W2B: [D] CIM 3.1.2D RoboCell [ER-4u] Relative Positions

Introduction

In this activity you will program a **robot** to dip a cylinder in three tanks full of a toxic liquid. The robot will pick up the cylinder, dip it in each of the three tanks for a period of five seconds, and then place it at the final position for the cylinder. Finally, the robot will return to its home position.

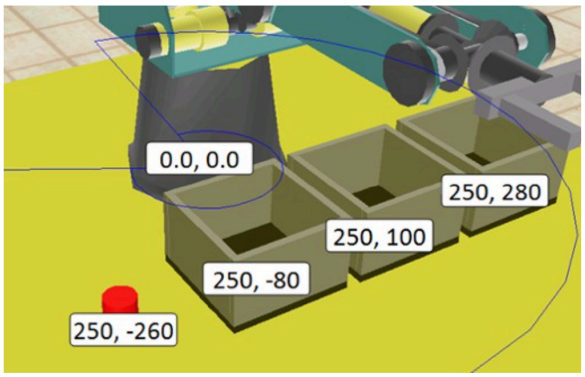
Equipment

Computer with intelitek® RoboCell software

- **YouTube Video Resource:**
- https://www.youtube.com/watch?v=p3_Wc-bvWEs&list=PLJuwb3xnlvclFigEg127kl_0baNgBkWjG&ab_channel=Chris%26JimCIM

Prerequisite Information- Relative Position

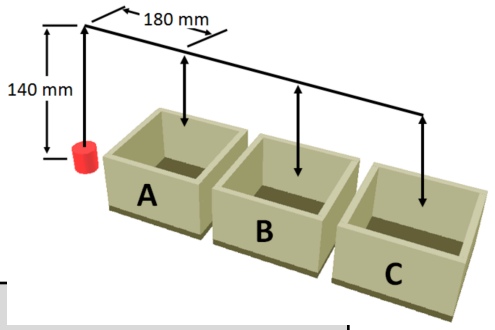
- Relative positions are positions whose coordinates are defined by a specific offset from another position. A relative position is linked to a reference position. If the coordinates of the reference position change, the relative position moves along with it, maintaining the same offset. Relative positions are useful when programming the path of the robot for pick-and-place tasks.
- For example, a relative position defined as a Z-offset of a few centimeters from a pick up position will enable the robot to approach and leave the pickup location without hitting other equipment in the system. If the pickup position must be adjusted and re-recorded, it will not be necessary to readjust and re-record the relative position above it.



Procedure

1. Review Relative Positions Information.
2. Create the graphics in CellSetup using the specifications below. Note that the tanks in this activity will not be modeled.

   a. Table: 1000 x 1000 Select:
   b. Robot: SCORBOT-ER 4
   c. Cylinder diameter = 40 mm; height = 40 mm
   d. Cylinders: C1 250, –260 Select:
   e. Insert three Bins:
      i. B1 250, –80
      ii. B2 250, 100
      iii. B3 250, 280
   f. Save this file as "LastName_312D".



Special Note: Previous Knowledge:
A program using absolute coordinates would use the following steps.

a. Initial cylinder position
b. 140 mm above the initial cylinder position
c. Inside tank A
d. 140 mm above tank A
e. Inside tank B
f. 140 mm above tank B
g. Inside tank C
h. 140 mm above tank C

3. You will use the instructions (in step 5) to program the relative positions, which simplify the programming by requiring only one absolute position and four relative positions as follows:

   a. Absolute home position, 99, is the robot initial position. The absolute position, 1, is 150 mm above the table in line with the cylinder.
   b. Relative positions:

i. Position 2: 140 mm below the current TCP.
ii. Position 3: 140 mm above the current TCP.
iii. Position 4: 180 mm to the right of the current TCP.
iv. Position 5: 150 mm above the current TCP.

c. Note that relative positions will guide the robot to the various tanks for dipping; however, the dipping time for each tank needs to be included in the program. The Wait command (WT) provides an effective solution. The Wait command halts the robot at certain points in the program for a pre-specified time. The time is entered in tenths of a second.

4. Teach the robot positions using the steps below.

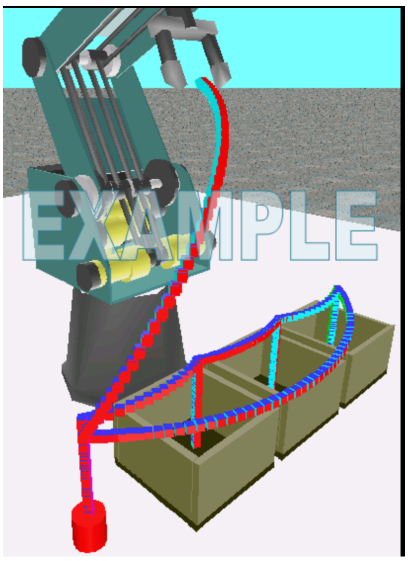
a. Open RoboCell and import the graphics file "LastName_A312d".
b. Record the initial position as 99, Home.
c. Zoom in to clearly see the cylinder.
d. Open the robot **gripper**.
e. Using the **Send Robot to Object** function, send the robot to the cylinder.
f. Position 1: In the Teach Positions dialog box, teach Position 1 as an **absolute** position using the steps below.
    i. Enter "1" in the Position Number box.
    ii. Select **Absolute**.
    iii. Enter the absolute coordinates for Position 1: X 250, Y –260, Z 150, Pitch –90, Roll 0
    iv. Click **Teach**.
g. Position 3: In the Teach Positions dialog box, teach Position 3 as a **relative** position 140 mm above the current robot position, using the steps below.
    i. Click **Expand**.
    ii. Enter "3" in the Position Number box.
    iii. Select **Relative To** and select **Current** for the reference position.
    iv. Enter "140" in the Z (mm) box.
    v. Confirm that all other fields show 0.
    i. Click **Teach**.

h. Position 2: Similar to the procedure for teach position 3, use **Relative To** the **Current** position with a Z-offset of –140 mm.

i. Position 4: Similar to the procedure for teach position 3, use **Relative To** the **Current** position with a Y-offset of 180 mm.

j. Position 5: Similar to the procedure for teach position 3, use **Relative To** the **Current** position with a Z-offset of 150 mm. The difference between positions 2 and 5 will raise the part an additional 10 mm to accommodate for the thickness of the floor of each tank.

5. Create a program to execute the operation shown below. Note that the program will contain many similar pieces of code, so the copy and paste tools will make creating the program more efficient

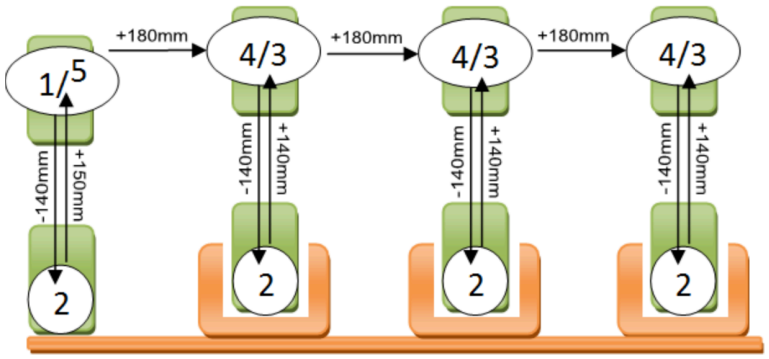


a. Add the four Remark statements to your program:
   i. R**emark: 3.1.2D Relative Position**
   ii. Remark: Your Name
   iii. Remark: Period X
   iv. Remark: Date: MM/DD/YY

b. Open Gripper.
c. Select **Go Position** 99 fast.
d. Select **Go Position** 1 fast.
e. Select **Go Linear** Position 2 speed 90%.
f. Close Gripper.
g. Select **Go Linear** Position 5 speed 90%.
h. Dip the cylinder in bin A using the steps below.
   i. Add a remark stating "Bin A" to indicate that the robot is now dipping the cylinder in Bin A.
   ii. Select **Go Position** 4 fast.
   iii. Select **Go Linear** Position 2 speed 90%.
   iv. Double-click WT (Wait), also located in the Program Flow section of the Command List.
   v. Enter "50". Note that 50 tenths of a second will create a 5 second pause inside the bin.
   vi. Click **OK** to close the dialog box.
   vii. Select **Go Linear** Position 3 speed 90%.
i. Dip the cylinder in bins B and C. The procedure for dipping will be similar to the commands you just entered. To simplify programming, use the copy

and paste tools to copy the program lines. Paste them at the end of the program.

j. Add commands at the end of the program to return the robot to its initial position. Place the cylinder and then move up 140 mm (Position 1).
k. Return the robot to the home position (Position 99).
l. Click the **Show Robot Path** button.
m. Run the program and verify the accuracy.



POSITION SEQUENCE
ABS Go2 - 99 START HOME
ABS Go2 - 1 ABPICK
REL GoLinear- 2 ATPICK - DOWN 140mm
CG CLOSE GRIPPER
REL GoLinear - 5 ABPICK – UP 150mm *(+ 10mm Accommodate Bin Floor Thickness)*
REL Go2 - 4 OVER 180mm
---TANK A
REL GoLinear - 2 DOWN 140mm
WT - WAIT
REL GoLinear - 3 UP 140mm
REL Go2 - 4 OVER 180mm
--- TANK B
REL GoLinear - 2 DOWN 140mm
WT - WAIT
REL GoLinear - 3 UP 140mm
REL Go2 - 4 OVER 180mm
--- TANK C
REL GoLinear - 2 DOWN 140mm
WT - WAIT
REL GoLinear - 3 UP 180mm
---RETURN PART
ABS Go2 - 1 BACK TO ABPICK
REL GoLinear - 2 BACK TO ATPICK
OG - OPEN GRIPPER
ABS GoLinear - 1 UP TO ABPICK
ABS Go2 - 99 RETURN HOME

Insert Code to program RoboCell. Make sure to Remark the following

i. Remark: Activity 3.1.2D Relative Positions
ii. Remark: Your Name
iii. Remark: Period X
iv. Remark: Date: MM/DD/YY

```
Remark: 3.1.2D Relative Position
Remark: Jeide, Matthew
Remark: Period 2
Remark: 11/07/2025
Go Linear to Position 99 Fast
Open Gripper
Go to Position 1 Fast
Remark: grab object
Close Gripper
Remark: bin 1
Go Linear to Position 3 Fast
Go Linear to Position 4 Fast
Go Linear to Position 2 Fast
Remark: bin 2
Go Linear to Position 3 Fast
Go Linear to Position 4 Fast
Go Linear to Position 2 Fast
Remark: bin 3
Go Linear to Position 3 Fast
Go Linear to Position 4 Fast
Go Linear to Position 2 Fast
Remark: dropoff
Go Linear to Position 3 Fast
Go to Position 11 Fast
Go to Position 1 Fast
Open Gripper
Go to Position 99 Fast
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#	Coor.	Axis 1 X (mm)	Axis 2 Y (mm)	Axis 3 Z (mm)	Axis 4 Pitch (deg)	Axis 5 Roll (deg)	Axis 7 mm/deg	Axis 8 mm/deg	Type
1	Joint	-46.12	2.86	53.01	34.12	0.00			
	XYZ	250.00	-260.00	10.00	-90.00	0.00			Abs. (XYZ)
2	Joint								
	XYZ	0.00	0.00	-130.00	0.00	0.00			Rel. Cur. (XYZ)
3	Joint								
	XYZ	0.00	0.00	140.00	0.00	0.00			Rel. Cur. (XYZ)
4	Joint								
	XYZ	0.00	180.00	0.00	0.00	0.00			Rel. Cur. (XYZ)
5	Joint								
	XYZ	0.00	0.00	150.00	0.00	0.00			Rel. Cur. (XYZ)
11	Joint	-46.12	-28.97	75.75	43.22	0.00			
	XYZ	250.00	-260.00	150.00	-90.00	0.00			Abs. (XYZ)
99	Joint	0.00	-120.28	95.02	88.81	0.00			Abs. (Joint)
	XYZ	169.03	0.00	504.33	-63.55	0.00			

6. E-Portfolio video with updated code.

E-Porfolio Published link with video file. Use the Snipping Tool to record. Then upload the file to your Google Drive to upload on your Portfolio.

https://m-jeide.github.io/eng-portfolio/CIM/Robocell

Conclusion

Answer in complete sentences each of the questions below.

1. Describe how the operation created in this activity could be applied in a manufacturing setting.

The operation created in this activity could be applied in manufacturing for coating, cleaning, or treatment processes where parts must be dipped into multiple chemical baths or finishing stations.

2. Describe situations where absolute or relative positions would be preferable.

Absolute positions are preferable when precise, repeatable locations are critical and the workspace remains fixed, such as placing components on a circuit board at exact coordinates or returning to a consistent home position. Relative positions are preferable when performing repetitive patterns or sequences where the relationship between positions matters more than their exact locations.