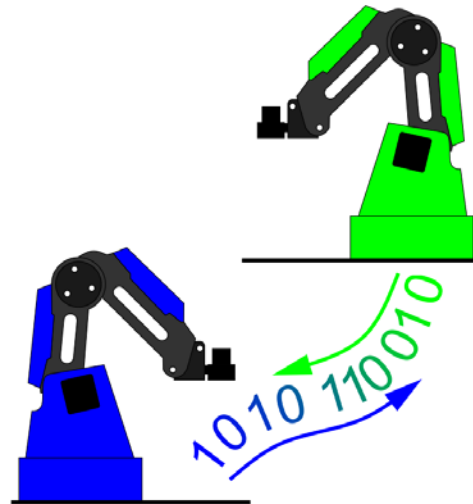
Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS shutdown the Dobot before making connections or damage to the robot could occur.

KEY VOCABULARY

- Handshake
- Signal
- Pull down resistor

- Optical Isolator
- Text
- Current limiting resistor

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

- DobotStudio software
- RobotC or other VEX control software
- Pneumatic Gripper or Suction Cup Gripper
- Handshake module
- VEX bump switch or limit switch
- VEX, PIC, Arduino may all be used in this activity, but wiring may vary.

PROCEDURE

1. Set up both **Robots** with a suction cup - **GP1 & SW1** and place Dobot field diagrams, taped to the work surface, between the two robots.
2. Wire **Robot1** with an **OUTPUT** signal **GP2 - EIO13**.
3. Wire **Robot2** with an **INPUT** signal **GP5 - EIO5.**
4. Wire both Robots to the Handshaking module as shown in the following pages. Be sure that wires are not going to be pulled out by the motion of the robots.
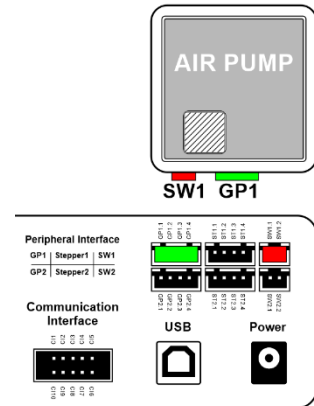

Open Loop System Block Diagram: Robot #1 acts as the input for robot #2. Robot #2 does not communicate back to robot #1 so there is no feedback. The Handshake Module acts as the device that helps make the handshake happen safely.
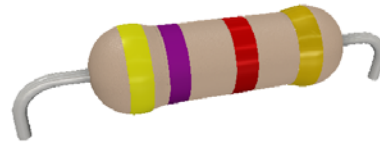
Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS turn it off before making connections or damage to the robot could occur. Be sure to ask your instructor if you have any questions.
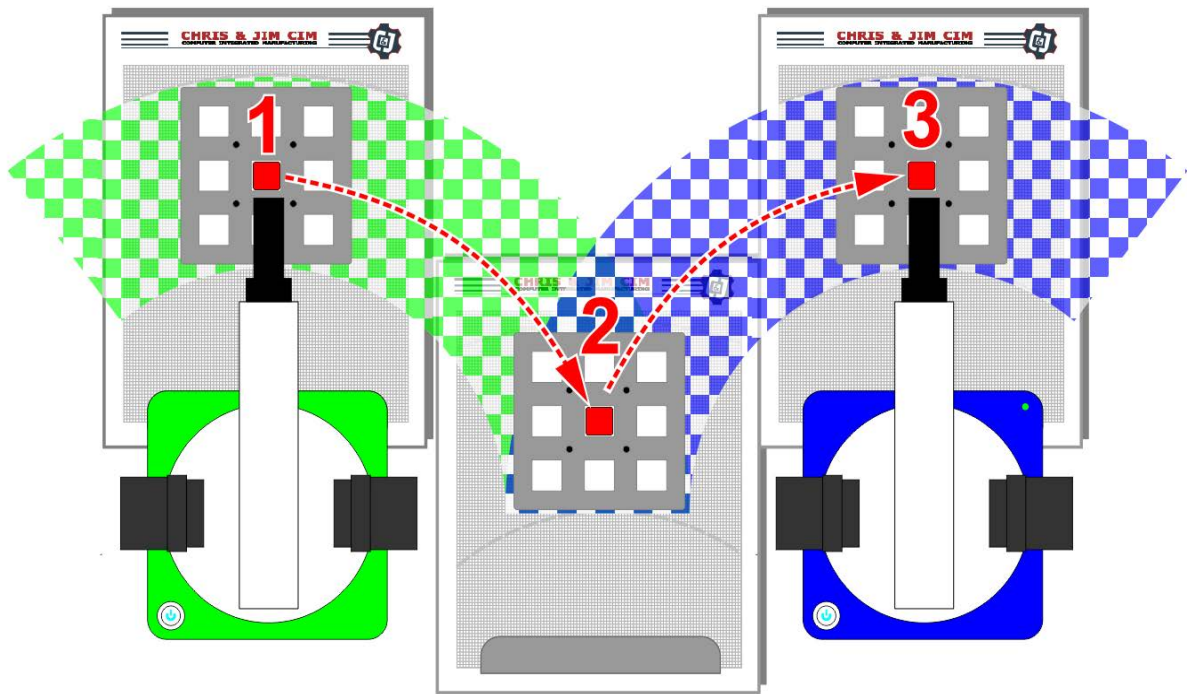
100 Ω - SEND SIDE
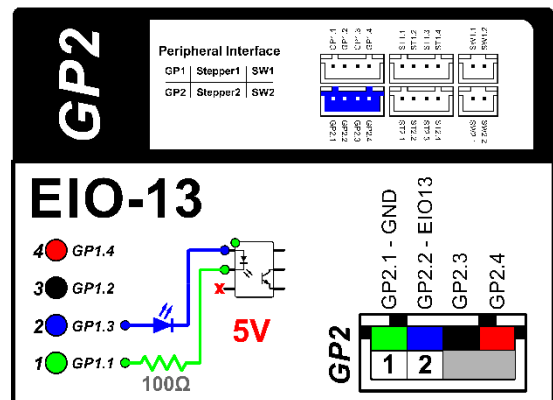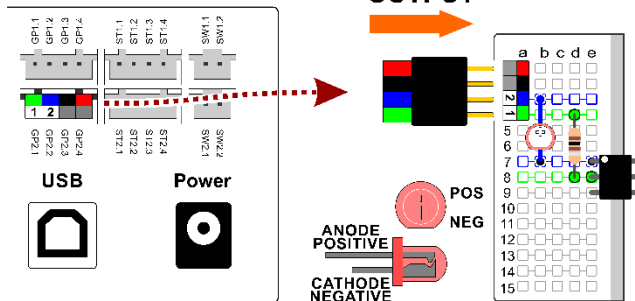
BROWN	BLACK	BROWN	GOLD
1	0	X10	5%

4.7k Ω - RECEIVE SIDE

YELLOW	VIOLET	RED	GOLD
4	7	X100	5%

OUTPUT SIGNAL

Dobot Send Signal

EIO-13 OUTPUT

USB   Power

ANODE POSITIVE

CATHODE NEGATIVE

POS   NEG

EIO-13

4 🔴 GP1.4
3 ⚫ GP1.2
2 🔵 GP1.3
1 🟢 GP1.1

5V

100Ω

GP2

Peripheral Interface

| GP1 | Stepper1 | SW1 |
| GP2 | Stepper2 | SW2 |

GP2.1 - GND
GP2.2 - EIO13
GP2.3
GP2.4

| GP2 | 1 | 2 | | |

INPUT SIGNAL

V1

Receive Signal — EIO-5 INPUT

GP5 3

V2

Receive Signal — EIO-5 INPUT

GP5 3

V1   GP5   V2

EIO-5

Signal ON = 1
Signal OFF = 0

GP5.1
GP5.2 - 5V
GP5.3
GP5.4 - EIO5

GP5.2
4.7kΩ GP5.4

3 GP5 | | 2 | | 4 |

EIO-5

Signal ON = 0
Signal OFF = 1

GP5.1 - GND
GP5.2
GP5.3
GP5.4 - EIO5

GP5.4
4.7kΩ GP5.1

3 GP5 | 1 | | | 4 |

V1

EIO-13
GND
100Ω
X
X
4.7kΩ
EIO-5
GND

EIO-13 OUTPUT

POS
NEG
ANODE POSITIVE
CATHODE NEGATIVE

EIO-5 INPUT

V2

EIO-13
GND
100Ω
X
X
GND
4.7kΩ
EIO-5

EIO-13 OUTPUT

POS
NEG
ANODE POSITIVE
CATHODE NEGATIVE

EIO-5 INPUT
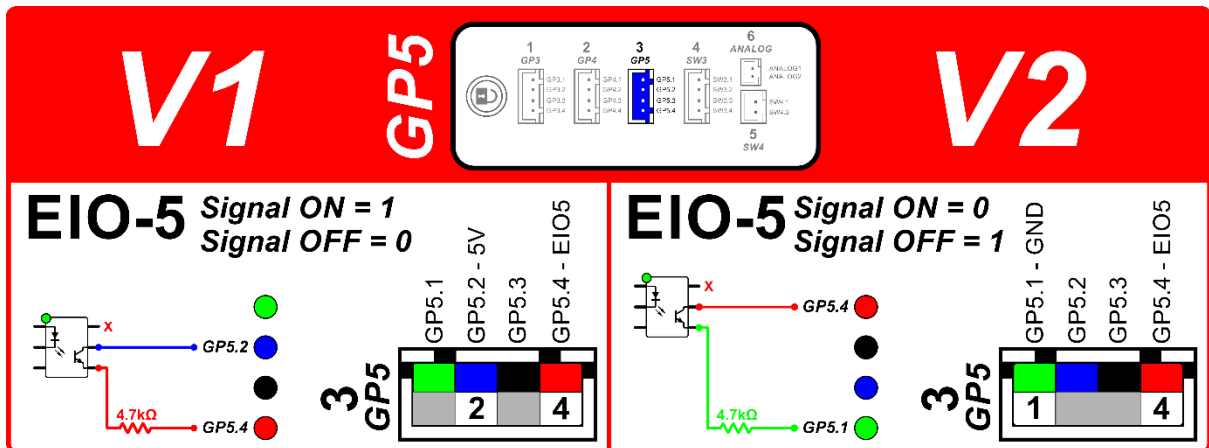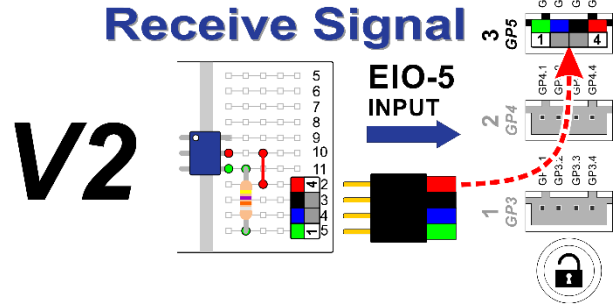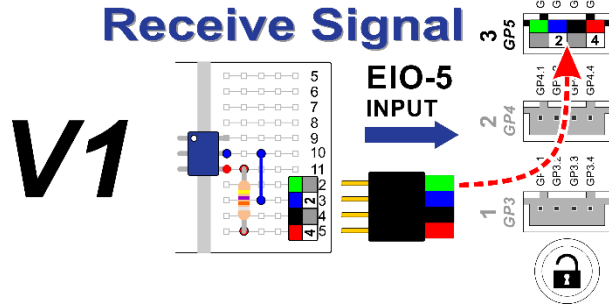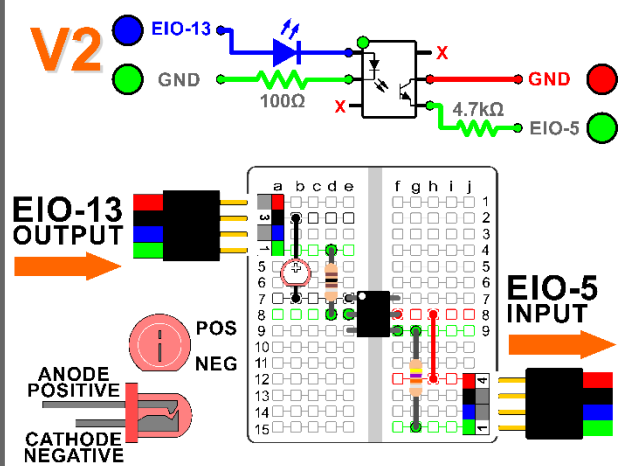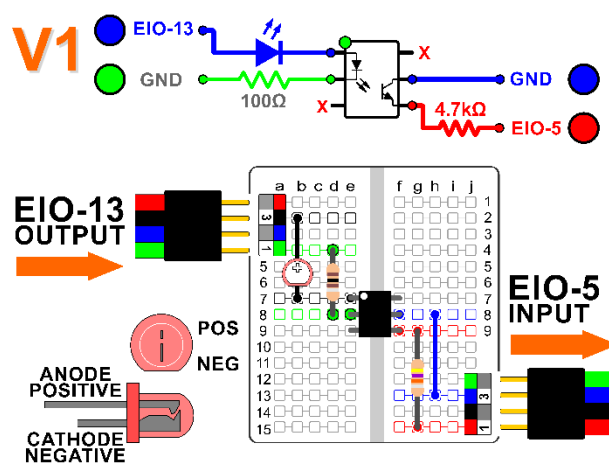
Wire Robot #1 so that GP2 is wired to the input of the handshake module. Then wire the output of the handshake module to the Input of robot #2. This is labelled #3 on the arm. Please refer to the wiring diagram above. You can use servo extension cables to do the wiring.

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 YELLOW and BLACK wires to trigger the input on the other robot.*

1. Be sure you are in Pro mode in the DobotStudio software.

   HELPFUL TIPS

   When you re-open this program if you do not switch to Pro mode, it will not use the inputs and outputs and the program will ignore them!
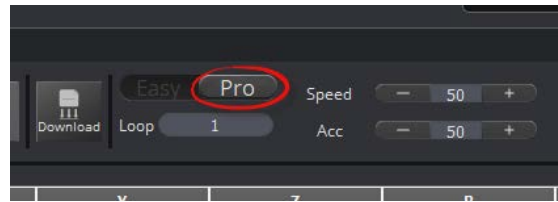
2. *Set up the Dobot Studio program for robot # 1 so that it moves the part from its position into the work envelope of the second robot. It needs to send a signal to EIO13 for 1 second (high), then turn the signal off (low)*
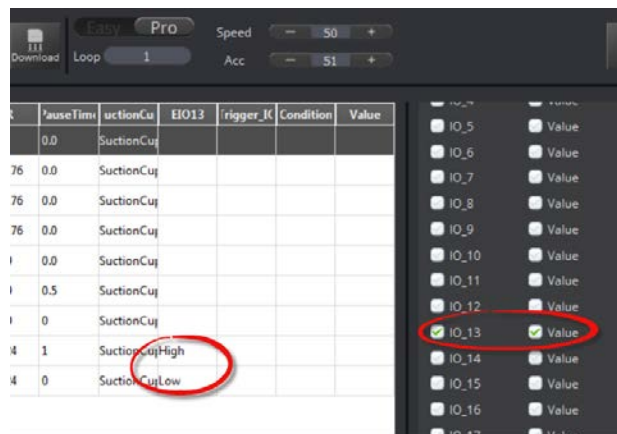
Be sure to use EIO13 as an output on the last two lines of code. Turn it on in the first one and pause for 1 second, then off on the second step. Use copy and paste to do this.

Also, add a check next to IO_13 as shown, then TEACH the position. This will add it to your program.

3. Set up the DobotStudio program for robot # 2 so that it waits until robot #1 sends a signal to pick it up, then place it somewhere else. Be sure to use EIO5 as the trigger input, and set it at High for 1 second, then turn it off in the next step.

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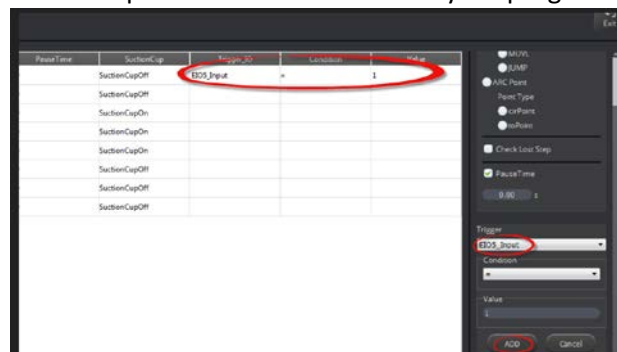
Be sure to consult the Dobot Input/Output manual if you want to use other inputs and outputs, as damage to your robot or your other equipment may result.

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

5. Once both programs are written, run the programs. If written correctly, robot #2 will wait for the signal from the first robot. If it does not work correctly, troubleshoot until it does.

6. *If your set up 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 below.*

2. *Copy and paste the psuedocode from your microcontroller program below.*

3. *What other inputs could you use on your robot to start this process? Use the Input/Output manual to answer this question, and do not attempt to try it without your instructor's permission.*

4. *What other outputs could you use on your robot to start this process? Use the Input/Output manual to answer this question, and do not attempt to try it without your instructor's permission.*

GOING BEYOND

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

_____   1. Add an input switch to the first robot to start the whole process.

_____   2. Make the robots **palletize** three **cubes** as the diagram below shows. Start with three cubes on the first pallet, use the second pallet as a buffer to do the hand off, and then have the second robot place them on pallet 3. Be sure to adjust the **roll angle** accordingly.