ROKAE 珞石

Stacking Process Kit
User Manual

人类生产生活的得力伙伴

Stacking Process Kit

User Manual

Document Version: C

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This manual is originally written in Simplified Chinese. Other language versions are translated.

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1. Manual Overview

1.1 About this manual

Thank you for choosing ROKAE robot system.
This manual describes how to use the stacking process kit in the xCore Control System of ROKAE robots.

1.2 Target group

This manual is intended for:

- Operators
- System integrators
- Service technicians

1.3 Operation preconditions

Readers shall:

- Have experience in installing and configuring ROKAE robots.
- Have received training on operating and programming the xCore control system of ROKAE robots.

1.4 Reference

- *xCore Control System User Manual*

1.5 Revision

Version No.	Description
-	Initial version.
A	Added the instructions on tool calibration on March 21, 2023
B	Revised the instructions on "Stacking Process Kit" - "Update Stacking" on March 31, 2023
C	Revise the instructions on "graphical programming"-"Program example" on May 5, 2023

2 Product Introduction

2.1 About stacking

Stacking is the process of placing work objects in a certain order by layers. Users only need to teach the robot how to pick and place one work object, including the pick/place method, work object size, arrangement mode, and overlap mode, and they can apply it to all work objects. Unloading placed work objects in reverse order is called unstacking. Users can handle all the target work objects on the pallet with minimum lines of commands or graphical commands, and general operators can easily master it too.

2.2 Basic concept

Below are the frequently used terms in stacking.

Term	Description
Work object	A general term for the items to be picked/placed.
Pallet	An area for placing work objects.
Stacking	The task of placing work objects in a certain order by layers.
Unstacking	The task of unloading placed work objects in reverse order.
Stacking tool group	The tool frame and work object frame used during robot picking/placing.
Pallet frame	The frame defined on the pallet. Same as the user frame.
Stack pattern	The overall shape of the work objects stacked on the pallet. It mainly consists of the following data: ● Work object information ● Work object picking position ● Plane pattern ● Layered pattern
Work object picking position	The difference between the rotation center of the robot end-effector flange and the center of the work object being picked when the robot picks the work object.
Plane pattern	The shape and sequence of work objects placed on a single layer.
Layered pattern	The plane pattern used for each layer.
Current layer number	The serial number of the layer the robot is stacking work objects on.
Current work object number	The serial number of the work object being stacked by the robot.
Reference work object point	The position of the first work object on the pallet, which is used as a reference for offset calculation for subsequent work objects.
Path point	Z-axis offset from the work object point, mainly consisting of the following reference points: ● Entry point (PalletEnterPoint) ● Ready point (PalletReadyPoint) ● Approach point (PalletApproachPoint) ● Work object point (PalletWobjPoint) ● Retract point (PalletRetractPoint) ● Exit point (PalletExitPoint)
Work object point	The coordinate of the current work object position, including X, Y, Z, and orientation.
Auxiliary point - approach point	The auxiliary point that offsets from the current work object point in the Z-axis direction when the robot is ready to place the work object. The robot can approach the work object point from different directions.
Auxiliary point - work object point	The coordinate of the current stacking position of the work object, including X, Y, Z, and angle.
Auxiliary point - retract point	The auxiliary point that offsets from the current work object point in the Z-axis direction after the placement. The robot can leave the work object point from different directions.

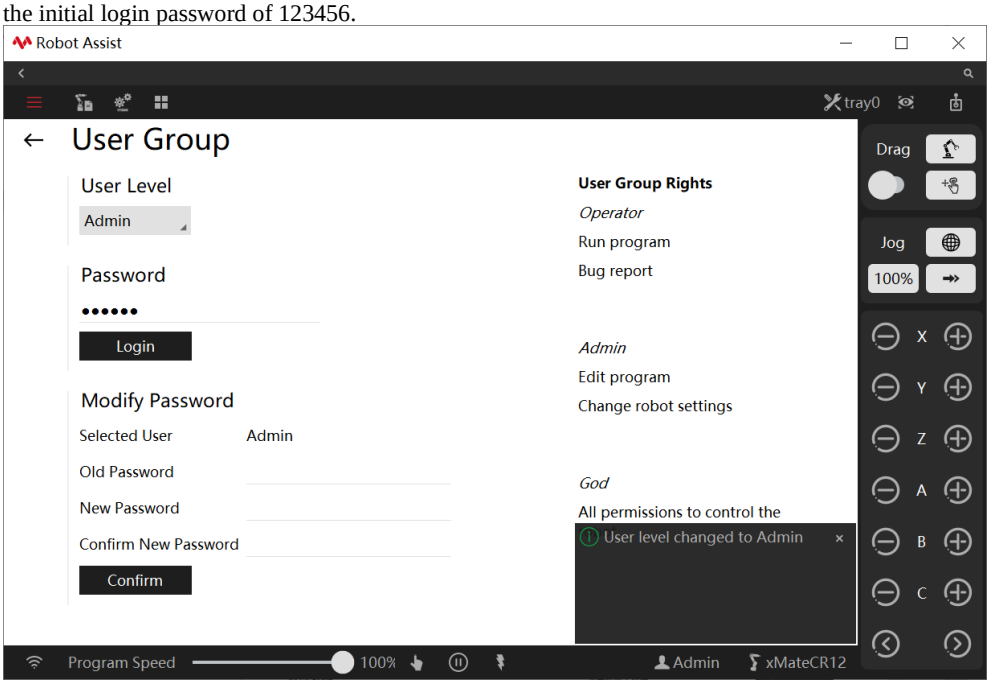
2.3 Product specifications

Options	Specification/performance
Stacking process	● Up to 100 stacking processes can be created.
Stacking tool group	● Each stacking process has only one stacking tool group (stacking tool frame, stacking work object frame). ● RL project tool data can be imported into the stacking tool.
Stack pattern	● Available patterns, including matrix overlapping, criss-cross, rotating, etc. ● Custom patterns are supported.
Plane pattern	● Up to 100 plane patterns can be created for each stacking process.
Number of work objects	● Up to 200 work objects can be created for each plane pattern.
Number of layers	● Up to 50 layers can be created for each stack.

3 Preparation

3.1 Operational permissions

When the robot controller is successfully connected, users will be automatically logged in to the Operator user group. With Operator permissions, users can view the robot's positions, parameters, and operation status, but they are unable to write robot programs or modify parameters. Click "Operator User Group" to enter the user group login screen, and log in as admin or above with the initial login password of 123456.

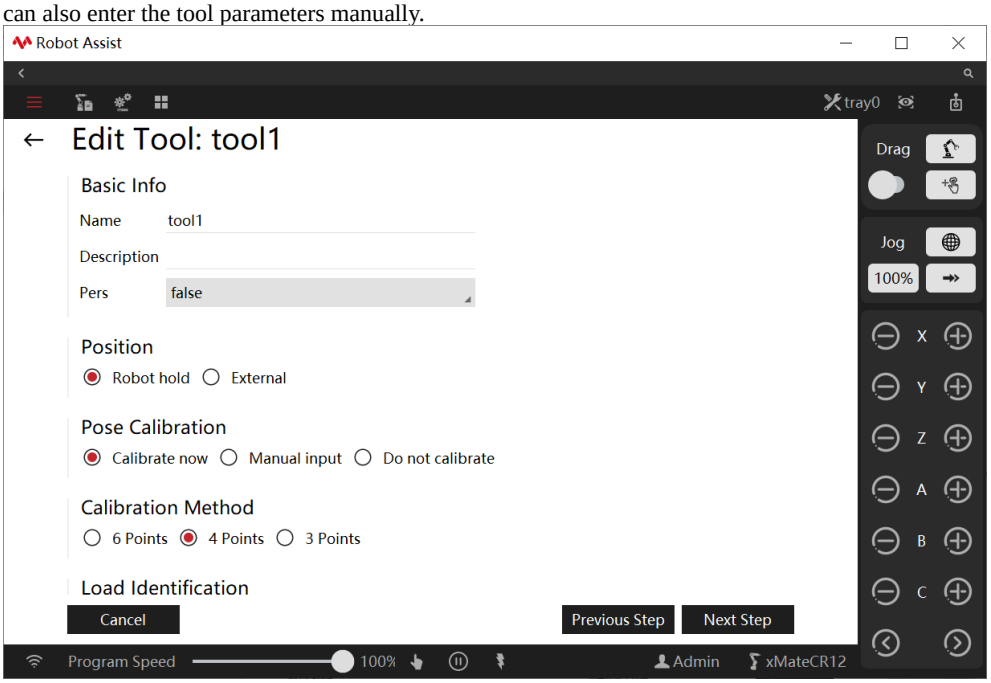


3.2 New tool

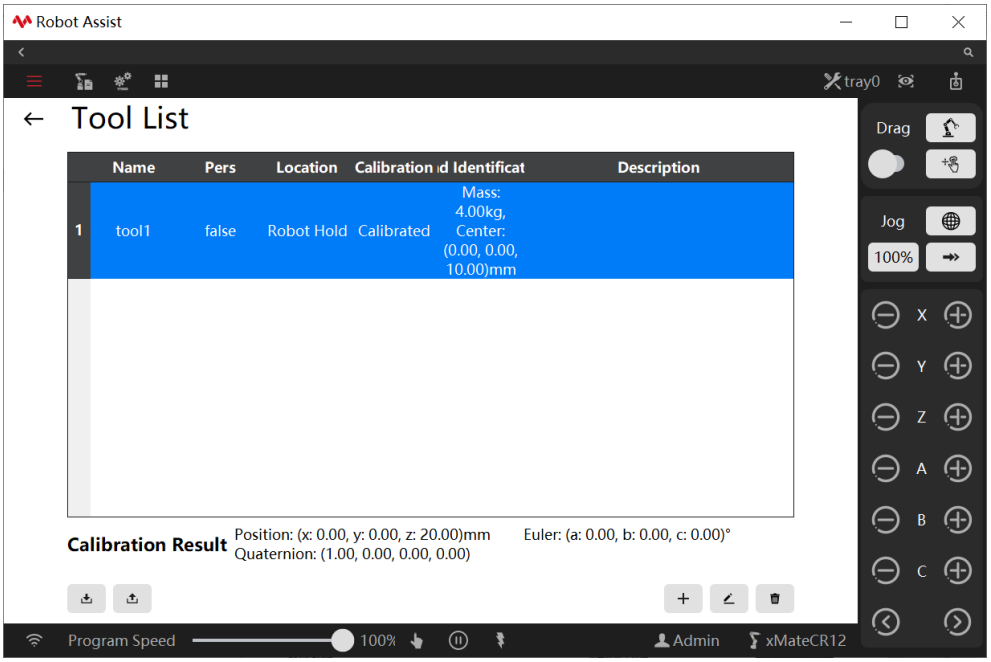
The stacking process provides users with a stacking tool group, and the default tool TCP is the center of the flange plane. When the robot end-effector is installed in offset to the end flange, a new tool can be created and calibrated in advance for higher stacking accuracy.
Please refer to the following steps:

1、Operate the robot to grip the work object. Fix a pointed object on the robot end-effector so that the axis of the tip goes through the center of the work object.

2、Click " Robot Programming" -> "Tools" to enter the tool list. Click " New" to open the "New tool" interface. Enter the tool name and set the tool position as handheld. The user can immediately calibrate the tool TCP through the four-point method and identify the load, the user can also enter the tool parameters manually.



3、After setting up the tool as guided, click "Next" to create the tool. Information on the new tool is displayed in the tool list.

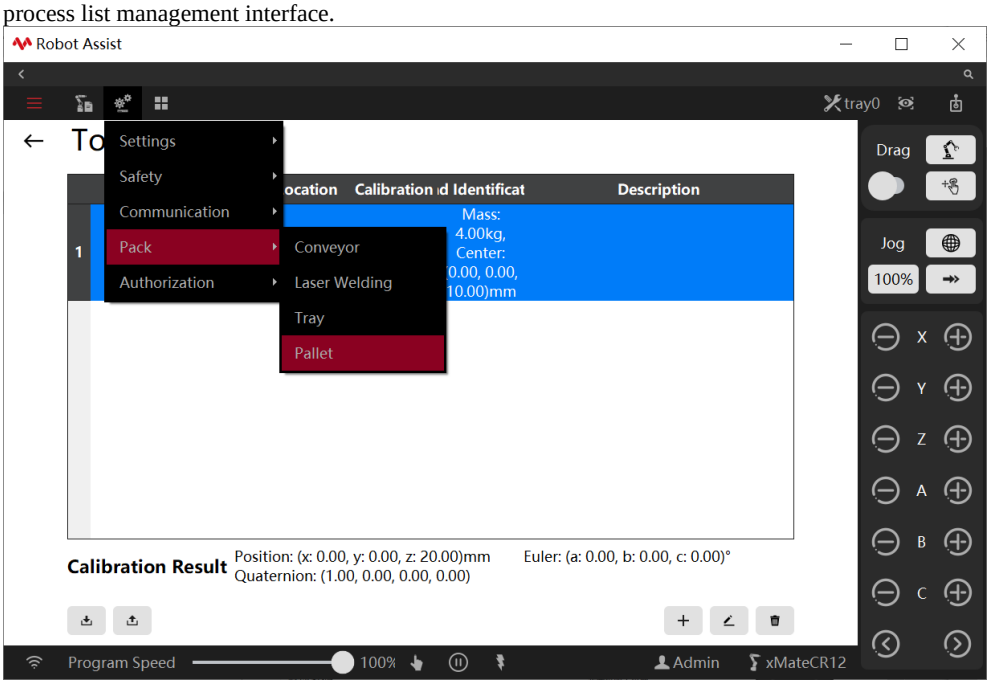


Notes

After tool calibration, open the control panel and switch to the tool frame to verify whether the calibration result is desired. If correct, users can then use the tool properly.

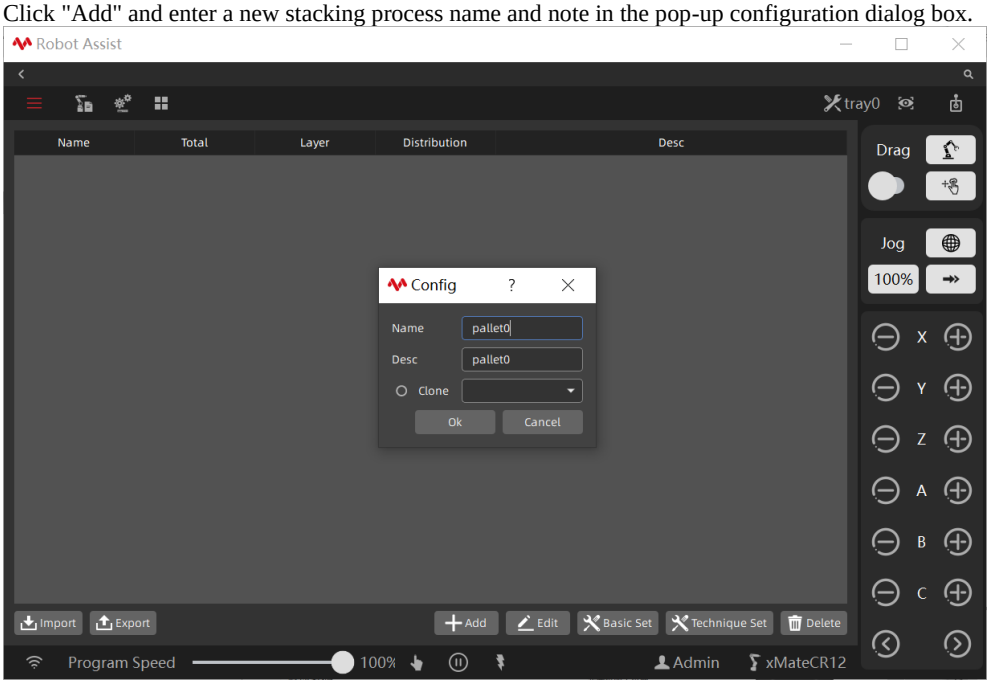
4 Process Management

Click "Robot Configuration" -> "Process Kit" - "Stacking" on the top status bar to enter the stacking process list management interface.

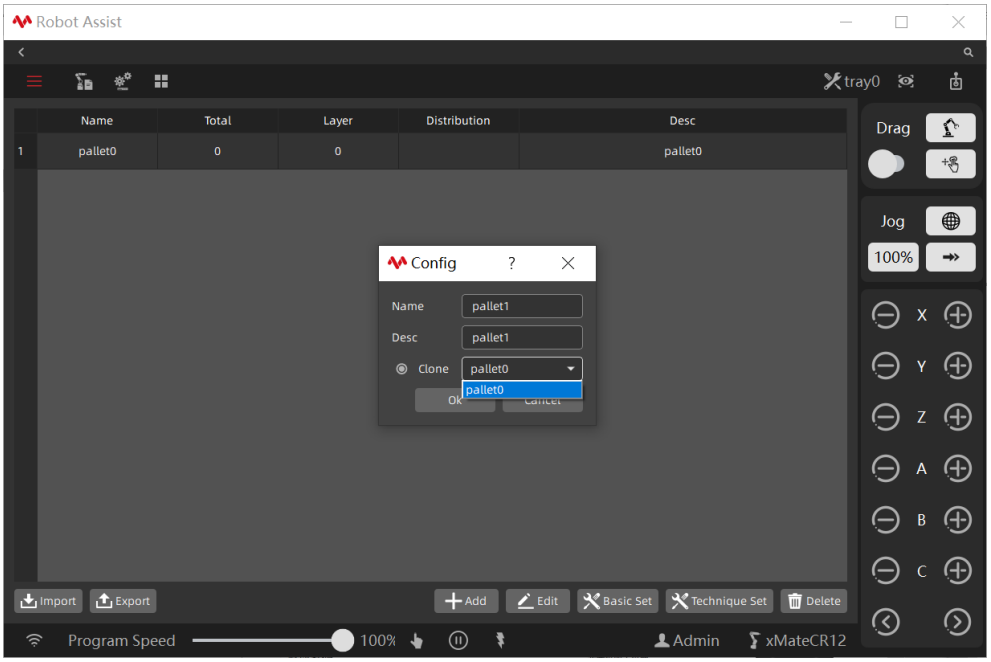


4.1 Add/clone process

Click "Add" and enter a new stacking process name and note in the pop-up configuration dialog box.

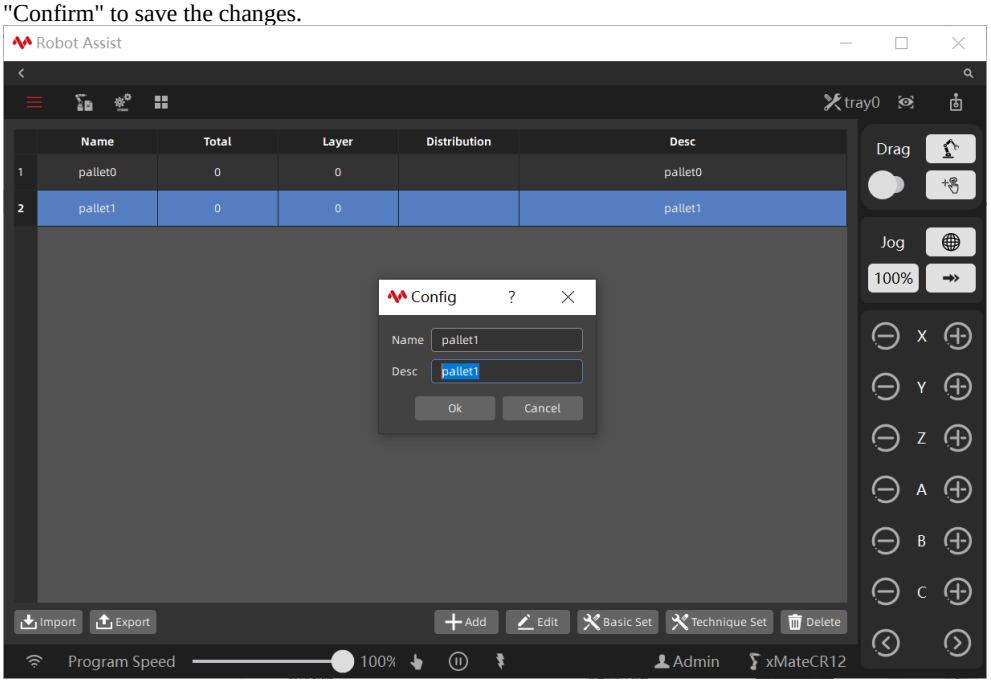


When "Clone" is checked, select the process to be cloned in the drop-down box and click "Confirm". The process selected in the drop-down box will be copied to the new process; when "Clone" is unchecked, a new empty process will be created.



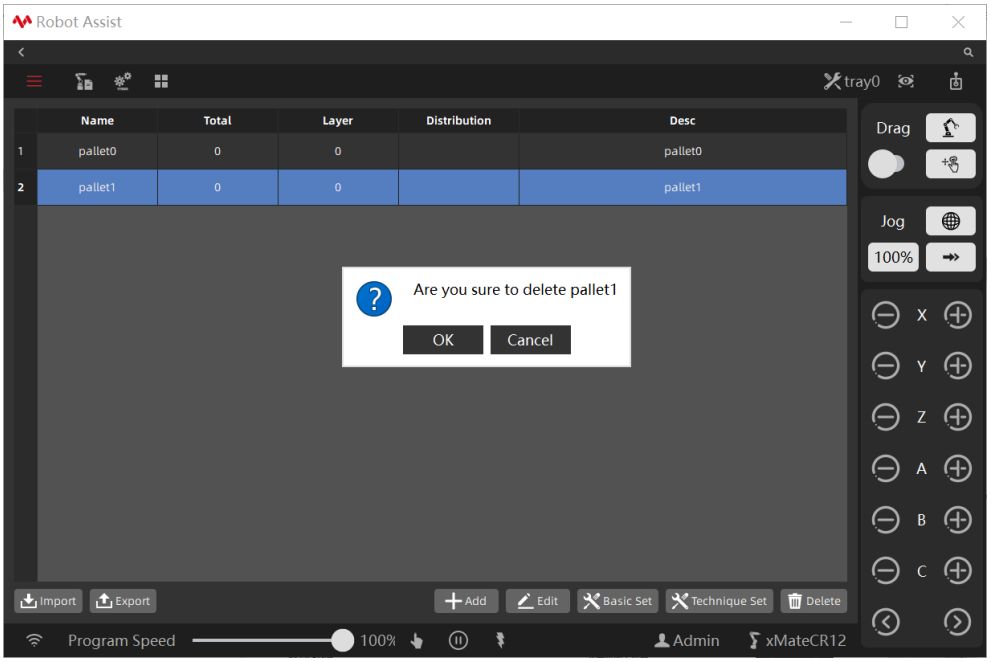
4.2 Edit process

To modify the name and note of the stacking process, select the desired stacking process in the process list. Click "Edit" and make modifications in the pop-up configuration dialog box, and click "Confirm" to save the changes.



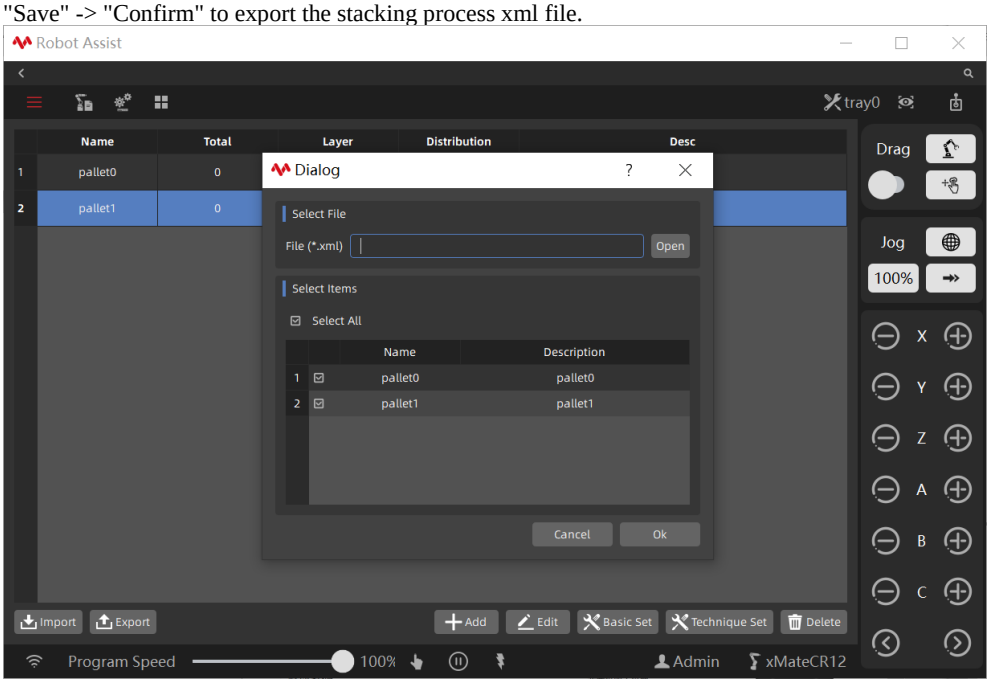
4.3 Delete process

Select the stacking process to be selected in the process list and click "Delete". In the pop-up confirm dialog box, click "Confirm" to delete the process.

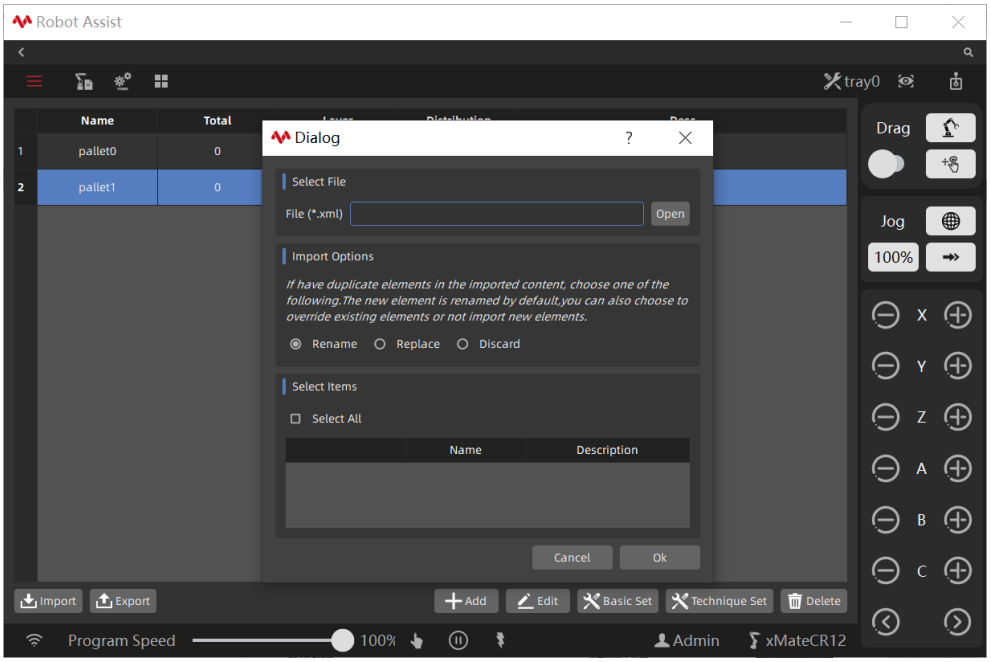


4.4 Export/import processes

Click "Export" and select the stacking process to be exported in the process list of the import/export dialog box. Click "Browse" to select the directory to be exported, enter the file name, and click "Save" -> "Confirm" to export the stacking process xml file.



Click "Import". In the import/export dialog box, click "Browse" to open the configured stacking process xml file. Select the stacking process to be imported, check "Auto rename", and click "Confirm" to import the stacking process.


Robot Assist
tray0
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Name
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1
pallet0
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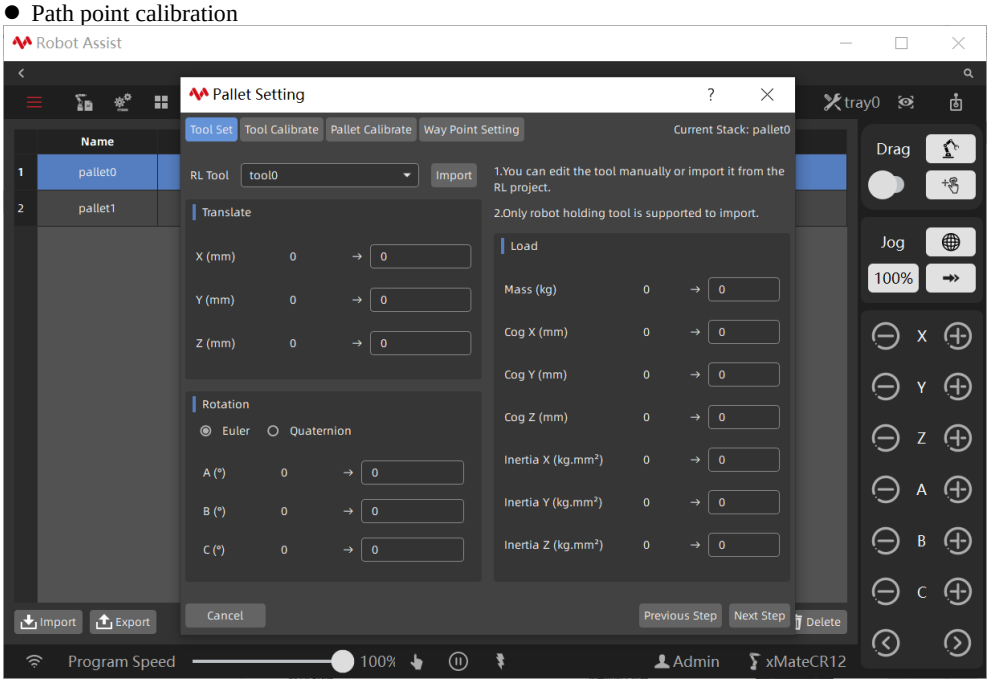
pallet1
0
Dialog
Select File
File (*.xml)
Open
Import Options
If have duplicate elements in the imported content, choose one of the following.The new element is renamed by default,you can also choose to override existing elements or not import new elements.
Rename
Replace
Discard
Select Items
Select All
Name
Description
Cancel
Ok
Import
Export
Add
Edit
Basic Set
Technique Set
Delete
Program Speed
100%
Admin
xMateCR12

5 Basic settings

Click "Basic settings" to enter the basic settings wizard process for creating a new stacking process. It includes the following 4 steps:

- Tool setting
- Tool calibration
- Pallet calibration
- Path point calibration

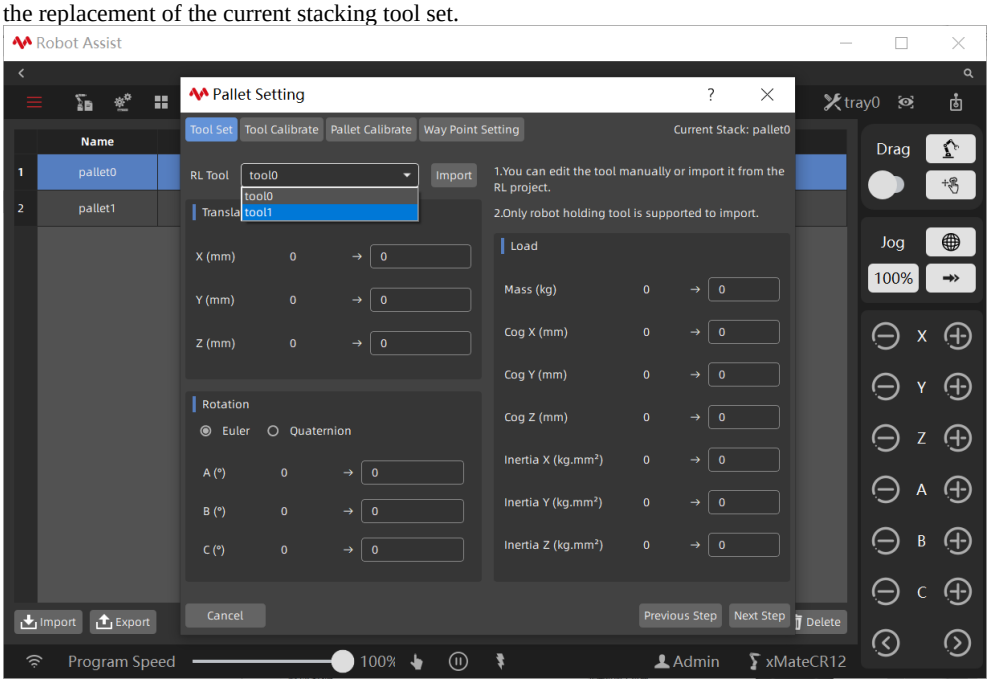


The wizard bar highlights the current step. After configuring the parameters of the current step, click "Next" to save the parameters and go to the interface of the next step. To modify previous steps, click the tabs to quickly switch to the corresponding interface.

5.1 Tool setting

The stacking tool refers to the robot end-effector, including grippers, vacuum or sponge suction cups, etc. The stacking tool frame is used to represent the actual pose of the robot end-effector. When one robot is equipped with multiple tools or quick-changing tools, the robot will have multiple stacking tool frames. Multiple stacking tools or processes need to be created.

In the "Tool Setting" interface, import the tools from the RL project or manually enter the information of current robot end-effectors, including the TCP position, direction, and load parameters.
Refer to the following steps to set up the tools:
1. Click the "RL Tools" drop-down box, select the required RL tools, and click "Import" to confirm the replacement of the current stacking tool set.



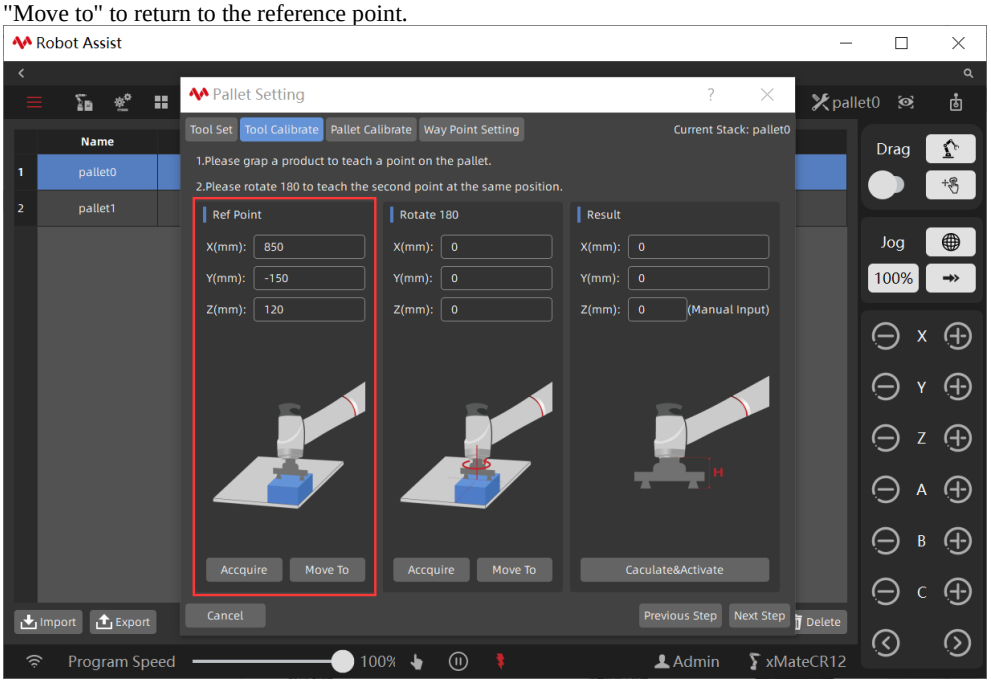
2. The tool position, direction, and load parameters can be changed based on the imported RL tool parameters.

> **Notes**
>
> Users must set the TCP and load parameters of the robot end-effector correctly. Otherwise, the robot may run unsteadily and out of position.

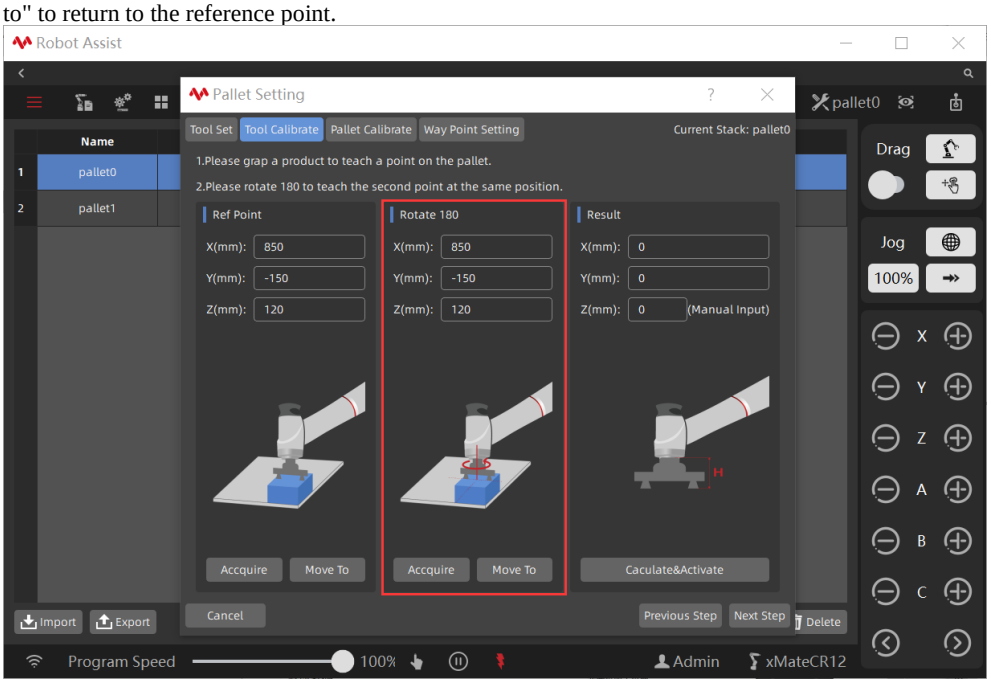
5.2 Tool calibration

When the position of the stacking tool's TCP is not on the axis of the rotation center of the work object to be gripped, there will be an offset when rotating and placing the work object. The offset between the axis of the rotation center of the work object gripped and the flange center will be automatically calculated by "Tool calibration" to correct the position of the stacking tool's TCP.

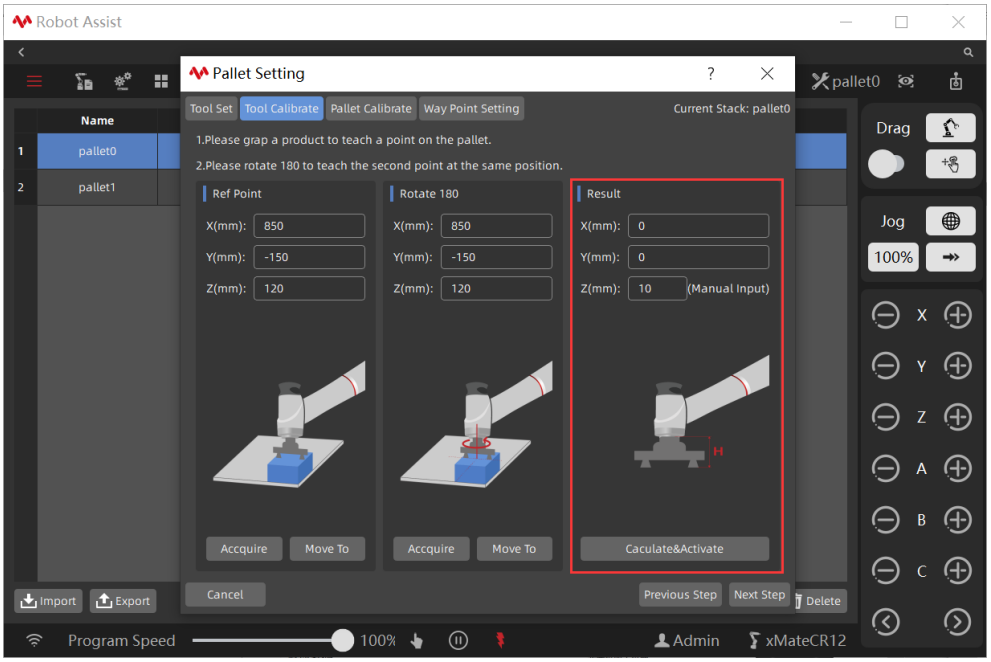
After setting up the tool, click "Next" to enter the Stacking tool calibration interface.
Refer to the following steps to calibrate the stacking tool:
1. Operate the robot to grip the product. Move the robot end-effector to one of the pallet vertices, and click "Get point" to record the reference point position. The X, Y, and Z values of the reference point are displayed, which can be manually adjusted. When the robot is not at the reference point, click "Move to" to return to the reference point.



2. Keep the robot gripping the product. Rotate the robot end-effector by 180° and make sure the position of the product on the pallet remains the same. Click "Obtain point position" to record the position of the reference point after 180° rotation. The X, Y, and Z values of the reference point are displayed, which can be manually adjusted. When the robot is not at the reference point, click "Move to" to return to the reference point.



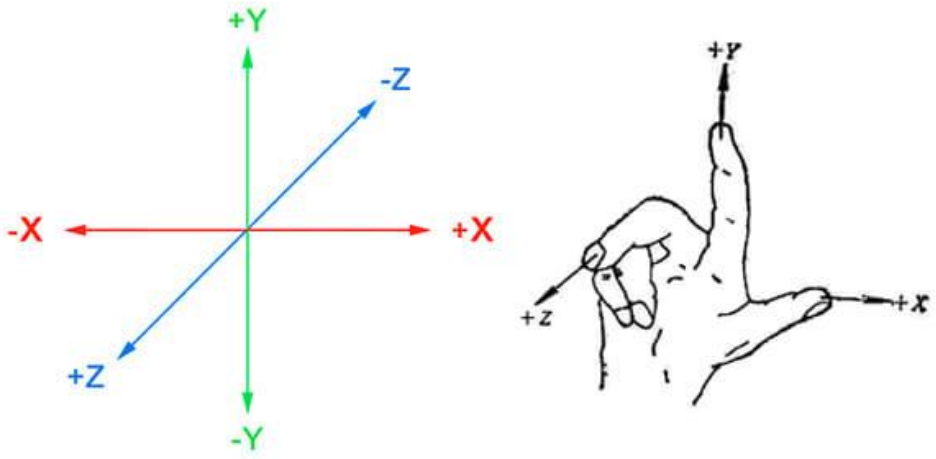
3. Manually enter the height between the current end-effector and the flange mounting plane.
4. When "Calculate and activate" is clicked, the system will automatically calculate the offset between the work object's center X and Y and the robot flange center and save it to the stacking tool frame. The offset is used to correct the tool TCP.



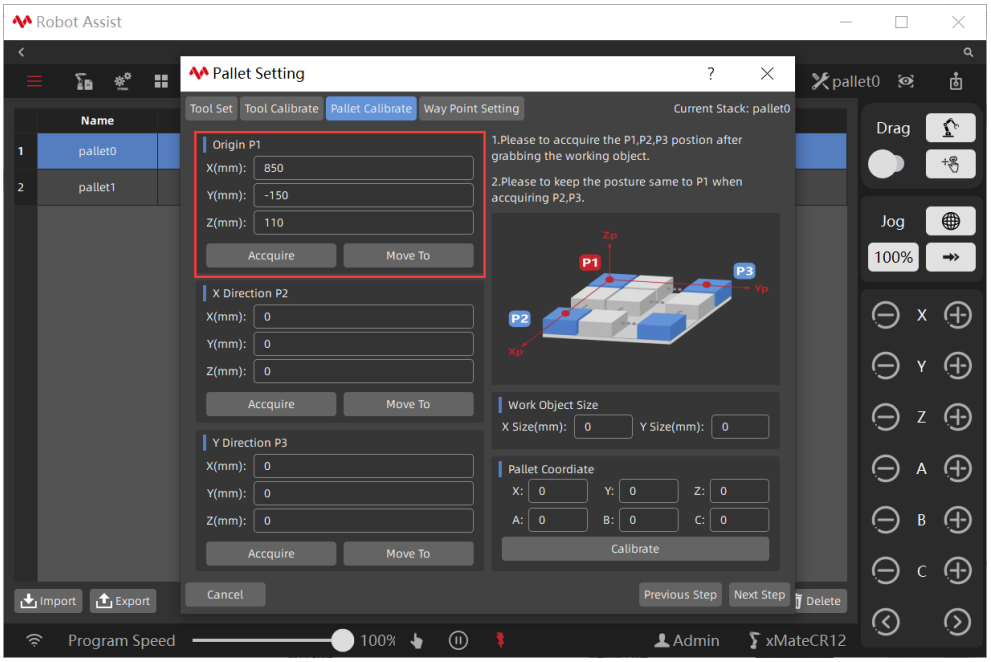
5.3 Pallet calibration

The pallet frame is the reference system for the robot to place products, and the pose of the placed products will be established on the pallet frame. When one robot needs to stack on multiple pallets, multiple pallet frames or multiple stacking processes need to be created.

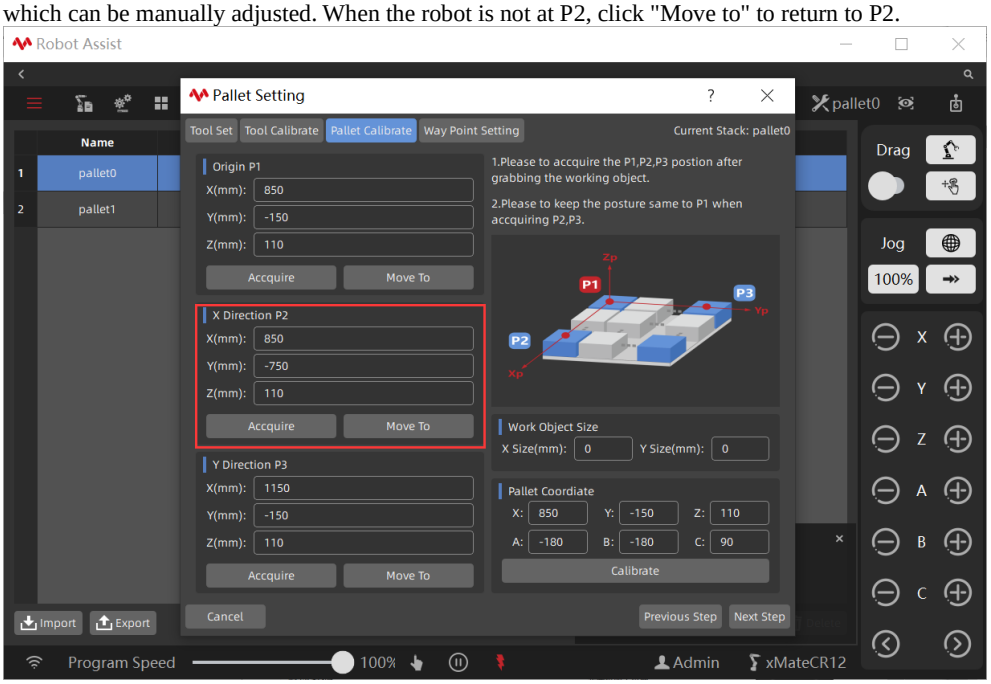
After tool calibration is complete, click "Next" to enter the pallet calibration interface. Refer to the following steps to calibrate the pallet:
1. Operate the robot to grip a product. Select three vertices on the pallet and determine the origin (P1), the X-axis vertice (P2), and the Y-axis vertice (P3) of the pallet frame according to the right-hand rule.



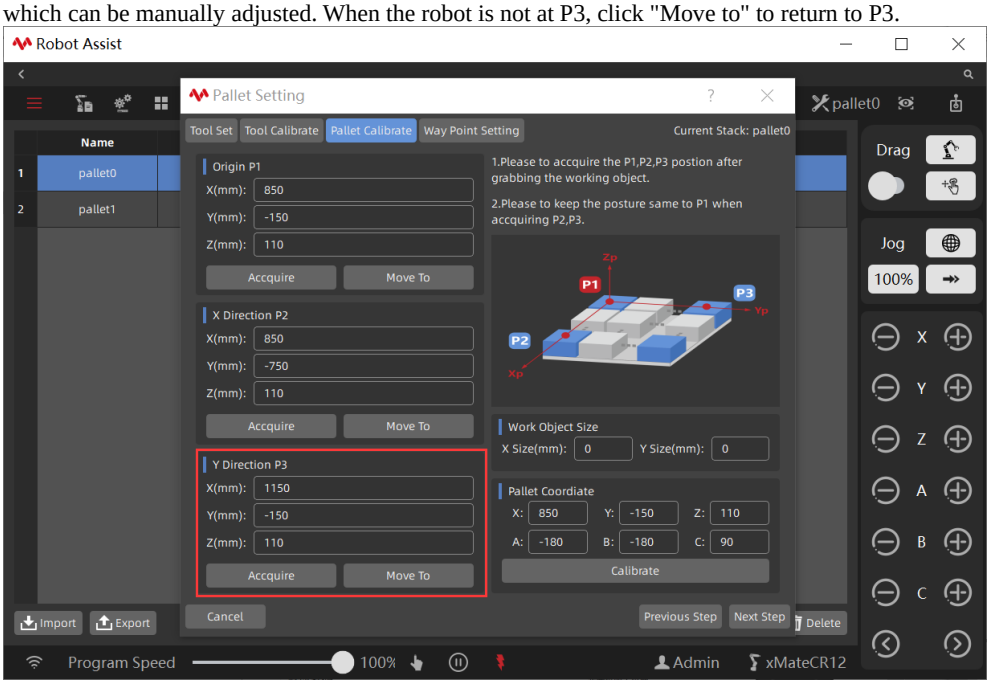
2. Keep the robot gripping the product. Move the robot end-effector to the origin, and click "Obtain point position" to record the position of P1. The X, Y, and Z values of P1 are displayed, which can be manually adjusted. When the robot is not at P1, click "Move to" to return to P1.



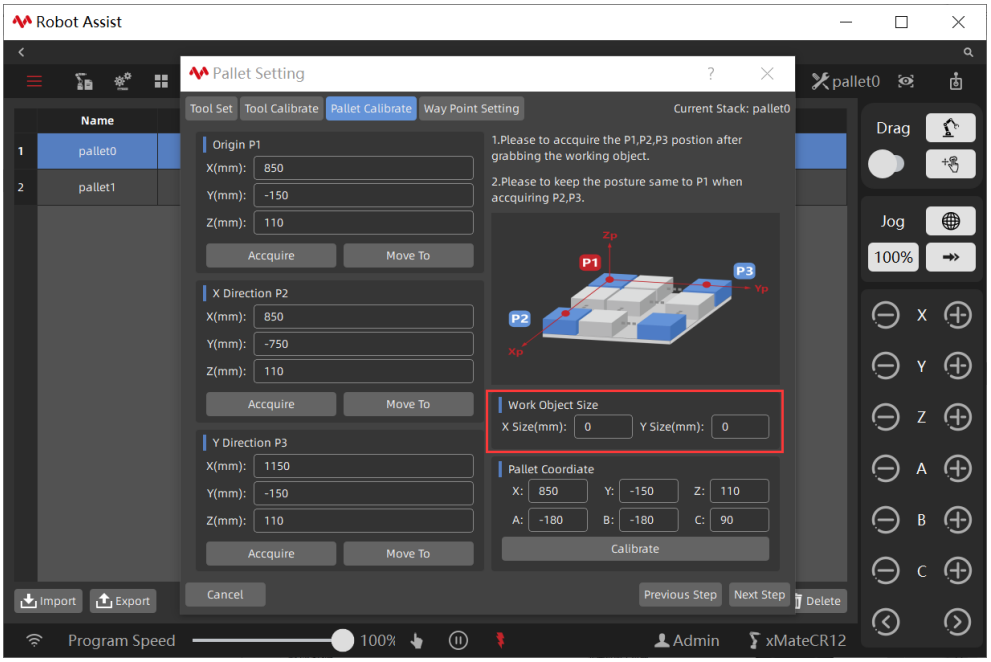
3. Keep the robot gripping the product. Move the robot end-effector to the X-axis vertice, and click "Obtain point position" to record the position of P2. The X, Y, and Z values of P2 are displayed, which can be manually adjusted. When the robot is not at P2, click "Move to" to return to P2.



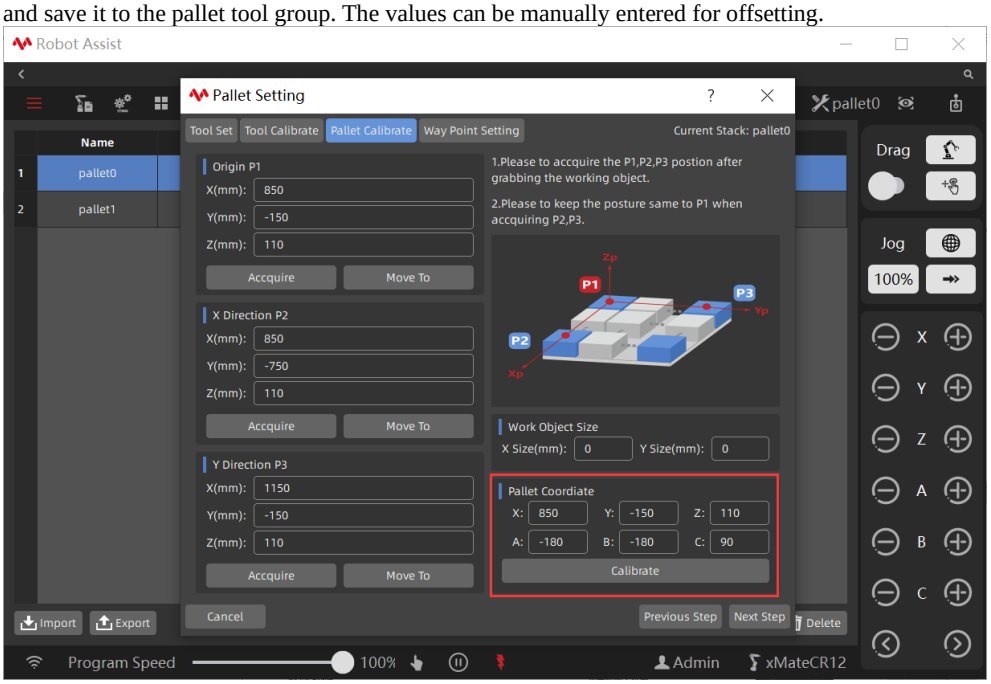
4. Keep the robot gripping the product. Move the robot end-effector to the Y-axis vertice, and click "Obtain point position" to record the position of P3. The X, Y, and Z values of P3 are displayed, which can be manually adjusted. When the robot is not at P3, click "Move to" to return to P3.



5. Manually enter the X-axis and Y-axis length of the work object in the pallet frame during teaching. The values will be used to correct the pallet frame position.



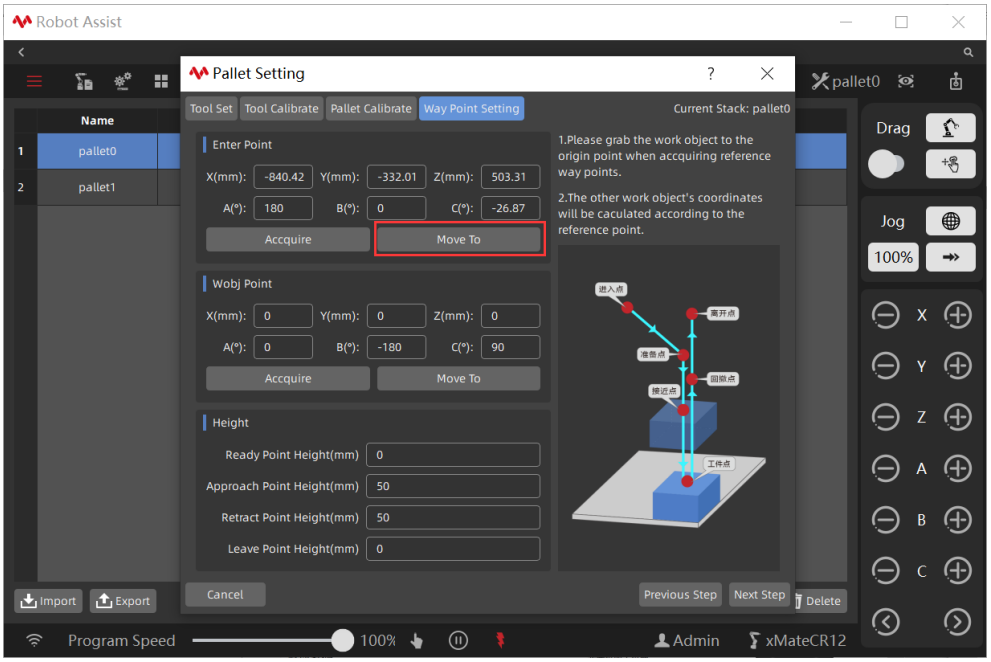
6. When "Calibrate" is clicked on, the system will automatically calculate the pallet frame position and save it to the pallet tool group. The values can be manually entered for offsetting.



5.4 Path point setting

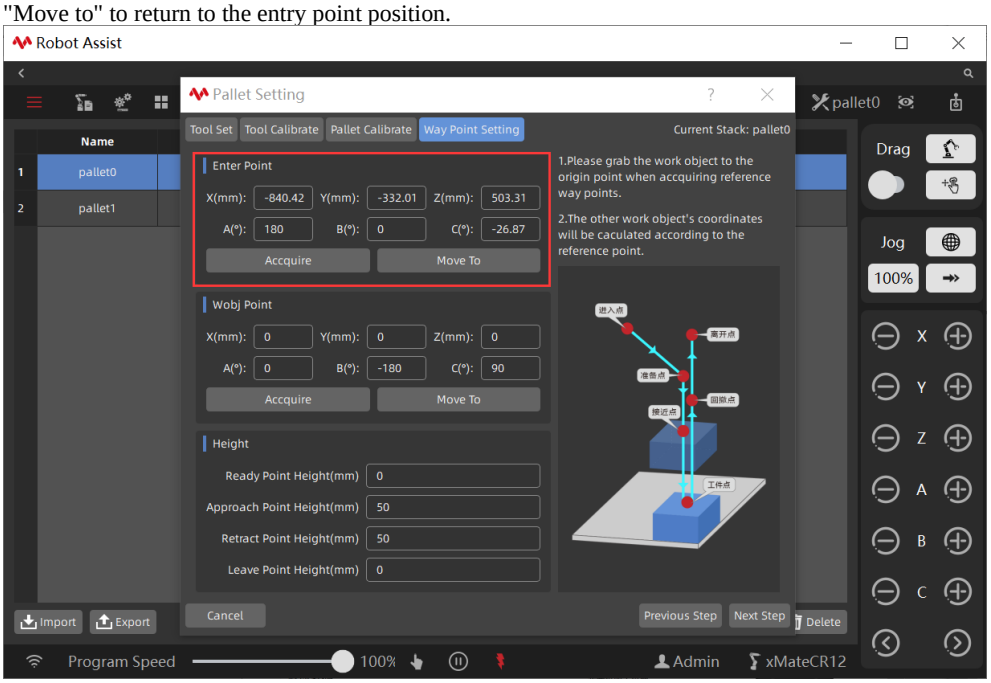
Only one stacking path point can be set for each stacking process, and the number of path points set is the same as the number of pallets. When the stacking system involves multiple pallets, multiple pallet frames or multiple stacking processes need to be created.

After pallet calibration, click "Next" to enter the path point setting interface and first return to the pallet origin position. The initial value of the entry point position is the pallet origin position. The robot will move to the pallet origin position when "Move to" the approach point is clicked.

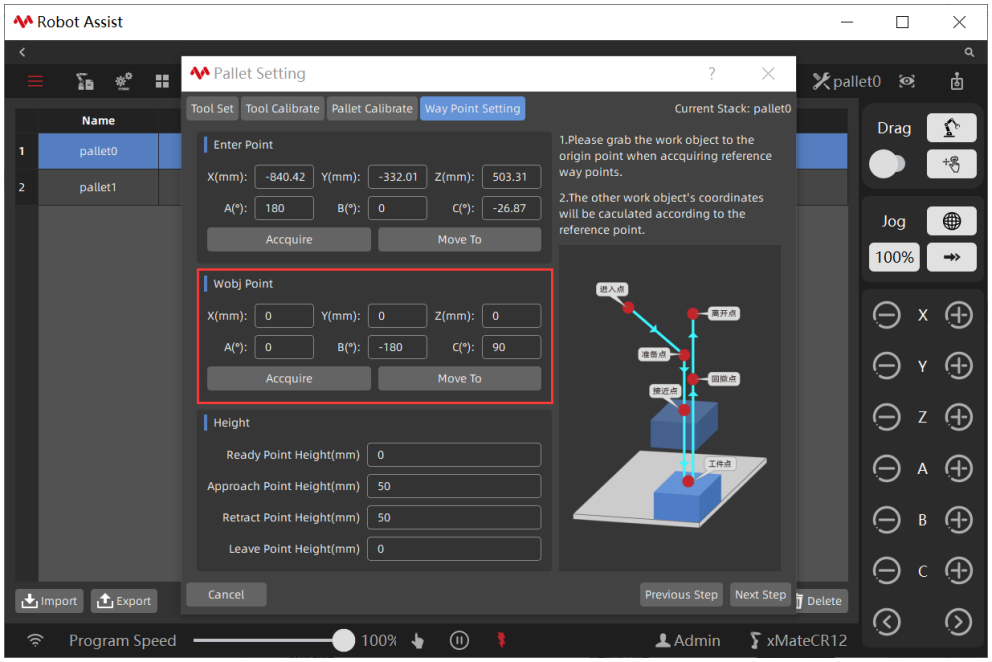


Refer to the following steps to set the path point:

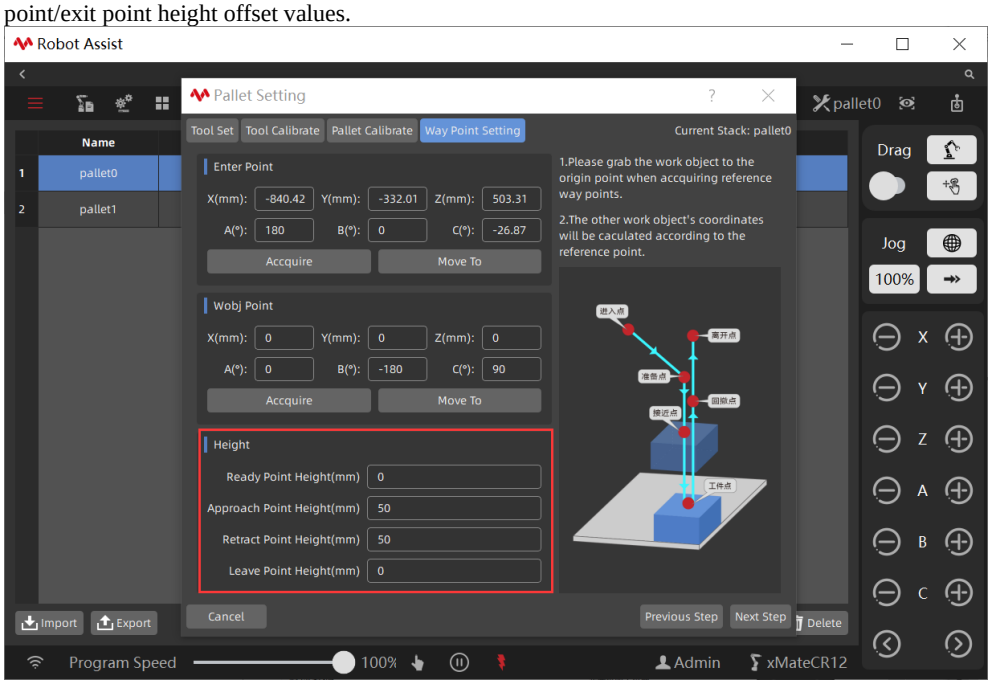
1. Keep the robot gripping the product. Move the robot end-effector to one entry point, and click "Obtain point position" to record the entry point position. The X, Y, and Z values of the entry point position are displayed, which can be manually adjusted. When the robot is not at the entry point, click "Move to" to return to the entry point position.



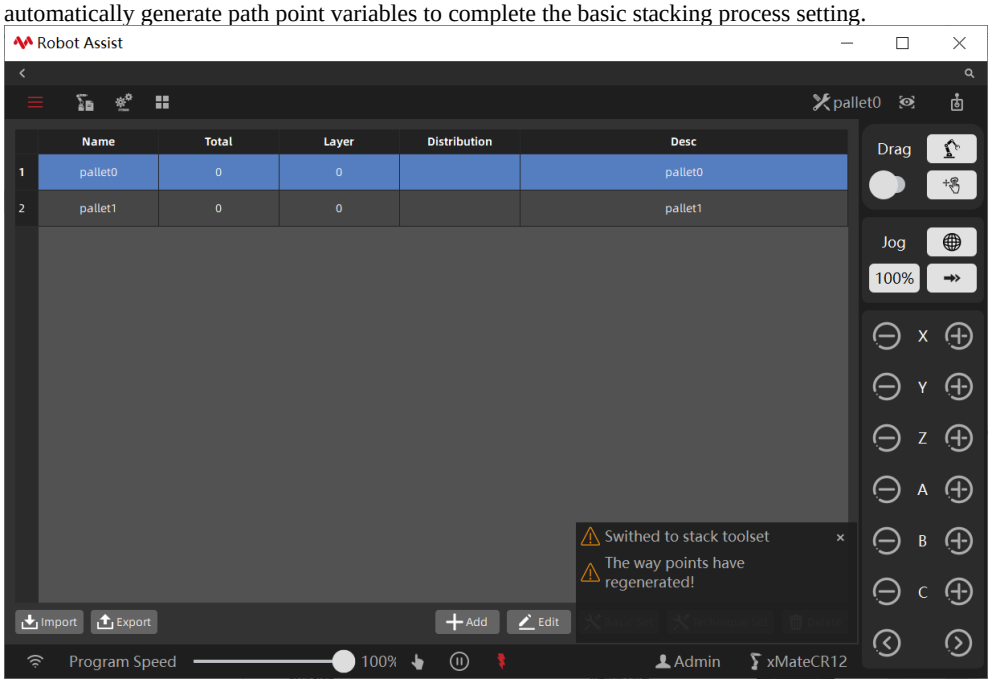
2. Keep the robot gripping the product. Move the robot end-effector to the reference work object point position. The initial value of the reference work object point is the pallet origin position, which is the position where the first product is placed. The coordinates of subsequent work objects will be offset and rotated based on it. The default reference work object point is the reference orientation. Click "Get point position" to record the reference work object point position, and the X, Y, and Z values of the work object point position will be displayed, which can be manually adjusted. When the robot is not at the reference work object point, click "Move to" to return to the reference work object point position.



3. Select the offset auxiliary point to be set and manually enter the ready point/approach point/retract point/exit point height offset values.



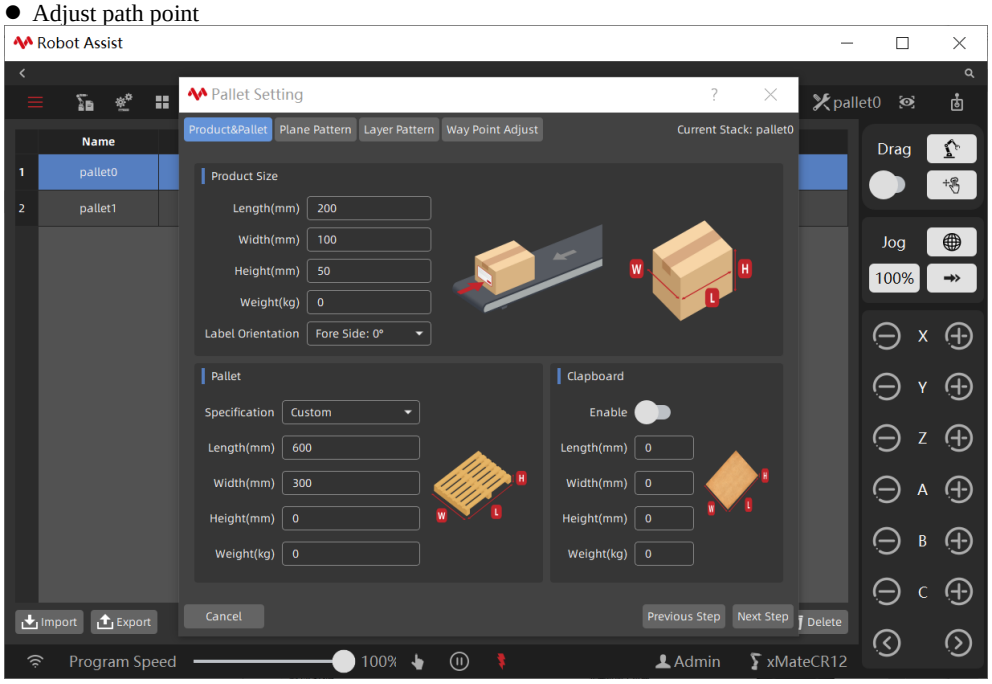
4. Click "Next" to save the parameters entered and return to the process list interface. The system will automatically generate path point variables to complete the basic stacking process setting.



6 Process setting

Click "Process Settings" to enter the process setting wizard for creating a new stacking process. It includes the following 4 steps:

- Set size parameters
- Set plane pattern
- Set layered pattern
- Adjust path point

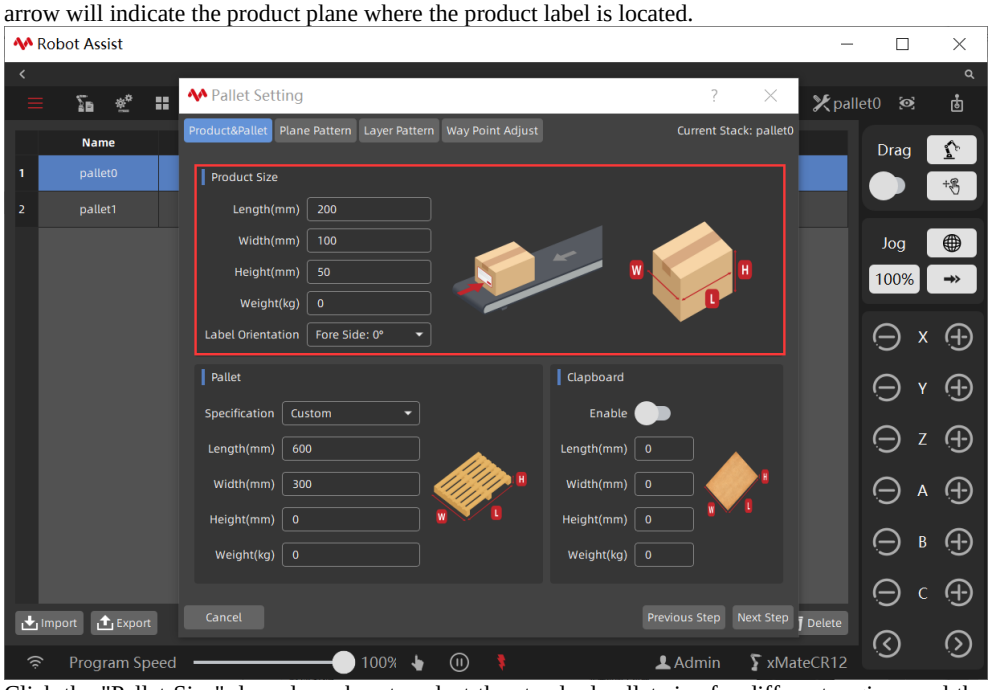


The wizard bar highlights the current step. After configuring the parameters of the current step, click "Next" to save the parameters and go to the interface of the next step. To modify previous steps, click the tabs to quickly switch to the corresponding interface.

6.1 Set size parameters

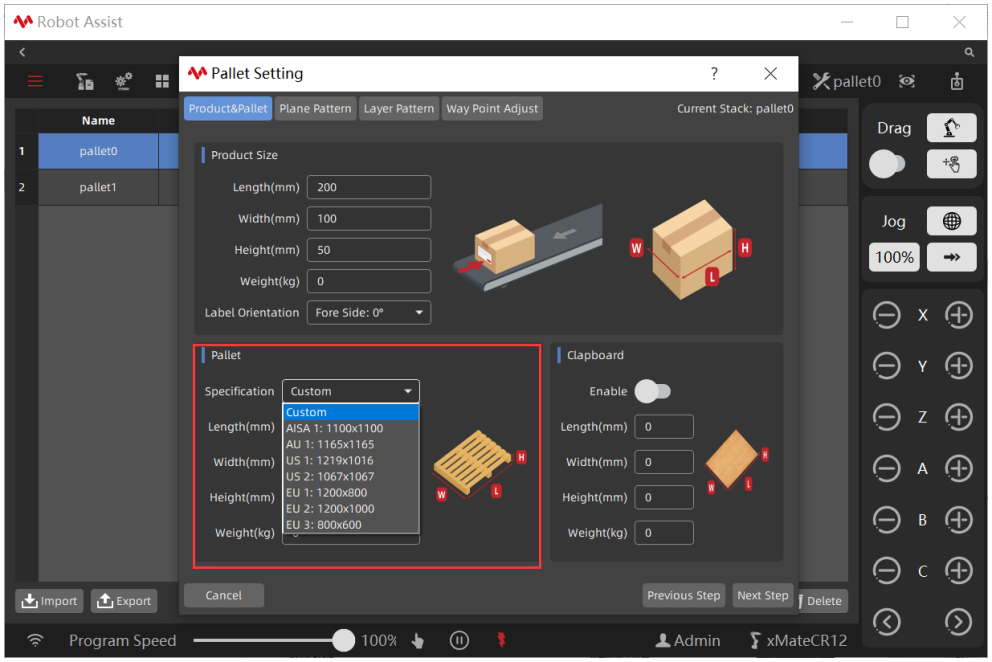
In the product & pallet size parameter setting interface, set the length, width, height, and quality of the product, pallet, and partition.

Click the "Label Orientation" drop-down box to set and display the product label position, and the arrow will indicate the product plane where the product label is located.

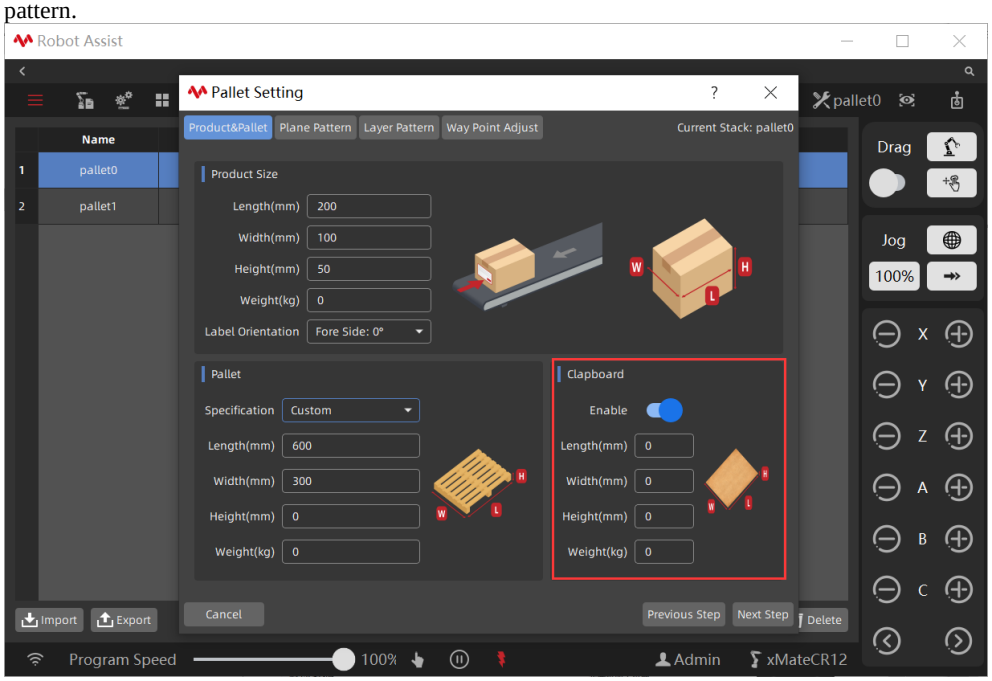


Click the "Pallet Size" drop-down box to select the standard pallet size for different regions and the custom pallet size. Predefined standard pallet sizes include:

- Custom
- 1100mm*1100mm
- 1165mm*1165mm
- 1219mm*1016mm
- 1067mm*1067mm
- 1200mm*800mm
- 1200mm*1000mm
- 800mm*600mm

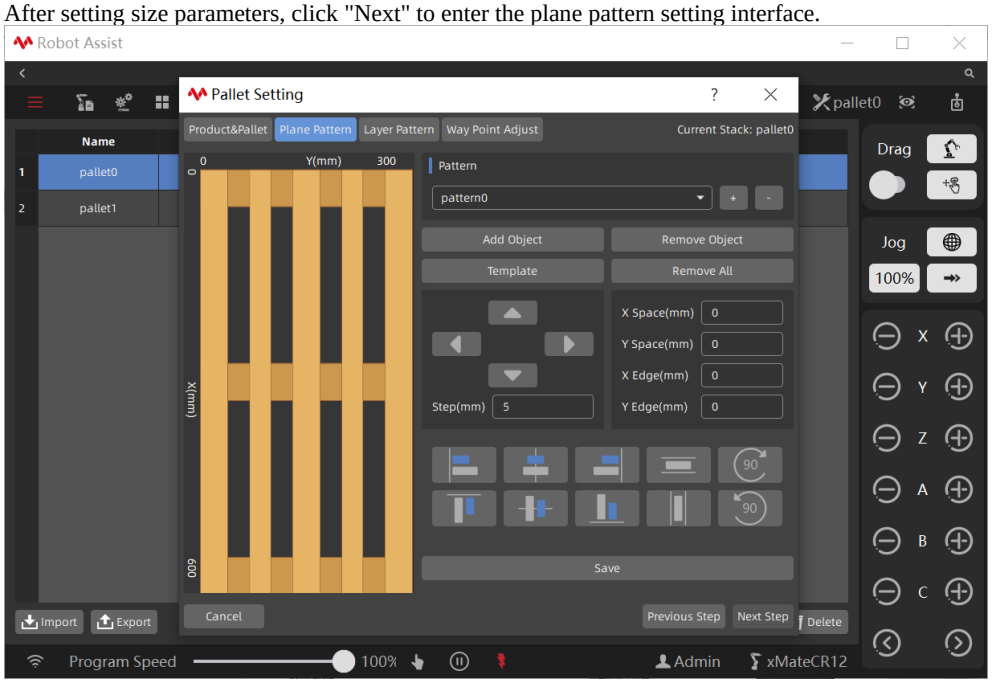


The partition is anti-slip paper placed between the layers to prevent the work object from slipping. The partition is disabled by default. Click "Enable" to add the partition, which is a specific plane pattern.



6.2 Set plane pattern

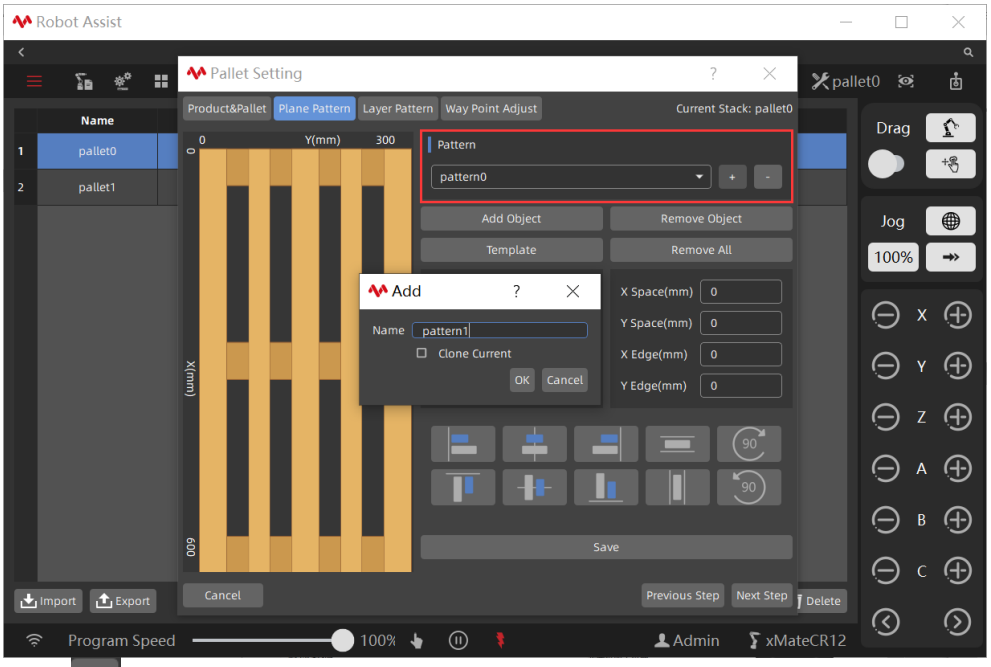
After setting size parameters, click "Next" to enter the plane pattern setting interface.



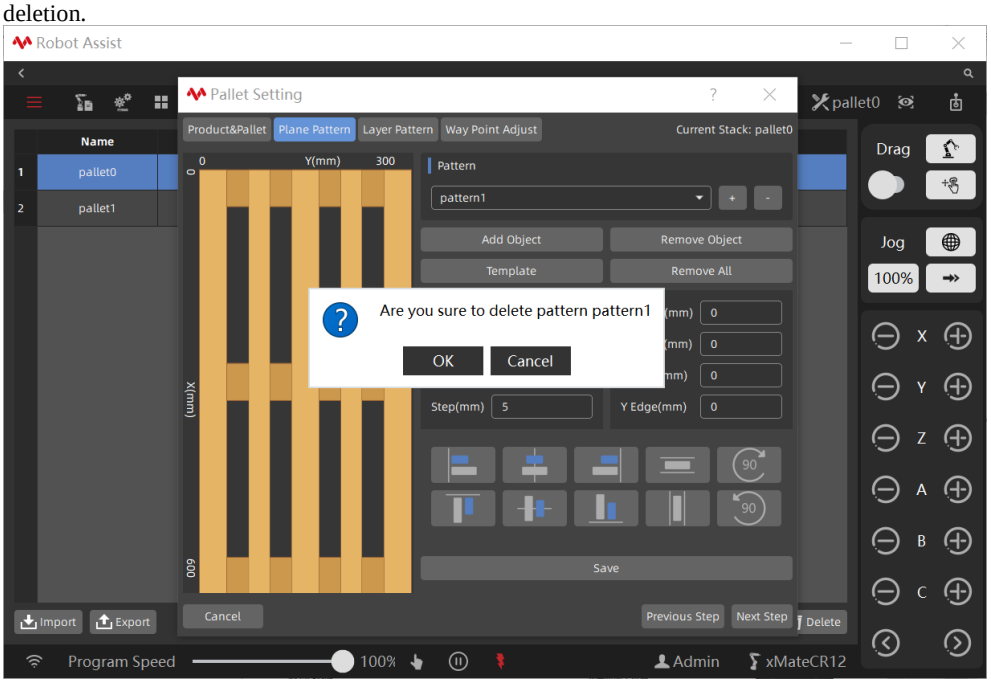
Choose the fixed plane pattern template and custom plane pattern templates depending on the situation.

6.2.1 Plane pattern management

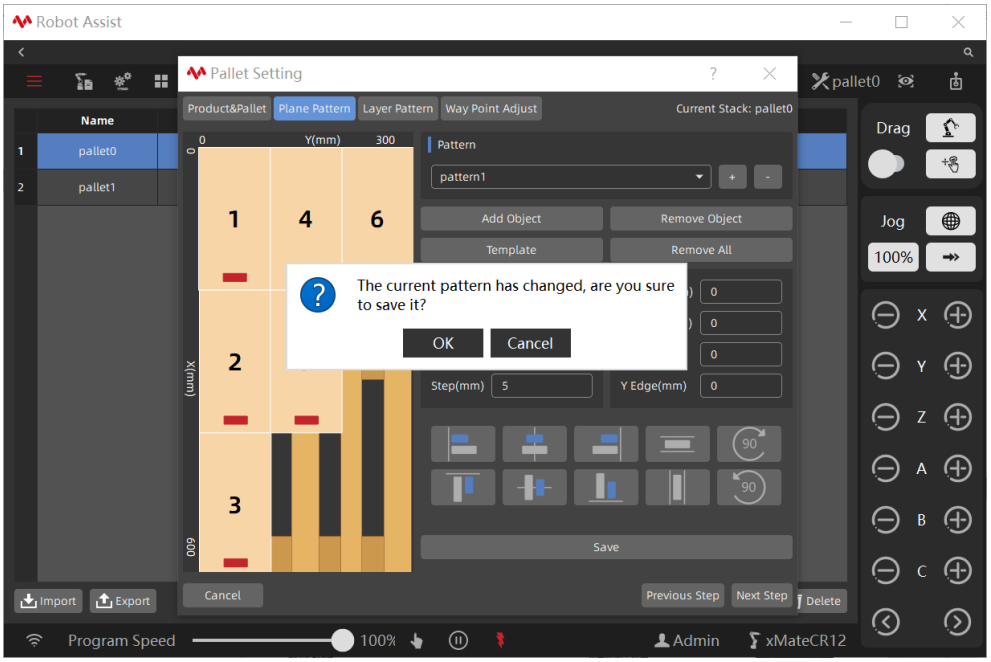
Click "+" to create a new plane pattern. When "Clone Current Pattern" is checked, the current pattern is copied to the new pattern; when "Clone Current Pattern" is unchecked, an empty pattern is created.



Click "-" to delete the current plane pattern. A pop-up window appears for you to confirm the deletion.



Click the drop-down box under the plane pattern to switch the pattern to be edited. When the plane pattern is changed, you can click "Save" to save the current pattern. If the changes are not saved, a pop-up window will appear for you to confirm whether to save the changes when entering the next step or switching patterns.



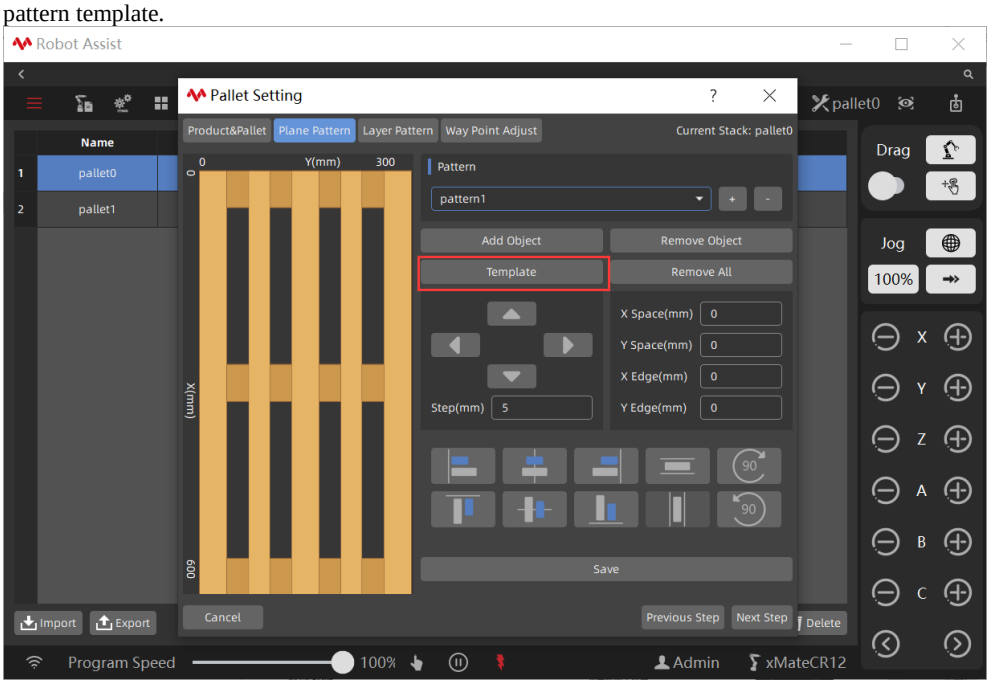
6.2.2 Fixed pattern template

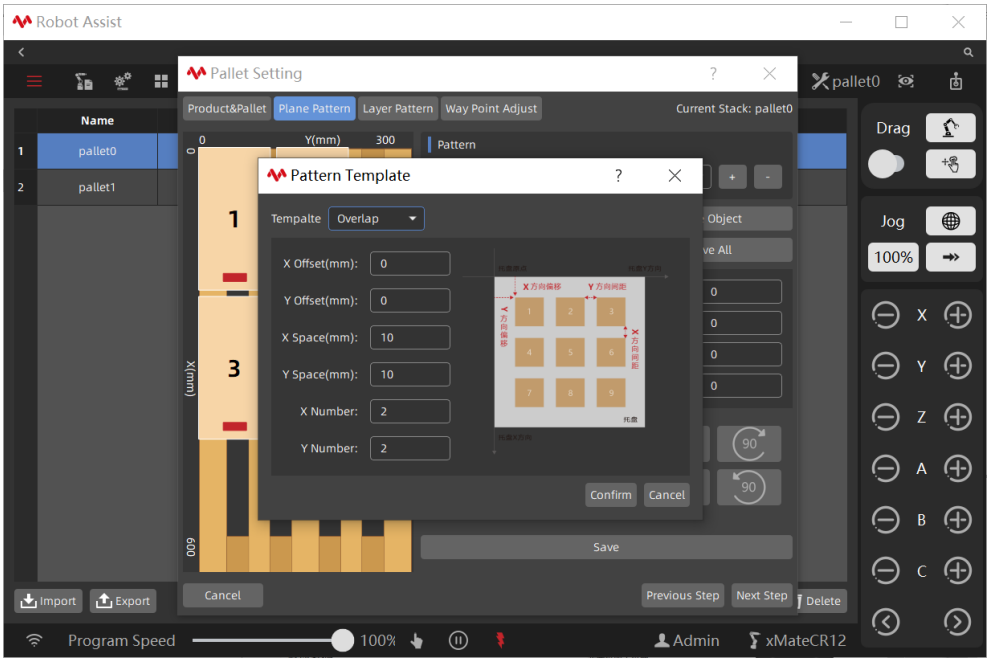
Click "Template" and select from the three pattern templates below:

- Matrix
- Criss-cross
- Loop

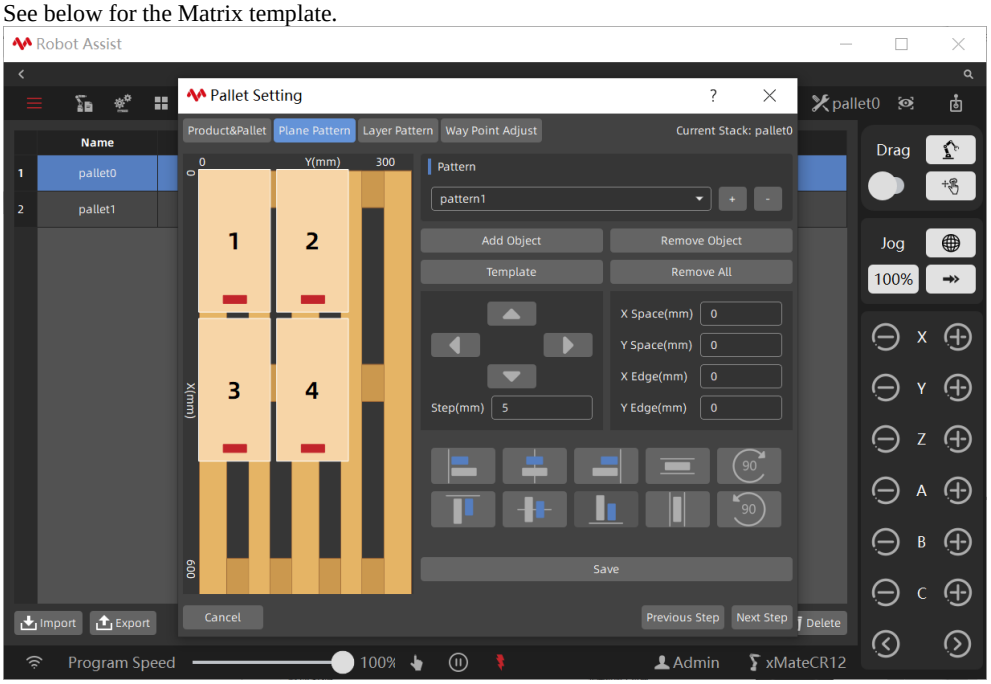
6.2.2.1 Matrix

Click the "Template" drop-down box to select the "Matrix" template. Set the offset between the work object and the pallet origin, spacing between adjacent work objects, the number of work objects in the X direction, and the number of work objects in the Y direction. Click Confirm to insert the Matrix pattern template.



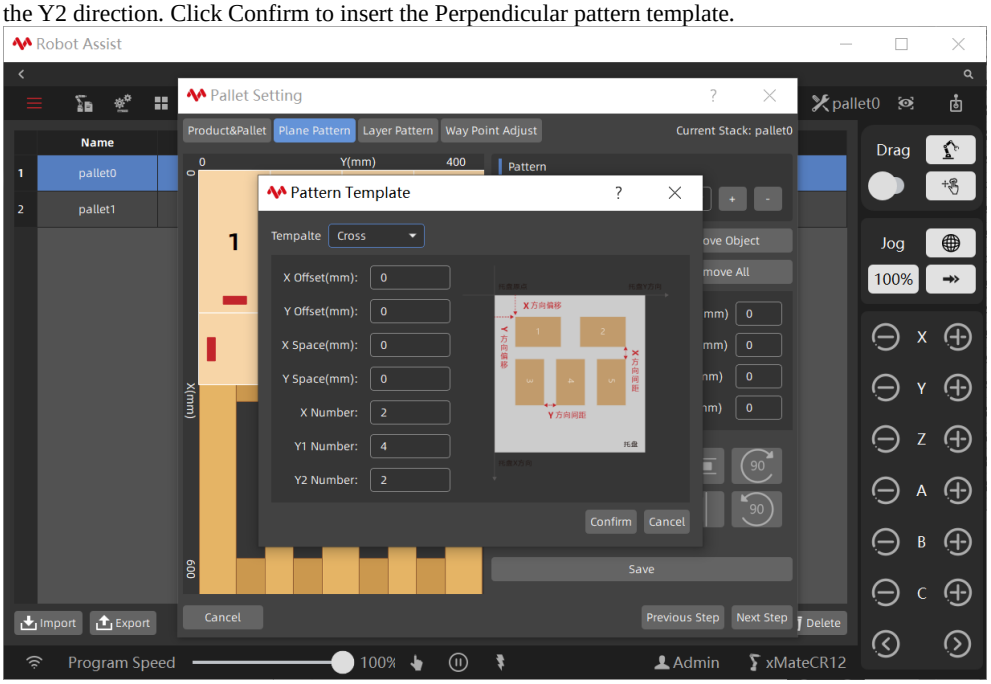


See below for the Matrix template.

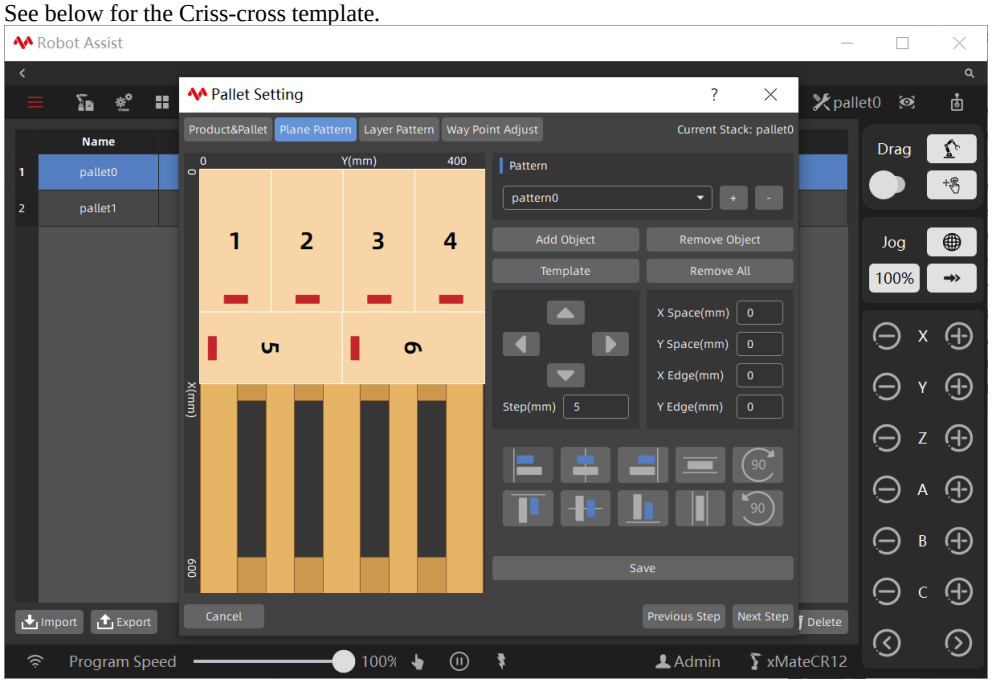


6.2.2.2 Criss-cross

Click the "Template" drop-down box to select the "Criss-cross" template. Set the offset between the work object and the pallet origin, spacing between adjacent work objects, the number of work objects in the X direction, the number of work objects in the Y1 direction, and the number of work objects in the Y2 direction. Click Confirm to insert the Perpendicular pattern template.

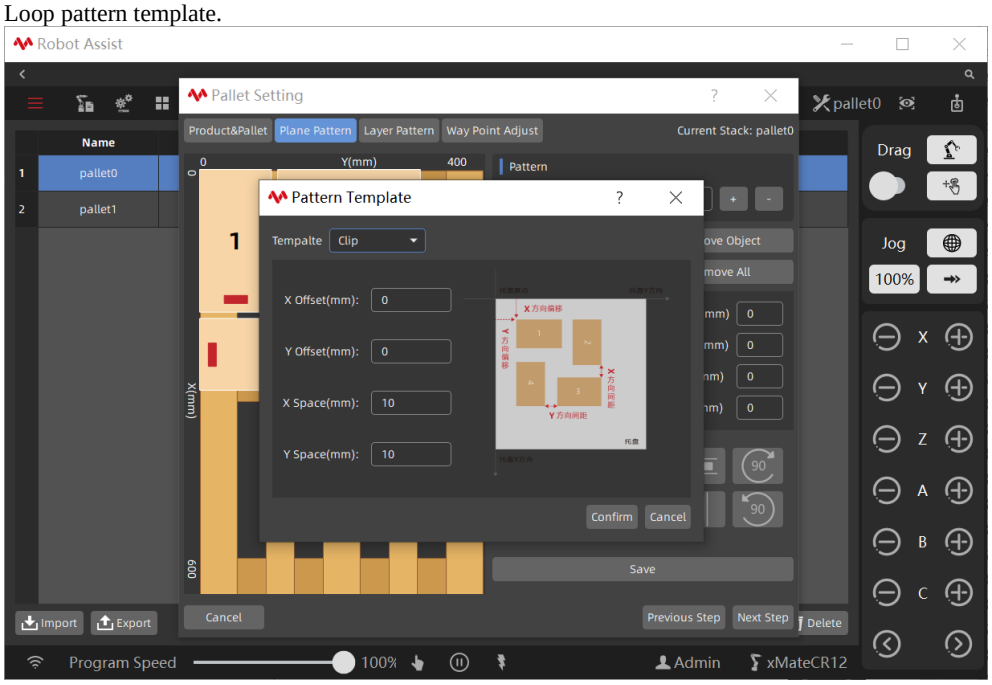


See below for the Criss-cross template.

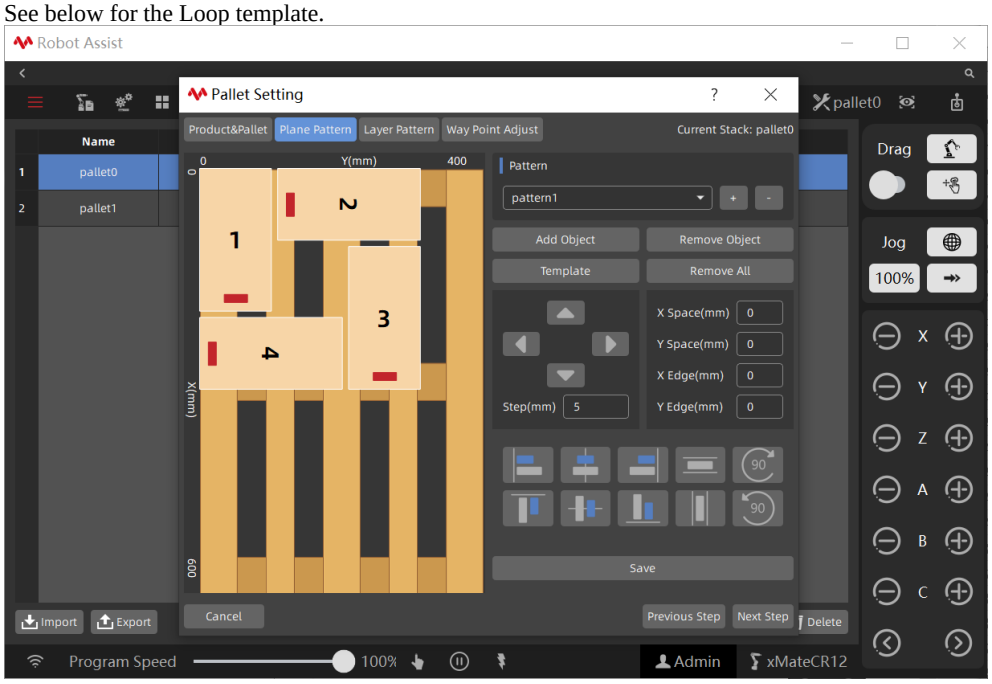


6.2.2.3 Loop

Click the "Template" drop-down box to select the "Loop" template. Set the offset between the work object and the pallet origin and spacing between adjacent work objects. Click Confirm to insert the Loop pattern template.

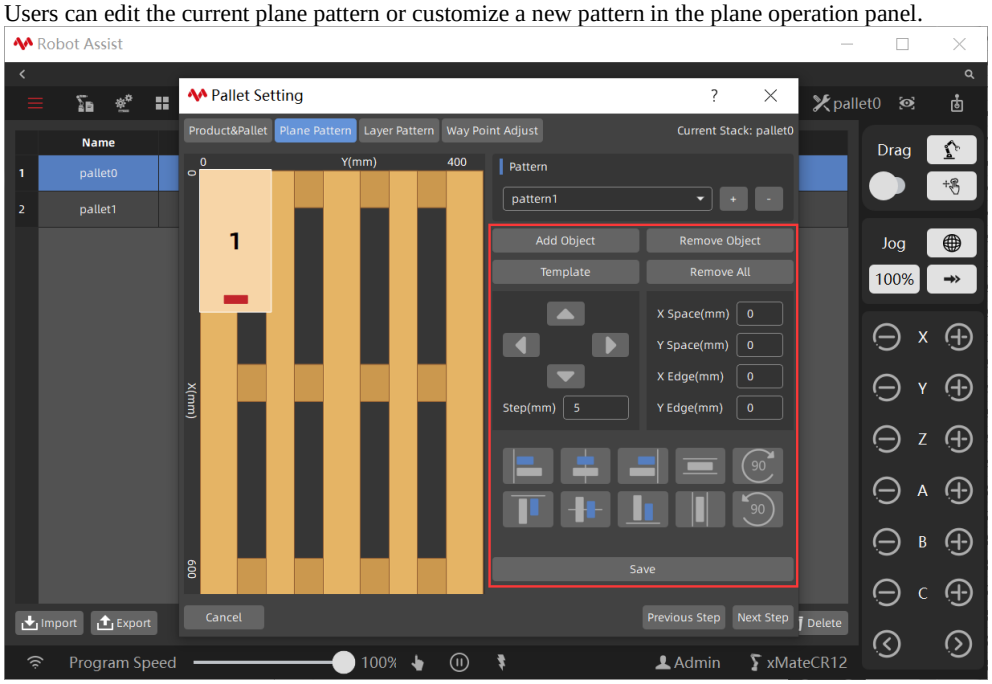


See below for the Loop template.



6.2.3 Plane operation panel

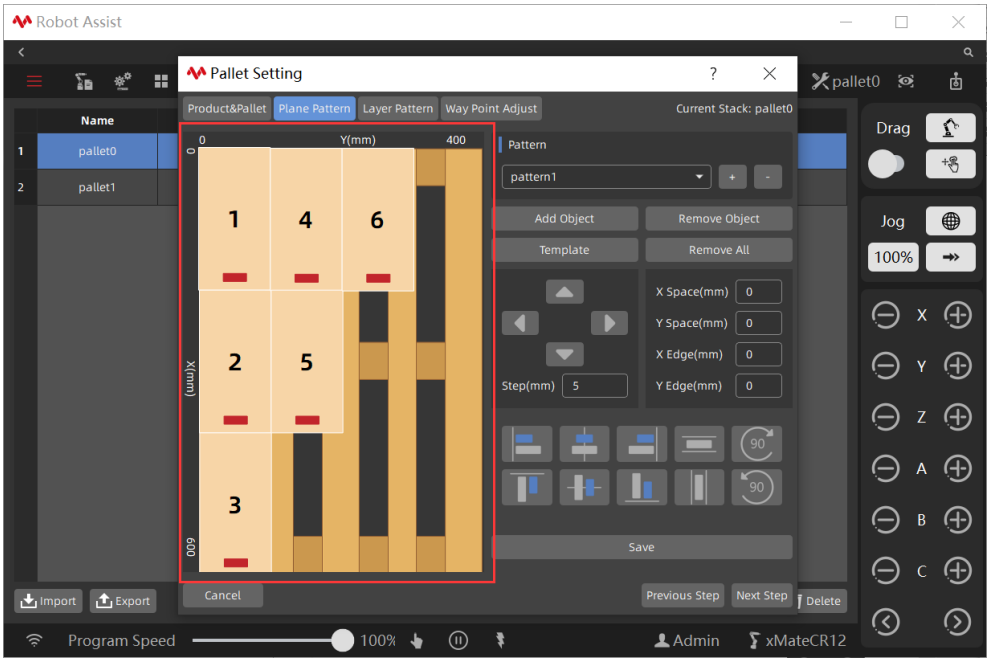
Users can edit the current plane pattern or customize a new pattern in the plane operation panel.



Options	Description
Add work object	Click "Add Work Object" to insert a configured work object at the origin of the pallet frame. By default, the long edge of the work object is parallel to the pallet X-axis and the wide edge of the work object is parallel to the pallet Y-axis.
Delete work object	Select one or more work objects in the left pattern editor and click "Delete Work Object" to delete the selected work objects.
Template	Users can insert work objects through fixed templates including Matrix, Criss-cross, and Loop.
Delete all	Click "Delete All" to clear all work objects in the current pattern editor.
Step move	Enter a step length, select work objects to be moved, and click "Move Direction" to move the work objects by fixed step length at a time along the X/Y axis.
Drag and drop	Users can drag the selected work object along the X/Y axis in the Pattern Editor.
Spacing setting	Set the spacing of adjacent work objects automatically sucked together in the X-axis and Y-axis on the pallet by providing X-axis spacing and Y-axis spacing. Set the X-axis and Y-axis spacing between the work object and the pallet edge by providing an X-axis and Y-axis margin.
Alignment method	Select the work objects to be aligned and click the alignment method to align the work objects.
Rotate work object	Rotate the work object 90° clockwise or counterclockwise from the current work object position in the Pattern Editor.
Click	Click to select one work object in the Pattern Editor.
Multi-select	Hold the Ctrl key and click to select multiple work objects in the Pattern Editor.
Box select	Box select multiple work objects in the Pattern Editor.

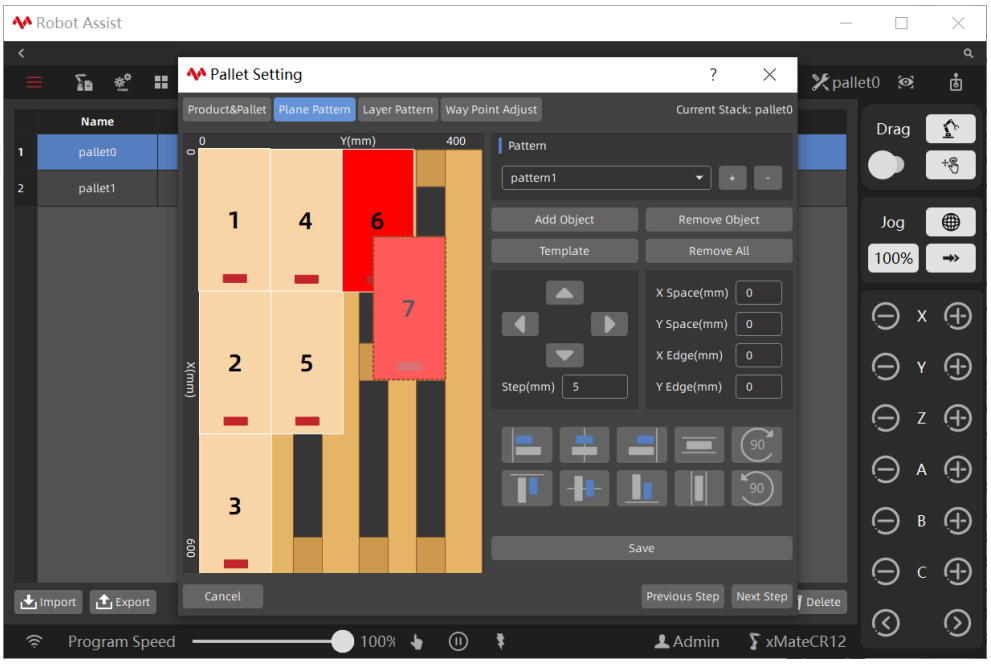
6.2.4 Custom pattern template

Users can modify inserted pattern templates or custom a new pattern template through the plane operation panel.



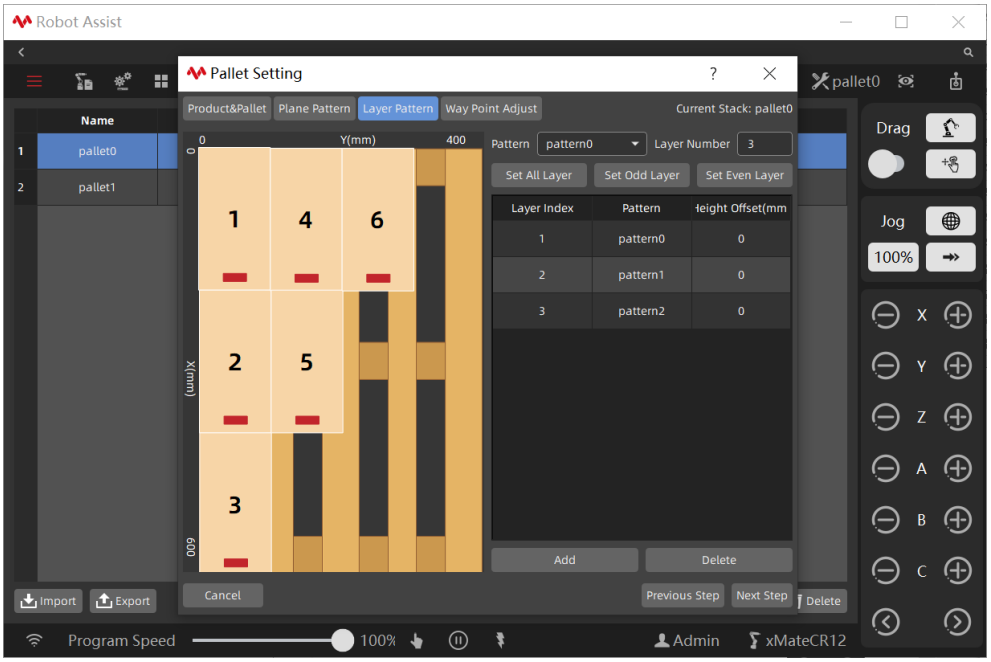
Notes

When work objects overlap, they will be displayed in red. Users need to adjust their positions to prevent overlapping.



6.3 Set layered pattern

After setting the plane pattern, click "Next" to switch to the layered pattern setting interface. Set the plane pattern for all the layers on the current pallet based on configured plane patterns.



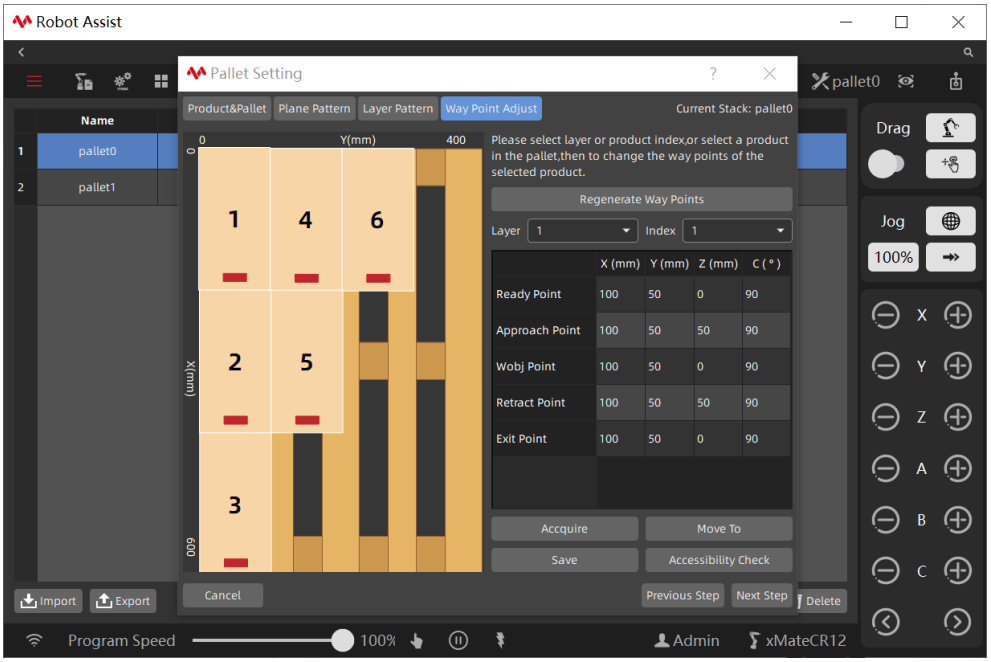
Options	Description
Plane pattern	Click the "Plane Pattern" drop-down box and select and preview configured plane patterns on the left.
Number of layers	Select the desired plane pattern and enter the total number of layers on the current pallet to quickly create corresponding layers and patterns.
Set to all layers	Select the desired plane pattern and click "Set to All Layers" to quickly apply the selected plane pattern to all layers.
Set to odd layers	Select the desired plane pattern and click "Set to Odd Layers" to quickly apply the selected plane pattern to all odd layers.
Set to even layers	Select the desired plane pattern and click "Set to Even Layers" to quickly apply the selected plane pattern to all even layers.
Pattern	Set the pattern of each layer and double-click to switch to other patterns.
Height compensation	Set the height compensation for each layer. When the height compensation is set, work object points and auxiliary points of the layer will be offset according to the compensation value as a whole.
Create new	Select the desired plane pattern and click "New" to add the highest layer and pattern.
Delete	Click "Delete" to delete the top layer.

6.4 Adjust path point

After setting the layer pattern, click "Next" to enter the path point adjustment interface. The system will automatically calculate the corresponding data of each work object point. Users can try each work object point and its approach point and retract point based on the layer number and the work object number or by selecting the work object position in the left pattern display zone. Users shall confirm that there is no interference with the environment.
Refer to the following steps to test run the path points:

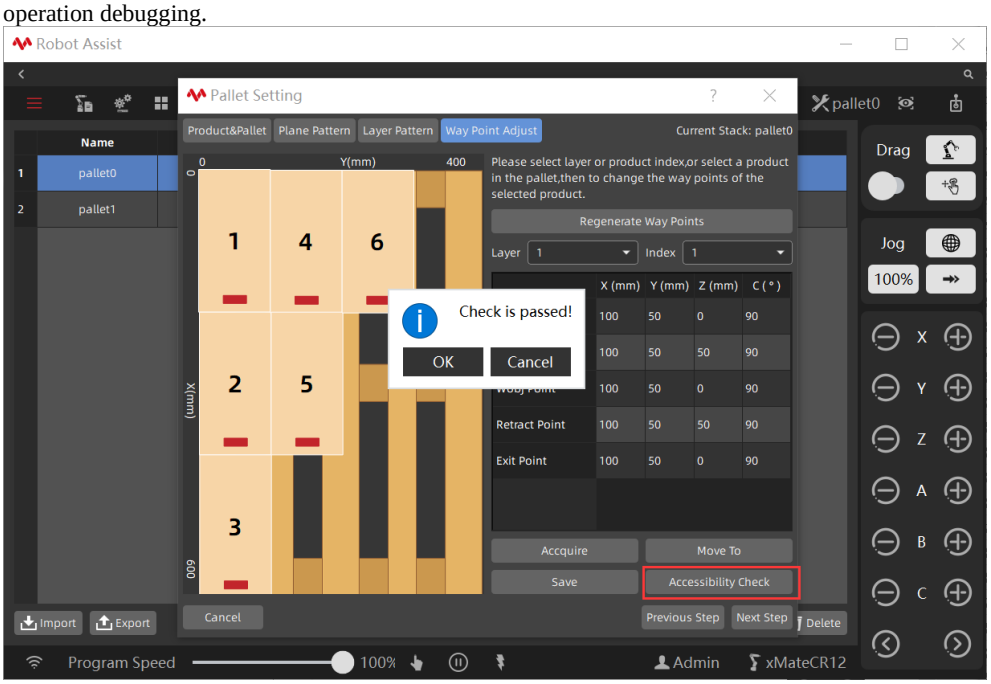
1) Select "Layer Number" and "Work Object Number" and click "Move to Approach Point", "Move to Work Object Point", and "Move to Retract Point". The robot will move to corresponding point positions. During the test run, pay attention to the moving trajectory estimation to prevent collisions.

2) In the case of work object point offset, users can click "Get" or manually input to change the individual work object point position and click to confirm the change. Changing a single-point position does not affect other points in the stacking process.



6.4.1 Accessibility check

When "Accessibility Check" is clicked, the system automatically judges the limit position and orientation change based on each trajectory point position automatically calculated. Users shall confirm the accessibility and interference of all positions on the pallet to minimize problems during operation debugging.



7 Auxiliary Programming

7.1 RL programming

7.1.1 Common variables

The following list shows variables commonly used in stacking RL programs:

Name	Type	Description
PalletEnterPoint	RobTarget variable	Pallet entry point, a transition point in the path.
PalletReadyPoint	RobTarget variable	Ready point or preparation point before placing the work object. The calculated position is stored in this variable with the current work object point position as the reference.
PalletApproachPoint	RobTarget variable	Approach point, which defines the height offset relative to the current work object point when the robot is ready to place the work object. The robot can approach the work object point from different directions. The calculated position is stored in this variable with the current work object point position as the reference.
PalletWobjPoint	RobTarget variable	Work object point, with the origin of the pallet frame as the reference. The calculated point position of each pallet is stored in this variable.
PalletRetractPoint	RobTarget variable	Retract point, which defines the height offset relative to the current work object point after the robot places the work object. The robot can leave the work object point from different directions. The calculated position is stored in this variable with the current work object point position as the reference.
PalletExitPoint	RobTarget variable	Exit point after the robot places the work object. The calculated position is stored in this variable with the current work object point position as the reference.
PalletTool	Tool variable	Stacking tool frame
PalletWobj	Wobj variable	Stacking work object frame

Notes

The above variables are fixed in the stacking process, and users could not create variables with the same name.

7.1.2 Commonly used functions

The following list shows functions commonly used in stacking RL programs

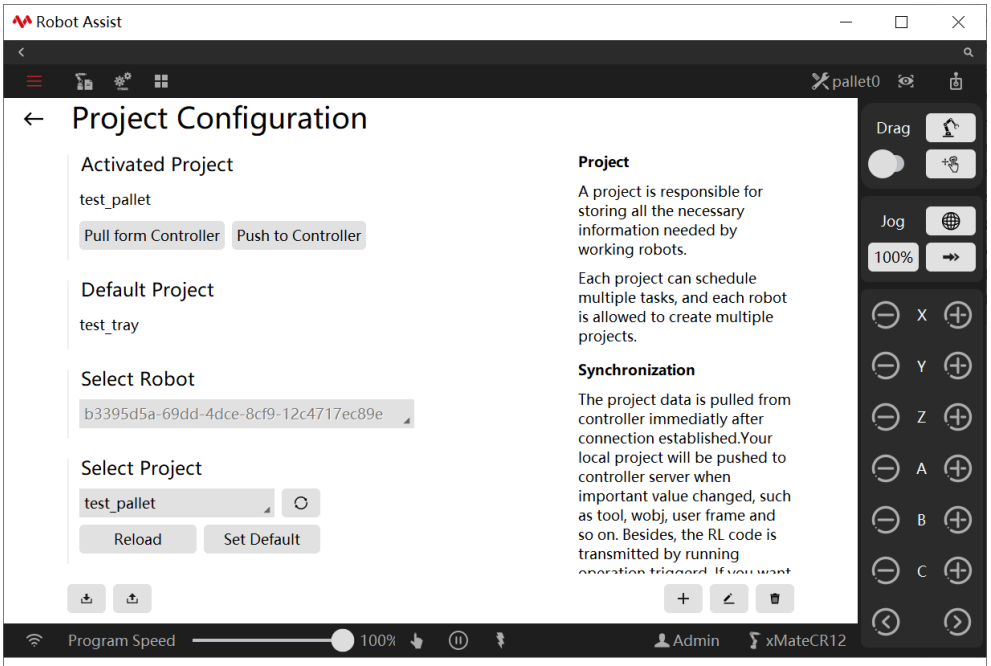
Name	Format	Description
PalletUpdate	Void PalletUpdate("pallet_name",int layer_index,int wobj_inedx)	Updates the position of the specified layer and the specified work object point of the specified pallet
PalletLayerCount	Int PalletLayerCount("pallet_name")	Get the total number of layers of the specified pallet
PalletWobjCount	Int PalletWobjCount(string "pallet_name",int layer_index)	Gets the total number of work objects on the specified layer of the specified pallet

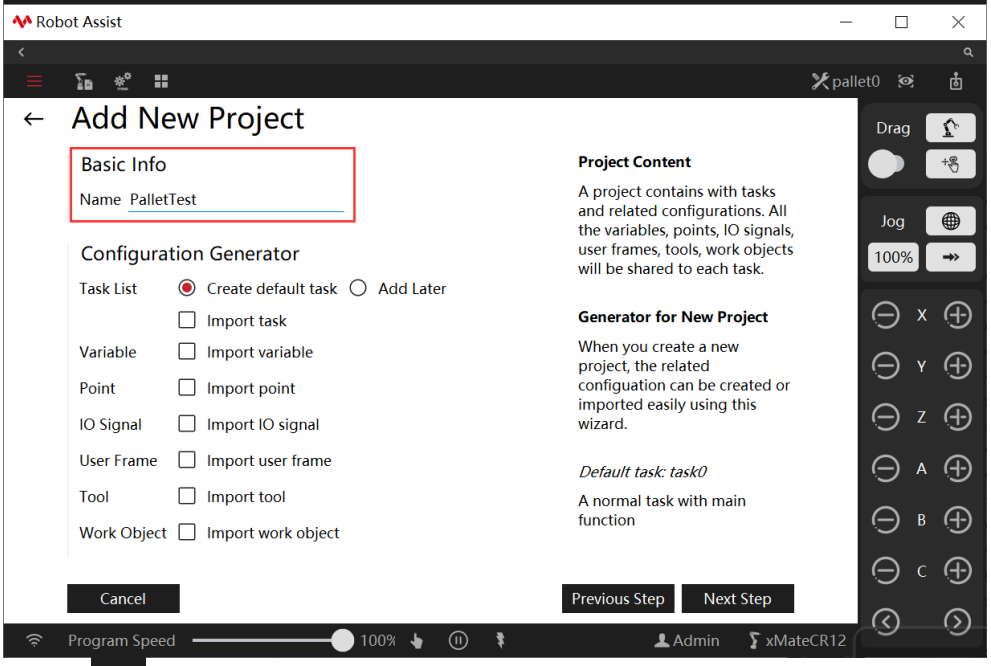
7.1.3 Programming

After pallet setup, click "  Robot Programming" to enter the RL programming editor.
Refer to the following steps to write pallet RL programs:

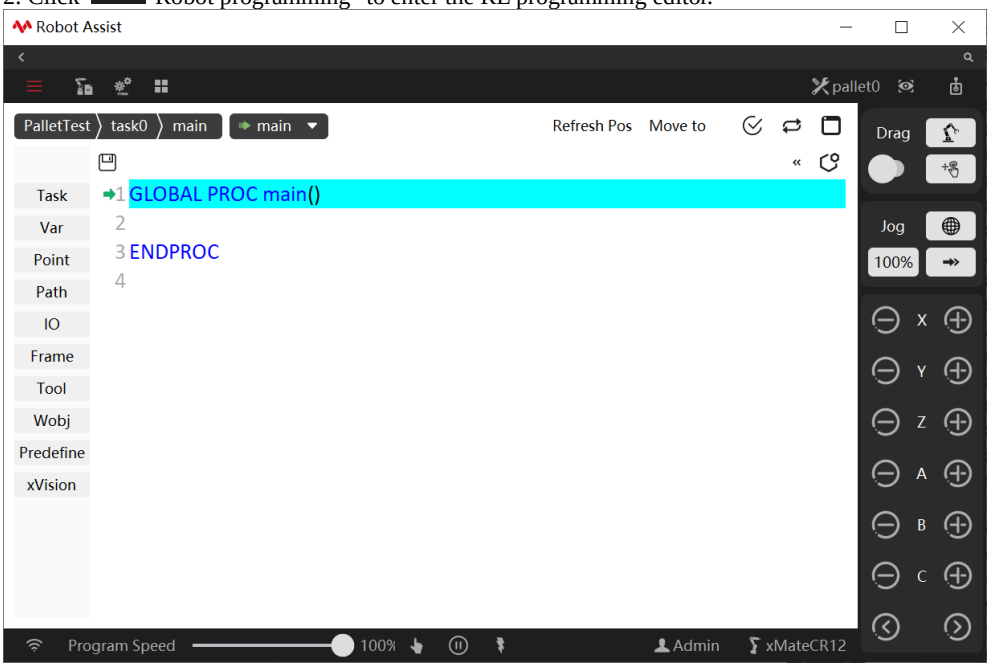
1. Click 

"Project Name" to enter the "Project Configuration" interface. Click  " New" to enter the "Add New Project" interface. Enter the project name and click "Next" to confirm the creation of a new project.

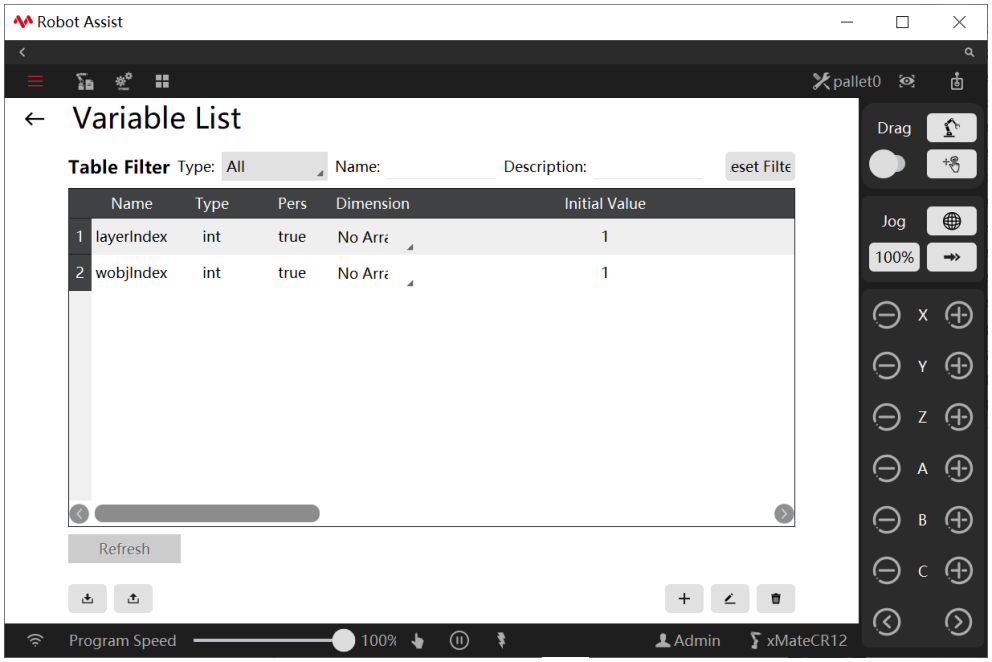




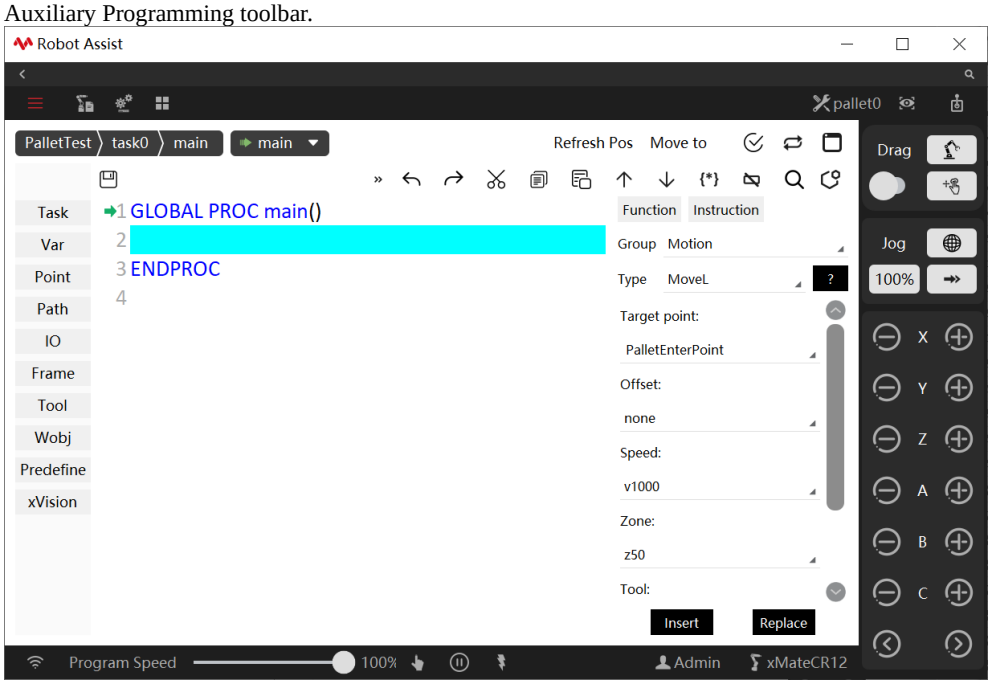
2. Click  "Robot programming" to enter the RL programming editor.



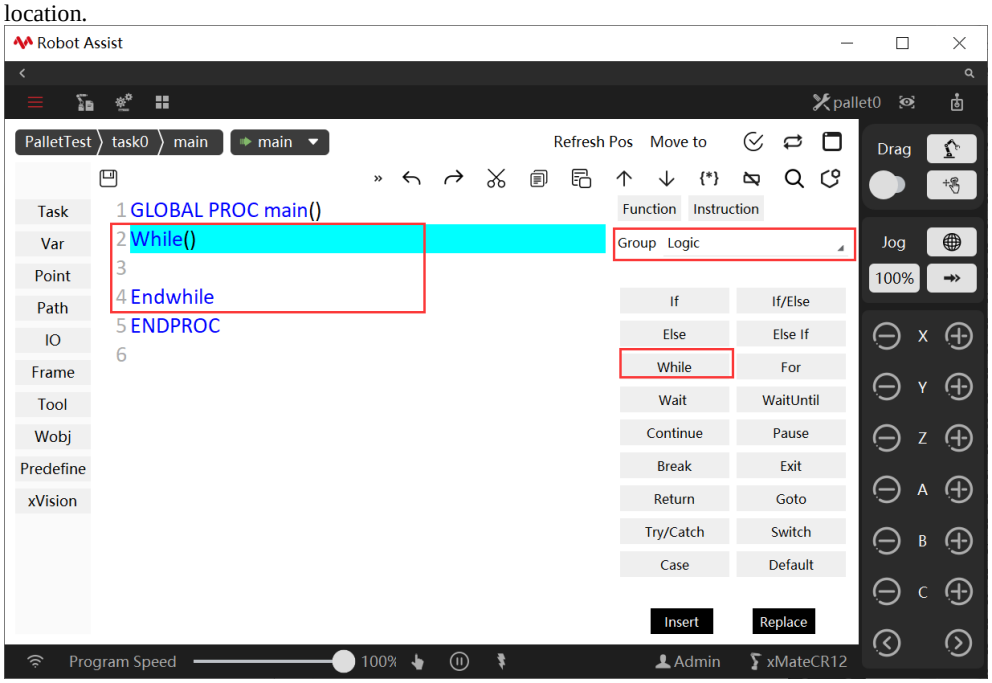
3. Click "Variables" to enter the variable list interface. Create two int type variables "Layer number layerIndex" and "Work object number wobjIndex" with the initial value of 1.



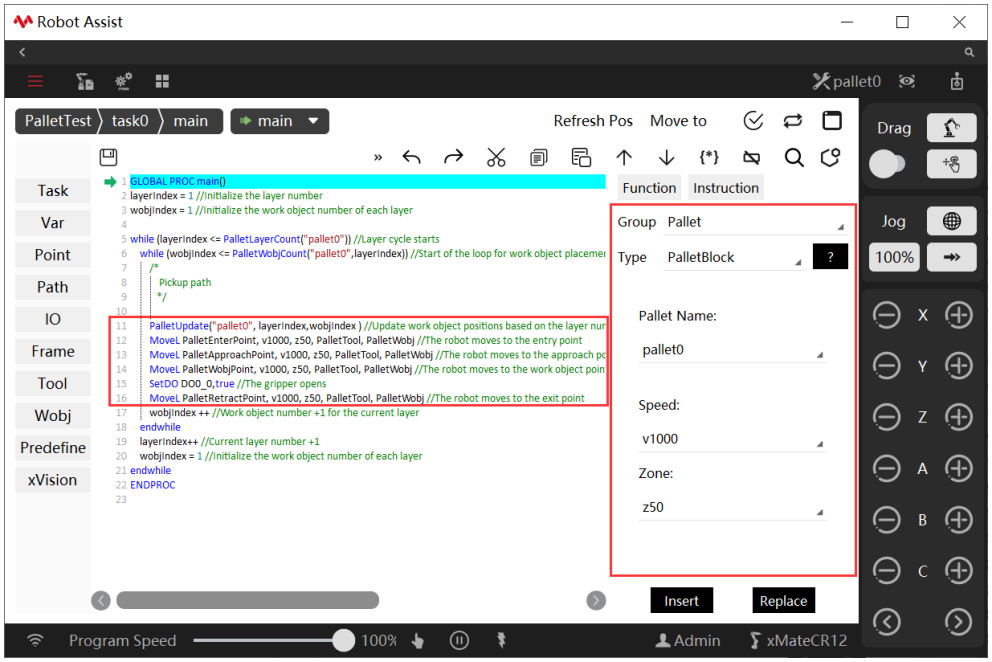
4. Return to the program editor interface and click "Auxiliary programming" to open the Auxiliary Programming toolbar.



5. Click "Instruction" -> "Logic Instruction" -> "while" and insert a loop command to the cursor location.



6. Click "Instruction" -> "Pallet" -> "PalletBlock" and insert the pallet command block to the cursor position. Manually enter the layer number and work object number variables.



7. Click "Instruction" -> "IO" -> "SetDO" and insert the signal output command to the cursor position.

7.1.4 Program example

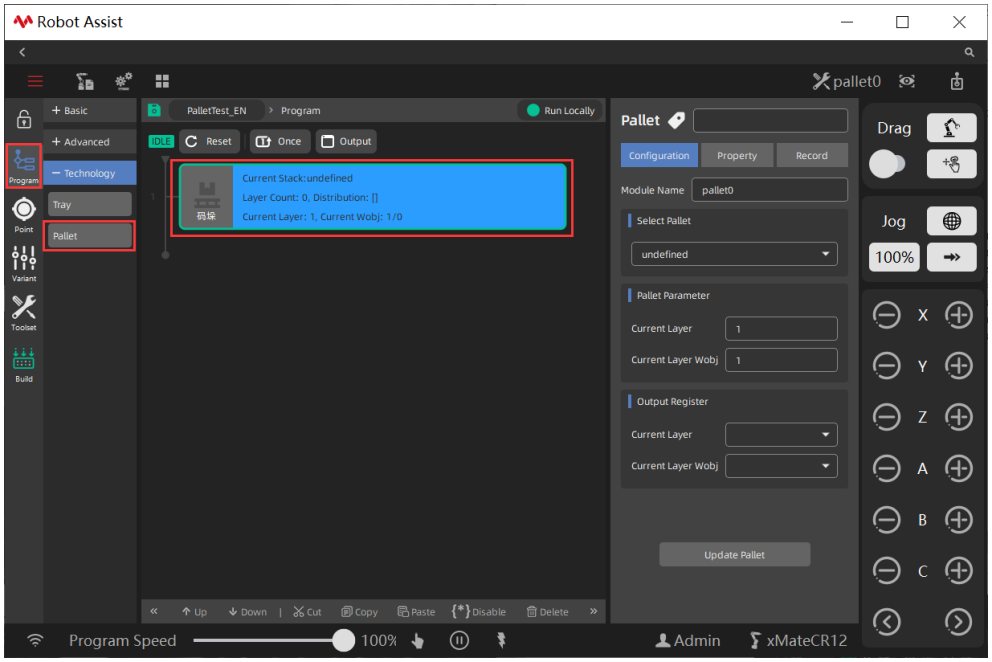
Refer to the following stacking RL program:

```
GLOBAL PROC main()
layerIndex = 1 //Initialize the layer number
wobjIndex = 1 //Initialize the work object number of each layer

while (layerIndex <= PalletLayerCount("pallet0")) //Layer cycle starts
    while (wobjIndex <= PalletWobjCount("pallet0",layerIndex)) //Start of the loop for work object placement count on each layer
        /*
        Pickup path
        */

    PalletUpdate("pallet0", layerIndex,wobjIndex ) //Update work object positions based on the layer number and the work object number
    MoveL PalletEnterPoint, v1000, z50, PalletTool, PalletWobj //The robot moves to the entry point
    MoveL PalletApproachPoint, v1000, z50, PalletTool, PalletWobj //The robot moves to the approach point
    MoveL PalletWobjPoint, v1000, z50, PalletTool, PalletWobj //The robot moves to the work object point
    SetDO DO0_0,true //The gripper opens
    MoveL PalletRetractPoint, v1000, z50, PalletTool, PalletWobj //The robot moves to the exit point
        wobjIndex ++ //Work object number +1 for the current layer
    endwhile
  layerIndex++ //Current layer number +1
  wobjIndex = 1 //Initialize the work object number of each layer
endwhile
ENDPROC
```

7.2 Graphical programming

7.2.1 Process module

The stacking module displays the current stacking name and the total number of layers on the pallet. When the program is running, users can check the No. of the layer and work object handled by the robot. that the robot is stacking. Each time the stacking module is executed, the system will automatically update the position of the next work object point and increase the work object number by 1. When the max number of work objects for each layer is reached, the work object number is automatically initialized to 1, and the layer number is added by 1. Click the stacking module and set the basic stacking parameters in the configuration panel on the right. Click "Update Stacking" to apply the current configuration.



Options	Description
Module name	Display the module name.
Select stacking	Click the drop-down box to bind the configured stacking process.
Current layer number	Set the starting layer of stacking.
Current work object number	Set the starting position of the work object on the specified layer.
Output register	Bind the register and output the current layer number and work object number
Update stacking	Synchronize the values of the currently selected stacking process variables to the current stacking process module.

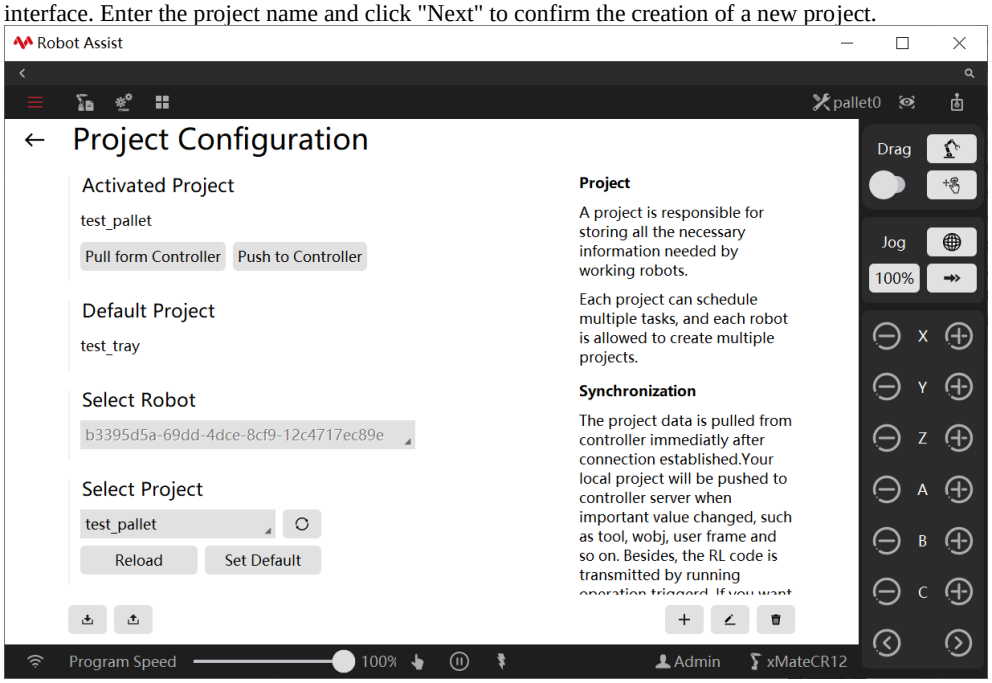
7.2.2 Programming

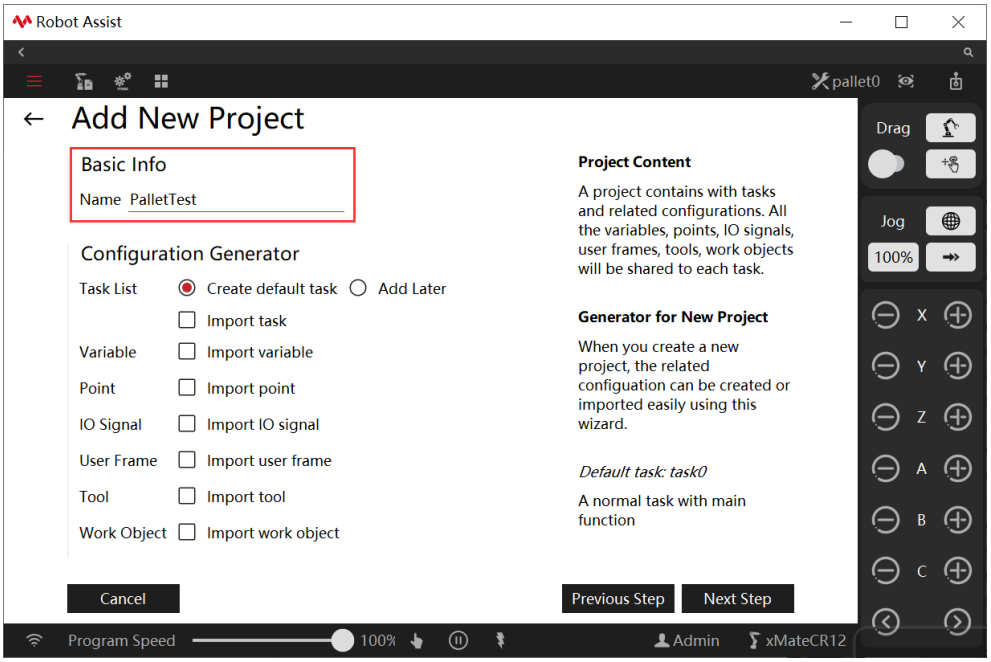
When the stacking process is set, click  “Robot Programming" to enter the RL programming editor interface.

Refer to the following to write the stacking program graphically:

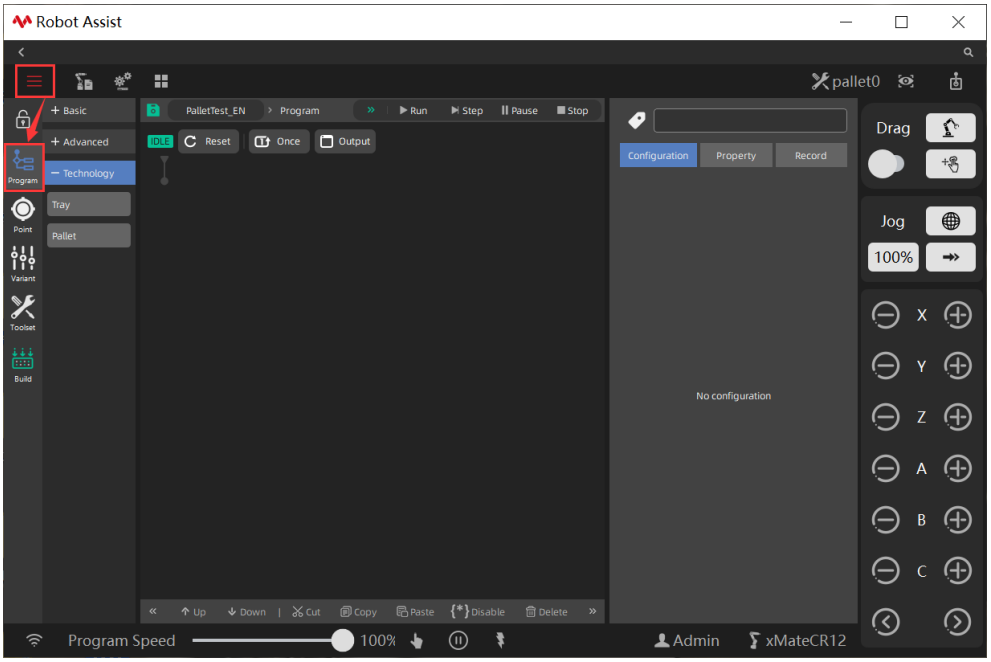
1. Click 

"Project name" to enter the "Project Configuration" interface. If there is no project, click  "New" to enter the "Add New Project" interface. Enter the project name and click "Next" to confirm the creation of a new project.

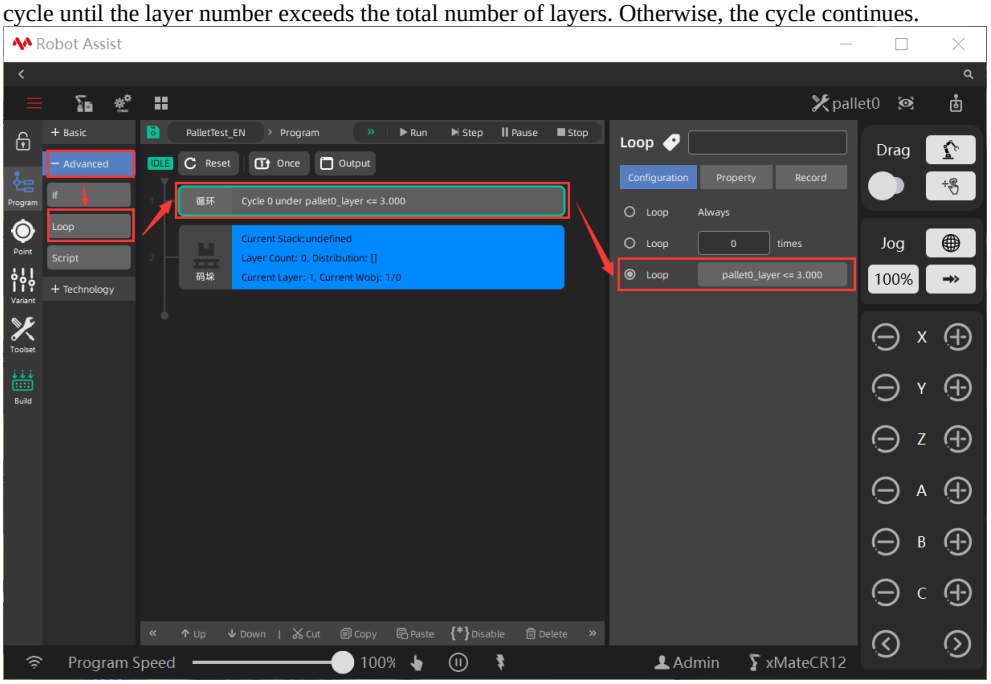




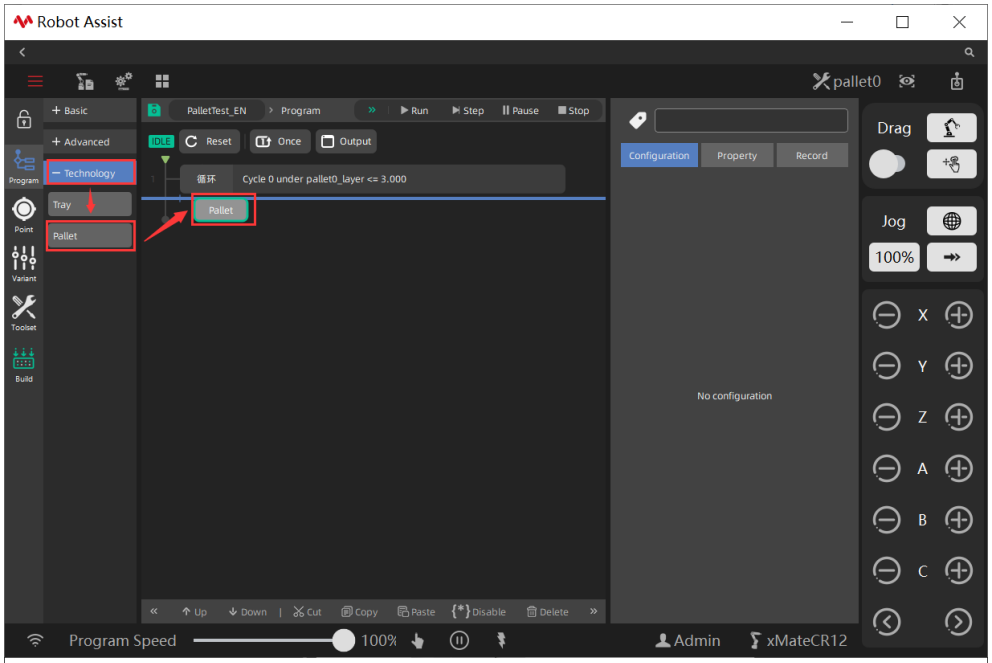
2. Click "Menu" -> "Graphical Programming" -> "Program" to enter the graphical programming editor interface.

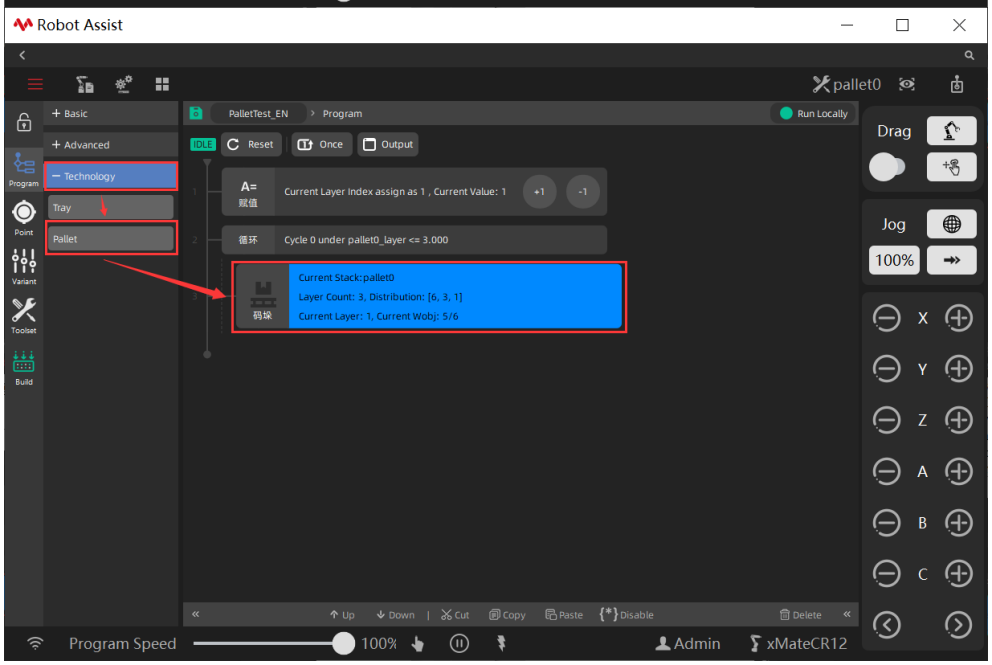


3. Click/drag "Advanced" -> "Loop" and insert the cycle module into the program tree. Configure the properties of the cycle module. Select the cycle condition mode and set the cycle condition as end the cycle until the layer number exceeds the total number of layers. Otherwise, the cycle continues.

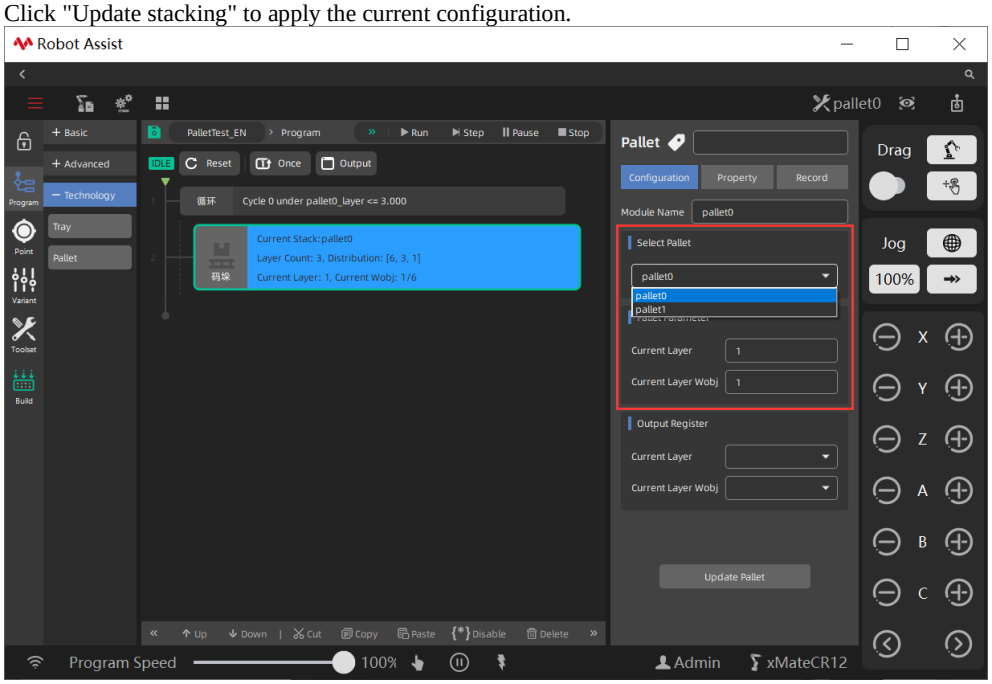


4. Click/drag "Process" -> "Stacking" and insert the stacking module into the program tree. Click "Expand to the Left" to display the module configuration panel.



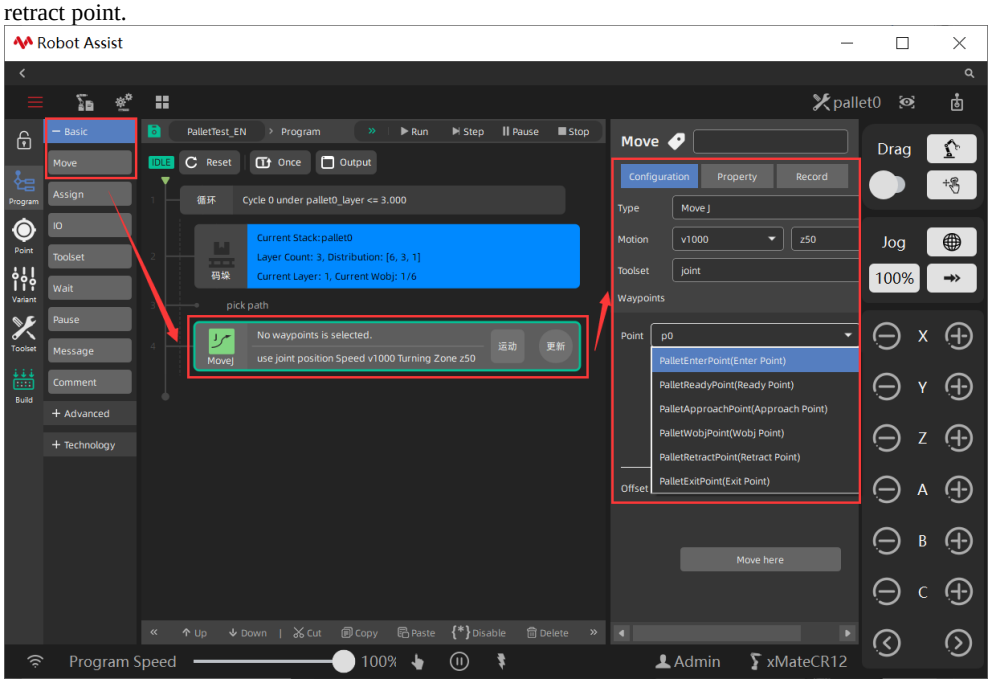


5. Click the "Stacking" module and switch to the "Stacking" configuration panel. Click the "Select stacking" drop-down box and select the configured stacking process "pallet0". The module will display the total number of "pallet0" layers, the current layer number, and the work object number on the current layer. Set "stacking parameters" current layer number and current layer work object number to 1, which means that the stacking starts from the first work object position on the first layer. Click "Update stacking" to apply the current configuration.

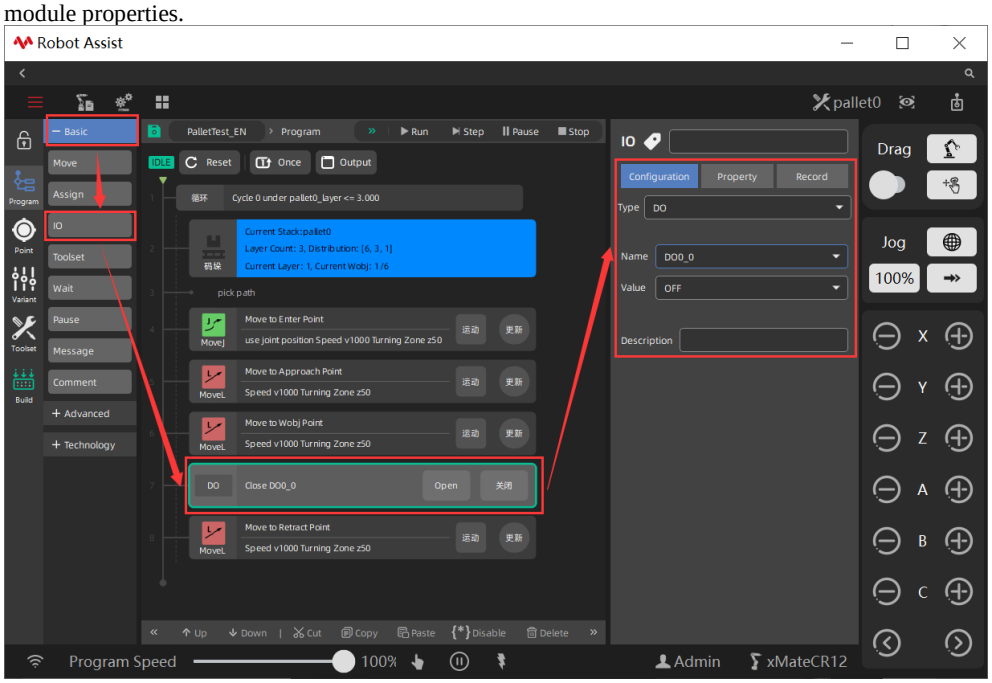


6. Click/drag "Basic" -> "Motion" and insert the required motion module into the program tree. Configure the motion module properties. Set the motion type, motion parameters, and tool group, and

select in the drop-down box the following points: entry point, approach point, work object point, and retract point.



7. Click/drag "Basic" -> "IO" and insert the IO module into the program tree. Configure the IO module properties.



7.2.3 Program example

Refer to the following graphical program for stacking: