

Activity 3.1.2d Relative Positions

PLTW

RELATIVE POSITIONS

☰ Introduction

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Introduction

GOALS	MATERIALS	RESOURCES
<ul style="list-style-type: none">• Teach absolute and relative positions to a robot.• Create a program that executes a specified robot path.• Identify scenarios where absolute or relative positions are preferable.		
GOALS	MATERIALS	RESOURCES
<ul style="list-style-type: none">• Computer with intelitek® RoboCell software		

GOALS	MATERIALS	RESOURCES
<ul style="list-style-type: none">• <u>RoboCell Planning</u>• <u>Activity 3.1.2d Relative Positions (Downloadable PDF)</u>		

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.

Procedure

Relative Positions

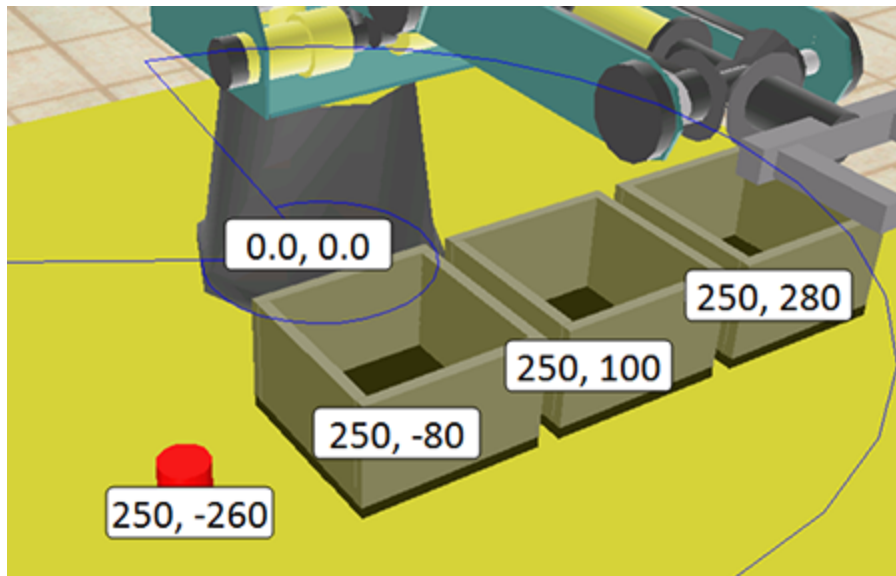
So far you have learned how to record and teach robot positions. These positions are specified by X, Y, and Z coordinates from the robot origin. Using these two methods can be quite exhausting when you need to record many positions for a complex robotic application. In this activity you will work with relative positions.

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.



1

Create the graphics in CellSetup using the following specifications. Note that the tanks in Figure 1 will not be modeled.

- Table: 1000 × 1000
- Robot: SCORBOT-ER 4
- Cylinder diameter = 40 mm; height = 40 mm
- Cylinders: C1 250, -260
- Insert three Bins:
 - B1 250, -80
 - B2 250, 100
 - B3 250, 280

- Save this file as “LastName_A312d”.

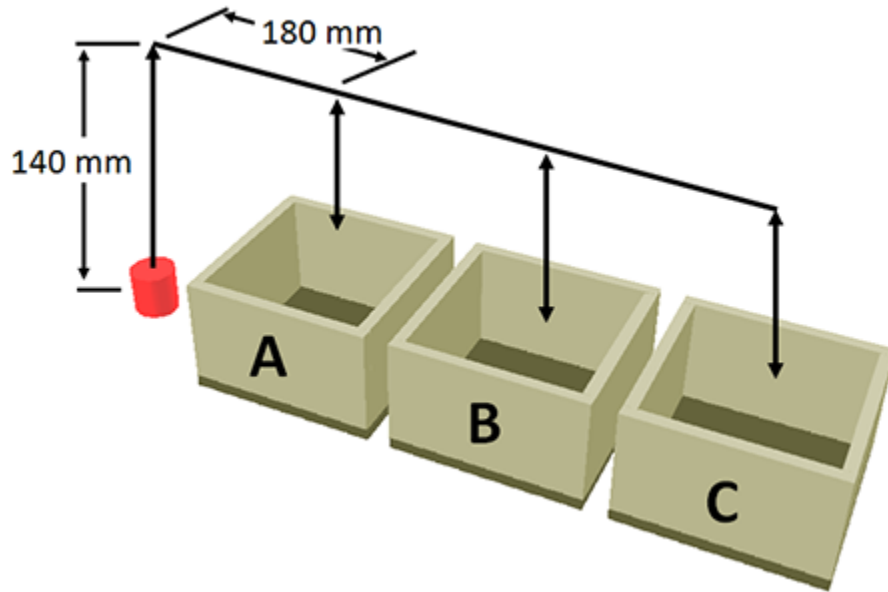


Figure 1. Robot Relative Positions



Absolute Coordinates

A program using absolute coordinates would use the following steps:

- Initial cylinder position
- 140 mm above the initial cylinder position
- Inside tank A
- 140 mm above tank A

- Inside tank B
- 140 mm above tank B
- Inside tank C
- 140 mm above tank C

2

You will use the instructions (in step 4) to program the relative positions, which simplify the programming by requiring only one absolute position and four relative positions as follows:

- Absolute home position, 99, is the robot initial position. The absolute position, 1, is 150 mm above the table in line with the cylinder.
- Relative positions:
 - Position 2: 140 mm below the current TCP.
 - Position 3: 140 mm above the current TCP.
 - Position 4: 180 mm to the right of the current TCP.
 - Position 5: 150 mm above the current TCP.

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.

3

Teach the robot positions using the following steps:

- Open RoboCell and import the graphics file “LastName_A312d”.
- Record the initial position as 99, Home.
- Zoom in to clearly see the cylinder.
- Open the robot [gripper](#).
- Using the **Send Robot to Object** function, send the robot to the cylinder.
- Position 1: In the Teach Positions dialog box, teach Position 1 as an **absolute** position using the following steps:
 - Enter “1” in the Position Number box.
 - Select **Absolute**.
 - Enter the absolute coordinates for Position 1: X 250, Y –260, Z 150, Pitch –90, Roll 0
 - Click **Teach**.

- Position 3: In the Teach Positions dialog box, teach Position 3 as a **relative** position 140 mm above the current robot position, using the following steps:
 - Click **Expand**.
 - Enter “3” in the Position Number box.
 - Select **Relative To** and select **Current** for the reference position.
 - Enter “140” in the Z (mm) box.
 - Confirm that all other fields show 0.
 - Click **Teach**

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

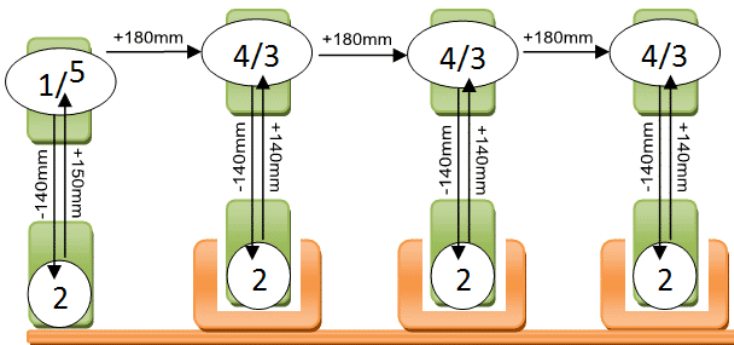
- Position 4: Similar to the procedure for teach position 3, use **Relative To the Current** position with a Y-offset of 180 mm.

- 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.

pieces of code, so the copy and paste tools will make creating the program more efficient.

- Add remarks commands to document the program.
- Open Gripper.
- Select **Go Position** 99 fast.
- Select **Go Position** 1 fast.
- Select **Go Linear** Position 2 speed 90%.
- Close Gripper.
- Select **Go Linear** Position 5 speed 90%.
- Dip the cylinder in bin A using the following steps:
 - Add a remark stating “Bin A” to indicate that the robot is now dipping the cylinder in Bin A.
 - Select **Go Position** 4 fast.
 - Select **Go Linear** Position 2 speed 90%.
 - Double-click WT (Wait), also located in the Program Flow section of the Command List.
 - Enter “50”. Note that 50 tenths of a second will create a 5 second pause inside the bin.
 - Click **OK** to close the dialog box.
 - Select **Go Linear** Position 3 speed 90%.

- 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.
- 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).
- Return the robot to the home position (Position 99).
- Click the **Show Robot Path** button.
- Run the program and verify the accuracy.



POSITION SEQUENCE

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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

```

Conclusion

Question 1

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

Question 2

Describe situations where absolute or relative positions would be preferable.