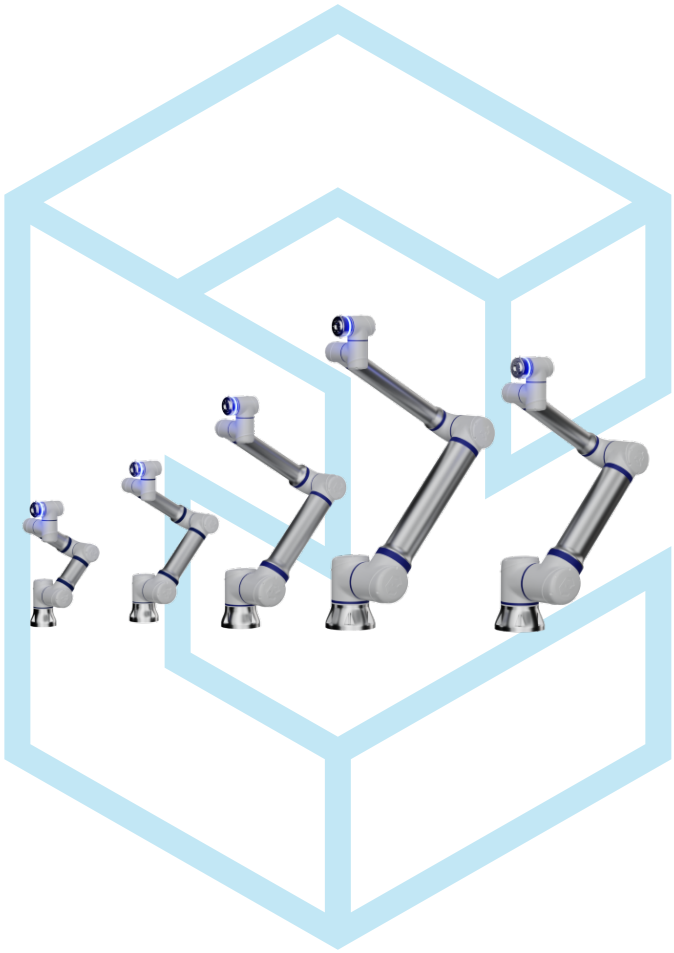
ELITE ROBOTS
艾利特机器人

ELITE ROBOTS CP Series User Manual



Palletizer WorkStation Plugin

ELITE ROBOT Co.,Ltd
2025-08-22
Version: Ver1.7

Please read this manual carefully before use

Please see the chapter of version information in this manual for the product version information and please check the actual product version information carefully before use, as to ensure consistency.

This user manual shall be periodically checked and revised, and the renewed contents will appear in the new version. The contents or information herein is subject to change without prior notice.

ELITE ROBOT Co.,Ltd. shall assume no liability for any errors which will occur in the manual probably.

ELITE ROBOT Co.,Ltd. shall assume no liability for the accident or indirect injury as a result of using this manual and the product mentioned herein.

Please read this manual before installing and using the product.

Please keep this manual so that you can read and use it for reference at any time.

The pictures in the specification shall be used for reference only. The goods received shall prevail.

Table 1. Version Information

Name	Version
Palletizer workStation plugin	Ver1.7
Manual version	Ver1.7

Contents

Chapter 1 Introduction to Palletizer Workstation

REMINDER

- This version of tPalletizer Workstation Plugin supports CS software version **2.13.2**.
- It is **not** compatible with CS software **V2.14** or higher.
- This version of Palletizer Workstation Plugin supports robot models: CS620, CS625, CS520H and CS530H.

1.1 Activate Palletizer Workstation

Power on the teach pendant, then activate Palletizer Workstation Plugin as follows. To access the registration code, please contact ELITE ROBOTS.

1. Tap the icon in the upper-right corner to open the **Settings** screen. Navigate to [System] > [ELITECOs]. Tap the "+" icon in the upper-right corner.

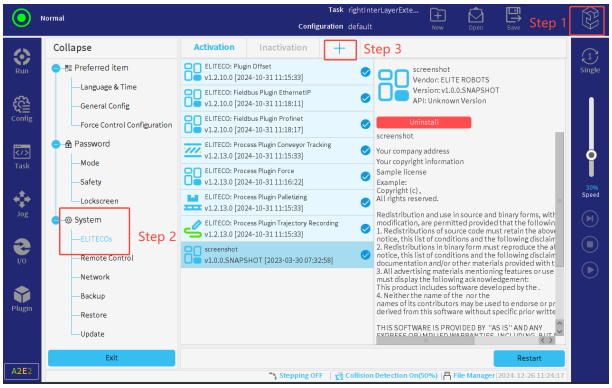


Figure 1-1 : The Plugin Activating Interface

2. In the pop-up window, select the file Palletizer1.7.elico and open it.

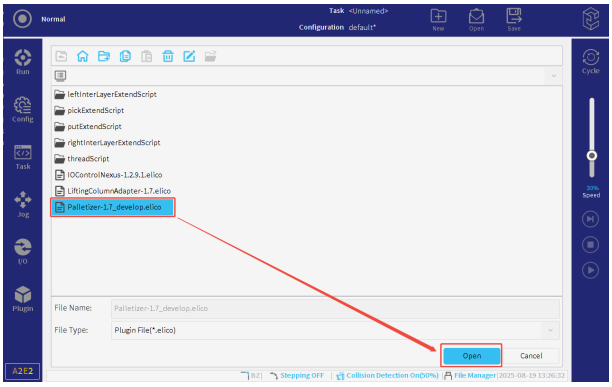


Figure 1-2 : Selecting the Plugins

3. Select [Inactivation], choose the plugin “EliRobot: Palletizer,” then tap [Activation].

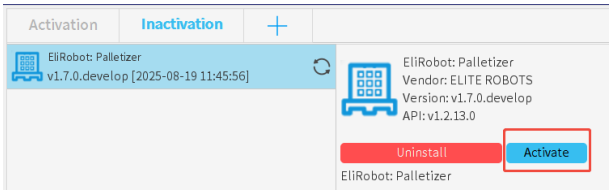


Figure 1-3 : Activate the Plugins

4. Tap the icon on the right side of the machine code. If the file shown in **Figure** 1-5 appears, tap [Save].

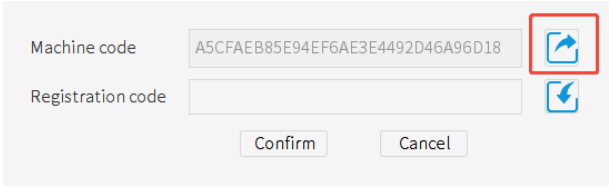


Figure 1-4 : The Logo at the Right Side of Machine Code

Figure 1-5 : The File for Configuring Machine Code

5. Enter the registration code and tap [OK]. A pop-up message confirms successful activation. Restart the teach pendant to enable Palletizer WorkStation.

NOTICE

- The registration code is valid for 1-100 days during the **trial period**.
- The code is valid permanently for the **official version**.

1.2 Enable Palletizer Workstation

After the teach pendant boots up, tap [Plugin] in the lower left corner to open **Palletizer Workstation**.

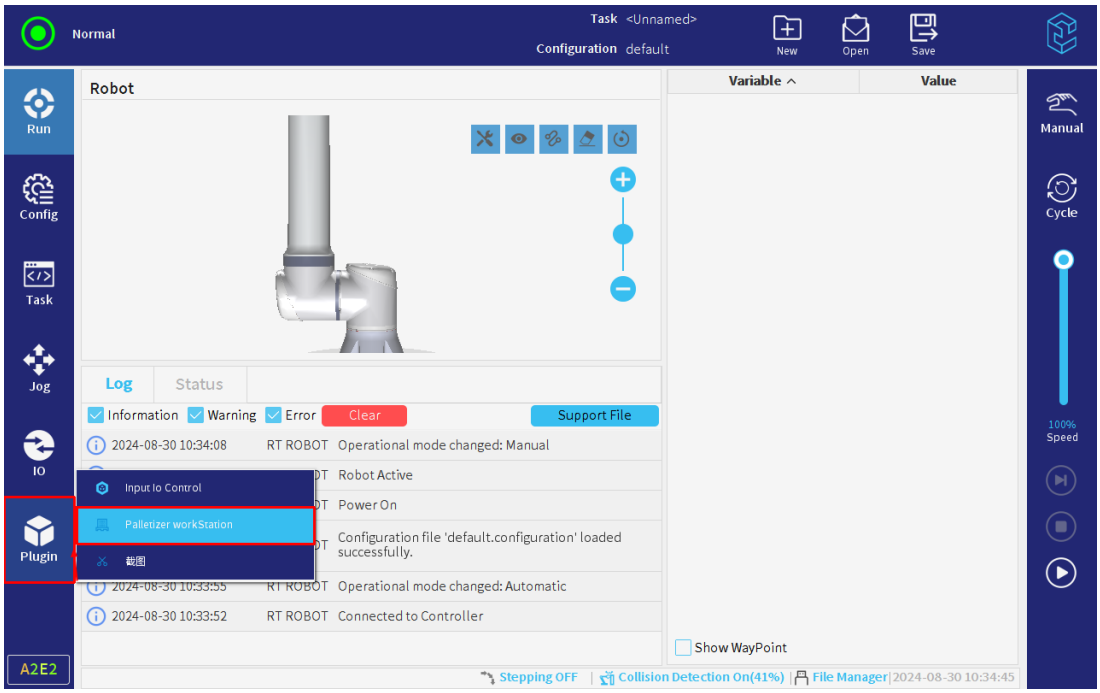


Figure 1-6 : Palletizer Workstation

NOTICE

When accessing Palletizer Workstation Plugin for the first time, bind a type for the workstation before accessing its interface.

1.3 User Role Sign-in

After accessing the Palletizer Workstation interface, tap the icon. The sign-in interface is shown in **Figure** 1-7 , where you can set the user role and password.

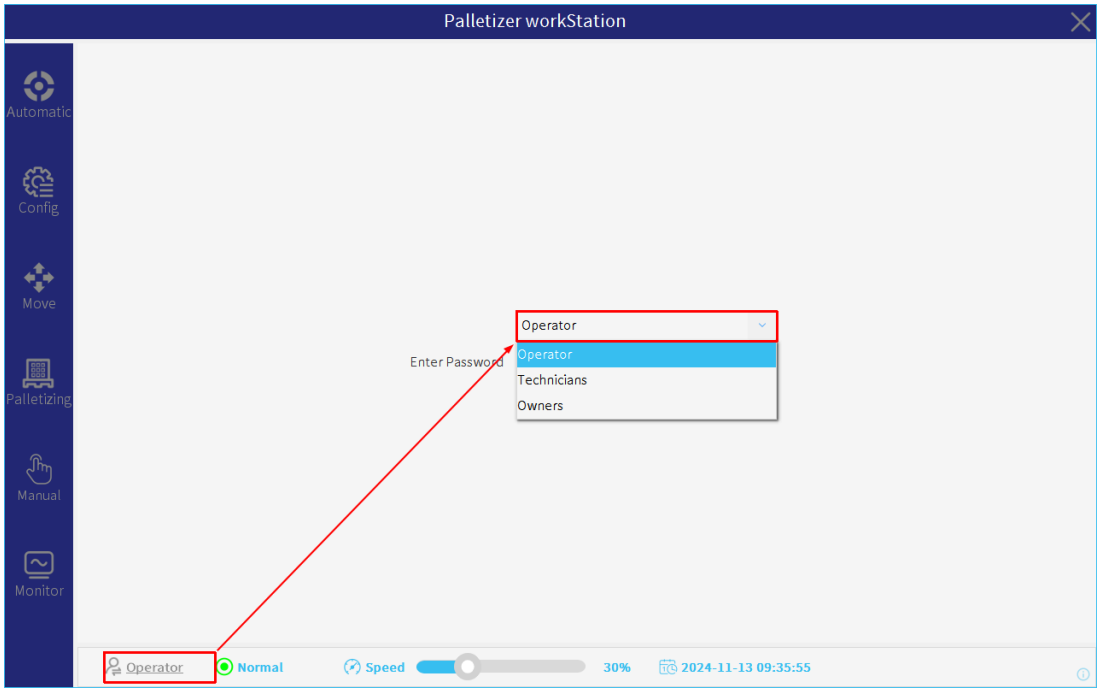


Figure 1-7 : User role sign-in

Owners: have full permissions;

Technicians: can edit palletizing process patterns and certain hardware parameters;

Operators: can select the formulation, enable/disable the daily production task. Configuration changes are not permitted.

Password: Owners and technicians have passwords, which need to be set up during the first sign-in. Operators can sign in without setting a password.

1.4 Initialization

Tap [Power On] to boot the robot, which will release its brakes.

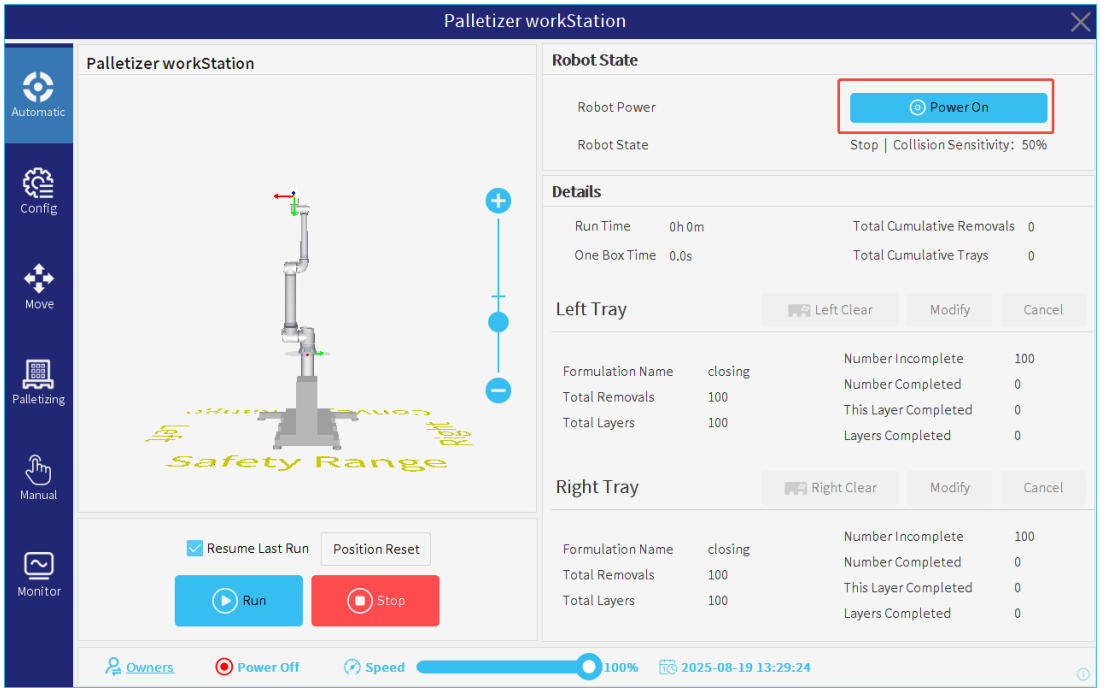


Figure 1-8 : Power on

The robot can be operated after it shows ”Normal” in the status bar, indicating the power-on process has been completed.

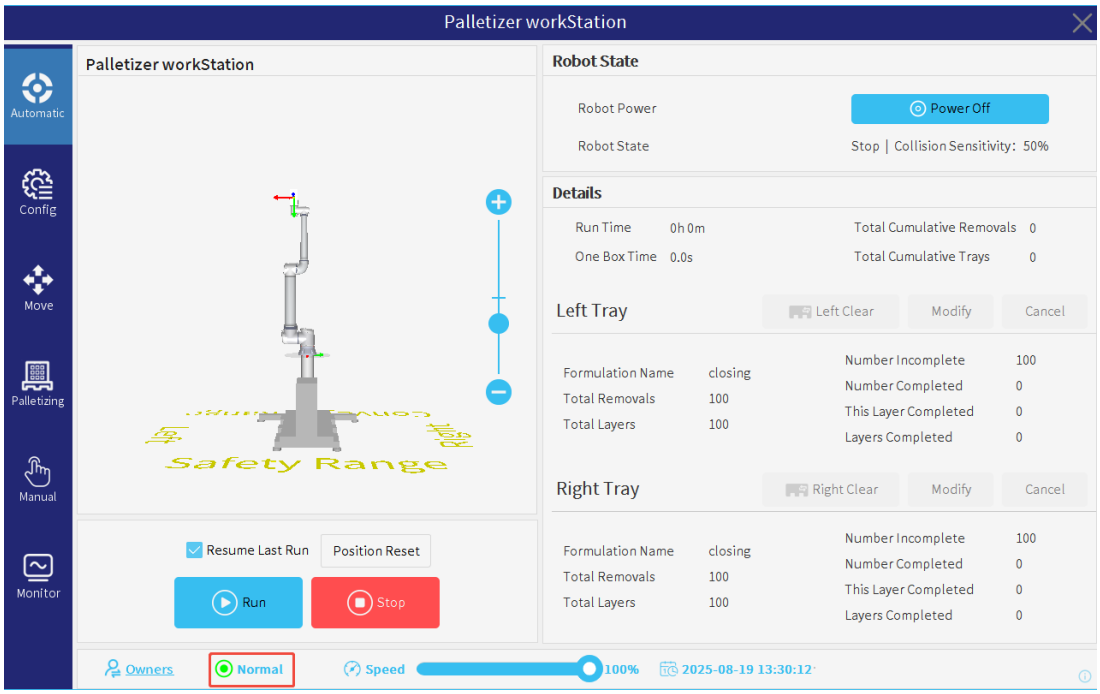


Figure 1-9 : Normal

1.5 Brief Description of the Process

REMINDER

Please enable the collision detection before configuring the palletizer workstation and running the formulation.

Steps for Configuring Palletizer Workstation:

① Configure hardware: pick tool, lifting, and optional hardware;

② Configure general settings: pick position, parameters compensate, palletizing area calibration, sensor digital input signal, origin, optional, and extend;

③ Create a formulation;

④ Select a formulation;

⑤ Run the formulation.

NOTICE

1. The configurations in black are required for the use of the Palletizer Workstation; failure to configure them may affect operation.
2. The configurations in blue are factory settings. Adjust them if the Palletizer Workstation position changes or the hardware is replaced.

After configuring Palletizer Workstation, select a formulation and tap [Automatic] > [Run]. Then the robot will execute the following steps for palletizing, covering both left and right palletizing:

① Reset;

② The robot awaits the signal from the conveyor sensor, indicating the arrival of the box at the pick position;

③ The robot picks up a box and the order to start palletizing left or right need to be selected;

④ After completing one side, it proceeds to palletize the other side;

⑤ Manually remove the fully palletized tray from one side and replace it with a new tray;

⑥ Clear the tray. The robot then resumes from the ④ step and work in a cycle.

1.6 Indicator and Alarm

Indicators and buzzers are integrated above the teach pendant bracket, which display differently during the operation of the robot. For more details, refer to the table below:

Status	Explanation
Left indicator: yellow	Left tray is waiting.
Left indicator: green	The robot is palletizing the left side.
Left indicator: yellow + Left buzzer: 1-second intervals	Left side completed. Clear the tray and the buzzer stops beeping.
Left indicator: red + Left buzzer: 1-second intervals	The Palletizer Workstation is in warning mode. For example, there are objects detected by the radar resulting in deceleration.
Left indicator: red + Left buzzer: continuous	The Palletizer Workstation is in a fault mode.
Right indicator: yellow	Right tray is waiting.
Right indicator: green	The robot is palletizing the right side.
Right indicator: yellow + Right buzzer: 1-second intervals	Right side completed. Clear the tray and the buzzer stops beeping.
Right indicator: red + Right buzzer: 1-second intervals	The Palletizer Workstation is in warning mode. For example, there are objects detected by the radar resulting in deceleration.

Status	Explanation
Right indicator: red + Right buzzer: continuous	The Palletizer Workstation is in a fault mode.
Left indicator & Right indicator: red	The Palletizer Workstation is in an alarm state.

Chapter 2 Introduction to Palletizer Workstation Interface

This chapter introduces the operations of Palletizer Workstation Plugin.

2.1 Automatic Run Tab

When accessing the Palletizer Workstation plugin for the first time, the workstation type needs to be bound. Then **Automatic** interface displays the robot's current pose, status, runtime details, and a status bar.

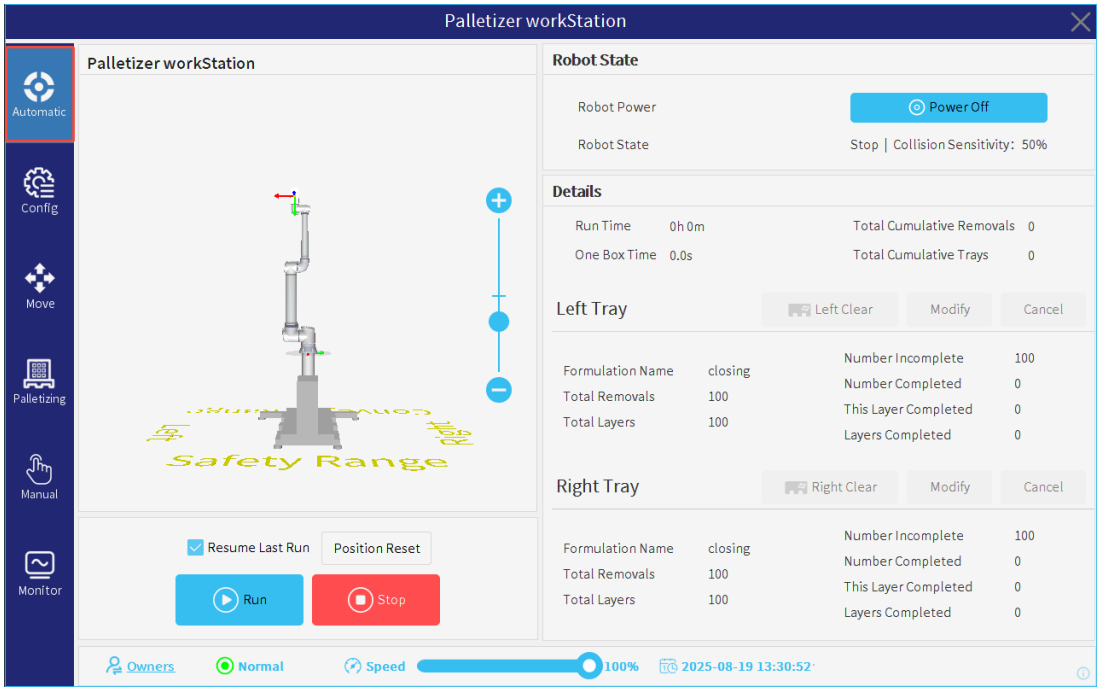


Figure 2-1 : Automatic Run

- **Resume Last Run:** After stopping the current task, tap [Run] again to continue palletizing. If unchecked, tapping [Run] restarts the task from the first box of the first layer.
- **Position Reset:** For the fixed pedestal, tap to move the robot back above the pick position. For the lifting column, tap to reset both the column and pick tool; the column then descends to zero position and the pick tool stops.
- **Run/Pause/Pursue:** to run/pause/pursue the current selected palletizing task;
- **Stop:** to stop running the current formulation.

NOTICE

Upon running, the system will trigger the safety check mechanism. If it detects that parameters pertaining to the current formulation may cause the left and right side pallets to exceed the maximum height and there might be a risk of collision, a warning box will pop up. Since it is only a precautionary safety warning, please make a judgment according to the actual situation. If the risk of collision is confirmed, please adjust it in time.

Robot State

- **Robot Power:** tap [Power On] button to boot up the robot, which will release its brakes. The robot can be operated once "Normal" is presented in the status bar below after powering it on;
- **Robot State:** to show the running status of the current task and the collision sensitivity.

Details

- **Run Time:** the duration of the current task;
- **Time per Box:**the duration to place a single box;
- **Total Cumulative Removals:** the cumulative times of the current removal task;
- **Total Cumulative Trays:** the total cumulative number of the current trays.

Left Tray & Right Tray

- **Left/Right Tray Clear:** to perform the zero operation after changing the new tray;
- **Modify:** to modify this layer completed and layers completed;
- **Save:** to save incomplete layers and completed layers.
- **Cancel:** to cancel the current editing;
- **Formulation Name:** the current running formulation name;
- **Total Removals:** the current formulation's total number of removals;
- **Total Layers:** the current formulation's total number of layers;
- **Number Incomplete:** the number of conveying operations not yet performed;
- **Number Completed:** the number of completed conveying operations;
- **This Layer Completed:** the number of the times of conveying on the current

layer; tap [Modify] to edit it;
- **Layers Completed:** the number of layers that has been palletized; tap [Modify] to edit it.

Status Bar

- : to change the user role and set password in the user role sign-in interface;
- : to show the robot state;
- : to show the current running speed of the robot, which can be adjusted in the formulation. It is recommended to use low speed for the first time to configure a formulation;
- : to show the date and time.

2.2 Configuration Tab

Tap [Config] to access its interface, which consists of workstation binding and settings for general, hardware, and safety.

2.2.1 General

2.2.1.1 Pick Position

Navigate to [config] > [General] > [Pick Position]. Pick positon setting allows determining the origin position, which is one corner position of the box after it reaches the end of the conveyor, as well as the positional relationship between the suction cup and the conveyor, thus determining the pick position. Before proceeding the following steps, these checks are required to be performed firstly:

- The positions of the robot and conveyor are fixed;
- The suction cup is configured.

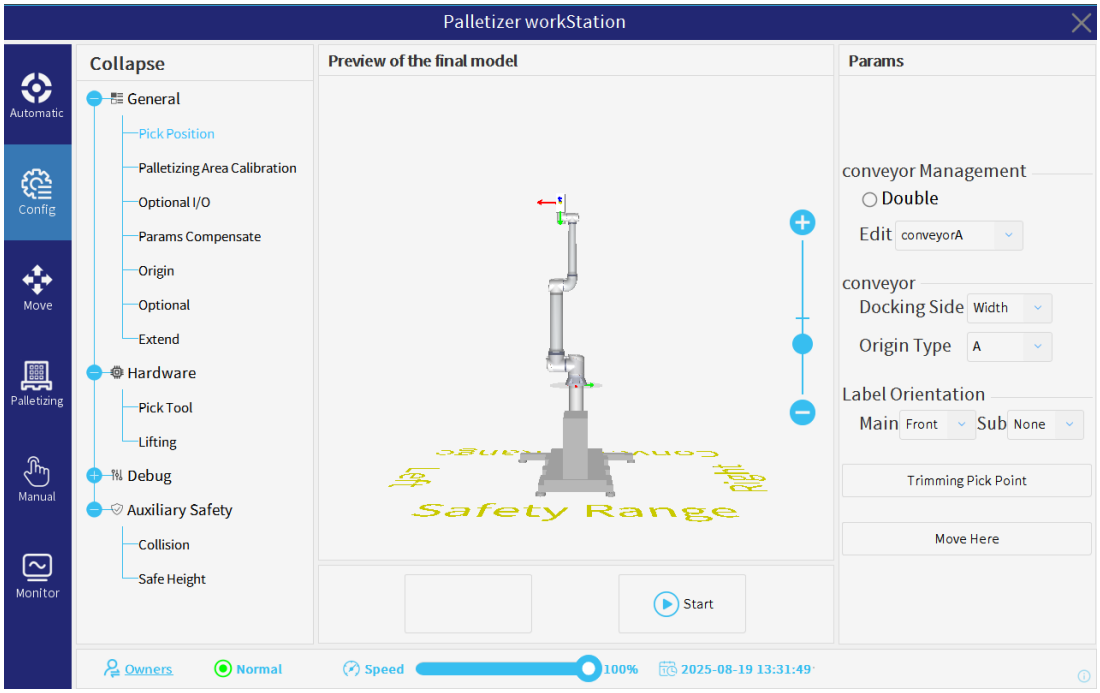


Figure 2-2 : Pick Position

Menu Options

1. **Number of Conveyor Lines**
   - Set the number of conveyor lines as required. Tap [Double] and choose Conveyor A/B in the drop-down box to configure its parameters. Tap it again to disable double conveyor lines.
   - Set the parameters of **Docking Side** and **Origin Type** of the conveyor line.

2. **Label Orientation:** to configure label types and their orientations.
   - If two labels are needed, set the orientation for the primary and secondary labels in the [Label Orientation] option. The main label is red and the secondary one as a green square. Their orientations cannot be the same.
   - If the orientation of either label is set as none, then there is only one label by default.

3. Tap [Trimming Pick Point], and then set the relevant parameters before tapping [Move Here].

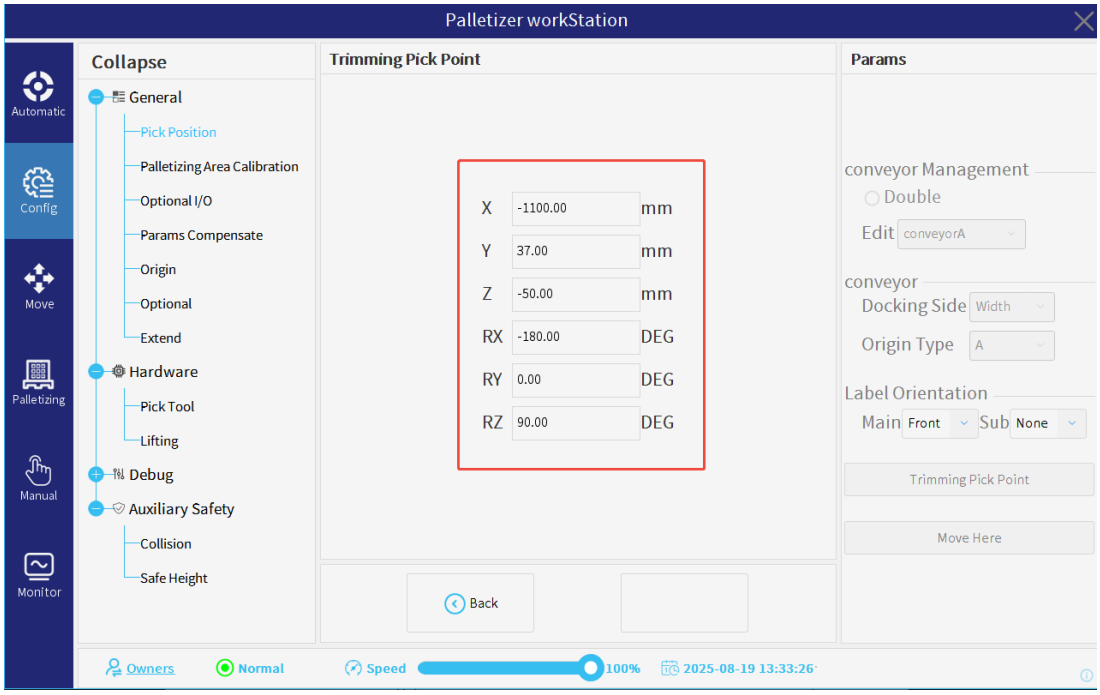


Figure 2-3 : Pick Position Adjustment

Step1: Coming Type

Tap [Start] and then set the **Origin Type** and **Docking Side**.

Click the icon to access **Figure** 2-5 where you can match the coming type according to your actual situation, and then set the above parameters according to the information of the matched type.

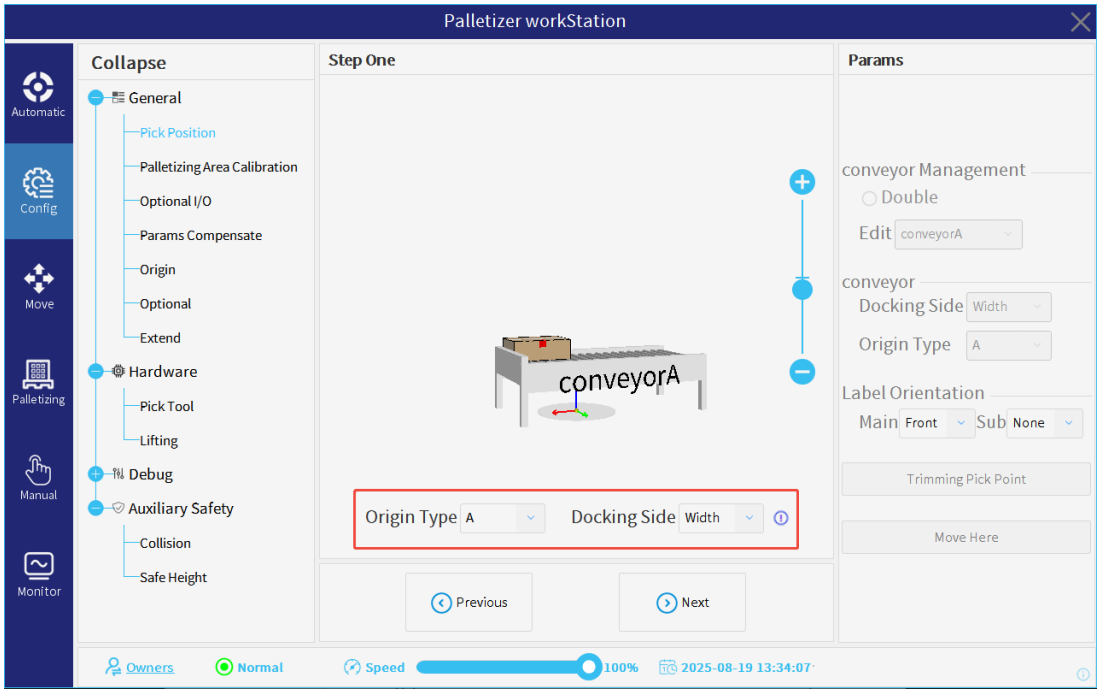


Figure 2-4 : Step 1

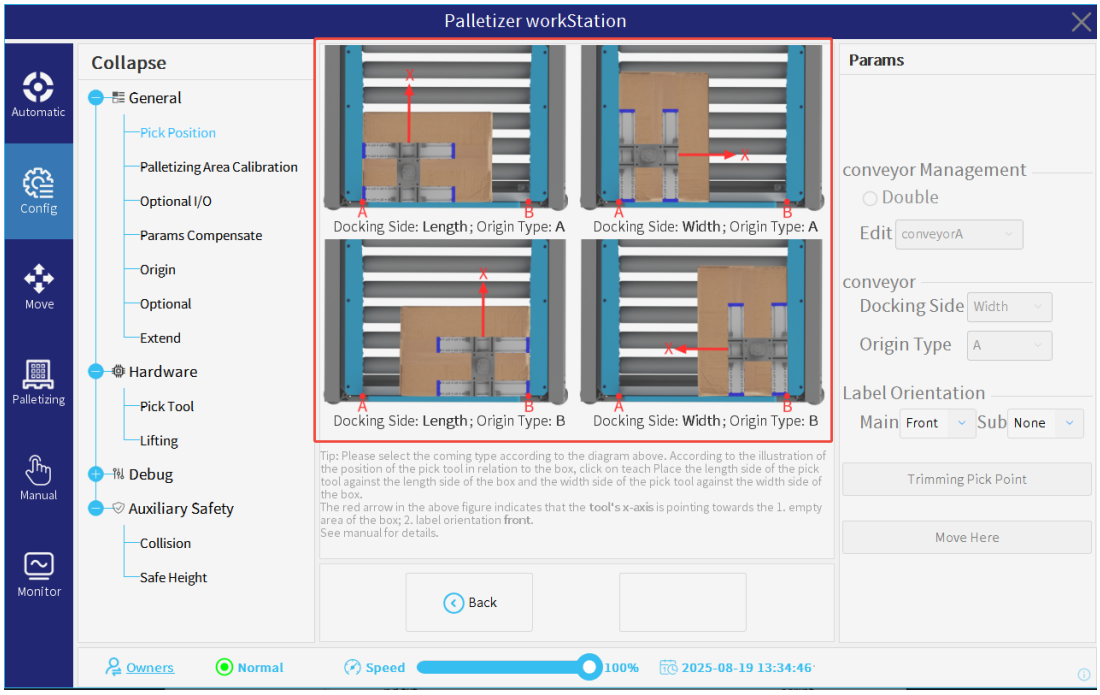


Figure 2-5 : Coming Type

Step2: Origin Configuration

Tap the [Teach] button to set the origin of the conveyor line. Then, tap the [Move Here] button. Use the slider on the right side to adjust the angle of the conveyor line.

Adjust the position of the suction cup according to the following instructions:

- The long/wide side of the picktool should align to the long/wide side of the box.
- Align one corner of the suction cup with both a corner of the incoming box on the conveyor and the predefined origin.
- The positive X-axis direction of TCP should be perpendicular to the box's long side of the box on the free side.
- The robotic arm height must be suitable for a secure pickup.

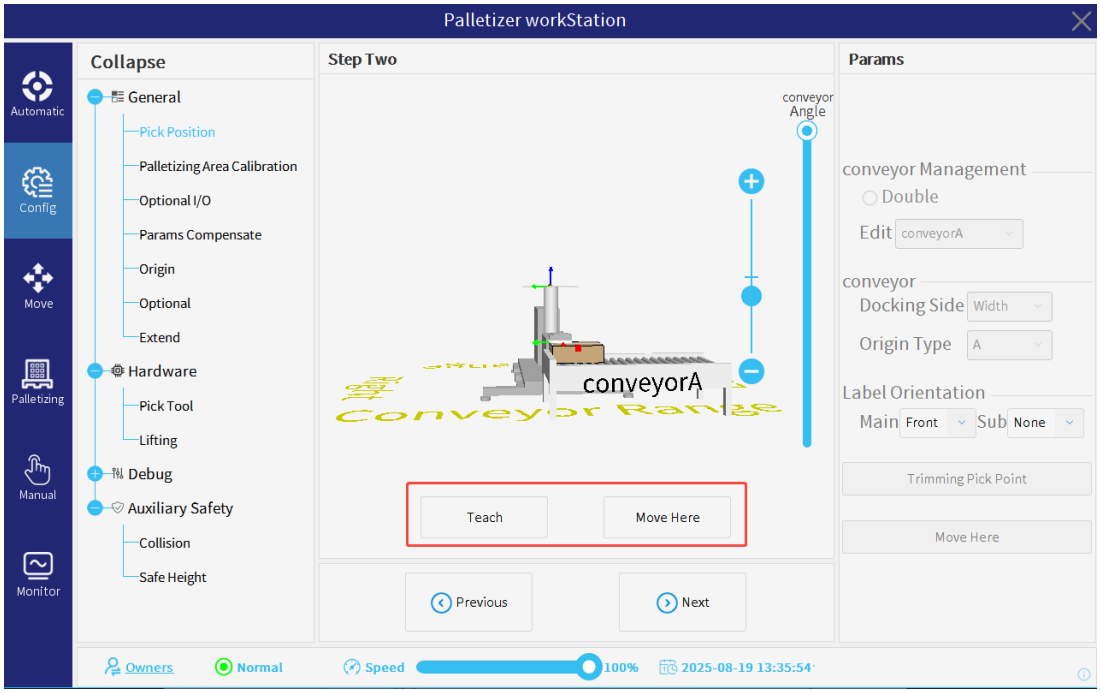


Figure 2-6 : Step 2

Step 3: Height Calculation

Manually enter the box height or tap [get formulation box height] to automatically generate the value (0-1000mm).

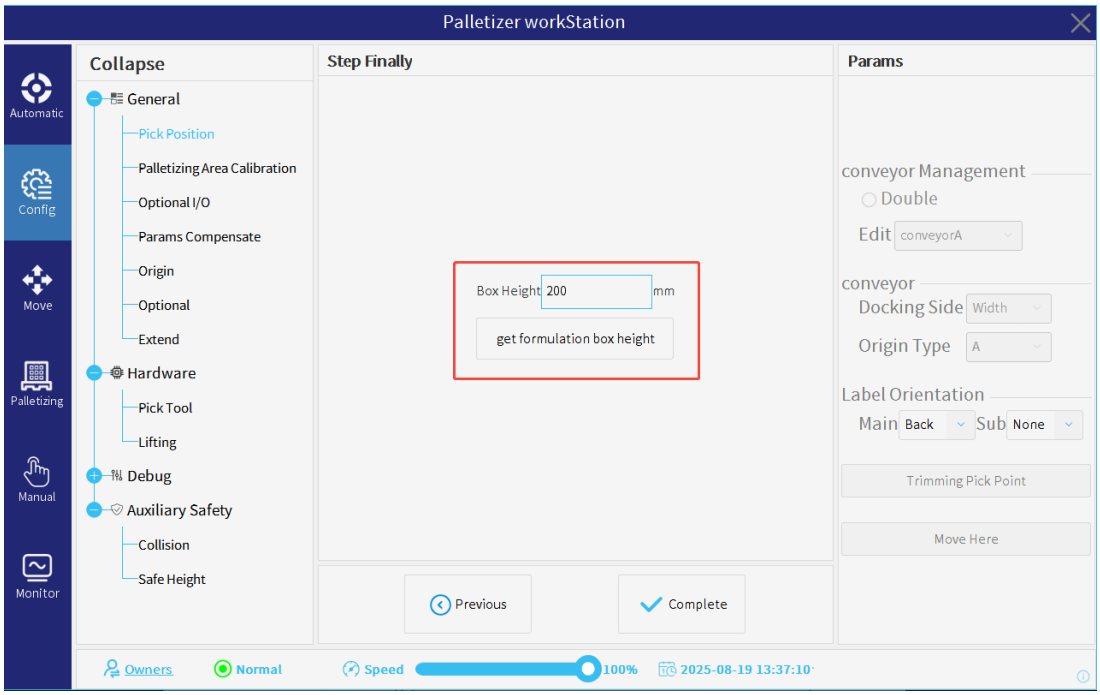


Figure 2-7 : Box Height Configuration

NOTICE

Once configured, the pick position is fixed. The center picking point of the box is then calculated based on the box's length, width, and height in the formulation. Therefore, there is no need to reset pick position after modifying the formulation or replacing the suction cup.

2.2.1.2 Palletizing Area Calibration

Tap [config] > [General] > [Palletizing Area Calibration]. Set the parameters for the horizontal (X, Y, and Z) and rotational (C) directions to align the base with the left/right tray.

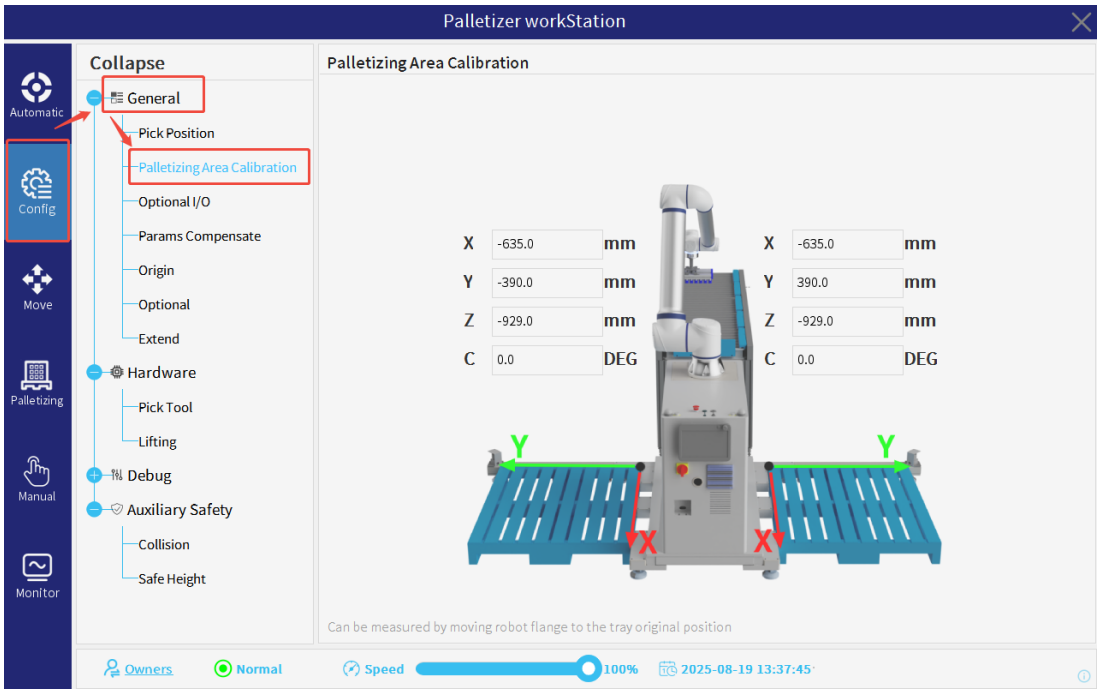


Figure 2-8 : Palletizing Area Calibration

NOTICE

With no suction cup installed, the end effector will move to the origin position of the tray coordinate system (a corner of the tray).

2.2.1.3 Optional I/O

Tap [Config] > [General] > [Optional I/O] to open the interface in **Figure** 2-9 . This interface displays the factory default I/O assignments. For each signal, select the corresponding physical I/O point from the dropdown menu based on your actual hardware wiring. For details on the listed default I/O, see **Chapter 4**.

Here are the function of other configurable I/O signals.

- **Reset**: to execute the reset action when the signal is high.
- **Air Pressure Detection**: to indicate whether the external air pressure is too low. A low-level signal will stop palletizing and trigger a pop-up alarm.
- **PickTool Detected InterLayer**: to indicate if an interlayer is detected during the downward probing of the suction cup. When the signal is high, the finishing of downward movement is detected.
- **InterLayer Sensor**: to indicate if any interlayer is available for pickup by the interlayer device. A high-level signal means the interlayer is available; and a low-level will pause the palletizing task with a pop-up alarm.

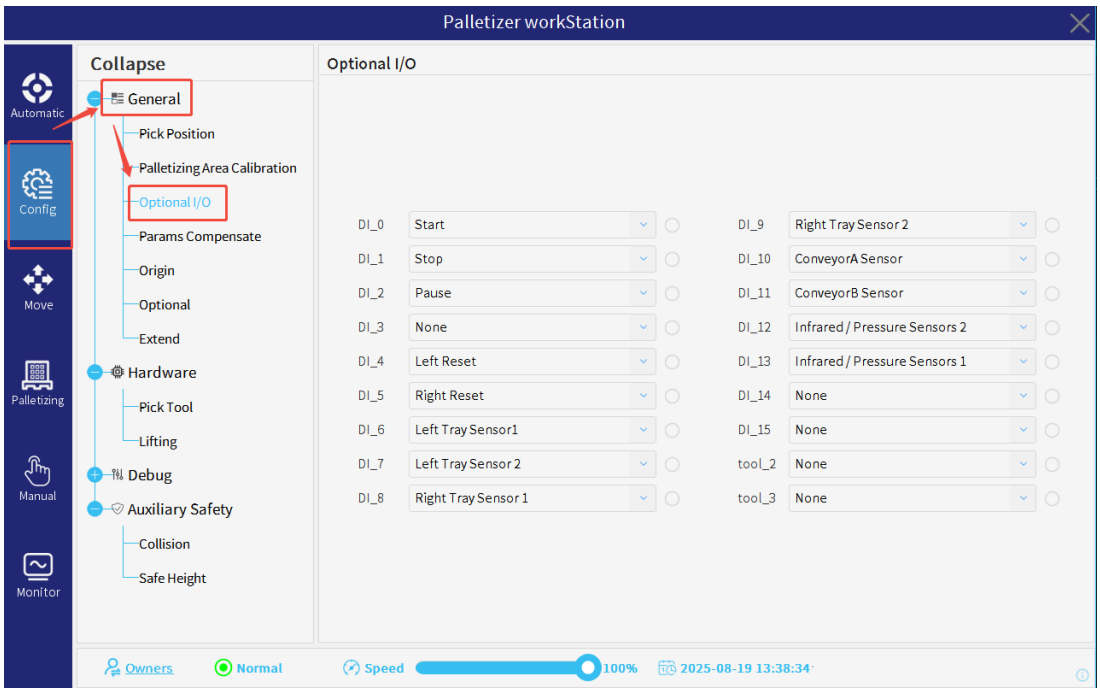


Figure 2-9 : Optional I/O

2.2.1.4 Parameters Compensate

Tap [config] > [General] > [Params Compensate] to get access to the parameter compensate setting interface.

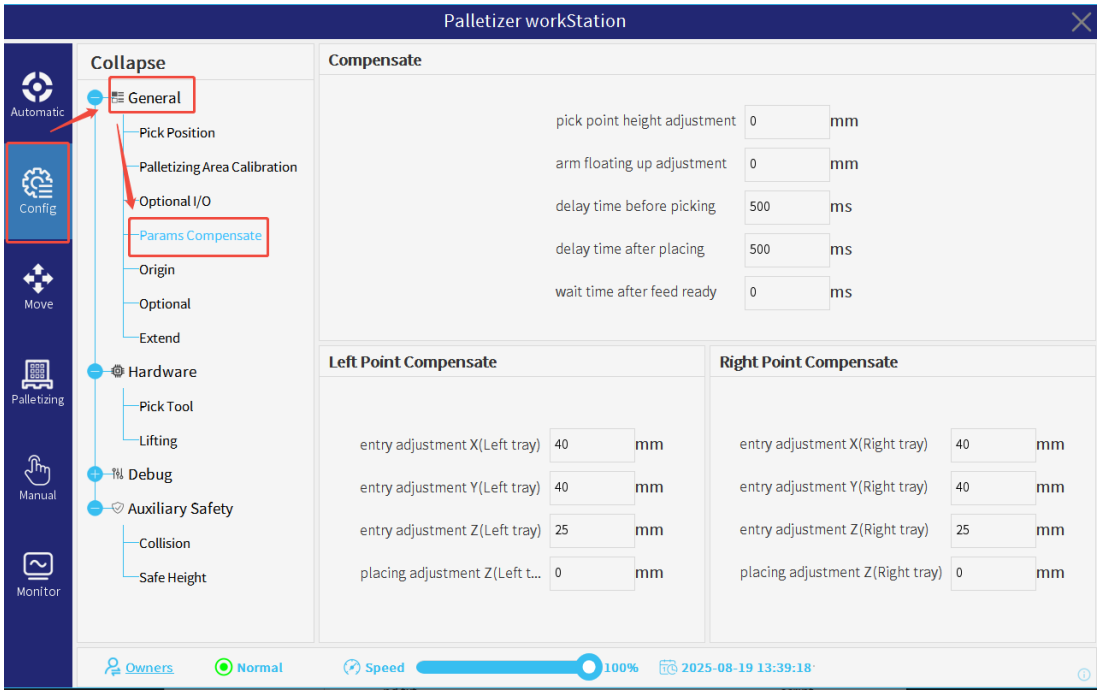


Figure 2-10 : Parameters Compensate

Configurable Parameters:

Compensation

- **pick point height adjustment:** the distance from the attachment surface of the suction cup to the surface of the picked up workpiece. Adjust if the suction cup is being compressed, for instance, too closely attached to the workpiece.
- **arm floating up adjustment:** the compensating distance from the end effector to the conveyor.
- **delay time before picking:** the waiting time for the suction cup to vacuum, or the fixture to pick up the workpiece (500ms by default).
- **delay time after placing:** the waiting time for the suction cup to devacuum, or the fixture to place the workpiece (500ms by default).
- **wait time after feed ready:** the waiting time for the robot to pick up the box after the box is detected.

Left Point Compensation

- **entry adjustment X/Y (Left tray):** the distance between the point above the left tray placing position and X/Y direction of the base coordinate for the placing position (default as 40mm).
- **entry adjustment Z (Left tray):** the distance between the point above the left tray placing position and Z-direction of the base coordinate for the placing position (default as 25mm).
- **placing adjustment Z (Left tray):** the distance between the bottom surface of

the attached box and the placing point in the left tray during placement.

The parameters for **Right Point Compensation** are identical to those for the left side.

NOTICE

The "entry" refers to the position above the placing position. The robot moves down from here, to the placing position, pushing other placed boxes to reduce collisions and irregularities caused by errors in length and width. This action is referred to as the pushing action.

2.2.1.5 Origin

Tap [Config] > [General] > [Origin] to the interface in **Figure** 2-11 where you can set the position of the origin.

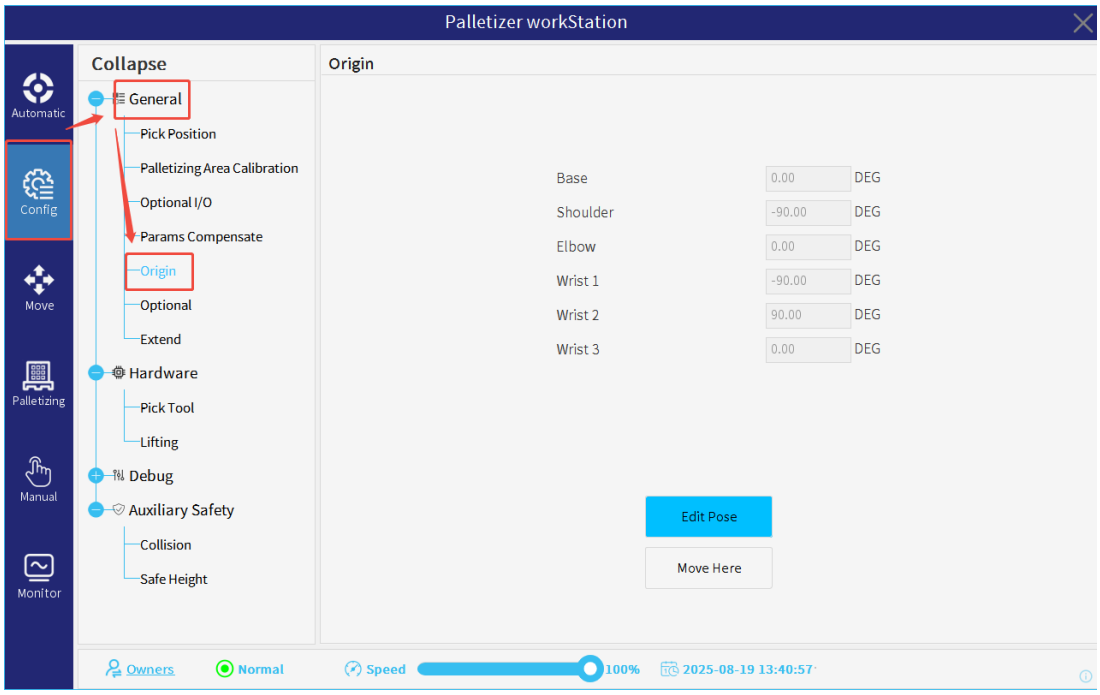


Figure 2-11 : Origin

Edit Pose: to teach the origin position in **Move** interface;

Move Here: to move the robot to the origin by long pressing [Move To Target].

2.2.1.6 Optional

If optional hardware such as remote control, Infrared/Pressure sensors, a buzzer or tray sensors are installed, select the corresponding option to enable its functionality.

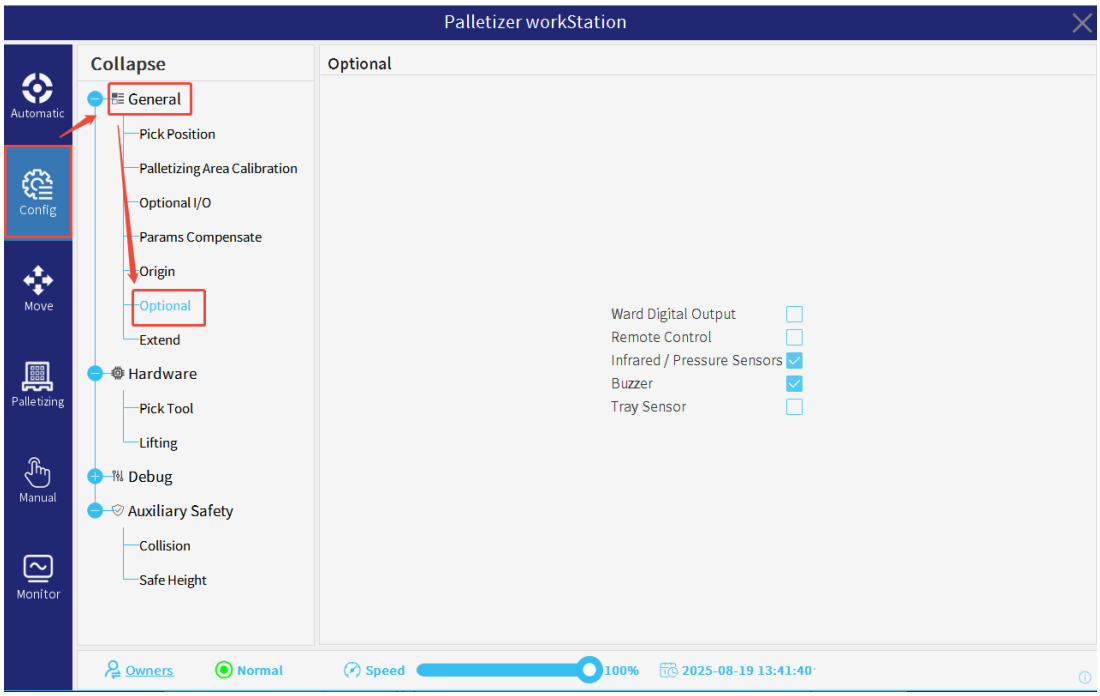


Figure 2-12 : Optional

Ward Digital Output: the digital output for the palletizing side. A high signal on DO10 indicates palletizing on the left side; and a high signal on DO11 indicates palletizing on the right side.

Remote Control: to remote control the robot.

Infrared/Pressure Sensors: an infrared sensor installed on the suction cup is used to detect if the box is in place; a negative pressure sensor is used to monitor vacuum and to control the adsorption and moving of the box.

Buzzer: to beep for alarms;

Tray Sensor: to detect accidental tray movement, triggering task interruption. The robot resumes operation after manually resetting the tray.

2.2.1.7 Extend

Tap [Config] > [General] > [Extend] to access the script management interface, where you can enable or disable the extend tasks as required.

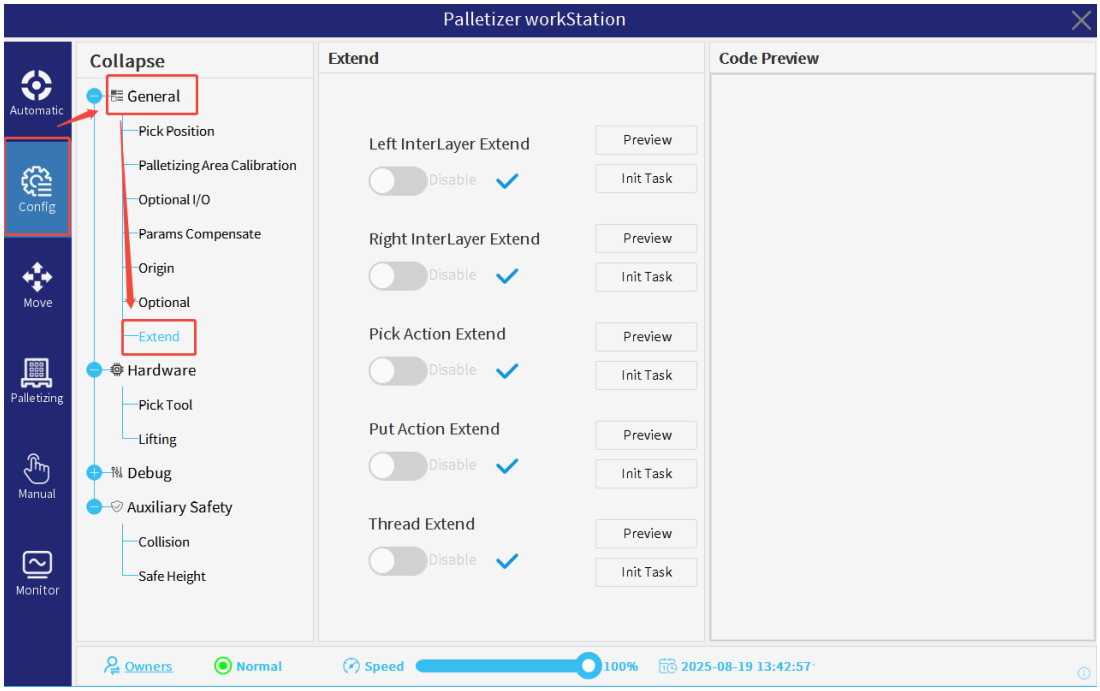


Figure 2-13 : Extend

Status Bar

-  : the extend script has been detected.
- : the task tree has been created.
- : this script is disabled before pressing this button.
-  : this script has been enabled.
- : to preview the details of the script.

Script Types

There are four types of extend scripts:

- **leftInterLayerExtend.task**: to remove the left interlayer.
- **rightInterLayerExtend.task**: to remove the right interlayer.
- **pickActionExtend.task**: to replace the original picking action.
- **putActionExtend.task**: to place the interlayer.
- **threadExtend.task**: to dynamically manage multi-thread resources.

Scripts Modification

Use the following procedure to initialize and update scripts:

1. Tap [Init Task] to generate the initialized script file.

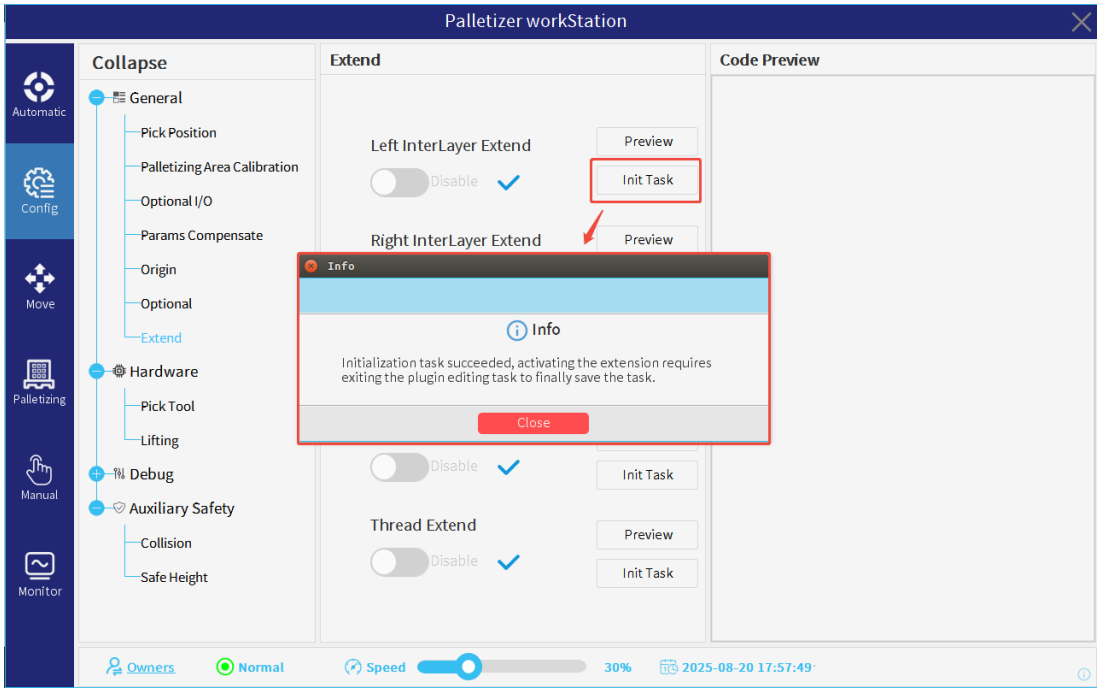


Figure 2-14 : Initializing script

2. Exit the Palletizer Workstation. Then open the initialized script file ([Open] > [Task]);

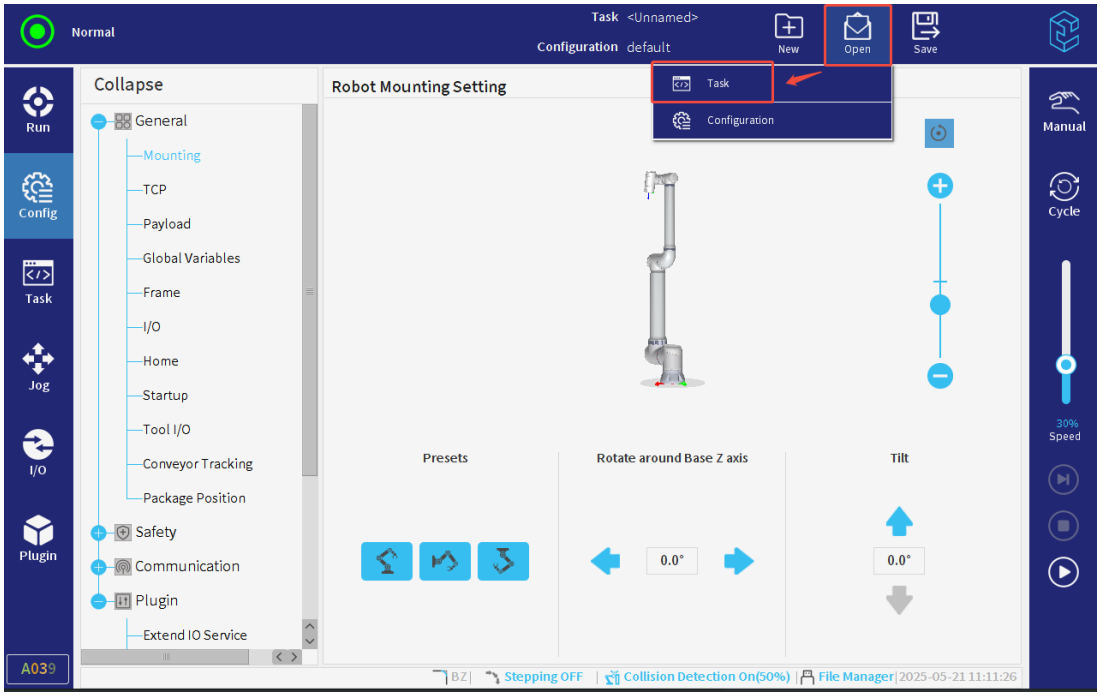


Figure 2-15 : Open A Task

3. Select the script file in the pop-up window.

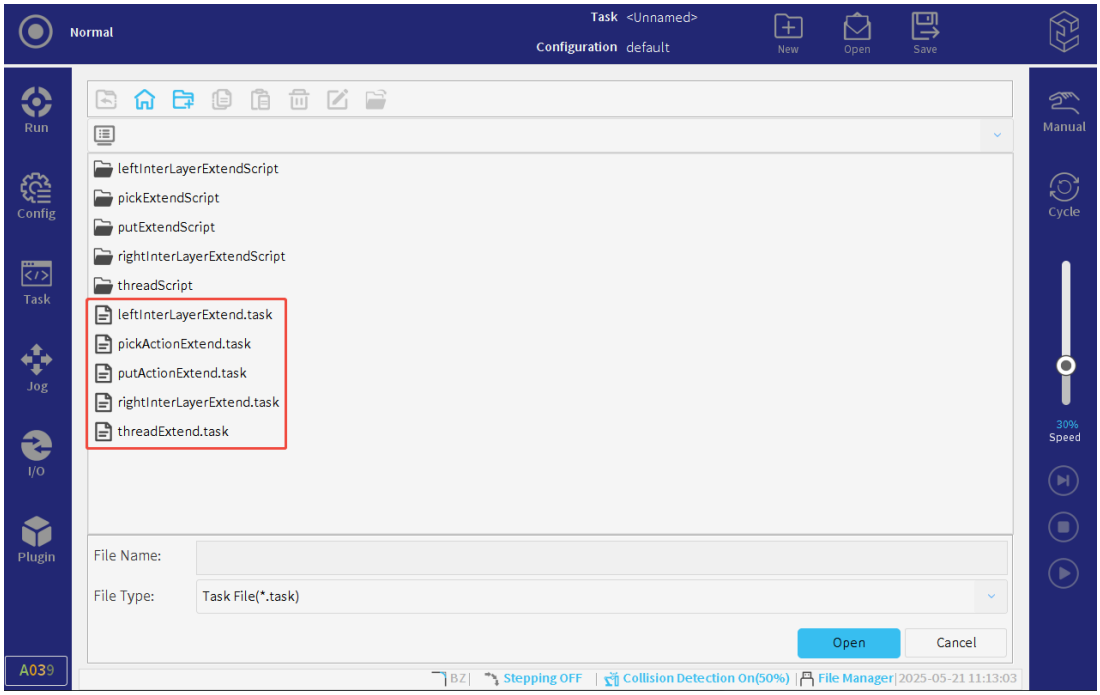


Figure 2-16 : Select Script

4. Tap [Task] in Navigation Bar. Modify the codes in the input box, then tap [save] to update the script.

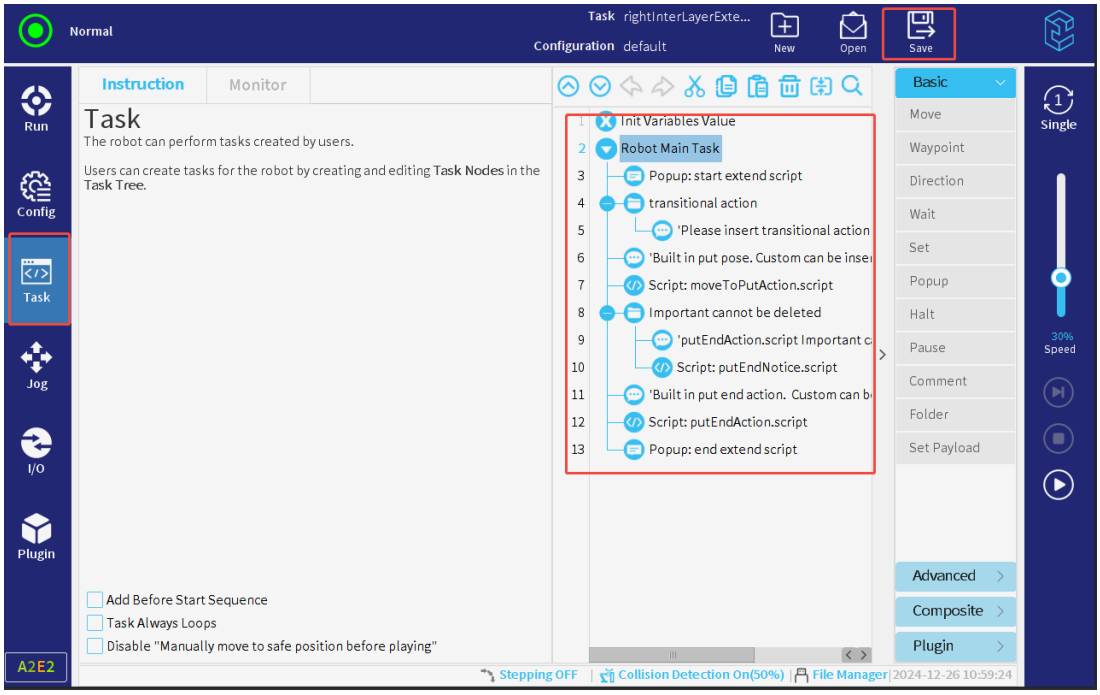


Figure 2-17 : Choose An Action

5. Exit the interface and return to the Palletizer Workstation. Toggle the [Disable] button to activate the script.

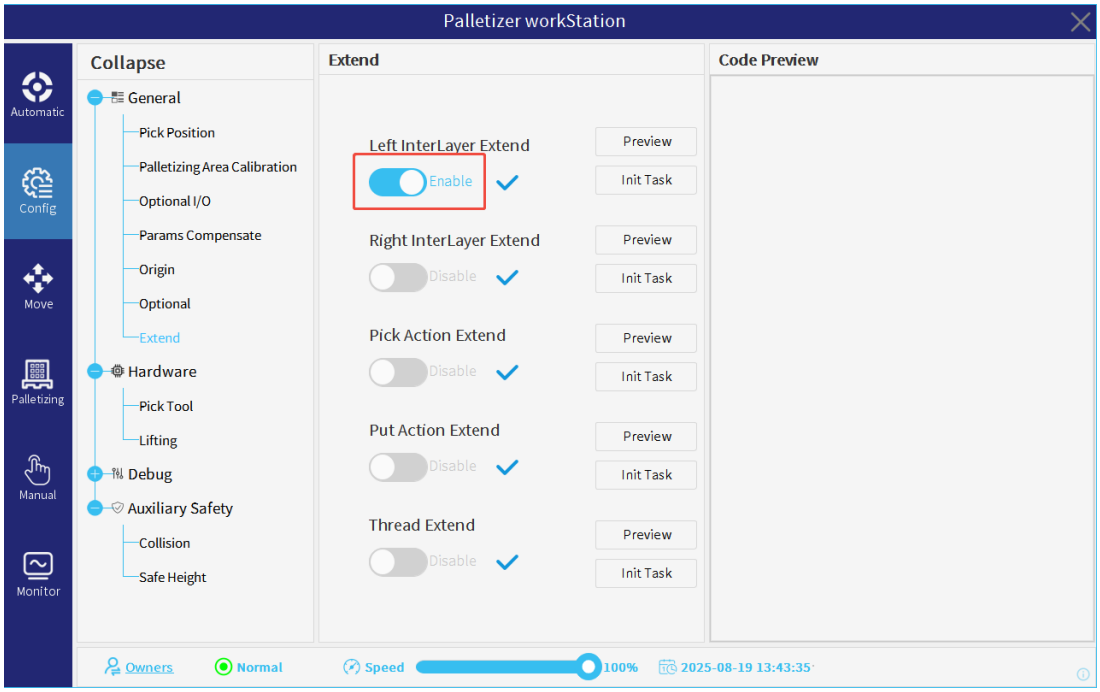


Figure 2-18 : Enable the Script

Script Explanation

1. **Loading Content of Scripts**
   Not all the scripts in the task cannot be loaded. Only the script in the task tree is available.
2. **Global Variables**
   The global variables of the plugin, as illustrated below, can be used.

```
hasNoLifting # whether there is a lifting column
hasNoPickTool # whether there is a suction tool
myselfPickTool # whether a customized suction tool is chosen
suddenlyBoxyFallingFlag # whether box drop detection is enabled
hasTraySensor # whether a tray sensor is installed

pickToolType # suction tool type

putBoxWaitTimeMs # waiting time for putting boxes
armFloatingUpCompensate # arm fLoating up height compensation (mm)

pickToolWeight # suction tool weight

armFloatingUpM # arm height required for putting boxes on the last
    layer

signalConveyerA # conveyer A signal
signalConveyerB # conveyer B signal
signalTrayLeft1 # left tray sensor 1
signalTrayLeft2 # left tray sensor 2
signalTrayRight1 # right tray sensor 1
signalTrayRight2 # right tray sensor 2
suddenlyBoxFalling1 # box drop detection 1
suddenlyBoxFalling2 # box drop detection 2
suddenlyBoxFalling3 # box drop detection 3

formulationRight =Formulation()
formulationLeft =Formulation()

hasLeftInterLayer # whether left formulation includes interlayer
hasRightInterLayer # whether right formulation includes interlayer

leftInterLayerExtend # whether left interlayer extension is enabled
rightInterLayerExtend # whether right interlayer extension is
    enabled
```

```
pickActionExtend =False # whether pick action extension is enabled
putActionExtend =False # whether put action extension is enabled

pickToolTcp = [0,0,0,0,0,0] # TCP of suction tool
```

```
class Box:
    def __init__(self):
        self.width = 0
        self.length = 0
        self.height = 0
        self.weight = 0
class Tray:
    def __init__(self):
        self.width = 0
        self.length = 0
        self.height = 0
class Interlayer:
    def __init__(self):
        self.width = 0
        self.length = 0
        self.height = 0

"""
Formulation data, unit mm, kg
"""
class Formulation:
    def __init__(self):
        self.tray = Tray()
        self.box = Box()
        self.interLayer = InterLayer()
        self.boxNum =0 # total number of boxes
        self.layerNum =0 # total number of layers
        self.formulationHeight =0 # total stacking height
        self.conveyerWard = ConveyerWard.noWard # assigned conveyor
            line
        self.pickModel = PickModel.one # picking mode
        self.pickStickModel = PickStickModel.Length # edge picking
           mode
        self.pickModelNum = 1 # number of boxes per pick
```

Here are the sample codes to access the global variables above.

```
DataContext.configContext.formulationLeft.box.weight # Obtain Box Weight for the Left Formulation
DataContext.configContext.putBoxWaitTimeMs # Waiting Time of Putting Boxes
```

3. **Runtime Global Variables**

   The global variables during running are as follows:

```
liftingHeightNow # current lifting column height
getWard() # get which side (left/right) is palletizing
getNowConveyer() # get which conveyor (A/B) is being picked from
```

   Here are the sample codes to access the global variables above.

```
DataContext.runTime.run.liftingHeightNow # get current lifting column height
DataContext.runTime.run.getWard() # get which side (left/right) is palletizing
```

4. **InterLayerExtend.task**

   - **Runtime Variables**

     Non-extended interlayer grasping and placing action variables can be used in the following extension scripts:

```
# for interlayer picking
heightMM # interlayer height
widthMM # interlayer width
lengthMM # interlayer length
pickUpJoint # taught joint position above interlayer for picking
pickUpPoseMRad # pose above interlayer picking joint (calculated by lifting column height)

# for interlayer placing
trayRpc # daemon client
nextBoxInstance # box instance data on daemon client
basePoseUp # pose above interlayer placing point
basePose # interlayer placing point
```

The following is sample code for retrieving non-extended interlayer action variables.

```
# Get interlayer picking variables
# print pose above left interlayer picking point
print(DataContext.runTime.interLayerPickLeft.pickUpPoseMRad)
# print right interlayer height
print(DataContext.runTime.interLayerPickRight.heightMM)

# get interlayer placing variables
# print interlayer placing pose
print(DataContext.runTime.interLayerTrayMove.basePose)
```

- **Counting after Interlayer Placement**
  Once the interlayer is placed and the arm returns to the picking position, the daemon server must first be notified that the ”placement is complete”.

```
# Count one interlayer moved
DataContext.runTime.interLayerTrayMove.trayRpc.count()
```

5. **putActionExtend.task**
   - **Runtime Variables of Scripts**
     The runtime variables for the extended script of placing action are as follows:

```
trayRpc # daemon Client
nextBoxInstance # Box Instance Data on daemon Client

basePoseUpJoint # Joint Pose above Base Pose
basePose # Base Pose
transitionJoint # Transition Joint above Tray Corner
```

Here are the run variables of the extend script for the box placement action.

```
# Output the joint above the position where boxes are placed
print(DataContext.runTime.tray.trayRpc.basePoseUpJoint)
```

- **Counting after Putting Boxes**
  Once boxes are placed and the arm returns to the picking position, the daemon server should be notified that the put action has already been completed.

```
# Count one box moved
DataContext.runTime.tray.trayRpc.count()
```

6. **pickActionExtend.task**
   - **Runtime Variables**

     Here are the runtime variables of the extend script for picking action.

```
pickLifting # picking position
thisActionPickUpTransitionMRad # point above picking position
teachPickJoint # taught joint of picking position
teachPickPose # taught picking pose
```

     Here are the sample codes to obtain the variables above.

```
#  Get picking position of conveyor line A
DataContext.runTime.conveyerA.pickLifting

# Get taught picking joint position of conveyor line B
DataContext.runTime.conveyerB.teachPickJoint
```

2.2.2 Hardware

2.2.2.1 Pick Tool

Tap [Config] > [Hardware] > [Pick Tool]. Then Toggle the button to the right of [Choose Installed Pick Tool] to enable the gripping tool. Toggle it again to disable. The center point of the suction cup must coincide with that of the TCP, which can be achieved by adjusting TCP X and TCP Y parameters.

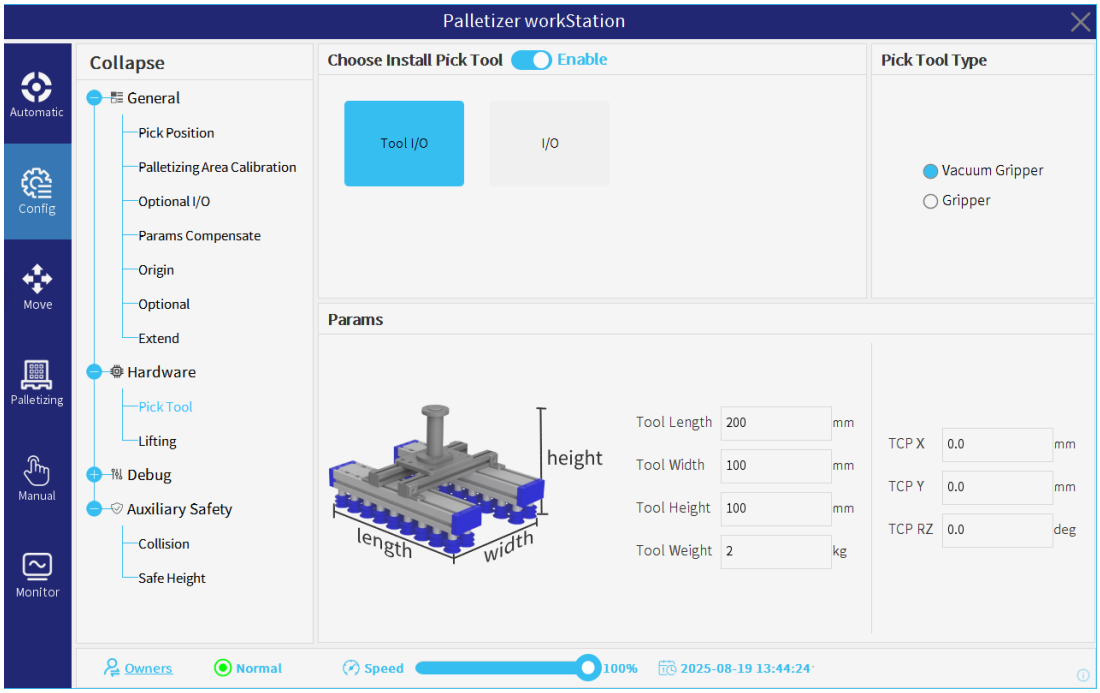


Figure 2-19 : Pick Tool

Model: support Tool I/O (Tool I/O) and I/O;

Type: support vacuum gripper and gripper.

Tool Dimensions:

- **Tool Length:** length of the suction cup;
- **Tool Width:** width of the suction cup;
- **Tool Height:** height of the suction cup.

Tool Weight: weight of the suction cup.

TCP Offset:

- **TCP X:** Offset distance of the TCP in the X direction;
- **TCP Y:** Offset distance of the TCP in the Y direction;
- **TCP RZ:** Rotational angle of the TCP.

NOTICE

1. The long side of the suction cup must be perpendicular to the positive X-axis direction of TCP; otherwise, Misalignment will cause the box placement position to deviate from that set in the formulation. For a square-shaped suction cup, any side can be perpendicular to the positive X-axis direction of

TCP.

2. It is necessary to verify whether the shape of the suction cup in the model matches the actual one.
3. **Tool I/O Configuration for Suction Cups:**
   - Single-pick Mode: Vacuum → Tool I/O 0, Vacuum off → Tool I/O 1.
   - Multi-pick Mode: Vacuum on 1 → Tool I/O 0; Vacuum on 2 → Tool I/O 1; Vacuum on 3 → Tool I/O 2.

2.2.2.2 Lifting Column

Tap [Config] > [Hardware] > [Lifting]. Then Toggle the button to the right of [Choose Install Lifting] to enable/disable lifting column.

Figure 2-20 : Lifting Column

Lifting Column Model: support 3 models including zeitech, skf, and LiftingPlugin.

Lifting Max Height: the maximum height of the lifting column (100-1000mm).

Arm Speed Limit: speed limit for the robotic arm, which is determined by the pallet pattern height.

- Above 900 mm: speed limit is 70%.
- Above 1500 mm: speed limit is 60%.
- Above 1900 mm: speed limit is 50%.

NOTICE

1. For more information about the lifting column, please refer to **Section 2.8.3**.
2. For some types of lifting columns, the robotic arm may experience noticeable vibrations when the column is raised to a high position. In this case, select the arm speed limit option to reduce them.

2.2.3 Debug

2.2.3.1 Workstation Binding

Select the palletizer workstation type to bind.

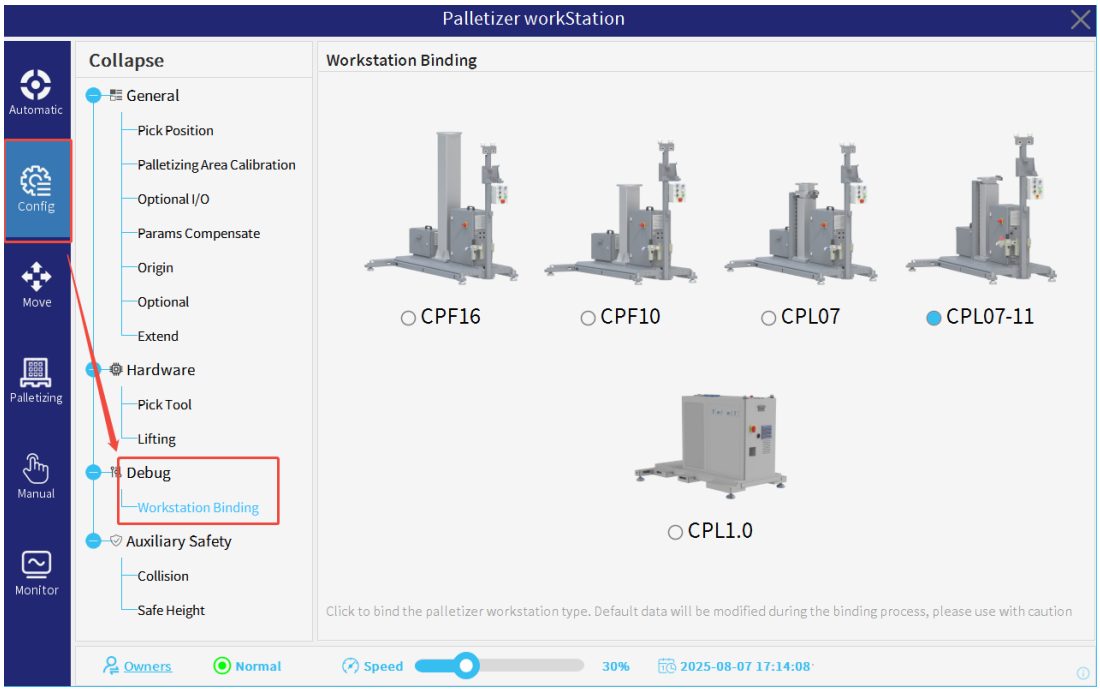


Figure 2-21 : Workstation Binding

NOTICE

After exiting from the **Formulation management** interface, the workstation data will not be cleared, and rebinding is not required when you restart the plugin.

REMINDER

Binding will modify the default data. Proceed with caution when changing the workstation type.

2.2.4 Auxiliary Safety

2.2.4.1 Collision

Toggle the [Collision Detection] button to enable/disable collision detection function. The higher the percentage, the greater the required force for collision detection. It is recommended to enable this function before running a formulation.

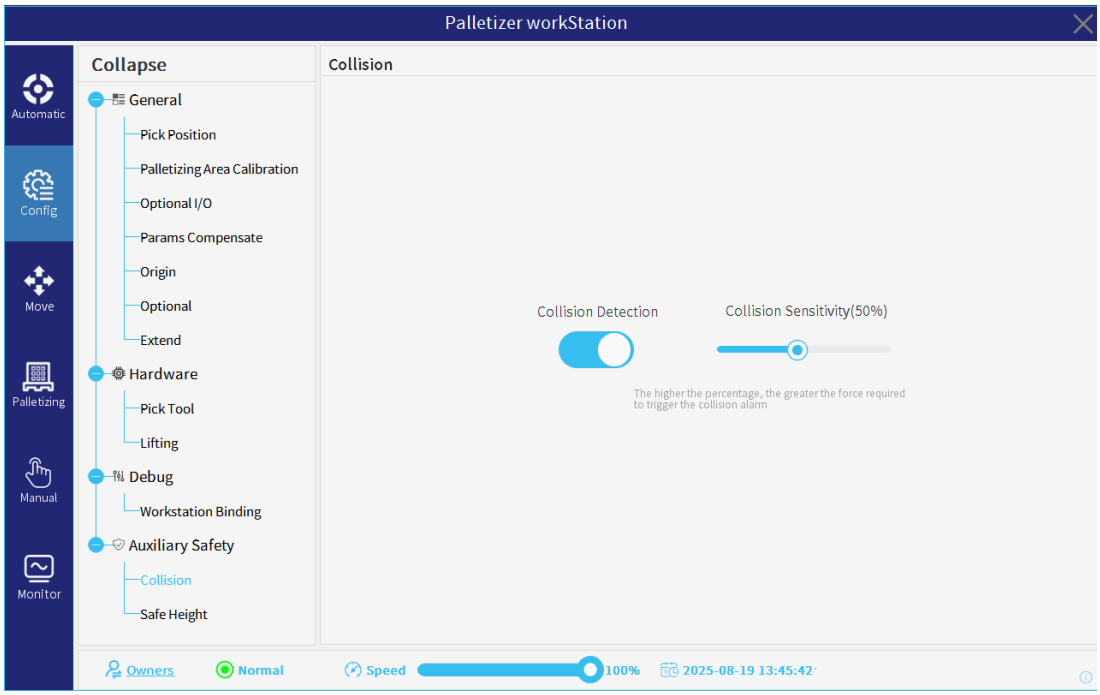


Figure 2-22 : Collision

NOTICE

If a collision occurs, the robot arm cannot be moved from the [Move] interface. In this case, disable collision detection for a moment, move the robot arm

and then re-enable it.

2.2.4.2 Safety Height

Tap [Config] > [Auxiliary Safety] > [Safe Height] to access its interface. Toggle the [Safety Height] switch to enable the safety height and customize its value.

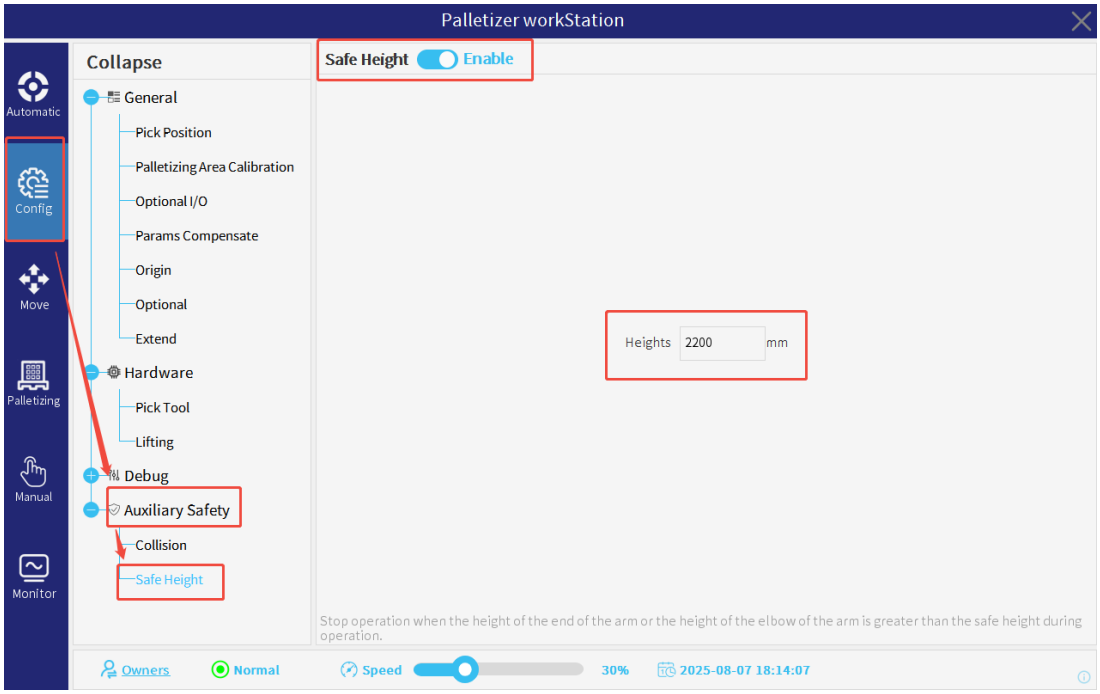


Figure 2-23 : Safety Height Settings

Safety height is the maximum height limit that the robot's elbow or end effector is allowed to reach (range: 1000-3000mm). If the elbow or end effector exceeds the safety height during operation, the robot will stop running and an alarm message "Exceeded Safety Height" is triggered.

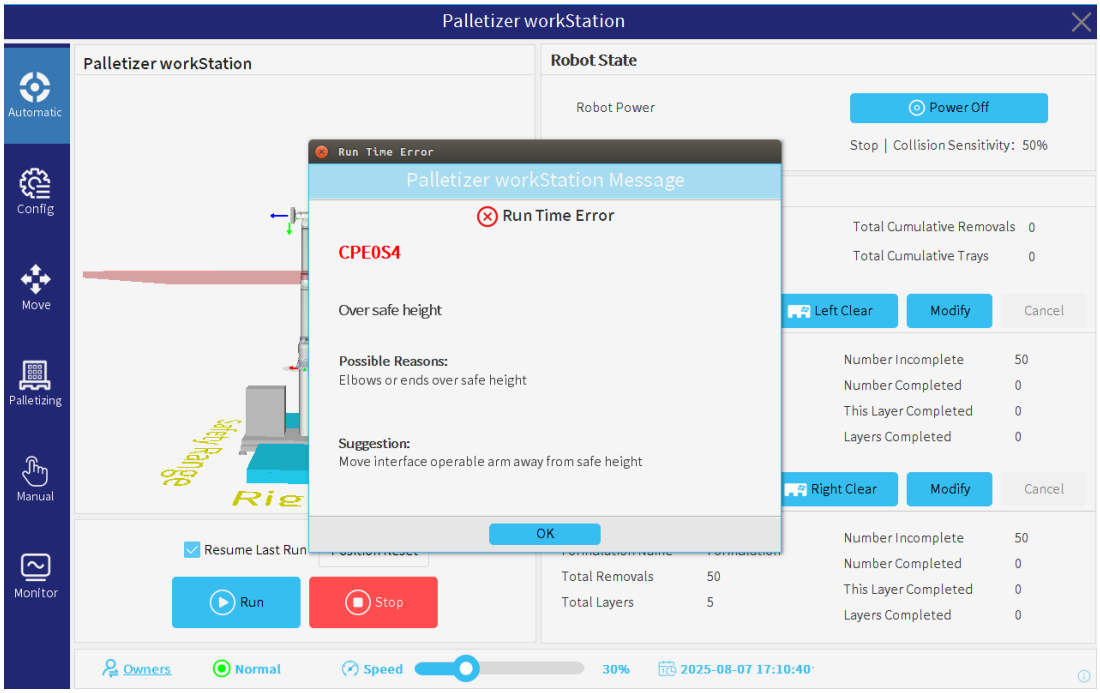


Figure 2-24 : Exceeding Safety Height Alarm

2.3 Move Tab

Configure the parameters about the coordinate system, tool position, joint position, step, etc.

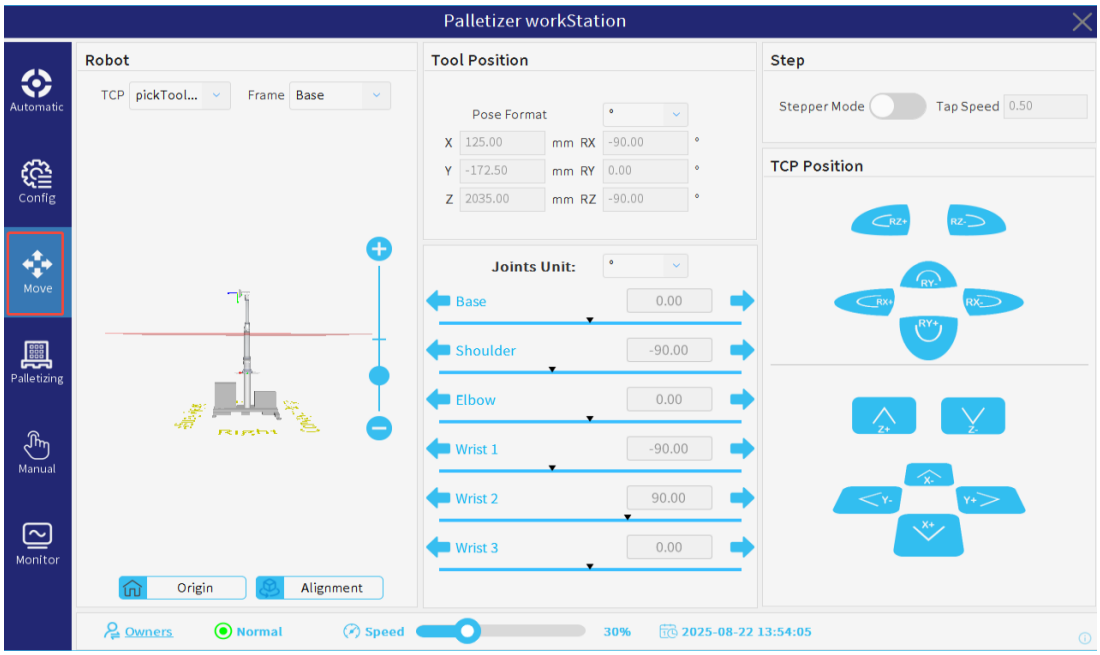


Figure 2-25 : Move

Robot

- **TCP:** the currently active TCP;
- **Frame:** the coordination of the robot, the frame can set as base or user-defined frame;
- **Origin:** the robot returns to the currently active origin set in [Config] > [Origin];
- **Alignment:** keep TCP and the currently selected frame parallel in XOY plane.

Tool Position

The tool position displays the coordinate value of the currently active TCP relative to the selected frame. X, Y, and Z coordinates specify the tool location. RX, RY, and RZ coordinates specify the direction. Tap the dropdown menu of [Pose Format] and [Joints Unit] to select the representation form of the direction.

- **RPY[rad]:** roll, pitch and yaw angles expressed in radians;
- **RPY[°]:** roll, pitch and yaw angles expressed in degrees.

Tap the arrow buttons to increase or decrease the current value to adjust the joints position.

Step

- **Stepper Mode:** tap the button on the right side to enable/disable the stepper mode;
- **Tap Speed:** to show the current stepping speed.

TCP Position

Under the selected frame, long press the arrow to move the robot arm in a specific direction.

2.4 Palletizing Tab

In palletizing tab, the operations for formulation can be performed, including selection, management, and creation.

2.4.1 Formulation Selection

Close the palletizer workstation or select the formulation to be used for left and right palletizing by tapping the dropdown menu of [Formulation Used].

Palletizing order of the left and right can be selected after tapping [Automatic] > [Run].

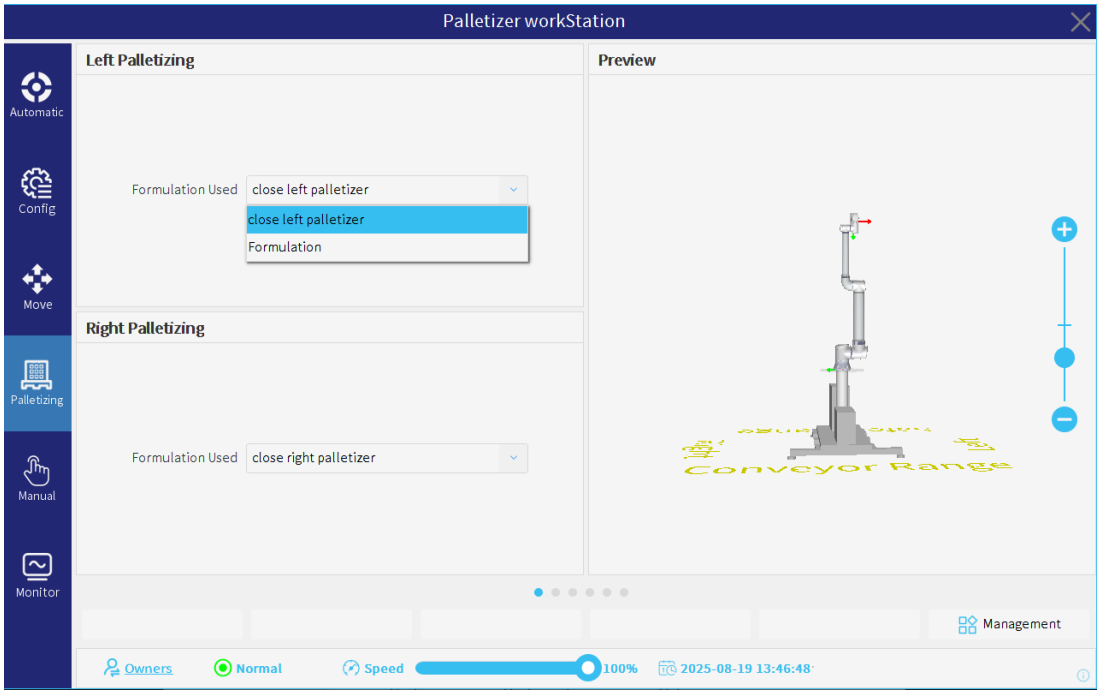


Figure 2-26 : Formulation Selection

NOTICE

1. If the adjustment of the left and right palletizing order is required, select the order after tapping [Automatic] > [Run].

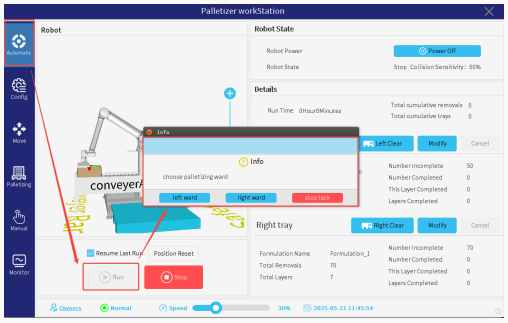


Figure 2-27 : Set left and right palletizing order

2. After specifying the formulation, the system will trigger the safety verifying mechanism. If it detects that the current parameters may cause the left and right palletizing sides to exceed the maximum height and create a risk of collision, a warning box will appear. This is only a precautionary safety warning, so please make a judgment according to the actual situation. If the risk of

collision is confirmed, please adjust it in time.

2.4.2 Formulation Management

The interface displays after tapping [Management].

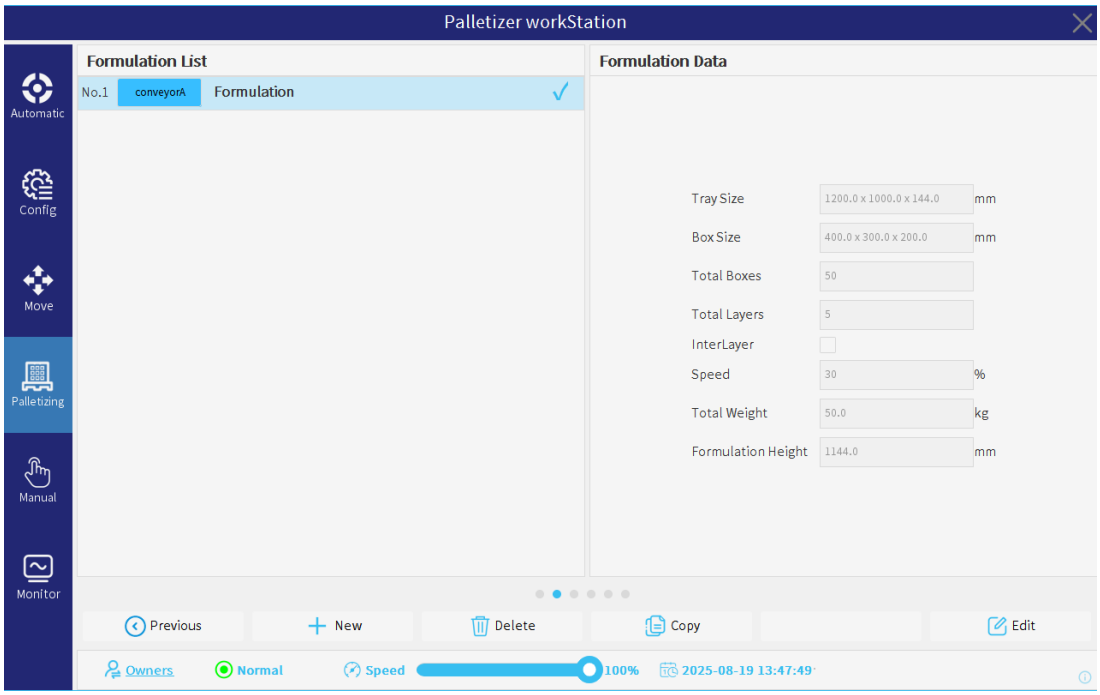


Figure 2-28 : Formulation Management

Previous: to back to the previous interface;

New: to create a formulation;

Delete: to delete the selected formulation (a confirmation is required).

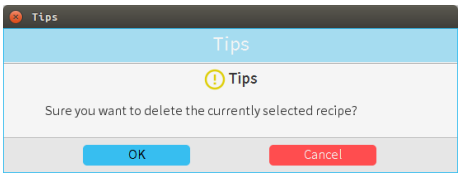


Figure 2-29 : Delete the Selected Formulation

Copy: to generate a complete copy of the selected formulation (multiple copies are supported).

Edit: to edit the selected formulation and adjust the relevant parameters.

NOTICE

When the option of double conveyor lines is enabled, the Formulation Management interface will be expanded as shown in **Figure** 2-30 , where the conveyor line can be assigned for the selected formulation. Note that this operation will alter the label orientation.

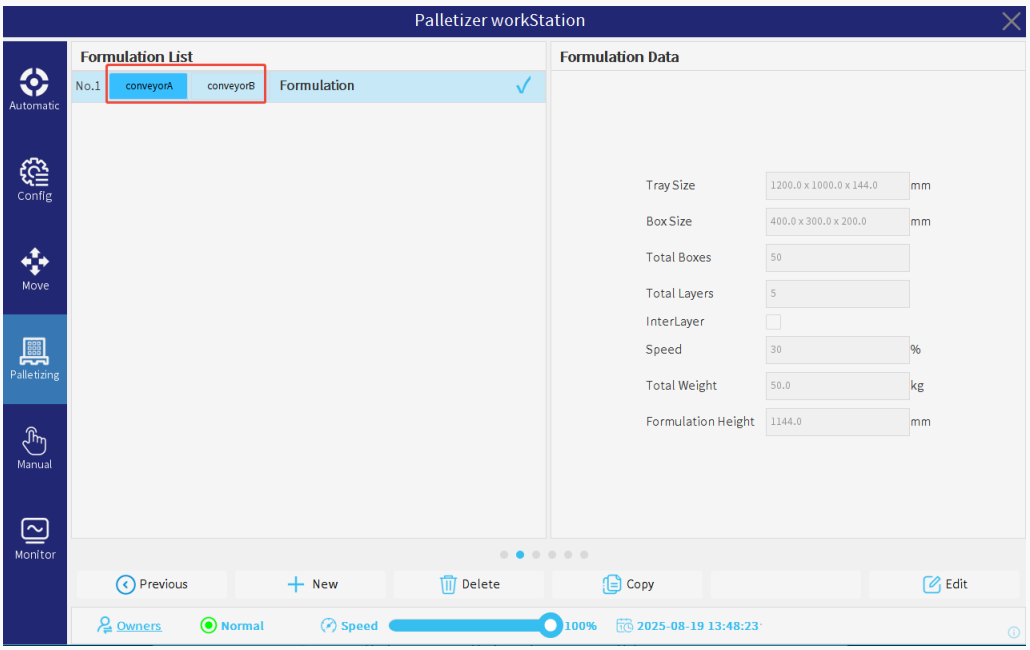


Figure 2-30 : Formulation Management (Double Conveyor Lines)

2.4.3 Formulation Creation

Create a new formulation, and perform operations for pallet setup, box settings, layout type setting and per layer layout setting.

2.4.3.1 Tray Set

Tap [New] in the Formulation Management interface to create a formulation. The interface displays after tapping [Edit], where the formulation name, the dimension of the tray length, width, and height) and permissible load can be modified. It is recommended to use the box size or product batch to name the formulation. Tap [Next] after the setup is completed.

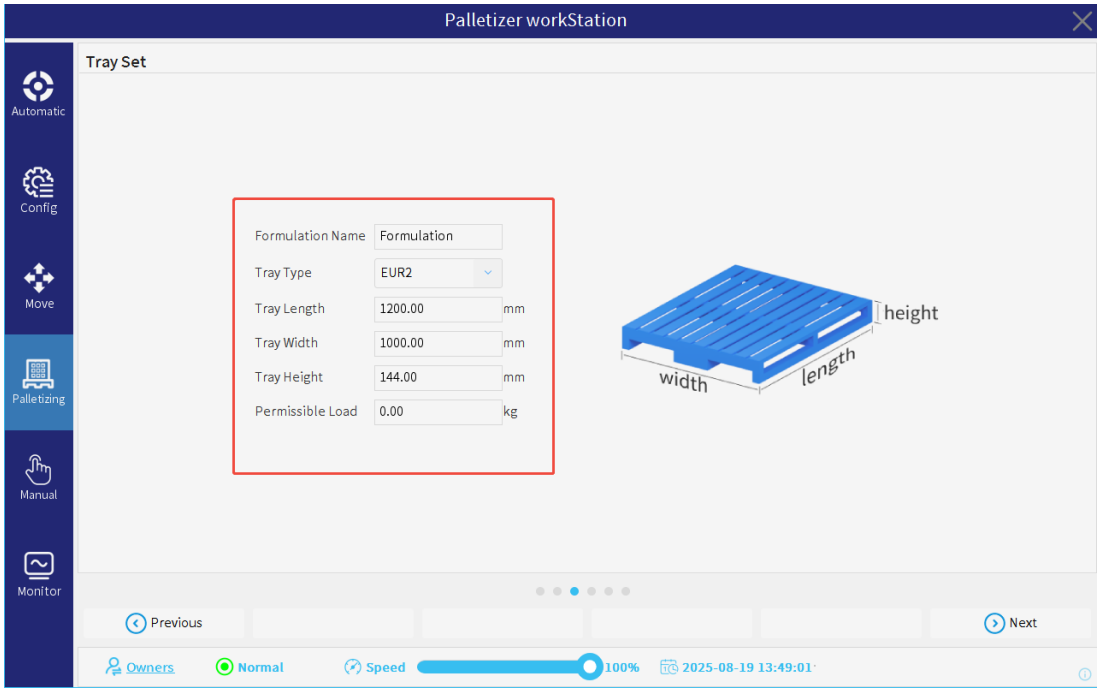


Figure 2-31 : Tray Set

1. It is recommended to name the formulation using the case size or product batch.
2. The available tray types are:
   - UK Standard: UK standard pallet (1200mm x 1000mm), mainly adapted to the United Kingdom and some European countries;
   - GMA 48*40: Grocery Manufacturers Association of America (GMA) standard pallet whose size is 48 inches x 40 inches (about 1219mm x 1016mm);
   - CHEP AU/NZ: refers to Jibao Australia or New Zealand pallets. The former is measured as 1165 x 1165mm and the latter 1200 x 1000mm;
   - EUR: European general standard pallet (1200mm x 800mm), suitable for continental Europe, Germany, France, etc;
   - EUR2/EUR3/EUR6: European standard subdivided pallets, EUR2 is used for Northern Europe and its size is 1200mm×1000mm; EUR3 is sized as 1000×1200mm; and 800×600mm for EUR6.
3. Tray size range: length/width 100-1400mm, height 100-400mm
4. Allowable load limit: 0-1000kg

2.4.3.2 Box Set

The **Box Set** interface provides users with options for configuring the parameters pertaining to the box's name, dimensions (length, width, height), and weight. Tap [Next] after the setting is completed.

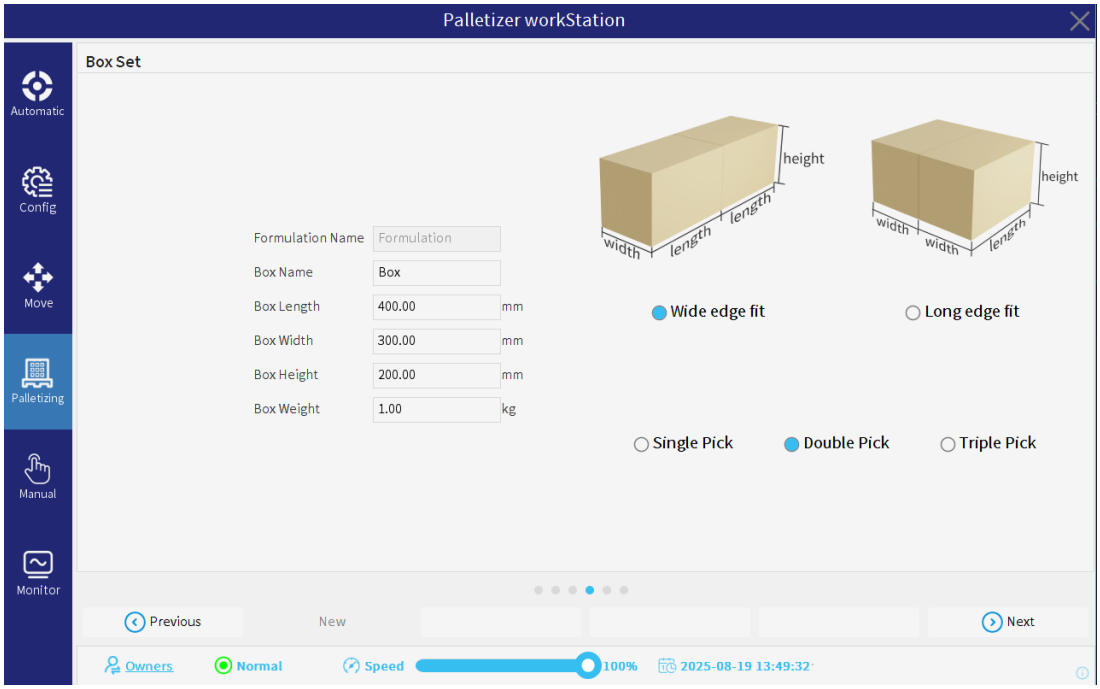


Figure 2-32 : Box Settings

- Box size range: L 20-1200mm, W/H 20-1000mm;
- Weight limit: single box weight $\leq$ 4kg
- This interface allows for two types of picking method, that is, single pick and double pick. For the latter, select either wide edge fit or long edge fit. For more details about how to configure the double pick, please refer to **Section 2.8.1**.

NOTICE

Since there might be size discrepancies among boxes, please measure multiple boxes and enter their average value to the input box. If there are bulges in the middle of the box, adjust the box height accordingly.

2.4.3.3 Layout Type Setting

In the interface of **Layout Type Setting**, the layout type can be created manually or automatically.

NOTICE

To ensure stack stability, it is recommended that the boxes on even layers and odd layers are placed symmetrically. An example of an odd layer is shown in **Figure** 2-33 , and an example of an even one in **Figure** 2-34 .

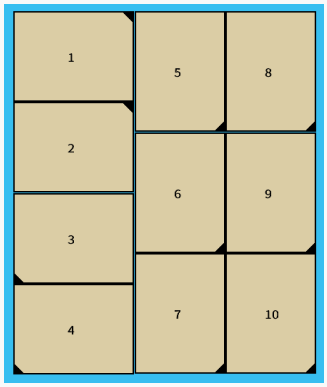


Figure 2-33 : Odd Layer

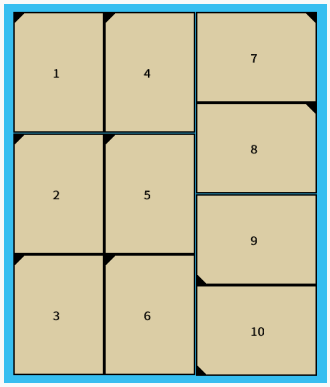


Figure 2-34 : EVen Layer

2.4.3.3.1 Add Layers Manually

Tap [New] to create a layer type in **Figure** 2-35 where you can perform editing, copying and deleting operations. View the real-time 3D visualization of the palletizing in the right area.

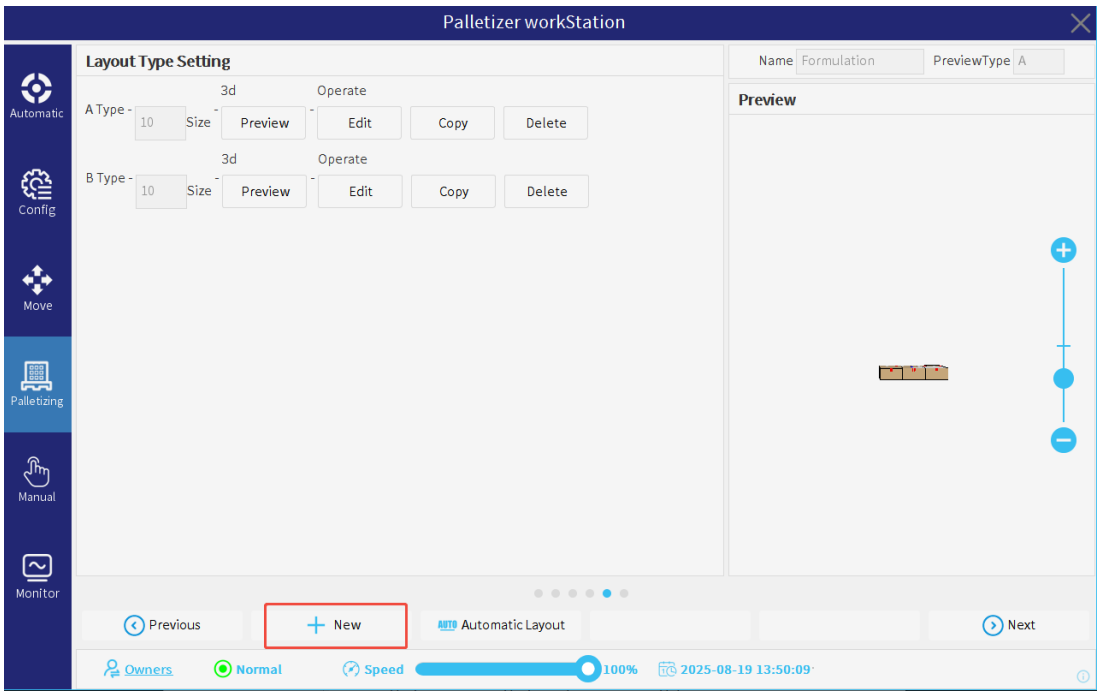


Figure 2-35 : Add Manually

Tap [Edit] to get access to the interface of box position. A new layer is configured

with 1 box by default and the number of boxes can be adjusted. Drag any box to adjust the arrangement of all boxes.

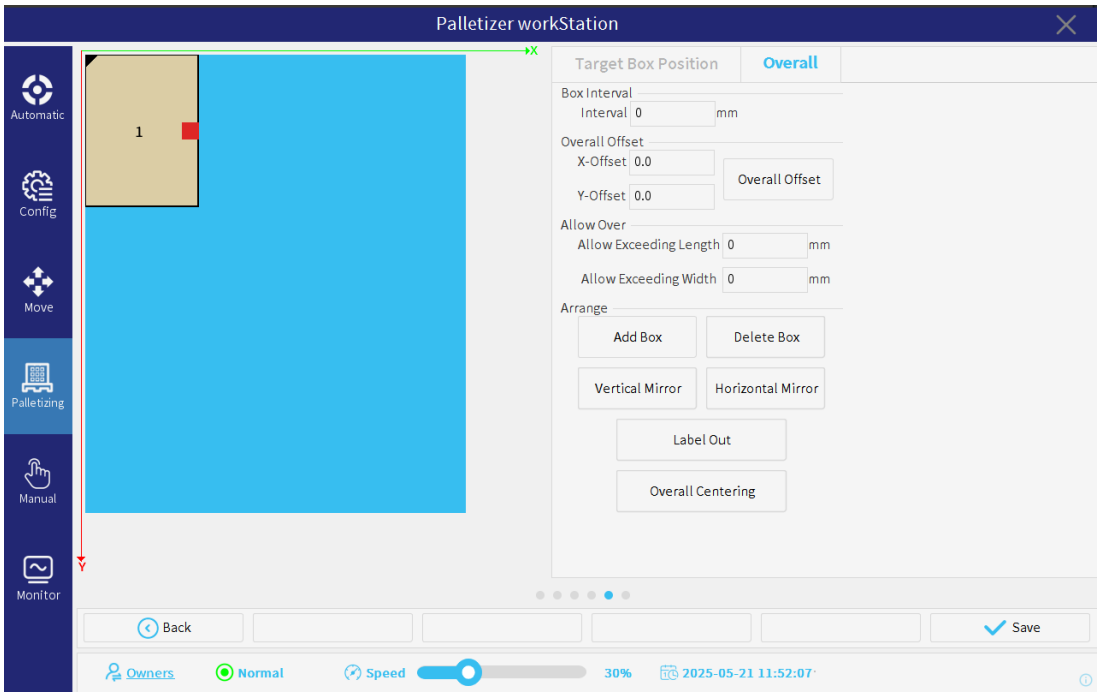


Figure 2-36 : Box Position and Order

Overall

- **Box Interval:** to set the spacing between boxes (0-30mm);
- **Overall Offset**
  - The offset values for X and Y direction can be adjusted;
  - Tap [Overall Offset] to offset all the boxes collectively.
- **Allow Over**
  - **Allow Exceeding Length:** the distance that the box can be excessed by the tray long side, with a maximum allowable exceeding of 30mm;
  - **Allow Exceeding Width:** the distance that the box can be excessed by the tray wide side, with a maximum of 30mm.
- **Arrange**
  - **Add Box:** to add a box;
  - **Delete Box:**to delete the selected box;
  - **Vertical Mirror:** to enable vertical mirroring adjustment of the currently set layer;
  - **Horizontal Mirror:** to enable horizontal mirroring adjustment of the layer;

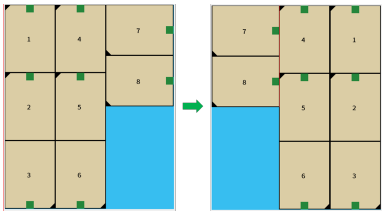


Figure 2-37 : Vertical Mirror Effect

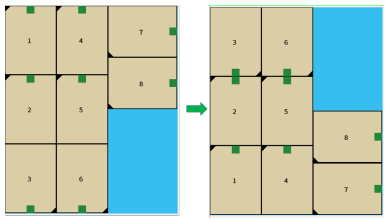


Figure 2-38 : Horizontal Mirror Effect

- **Label Out:** Select a box. Click it again to rotate it and the label is adjusted to face out;
- **Overall Centering:** to adjust all boxes to be arranged with centering.

Target Box Position

Users can set parameters in X and Y directions, and rotational angles to adjust the position of the box.

After the adjustment of the box position, tap [Save].

NOTICE

- If you need to put the labels face outward, tap [Label Out] after adding the required number of boxes, then all the boxes will be rotated immediately to make the labels face outward.
- The red zone in the figure represents that the boxes are overlapped. If it occurs, the settings cannot be saved until the box is adjusted to a proper position.

2.4.3.3.2 Add Automatically

Tap [Automatic Layout] to access the corresponding interface. This interface provides users with a number of templates for layer arrangement. When the "Filter" option is selected, the system will automatically screen out irregular stacking patterns and display only those that are horizontally, vertically and centrally symmetric.

Configure the parameters for [Allow Over Tray] and [Box Interval] (0-30mm) in the right area of **Figure** 2-39 .

Figure 2-39 : Automatic Layout Interface

NOTICE

- Select the layout type illustration by tapping it once and unselect it by tapping it again;
- Multiple layout type illustrations can be selected at the same time;
- When configuring [Label Out] after tapping [Config] > [General] > [Pick Position], labels of all boxes will be outward. If the orientation for the main or sub label is set to none, then labels will be toward the same direction. For the rotational angel of box less than 90 degrees, the labels will be not displayed.
- In multi-pick mode, box interval cannot be set.

After selecting the layered type, tap [Select] to arrange the layered type automatically. After automatic layouts are set, if you need to adjust the box position, click Edit to enter the box position modification interface for adjustment.

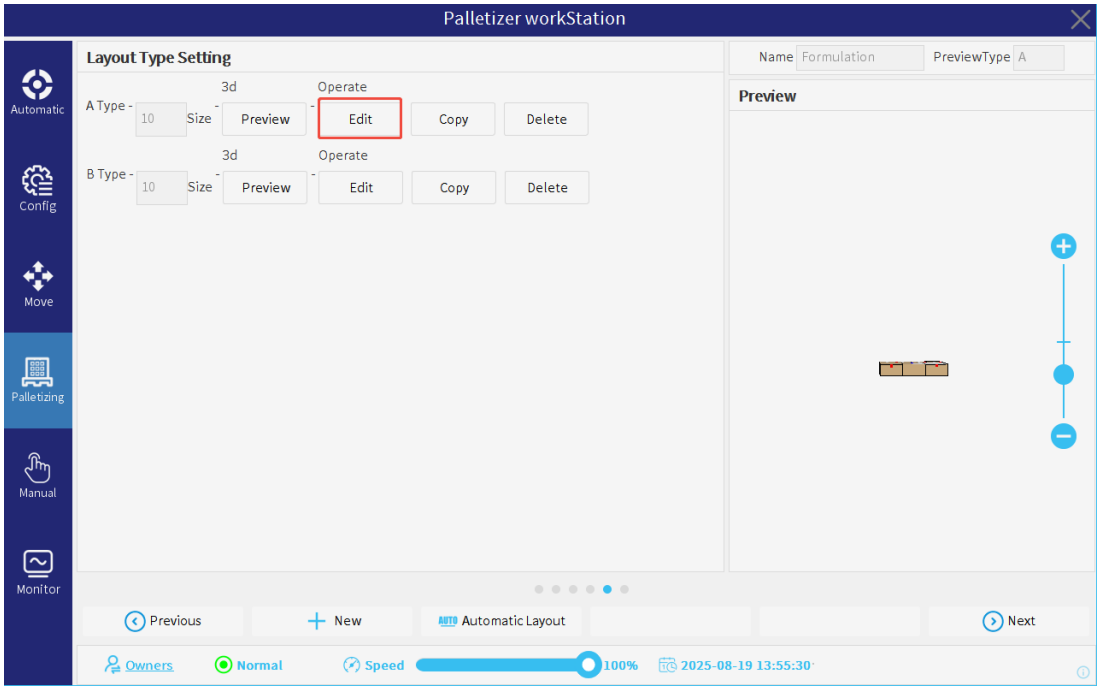


Figure 2-40 : Automatic Layerout

2.4.3.4 Per Layer Layout Setting

Per Layer Layout Setting interface provides users with such operations as creating and deleting layers, selecting layer types, choosing whether to use the interLayer, managing the running speed of the formulation as well as setting parameters, a mirror and the placement order.

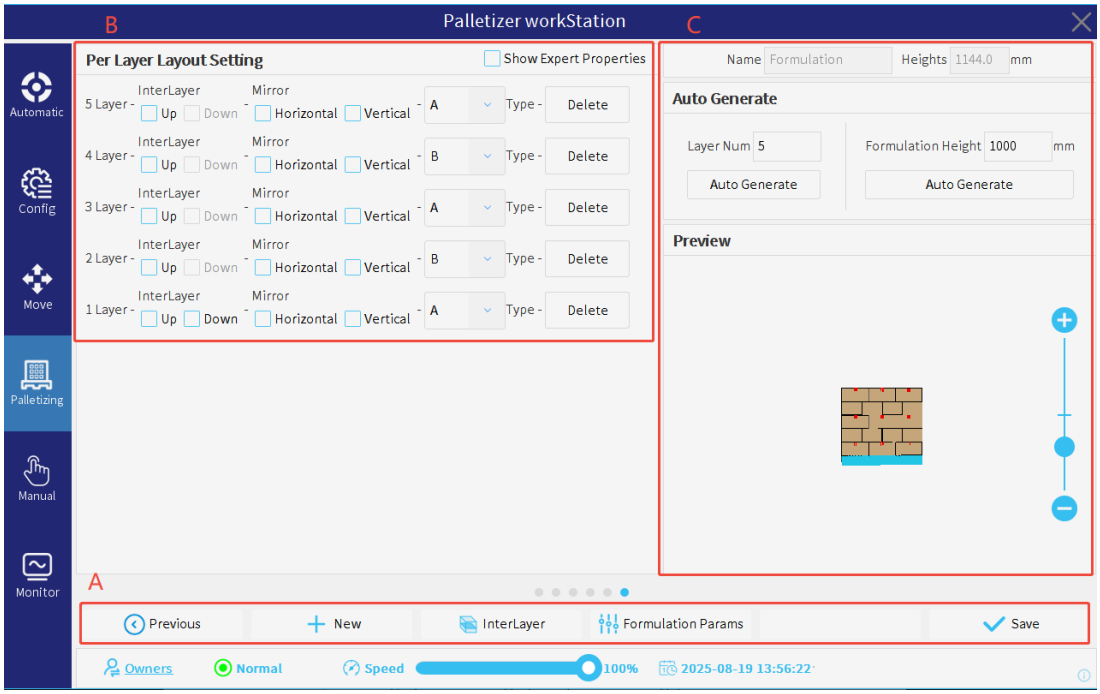


Figure 2-41 : Per Layer Layout Setting

Description for Area A

- **New:** to create a layer;
- **InterLayer:** tap to access the setting interface which provides options for parameter adjustment.

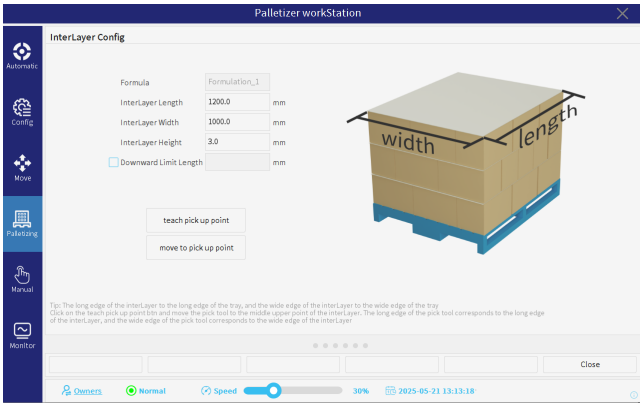


Figure 2-42 : Interlayer Setting

- InterLayer dimension limit: Length/Width $\leq$ 2000mm; Height $\leq$ 100mm
- **Downward Limit Length:** to set the robot's longest downward probing depth along the Z-axis, with a maximum depth of 2000mm. If the robot's downward depth exceeds the maximum, a safety alarm will be triggered;
- **Teach Pick Up Point:** tap to enter the interface, where the spatial coordinates of the pickup point can be taught before tapping "OK" to return to the interface;
- **Move to Pick Up Point:** to move the robot to upper position of the pick up point.

- **Formulation Parameters:** to set the running speed of the current formulation in **Figure** 2-43 , with a range of 2-100%.

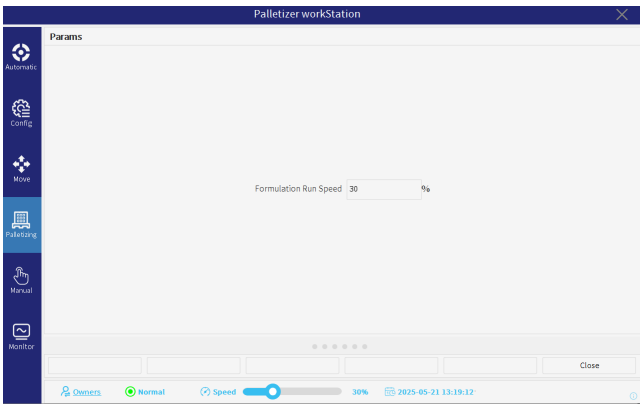


Figure 2-43 : Formulation Parameters

- **Save:** save the formulation.

Description for Area B

- **Up:** to select an upper interlayer for the current layer;
- **Down:** to select a down interlayer for the current layer;
- **Horizontal:** to add a horizontal mirror to the current layer to generate a new layer;
- **Vertical:** to add a vertical mirror to the current layer to generate a new layer;
- **class:** to select a type for the current layer (options including those types generated in the previous step);
- **Delete:** to delete the current layer;
- **Show Expert Properties:** check to show more advanced settings.

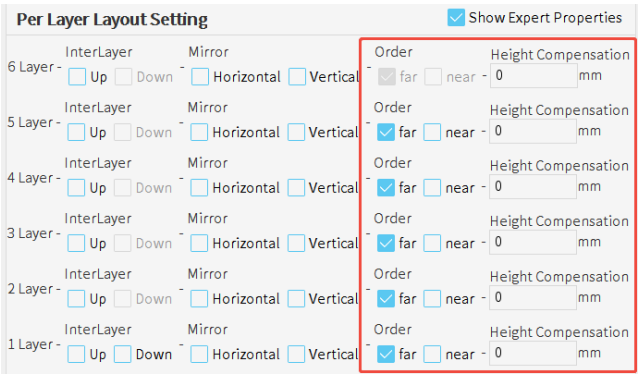


Figure 2-44 : Show Expert Properties

- **Far:** to set the placement order [from near end to far] for the current layer;
- **Near:** to set the placement order [from far to near] for the current layer;
- **Height Compensation:** to specify the value in the input box to dynamically adjust the stacking height of each layer, ranging from -200 to 200mm. For instance, if the second layer is set to 20mm, the system will add 20mm to the height calculation of that layer, which is used to compensate for the height of the first layer after it is compressed, so that the entire stacking height meets the desired target. The initial compensation value of 0mm indicates that no adjustment is required if no compression is detected.

Description for Area C

- **Auto Generate**

  There are two ways for automatically generating the number of layers of the current formulation.
  - Specify the required number of layers in the input box (at most 100 layers), then tap [Auto Generate] > [OK].
  - Or set the target pallet height in the input box (max. 10000mm) and the system will automatically calculate the number of layers. The calculation method is: (stacking height - pallet height)/height of a single box. Tap [Auto Generate]

> [OK] in the automatic pop-up window.

- The height of the formulation varies with the number of layers or stacking height. The calculation method is: tray height + number of layers * height of the boxes + height of the interlayers set for the layer + height compensation set for the layer.
- The system automatically generates 5 layers by default. If you only set 1 type of layer, the system will generate the upper and lower layers as mirror image of each other by default. If you set 2 types of layer, the system defaults to generate the upper and lower layers with A and B layers. Tap the corresponding option to make an adjustment.
- Once the parameters of all layers are set, the preview window on the right side will show a view of 3D palletizing, supporting 360° rotation.

After configuration, tap [Save] button to save the current formulation and complete the creation.

NOTICE

After setting up mirroring, the labels are always uniformly facing outward.

2.5 Manual Tab

The interface displays after tapping [Manual], where the suction cup and lifting column can be manually operated.

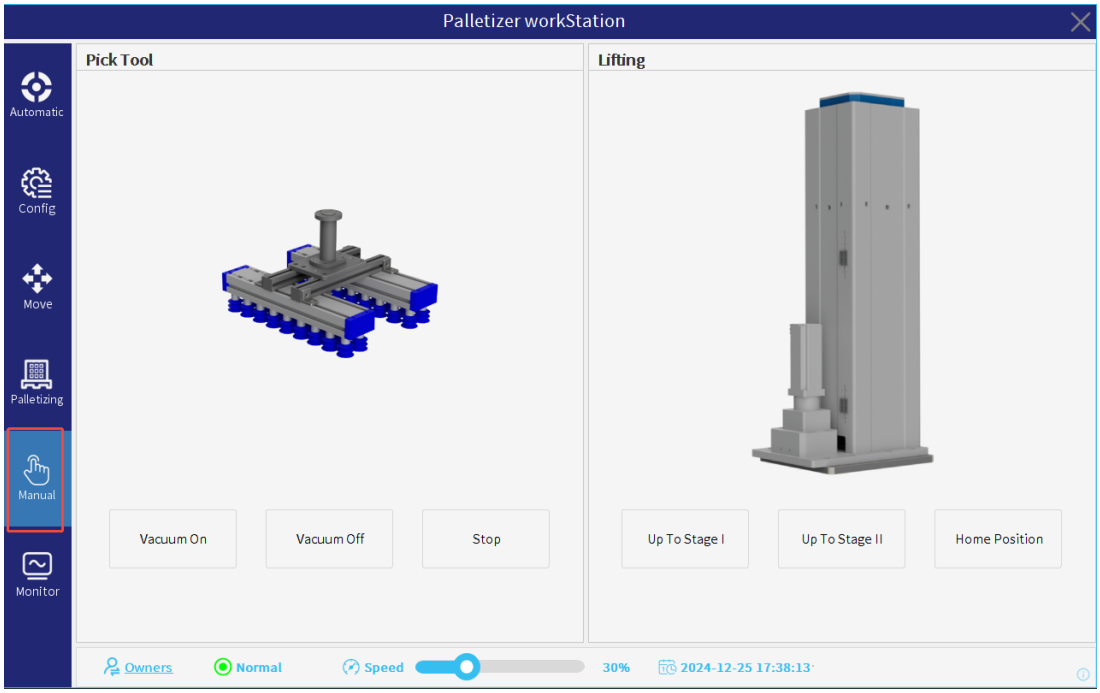


Figure 2-45 : Manual

Suction Cup

- **Vacuum On:** to pick up the workpiece;
- **Vacuum Off:** to place the workpiece;
- **Stop:** to disable the suction cup.

Lifting Column

- **Up To Stage I:** to increase the lifting column height by 200mm.
- **Up To Stage II:** to increase the lifting column height by 400mm.
- **Home Position:** to decrease the lifting column height to 0 mm.

NOTICE

Before performing manual operations, ensure that the suction cup and lifting column are enabled in the configuration tab.

2.6 Monitor Tab

The interface displays after tapping [Monitor] where the I/O monitor and log can

be viewed.

2.6.1 I/O monitor

The I/O Monitor interface provides options for the digital input and output. The state of digital output can be manually edited by checking the circle box.

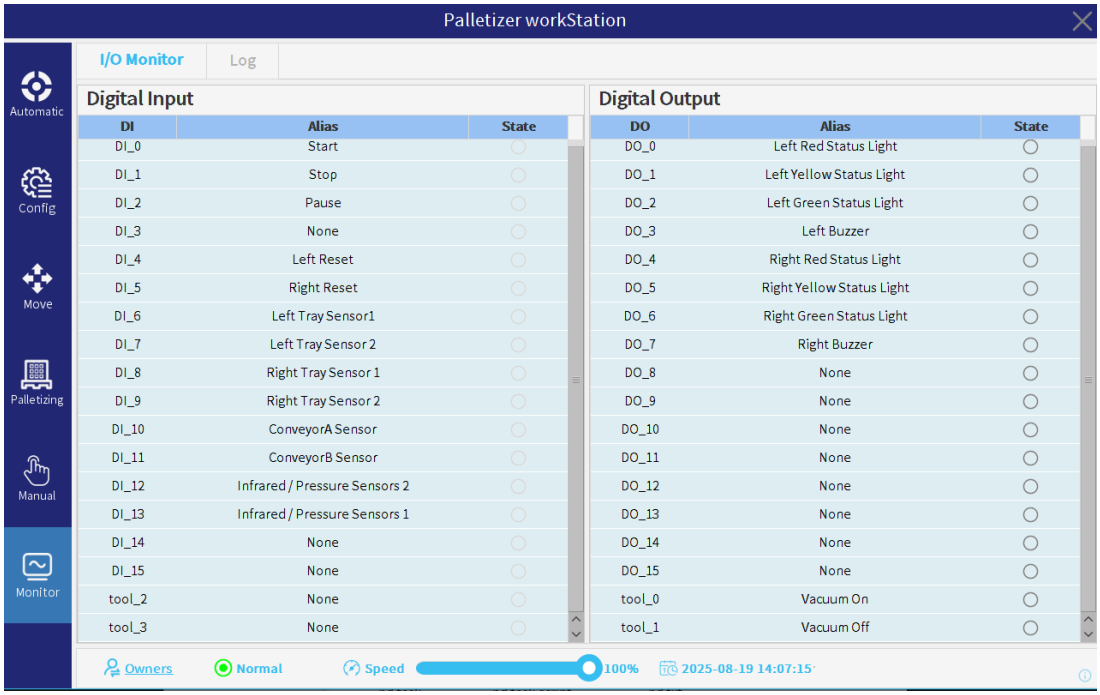


Figure 2-46 : I/O Monitor

2.6.2 Log

The Log interface records those information, warning, and error generated during the robot operation can be recorded. Filter the message by unchecking the box.

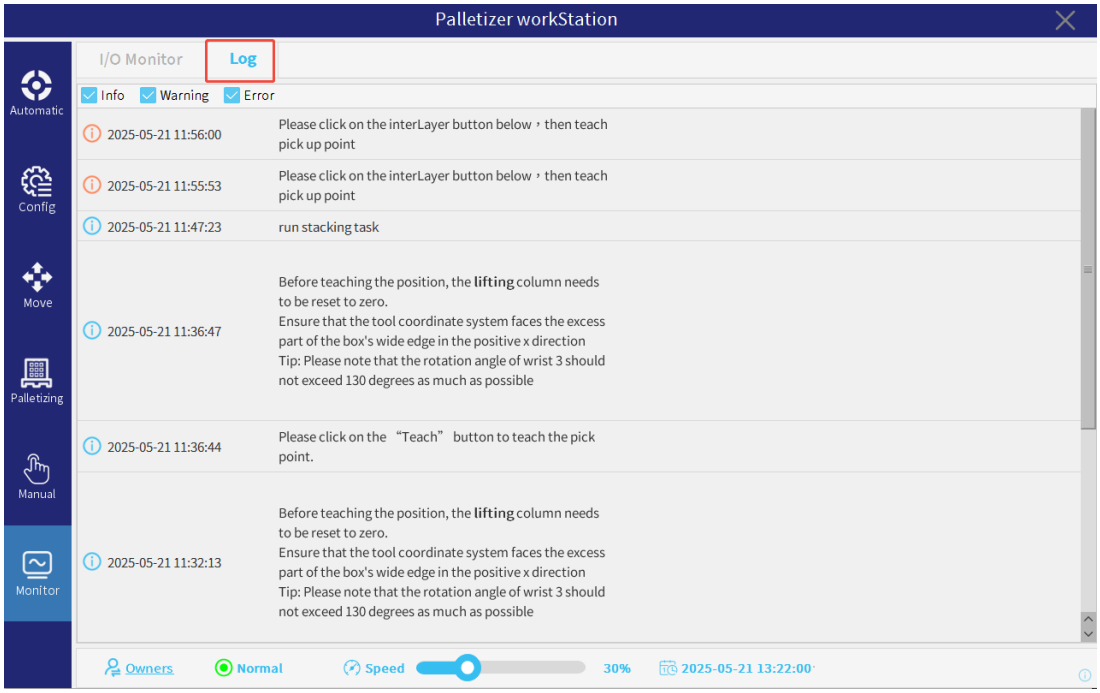


Figure 2-47 : Log

2.6.3 Modbus Monitor

Tap [Config] > [General] > [Optional], and check [Remote Control].

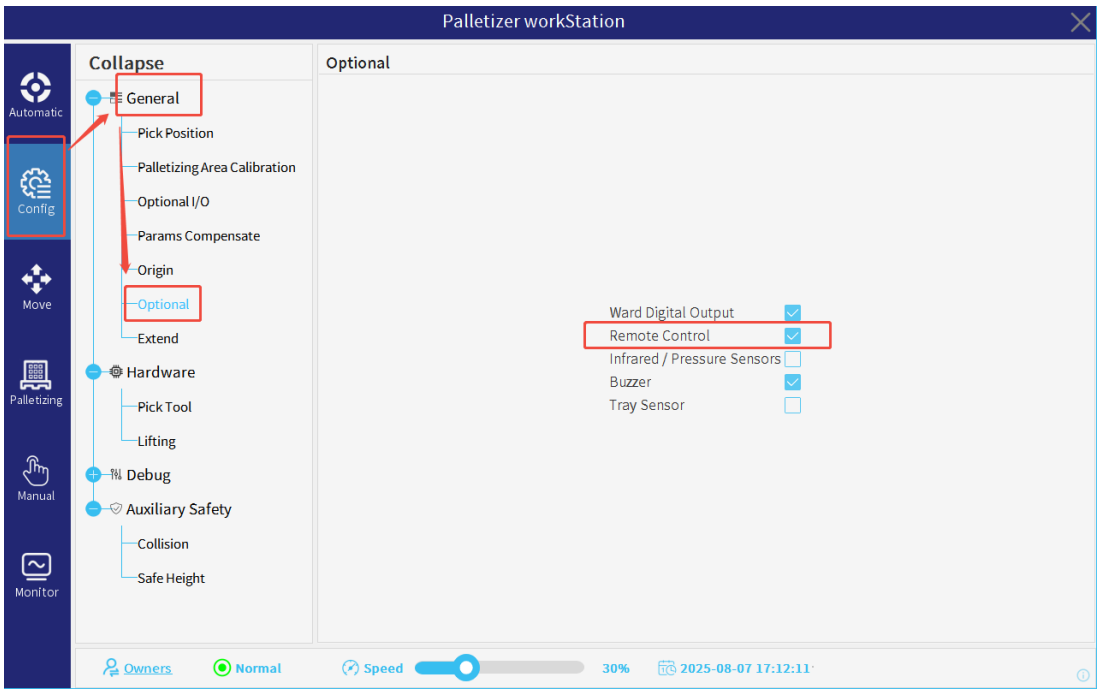


Figure 2-48 : Enable Remote Control

Tap [Monitor] > [Modbus Monitor]. The values and functions of all Modbus registers can be viewed in the Modbus Monitoring interface. For more information, please refer

to Section 4.2 **Modbus Slave Remote Control** in Appendix.

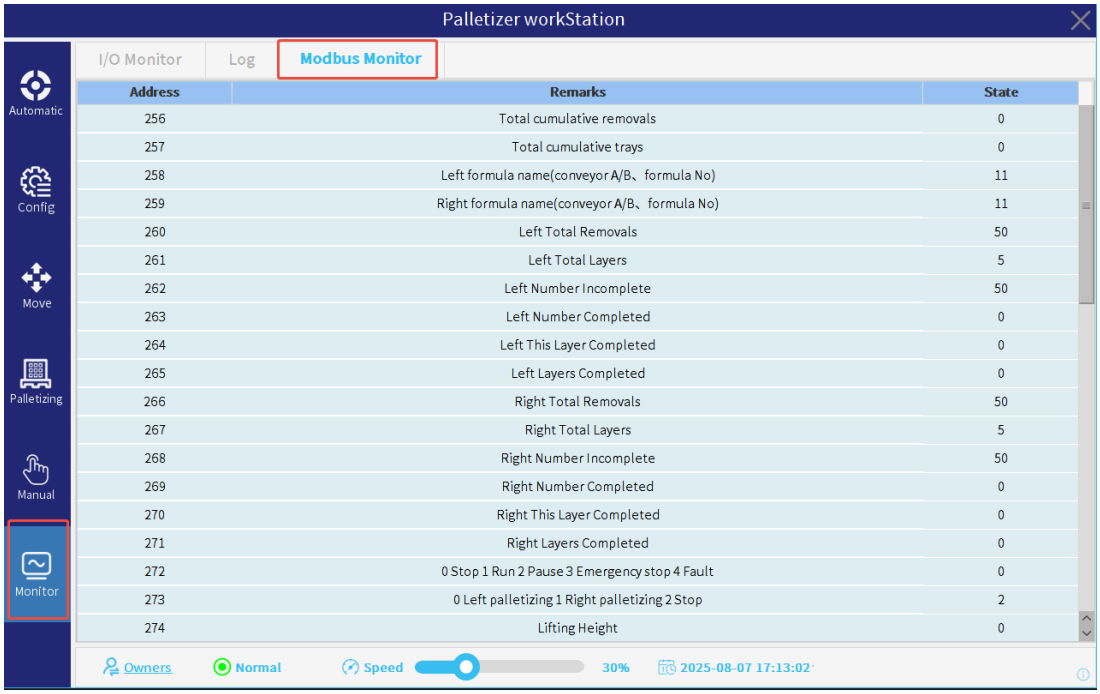


Figure 2-49 : Modbus Monitoring

2.7 External Configuration tab

An external configuration tab outside the plugin allows to manage the Palletizer Worktation data.

2.7.1 Palletizer Workstation Data Safety

If the data of Palletizer Workstation is needed to be deleted and reconfigured, navigate to [Config] > [Plugin] > [palletizer workStation data safe] to delete the data in **Figure** 2-50 .

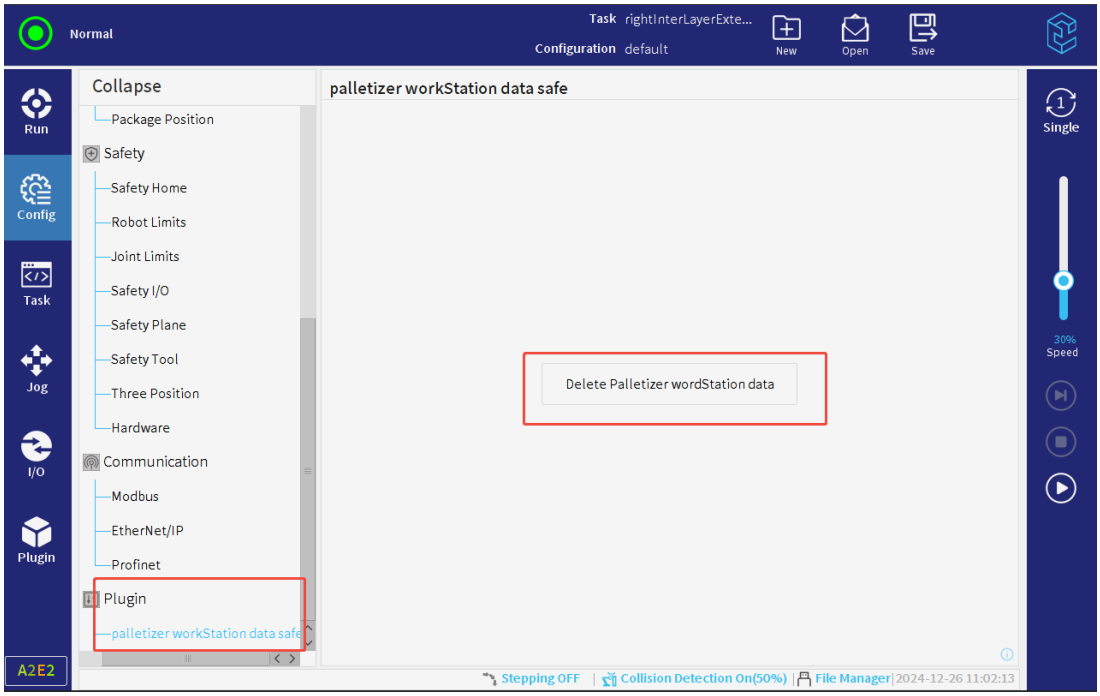


Figure 2-50 : Delete Palletizer Workstation Data

2.8 Other Functions

The plugin provides advanced functions such as multi-pick mode and dual-line palletizing, which facilitates the realization of palletizing tasks.

2.8.1 Multi-pick

The multi-pick function enables the robot to grasp two or three boxes simultaneously for palletizing. Boxes to be picked simultaneously can be set to be attached edge-to-edge on either the long side or the wide side.

2.8.1.1 Operation Instructions

Configure the double-pick or triple-pick mode in the following steps:

1. **Configure Digital Signals**
   - Access the [Input IO Control] plugin from the navigation bar.
   - Check to enable DI10 and DI11.

2. **Set Tool I/O**
   - Tap [Config] > [General] > [Tool I/O].

- Set the mode for digital I/O signals under [Working Mode].

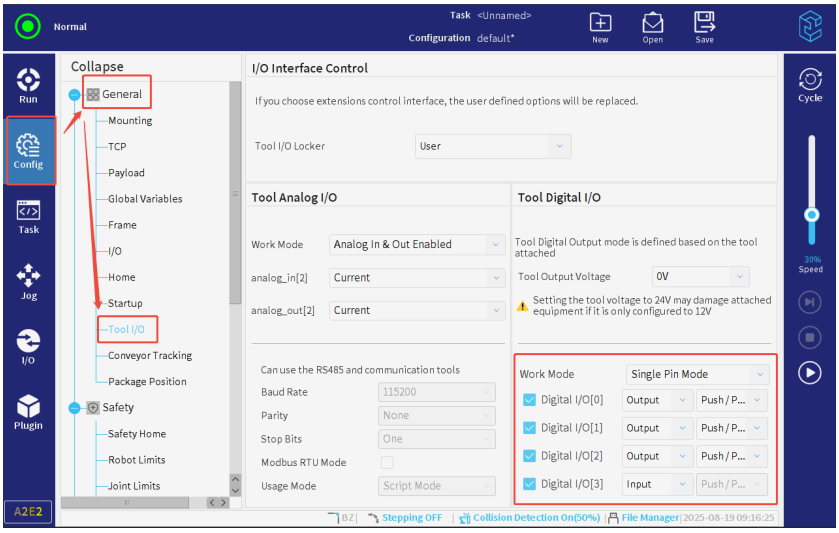


Figure 2-51 : Set Tool I/O

3. **Formulation Creation and Configuration**
   (a). Enter the Palletizing WorkStation and bind the corresponding workstation type.
   (b). Tap [Palletizing] > [Management] > [New] > [Edit] to create a new formulation.

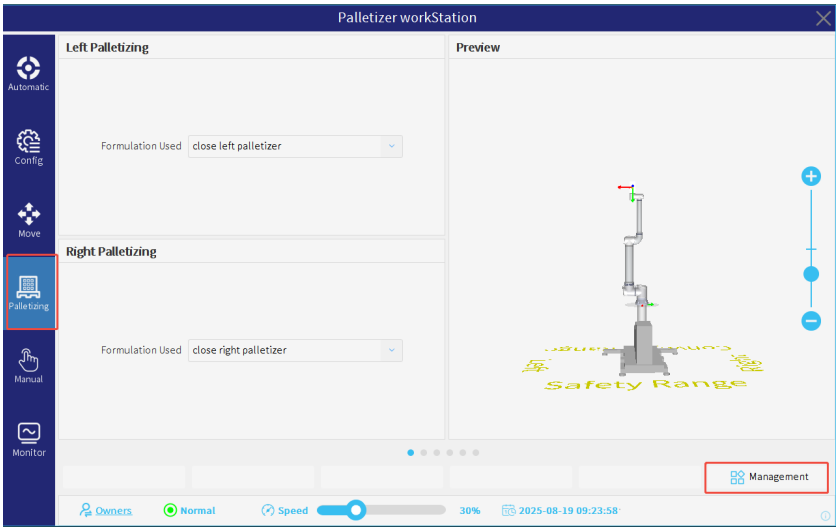


Figure 2-52 : New Formulation (1)

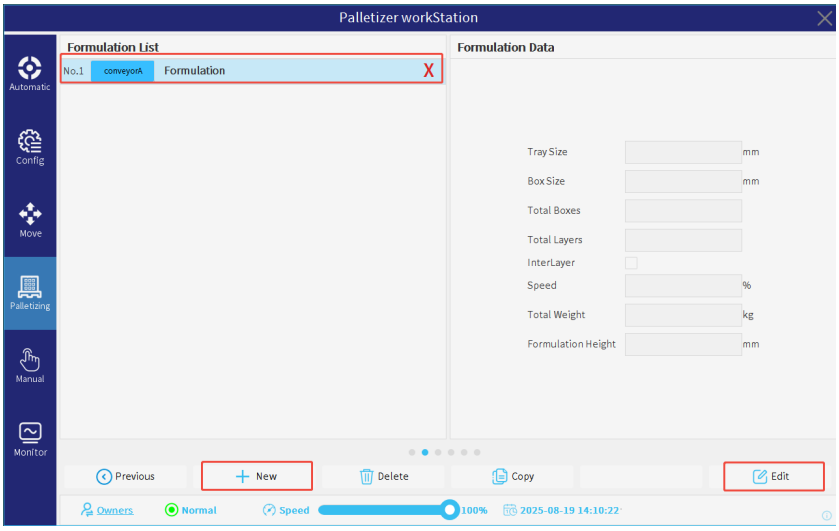


Figure 2-53 : New Formulation (2)

(c). **Tray Settings**: Configure the tray parameters.

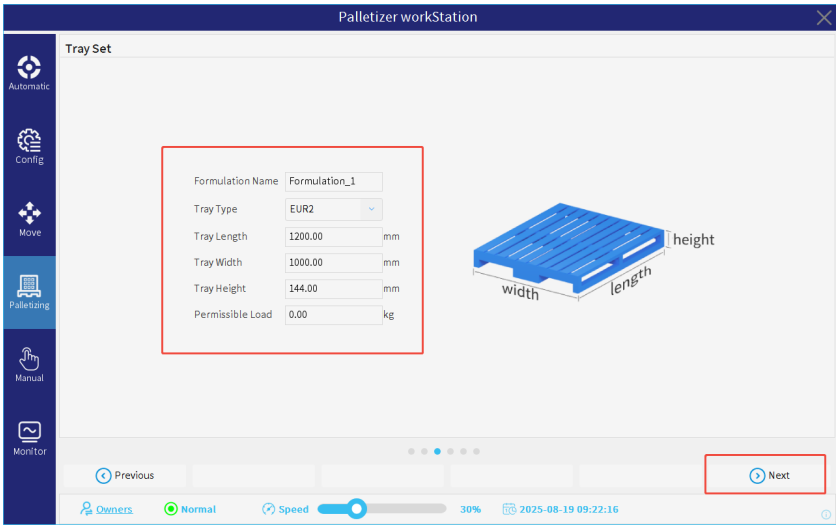


Figure 2-54 : Tray Settings

(d). **Box Settings**

- Set the box parameters.
- Select the picking mode (check [Double Pick] or [Multi-pick]).
- Select the fitting method (check [Wide-edge Fit] or [Long -edge Fit]).
- Tap [Next].

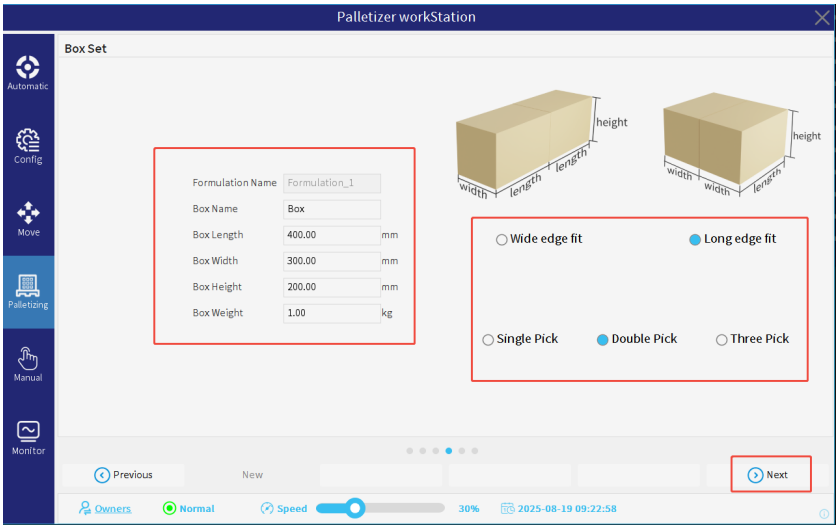


Figure 2-55 : Set Picking Mode

(e). **Create Layer Pattern** (choose one of the two)

- **Automatic Layout**: Tap [Automatic Layout], and select the desired layout type.
- **Manual Creation**: tap [New] to manually create a layer type.

(f). **Edit Layer Type**: In the settings of the created layer type (such as A/B/C type), tap [Edit] to set the target box position and overall parameters.

(g). **Add Picking Links**

Tap [Multi-pick] and create links between boxes in the current layer type. The link is a prerequisite for the robot to grasp multiple boxes at once.

- **Double Pick**: Enter the numbers of two boxes in [from xx link to xx] and then tap [Link Box] to generate a double-pick link between the boxes.
- **Triple Pick**: Enter the numbers of three boxes in [from xx link to xx link to xx] and then tap [Link Box].
- After successful setting, a blue link icon will be displayed in the preview window on the left.
- **Adjust Link**: If you need to modify, tap [Delete Link] or [Del all links] to unlink, and then relink.

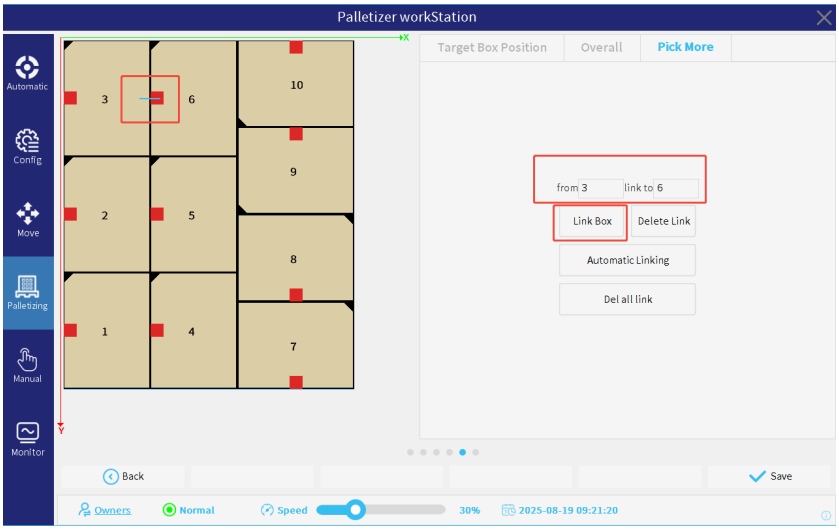


Figure 2-56 : Set Links for Double Pick

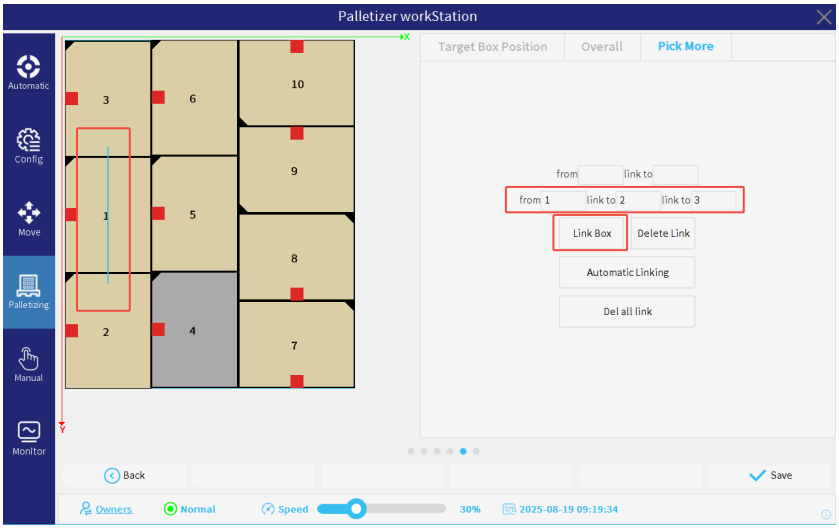


Figure 2-57 : Set Links for Triple Pick

(h). **Set Layer Parameters**: configure the parameters for each layer. The total number of layers can also be adjusted. Tap [Save] to complete the formulation creation.

4. Select the required formulation for left and right side palletizing, and start running the task in [Automatic] interface.

NOTICE

1. In multi-pick mode, the box interval setting in [Automatic Layout] interface is disabled.
2. Double-pick mode only supports links between two boxes, while triple-pick

mode allows links between two or three boxes.

2.8.1.2 I/O Signal Control

In multi-pick mode, if detecting the drop sensor and the pressure sensor is required, please configure them according to the following instructions:

- **Signal Description**
  - **DI12**: Infrared/Negative Pressure Sensor 2 Detection Signal
  - **DI13**: Infrared/Negative Pressure Sensor 1 Detection Signal
  - **DI14**: Infrared/Negative Pressure Sensor 3 Detection Signal (for triple-pick)
- **Signal Configuration**
  1. Access the [Input IO Control] plugin, and check the boxes to enable DI10 and the required sensors.
     - Double-pick mode: DI12 and DI13
     - Triple-pick mode: DI12, DI13 and DI14

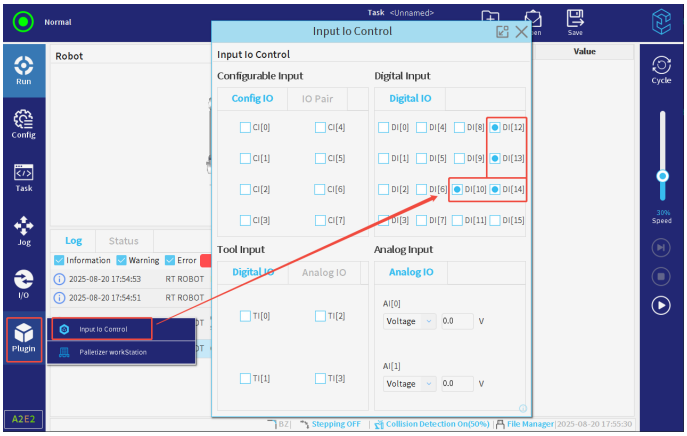


Figure 2-58 : Multi-pick sensor detection signals

2. Tap [Optional] and check [Infrared/ Pressure Sensor].

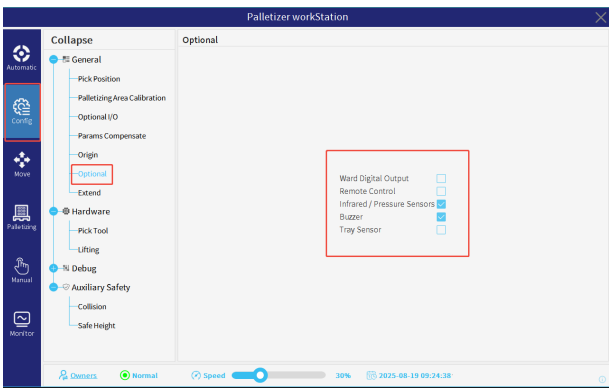


Figure 2-59 : Enable Infrared/Negative Pressure Sensor

3. Tap [Optional I/O]. Configure DI12 as [Infrared/Negative Pressure Sensor 2] and DI14 as [Infrared/Negative Pressure Sensor 3].

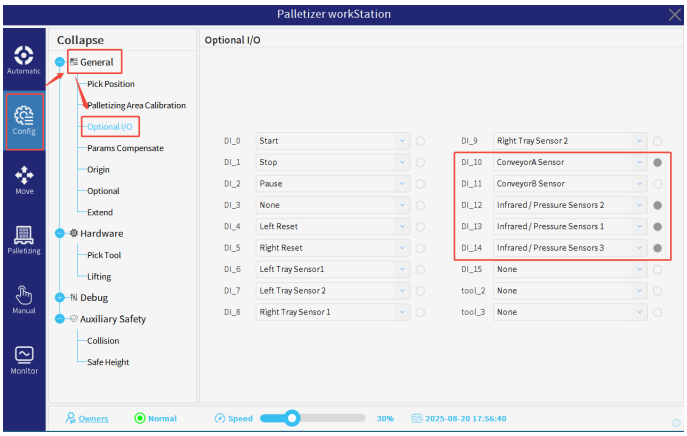


Figure 2-60 : Configure signals

2.8.2 Conveyor Mode

Single-line and dual-line conveyor modes are supported for palletizing. After enabling dual-line conveyor mode, choose the required operating mode based on the formulation configuration:

1. **Dual-line, Dual-pallet Mode**
   The dual-line conveyor function supports using left and right physical conveying lines to supply materials to two pallet positions. Conveyor line assignment is flexible based on the formulation. The robot alternately picks up materials based on the material status on both sides to achieve efficient palletizing.
   - Dual-line Palletizing Different Types of Material: Both conveyor lines supply different types of boxes, and the robot performs picking alternately.
     - When there are materials to be grasped on both sides, pick them up in the order of "Left → Right → Left → Right".
     - When there are materials to be grasped only on one side, the robot prioritizes grasping the side to be processed.

2. **Single-line, Dual-pallet Mode**
   When formulations for both sides use the same conveyor line, this line supplies material to both palletizing positions by default.

3. **Single-line, Single-pallet Mode**
   If only one side's formulation uses a conveyor line while the other is not configured with any one, the selected conveyor line is still responsible for material supply to the palletizing position by default.

2.8.2.1 I/O Signal Control

Dual-line palletizing is determined by Digital Input (DI) signals.

2.8.2.1.1 I/O Signal Description

- **DI10**: Material arrival signal on conveyor line A
- **DI11**: Material arrived signal on conveyor line B
- **Signal Combination**
  - DI10=High & DI11=High: the robot alternates between left and right to move materials on both sides.
  - DI10=High & DI11=Low: only pick and place materials from conveyor line A.
  - DI10=Low & DI11=High: only pick and place materials from conveyor line B.

2.8.2.1.2 Steps for I/O Signal Configuration

1. Access the [Input I/O Control] plugin, and check to enable DI10 and DI11.

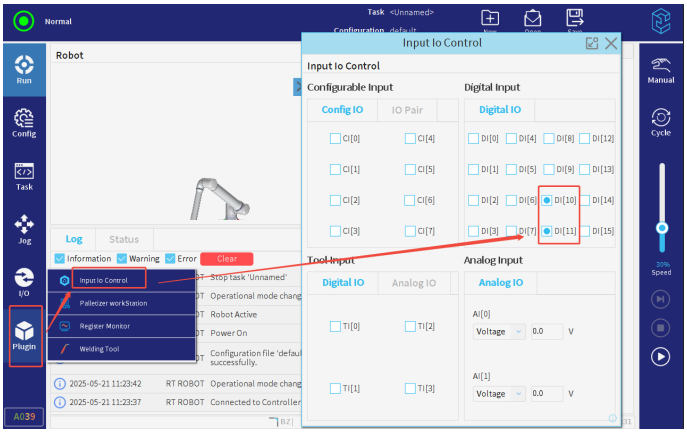


Figure 2-61 : Enable Digital Input Signal

2. You can confirm the binding relationship between the digital input signals and the conveyor lines through [Monitor].

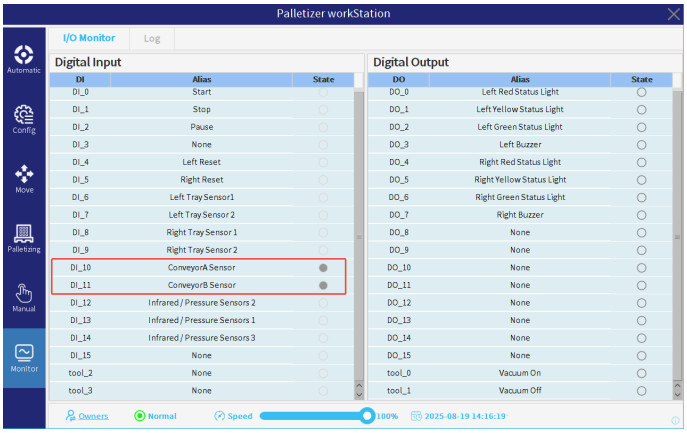


Figure 2-62 : Binding Relationship between Digital Signals and Conveyor Lines

2.8.2.2 Operation Instructions

Configure dual-line palletizing function in the following steps:

1. **Configure I/O Signals**
   Enable DI10 and DI11 signals.

2. **Enable Dual Conveyor Lines**
   Navigate to [Config] > [General] > [Pick Position] and check [Dual Conveyor Line] to enable dual-line palletizing.

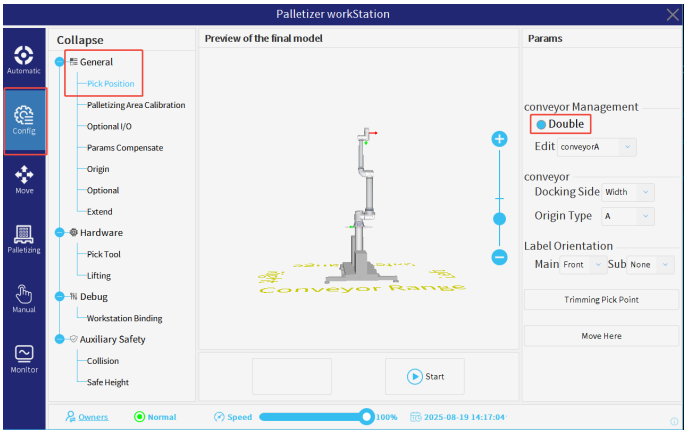


Figure 2-63 : Enable Dual Conveyor Lines

3. **Create Formulation**
   - Tap [Palletizing] > [Formulation Management] to create a new formulation and set the parameters related to tray and boxes, and also picking method.
   - Select the desired layer layout through [Automatic Layout]. Save the settings after generating the number of layers. Create another one in the same way.

Figure 2-64 : Select Layer

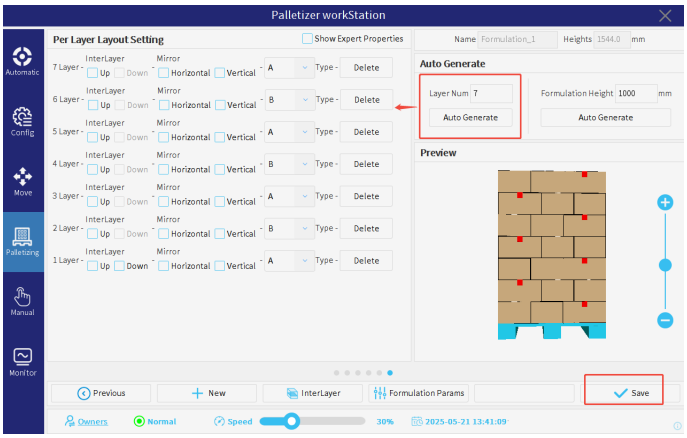


Figure 2-65 : Auto-generated Layers

4. **Assign Conveyor Lines**

   After setting up, specify the corresponding conveyor line for each formulation. It is important to note that the label orientation will change after assigning different conveyor lines for the formulation.

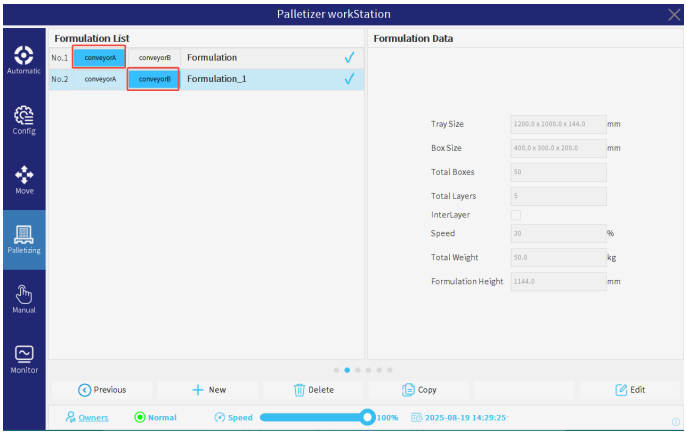


Figure 2-66 : Set Corresponding Conveyor Lines

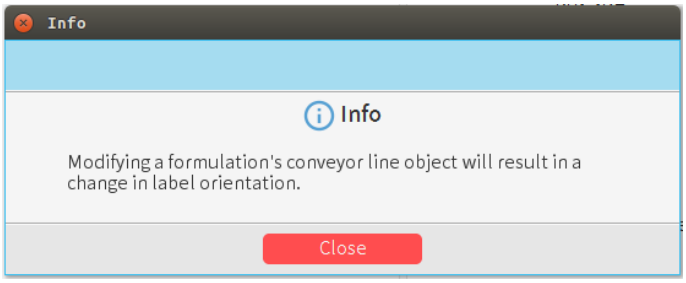


Figure 2-67 : Label Orientation Modification Warning

5. **Configure Conveyor Line Parameters**
   Tap [Config] > [General] > [Pick Position]. Follow the prompts or the description in Section 2.2.1 to set the parameters of conveyor line A/B in sequence: origin position, docking side, picking point teaching. Settings in **Figure** 2-68 are applied to conveyor line A.

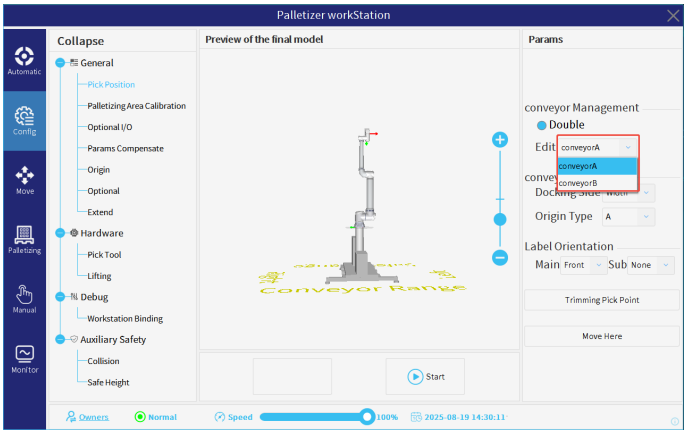


Figure 2-68 : Conveyor Line Explanation

6. **Run Verification**
   After completing the configuration, enter the [Automatic] interface. Power on the robot and execute the palletizing task.

2.8.3 Lifting Column Adapter Plugin

The Lifting Column Adapter plugin developed by Elite is used to configure parameters for the lifting column and view its status information.

Install this plugin following the instructions in Section 1.1.

2.8.3.1 Configuration

Tap [Config] - [Plugin] - [Lifting Column Plugin] to access the corresponding interface.

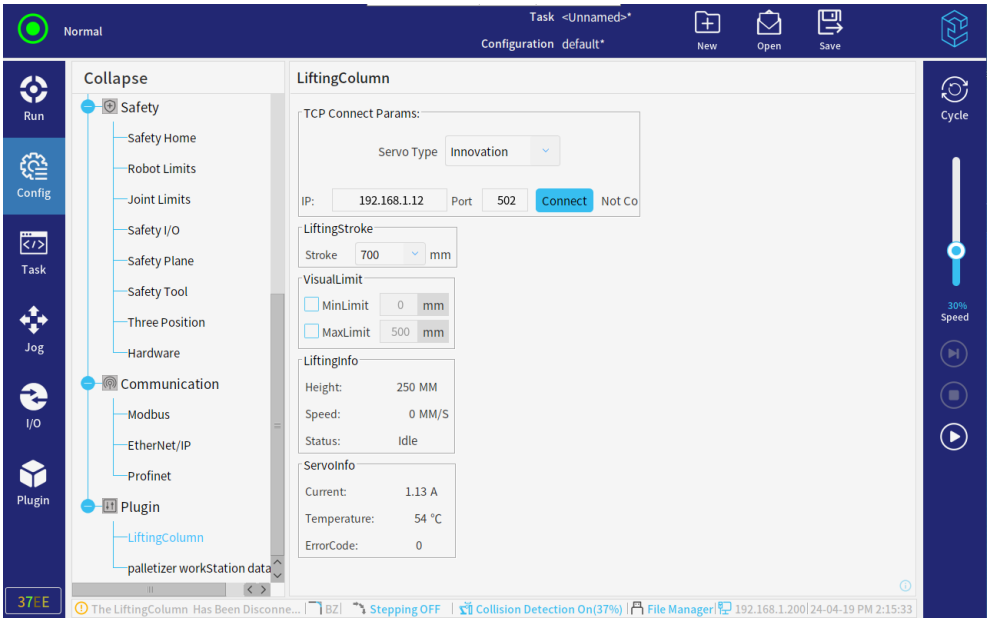


Figure 2-69 : Config-Lifting Column Plugin

Menu Options

1. **TCP Connection Parameters**
   - Servo Type: the currently connected lifting column model, such as Ewellix, Innovation, Leadshine, and Linak.
   - IP: IP address of the currently connected robot.
   - Port: the currently connected port number.
   - Tap [Connect] button. A successful connection to the lifting column is indicated when the button turns red and displays ”Disconnect”. Tap the button again to disconnect.
2. **Lifting Column Stroke**: the lifting height of the lifting column (mm). It varies with the lifting column model.
   - Linak11: 500-900mm;
   - Other models: 500-700mm.
3. **Virtual Limit**: safe operating range (mm) for the lifting column’s movement, which must be set within the lifting column’s stroke.
4. **Lifting Column Info**
   - Height: the current height (mm) of the lifting column.
   - Speed: the operating speed (mm/s) of the lifting column during ascent/descent.
   - Status: the current operating status of the lifting column.
5. **Servo Info**
   - Current: the current of the currently run servo (A).
   - Temperature: the running temperature of the current servo (°C).
   - Error Code: the highest priority error currently active for the lift column (see

Section 4.3).

2.8.3.2 Task

Tap [Tasks] > [Plugins] > [LiftingColumn] to access the Lifting Column Movement Settings interface.

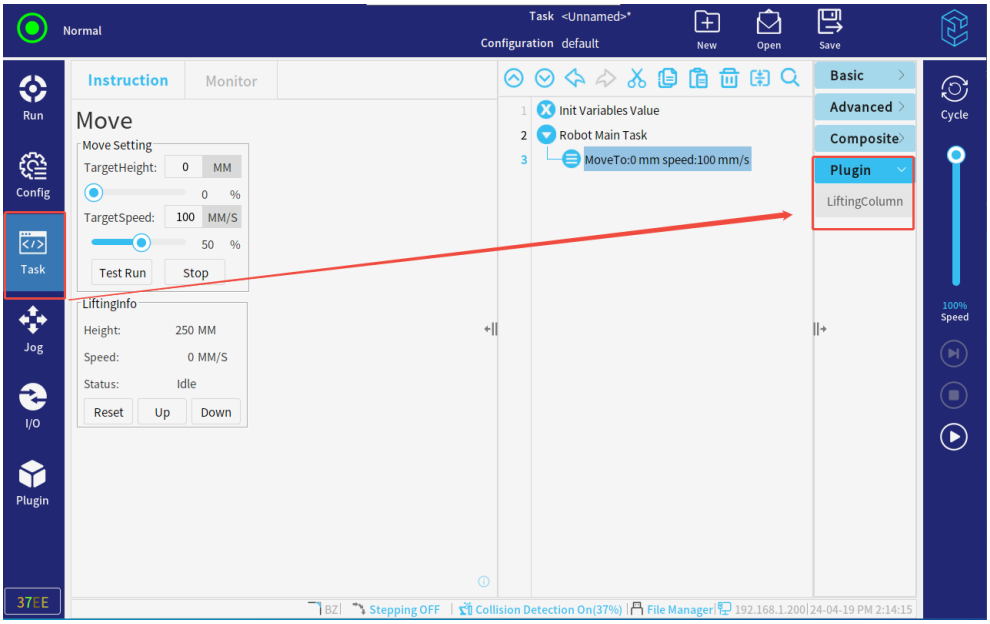


Figure 2-70 : Task-Move Interface

Menu Options

1. **Movement Settings**
   - Target Height: the height (mm) to reach for the lifting column, which must be set within the virtual limit range.
   - Target Speed: the speed at which the lifting column needs to operate (range: 0-200mm/s).
   - Tap [Test Run] button. The lifting column starts moving. This allows testing the configured parameters. Tap the [Stop] button to stop movement immediately.
2. **Lifting Column Info**
   - Height: the current height of the lifting column.
   - Speed: the operating speed of the lifting column during ascent/descent.
   - Status: the current operating status of the lifting column.
   - When an error occurs, tap [Reset] button to clear it.
   - Long press [Up]/ [Down] button to continuously raise/lower the lifting column. Once the button is released, the column stops its movement.

Chapter 3 Notes

3.1 Tidiness

If the stacking pattern is not tidy, please make some adjustment in [Config] and [Palletizing] interface based on the following situations.

- The misalignment between the center of the suction cup and the center of the box causes the deviation in the placement position:
  - Adjusting the pick position is recommended. For details, refer to **Subsection 2.2.1.1**;
  - It is recommended to fill in the accurate value of box length and width. For more information, refer to **Subsection 2.4.3.2**;
  - It is recommended to fill in the accurate value of tray length and width and also rotate the TCP coordinate by adjusting "TCP RZ", so that the X-axis positive direction is perpendicular to the long side of the tray. For details, refer to **Subsection 2.2.2.1**.
- Displacement occurs after the robot places the box:
  - It is recommended to set the box height parameter based on the average height of the boxes. For details, refer to **Subsection 2.4.3.2**;
  - Decreasing the value for parameter "Z" of palletizing area calibration is recommended. For the instruction, refer to **Subsection 2.2.1.2**.
- Irregular rotation of the stack due to the robot arm installation deviation:
  It is recommended to adjust the rotation parameter "C" of palletizing area calibration. For details, refer to **Subsection 2.2.1.2**.
- After placing the box from the suction cup, collisions occur with the stack during movement:
  - Accurate tray dimensions are recommended. For more information, refer to **Subsection 2.4.3.1**;
  - It is recommended to adjust the height parameter "Z" of palletizing area calibration. For details, refer to **Subsection 2.2.1.2**;
  - It is recommended to fill in the box height with the average height of boxes to reduce the cumulative height errors because of the multiple layers. For the instruction, refer to **Subsection 2.4.3.2**.

3.2 Stacking Pattern

The stacking pattern shown in **Figure** 3-1 is stable and recommended. The boxes on even and odd layers are placed symmetrically with alternating left and right axes, providing greater stability.

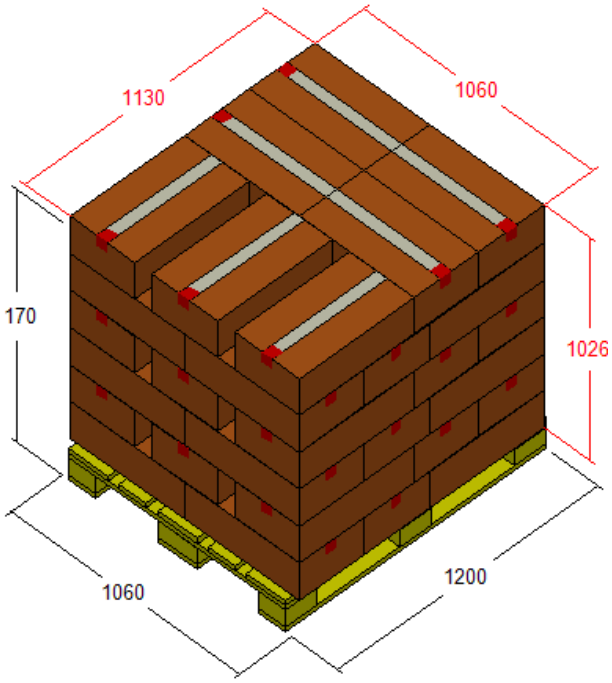


Figure 3-1 : Stable stacking pattern

These two stacking patterns are not recommended.

Stacking symmetrically with alternating left and right axes may result in inconsistent heights if the boxes are bulging, as shown in **Figure** 3-2 .

Stacking in a hollow square pattern makes it difficult to compensate for errors caused by box bulging, leading to an uneven stacking pattern, as shown in **Figure** 3-3 .

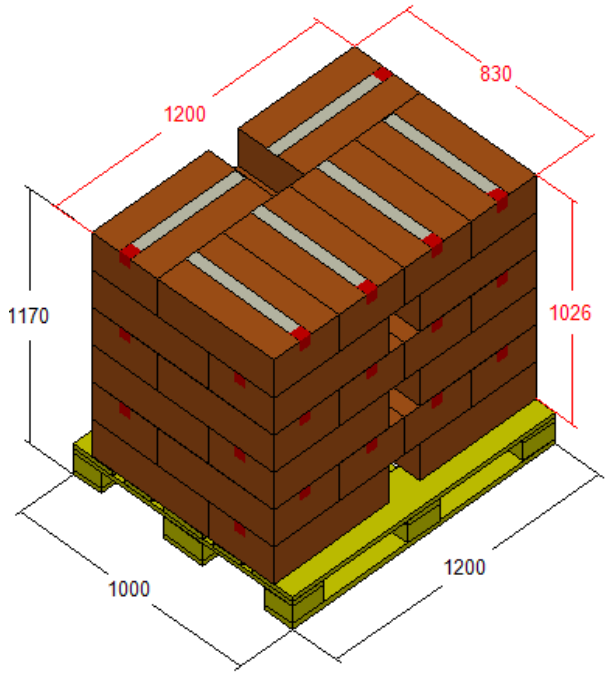


Figure 3-2 : Unstable pattern 1

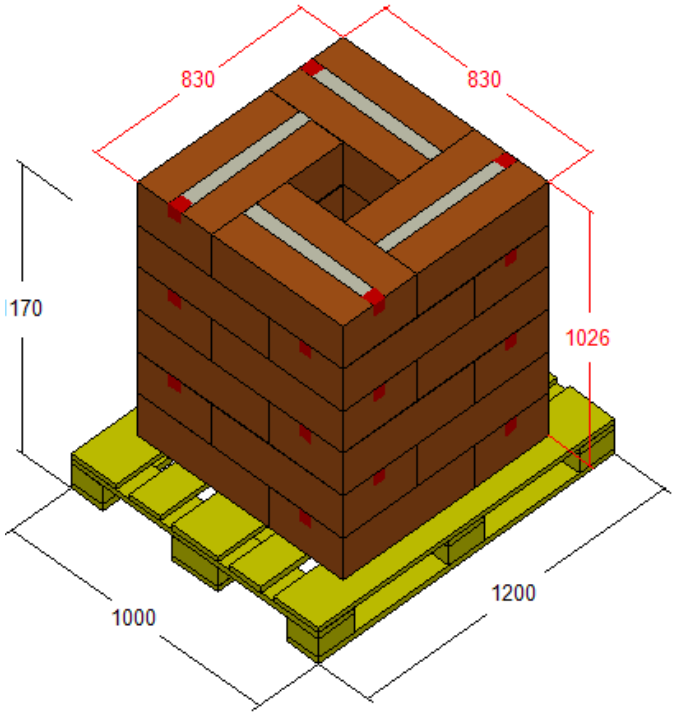


Figure 3-3 : Unstable pattern 2

3.3 Plastic-wrapped Box

If the box is plastic-wrapped, follow the advice below.

- Ordinary octopus suction cups and foam suction cups can not pick up plastic wrap. It is recommended to use bellows suction cup;
- The distance between the suction nozzle and the plastic-wrapped box's edge/suction nozzle is too small, which may easily cause the suction nozzle to fall off during the picking process;
- The plastic-wrapped box is easy to be deformable after picking and the box height changes in some degree. It is recommended to properly add the value by tapping [Params compensate] > [entry adjustment Z(Left tray) & entry adjustment Z(Right tray)].

3.4 Lightweight Box

If the box is lightweight, follow the advice below.

- The time it takes for the lightweight box to fall off the suction cup is longer, so it is recommended to adjust the delay time after placing of parameters compensate accordingly. For details, refer to **Subsection 2.2.1.4**;
- The lightweight box falls slowly from the suction cup, thus it is recommended to adjust the air pressure. Lower pressure leads to faster placement speed.

3.5 Air Supply

Since the unstable internal air sources in the factory potentially cause boxes to drop during palletizing, please use air compressor or air tank according to the actual situation on site.

3.6 Backup and Restore

To backup and restore configurations, refer to the two sections **Backup** and **Restore** in **Chapter 3** in CS Series User Manual.

Chapter 4 Appendix

4.1 I/O Instructions for Use

Table 4-1 . Digital I/O

Name	Type	Alias	Function
DI0	DI	Start	Start palletizing at the high level
DI1	DI	Stop	Stop palletizing at the high level
DI2	DI	Pause	Pause palletizing at the high level
DI3	DI		
DI4	DI	Left Reset	Clear the left tray when the high level keeps 1s.
DI5	DI	Right Reset	Clear the right tray when the high level keeps 1s.
DI6	DI	Left Tray Sensor 1	Check if the tray can be detected. When the signal is at the low level, the program will be paused and there will be a pop-up alarm. Replace the tray manually before restarting the program.
DI7	DI	Left Tray Sensor 2	
DI8	DI	Right Tray Sensor 1	
DI9	DI	Right Tray Sensor 2	
DI10	DI	Conveyor A Sensor	Check if boxes are at the conveyor A. When the signal is at the high level, they will be detected and the pick action will be executed.
DI11	DI	Conveyor B Sensor	Check if boxes are at the conveyor B. When the signal is high, they will be detected and the pick action will be executed.

Name	Type	Alias	Function
DI12	DI		
DI13	DI	Infrared Negative Pressure Sensor	Check if the absorbed boxes drop during palletizing. If they do drop and the low level keeps 0.5s, the system will stop palletizing and there will be a pop-up alarm.
DI14	DI		
DI15	DI		
DO0	DO	Left Red Dtatus Light	Indicate robot alarms.
DO1	DO	Left Yellow Status Light	Indicate the left tray is in the waiting state.
DO2	DO	Left Green Status Light	Indicate the left palletizing is in progress.
DO3	DO	Left Buzzer	Beep for alarms.
DO4	DO	Right Red Status Light	Indicate robot alarms.
DO5	DO	Right Yellow Status Light	Indicate the right tray is in the waiting state.
DO6	DO	Right Green Status Light	Indicate the right palletizing is in progress.
DO7	DO	Right Buzzer	Beep for alarms.
DO8	DO		
DO9	DO		
DO10	DO		
DO11	DO		
DO12	DO		
DO13	DO		
DO14	DO		
DO15	DO		

Name	Type	Alias	Function
tool0	TO	Single-pick mode: Vacuum On	Single-pick mode: Pick up the workpiece.
		Multi-pick mode: Vacuum 1	Multi-pick mode: Pick up the workpiece.
tool1	TO	Single-pick mode: Vacuum Off	Single-pick mode: Place the workpiece
		Multi-pick mode: Vacuum 2	Multi-pick mode: Pick up the workpiece.
tool2	TO		
		Triple-pick mode: Vacuum 3	Triple-pick mode: Pick up the workpiece.
tool3	TO		

Table 4-2 . Configurable I/O

I/O Name	Configured
CIO	Reduced mode (for optional laser radars)
CI1	
CI2	
CI3	
CI4	Safeguard reset
CI5	
CI6	
CI7	
CO0	Emergency stop output
CO1	

CO2	
CO3	
CO4	
CO5	
CO6	
CO7	

NOTICE

If your motor is located inside the lifting column, CO0 and CO1 MUST be configured as Emergency stop output.

4.2 Modbus Slave Remote Control

Table 4-3 . Modbus Slave Remote Control

Address	Value	Function	Value Explanation
256	0	Total Cumulative Removals	
257	0	Total Cumulative Trays	
258	0	Left Formulation Name	No Formulation
	1-9	Left Formulation Name	Single-digit value represents formulation No.
	11	Left Formulation Name	Conveyor A+Formulation 1
	12-19	Left Formulation Name	Conveyor A+Formulation No.
	0	Right Formulation Name	No Formulation

Address	Value	Function	Value Explanation
259	1-9	Right Formulation Name	Single-digit value represents formulation No.
	11	Right Formulation Name	Conveyor A+Formulation 1
	12-19	Right Formulation Name	Conveyor A+Formulation No.
260	100	Total Cumulative Removals of Left Palletizer	
261	100	Total Cumulative Layers of Left Palletizer	
262	100	Number Incomplete of Left Palletizer	
263	0	Number Completed of Left Palletizer	
264	0	This Layer Completed of Left Palletizer	
265	0	Layers Completed of Left Palletizer	
266	100	Total Cumulative Removals of Right Palletizer	
267	100	Total Cumulative Layers of Right Palletizer	
268	100	Number Incomplete of Right Palletizer	
269	0	Number Completed of Right Palletizer	
270	0	This Layer Completed of Right Palletizer	
271	0	Layers Completed of Right Palletizer	
	0	Palletizing Task Status	Stop
	1	Palletizing Task Status	Run

Address	Value	Function	Value Explanation
272	2	Palletizing Task Status	Pause
	3	Palletizing Task Status	Emergency Stop
	4	Palletizing Task Status	Fault
273	0	Active Palletizing Side	Left Side
	1	Active Palletizing Side	Right Side
	2	Active Palletizing Side	Inactive
274	0	Lifting Column Height	
275	0	Lifting Column Status	Pause
	0	Lifting Column Status	Run
276	0	Lifting Column Error Code	
277	500	Lifting Column Max Height	
278	0	Full Status of Left Side	Not Full
	1	Full Status of Left Side	Full
279	0	Full Status of Right Side	Not Full
	1	Full Status of Right Side	Full
296	0	leftInterLayerExtend.task	Disabled
	1	leftInterLayerExtend.task	Enabled
297	0	rightInterLayerExtend.task	Disabled
	1	rightInterLayerExtend.task	Enabled
298	0	PickActionExtend.task	Disabled
	1	PickActionExtend.task	Enabled
299	0	PutActionExtend.task	Disabled
	1	utActionExtend.task	Enabled
300	0	ThreadExtend.task	Disabled
	1	ThreadExtend.task	Enabled

Address	Value	Function	Value Explanation
301	0	Conveyor Number	Single Conveyor Line
	1	Conveyor Number	Double Conveyor Lines
302	0	Multi-pick Mode	Disabled
	1	Multi-pick Mode	Enabled
303	0	Lifting Column	Disabled
303	1	Lifting Column	Enabled
304	0	Suction Cup	Disabled
	1	Suction Cup	Enabled
305	0	Access Level	Operator
	1	Access Level	Technicians
	2	Access Level	Owners
306	0	Palletizer Workstation Type	CPL1.0
	1	Palletizer Workstation Type	CPF16
	2	Palletizer Workssation Type	CPF10
	3	Palletizer Workstation Type	CPL07
	4	Palletizer Workstation Type	CPL07-11
326	1	Start and Auto Reset	Start
327	1	Start and Auto Reset	Stop
328	1	Start and Auto Reset	Pause
329	1	Start and Auto Reset	Resume
330	1	Start and Auto Reset	Left Reset
331	1	Start and Auto Reset	Right Reset
332	0	No Formulation/Formulation Number	Left Formulation Name
333	1	Write and Auto Reset	Write Left Formulation

Address	Value	Function	Value Explanation
334	0	No Formulation/Formulation Number	Right Formulation Name
335	1	Write and Auto Reset	Write Right Formulation
336	0	Preset total number boxes when left fomulation ends, and auto reset	
337	0	Preset total number boxes when right fomulation ends, and auto reset	

4.3 Alarms

Table 4-4 . Palletizer WorkStation Program Alarms

Alarm Type	No.	Description	Possible Cause	Suggestions
Runtime Alarms	CPE0S1	Sensor failed to detect the interlayer	The sensor cannot detect the interlayer while the task is running.	
	CPE0S2	Downward limit exceeded	The downward operation exceeded the maximum allowed length while running.	Please check the interlayer sensor condition.
	CPE0S3	Box drop undetected	The infrared/negative pressure sensor did not detect boxes during movement.	Please check operation status and then re-run the task.
	CPE0S4	Safe height exceeded	The robot's elbow or end effector exceeded the safe height.	Move the robotic arm back within the defined safe height via [Move] interface.
	CPE1S1	Failed to open configuration file	Invalid configuration file format	Do not close the popup if data recovery is needed. Click [Shutdown] to switch off, then power on again and contact Elite Robots for data recovery.
	CPE1S2	Model update error	3D model loading failed	Please re-edit the incorrectly saved/loaded formulation, then save and reload it.

Alarm Type	No.	Description	Possible Cause	Suggestions
Model/ Config File Error	CPE2S1	Formulation 3D update error	Loading error when accessing daemon box 3D data	Please check the formulation and re-edit the incorrectly saved/loaded formulation. Save and reload it.
	CPE2S2	Editing progress error	3D model loading error when editing placement progress on [Automatic] interface	Please check the formulation and re-edit the incorrectly saved/loaded formulation. Save and reload it.
	CPE3S1	Primary/ secondary label mismatch		
	CPE3S2	Illegal path, task initialization failed	Abnormal simulation path	Please delete such characters as [,], and spaces from the path.
	CPE3S3	Daemon service connection failed	VM version is outdated.	Please download the new VM version.
	CPE3S4	Conveyor line configuration error	Conveyor line B can not be used in single-line mode.	Please reselect the conveyor line.
	CPE3S5	Mismatched box size	Box size on the left and right sides differs from each other in single-line mode.	
	CPE3S6	Box links already existed	Box links already existed in multi-pick mode.	

Alarm Type	No.	Description	Possible Cause	Suggestions
	CPE3S7	Lifting column connection failed	Lifting column plugin was not connected successfully.	Please check the connection status. Disable the Palletizer Workstation plugin and check the Lifting Column Adapter plugin status.
	CPE3S8	Right formulation unselected	The right formulation is not selected in dual-line mode.	Both sides must have formulations in dual-line mode.
	CPE3S9	Left formulation unselected	The left formulation is not selected in dual-line mode.	Both sides must have formulations in dual-line mode.
	CPE3S10	Assignment error	A conveyor line cannot be assigned to both formulations.	
	CPE3S11	Drop detection unselected	Drop detection was not selected as the sensor digital input signal.	Please tap [Config] > [General] > [Optional] and select IR/Negative Pressure Sensor. Then navigate to [Config] > [General] > [Optional I/O] to select IR/Negative Pressure Sensor.
	CPE3S12	Left sensor detection switch 1/2 unselected	Left sensor detection switch 1/2 was not selected as the sensor digital input signal.	Please tap [Config] > [General] > [Optional] and select Tray Sensor. Then navigate to [Config] > [General] > [Optional I/O] to select Left Tray Sensor 1/2.

Alarm Type	No.	Description	Possible Cause	Suggestions
	CPE3S13	Right sensor detection switch 1/2 unselected	Right sensor detection switch 1/2 was not selected as the sensor digital input signal.	Please tap [Config] > [General] > [Optional] and select Tray Sensor. Then navigate to [Config] > [General] > [Optional I/O] to select Right Tray Sensor 1/2.
	CPE3S14	PickTool detected interlayer unselected	PickTool detected interlayer was not selected as the sensor digital input signal.	Placing the interlayer is needed in the formulation. Please tap [Config] > [General] > [Optional I/O] to select the interlayer sensor.
	CPE3S15	InterLayer sensor unselected		Placing the interlayer is needed in the formulation. Please tap [Config] > [General] > [Optional I/O] to select the interlayer sensor.
	CPE3S16	Conveyor sensor A unselected	Conveyor sensor A was not selected as the sensor digital input signal.	Please tap [Config] > [General] > [Optional I/O] to select Conveyor sensor A.
	CPE3S17	Conveyor sensor B unselected	Conveyor sensor B was not selected as the sensor digital input signal.	Please tap [Config] > [General] > [Optional I/O] to select Conveyor sensor B in dual-line mode.
	CPE3S20	Formulation files deleted	The formulation file was deleted when the system attempted to load it.	Please re-enter the editing interface and re-edit the incorrectly saved/loaded formulation. Save and reload it.

Alarm Type	No.	Description	Possible Cause	Suggestions
	CPE3S21	Mismatched picking modes	In single-line mode, picking modes for left and right formulations must be the same.	
	CPE3S22	Tool Output error	Tool I/O was configured incorrectly or unconfigured.	

Table 4-5 . Errors of Lifting Column Plugin

Error Code	Description
0	No Error
1	Command Stop Required
2	Hall Sensor Fault
3	Overvoltage
4	Undervoltage
5	Failure to maintain heartbeat signal
7	Temperature Error
8	Internal Heartbeat Signal Error
9	SMPS Power Supply Error (Internal)
10	Current Measurement (Internal)
11	Parallel System Coordiation in Progress
254	Unspecified Internal Failure
255	Unspecified External Failure

Note that the 8-bit error code indicates currently active errors with the highest priority.

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