

3 Using Jumps and Loops

NAME: _____

Date: _____ Section: _____

INTRODUCTION

A pick and place style of moving objects around are staples of industrial robots. Another reason to use robots in industry and automation is because of danger to humans. Robots can work in adverse environments that are dangerous to humans; especially when dealing with chemicals and other toxic substances.

Sometimes the best way to pick up an object is with a suction cup or vacuum gripper. This works especially well with very small objects and provides a less expensive alternative to a mechanical gripper.

In this activity, you will perform an anodizing operation (which can use harmful chemicals) with a robot arm using the air pump kit and a vacuum gripper.

Do not let go of the object in the tanks... Just wait for the 2 second dip to complete and move on.



Dip Tank Set Up using 3D printed dip tanks and a Dobot field diagram. In this diagram four tanks are used.



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
- Touch up
- Teach
- Suction
- Vacuum
- Linear movement
- Joint movement

EQUIPMENT & SUPPLIES

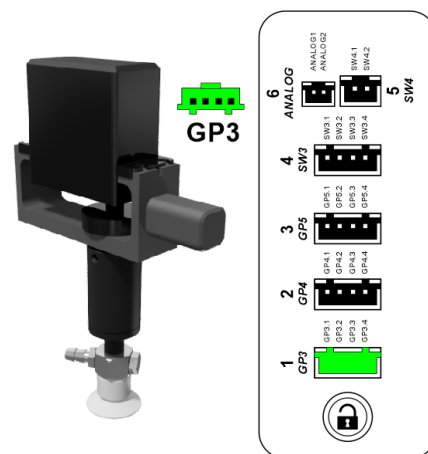
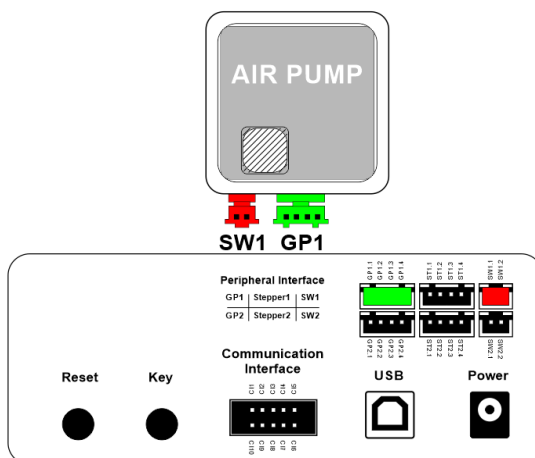
- Dobot Magician
- Dobot Dipping Field Diagram
- ¾ inch wooden cylinders
- End of arm tooling (EoAT)
- Suction Cup Gripper
- DobotStudio software
- 4 simulated dip tanks
- *(1" PVC Caps or small plastic cups work well)*

PROCEDURE

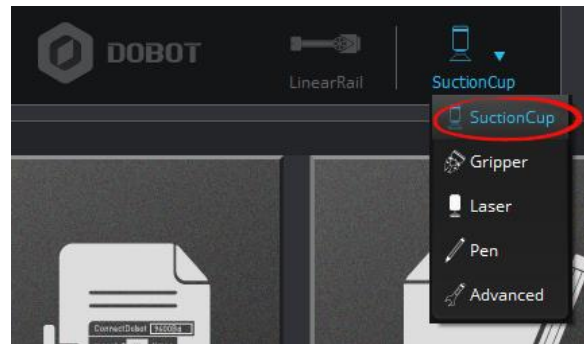


Caution: NEVER wire anything to the Dobot Magician while it has power on. ALWAYS turn it off before making connections or damage to the robot could occur.

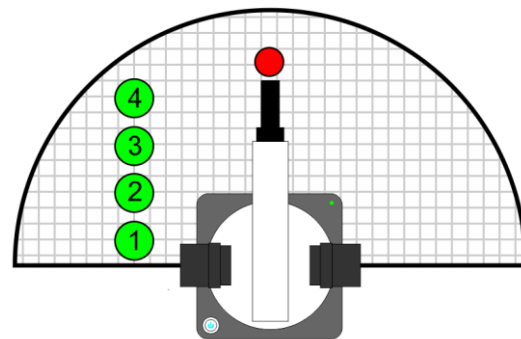
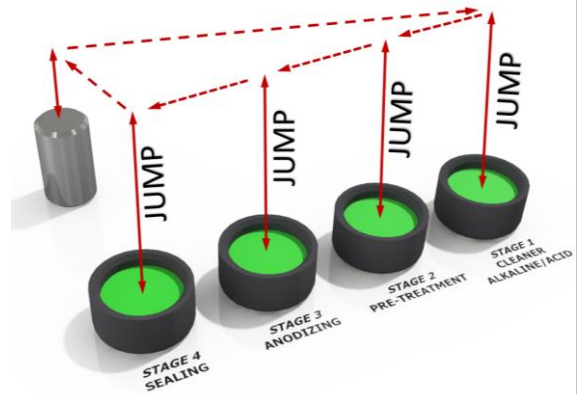
1. Attach the *Suction Cup* to the *rotational servo* and then attach it to the robot, and plug in the wires as shown below.



1. Open Dobot Studio software, connect and home the robot, and be sure the *Suction Cup* is chosen as the **END OF ARM TOOLING (EoAT)**



2. Now open the *Teach and Playback* module in DobotStudio and write a program to perform the following actions:
 - a. Go home
 - b. Pick up the cylinder from the pallet
 - c. Dip it in Tank 1 for 2 seconds
 - d. Move the object and dip it in Tank 2 for 2 seconds
 - e. Move the object and dip it in Tank 3 for 2 seconds
 - f. Move the object and dip it in Tank 4 for 2 seconds
 - g. Move the part back to the pallet.
 - h. Go home



3. Be sure to turn on/off the *Suction Cup* when necessary.
4. Hit the *Play* button to run your program and see what happens. *Did it work the first time? If not, what did you have to change to make it work?*

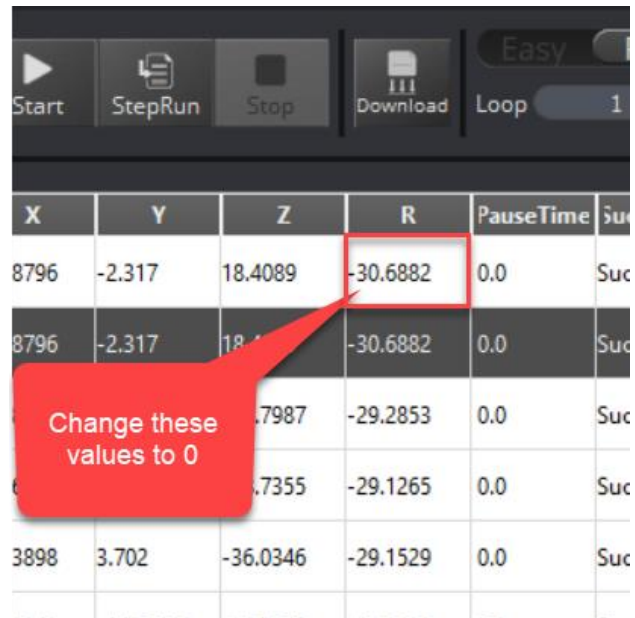
SuctionCup	
SuctionCupOff	El
SuctionCupOff	
SuctionCupOn	
SuctionCupOn	
SuctionCupOn	
SuctionCupOn	



5. When recording points using the *lock button*, it is not always very accurate. When you look at all the Z values of all the above tank positions, they are probably very different.

We can make them all the same by clicking on the values and typing in a value that works well; this is called **TEACHING**. When fixing points like this it is also called **TOUCHING UP** points.

Go and **TOUCH UP** all the z values to make the dipping operation happen at the same heights above the tank, and in the tank and have your instructor check it.



X	Y	Z	R	PauseTime	Suc
8796	-2.317	18.4089	-30.6882	0.0	Suc
8796	-2.317	18.4	-30.6882	0.0	Suc
		.7987	-29.2853	0.0	Suc
		.7355	-29.1265	0.0	Suc
3898	3.702	-36.0346	-29.1529	0.0	Suc



You can even use this method to touch up the x and y values of the tanks to make sure they are in a straight line.

6. How many lines of code did it take to write the program using what you have learned before? How many points did you have to teach it?

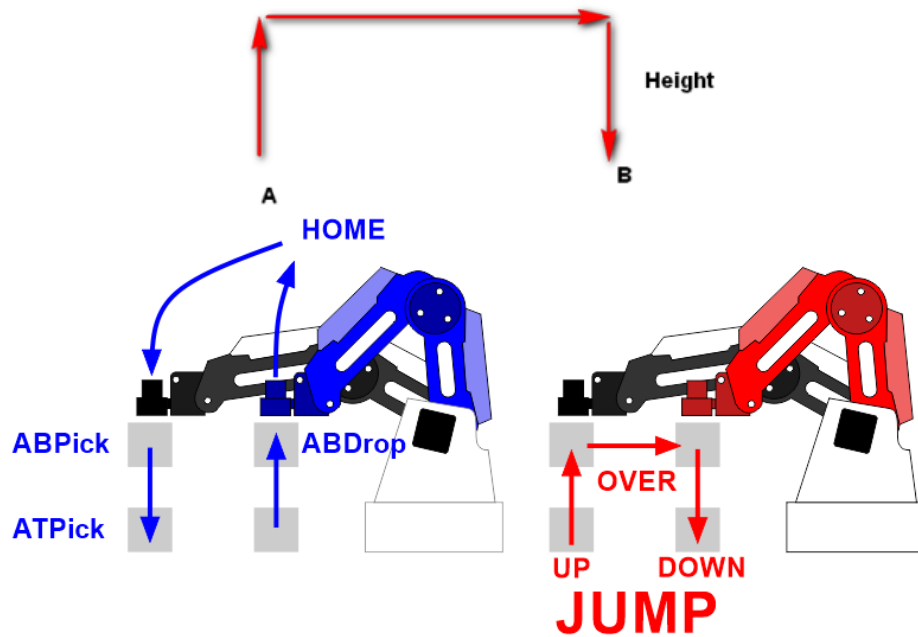
7. Now we are going to use the **JUMP** command to make the program even easier, and much more accurate. Open a new program.



What is a **JUMP**? A JUMP movement combines three steps into one. It combines the raise up, over, and back down to the same Z level at new location. This type of movement simplifies repetitive movements such as a dipping operation or soldering operation. The Z Height is defined in the JUMP parameters in the settings menu.

A JUMP movement does not replace the initial ABOVE position, AT the initial position or ABOVE the final position. It is only used to RASIE UP / MOVE TO A DIFFERENT POSITION / RETURN TO Z FROM LAST POSITION.





8. This time, only record the following points: Home, Pick, Tank 1, Tank 2, Tank 3, and Tank 4.

Do not record an above point for each tank except Tank 4. Jumps will replace these points

Option	MotionStyle	Name	X
1	MOVJ	Home	206.3179
2	MOVJ	Pick	248.3739
3	MOVJ	1	-99.1319
4	MOVJ	2	-38.7116
5	MOVJ	3	13.1997
6	MOVJ	4	72.7921
7	MOVJ	Home	206.3179

9. Now change the MotionStyle of the Tank 1, Tank 2, Tank 3, and Tank 4 to *JUMP*. Double click on the *MotionStyle* box for each point and change it from *MOVJ* to *JUMP*

Now play the program.

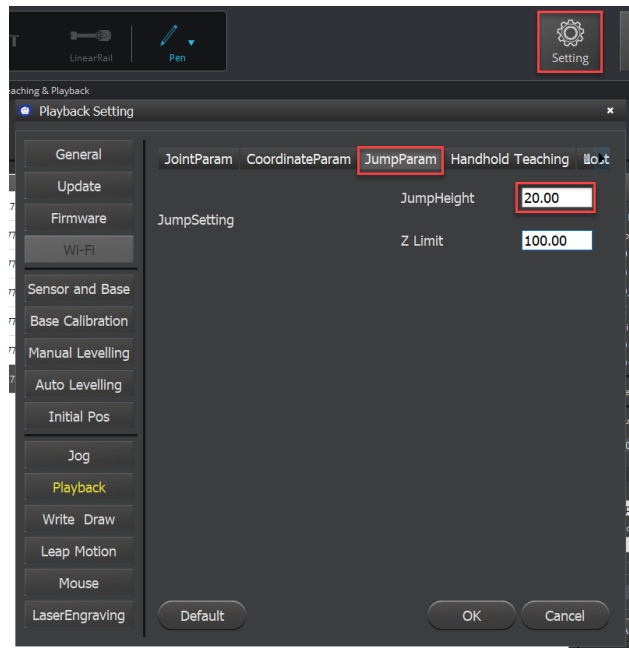
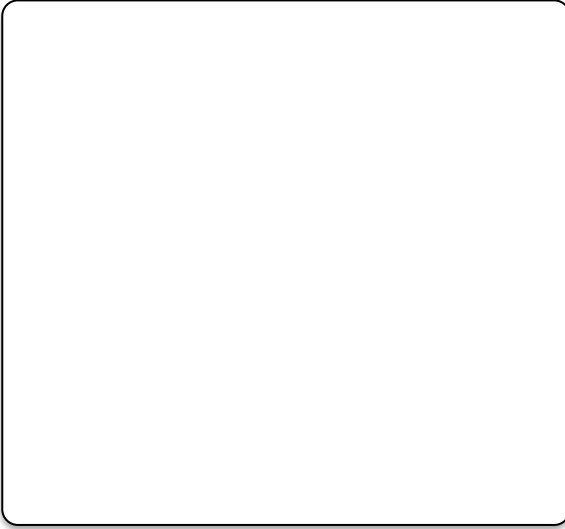
What does this change do to the program?

Option	MotionStyle	Name
1	MOVJ	Home
2	MOVJ	Pick
3	JUMP	Tank 1
4	MOVJ	Tank 2
5	MOVJ	Tank 3



10. If you ever want to change the height in Z that the *JUMP* actually jumps to, open the *Settings*, and on the *JumpParam* tab change the *JumpHeight* to whatever you need it to be to clear the tank.

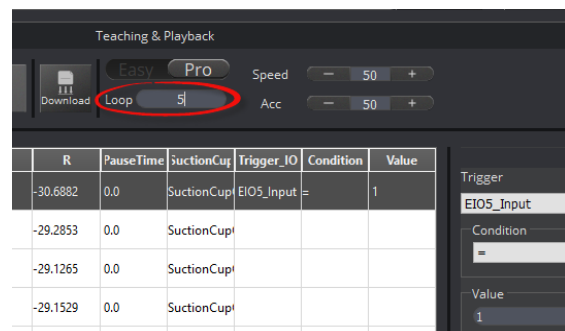
Compare the first dipping program to the second one with JUMPS and explain how it is more efficient.



11. Now let's make the robot repeat the operation five times. It's easy. We use a tool called **LOOP** to make something happen multiple times so that our program is shorter and more efficient.

12. To make your program **LOOP** multiple times, just add the number of times you want it to repeat.

13. Be sure to save your work when done.



CONCLUSION

1. Describe a MOVL move using the Dobot.
2. Describe a MOVJ move when using a Dobot.
3. What makes a Jump command more efficient to code than a MOVJ or MOVL?
4. What kind of manufacturing process is dipping? Explain your answer.
5. What is anodizing? Explain how it works and why we do it.

GOING BEYOND

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

- | | |
|-------|--|
| _____ | 1. Take away the first tank and change the program to fix the operation using the software. |
| _____ | 2. Add another tank and change the program to fix the operation using the software. |
| _____ | 3. Raise the tanks using a block of wood provided by your instructor and fix the operation using the software. <i>What is the most efficient way to do this?</i> |

