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- Routine Technical Inquiries: [techsupport@motoman.com](mailto:techsupport@motoman.com)

Allow up to 36 hours for response

## Instructions

### For PalletBuilder Operation

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Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

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Have the following information available when contacting the YASKAWA Representative:

- System
- Primary Application
- Software Version (*Located on Programming Pendant by selecting: {Main Menu} - {System Info} - {Version}*)
- Warranty ID (*Located on Robot Controller*)
- Robot Serial Number (*Located on Manipulator data plate*)
- Robot Sales Order Number (*Located on Robot controller data plate*)

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# 1 Introduction

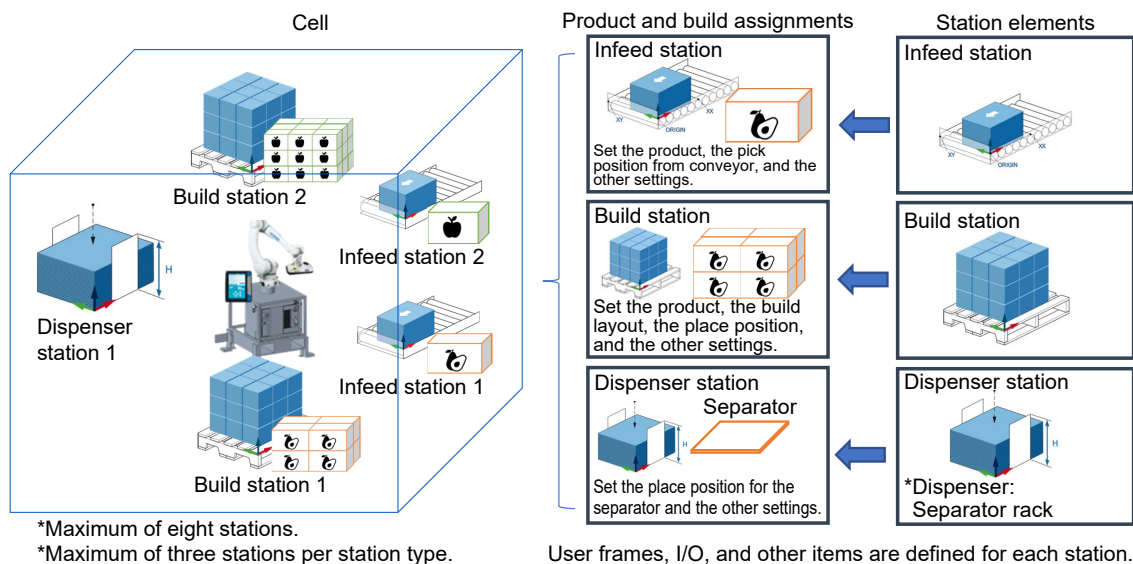
PalletBuilder is software that can perform palletizing with a simple setup procedure.

## 1.1 PalletBuilder Configuration

PalletBuilder has been designed to operate in a palletizing environment called a cell. Stations that hold positions (coordinates) and I/O information are placed inside the cell.

There are various types of stations that include the infeed station (e.g., conveyor), the build station (e.g., pallet), and the dispenser station (separator). The palletizing environment can be built by assigning products and build patterns to these stations.

For example, to stack two types of product on two pallets using two conveyors, the cell configuration is made with two infeed stations, two build stations (and one dispenser station, depending on the user's needs).



## 2 Cell Setup and Build Pattern Creation Procedures

### 2.1 Creation Procedure Flow

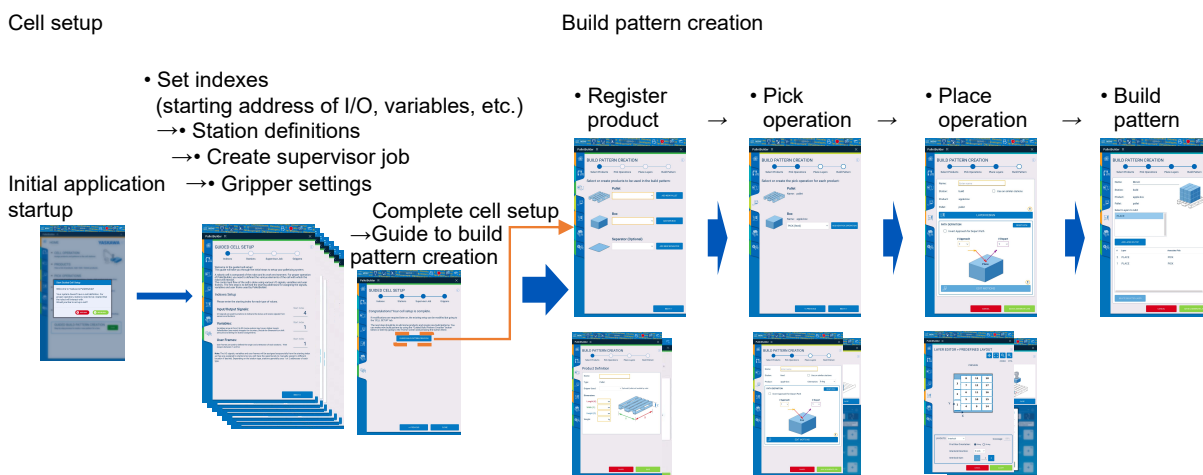
The procedure is broadly separated into two parts: cell setup and build pattern creation.

#### (1) Cell Setup

Define and configure the cell. This includes setting the number of stations to use, configuring the coordinate system and I/O (I/O signals assigned to sensors and buttons) settings, and registering the gripper. When PalletBuilder starts for the first time, the guided cell setup procedure starts. Set up the cell by following the on-screen instructions. The cell setup can also be edited after the guided procedure is finished.

#### (2) Build Pattern Creation



Register and set the product, the pick and place positions, the build layout, and the other options. The build pattern can be created by following the guided build pattern creation procedure. The settings can also be edited on each tab after the guided procedures are finished.



### 2.2 Start the Application

On the Smart Pendant, tap {MENU} - {Utility} - {PalletBuilder}. The PalletBuilder window fills the entire Smart Pendant screen.

The application can be closed by tapping {X}. When PalletBuilder is started again, the Home window will appear. If the user is in the middle of an operation and has unsaved data when attempting to close PalletBuilder, a message will appear prompting the user to complete the current application before closing PalletBuilder.

The application can be minimized by tapping . Tapping  again will maximize the window size and return the application to its original state.

## 2.3 Cell Setup

When PalletBuilder is started, the start window for the GUIDED CELL SETUP procedure automatically opens. Follow the guided procedure on the CELL SETUP window and configure the settings. For the GUIDED CELL SETUP procedure, tap the {NEXT>>} button at the bottom right of the window to switch the setup window in the following order:

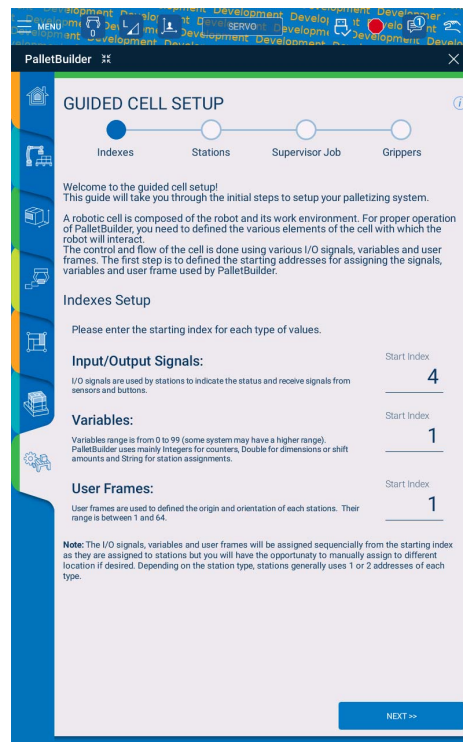
Index settings → Station definitions → Save supervisor job → Gripper definitions

To set up the cell without using the GUIDED CELL SETUP window, use the tab for the CELL SETUP window at the bottom of the list of tabs on the left side of the window to access the cell setup items.

### 2.3.1 Index Settings

PalletBuilder uses I/O, variables, and user frames. The index settings set the starting address to be used for each of these items. PalletBuilder automatically assigns each value in order from the starting address that is set.

The default values can be used unless there is a specific reason to change them.



For HC-series manipulators, input signals 1, 2, and 3 and output signal 1 are already used. Use caution when setting the I/O signals.

## 2 Cell Setup and Build Pattern Creation Procedures


### 2.3 Cell Setup

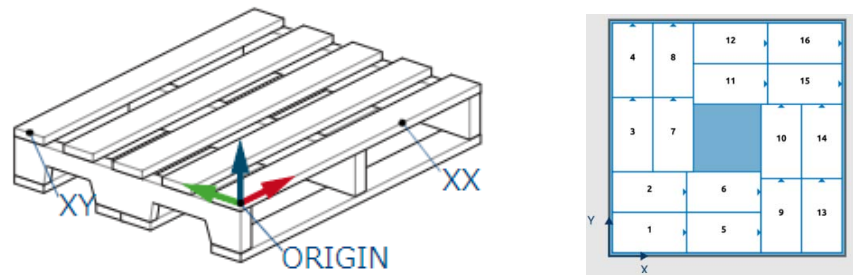
#### 2.3.2 Station Settings

Set the number of each type of station on this window. The values can also be changed later.

#### 2.3.3 Build Station

① User Frame

Set the user frame as shown below. When the build pattern is created, it is created based on the origin of the user frame. Select  to access the user frame definition window.



② Variables Assignment

The variables are automatically assigned. The default values can be used unless there is a specific reason to change them.

(The variables are automatically assigned from the number set in *chapter 2.3.1 "Index Settings"*.)

③ I/O Assignment

These are general purpose input/output assignments. Set a signal that is not required to unused by clearing ☒ in its check box.

<b>Ready Input Signal</b>	The signal indicates the presence of the pallet. When this signal is enabled and the assigned signal is ON, the product can be stacked at this build station.
<b>At Station Output Signal</b>	This signal is turned ON when the manipulator is being operated at this station.
<b>Reset Input Signal</b>	This signal resets the number of stacked products. When stacking is completed, turn this signal ON after replacing the pallet with an empty pallet to start stacking products again from the first layer.
<b>Complete Output Signal</b>	This signal is turned ON when stacking is completed.

④ Call Job

An arbitrary job can be called before and after the place operation is performed at the build station. This can be used in a variety of ways, such as to add a path (teaching points) to transit between stations.

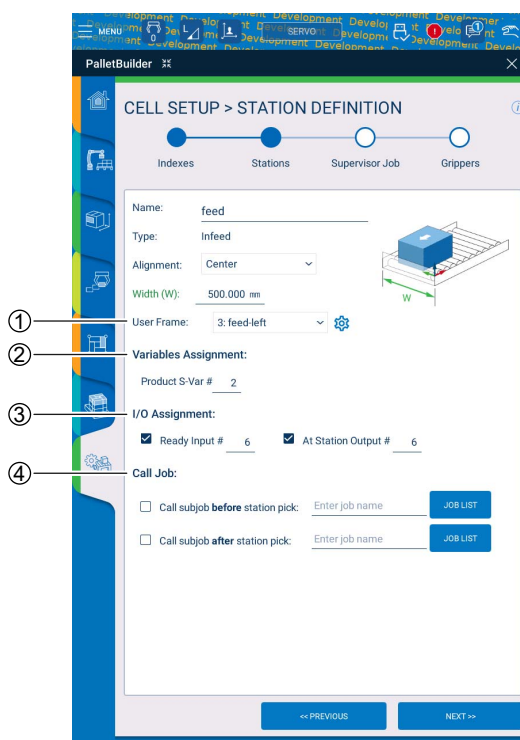
These settings are optional.

## 2 Cell Setup and Build Pattern Creation Procedures


### 2.3 Cell Setup

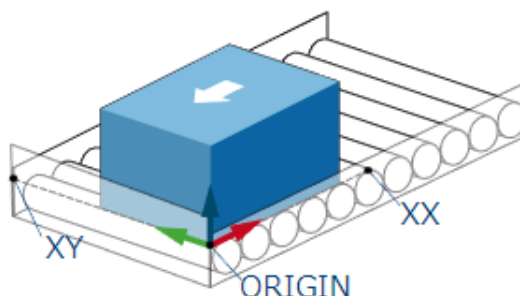
#### 2.3.4 Infeed Station

The alignment and width are settings to simplify teaching at a later stage. The initial position of the manipulator when teaching the pick operation changes with this value.



##### ① User Frame

Set the user frame as shown below. Select  to access the user frame definition window.



{Alignment} and {Width (W)} are used to set the initial position (default path) when editing the motion. Teaching the manipulator is simplified in *chapter 2.4.3 "Pick Operations"* by setting these values correctly.

##### ② Variables Assignment

This area is almost the same as the build station. The default value can be used unless there is a specific reason to change it.



2     Cell Setup and Build Pattern Creation Procedures

2.3   Cell Setup

③ I/O Assignment

These are general purpose input/output assignments.

<b>Ready Input Signal</b>	<div>The signal indicates the presence of the product. When this signal is enabled and the assigned signal is ON, the product can be picked from this infeed station.</div> <div><div>NOTE</div><div>When the ready input signal on the build station side is also ON, stacking is started. The product is not stacked when only one signal (either the infeed or build signal) is ON.</div></div>
<b>At Station Output Signal</b>	<div>This signal is turned ON when the manipulator is being operated at this station.</div>

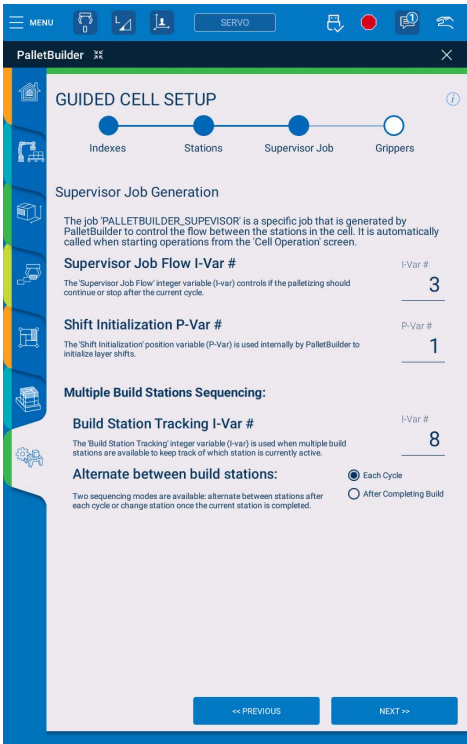
④ Call Job

An arbitrary job can be called before and after the place operation is performed at the infeed station. This can be used in a variety of ways, such as to add a path (teaching points) or to turn I/O ON and OFF.

These settings are optional.

2.3.5 Supervisor Job

The default values can be used unless there is a specific reason to change them.



If multiple build stations exist, the user can select how the palletization operation transitions between build stations.

Each Cycle: A build station can change after each cycle.

After Completing Build: A build station can change after the current build station is completed.

## 2 Cell Setup and Build Pattern Creation Procedures

### 2.3 Cell Setup

#### 2.3.6 Grippers

Set the definitions of the grippers on this window. For HC-series manipulators, gravity and inertia are handled as external forces when collaborative operation is enabled. For this reason, the mass of the tool to be mounted to the manipulator and the mass of the workpiece to be transported must be set in advance. The gripper can be registered for each product in PalletBuilder.

#### ① Gripper Definition

**Empty Tool#:** Set the gripper information for when the product is not held by the tool.

**Loaded Tool#:** Set the gripper information for when the product is held by the tool. Set the mass and position of the center of gravity as that of the gripper with the product, respectively.

#### ② Gripper Control

- **Simple Control:** Configure the settings on this window. Assign Output# to the grip ON/OFF signal for the gripper.  
Invert Gripper Output Logic:  
Select this check box for a gripper with logic that turns ON the grip when the signal is OFF.
- **Complex Control:** Set the subjobs to be called for gripper control. Individual jobs can be set for grip ON and grip OFF in complex control.

When the settings are completed, proceed to the guided procedure for BUILD PATTERN CREATION.

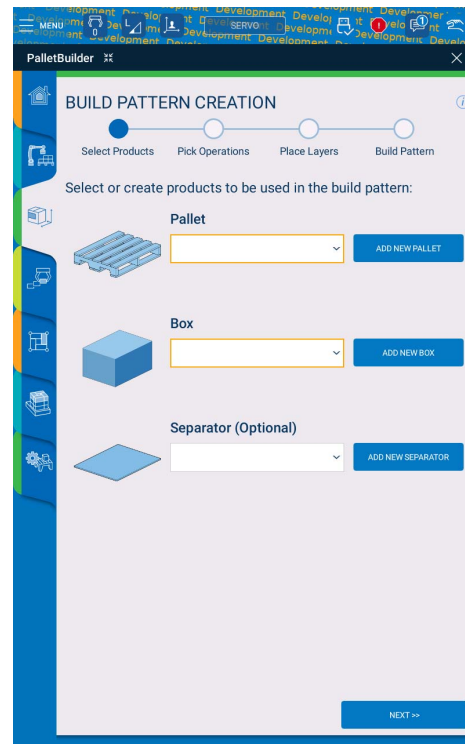
## 2.4 Build Pattern Creation

When cell setup is completed, proceed to build pattern creation. Create the build pattern by following the guided procedure on the BUILD PATTERN CREATION window.

Configure the settings in the following order: Select Products → Pick Operations → Place Layers → Build Patterns. To create a build pattern without using the guided procedure on the BUILD PATTERN CREATION window, use the third, fourth, fifth, and six tabs on the left side of the window to access the relevant settings. Configure the settings on each of those tabs.

### 2.4.1 Select Products

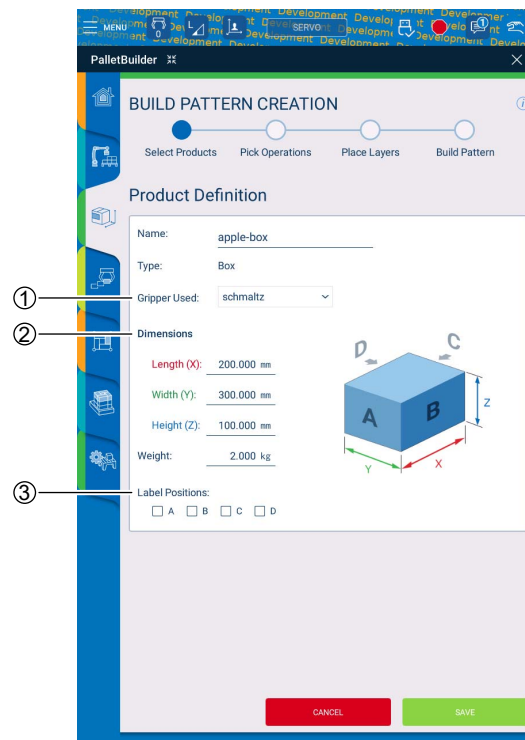
Register the pallet, the product (box), and the separator (as required).



## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

#### 2.4.2 Register the Product (Box)



##### ① Gripper Used

Select a gripper that was registered in the gripper definitions.

##### ② Dimensions

Register the dimensions of the box. PalletBuilder operates by measuring the travel distance based on the dimensions set here.

##### ③ Label Positions

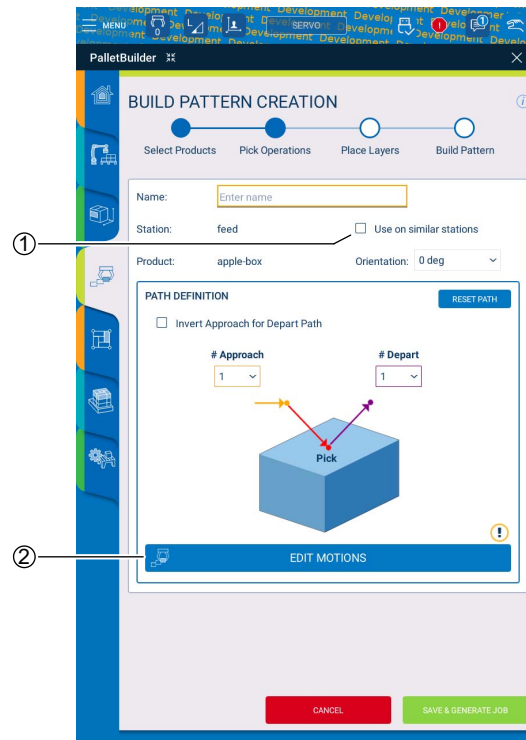
The layout can be created in the Layer Editor to be set in *chapter 2.4.4 "Place Layers"* based on the positions of the labels set here.

Configure the pallet and the separator in the same manner as the product (box).

## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

#### 2.4.3 Pick Operations

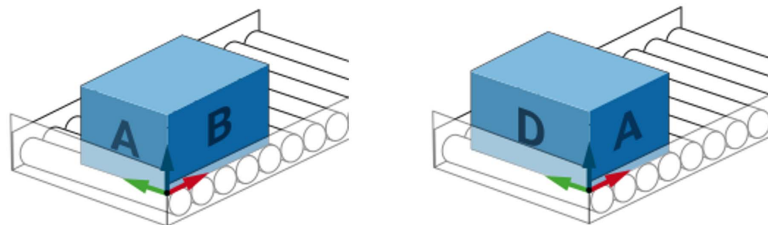


##### ① Use on Similar Stations

Select this check box to set a pick operation for the same product (box) in the same position based on the user frame at a different infeed station.

Orientation: The initial position of the manipulator in {EDIT MOTIONS} (described in the next section) can be adjusted to 0° or 90° to match the box orientation on the infeed (conveyor). If the box is positioned on the infeed (conveyor) with the longer side facing forward (Length (X) as described in the Product Definition), set the position to 90°. Otherwise, keep the default 0° setting.

The approach position and the departure position can be registered up to three points each.



Orientation 0°

Orientation 90°

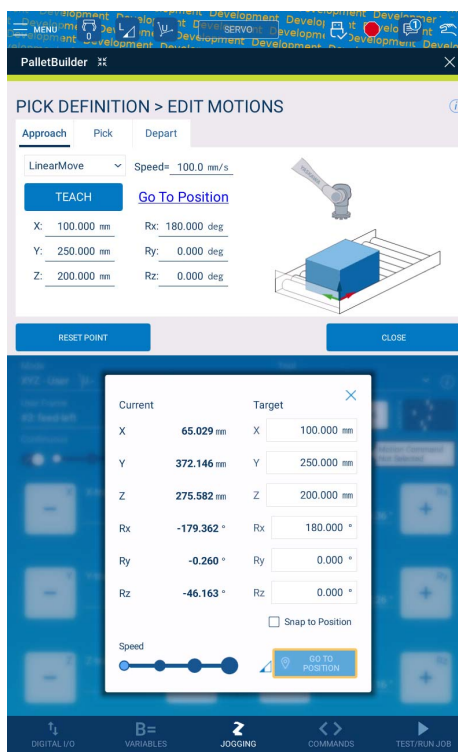
## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

#### ② Edit Motions

The approach position, the pick position, and the departure position can be configured on this window.

Tap {EDIT MOTIONS} to access the EDIT MOTIONS window.



Tap {Go To Position} to display a dialog box in which the target position is specified at the bottom of the window.

Tap {GO TO POSITION} on this dialog box

If the user frame and alignment settings are correct, the manipulator moves to the approach position, the pick position, and the departure position appropriate for the product (box).

Adjust a position by moving the manipulator and tapping {TEACH} to register that position.



The teaching point of the pick position affects the accuracy of stacking products. Align the TCP (tool center point) of the manipulator with the center of the box and teach the manipulator so that the angle of the Z-axis of the gripper (axis level to the ground) is the same as the angle of the product (box).

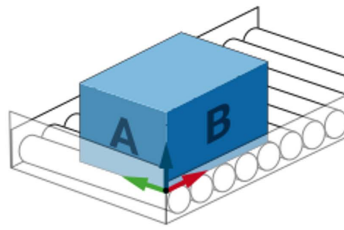


The HC30PL has restrictions on the angle of the B-axis and the R-axis.

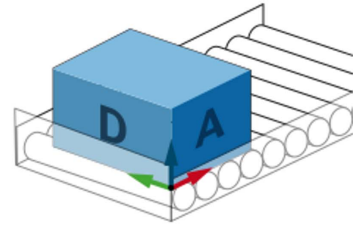
## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

Set the labels with the orientation shown below.

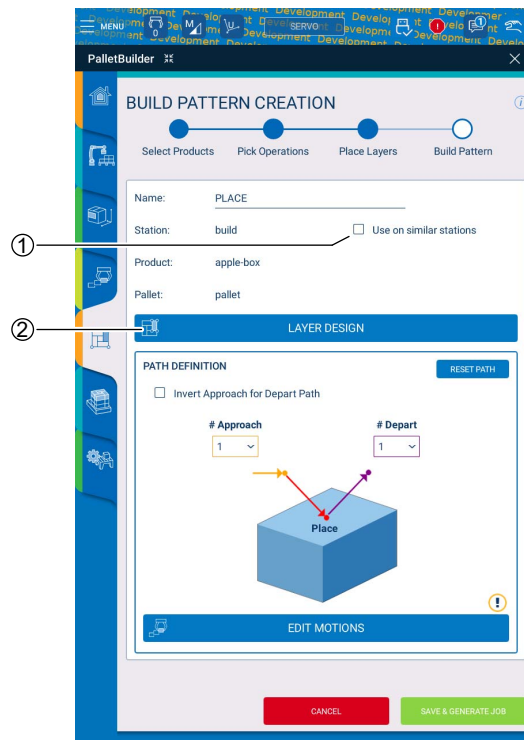


Orientation 0°



Orientation 90°

#### 2.4.4 Place Layers



##### ① Use on Similar Stations

Select this check box to set a place operation for the same product (box) in the same position based on the user frame at a different build station.

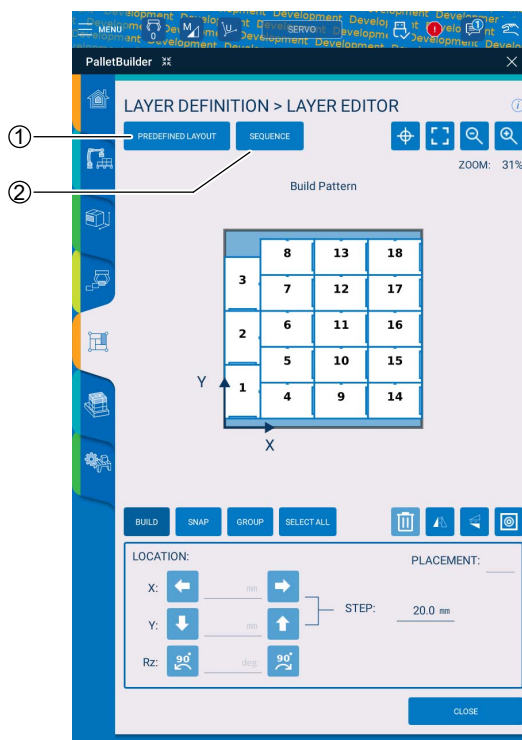
##### ② Layer Design

Refer to *chapter 2.4.5 "Layer Editor"* and configure the settings.

## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

#### 2.4.5 Layer Editor



#### ① PREDEFINED LAYOUT

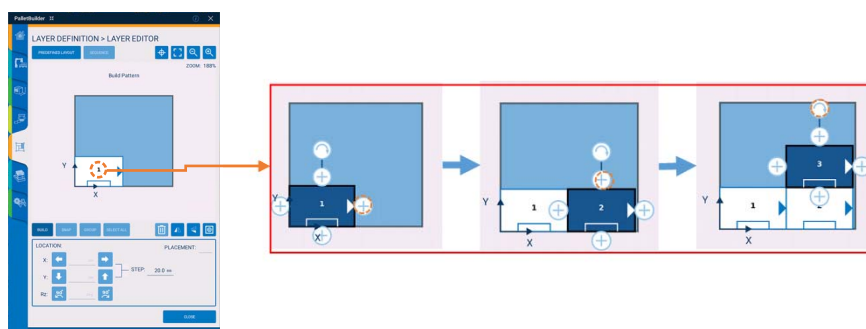
Select from {Block}, {Interlock}, {Pinwheel}, and {Diagonal}. The layout is displayed when a selection is made.

#### ② SEQUENCE

Set the order in which to place the product.

Use the following method to set and adjust the pattern as desired.


Tap {BUILD} and increase the number of boxes as desired.



#### LOCATION:

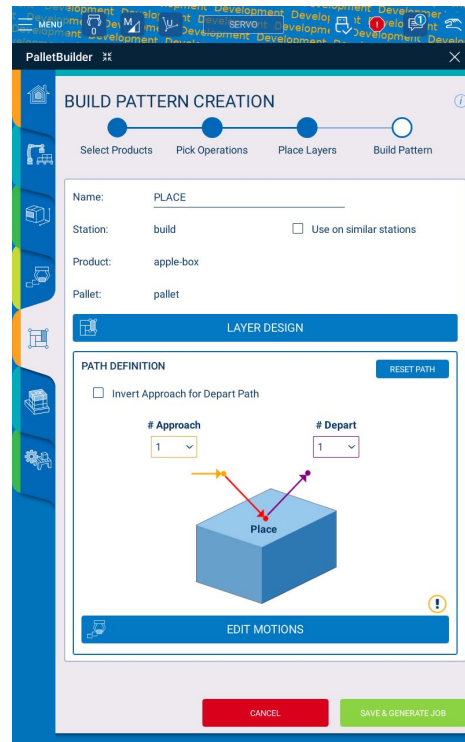
Use the {X}, {Y}, and {Rz} buttons to set the position and angle (in 90° increments) of the selected product.



For more details on the other available functions, tap the information  icon in the top right corner of the window.



#### 2.4.6 Place Layers - Edit Motions



Tap {EDIT MOTIONS} to set the approach position, the place position, and the departure position of the first box (labeled 1 in the figure). Always teach the layer directly on the pallet (as if it was the first layer), even if it is intended to be used as the second or subsequent layer.

The operations on this window are the same as in *chapter 2.4.3 "Pick Operations"*.

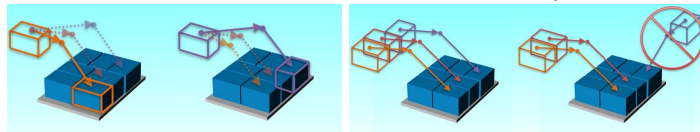


The user should pay attention on the orientation of the product relative to the gripper when it is picked at the infeed, so that the gripper and product labels are properly oriented when the product is placed.

## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

#### Fixed Position and Relative Position in Place Operation



Fixed position

Relative position

- In place position teaching, a fixed position and a relative position can be selected.

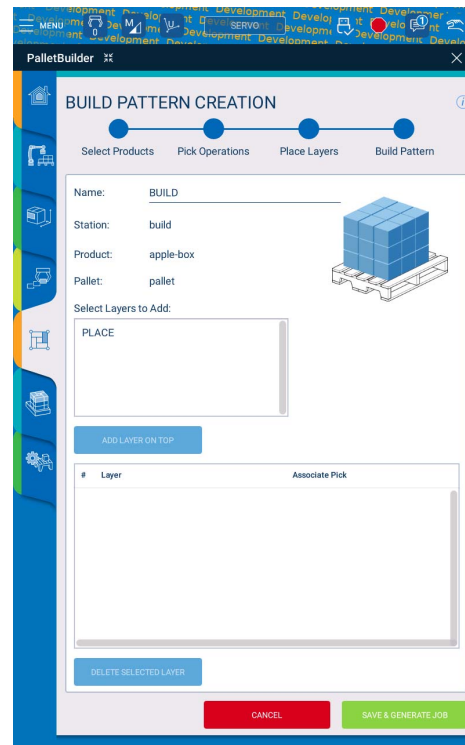
**Fixed position:** The approach position and the departure position are common in the place positions of all products (boxes) in the same layer.



**Relative position:** The approach position and the departure position are set to a position shifted the same distance from the place position of each product (box).

- As shown in the figure, relative position shifts the position by only the amount of a box position. However, be aware that the position does not shift in the direction of rotation.
- Even for fixed position, the next layers (second and third layers) are shifted upward (Z direction) in the amount of the height of that layer. If this upward shift is a problem, teaching points can be created so the manipulator does not shift upward for each layer by teaching the positions in a subjob in the station settings of the cell setup.

### 2.4.7 Build Pattern Creation



Set the layers to be assembled on the build station. Available layer styles are displayed in the top box. Select the desired layer style and tap the "ADD LAYER ON TOP" button to add it to the build layer stack shown below. Repeat until all the required number of layers have been added to the build. If different layer styles are available, the user can alternate between them to create interlocking layers or add separators between layers.

When the settings are completed up to this point, proceed to {Assign Pattern To Station}.

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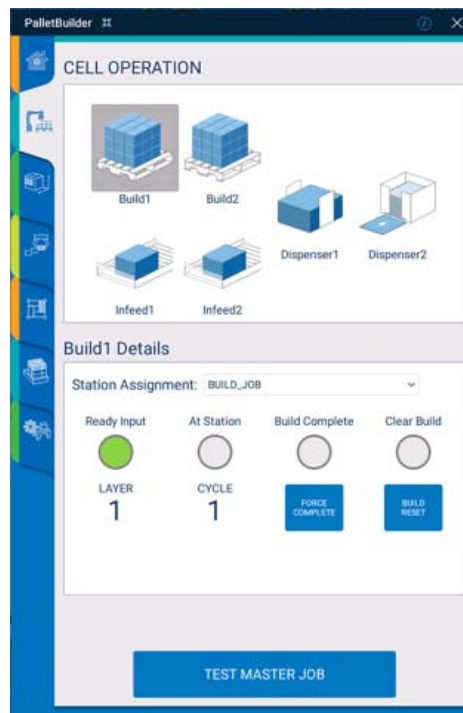
## 2 Cell Setup and Build Pattern Creation Procedures

### 2.4 Build Pattern Creation

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#### 2.4.8 Cell Operation

On the CELL OPERATION window, select the desired station from the top view to display details in the bottom view. Assign the previously created products and build patterns to the infeed stations and the build stations.



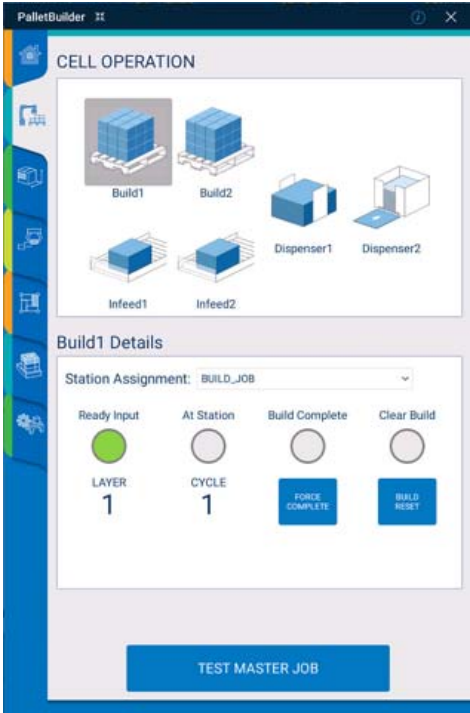
2

Cell Setup and Build Pattern Creation Procedures

2.4

Build Pattern Creation

In PalletBuilder, the product to pick can be selected and the build pattern can be assigned to a station on the CELL OPERATION window. This assignment can also be cleared depending on the station. For example, in a cell with two infeed stations and two build stations, to use only one infeed station and two build stations (or one build station only), clear a station assignment and PalletBuilder can operate with only the selected stations.



Example of Station Assignments

- For stacking two products with two infeed and two build stations

Station*	Station Assignment*
feed_station1	APPLE
feed_station2	ORANGE
build_station1	APPLE_BUILD
build_station2	ORANGE_BUILD

\*The stations and station assignment names are used to explain this example only.

- For stacking one product with one infeed and two build stations

Station*	Station Assignment*
feed_station1	APPLE
feed_station2	No assignment (blank)
build_station1	APPLE_BUILD
build_station2	APPLE_BUILD2

\*The stations and station assignment names are used to explain this example only.

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### 3 Run Procedures

#### 3.1 Operation Check in Teach Mode

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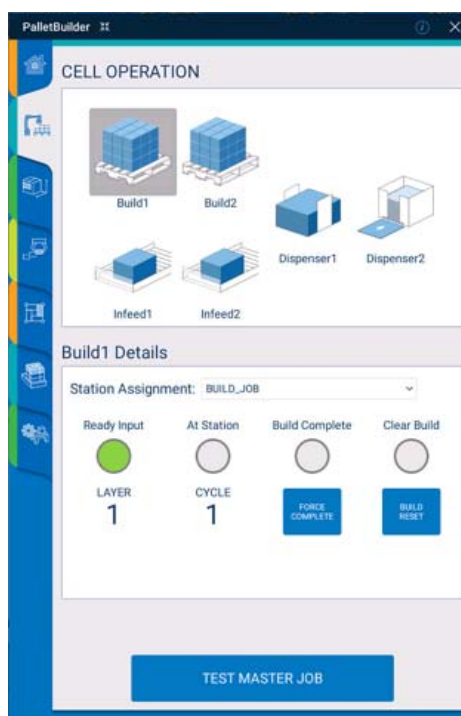
## 3 Run Procedures

On the CELL OPERATION window (second tab from the top in the list of tabs on the left side), the created build pattern can be run in test operation (teach mode) and palletizing operation (play mode).

### 3.1 Operation Check in Teach Mode

Tap {TEST MASTER JOB} in test mode to run the job.

The job window opens.



Start the job with servo ON → {RUN} button.

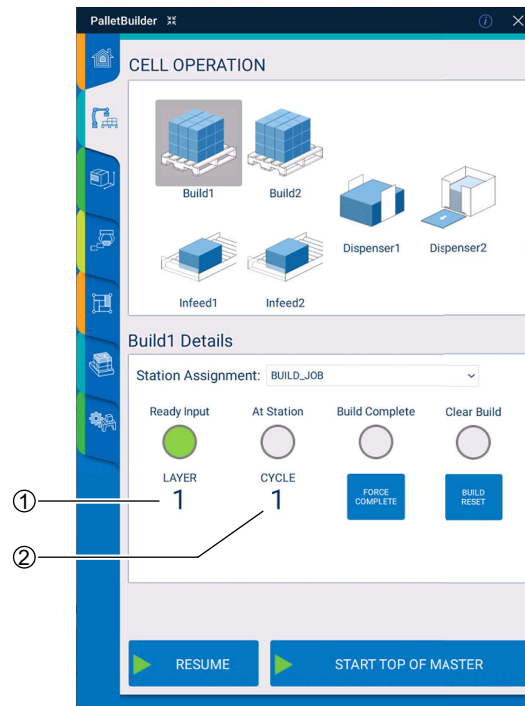


When the ready input signals on the infeed and build stations are assigned, stacking does not start until both signals turn ON.

### 3.2 Operation Check in Play Mode

When the operation of the job can be confirmed, set the manipulator to play mode and run the job.

By switching to play mode, the window changes to the palletizing operation window shown below.



① LAYER

Displays the layer number.

② CYCLE

Displays the product (box) number in the layer.

When stacking is completed, replace the pallet with an empty one, and tap {BUILD RESET} to start stacking the first product (box) on the first layer again.

To restart stacking from the beginning when stacking is not complete, tap {FORCE COMPLETE}, replace the pallet with an empty one, and then tap {BUILD RESET}.

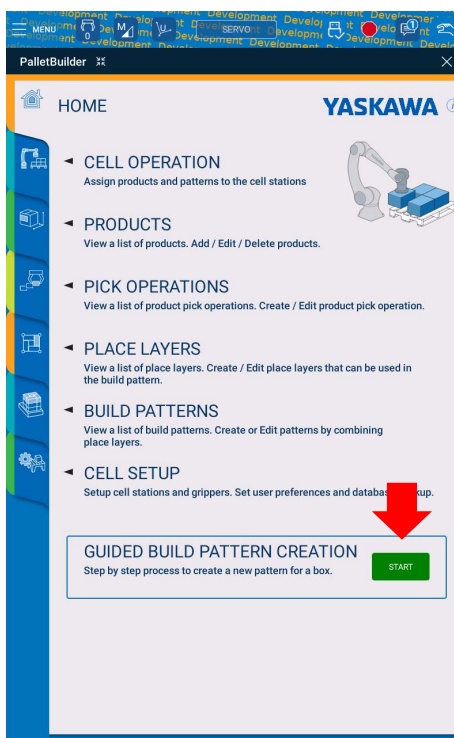
- 4 Addition and Modification Procedures
- 4.1 Add Product/Build Pattern

## 4 Addition and Modification Procedures

### 4.1 Add Product/Build Pattern

To add a product, select {START} for the GUIDED BUILD PATTERN CREATION procedure on the HOME window and follow the on-screen instructions.

The operations are the same as the procedure in *chapter 2.4 “Build Pattern Creation”*.





## 4 Addition and Modification Procedures

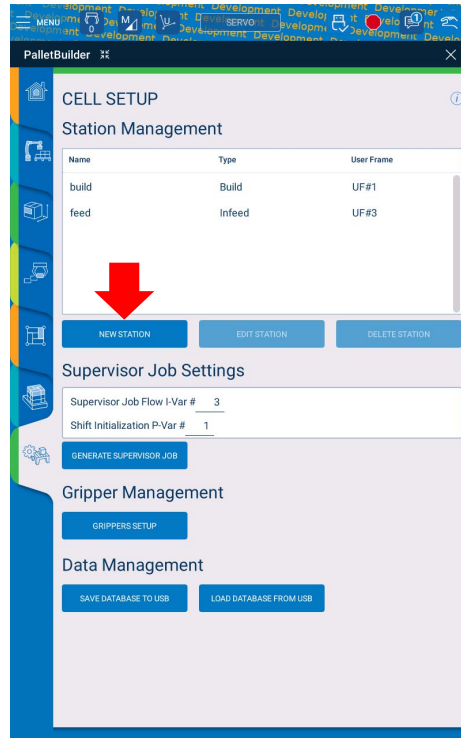
### 4.2 Add Station

#### 4.2 Add Station

To add a new station, tap the {NEW STATION} button on the CELL SETUP tab and create a new station.

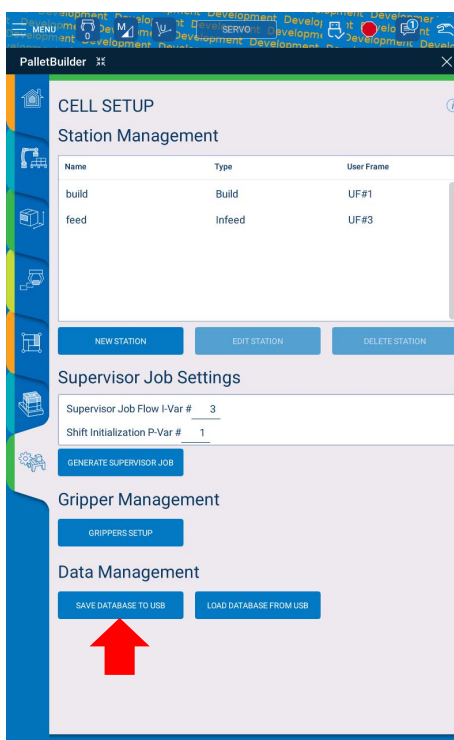
After the station is created, create new build patterns as needed.

Refer to adding items in *chapter 4.1 “Add Product/Build Pattern”*.



## 5 Data Backup

The products, stations, build patterns, and other data can be saved to a USB memory device. When a USB memory device is inserted into the Smart Pendant, tap {SAVE DATABASE TO USB} to save the data. If the information is saved successfully, a message is displayed on the Smart Pendant window. The PalletBuilderData.json file is saved to the USB memory device. To load this data, tap {LOAD DATABASE FROM USB}.



The pick operations, the place operations, the build patterns, and supervisor jobs are not automatically generated by loading the data. The necessary jobs must be generated on each tab.



The PalletBuilder data is saved in the Smart Pendant (not in the controller). Backup should be made after modifications and saved in the event the Smart Pendant is damaged or needs to be replaced.

## 6 Q&A

Question	Answer
The manipulator cannot stack products well. There are variations in the angle at which the manipulator stacks products, unnecessary spaces between the boxes, or interference between the boxes.	When teaching the pick position for the pick operation, make sure that the relative position of the gripper is exactly the same as the position of box 1 of the layer. Usually, the easiest way to do this is to align the TCP of the gripper with the center of the box. The angle of the gripper should also match the angle of the box.
The system is not palletizing.	Check that the build station is assigned, the Ready Input signal is ON, and the Build Complete signal is OFF. Check that the infeed (or dispenser) is assigned with a product that matches the pattern assigned at the build station, and that the Ready Input signal is ON.
When the boxes are placed, they interfere with each other.	When teaching the motion path to create layers, offset the approach points to the side where the pallet is empty, so that the boxes will be placed at an angle, instead of straight down.
Modifications made to PalletBuilder are not being applied when running the system.	Check that the status of the jobs required for the pick operation, the place operation, and the build pattern is "OK"? If the status is "Old" or "Modified", tap {Generate Job}.
Can a job created by PalletBuilder be edited?	A job created by PalletBuilder can be edited, but the modifications will be outside of PalletBuilder control. Such jobs will be marked as "Modified" and can no longer be modified using PalletBuilder. If {Generate Job} is used from PalletBuilder, the data before editing will be overwritten.
Can a created build pattern be used in a different build station?	A Build Pattern cannot be used on different build station because the build station user frame, variables and I/O are different. However, the Place Layers can be used by build patterns for different build stations. When creating a place layer, select the {Use on similar stations} check box to allow that layer to be used on other stations. The layers will then be used with respect to the user frame of the build pattern station. In the same manner, select the {Use on similar stations} check box in a pick operation to allow the pick operation for the same product to be selected in other infeed stations.
The separator cannot be grasped well in dispenser search stack.	Lower the speed of the pick position. The recommended speed is approximately 25 mm/s.

# Instructions

**For PalletBuilder Operation**

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**YASKAWA**

YASKAWA ELECTRIC CORPORATION

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