AUBOPE Extension

“Stack” Craft package

Manual

AUBO (Beijing) Robotics Technology CO., LTD.

Statement

- It is strictly forbidden to reprint any of the contents of this material.
- The information in this material is subject to change without notice and should not be regarded as a commitment by AUBO (Beijing) Robotics Technology Co., Ltd.
- Please read this manual before installing and using the product.
- Please keep this manual to read and as reference any time.
- The pictures in this manual are for reference only, please refer to the actual pro duct received.

Catalog

1 General Introduction

AUBOPE software provides various plugin function or craft packages to user for the purpose extend the scope of application and make peripherals much easier to set up with AUBO system.

The “Stack” craft package is used to help the user simplify the project set up and parameter settings in stacking or de-stacking application.

NOTE：

- Transition points must be added near the stacking area or destocking area (to prevent the potential singular position of the manipulator due to the user settings from the special position to the palletizing area or depalletizing area)
- To run the program for the first time, the user must first run the program in simulation mode or run the program in a slow running speed. After that, then increase the manipulator speed.
- If the user would like to use Robotiq gripper, please be sure to connect and activate the gripper in “Extension” – “Peripherals” – “Robotq2F” plugin page.
- The “Stack” craft package will use the below User IO by default:
  - DO_00: Prompt output after one round of stacking or destocking is completed.
  - DO_01: After the user sets the input detection, if the input signal is detected successfully, then this output is valid.
  - DI_00: After one stacking or de-stacking round is completed, this input signal is used to begin the next round.

2 Function Acquisition

To acquire the “Stack” craft package for AUBOPE software, the user can simply put the plugin file to a folder shown below:

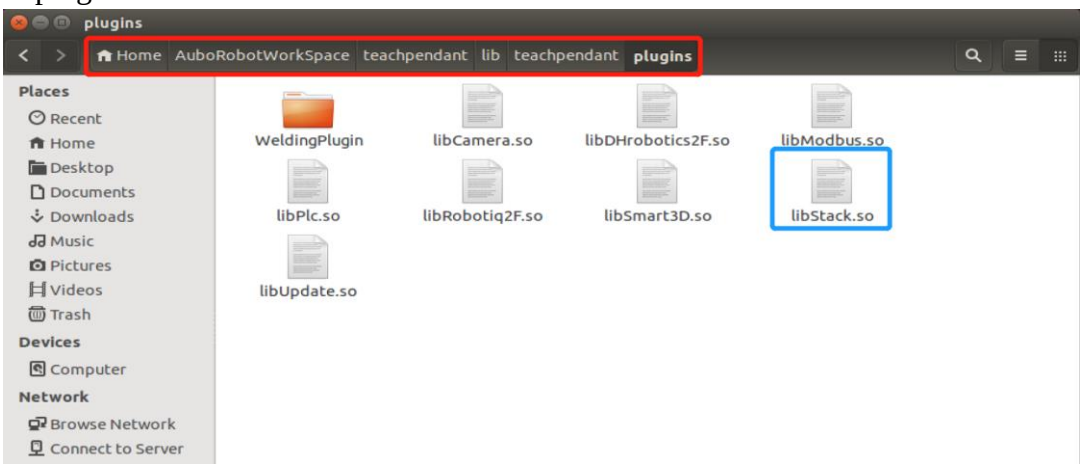

Figure 2.1 Plugin file folder location

The User can find the plugin files from AUBO forum or from Google Drive Link: https://drive.google.com/drive/folders/19RT40-7Ry9f0ahb9m4tBGksxsrKUHxa1?usp=sharing

After putting the plugin file to the folder, when restarting the AUBOPE software, the user can find the “Stock” function has been add to the “Extension” page:

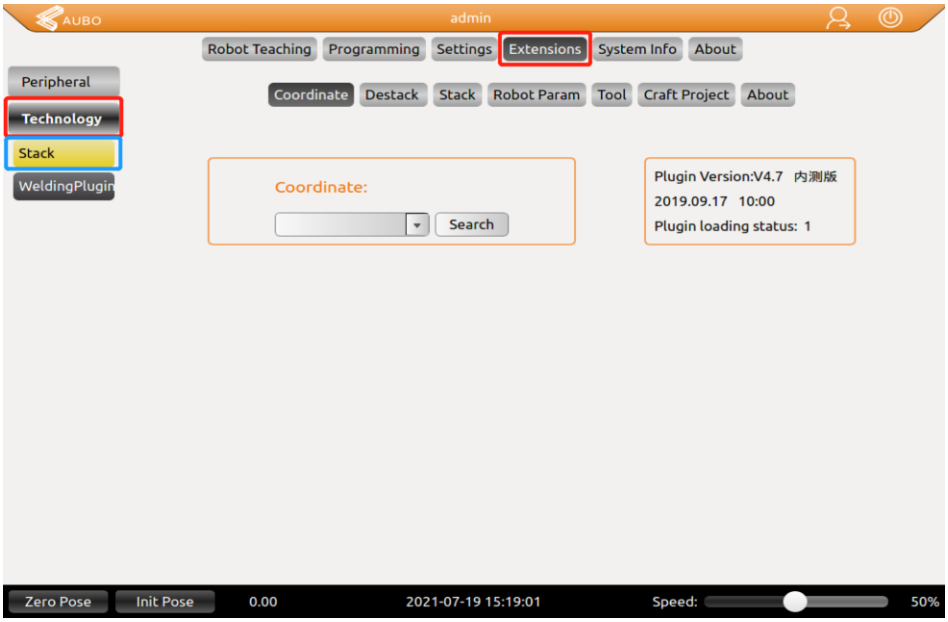

Figure 2.2 Stock Craft Package in AUBOPE software

NOTE:

After putting the plugin file, if the AUBOPE software was unable to start up normally, please remove that plugin file and contact AUBO Technical Support Team for more information.

3 Interface Introduction

3.1 Coordinate

This is the user coordinate system setting interface of the Stack Craft Package. (Figure 3.1)

The user needs to select a user coordinate system (required) in this interface, and the user can only select the pre-defined user coordinate systems (We recommend the user to pre-define the desire user coordinate system with the desire robot tool). The user coordinate system selected here can be understood as the coordinate system of Stacking or de-stacking pallets.

On the right side of the interface, there are plugin file version, build date and other information.

Figure 3.1 "Coordinate" page of Stack Craft Package

3.2 De-Stack

This is the De-Stacking parameter setting interface, in which some basic parameters about removing item out of the pallets will be set:

The row number, column number, layer number, coordinate information of point 1 (shown in the model diagram in the interface) of the depalletizing area, and the heading offset value, column offset value, layer offset value, etc. based on the point 1 coordinate.

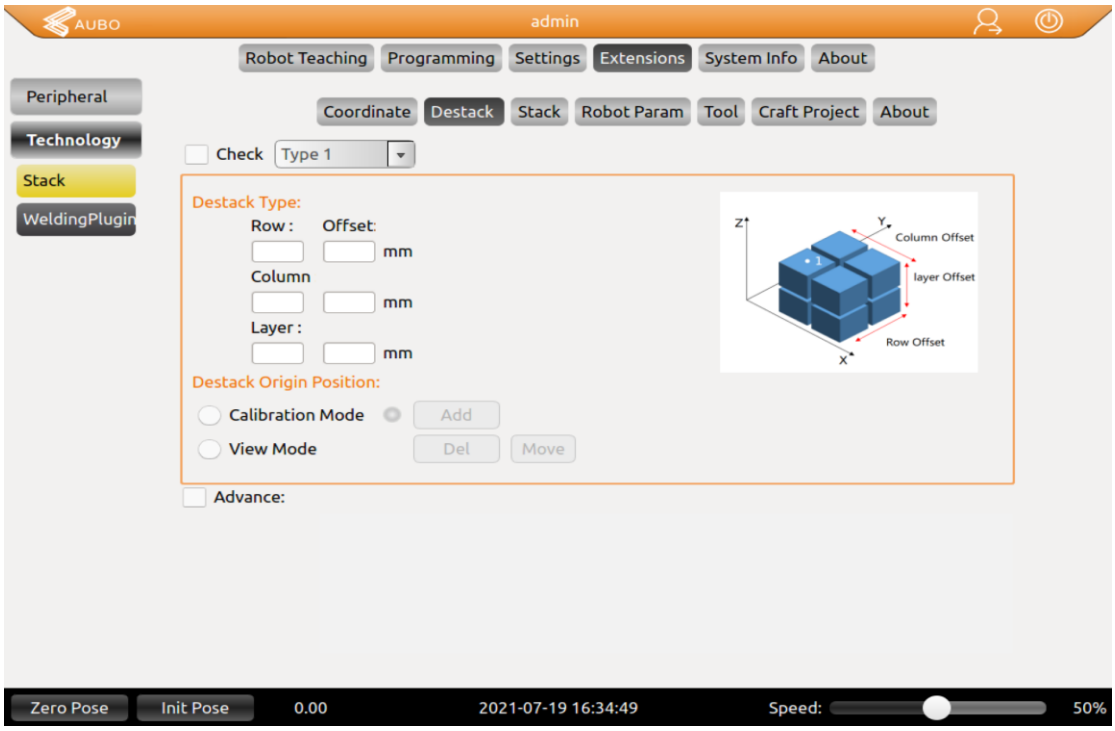

Figure 3.2 "De-Stack" page of Stack Craft Package

3.2.1 Types of De-Stack

There are three different de-stack types for user to select, the user must click the "Check" box to confirm the type of selection:

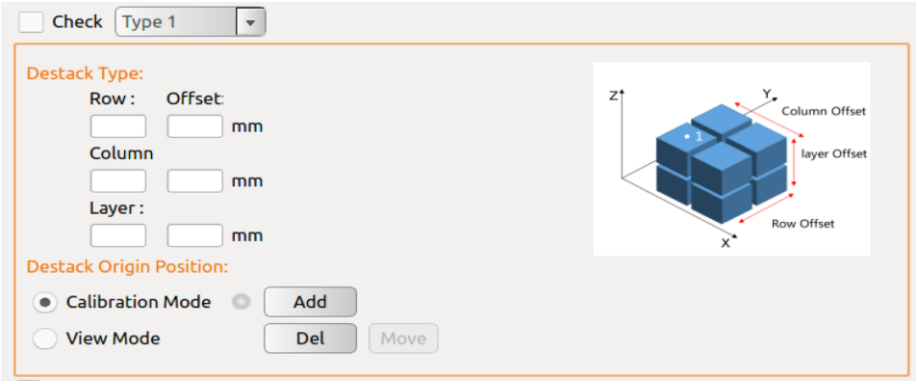

Figure 3.3 "De-Stack" Type 1

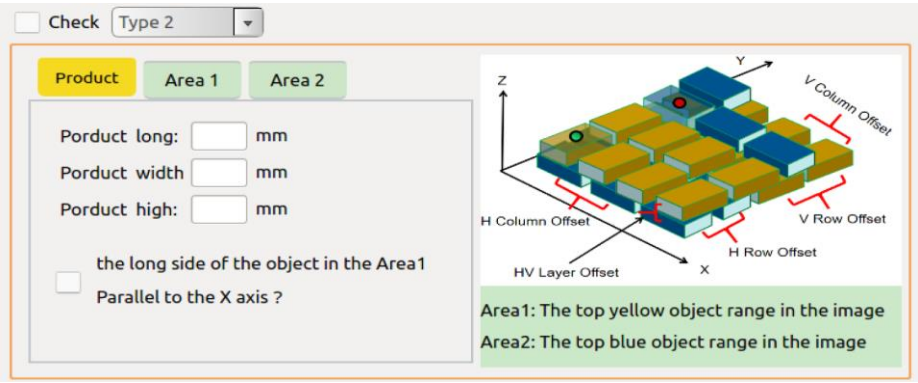

Figure 3.4 "De-Stack" Type 2

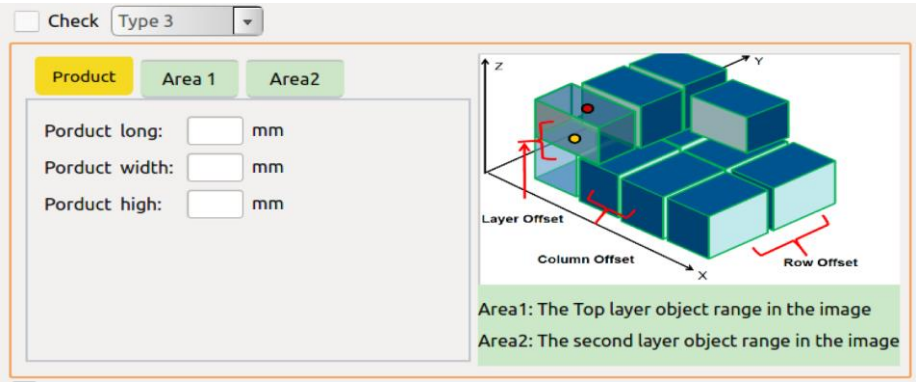

Figure 3.5 "De-Stack" Type 3

3.2.2 Advance Settings

This is the Advance De-stacking parameter setting interface.

The main purpose of this function is to modify the position of a certain waypoint in a certain group of waypoints. The setting parameters include: Select the waypoint group (the same as the saved file name), select the waypoint (named by serial numbers) , row offset value, column offset value, and layer offset value of the current waypoint.

This is based on the row offset value and column offset value of the current waypoint, Layer offset value, etc.

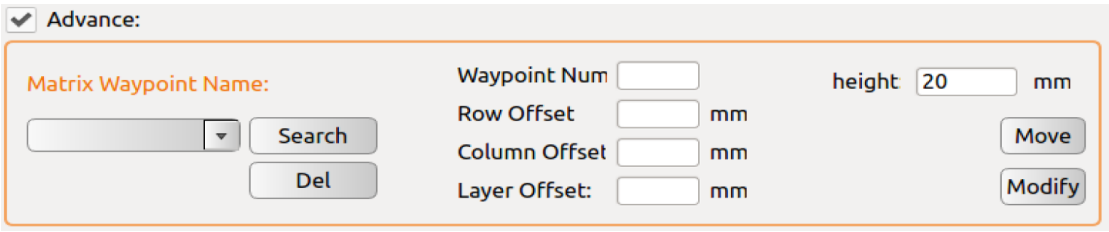

Figure 3.6 Advance Settings of "De-Stack"

NOTE:

We take the diagram in figure 3.3 as an example.

- The X axis of the user coordinate system defined according to the pallet must have **a vertical relationship with the <u>rows</u>** in the palletizing area.
- The Y axis of the user coordinate system defined according to the pallet must have **a vertical relationship with the <u>columns</u>** of the depalletizing area.
- The Z axis must **be perpendicular to the pallet <u>upward</u>**.

The offset of rows, columns, and layers is positive in the positive direction of the Y-axis, X-axis, and Z-axis.

For example, when setting point 1 as the origin, then the row offset value, column offset value, and layer offset value should all be positive.

3.3Stack

This is the Stacking parameter setting interface, in which some basic parameters about removing item out of the pallets will be set:

The row number, column number, layer number, coordinate information of point 1 (shown in the model diagram in the interface) of the depalletizing area, and the heading offset value, column offset value, layer offset value, etc. based on the point 1 coordinate.

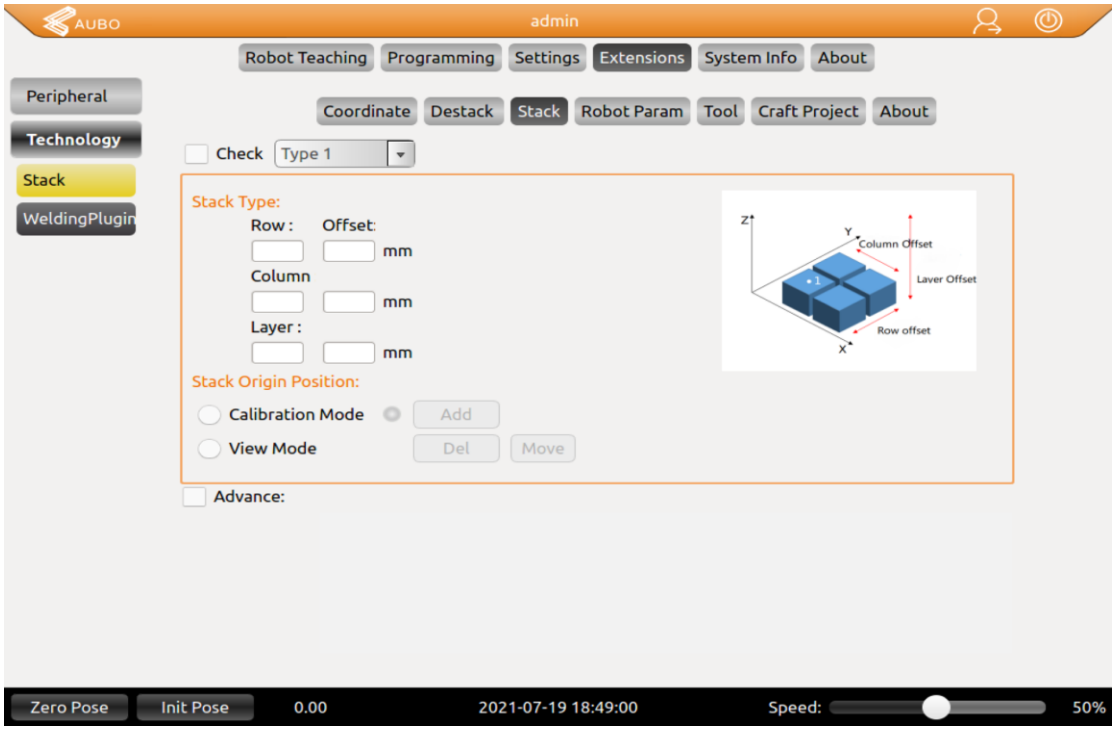

Figure 3.7 "Stack" page of Stack Craft Package

3.3.1 Types of Stack

There are three different stack types for user to select, the user must click the "Check" box to confirm the type of selection:

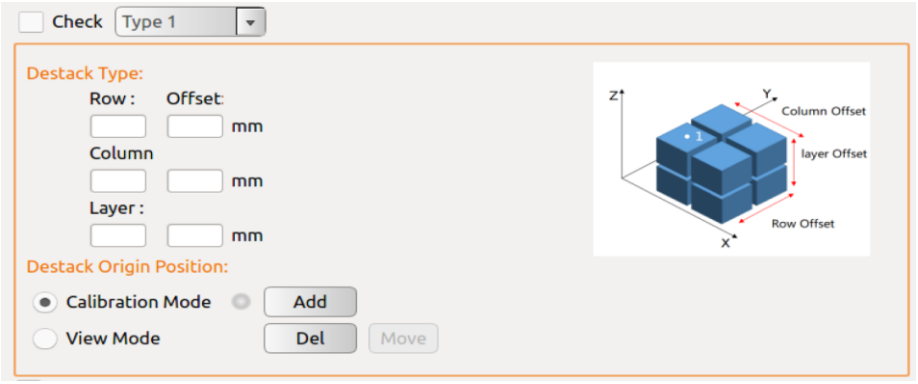

Figure 3.8 "Stack" Type 1

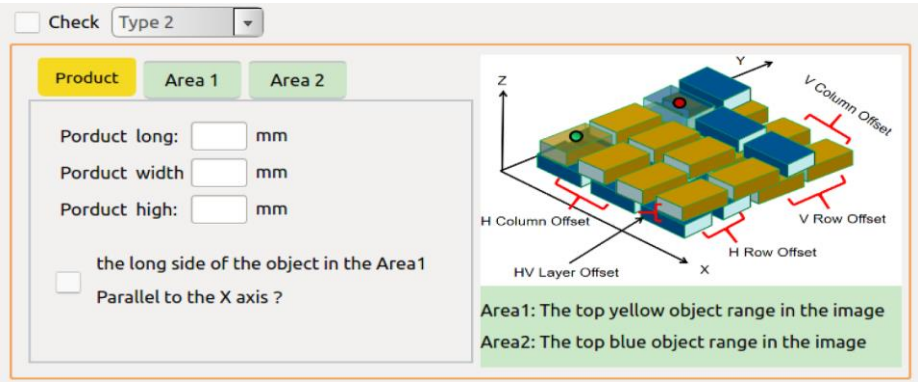

Figure 3.9 "Stack" Type 2

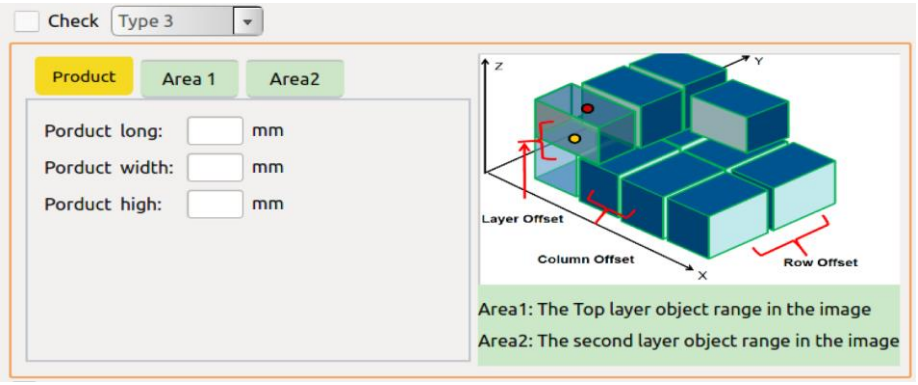

Figure 3.10 "De-Stack" Type 3

3.3.2 Advance Settings

This is the Advance Stacking parameter setting interface.

The main purpose of this function is to modify the position of a certain waypoint in a certain group of waypoints. The setting parameters include: Select the waypoint group (the same as the saved file name), select the waypoint (named by serial numbers), row offset value, column offset value, and layer offset value of the current waypoint.

This is based on the row offset value and column offset value of the current waypoint, Layer offset value, etc.

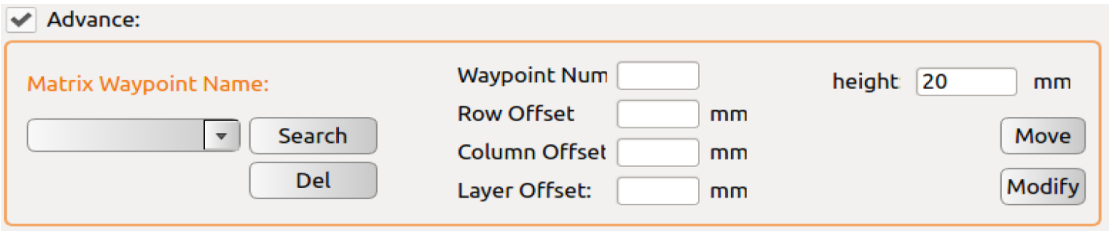

Figure 3.11 Advance Settings of "Stack"

NOTE:

We take the diagram in figure 3.8 as an example.

- The X axis of the user coordinate system defined according to the pallet must have **a vertical relationship with the <u>rows</u>** in the palletizing area.
- The Y axis of the user coordinate system defined according to the pallet must have **a vertical relationship with the <u>columns</u>** of the depalletizing area.
- The Z axis must **be perpendicular to the pallet <u>upward</u>**.

The offset of rows, columns, and layers is positive in the positive direction of the Y-axis, X-axis, and Z-axis.

For example, when setting point 1 as the origin, then the row offset value, column offset value, and layer offset value should all be positive.

3.4 Robot Param

This is the robot parameter and process parameter setting interface.

The interface is divided into two parts, one part is for setting robot parameters: joint motion (move_joint) speed percentage, joint motion (move_joint) acceleration percentage, linear motion (move_line) speed percentage, linear motion (move_line) acceleration percentage, preparation point height, Tool Close time, Tool Open time, and reclaiming direction select.

The other part is the viewing and setting of stacking or de-stacking parameters: the user can view the total number of stacking or de-stacking, current stacking or de-stacking completed number, and set the number to start stacking or de-stacking.

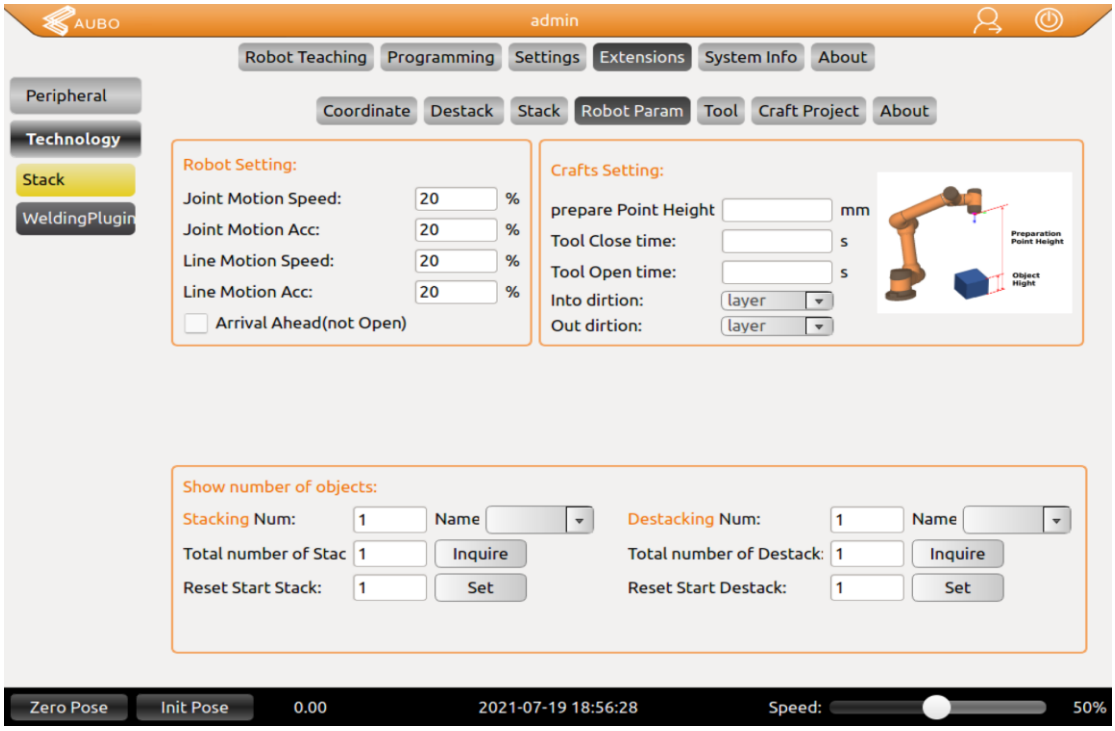

Figure 3.12 Advance Settings of "Stack"

3.5 Tool

This is the stacking or de-stacking tool setting interface.

The user can select Robotiq 2F gripper as the tool, use directly utilize the User IOs or Tool IOs to connect external device and make them as a tool.

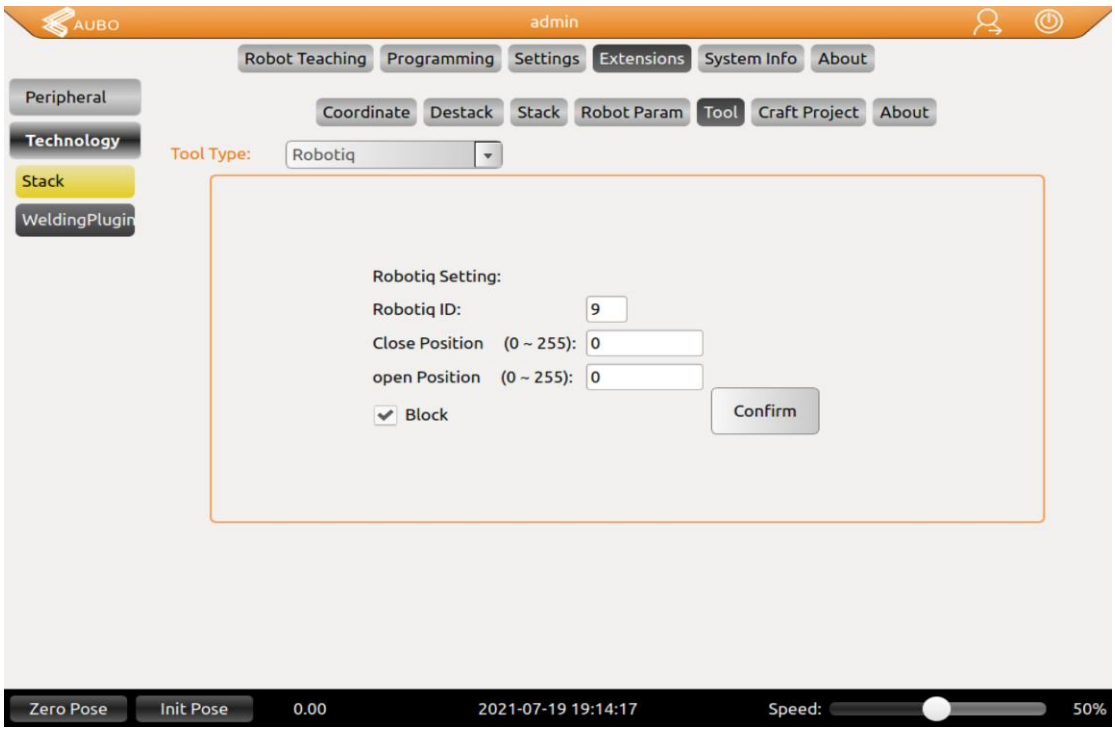

Figure 3.13 Tool Settings

3.5.1 Tool Type - Robotiq

This picture shows the parameter configuration of the robotiq gripper.

Parameters include: RobotiqID, Robotiq closed position, Robotiq open position, whether Robotiq movement is blocked (default blocked).

After setting, click the "Confirm" button to apply the changes.

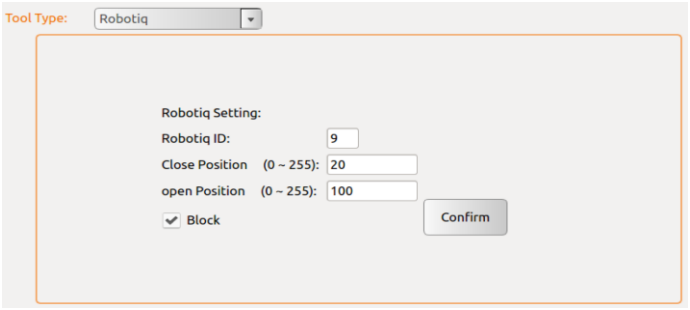

Figure 3.14 Robotiq Settings of "Tool"

3.5.2 Tool Type – User IO Output

This is the user IO output setting interface, which is designed for the gripper that is controlled by digital signal. (Six groups of output ports are provided, DO_02 ~ DO_07).

The user can set certain user DO status when the tool is opened and when the tool is closed. Then click “Confirm” to save the settings.

After the setting is completed, the IO status set by the user can be queried. If the IO setting goes wrong, the user needs to click the “Reset” button and reset the IO status.

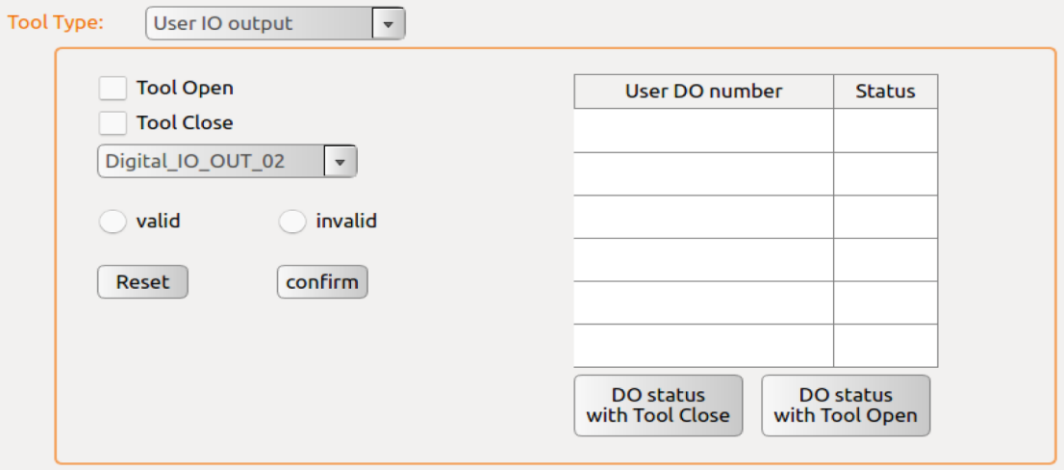

Figure 3.15 User IO Output Settings of “Tool”

3.5.3 Tool Type – Tool IO Output

This is the tool IO output setting interface, (four groups of IO ports are provided, the user should set the Tool IO voltage and the corresponding IO output in "Settings"-"IO Status"-"Tool IO" before use).

The user can set certain user DO status when the tool is opened and when the tool is closed. Then click “Confirm” to save the settings.

After the setting is completed, the IO status set by the user can be queried. If the IO setting goes wrong, the user needs to click the “Reset” button and reset the IO status.

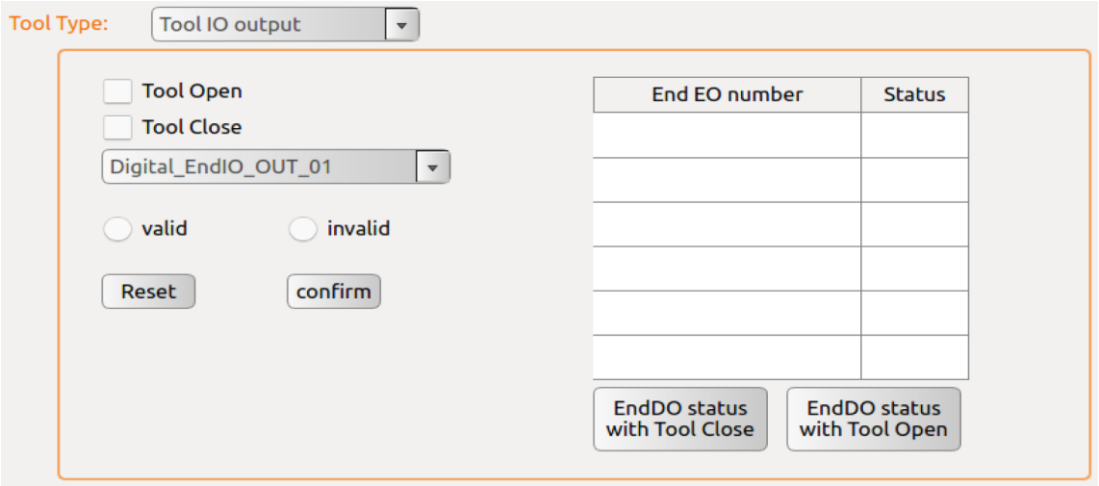

Figure 3.16 Tool IO Output Settings of “Tool”

3.5.4 Tool Type – User IO Input

This is the user IO input setting interface; the user can set certain input ports to detect signal that indicates the state of the gripper. (Six groups of output ports are provided, DI_01 ~ DI_06).

The user can set ports for detecting the state when the tool is opened and the state to when the tool is closed. Then click “Confirm” to save the settings.

After the setting is completed, the IO status set by the user can be queried. If the IO setting goes wrong, the user needs to click the “Reset” button and reset the IO status.

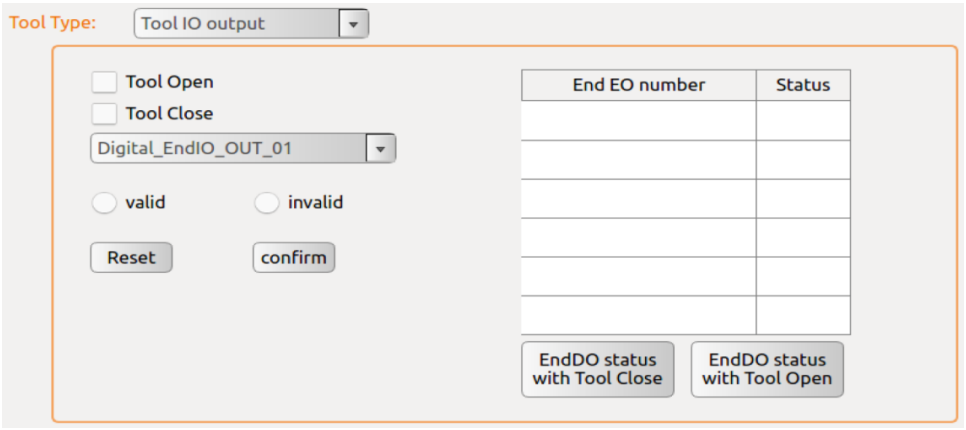

Figure 3.17 User IO Input Settings of “Tool”

3.6 Craft Project

This is the Project Saving and Loading interface. (Figure 3.18)

The user can save and load a craft project in this interface. After clicking “Save” button, a window will pop up and shows “Script Generate Successful”.

NOTE:

The craft project can only be saved at this interface. Even though the user has click many “Confirm” buttons to apply the settings or modifications, they can only be saved after clicking the “Save” button.

Figure 3.18 Craft Project Saving

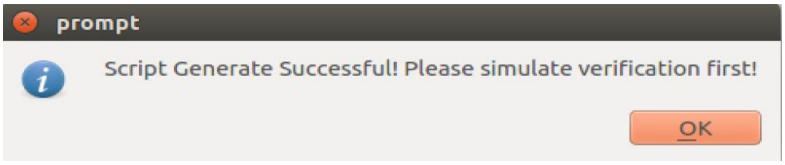

Figure 3.19 Message after clicking the “Save” button

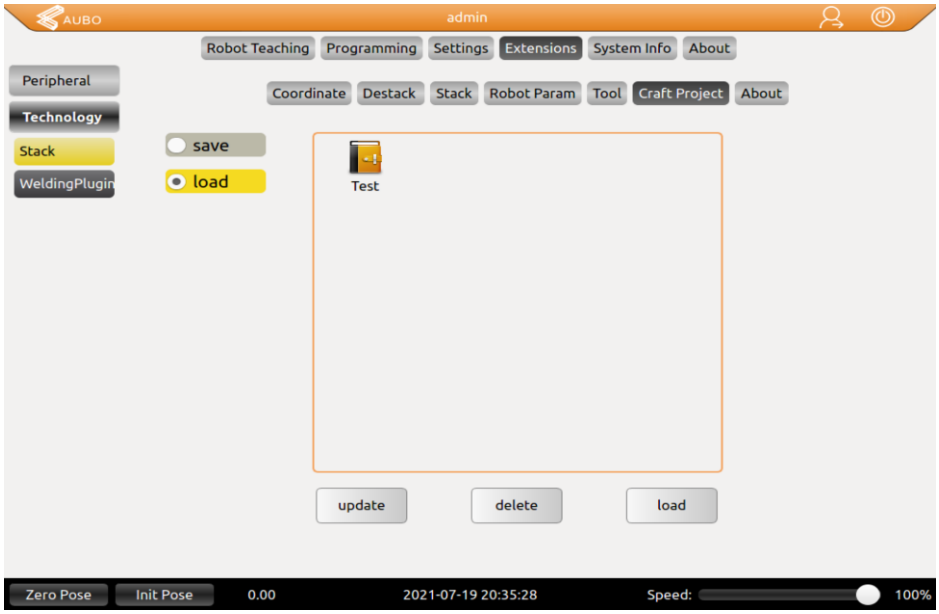

Figure 3.20 Craft Project Loading

Once the "Script Generate Successful", three script files will be generated: project_file_name, project_file_name_Judgment, and project_file_name_Record.

These three scripts are used to: execute stacking/de-stacking, decide whether the stacking/de-stacking is complete and count stacking/de-stacking numbers.

The user can now insert those script files to robot project to control the robot stack or de-stack workpieces.

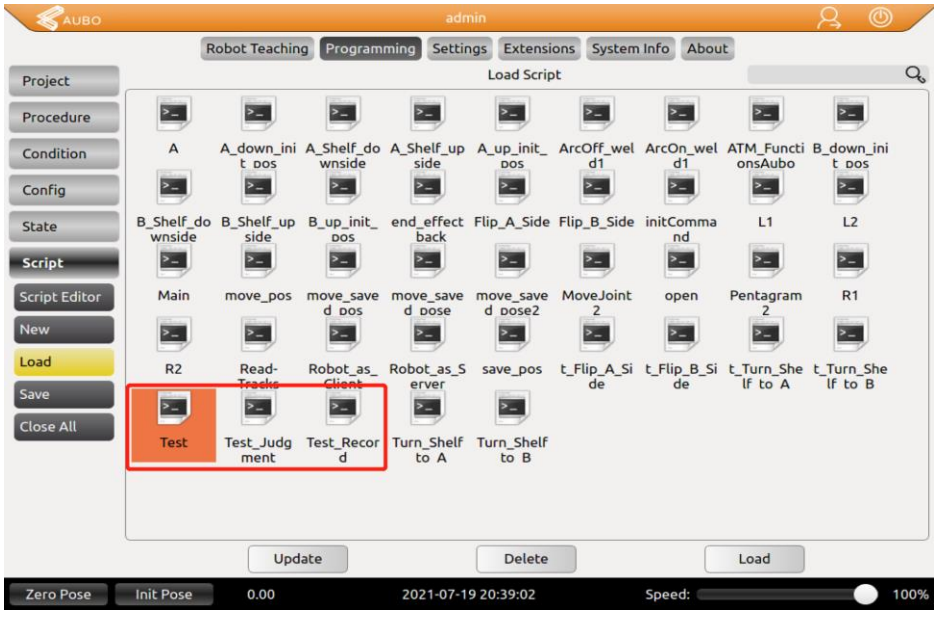

Figure 3.21 Craft Project Generation

4 Example

Target of Stack and De-stack:

Use “Stack” craft package, move the eight wood cubes (De-stack area) to the left stack area, and place them in the order shown in figure 4.1

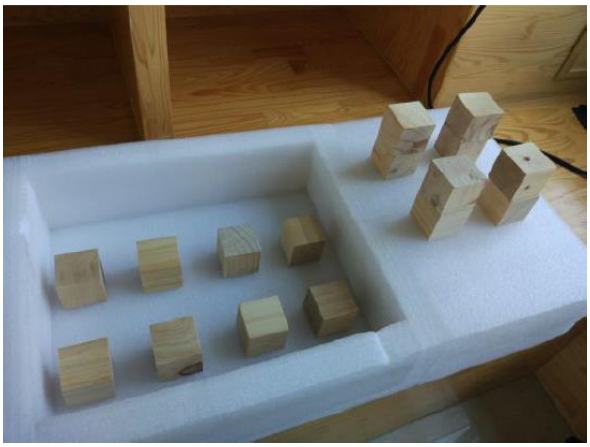

Figure 4.1 Stack – De-stack Example

Step 1.

Stack pallet origin position setup as shown in figure 4.2, if the workpiece pickup location is 1, then the pallet origin position is “origin position 1”; “pick location 2” and “origin position 2” is the same.

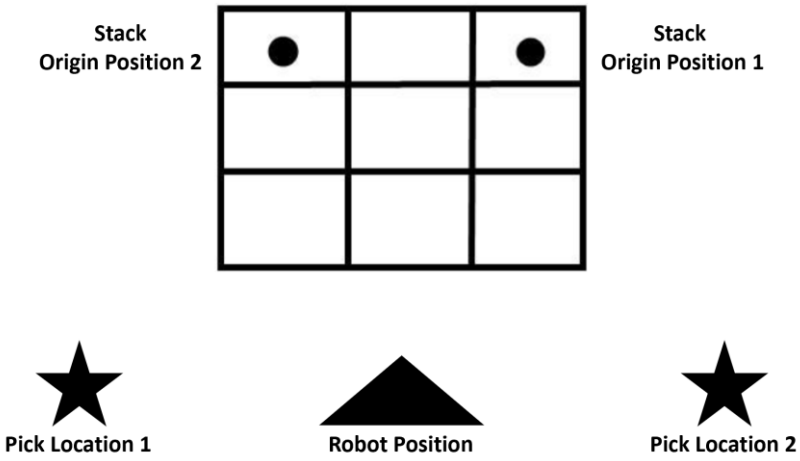

Figure 4.2 Pallet origin position setup

Step 2.

In figure 4.3, you can see the user coordinate system and the rows, column direction. Please be sure that the row direction and the column direction must be vertical toward X axis and Y axis. And the Z axis is pointing upward.

The parameters that are going to determine are positive or negative will all depends on this.

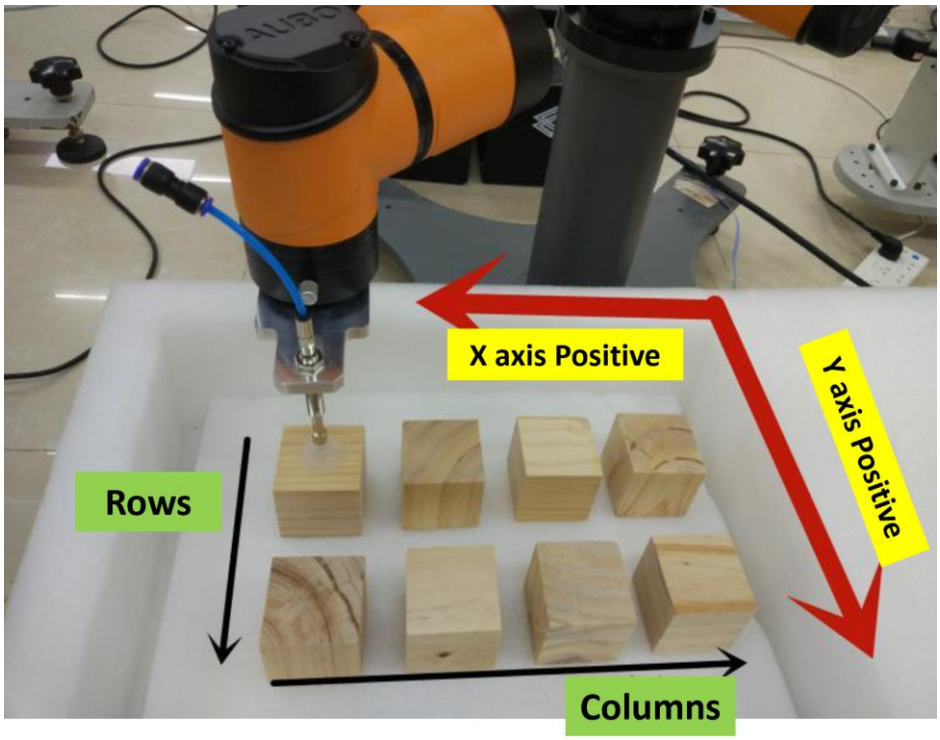

Figure 4.3 User Coordinate System and row, column setup

Step 3.

In figure 4.4, we measured that in the pallet, the row offset is 100mm.

(Please input the offset data according to the exact pallet dimensions)

Figure 4.4 Pallet row offset measurement

Step 4.

In figure 4.5, we measured that in the pallet, the column offset is -70mm. (Because the column offset direction is opposite to the X axis)

(Please input the offset data according to the exact pallet dimensions)

Figure 4.5 Pallet row offset measurement

Step 5.

Go to “Settings” – “Robot” – “Coord Cal” to create a user coordinate system according to the exact pallet.

Then go to “Extensions” – “Technology” – “Stack” – “Coordinate” page, click “search” button then select the desired user coordinate system.

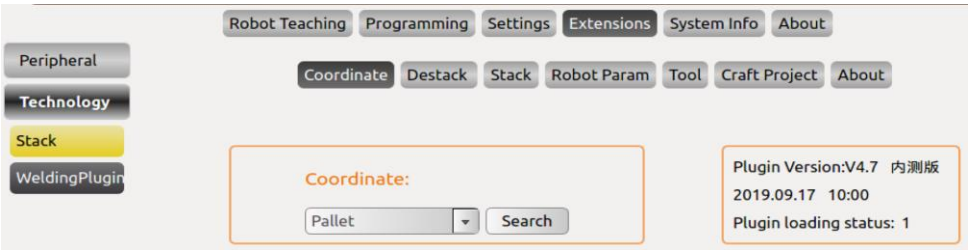

Figure 4.6 User Coordinate System Selection

Step 6.

Go to “Stack” page, click “Type 1”.

Input row, column, layer quantity and offset value. (According to the steps above, here we need to input the data has shown in figure 4.7)

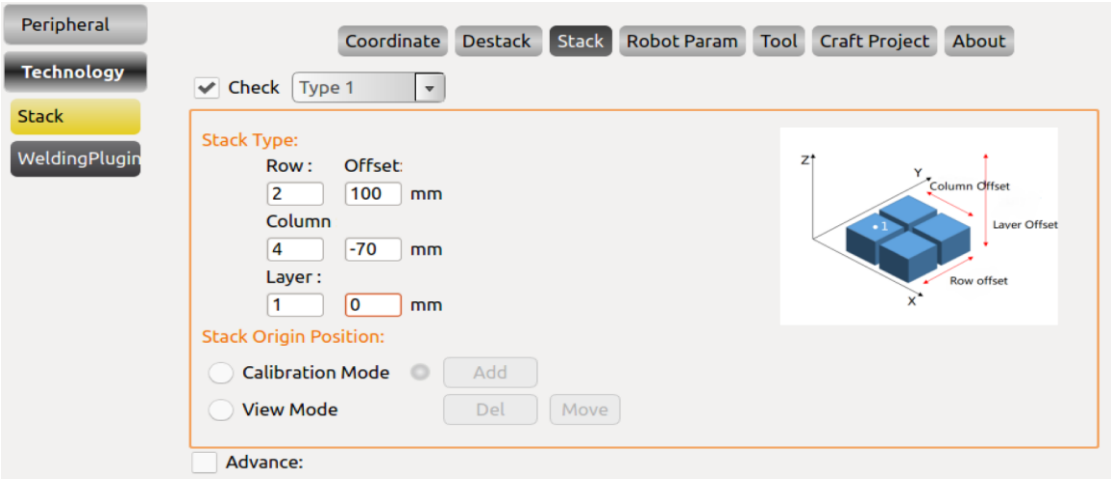

Figure 4.7 Stack parameter input

Step 7.

Click “Calibration Mode”, go to “Robot Teaching” interface, move the robot to the “Origin Position” (mentioned in step 1), then go back and click “Add” to save the origin waypoint. When the indicator on the left turns green, that means the point has been successfully saved.

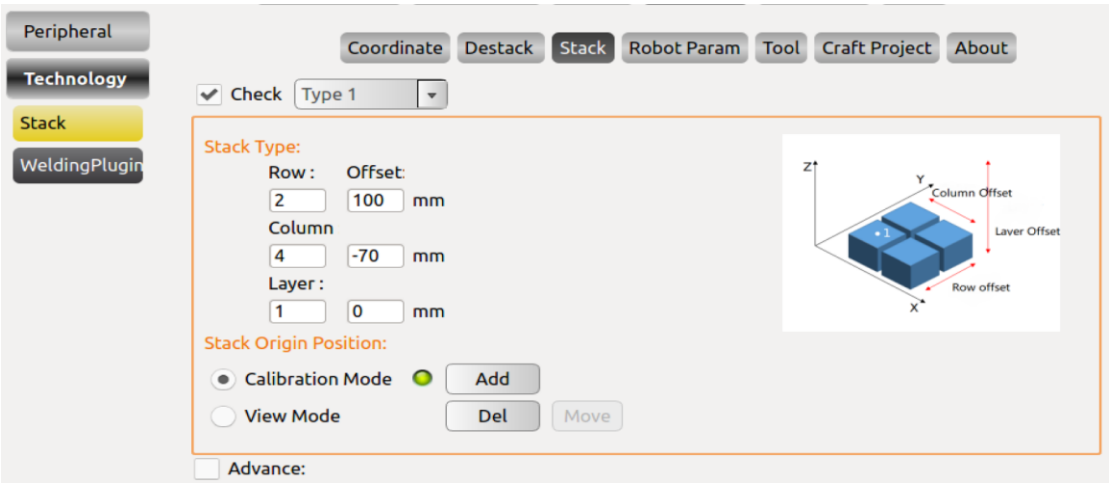

Figure 4.8 Origin Point set up

Step 8.

Go to “Robot Param” page, input robot moving parameters:

Joint Motion Speed: 20%	Prepare Point Height: 50mm
Joint Motion Acc: 20%	Tool Close time: 0.5s
Line Motion Speed: 20%	Tool Open time: 0.5s
Line Motion Acc: 20%	Into direction: Layer
	Out direction: Layer

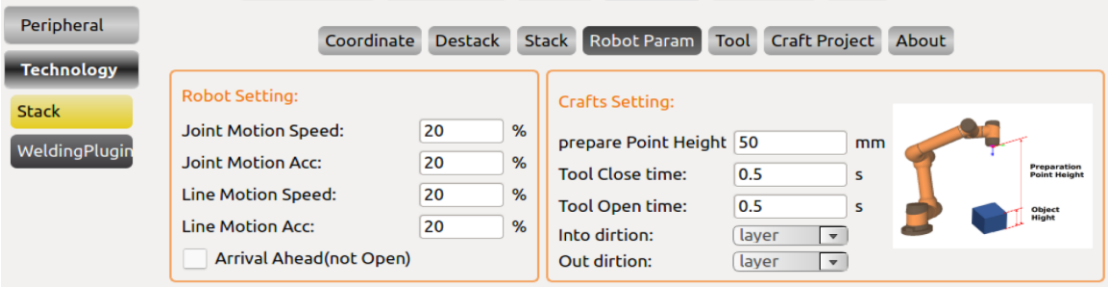

Figure 4.9 Origin Point set up

Step 9.

Go to "Tool" page, select Tool Type to "User IO output", set:

When tool opens - Digital_IO_OUT_02 is valid

When tool close - Digital_IO_OUT_02 is invalid

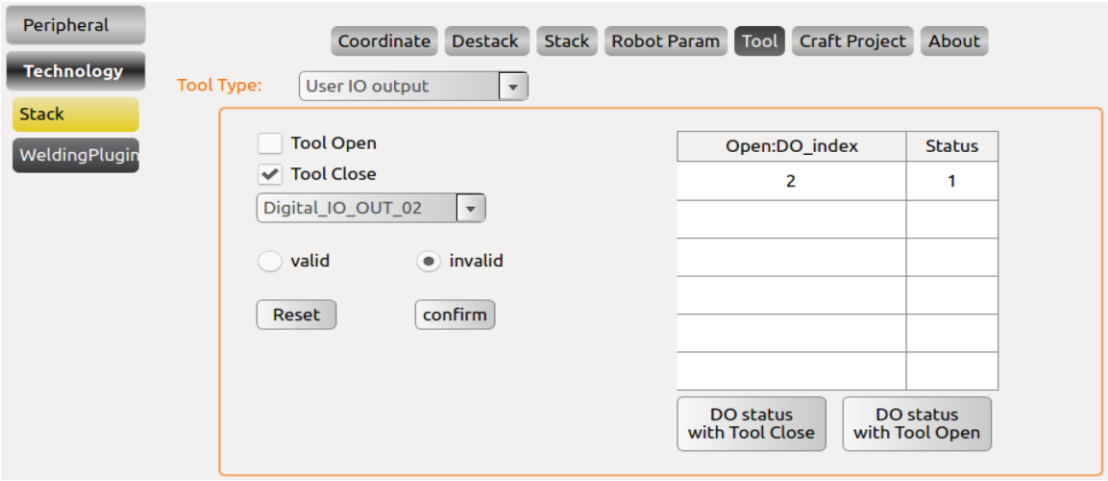

Figure 4.10 Tool Settings at Stack

Step 10.

Go to "Craft Project" page, input file name "Stack" and click "Save" button.

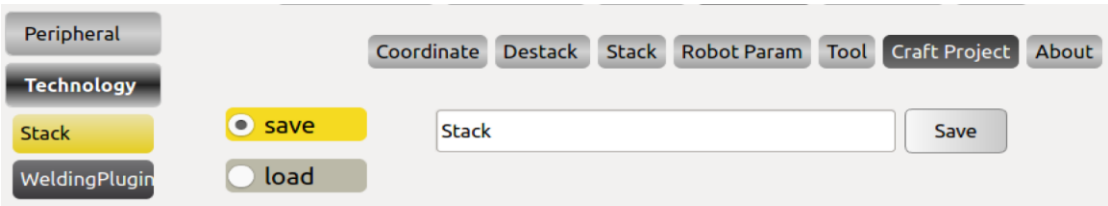

Figure 4.11 Save Stack Craft Project

Step 11.

Go to "Programming" interface, in "Script" – "Load" page, when you click "Update" button, you could find three script files are generated: **Stack**, **Stack_Judgement** and **Stack_Record**.

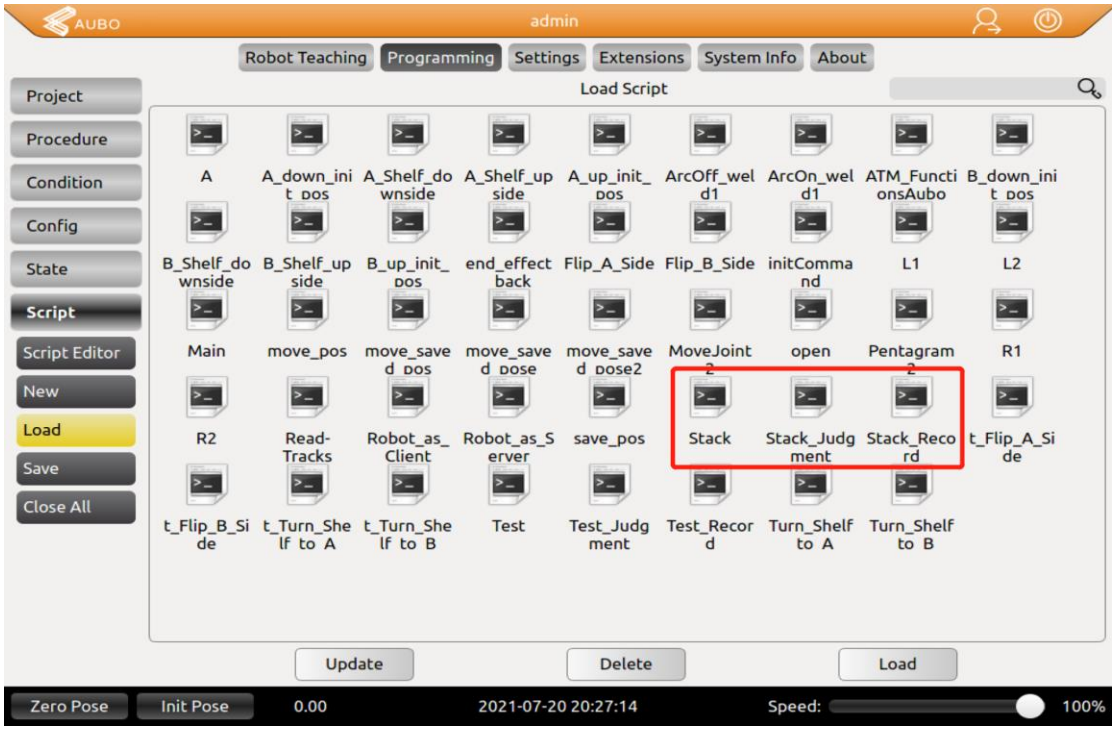

Figure 4.12 Stack Script Generation

Step 12.

De-Stack pallet origin position setup as shown in figure 4.13, if the workpiece pickup location is 1, then the pallet origin position is “origin position 1”; “pick location 2” and “origin position 2” is the same.

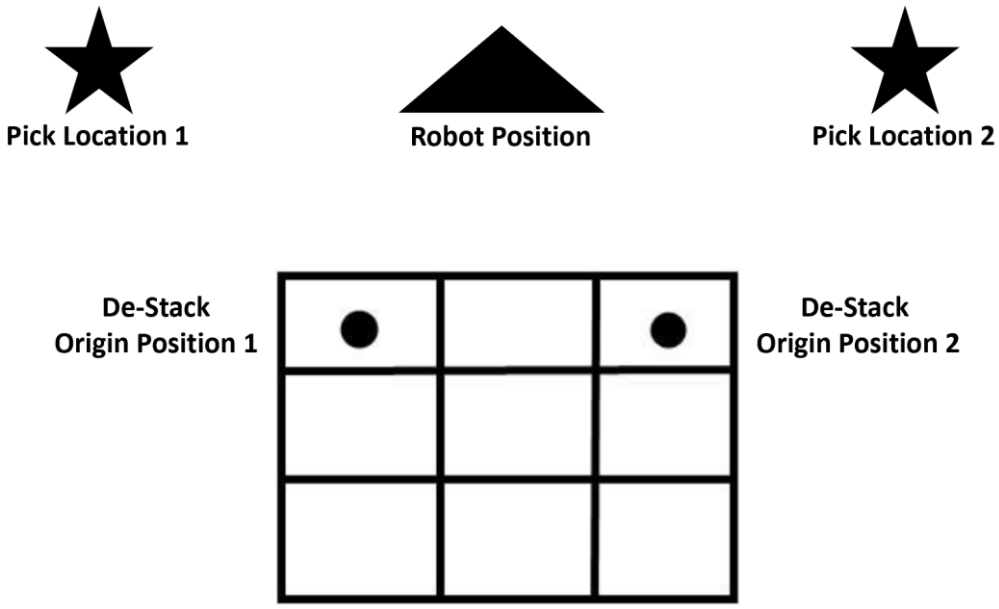

Figure 4.13 De-Stack Pallet origin position setup

Step 13.

In figure 4.14, you can see the user coordinate system and the rows, column direction. Please be sure that the row direction and the column direction must be vertical toward X axis and Y axis. And the Z axis is pointing upward.

The parameters that are going to determine are positive or negative will all depends on this.

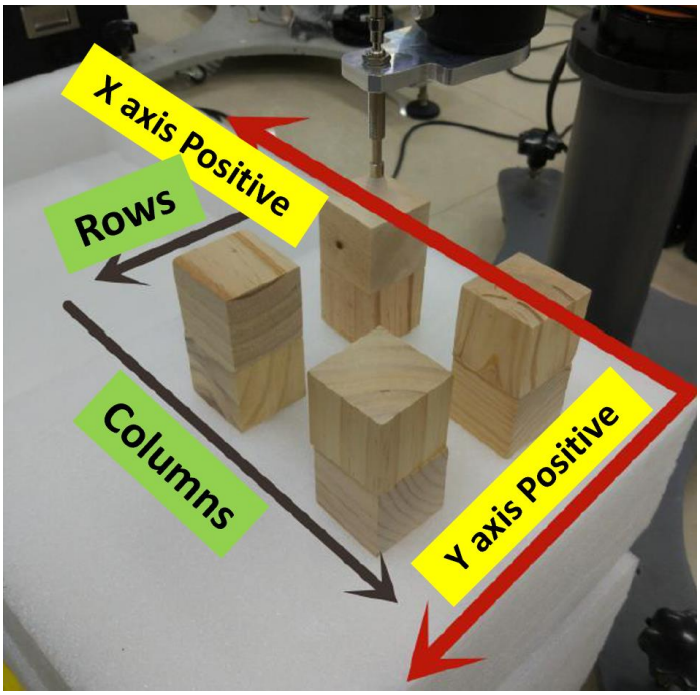

Figure 4.14 User Coordinate System and row, column setup

Step 14.

In figure 4.15, we measured that in the pallet, the row offset is 110mm.

(Please input the offset data according to the exact pallet dimensions)

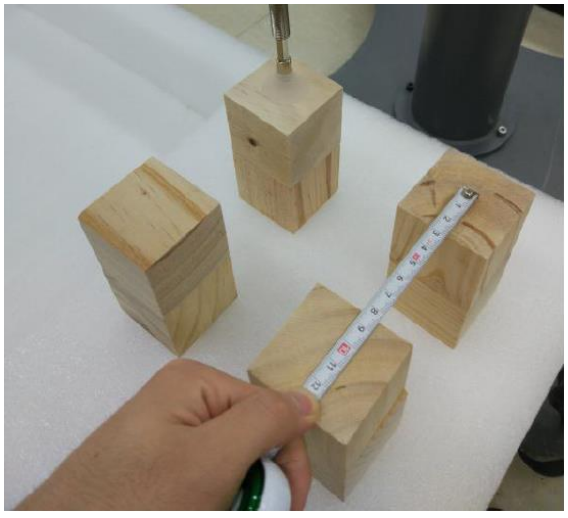

Figure 4.15 Pallet row offset measurement

Step 15.

In figure 4.16, we measured that in the pallet, the column offset is -120mm. (Because the column offset direction is opposite to the X axis)

(Please input the offset data according to the exact pallet dimensions)

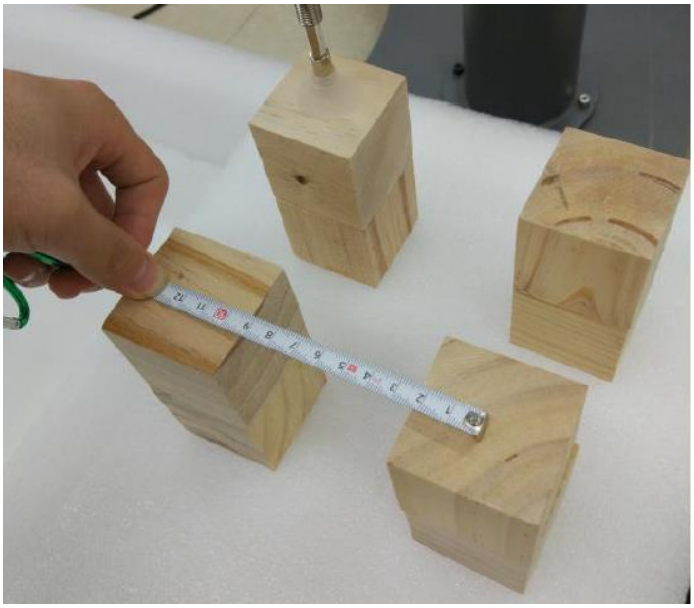

Figure 4.16 Pallet row offset measurement

Step 16.

In figure 4.17, we measured that the in the pallet, the layer offset is 50mm. (Although the Z axis offset direction is opposite to the layer direction, there is no need to add "-", because the system will process it as a negative value by default)

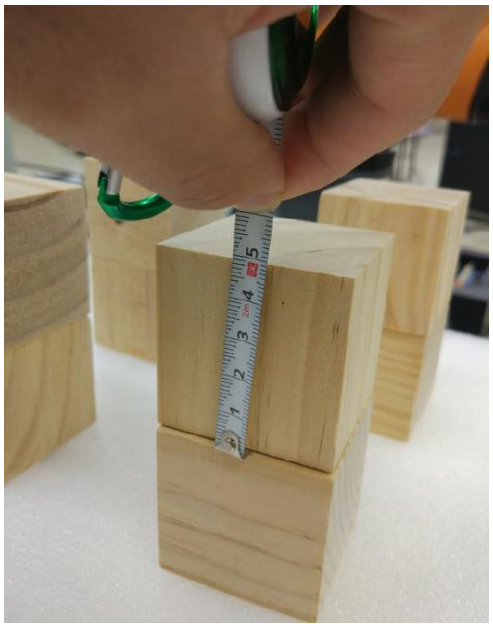

Figure 4.17 Pallet Layer offset measurement

Step 17.

Go to “Settings” – “Robot” – “Coord Cal” to create a user coordinate system according to the exact pallet.

Then go to “Extensions” – “Technology” – “Stack” – “Coordinate” page, click “search” button then select the desired user coordinate system.

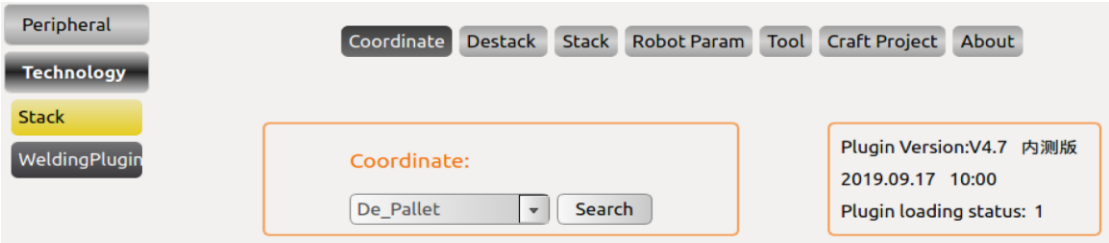

Figure 4.18 User Coordinate System Selection

Step 18.

Go to “Destack” page, click “Type 1”.

Input row, column, layer quantity and offset value. (According to the steps above, here we need to input the data has shown in figure 4.19)

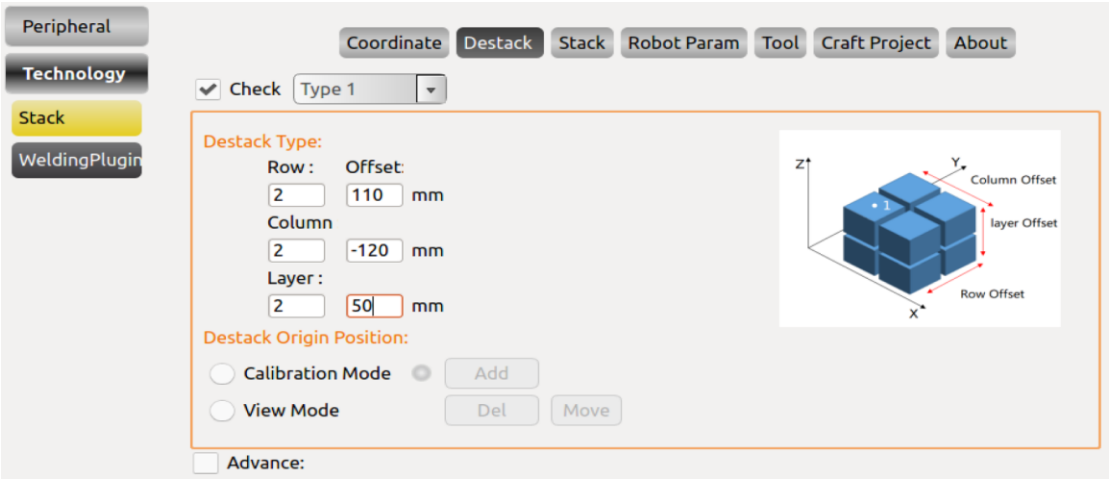

Figure 4.19 Se-Stack parameter input

Step 19.

Click “Calibration Mode”, go to “Robot Teaching” interface, move the robot to the “Origin Position” (mentioned in step 12), then go back and click “Add” to save the origin waypoint. When the indicator on the left turns green, that means the point has been successfully saved.

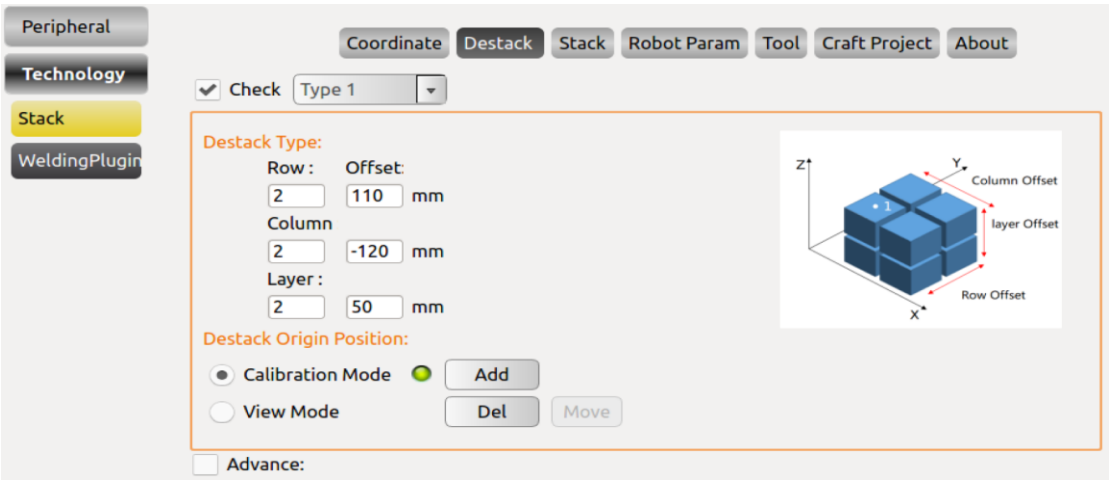

Figure 4.20 De-Stack Origin Point set up

Step 20.

Go to "Robot Param" page, input robot moving parameters:

Joint Motion Speed: 20%	Prepare Point Height: 50mm
Joint Motion Acc: 20%	Tool Close time: 0.5s
Line Motion Speed: 20%	Tool Open time: 0.5s
Line Motion Acc: 20%	Into direction: Layer
	Out direction: Layer

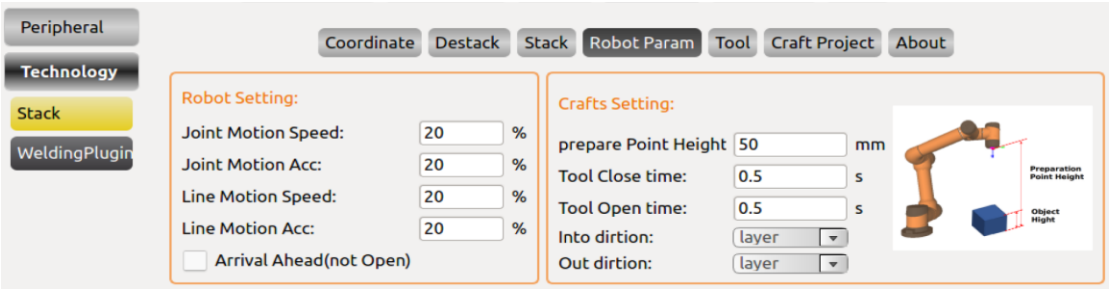

Figure 4.21 Origin Point set up

Step 21.

Go to "Tool" page, select Tool Type to "User IO output", set:

When tool opens - Digital_IO_OUT_02 is valid

When tool close - Digital_IO_OUT_02 is invalid

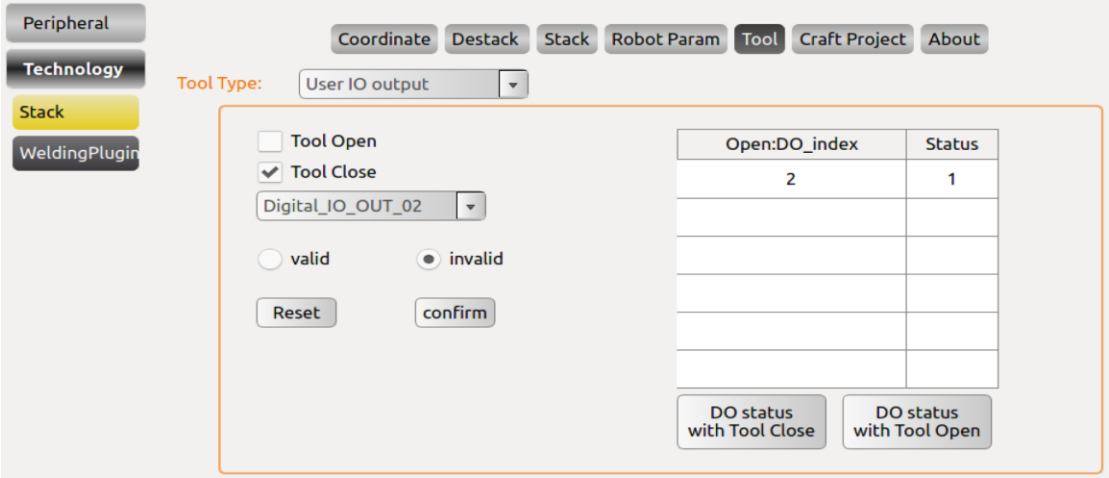

Figure 4.22 Tool Settings at Stack

Step 22.

Go to “Craft Project” page, input file name “Stack” and click “Save” button.

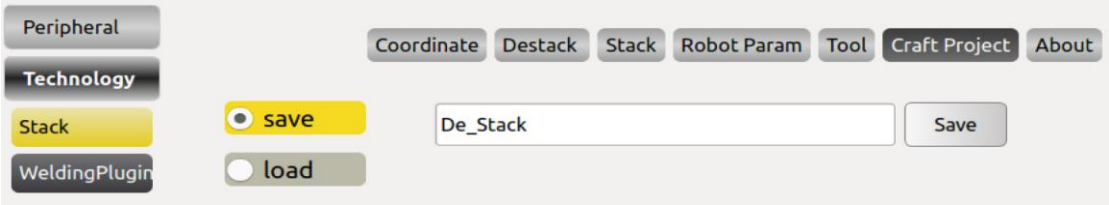

Figure 4.23 Save De-Stack Craft Project

Step 23.

Go to “Programming” interface, in “Script” – “Load” page, when you click “Update” button, you could find three script files are generated: **De_Stack**, **De_Stack_Judgement** and **De_Stack_Record**.

Figure 4.24 De-Stack Script Generation

Step 24.

Go to “Programming” interface, create a new project, add “loop” command, select loop always and confirm this command. Then go to “Advance”, add six “Script” into the loop.

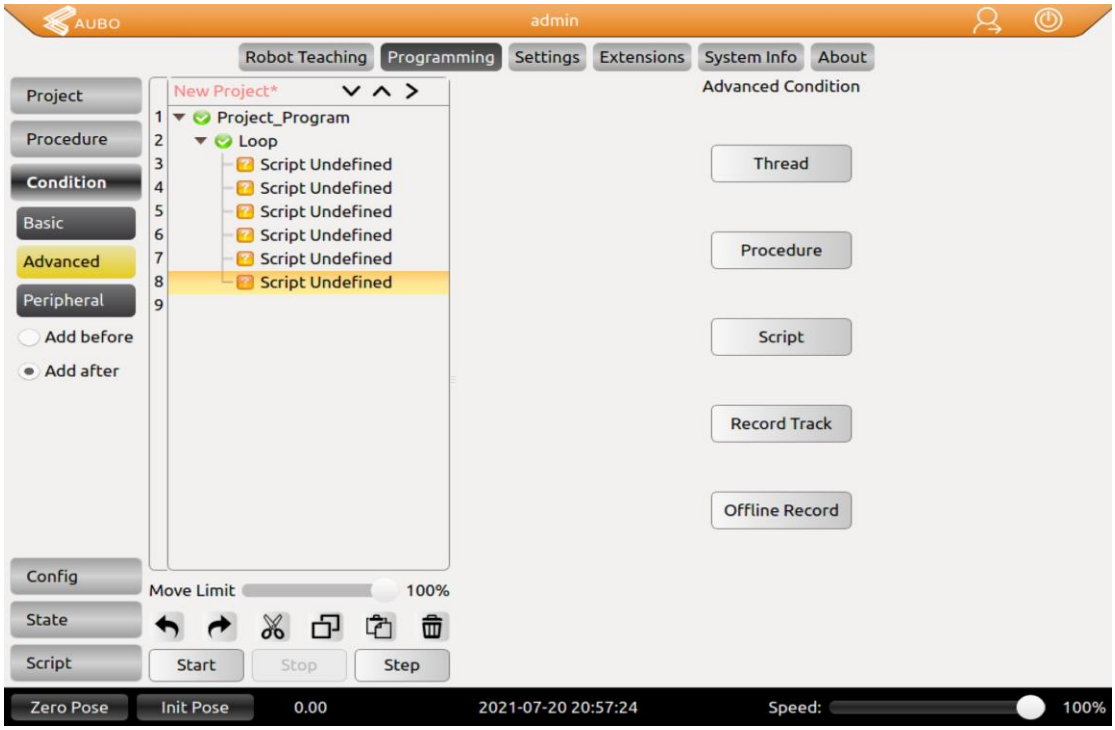

Figure 4.25 Create New Project

Step 25.

Click “Script Undefined” commands, add script files with the order shown in figure 4.26.

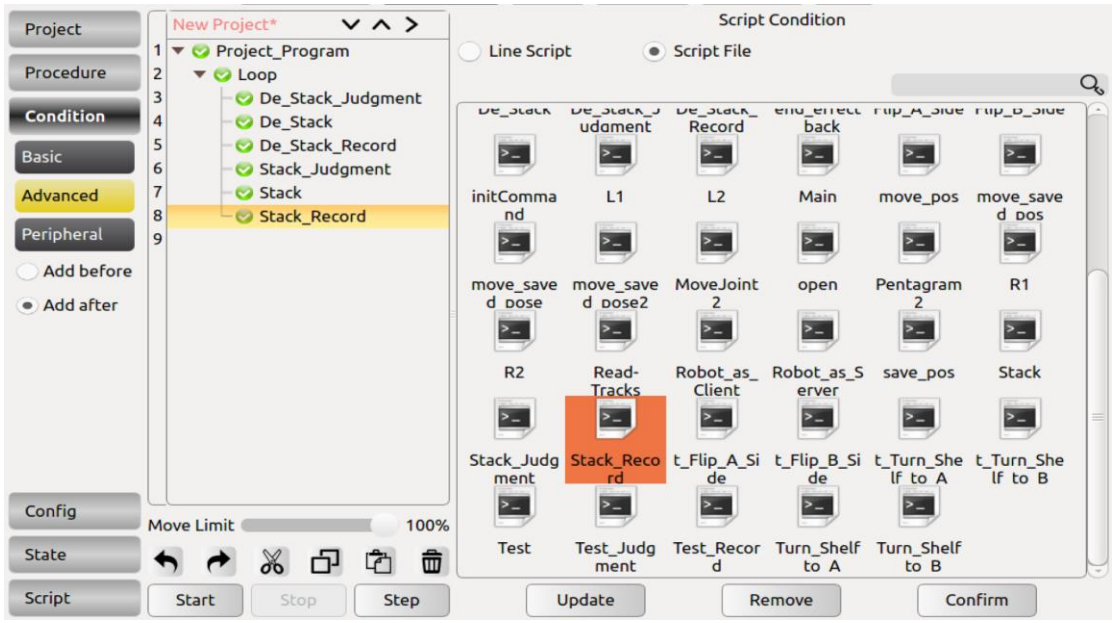

Figure 4.26 Add Script Files

Step 26.

Add a waypoint before the De-stack scripts as the robot's ready point.

Add a waypoint before the Stack scripts as a transition point and ready point before stacking operation begins.

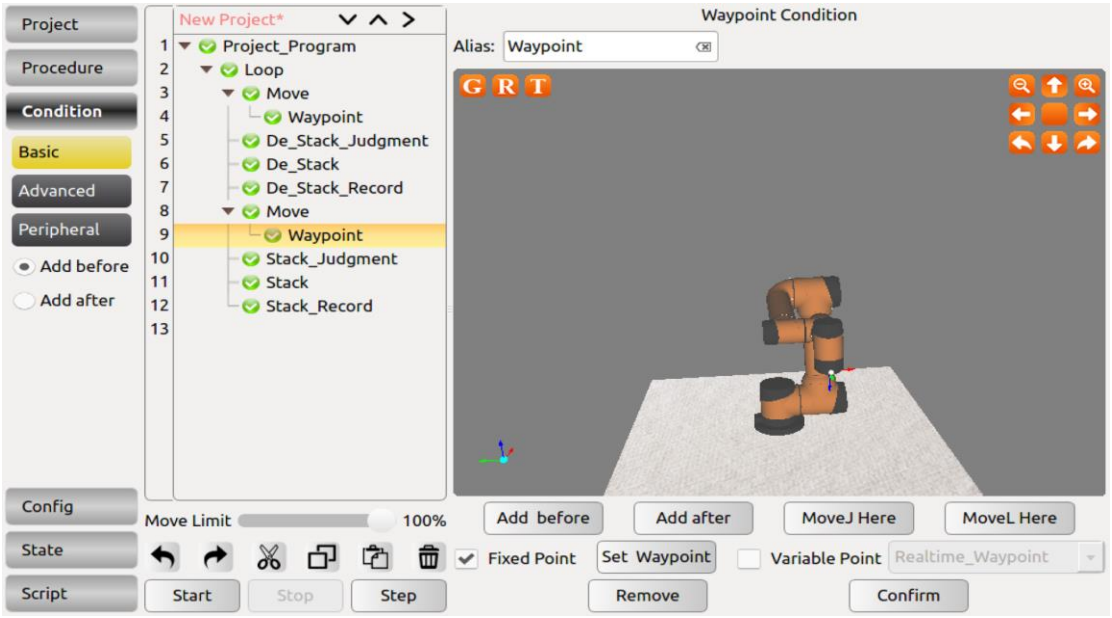

Figure 4.27 Add Waypoints

Step 27.

Save and run this project in 20% Move Limit to test the robot movement.

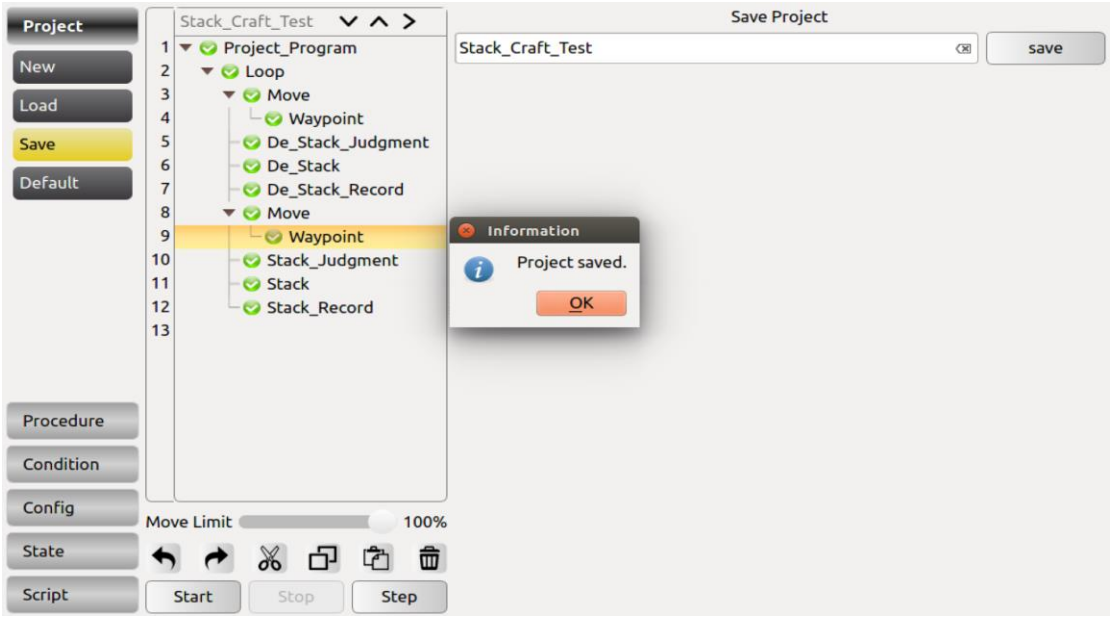

Figure 4.28 Project Save

Step 28.

When the stack and de-stack operation is complete, the robot will stop moving. Then, the control box will output single on DO_00, to indicate that the process has complete. (See figure 4.29)

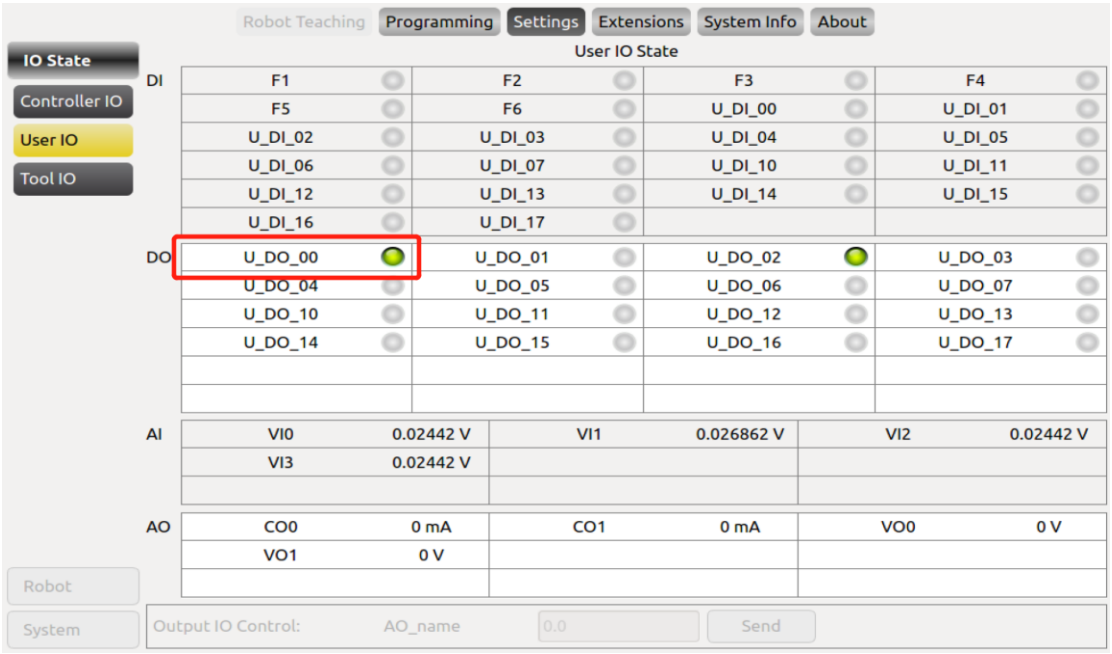

Figure 4.29 Project Complete