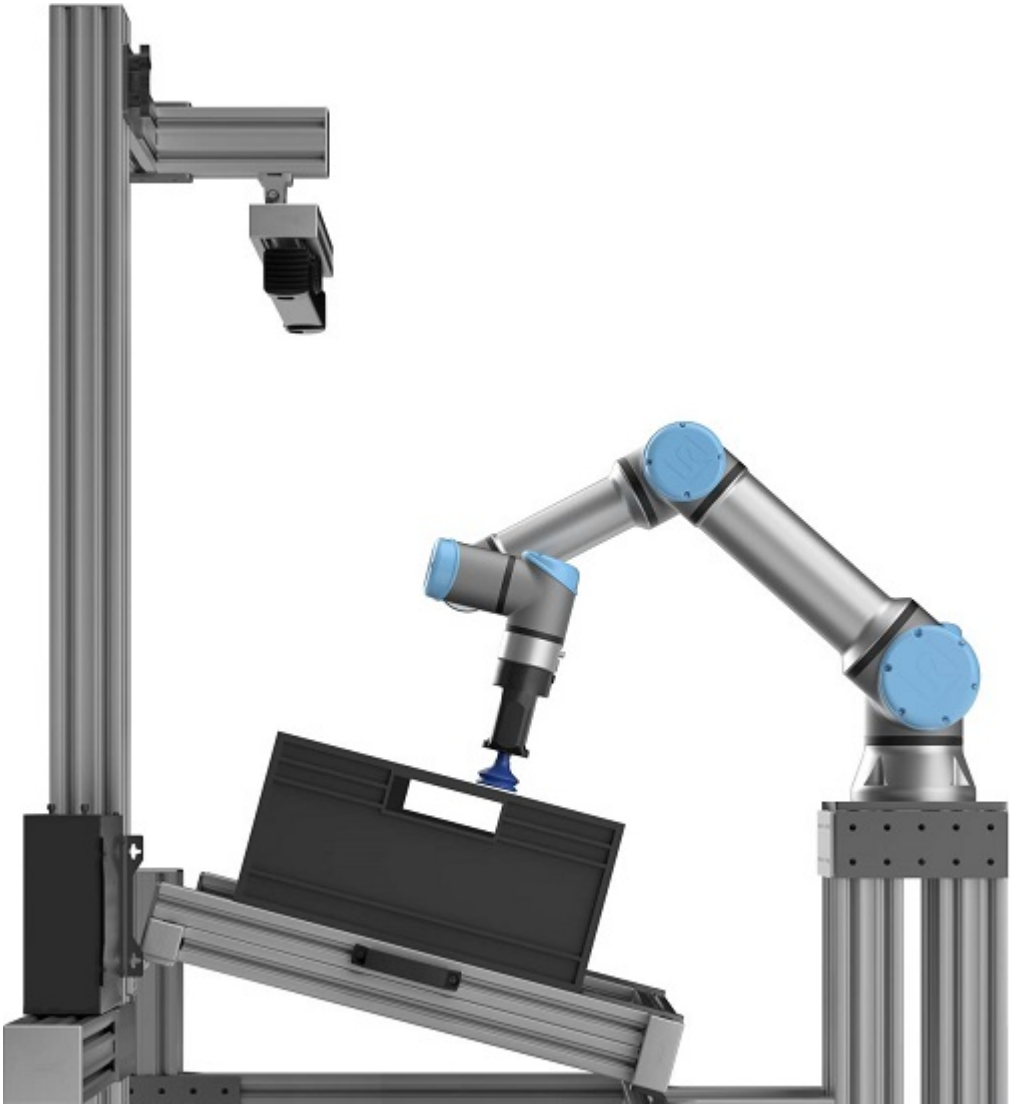
UNIVERSAL ROBOTS



ActiNav

AUTONOMOUS BIN PICKING

UNIVERSAL ROBOTS

ActiNav Autonomous Bin Picking

Operating Guide

Original instructions (en)

Contents

1. Introduction

1.1. About this document

This guide contains information on how to set up, configure, and use the ActiNav Bin Picking application.

2. Bin Picking Process

This section describes the key steps in the ActiNav setup.

2.1. 3D sensor alignment

The ActiNav system includes a 3D sensor that scans the parts and a robot arm that manipulates the parts. 3D sensor alignment is necessary to let the system know where exactly the robot arm is mounted in relation to the 3D sensor.

You do the alignment by moving the robot arm with the alignment marker attached and recording the marker position samples. For more information, see section 3.1. 3D sensor alignment on page 3.

2.2. Tool

In ActiNav an end effector is referred to as the Tool.

A CAD model of the tool is used for display purposes, and to provide a template for creating Clearance Shapes. For more information, see section 1. Configuring a Tool on page 1.

2.3. Environment

The Environment is a virtual representation of the workspace. Objects in the workspace are represented by Clearance Shapes.

When a program is running, the robot, tool and part do not touch any Clearance Shapes.

In ActiNav, you can create and configure multiple different environments.

2.4. Clearance Shapes

Clearance Shapes are created in the Environment to represent objects in the real world or, to serve as virtual barriers. They let ActiNav move the robot arm, the tool, and the parts without collisions.

You can create Clearance Shapes by teaching key points with the TCP, or by entering shape characteristics in the **Shape Properties** and **Shape Coordinates** sections.

2.5. Bin

The Bin is the object in the Environment that represents the bin in the workspace.

You define the Bin by teaching the walls and the floor of the Bin, and then specifying its properties and the scan zone settings. For information on creating the Bin, see section 3.5. Bin on page 12.

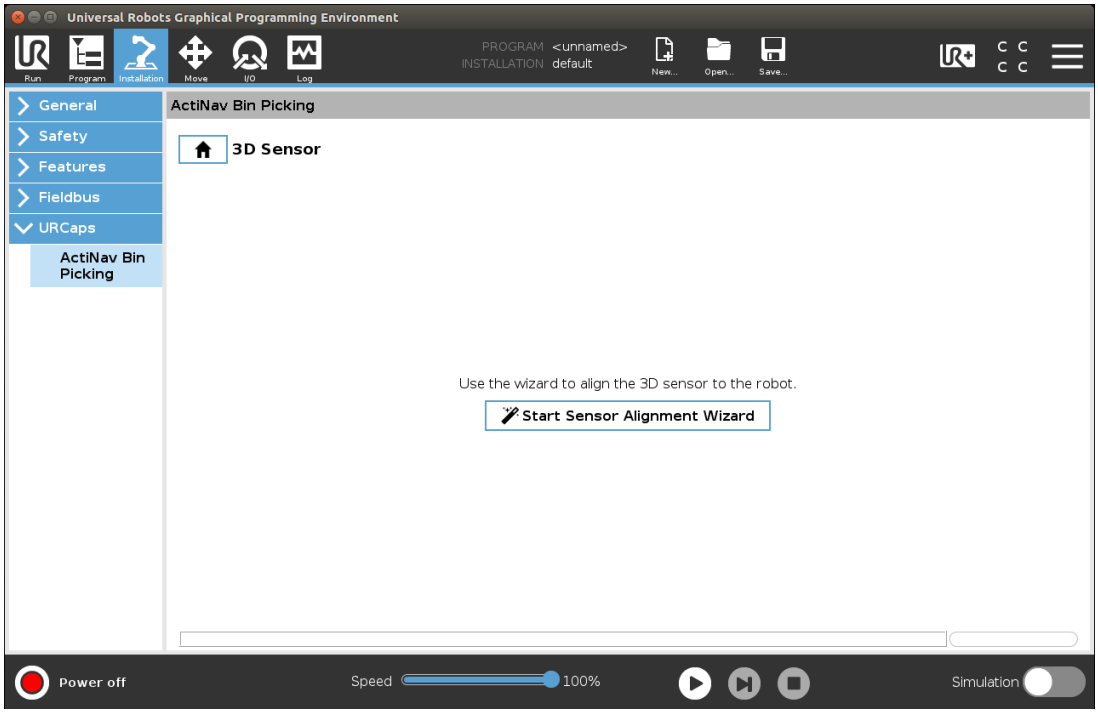
PolyScope shows the Bin as a set of Clearance Shapes, but you cannot edit those Shapes in the Environment screen. You can edit them by changing the properties of the Bin.

3. Procedures

This section describes how to perform various procedures related to the configuration of the ActiNav Bin Picking applicationsetup.

3.1. 3D sensor alignment

3D sensor alignment is necessary to let the system know where exactly the robot arm is mounted in relation to the 3D sensor.



3.1.1. Starting alignment and attaching the alignment marker

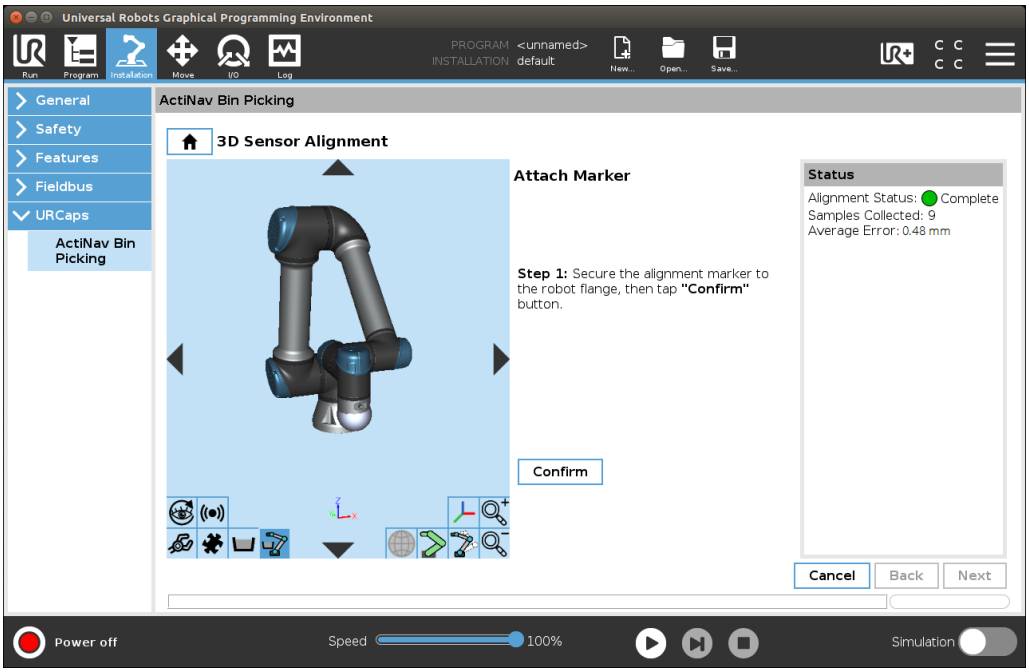
NOTICE

Bin placement may limit the range of movement for the alignment marker, and compromise the alignment accuracy.

- Remove the bin before you start recording samples for the 3D sensor alignment.

1. In PolyScope, select **Installation > URCaps > ActiNav Bin Picking > 3D Sensor**.
2. On the **3D Sensor** screen, select **Start Sensor Alignment Wizard**.
3. Attach the alignment marker to the tool flange. Tap **Confirm**, and then tap **Next**. PolyScope

shows the **Collect Samples** screen, to record your scan samples.



3.1.2. Recording samples

This procedure has the following success criteria:

- Record at least 8 scan samples.
- The average error value is less than 1 mm. It might be necessary to record more than 8 samples to achieve such value.

Positioning the alignment marker has the following success criteria:

- Ensure the marker is always facing the 3D Sensor.
- Ensure each new alignment marker position is different from the previous move.
- Move the marker within the scan volume covered by the sensor.
- Move the marker within the volume occupied by the bin.

To record the scan samples:

1. Tap **Reset Samples** to ensure that the previously recorded samples do not affect the alignment results.
2. Tap **Move**. Use the Freedrive mode, or the Move arrows, to move the alignment marker to a new position within the 3D sensor scanning volume.
3. Ensure that the line of sight between the alignment marker and the 3D sensor is not blocked by any objects.
4. Tap **Add Sample**. The 3D sensor performs a scanning sequence and searches for the alignment marker.
   If the scan is successful, the **Status** pane updates the **Samples Collected** and **Average Error**

fields.
If the scan is unsuccessful (the 3D sensor could not detect the alignment marker), PolyScope shows an error prompting you to move the marker again and repeat the scan.

5. Repeat steps 2-3 until you record at least 8 unique position samples and the average error value is less than 1 mm.
6. After recording 8 samples, the **Alignment Status** indicator turns green. Tap **Next**.
7. Remove the alignment marker from the tool flange and tap **Done**.

The 3D sensor alignment is completed.

3.2. Tool

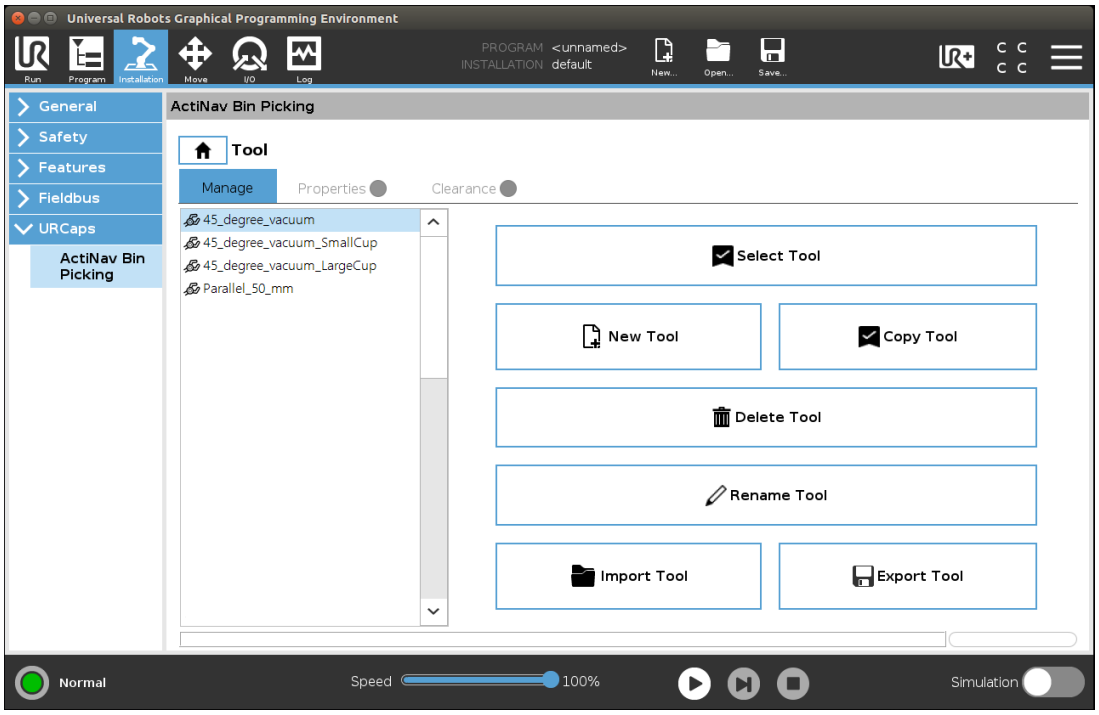
ActiNav works with the tool you decide is best suited to your application.

You need the CAD model of the tool to add a Tool object in ActiNav.

Tool CAD model requirements:

- Supported formats: STEP, OBJ.
- The origin and alignment of the XYZ axes of the tool flange and the tool must coincide when the tool is attached to the flange.

> **NOTICE**
>
> Creating CAD models with excessive texture, or any invisible internal details, can slow down the live display in the ActiNav Viewer, or can fail to import.
>
> - Ensure the CAD model is as compact and simple as possible.



3.2.1. Adding a Tool

To add a Tool to the installation:

1. Insert a USB flash drive with the CAD model of the tool into the Teach Pendant.
2. In PolyScope, select **Installation > URCaps > ActNav Bin Picking > Tool**.
3. In the **Manage** tab, tap **New Tool**.
4. In the **Import File** dialog, tap **Browse**.
5. Navigate to **Media**, select the Tool model file, and tap **Open**.
6. PolyScope imports the CAD model and shows the **Properties** tab.

Now you can define the TCP and the Tool properties.

3.2.2. Setting TCP and Tool Properties

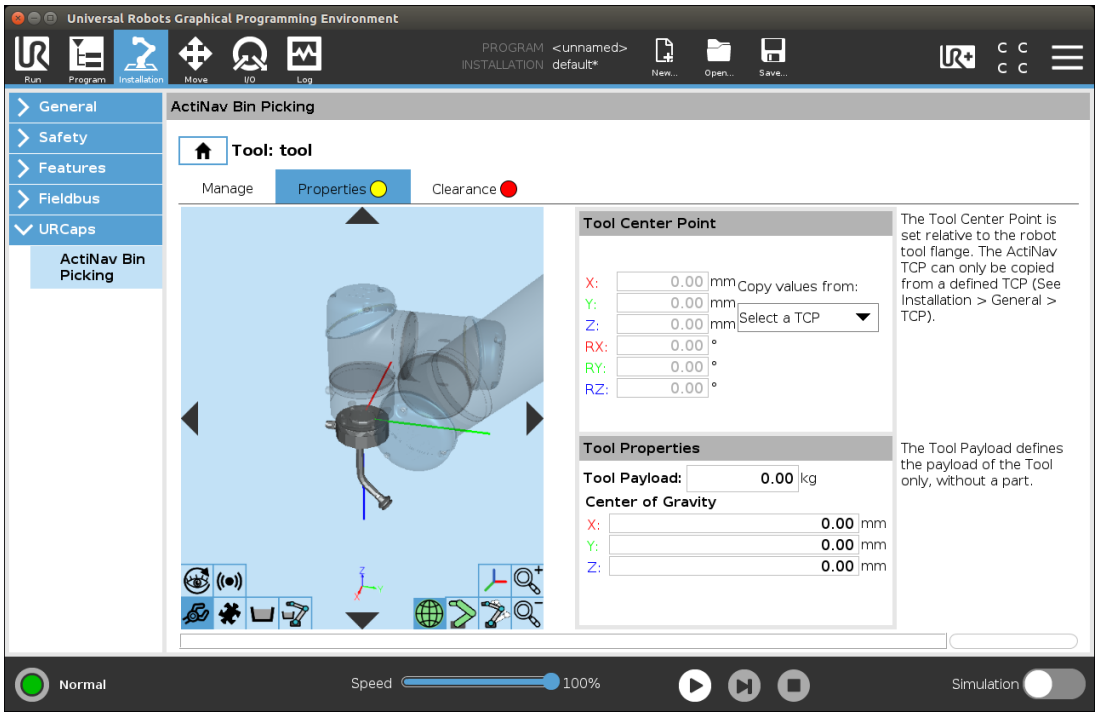
In the **Properties** tab, you configure the TCP, the Tool payload, and the Tool center of gravity.

TCP

The **Tool Center Point** section contains the TCP coordinates and orientation relative to the robot tool flange.

Tap **Copy values from** to copy the TCP values from one of the TCPs configured in the current installation.

To teach TCP values for the Tool using PolyScope, use the **TCP Position Wizard** in PolyScope in **Installation > General > TCP**.



Tool Properties

In the **Tool Properties**, enter the tool payload and the center of gravity coordinates.

> **NOTICE**
>
> Failure to enter the same data in both the Tool Payload and the Center of Gravity can result in protective stops and/or robot joint wear.
>
> - Manually enter both the Tool Payload and the Center of Gravity in the ActiNav Tool screen.

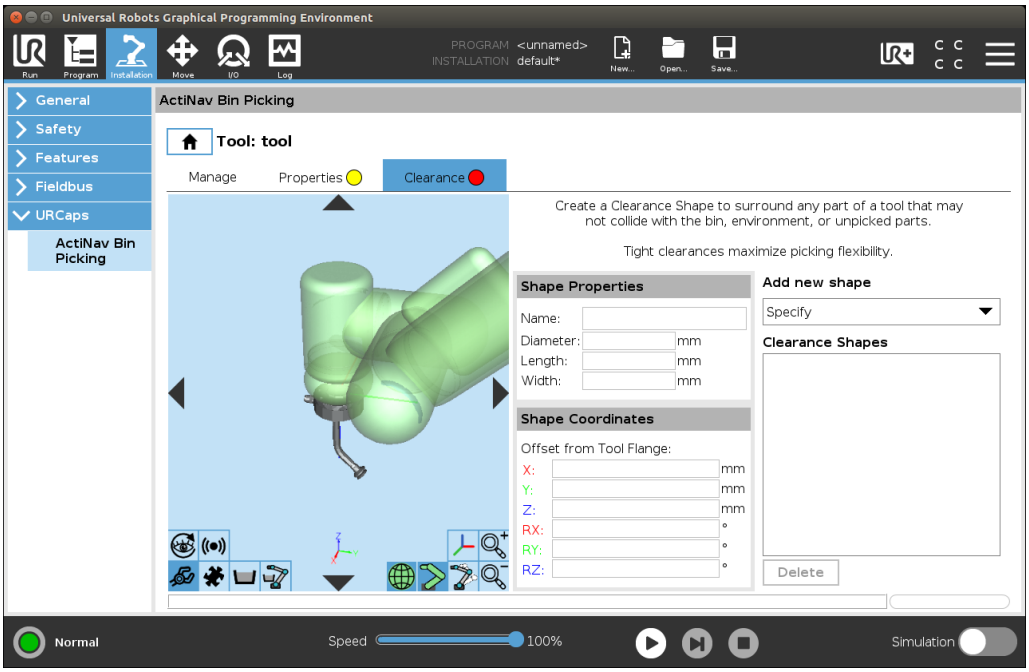
3.2.3. Creating Clearance Shapes for the Tool

Clearance shapes for the Tool are created at the origin of the tool flange.

To create a Clearance Shape:

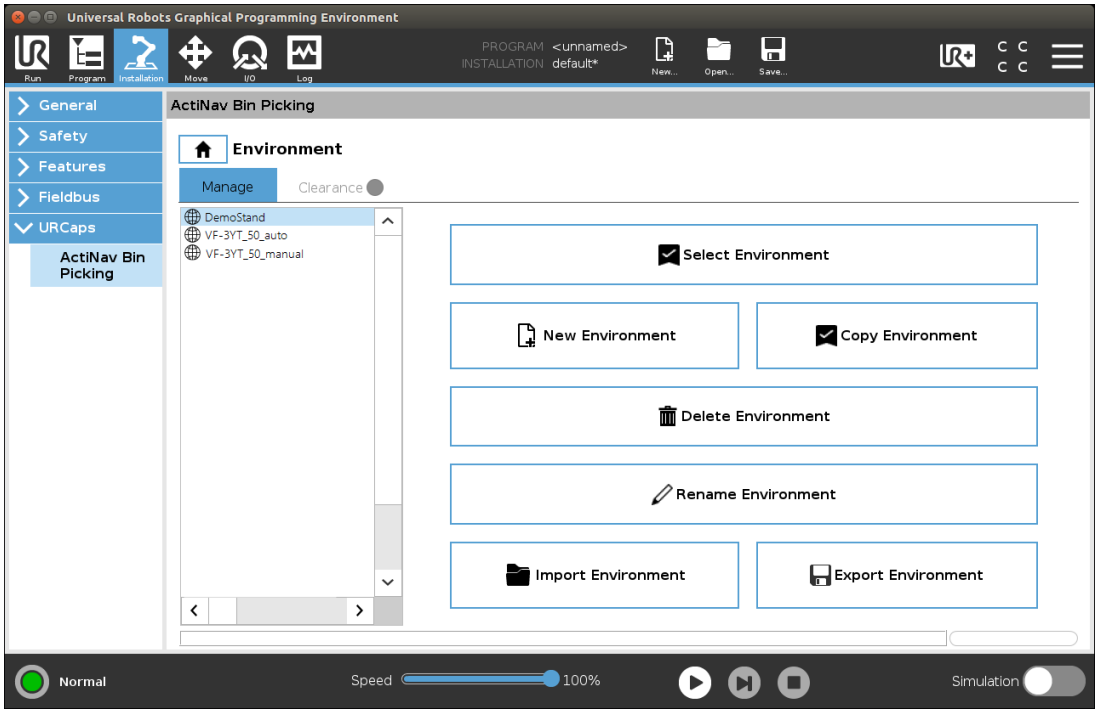
1. Select the **Clearance tab**.
2. In the **Add new shape** section, select desired shape type (Sphere, Capsule, or Lozenge).
3. PolyScope creates the new Shape with a default name. Edit the name if necessary.
4. Enter the values in the **Shape Properties** and **Shape Coordinates** sections. The available fields

depend on the shape type.



3.3. Environment

On the **Environment** screen, you configure the clearance shapes that either represent the physical objects inside the workspace, or serve as a virtual barrier.



To create a new environment:

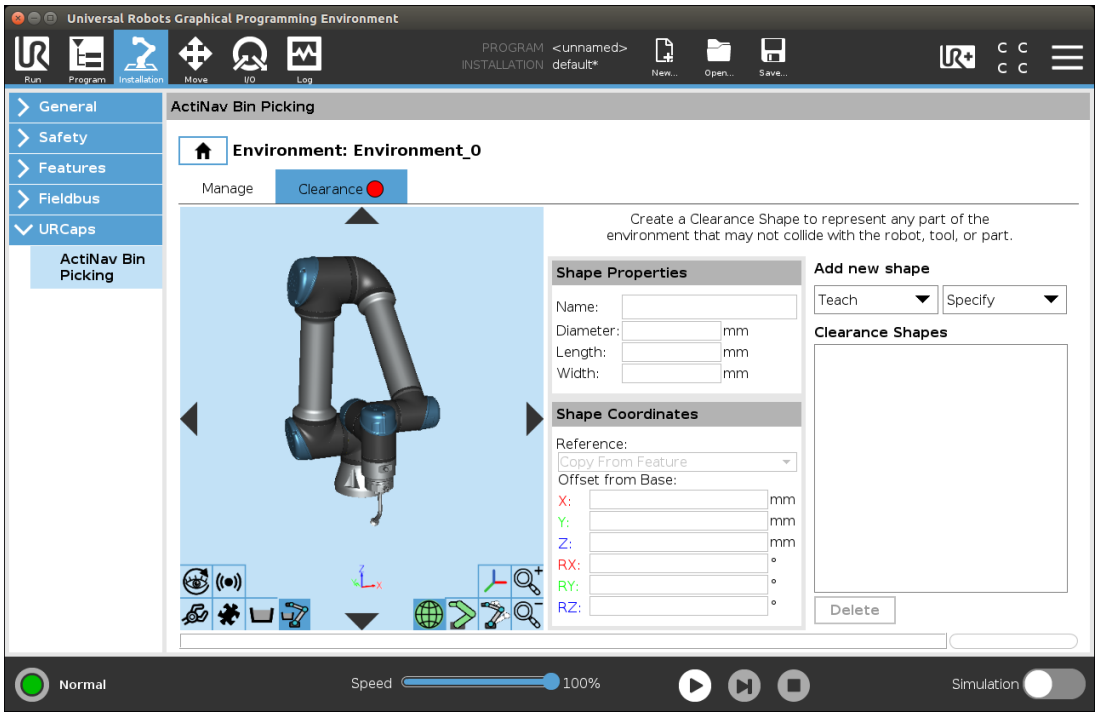
1. In PolyScope, select **Installation > URCaps > ActiNav Bin Picking > Environment**.
2. In the **Manage** tab, tap **New Environment**.
3. The **Clearance** tab becomes active.
4. Create the Clearance Shapes for the environment. See Clearance Shapes.
5. When you are done creating or editing the Clearance Shapes, tap **Save Shape Changes**.

3.4. Clearance Shapes

Clearance Shapes are objects in the ActiNav environment that represent objects in the real world or serve as virtual barriers. They let ActiNav move the robot arm, the tool, and the parts without collisions.

You can create Clearance Shapes by teaching key points with the TCP, or by entering shape characteristics in the **Shape Properties** and **Shape Coordinates** sections.

In ActiNav, you can add Clearance Shapes to the following objects: Environment, Tool, Part.



3.4.1. Creating a Clearance Shape

To create a Clearance Shape:

1. Select the **Clearance** tab.
2. In the **Add new shape** section, tap **Teach**.
3. Select the shape type (Sphere, Capsule, or Lozenge).

4. PolyScope creates the new Shape with the default name. Edit the name if necessary.
5. Enter the values in the **Shape Properties** and **Shape Coordinates** sections. The available fields depend on the Shape type.

3.4.2. Creating a Clearance Shape by Teaching

In the **Environment** screen you can add Clearance Shapes by teaching key points with the TCP.

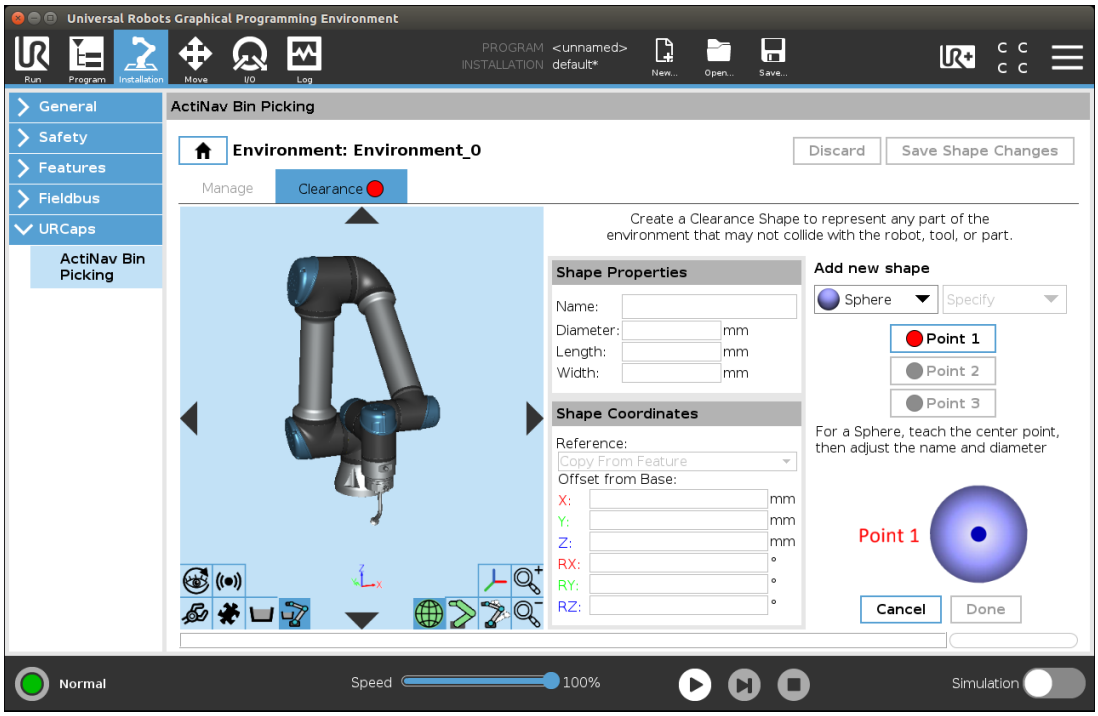
To create a Clearance Shape:

1. Select the **Clearance** tab.
2. In the **Add new shape** section, tap **Teach**.
3. Select the shape type (Sphere, Capsule, or Lozenge).

The following sections describe how to teach different types of Shapes.

Teaching a Sphere

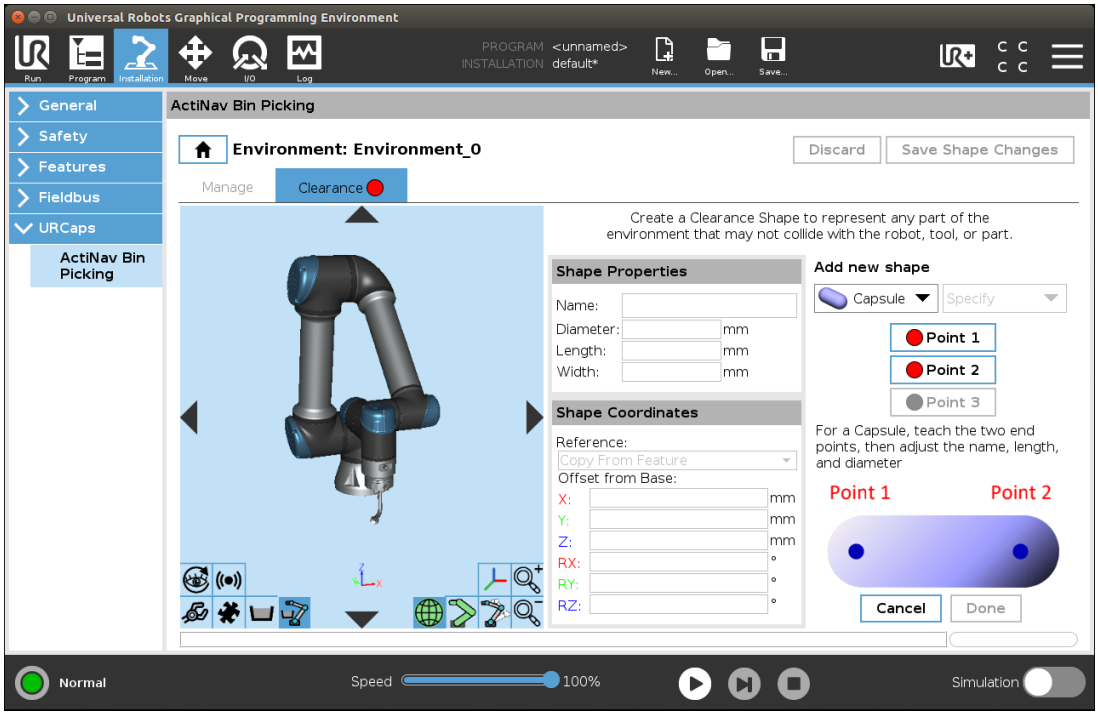
To create a Sphere, teach the center point and enter the diameter.



1. In the **Teach** menu, tap **Sphere**.
2. Tap **Point 1**. PolyScope shows the **Move** tab.
3. Move the TCP to the place where the center of the Sphere should be and tap **OK**.
4. Tap **Done**.
5. In the **Shape Properties** section, fill in the **Diameter** field.
6. In the **Name** field, enter the name for this shape.

Teaching a Capsule

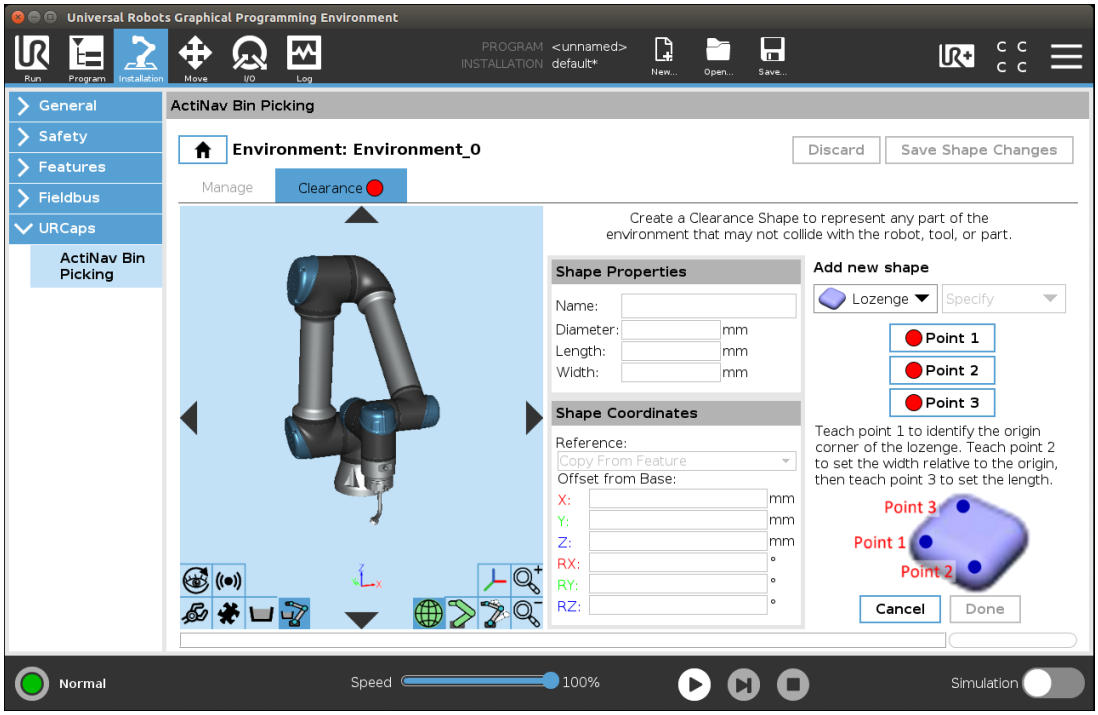
To create a Capsule, teach the two end points, enter the length, and the diameter.



1. In the **Teach** menu, tap **Capsule**.
2. Tap **Point 1**. PolyScope shows the **Move** tab.
3. Move the TCP to the place where the end point should be and tap **OK**.
4. Repeat steps 2-3 for end point 2.
5. Tap **Done**.
6. In the **Shape Properties** section, fill in the **Diameter** field. PolyScope calculates the **Length** filed value automatically.
7. In the **Name** field, enter the name for this shape.

Teaching a Lozenge

To create a Lozenge, teach the three points and enter the thickness.



1. In the **Teach** menu, tap **Lozenge**.
2. Tap **Point 1**. PolyScope shows the **Move** tab.
3. Move the TCP to the place where the point should be and tap **OK**.
4. Repeat steps 2-3 for points 2 and 3.
5. Tap **Done**.
6. In the **Shape Properties** section, fill in the **Thickness** field. PolyScope calculates the **Length** and the **Width** values automatically.
7. In the **Name** field, enter the name for this shape.

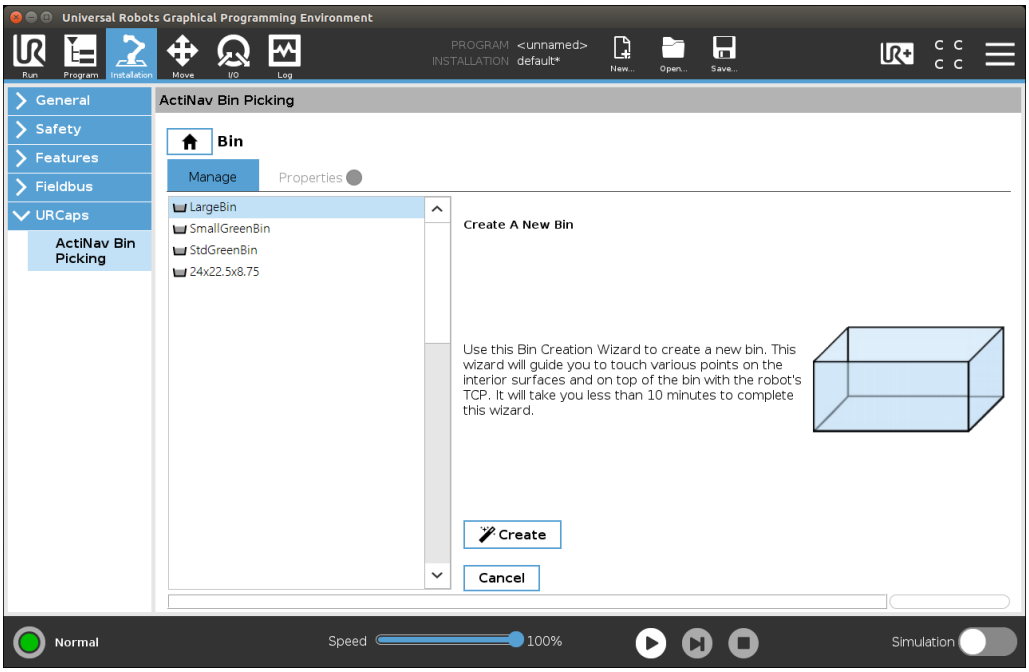
3.5. Bin

On the **Bin** screen, you configure the shape and the properties of the bin.

3.5.1. Creating a new Bin

To create a new bin:

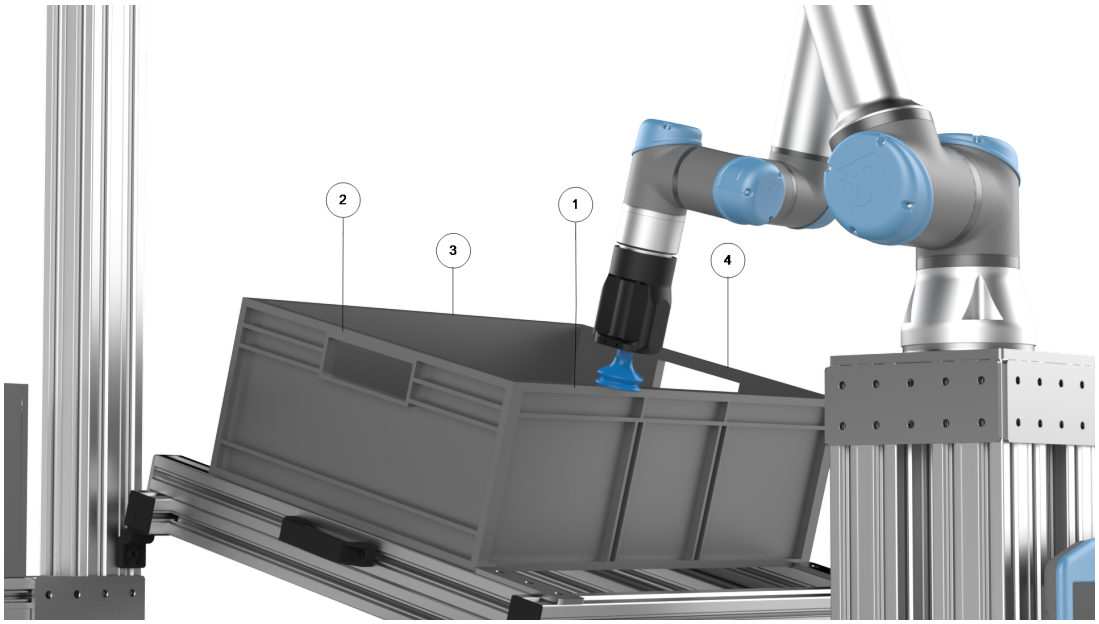
1. In PolyScope, select **Installation > URCaps > Bin Picking > Bin**.
2. In the **Manage** tab, tap **New Bin**. PolyScope shows the **Create a New Bin** screen.
3. Tap **Create**. PolyScope shows the **Bin Creation Wizard** screen.



3.5.2. Creating a Bin by Teaching

The **Bin Creation Wizard** guides you through the process of creating the shape of the bin. The process consists of defining 4 walls and the bottom of the bin.

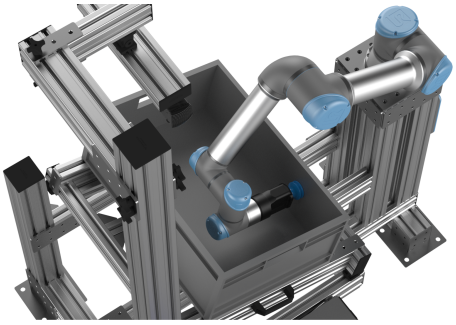
On each step, the wizard highlights the wall of the bin that you define. Start with the front bin wall, then define the left bin wall. Continue to define the back bin wall and the right bin wall.

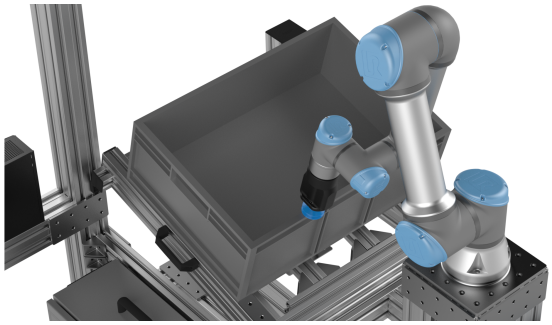


1	front bin wall	2	left bin wall
3	back bin wall	4	right bin wall

Defining the walls of the bin

To define a wall, you must define 4 points on the interior side of the wall, and one point at the top of the wall.





The 4 points should not be near each other.

If the wall has grooves, or is irregular, define points on the innermost surface of the wall.

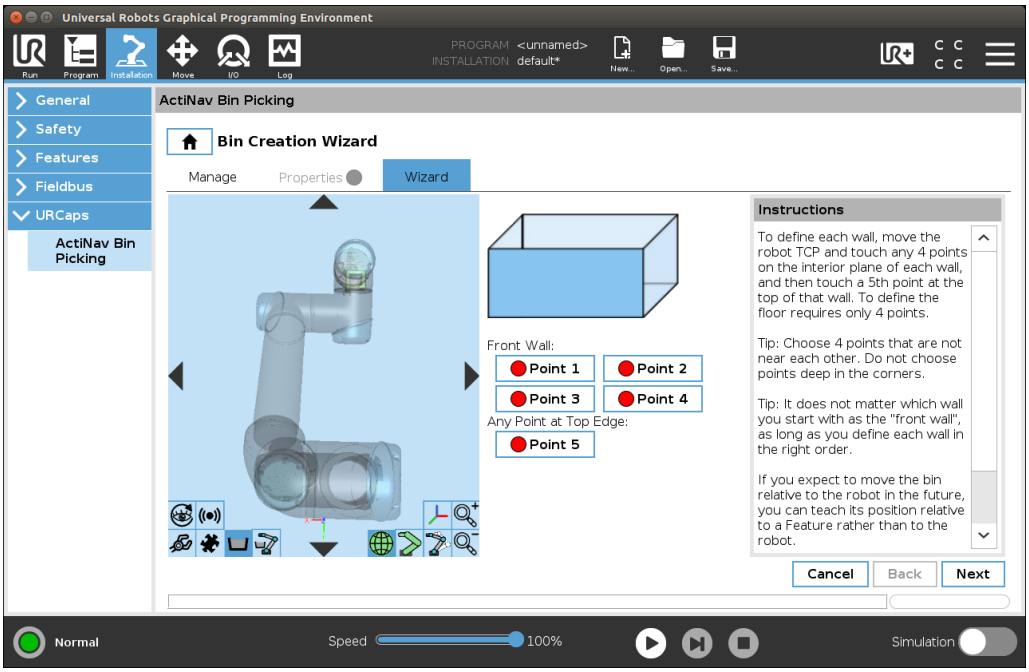
To define points, move TCP so that it touches a wall in those points. When defining the point at the top edge of the wall, move the TCP so that it touches the edge of the wall from the top (this can be any point on the edge).

To define the walls of the bin:

> **NOTICE**
>
> Defining the walls of the bin incorrectly can result in an incomplete bin shape.
>
> - Define the bin walls in a clockwise direction.

1. Tap **Point 1**. PolyScope shows the **Move** tab.
2. Move the TCP so that it touches a point on the wall (for one of the points on each wall, the dialog prompts you to touch the edge of the wall). Tap **OK**. The circle next to **Point 1** becomes green.
3. Repeat steps 1-2 for the rest of the points.
4. After defining all points on the current wall, tap **Next**. The wizard highlights the next wall where you repeat this procedure. For example, when you define the five points on the front wall of the

bin, tap **Next** to move on to wall 2.

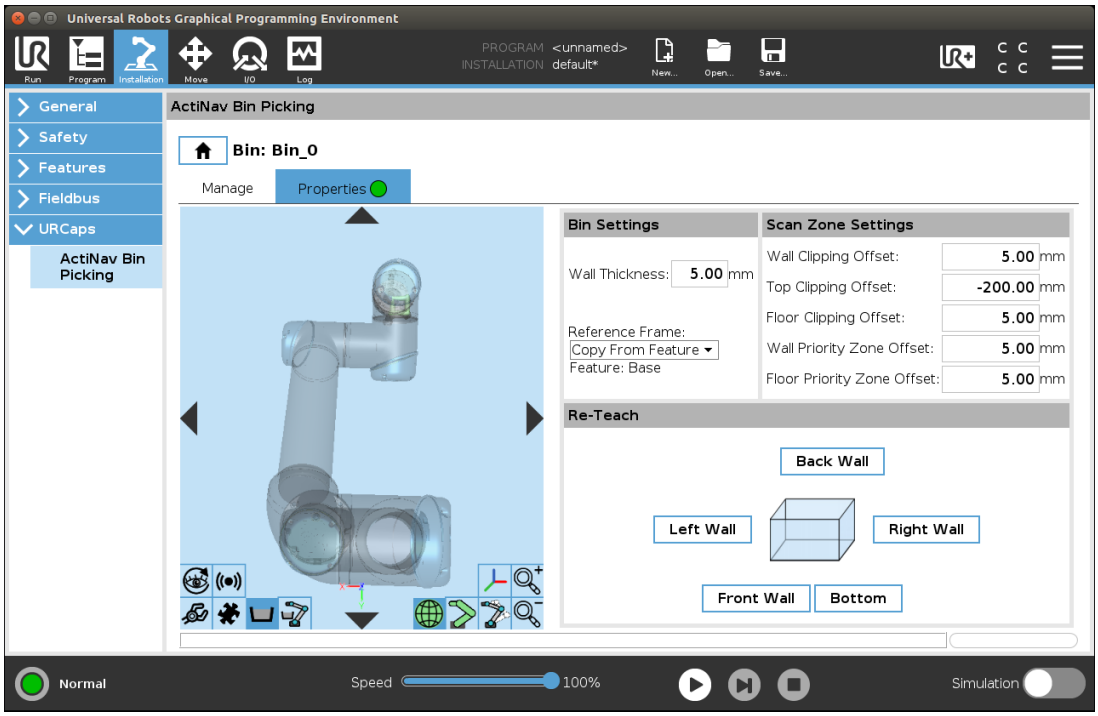


The procedure for defining the floor is the same as for the walls, except that you do not specify a point at the edge of the floor.

After defining the walls of the bin, proceed to Bin properties below.

Bin properties

To edit the properties of the bin, in the **Manage** tab, select the bin that you want to edit.



Bin settings

Use this dialog to set the basic bin settings.

Wall thickness: the thickness of the wall is taken symmetrically from the plane created by teaching the points..

Scan Zone Settings

The Scan Zone is the virtual region within the bin the scanner detects by clipping out the walls and floor of the bin.

Use the Scan Volume Settings dialog to set the properties that define the scan volume.

Floor Clipping Offset: The offset measured up from the floor of the bin.

> **NOTICE**
>
> Including the floor in the scan zone can lead to false matches and collisions between the tool and the floor.
>
> - Do not allow the scanner to detect the floor of the bin in the Scan Zone.

Wall Clipping Offset: The offset measured inside from the walls of the bin.

Top Clipping Offset: The offset measured up from the plane lying on top of the bin.

Re-Teach

Use this dialog to re-teach any of the walls, or the floor of the bin, without re-teaching the entire bin.

3.6. Part

As with the tool, a suitable part is configured for each application.

You need a CAD model, or a 3D scan of the part to add a Part object in ActiNav.

Part CAD requirements:

- Supported formats: STEP, OBJ, STP, PLY.

> **NOTICE**
>
> To avoid trouble defining clearance shapes, verify the origin of the part model is within the volume of the part.

3.6.1. Adding a Part

To add a Part to the installation:

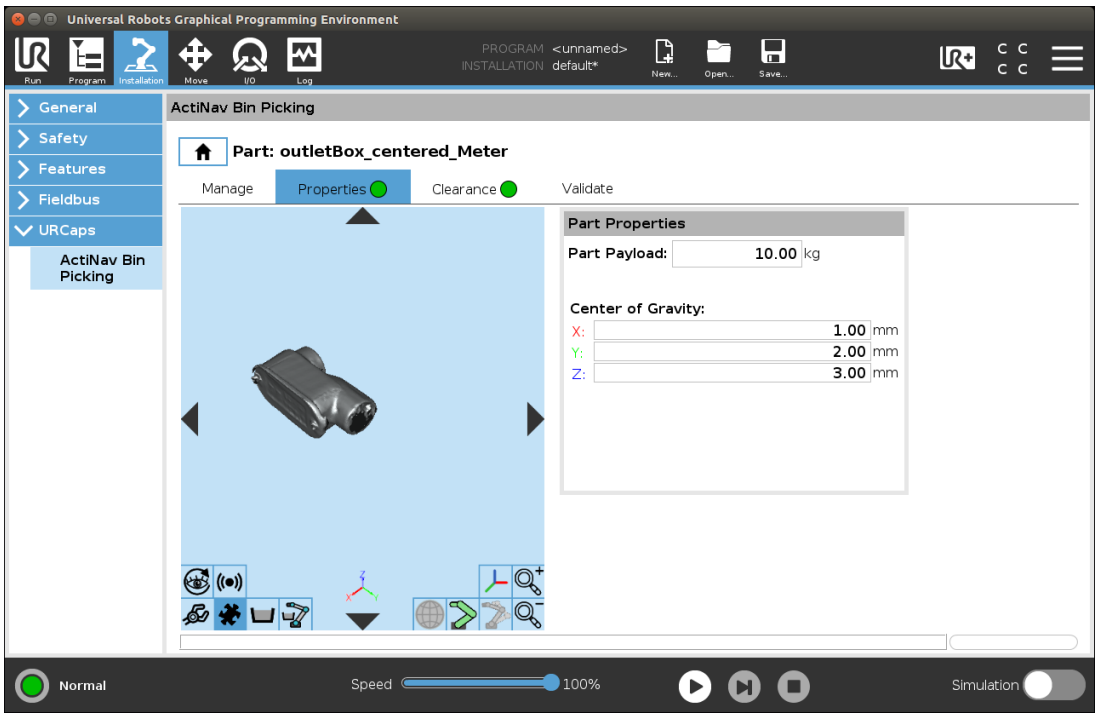
1. Insert a USB flash drive with the CAD model of the part into the Teach Pendant.
2. In PolyScope, select **Installation > URCaps > Bin Picking > Part**.
3. In the **Manage** tab, tap **New Part**.
4. In the **Import File** dialog, tap **Browse**.
5. Navigate to **Media**, select the Part model file, then select the desired part name.
6. PolyScope imports the CAD model and shows the **Properties** tab.

Now you can define the Part properties.

3.6.2. Setting Part Properties

Part Properties

In the **Part Properties**, enter the required part payload and center of gravity coordinates.



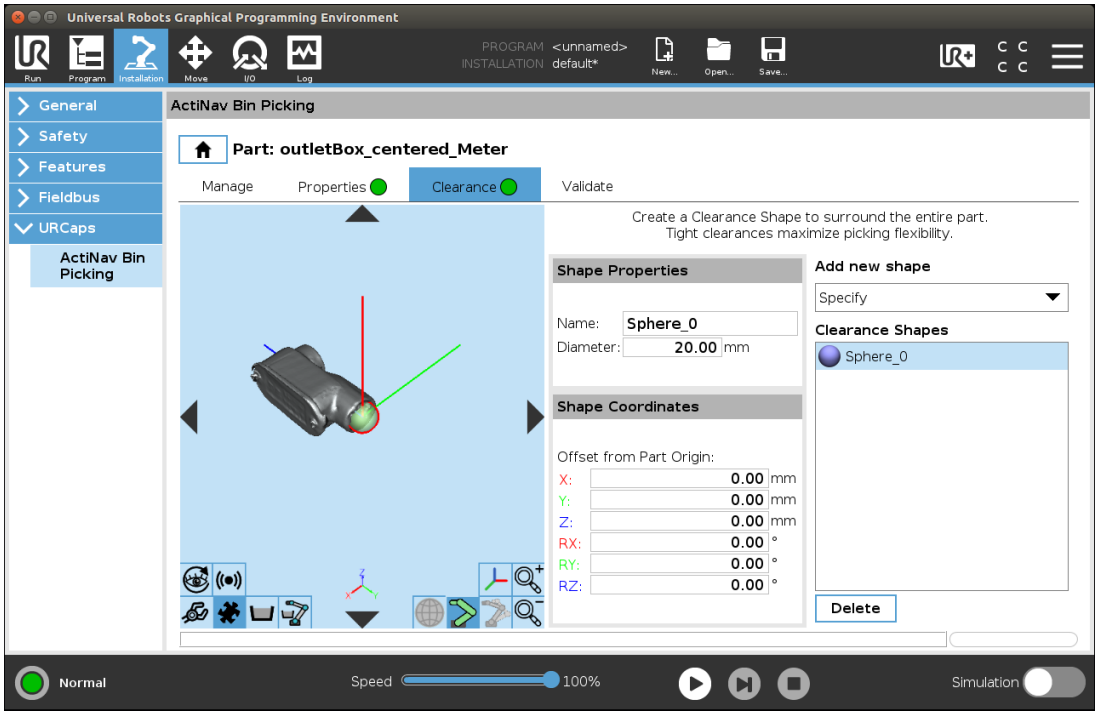
3.6.3. Creating a Clearance Shape for the Part

Create as few Clearance Shapes as possible to cover the entire object.

To create a Clearance Shape:

1. Select the **Clearance tab**.
2. In the **Add new shape** section, select desired shape type (Sphere, Capsule, or Lozenge).
3. PolyScope creates the new Shape with a default name. Edit the name if necessary.

4. Enter the values in the **Shape Properties** and **Shape Coordinates** sections. The available fields depend on the shape type.



3.6.4. Validating a Part

In the Validate section, you can ensure the part is detectable. You can also change/set the vision parameters.

The Bin must be set up with accurate clippings, see section 3.5. Bin on page 12.

> **NOTICE**
>
> Incorrect scanning can result in the scanner detecting zero parts.
>
> - Verify the part placement before validating the part.

To validate a Part:

1. Clear the bin.
2. Place five parts into the bin, with the same pickable side up.
3. In the **Validate** tab, tap **Scan**.
4. Set the Perception Settings depending on the size and shape of the part.

   If fewer than five parts are detected, change the Perception Settings and repeat steps 2 and 3.
5. Verify all five parts are detected, and note the Confidence score.
6. Repeat steps 2 - 5 for all pickable surfaces of the part.

The percentage value of the Confidence Threshold relates to the likelihood of the sensor to detect a part.

7. As a starting point for a new part, enter the lowest Confidence score you recorded in the Confidence Threshold box.

   You can always change the lowest Confidence score, if the parts are not matched accurately enough, or if the cycle time os too slow.

4. Simple application examples

This section describes detailed examples of the steps in a Pick and Place Program, using the following elements:

- Tool type: Vacuum end effector.
- Part type: Electrical conduit elbow.

You can use the examples to create, verify, or compare your Pick and Place Program. There are some minor variations depending on the tool type and part type you are using.

4.1. Basic Pick and Place Program

This section assumes all items under **Program > URCaps > Pick and Place Loop** are configured.

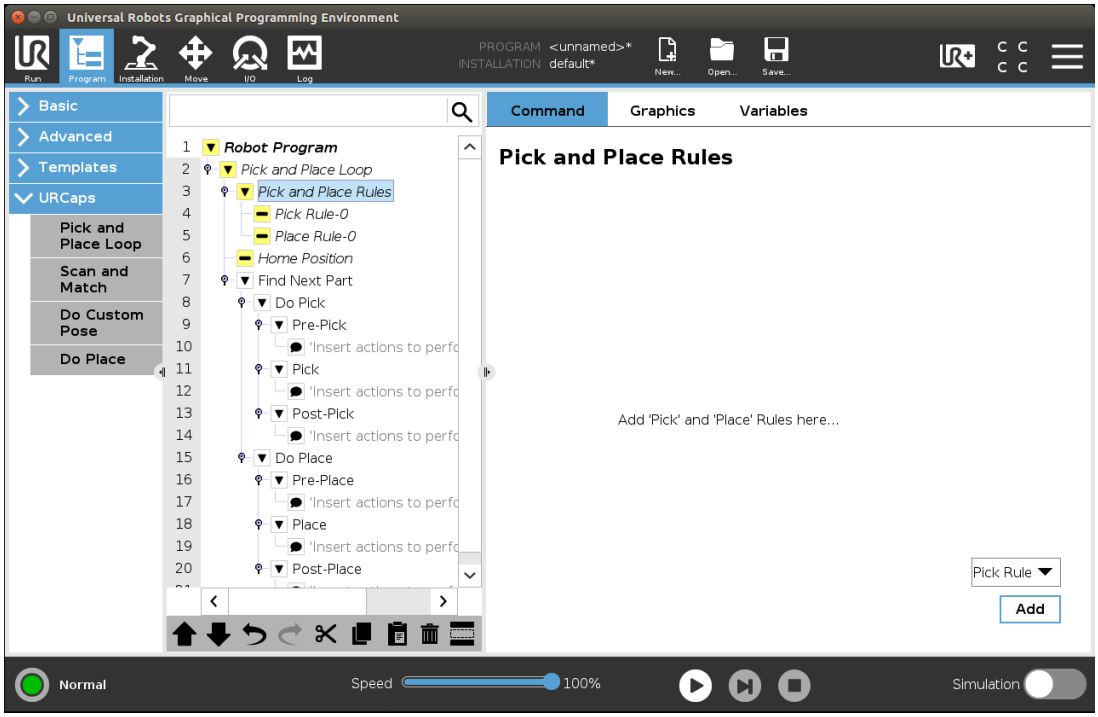
The **Pick and Place Loop** program template contains the following nodes:

- Pick and Place Rules
- Home Position
- Find Next Part

This section describes how to create a basic Pick and Place Program using the **Pick and Place Loop** program template.

4.1.1. Adding a Pick and Place Loop

In an empty program, go to **Program > URCaps** and tap **Pick and Place Loop**.

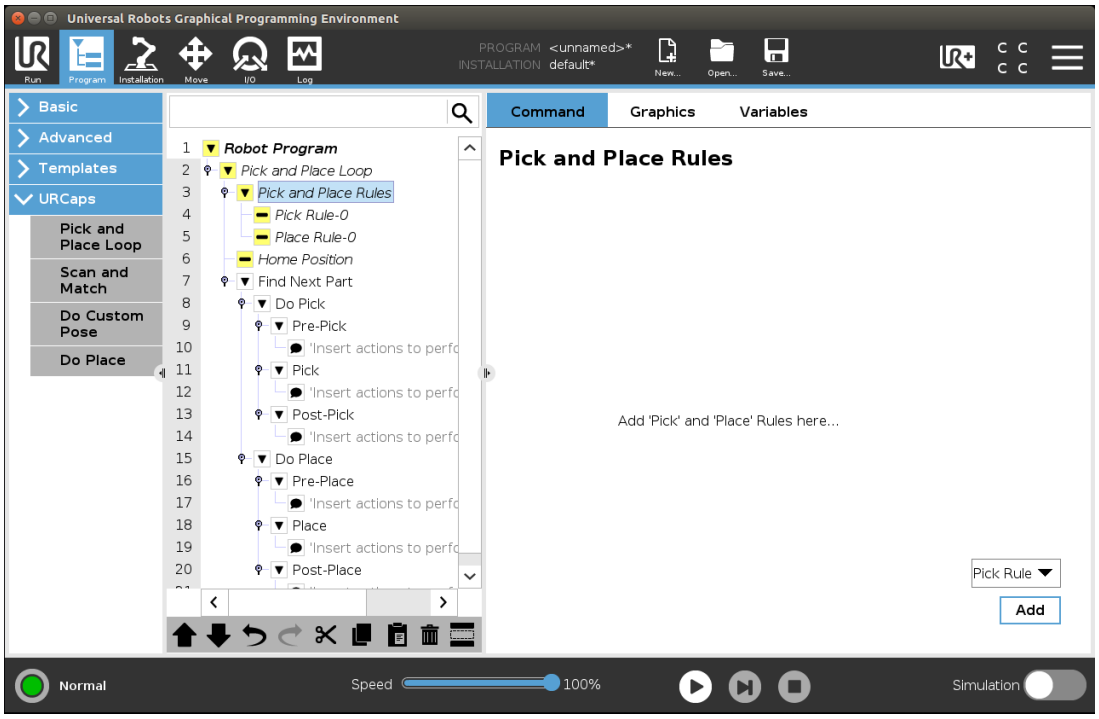


4.1.2. Pick and Place Rules

Create Pick and Place Rules to teach the robot how to pick up and how to place a part.

Creating a Pick Rule

1. In the **Pick and Place Loop** program tree, tap the **Pick and Place Rules** node.
2. In **Pick and Place Rules** pane, select **Pick Rule**.
3. Tap **Add**. A new node **Pick Rule-0** appears in the program tree.
4. Select the new **Pick Rule-0** node to define the **Pick Rule Properties**.



The following section describes how to define Pick Rule Properties>.

Defining a Pick Rule

To define a Pick Rule, first teach the Pick position, then define the Pre-Pick and Post-Pick positions.

Teaching a Pick position

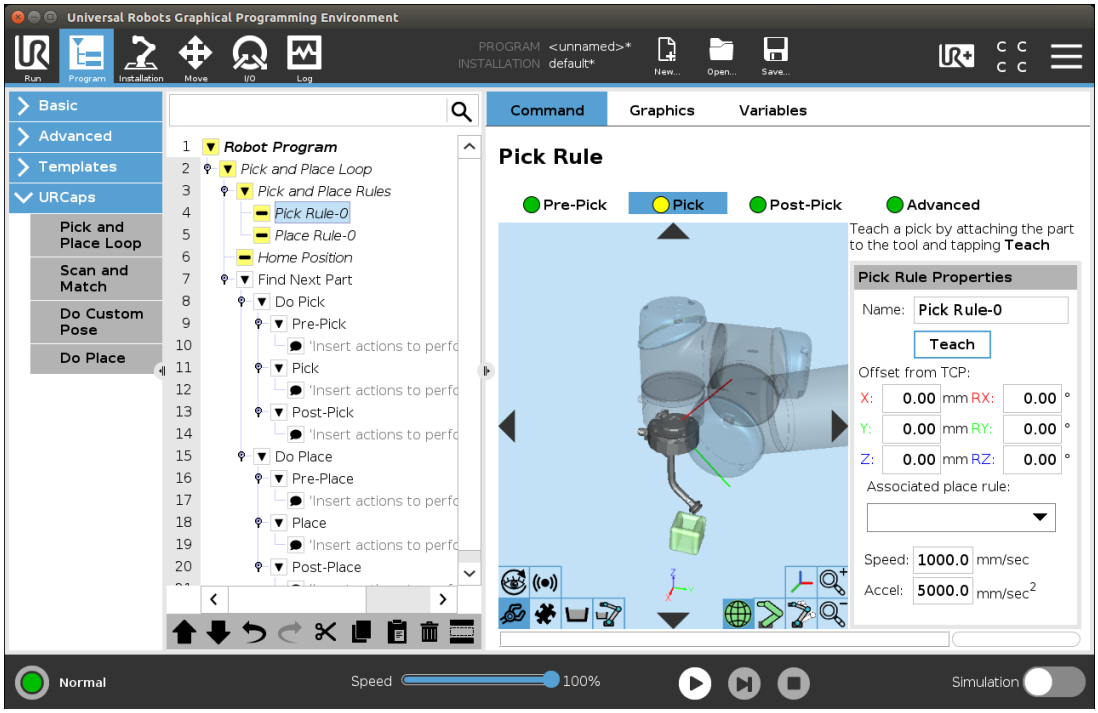
To teach a Pick position:

1. Tap the **Pick Rule-0** node.
2. In the **Pick Rule** pane, select **Pick**.
3. Tap **Teach** to start the **Pick** position teaching wizard.
4. Turn on the tool and attach the part.

5. Freedrive the robot, or use the Move arrows, to move the tool so that part is detectable to the sensor.
6. Tap **Scan**

   If the part is detected, the **Scan Results** show the part coordinates relative to the tool.

   If the part is not detected, repeat step 5, adjusting the position of the part.
7. Tap **Done**
8. Turn off the tool and unattach the part.

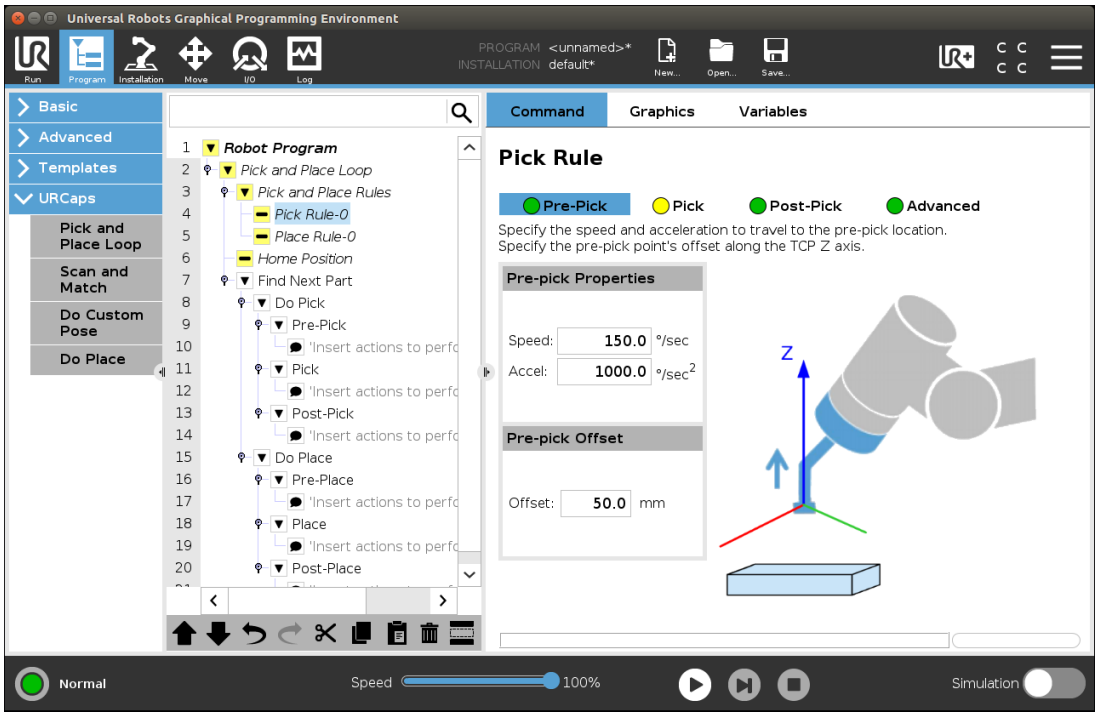


Defining a Pre-Pick position:

The Pre-Pick position determines the distance between the tool tip and the part, before the part is picked up.

To define a **Pre-Pick** position, tap the **Pre-Pick** tab and edit the **Pre-Pick Properties** if necessary.

The Pre-pick Offset must allow ActiNav to find a pick that is clear of obstacles. As such, the default Pre-pick Offset is set to 50mm.

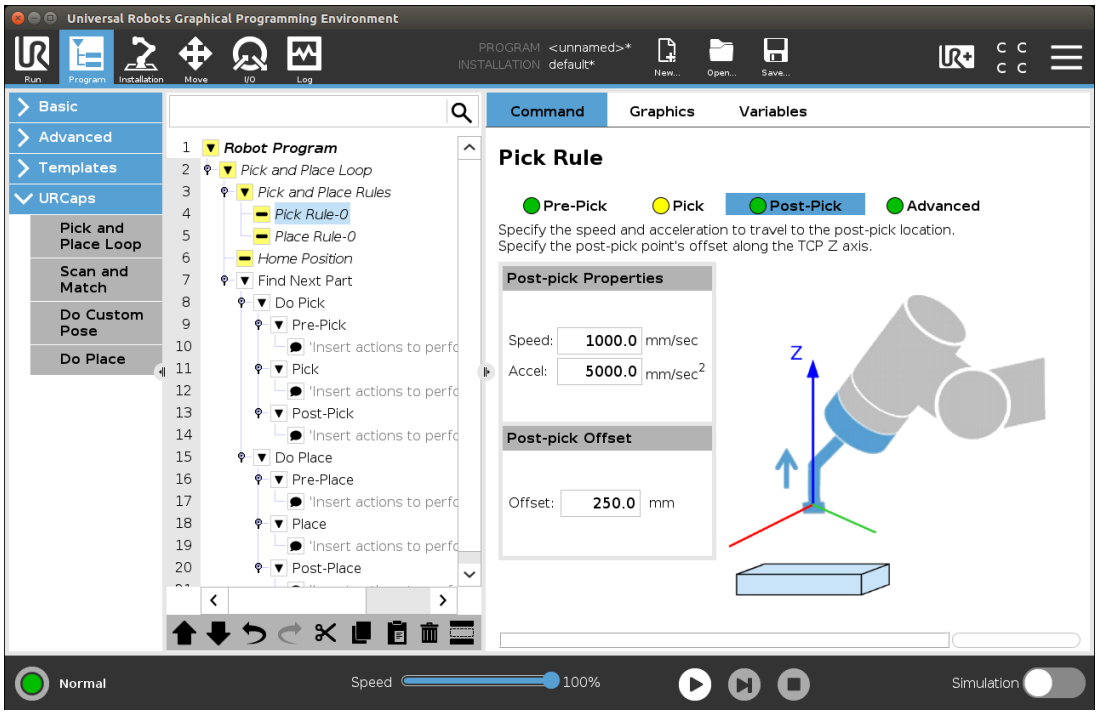


Defining a Post-Pick position:

The Post-Pick position determines how the tool and part move away from the floor of the bin.

To define a **Post-Pick** position, tap the **Post-Pick** tab and edit the **Post-Pick Properties** if necessary.

For best performance, you can set the Post-Pick Offset so the part completely clears the top of the bin walls when the part is picked (up) from the bottom of the bin.



Creating a Place Rule

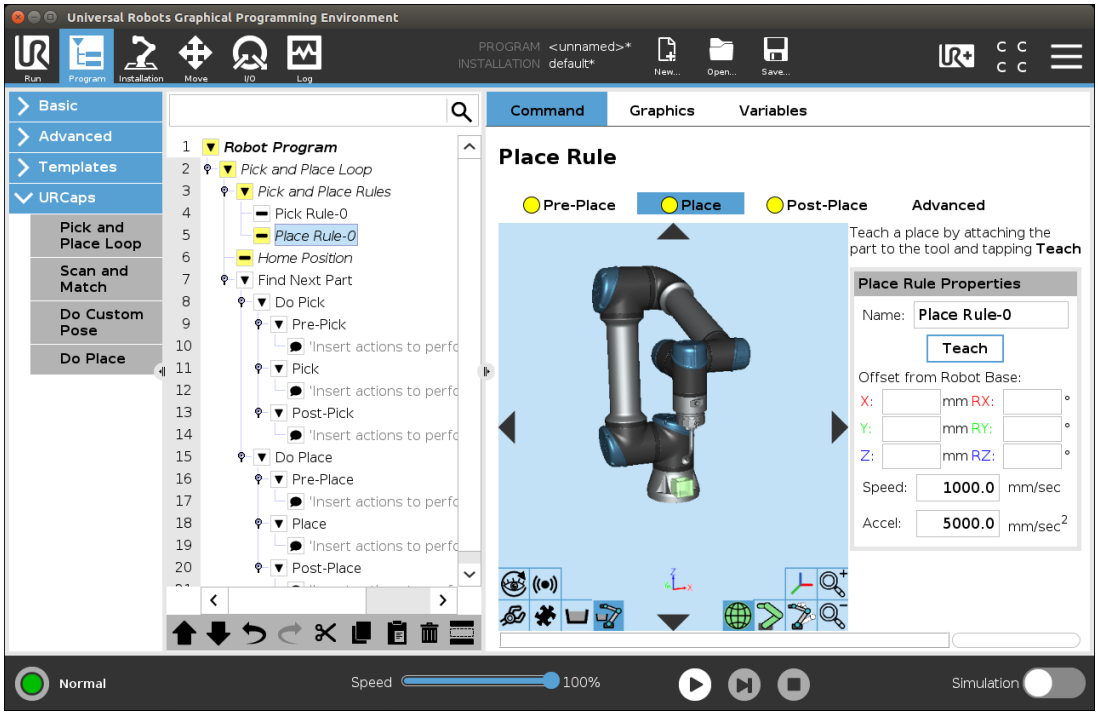
1. In the **Pick and Place Loop** program tree, tap the **Pick and Place Rules** node.
2. In the **Pick and Place Rules** pane, select **Place Rule**.
3. Tap **Add**. A new node **Place Rule-0** appears in the program tree.
4. Select the new **Place Rule** node to define the **Place Rule** properties.

The following section describes how to configure Place Rule properties.

Defining a Place Rule

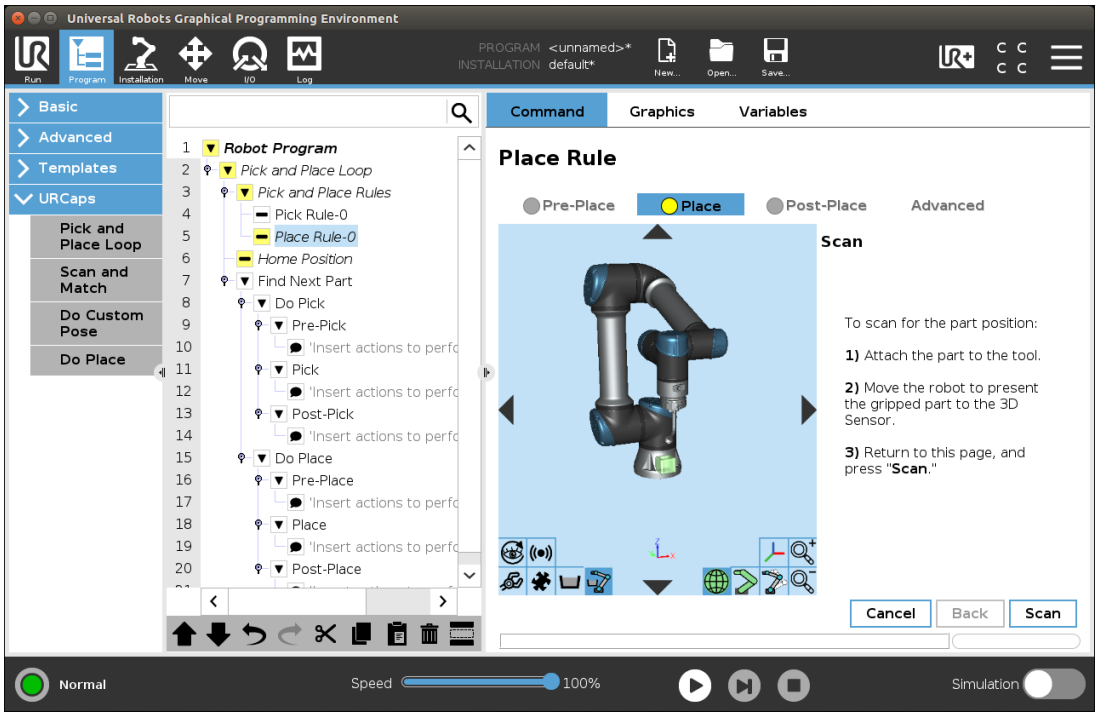
To define a place rule, use the Place Rule teaching wizard to first teach the **Place**, then teach the **Pre-Place** and **Post-Place** positions.

The wizard allows you to correctly teach and scan all coordinates from the Place Rule pane.



Teaching a Place position

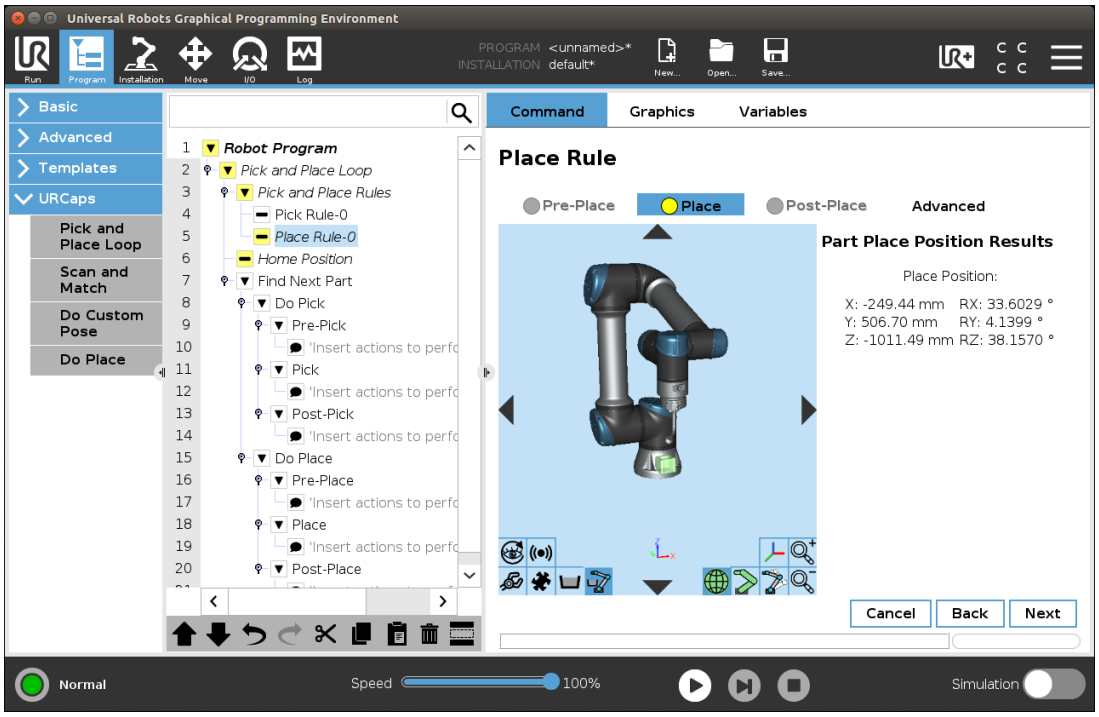
To teach a Place position:



1. Tap the **Place Rule-0** node.
2. In the **Place Rule** panel, select **Place**.
3. Tap **Teach** to start the Place Rule teaching wizard.
4. Turn on the tool and attach the part.
5. Freedrive the robot, or use the Move arrows, to move the tool so that part is detectable to the sensor.
6. Tap **Scan**.

   If the part is detected, the **Scan Results** show the part coordinates relative to the tool.

   If the part is not detected, repeat step 5 adjusting the position of the part.
7. Tap **Next** to continue the Place Rule teaching wizard.
8. Tap **Next** again. PolyScope shows the **Move** tab.
9. Teach the **Pre-Place** position.

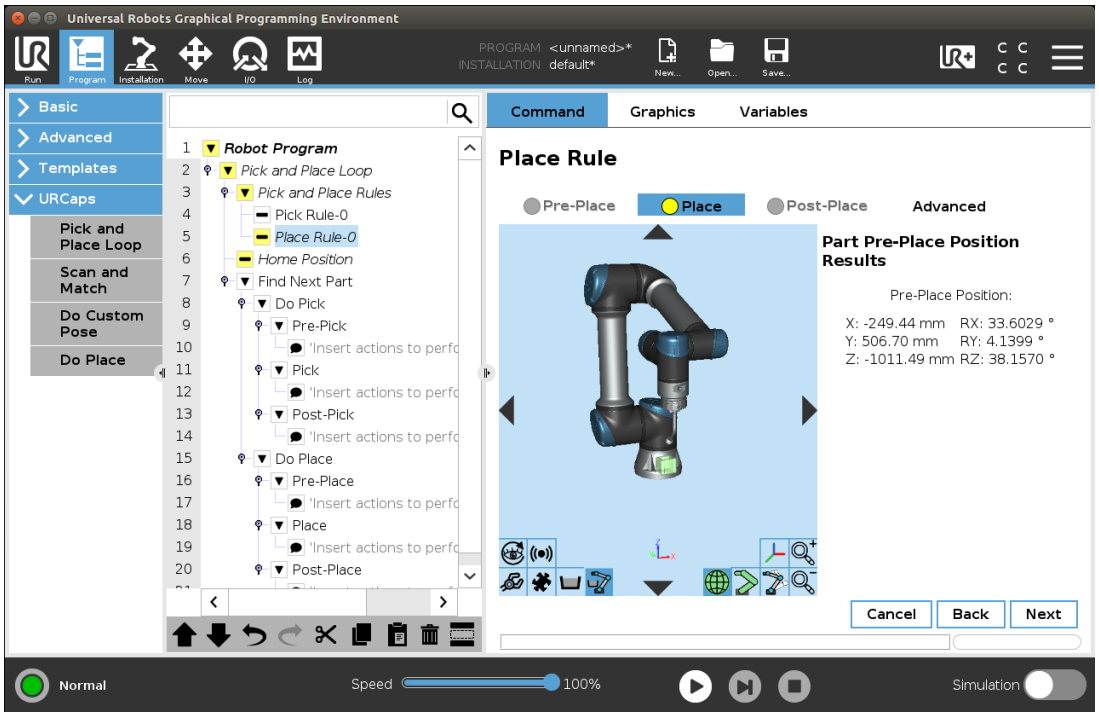


Teaching a Pre-Place position

The Pre-Place position determines how the tool and part are positioned before the part is placed.

To teach a Pre-Place position:

1. Freedrive the robot, or use the Move arrows, to teach the **Pre-Place** position.
2. Tap **OK** to display the **Part Pre-Place Position Results**.
3. Tap **Next** to continue the Place Rule teaching wizard.
4. Tap **Next** again. PolyScope shows the **Move** tab.
5. Teach the **Post-Place** position.

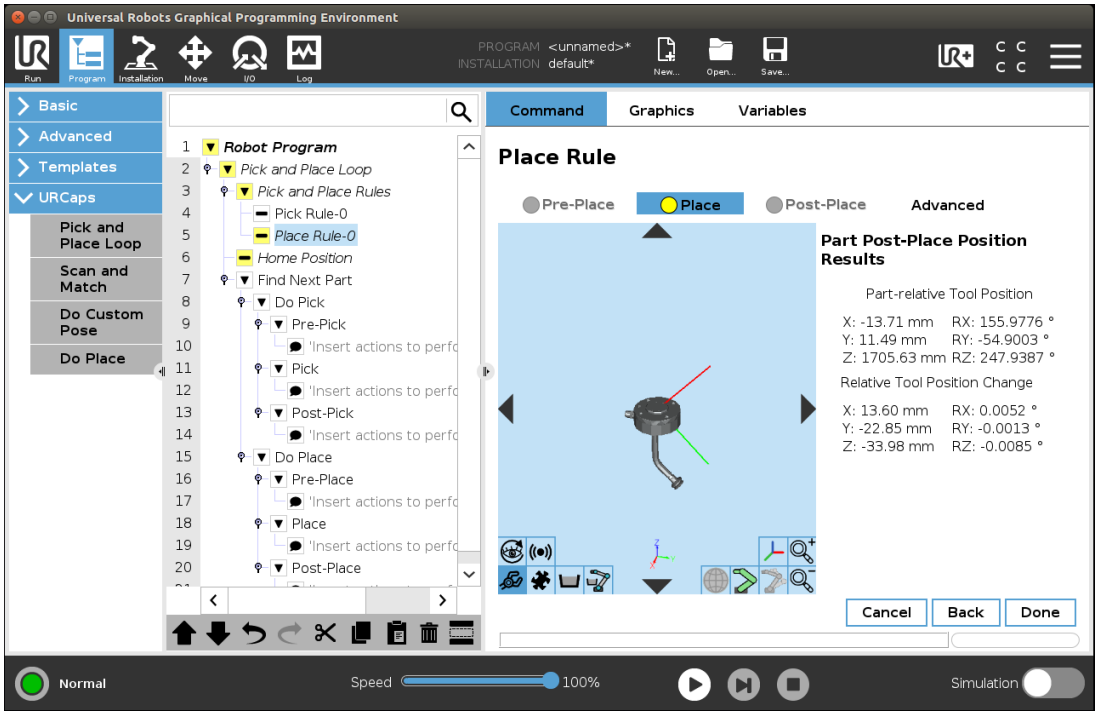


Teaching a Post-Place position

The **Post-Place** position determines how the tool moves away, once a part is placed.

To teach a Post-Place position:

1. Freedrive the robot, or use the Move arrows, to teach the **Post-Place** position.
2. Tap **OK** to display the **Part Post-Place Position Results**.
3. Tap **Done**.



4.2. ActiNav Home Position

The **ActiNav Home Position** node defines the return position for the robot at the beginning a program, and at each subsequent loop of the program.

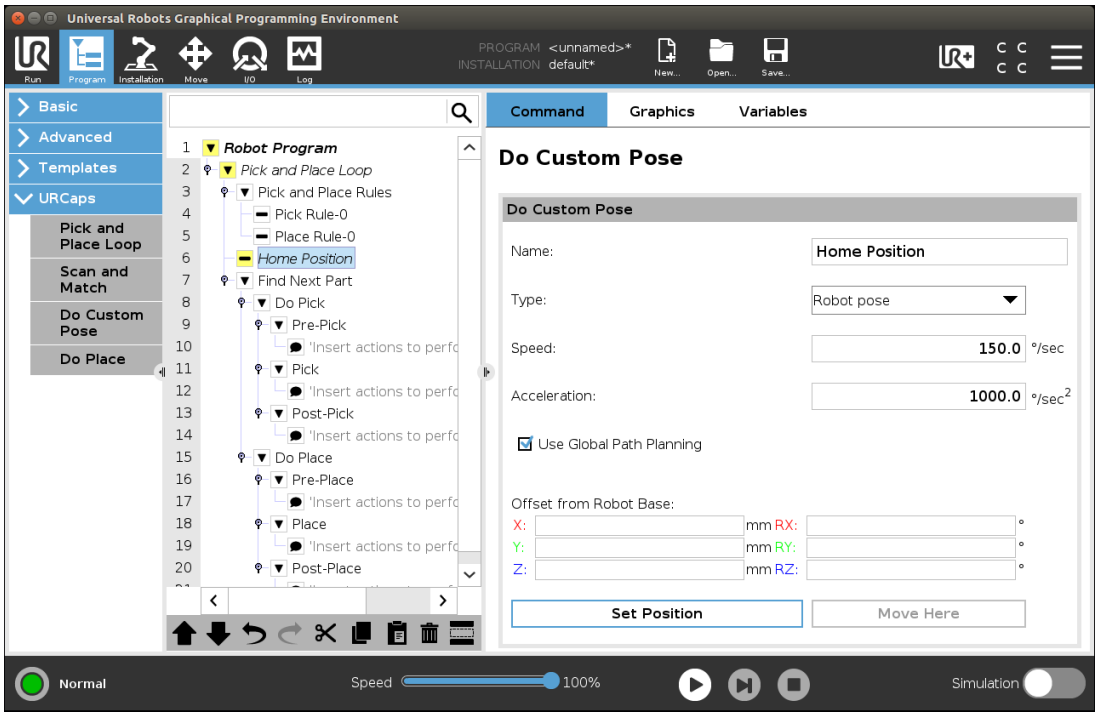
The **Pick and Place Loop** always includes an **Actinav Home Position** node, that you must configure to return the robot to a specific position before a new loop begins.

> **NOTICE**
>
> The robot arm must not be in a position to obstruct, or to intefere with, the scan area.
>
> - Teach a **Home Position** that is outside of the scan area.
>
> The program runs more effciently if the Home Position is along a reasonable path between the bin and the Place location.

4.2.1. Configuring ActiNav Home Position

To configure an ActiNav Home Position node:

1. In the **Pick and Place Loop** program tree, select **Home Position**.
2. In the **Do Custom Pose** pane, ensure the **Type** is **Robot pose**.
3. Select **Use Global Path Planning**.
4. Tap **Set Position**. PolyScope shows the **Move**tab.
5. Move the robot to a specific position and tap **OK**.



4.3. Find Next Part

Set Find Next Part parameters for **ActiNav Bin Picking** to select the next best part candidate to be picked up.

4.3.1. Configuring Do Pick

When the robot reaches the position/s defined in the **Pick Rules**, you must assign actions to the tool. Each **Pick Rule** position, must have an assigned **Do Pick** action for the tool to pick, and attach to, a part.

To configure the **Do Pick**, you assign the following actions to the tool:

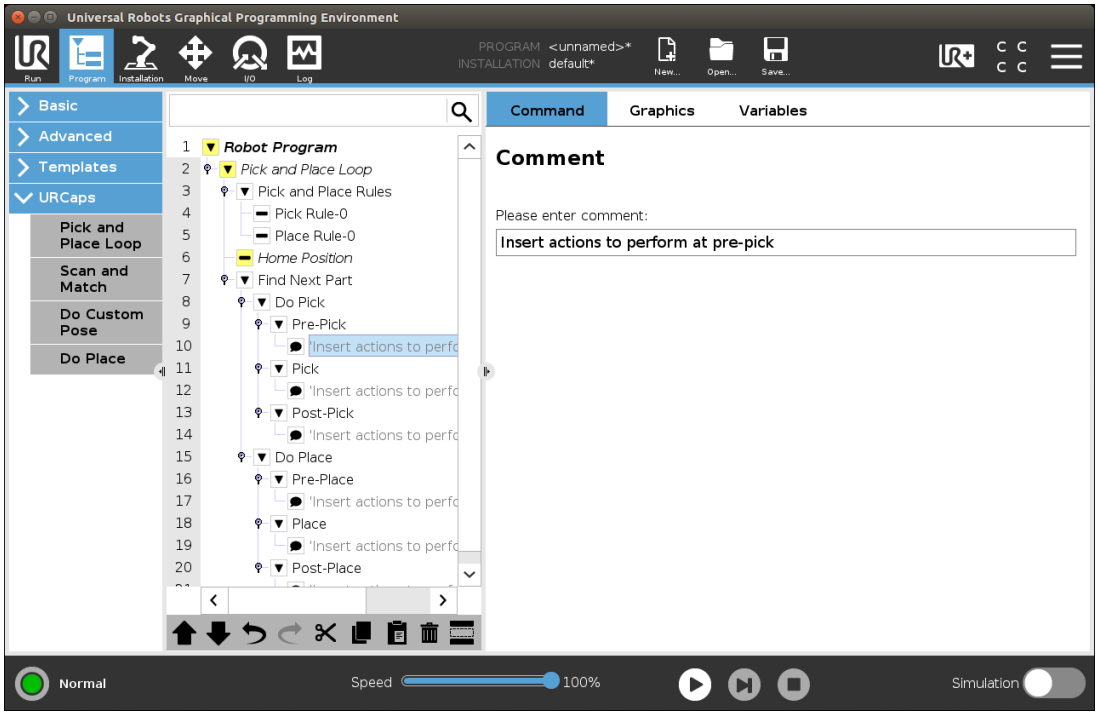
- Pre-Pick
- Pick
- Post-Pick

To assign a Pre-Pick action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Pre-Pick**.
2. Add the required program nodes for your desired actions, under the **Pre-Pick** node.

   You can also add the required program nodes to the **Insert actions to perform at pre-pick** field.

   Your desired actions are performed once the robot reaches the **Pre-Pick** position.



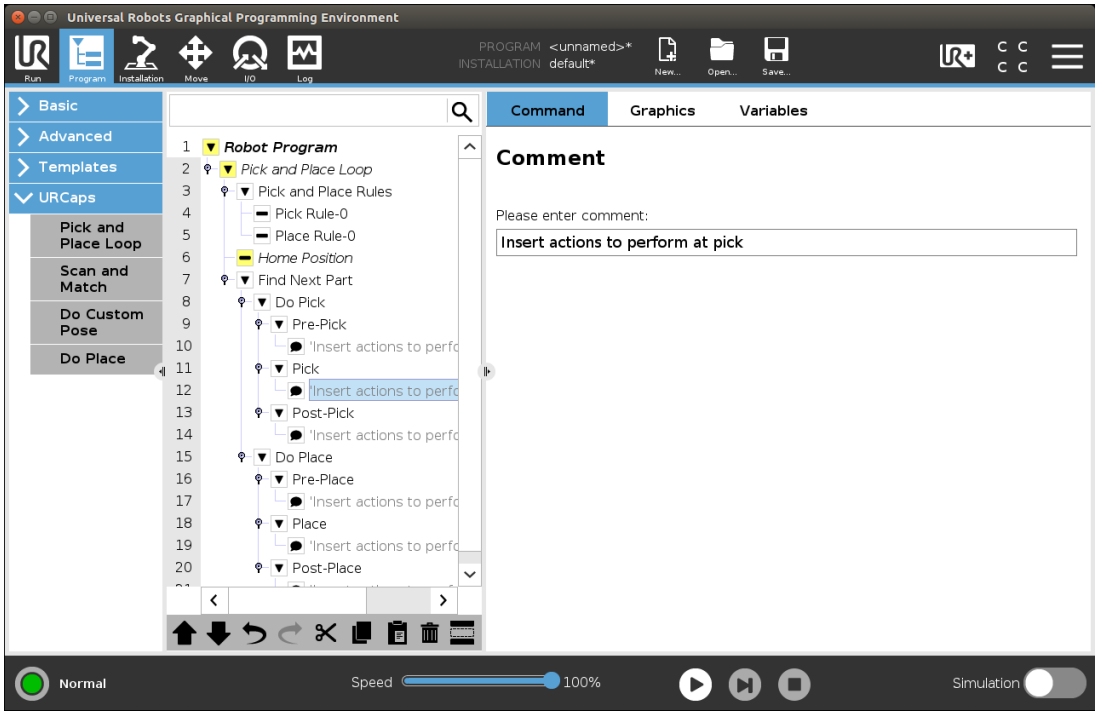
In this example, a digital output is programmed to turn on the suction cup of the vacuum gripper.

To assign a Pick action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Pick**.
2. Add the required program nodes for your desired actions, under the **Pick** node.

   You can also add the required program nodes to the **Insert actions to perform at pick** field.

   Your desired actions are performed once the robot reaches the **Pick** position.

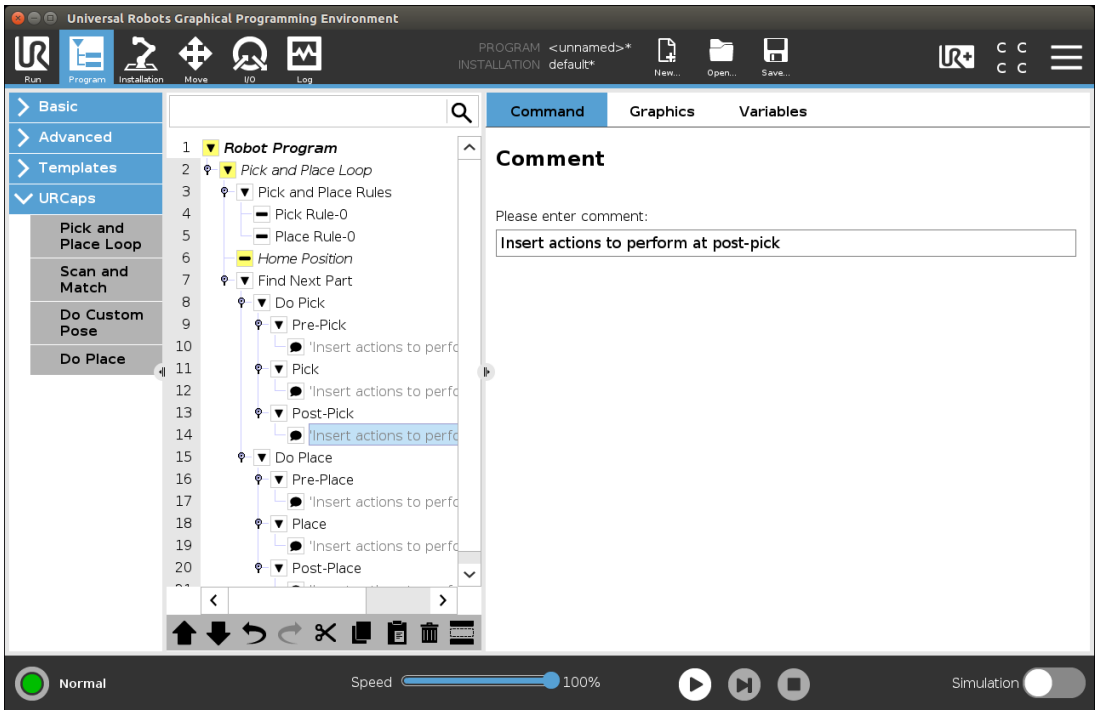


To assign a Post-Pick action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Post-Pick**.
2. Add the required program nodes for your desired actions, under the **Post-Pick** node.

   You can also add the required program nodes to the **Insert actions to perform at post-pick** field.

   Your desired actions are performed once the robot reaches the **Post-Pick** position.



4.3.2. Configuring Do Place

When the robot reaches the position/s defined in the Place Rules, you must assign actions to the tool. Each Place Rule position, must have an assigned Do Place action for the tool to place, and detach from, a part.

To configure the Do Place, you assign the following actions to the tool:

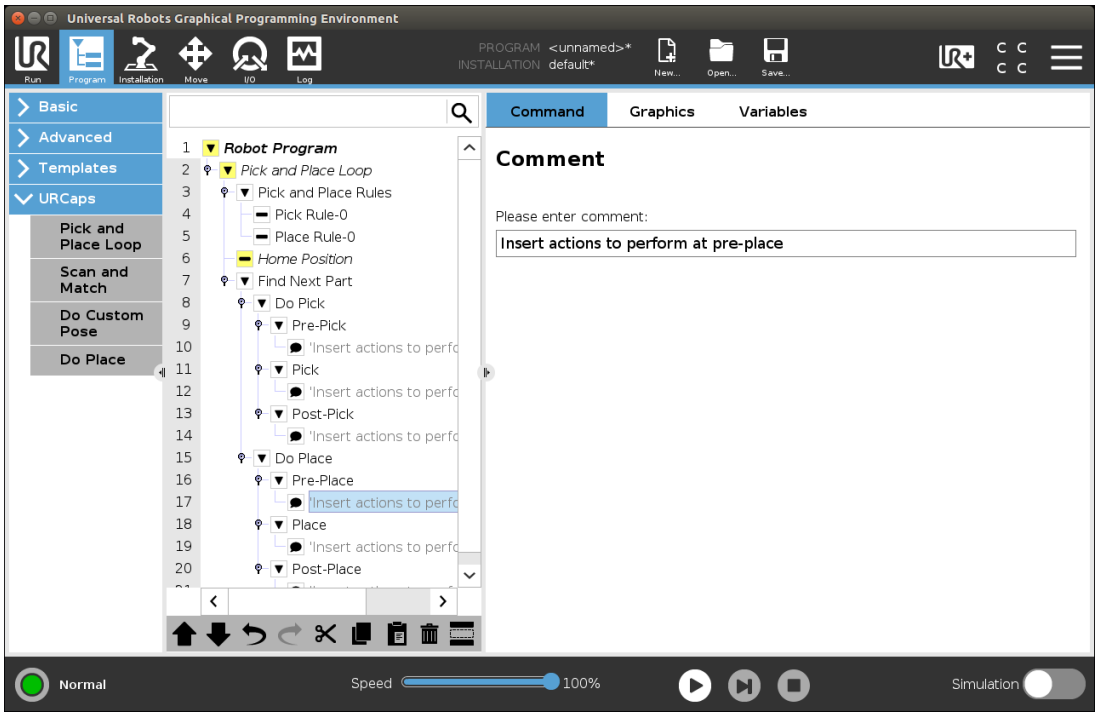
- Pre-Place
- Place
- Post-Place

To assign a Pre-Place action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Pre-Place**.
2. Add the required program nodes for your desired actions, under the **Pre-Place** node.

   You can also add the required program nodes to the **Insert actions to perform at pre-place** field.

   Your desired actions are performed once the robot reaches the **Pre-Place** position.

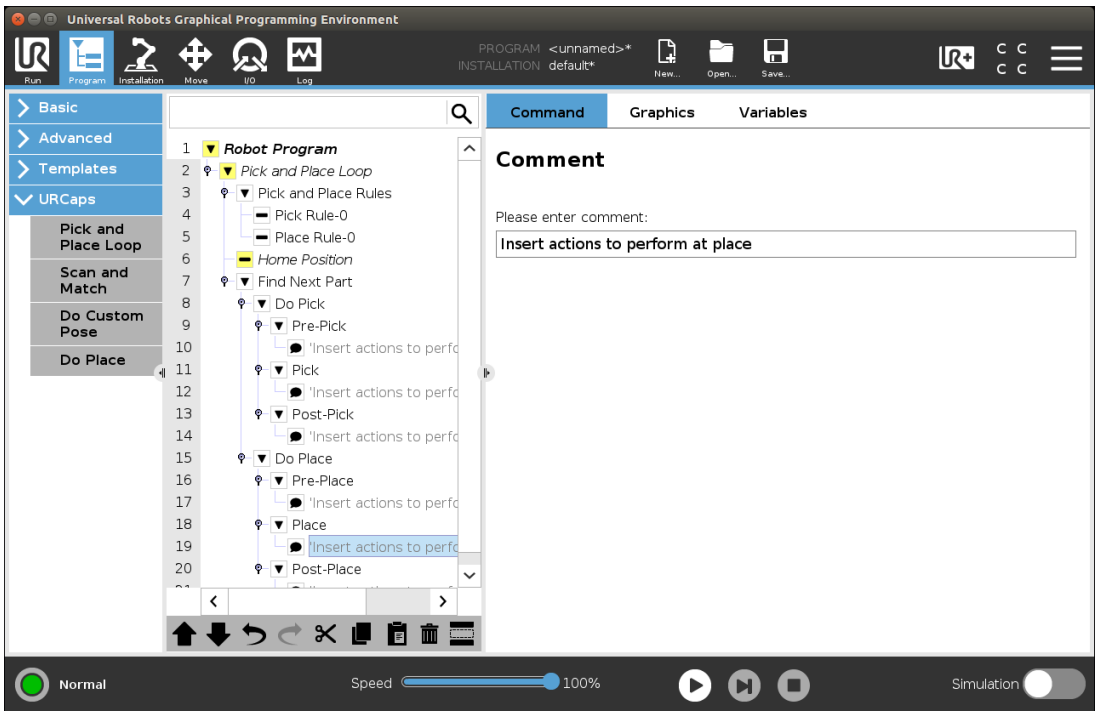


To assign a Place action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Place**.
2. Add the required program nodes for your desired actions, under the **Place** node.

   You can also add the required program nodes to the **Insert actions to perform at place** field.

   Your desired actions are performed once the robot reaches the **Place** position.

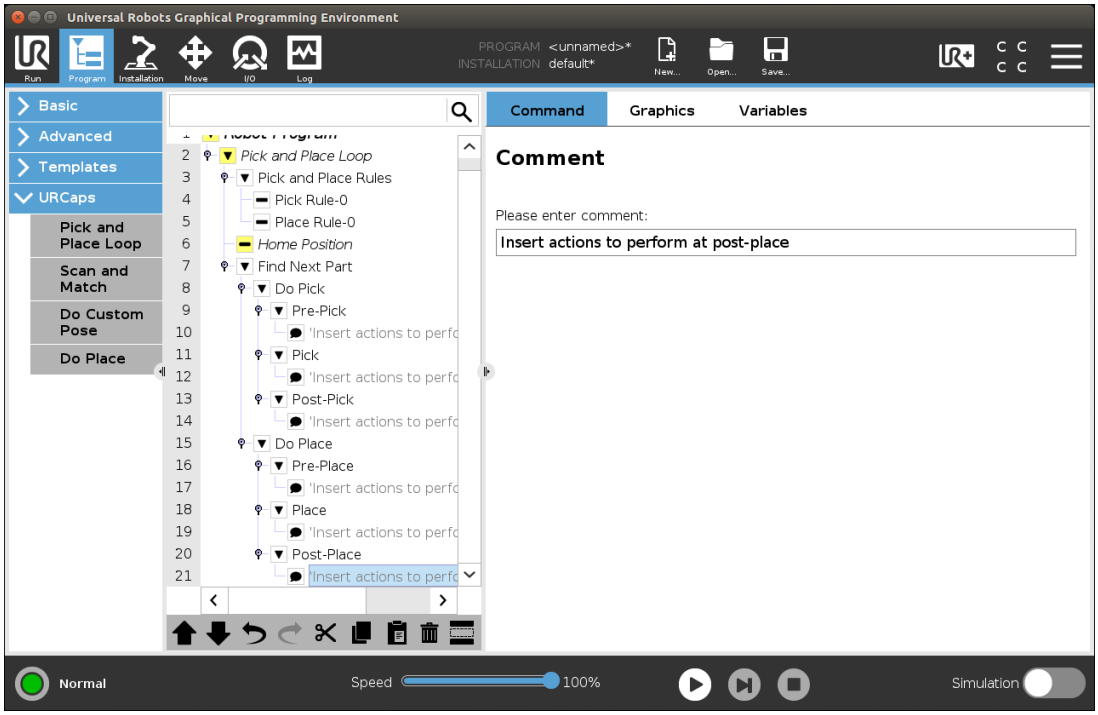


To assign a Post-Place action:

1. In the **Pick and Place Loop** program, under **Find Next Part**, tap **Post-Place**.
2. Add the required program nodes for your desired actions, under the **Post-Place** node.

   You can also add the required program nodes to the **Insert actions to perform at post-place** field.

   Your desired actions are performed once the robot reaches the **Post-Place** position.

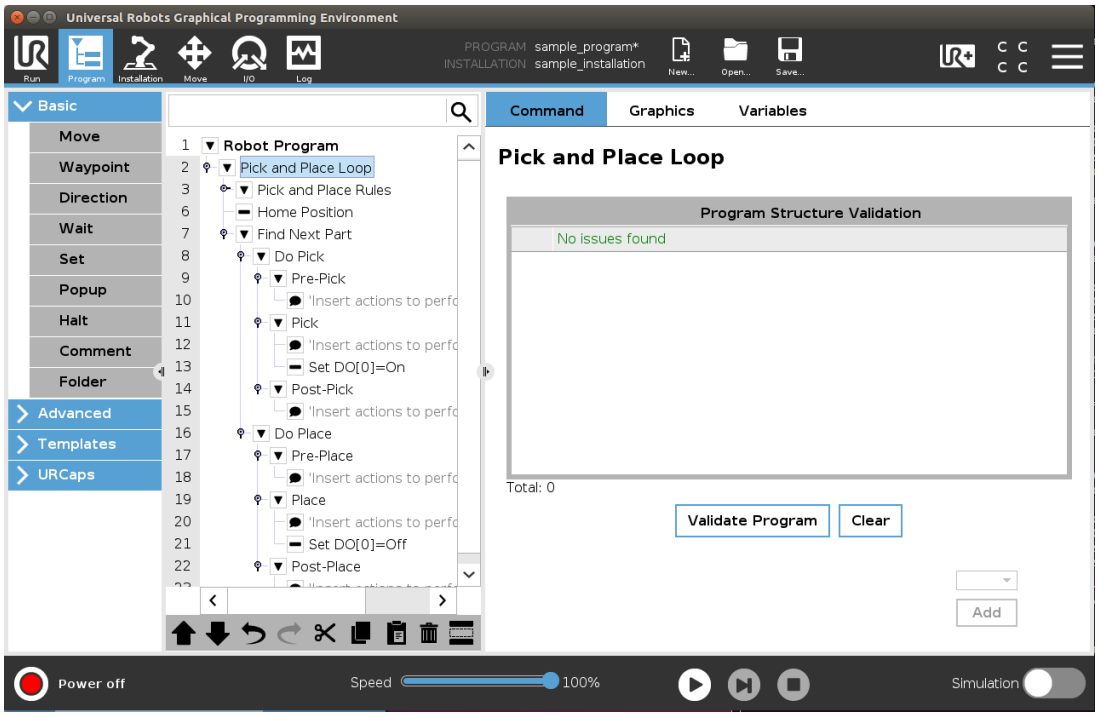


5. Program Structure Validation

This section describes how to check your **ActiNav Bin Picking** program for errors.

This procedure has the following success criteria:

- A completed program is checked for errors and no issues are found.



5.1. Validating a program

1. In a complete program, select **Pick and Place Loop**.
2. In the **Pick and Place Loop** pane, tap **Validate Program**.
3. If there are errors in your program, messages appear in the **Program Structure Validation** section.

Now you can locate where an error occurs.

To locate an error in your program:

1. Locate the error in the your program by following the reference numbers at the start of the error message.
   - The first number locates the main node under **Pick and Place Loop**.
   - The second number locates the error line under one of the main nodes.
2. Correct the error.
3. When the error is corrected run the **Program Validator** again.