

Nuevas técnicas de automatización industrial

1<sup>st</sup> february 2024 tidyPal User Manual

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### Overview



- 1 Introduction
- 2 Requirements
- 3 Elements
- 4 Functionalities
- 5 Axis configuration
- 6 Safety
- 7 Assembly and maintenance
- 8 Best practices
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### Overview



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### Introduction



### **?**) What is tidyPal?

tidyPal is a solution made up of hardware and software, which allows the automation of the palletizing process.

With the software you can configure the different hardware components of the station such as pallet types, box types, robot I/O, work mode, etc. Also with the option to create the automatic mosaic.



**Warning:** we are not responsable for damage caused by misuse of this producto. An e-series robot is used int his manual, the software is not compatible with the CB series.

# Introduction



#### Automatic mosaic

tidyPal is capable of working without the need to define the mosaic to be palletized by the user. The software will calculate the most optimal distribution both in stability and in use of space, you will only need the dimensions of the box and the pallet to be palletized.

Pallets:

- American pallet
- Euro pallet
- Half euro pallet



**Dimensions:** 

- Width (W)
- Length (L)
- Height (H)



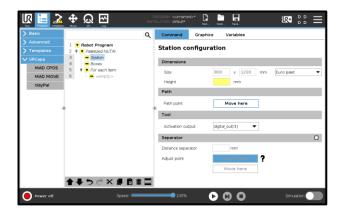


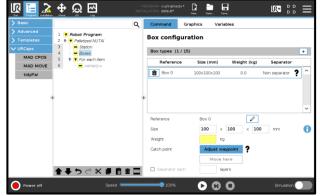


#### Automatic mosaic

The product has a graphical interface where you can configure the different parameters and functionalities.<sup>1</sup> Once set, at the beginning of the palletizing process, it will calculate the mosaic automatically and then start the process.

The result of the calculation algorithm will always be the same for a given configuration.





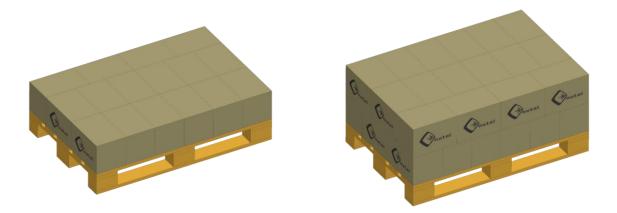
1 These functionalities will be explained later in the manual.

### Introduction



#### Automatic mosaic

This section presents the distribution of layers obtained by the algorithm for a box with dimensions (W=200,L=300,H=200) mm and in a Euro pallet. The odd and even layers are shown below:



The algorithm will try to make the layers avoiding columns of boxes in the same position to obtain greater stability.

### Overview

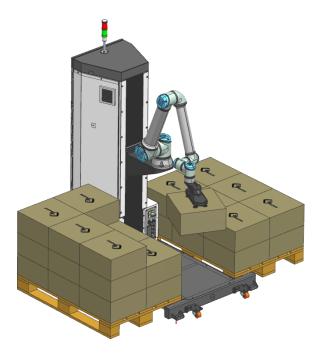


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### Requirements

### Product specifications tidyPal:

- Allowable box weight 10 Kg
- Maximum pallet height 2150 mm (from the ground)
- Station for two bays.
- American, Euro and Half pallet.
- Palletizing speed 6/10 boxes per minute\*



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\* Depending on the speed and accelearations configured for both the robot and the vertical axis.

### Requirements



### **RTDE connection**

This software uses the Real-Time Data Exchange (RTDE) protocol of Universal Robots to synchronize information necessary for the operation of URCap.

Below is a table with the registers in use:

Type of register	Numbers of registers
int_register	40,41,42
bit_register	66

Warning: verify that no other program or URCAP mentioned above to void possible interference that may cause the software to function incorrectly.

### Overview



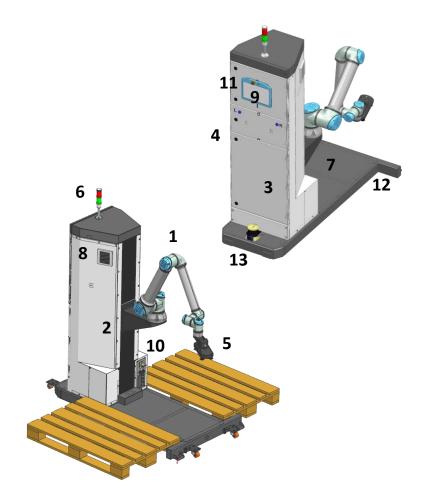
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### Elements

### Product elements tidyPal:

- (1) Robot UR10e
- (2) Electric axis 1000 mm career
- (3) Festo motor driver CMMP-AS
- (4) Software URCap
- (5) Custom gripper
- (6) Signalling beacon
- (7) Frame
- (8) Control cabinet
- (9) Teachpendant
- (10) Connection plate
- (11) Emergency button
- (12) Pallet presence sensor
- (13) Safety Scanner (optional)



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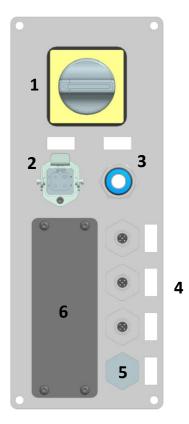


### Elements

#### **Connection plate:**

This section presents the connections available at the station:

- (1) Master switch
- (2) Supply
- (3) Air entry
- (4) Digital inputs
- (5) Extension input
- (6) Extension plate



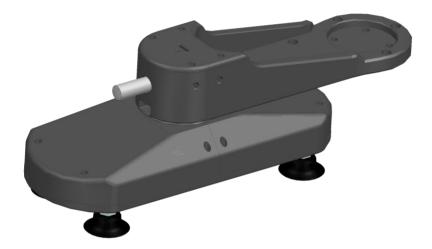
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### Elements



#### **Custom gripper:**

This section presents the gripper designed by Nutai S.L. for the palletizing process with which loads of up to 10 Kg\* can be lifted.



\* The maximum load of the claw will depend on the material to be handled, it will be necessary to carry out tests for each application.

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This section explains everything related to the functionalities of the URCap software. It is divided into the following subsections:

#### 1. Program panel

Configuración de parámetros del modo de trabajo, estación y caja.

Parameters configuration of the work mode, station and box.

#### 2. Toolbar panel

Diagnosis of the machine during the process.





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The program panel has 4 main nodes: *Palletized NUTAI, Station, Boxes y At each item*. (

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□ Icon about ethernet connection.



### **Palletized NUTAI**

You can configure from the NUTAI Palletizing node the different start modes of the station: New cycle and Continue cycle(□).

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Logos from product and company is also displayed.



#### **Palletized NUTAI**

The New cycle mode allows you to start a palletizing process with the possibility of working on demand for boxes, pallets or infinite<sup>1</sup>. (

		PROGRAM <unnamed>* 😭 📑 📮 INSTALLATION default* New Open Save</unnamed>	
<ul> <li>&gt; Basic</li> <li>&gt; Advanced</li> <li>&gt; Templates</li> <li>&gt; URCaps</li> <li>MAD CPOS</li> <li>MAD MOVE</li> <li>tidyPal</li> </ul>	I     V     Robot Program       2     V     Palletized NUTAL       3	Q     Command     Graphics     Variable       tidyPal       Information       tidyPal       Init type       New cycle       Continue cycle	es V nutai
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□ <sup>1</sup>To configure infinite mode, enter -1 in Number of boxes or pallets.



### **Palletized NUTAI**

Other parameters that must be configured are the initial pallet and the type of  $box^1$  ( $\Box$ )

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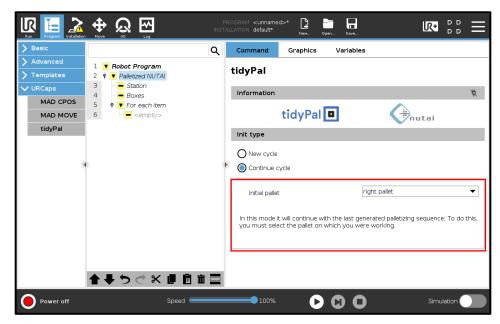
<sup>1</sup> In the Boxes node, later, it Will be explained how to define a type of box.



### **Palletized NUTAI**

The Continue cycle mode should be used when the robot stops in the middle of a cycle for any reason such as machine failure, protection/emergency stop, power failure, etc.

To continue with the previous cycle, you must choose the pallet you were working on.(

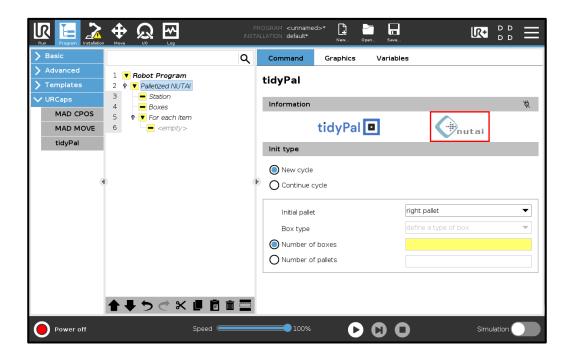


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### **Palletized NUTAI**

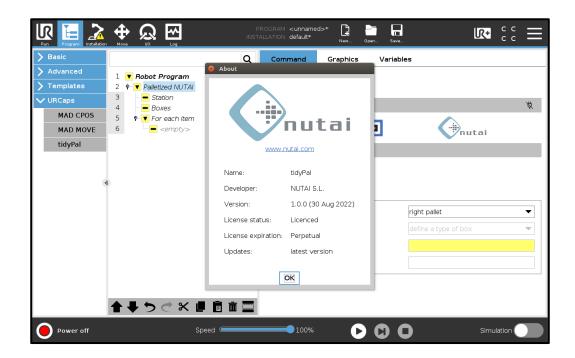
In this node, to find more information about the software, click on the NUTAI logo and a pop-up (
) will appear.





### **Palletized NUTAI**

The pop-up will display additional information about the software, such as its current version, whether it is up to date or the type of licence.





#### Station

In this node the different general parameters for the palletizing station are configured.

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#### Station

In the section of *Dimensions the type of pallet and the palletizing height must be configured.* (

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### Station

In the Trajectory section, the robot can be positioned at the waypoint. (

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#### Station

In the Tool section, the digital output that will be used to control the action of the gripper must be configured. (

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#### Station

In the Spacer section, the travel distance is configured, which is the maximum distance from the configurable point to the last available spacer and the thickness of the spacers.

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> Basic		٦ I	Command	Graphics	s Variables	
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			Separator			
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□ This section can be disabled using the checkbox.



#### Station

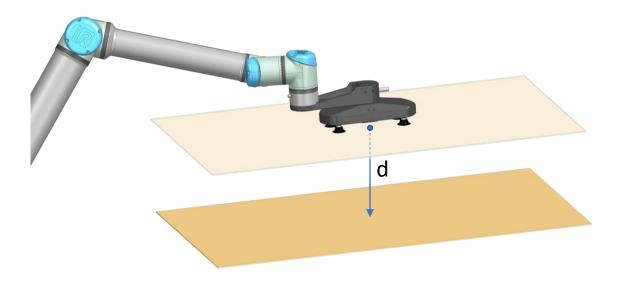
In addition, the pick-up point must be configured, this being the beginning of the stack of separators. Using the Move button here you can move the robot to the configured point( $\Box$ ).

Run Program Installation			OGRAM <b><unname< b=""> LATION <b>default</b></unname<></b>	j>* <b>[</b> ] New	Open	Save	R+	с с с с	
> Basic	Q	ε	Command	Graphics	s V	/ariables			
> Advanced	1 <b>V</b> Robot Program		Station co	nflaura	tion				
> Templates	2 ♥ ▼ Palletized NUTAI		Station Co	nngura	nuon				
V URCaps	3 Station 4 Boxes	Pallets							
MAD CPOS	5 🔹 🔻 For each item		Size		800	x 1200	mm EUR 1	•	
MAD MOVE	6 – empty>		<pre>empty&gt;</pre>	Height			mm		
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### Station

The following image shows the pick-up point and the distance that must be configured for the Separator section.





#### Station

Finally, the distances from the center of the spacer to the gripping point of the gripper must be configured.(□).

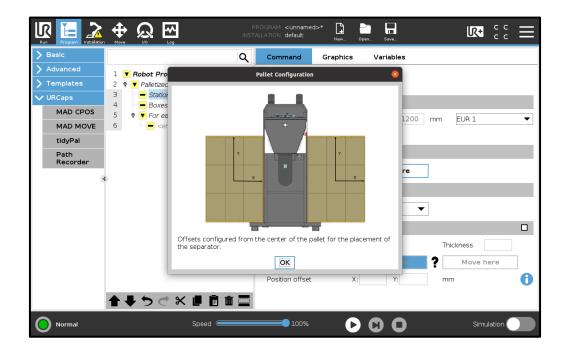
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<b>&gt;</b> Básico		۹	Comando	Gráficos	Variables		
<ul> <li>Avanzado</li> <li>Plantillas</li> </ul>	1 ▼ Programa de robot 2		Configura	ición de	estación		
✔ URCaps	3 – Estación 4 – Cajas		Palets				
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□ The icon will display a pop up with extra information.



#### Station

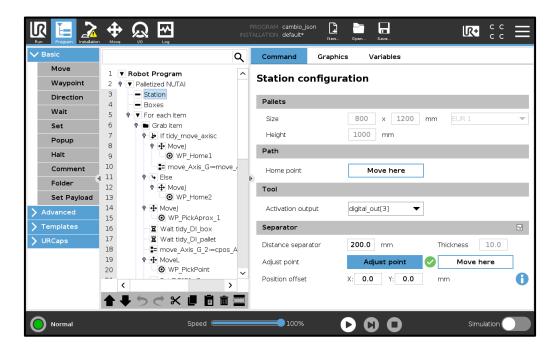
Distance between the gripper with the separator and the center of the pallet layer.





#### Station

In manual mode, the data from the configuration<sup>1</sup> shall be loaded. The interface shall be updated with these parameters and the components shall be locked.

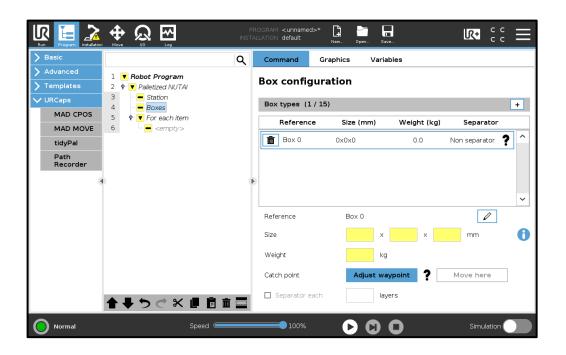


<sup>1</sup> In the Installation section, the configuration of the file is detailed.



#### Boxes

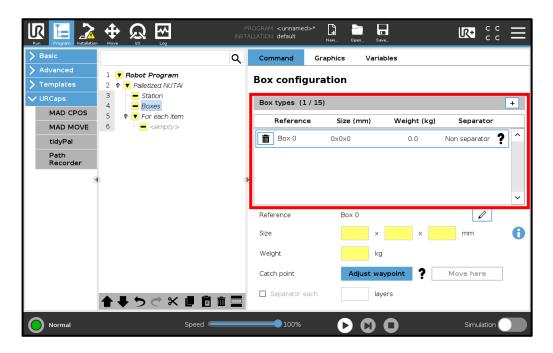
In this node the different general parameters will be completed to configure the different types of boxes.





#### Boxes

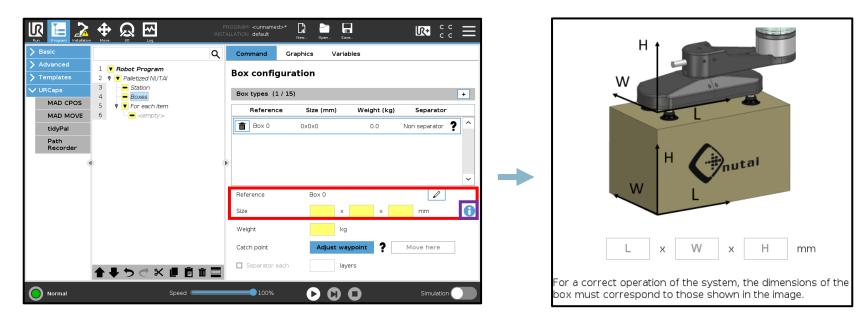
First, a list is shown with the different boxes with their parameters and configuration status. This list is expandable up to 15 types of boxes, to insert new boxes, the button will be used. + ( $\Box$ )





#### **Boxes**

In this section (**□**) the reference and dimensions of the box will be configured, as well as an Information button with a representative image of the box (**□**).



If you set the box size incorrectly, it may cause equipment malfunction.



#### Boxes

In this section (**D**) the weight of the box and its collection point are configured, as well as a button to position the robot in this same position.

			OGRAM <unnamed: .LATION default</unnamed: 	>* 📮 New.		Save			
> Basic	C	λ	Command	Graphi	ics V	ariables			
<ul><li>&gt; Advanced</li><li>&gt; Templates</li></ul>	1 ▼ Robot Program 2 ∲ ▼ Palletized NUTAI	Box configuration							
✔ URCaps	3 - Station 4 - Boxes		Box types (1	/ 15)					+
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#### Boxes

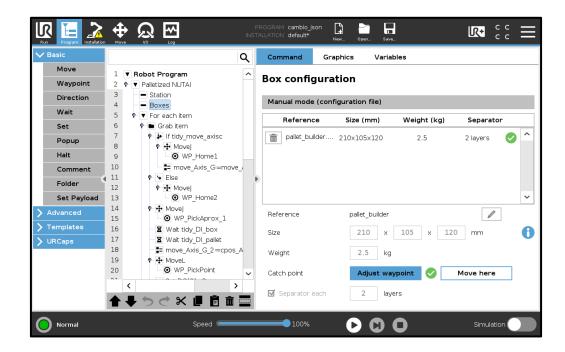
In this section (**D**) it is selected if a separator is needed and every how many layers to position it.

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> Basic	۹	Command	Graphics Vari	iables		
<ul><li>&gt; Advanced</li><li>&gt; Templates</li></ul>	1 ▼ Robot Program 2 ♥ ▼ Palletized NUTAI	Box config	uration			
✔ URCaps	3 - Station 4 - Boxes	Box types (1)	( 15)			+
MAD CPOS	5 ♀- ▼ For each item	Reference	Size (mm)	Weight (kg)	Separator	
MAD MOVE tidyPal	6 <empty></empty>	Box 0	0x0x0	0.0	Non separator <b>?</b>	^
Path Recorder					•	
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#### Boxes

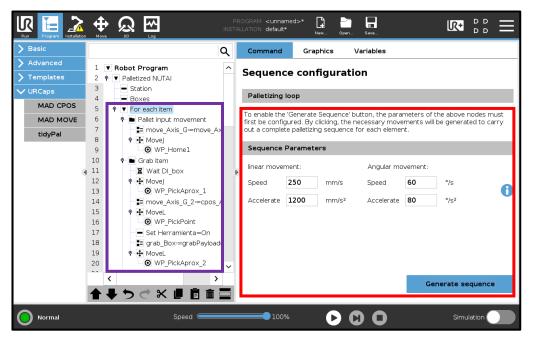
In manual mode, you will only have a box with the parameters from the configuration file. As in the Station node, the components will be locked and updated with the parameters from the file.





#### At each item

In the node At each item you can configure the speed and acceleration of the movements. In addition, the nodes of the cycle will be generated using the Generate Sequence button. (

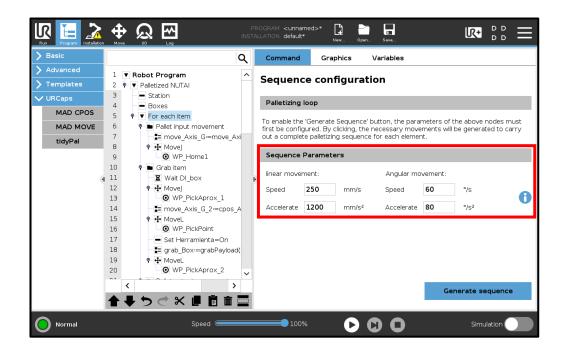


□ Tree of nodes generated by the URCap.



#### At each item

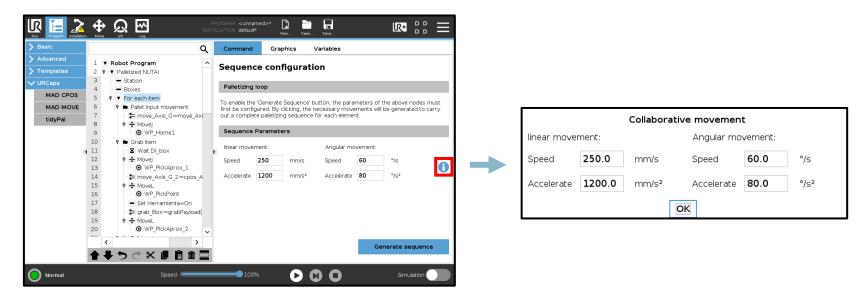
In the Sequence Parameters section, you can adjust the different speeds and accelerations of the process.





#### At each item

When selecting the information button, a pop-up will appear with the default parameters for a collaborative movement. (



\* The collaborative movement values are indicative because they may change depending on the gripper, material to be handled, etc.







The toolbar panel shows the status of the machine during the work cycle as well as the status of the bays. (

			IOGRAM <b><unnam< b=""> LLATION default*</unnam<></b>	ned>*	New Open	Save			
> Basic		۹	Command		tidyPal 🔳		CobotVNC		Axis Drive Jier - FESTO
> Advanced	1 🔻 Robot Program	^	Samuana						
> Templates	2 🕈 🔻 Palletized NUTAI		Sequenc	e co	Machine Status	S	topped		
✔ URCaps	3 Station 4 Boxes		Palletizing l	qoo	Station R	Α	ctive		
MAD CPOS	5 ■ For each item		-				·		
MAD MOVE	6 🗣 🖿 Pallet input mov		To enable the first be config	ured.	Station L		mpty		
tidyPal	7	G=move_Axi	out a complete	e pallet	izing sequence fo	r each eleme	ent.		
	9 O WP_Home	1	Sequence F	Param	eters				
	10       ♥ ■ Grab item         11       ■ 𝔅 Wait DI box         12       ♥ ➡ Movel         13       ■ 𝔅 Wait DI box         14       ■ 𝔅 Wait DI plckA         15       ♥ ➡ Movel         16       ■ 𝔅 WP_PlckA         17       ■ Set Herramie         18       ➡ ➡ Movel         20       ■ 𝔅 WP_PlckA         20       ■ 𝔅 WP_PlckA	5_2≔cpos_A pint ınta=On ırabPayload(	•	nent: 250 1200	mm/s mm/s²	Angular m Speed Accelerate	60 80	°/S °/S <sup>2</sup>	ð
~									
Paused	Spe	ed 🦲	100%						



In this section presents the different states of the toolbar:

MACHINE STATE	COLOUR	
STOPPED/WAITING BOOT	Off	
WORKING	Green	
WARNING M. CYCLING	Yellow	
WARNING M. BLOCKED	Orange	
FAILURE	Red	

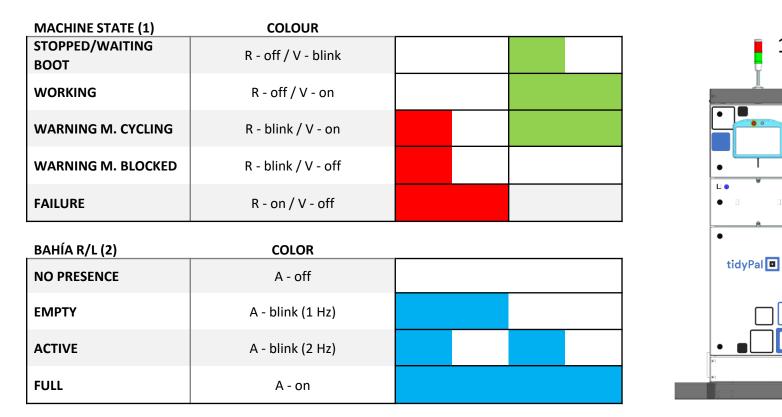
BAY R/L	COLOUR	
NO PRESENCE	Off	
ЕМРТҮ	Green	
ACTIVE	Orange	
FULL	Red	



•⁼∎2

#### **Functionalities**

This section presents the different states of the signaling beacon and the pilots in the palletizing station:



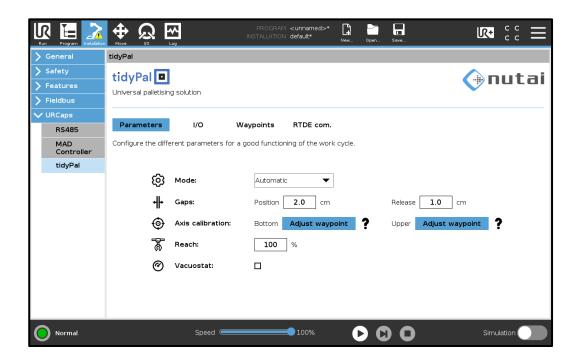




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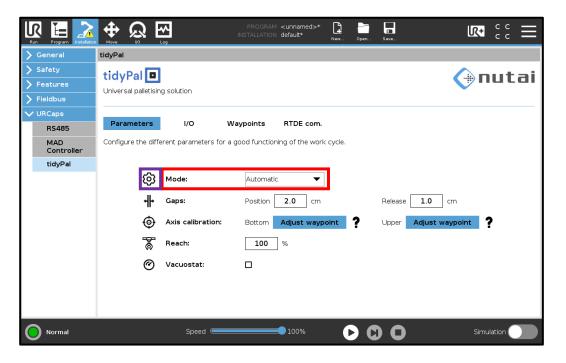


Additional parameters for the palletising process can be configured in the installation panel. There are 4 sections: Parameters, RTDE Communication, Waypoints and I/O.





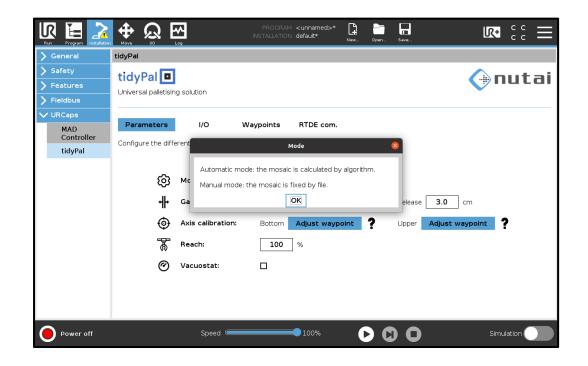
In the parameters section, different general parameters of the palletising process are configured.



Button to display pop-up message.

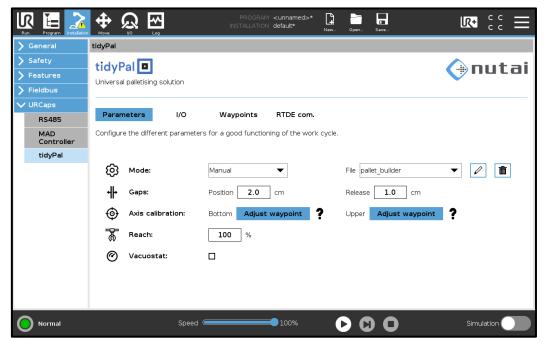


There are two working modes: Automatic in which the mosaic is calculated by algorithm and Manual in which the mosaic is fixed per file.



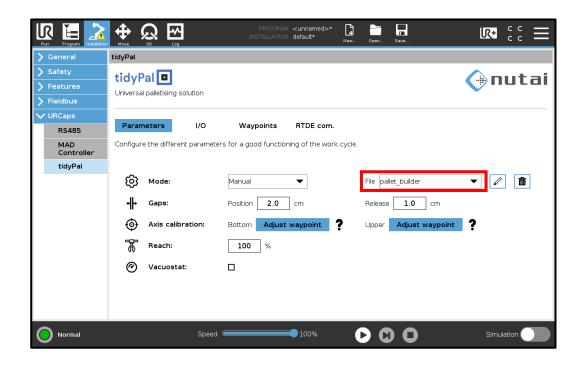


In manual mode the configuration file that has the necessary parameters for the sequence required by the client must be configured. In this mode the graphical interface of the programme node will automatically update and lock the already configured elements.



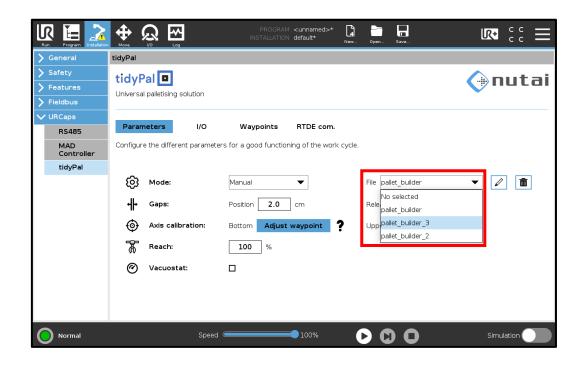


In the file selector will appear the files that we previously installed with the configuration file generated by the Pallet Builder application. Link:



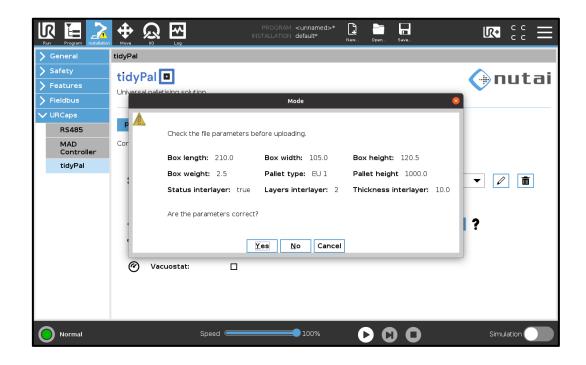


The list of files installed and available for use is displayed here.





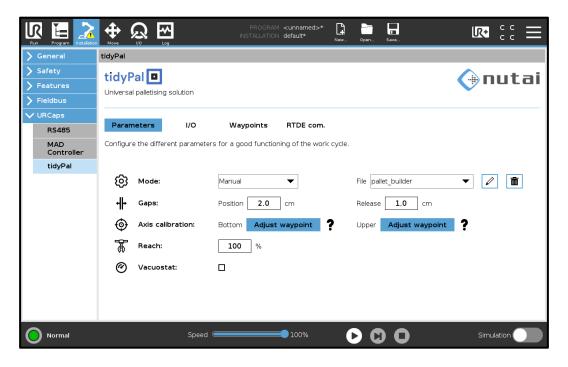
When selecting a configuration file, the parameters must be checked before applying them to the programme.





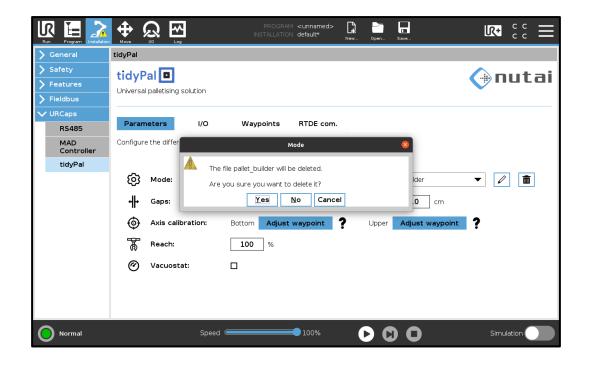
Two buttons are available:

- : will edit the name of the selected file.
- 💼 : will delete the selected file.





When deleting a file, a window will appear to confirm if you want to delete it.





Now that the configuration file has been presented, we will explain how to add new configuration files to the robot.

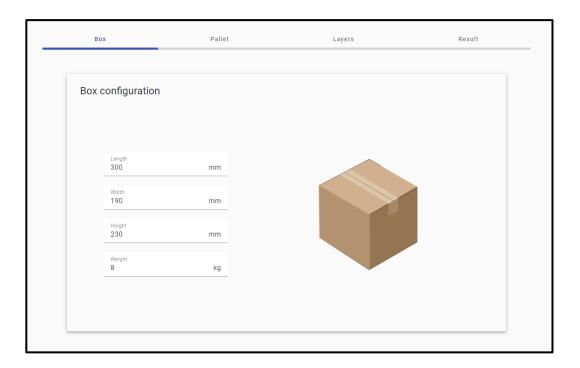
With the software developed by Nutai, Pallet Builder, a Zip file is generated with which we will follow the following steps:

- Unzip to the root of a USB flash drive.
- Insert the flash drive into the USB port of the teach pendant.
- Wait until the file is copied and the confirmation message appears.
- Make sure that the flash drive is in FAT32 format.



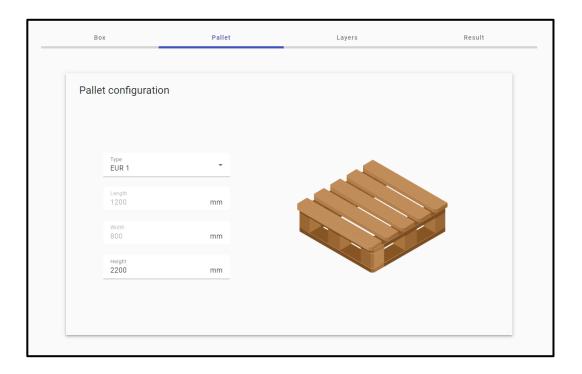
The pallet builder software and its different functionalities are shown below.

The first window allows you to configure the parameters of the box, such as length, width, height and weight.



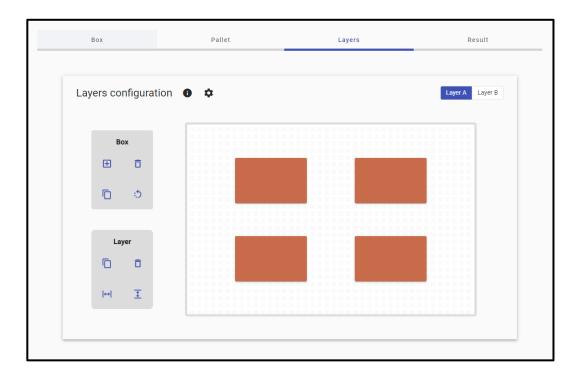


In the following window, the pallet type and maximum palletising height are configured.



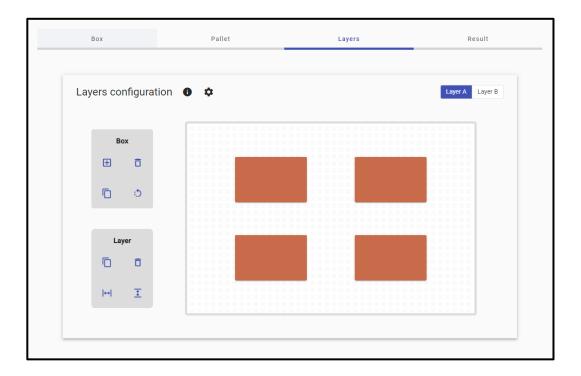


In the layers window, the mosaic is constructed by placing each box in the desired position. There are different functionalities such as add box, delete box, duplicate box and undo action.





In addition there are other functionalities applied to the layer such as duplicate layer, delete layer, align on X-axis and align on Y-axis.



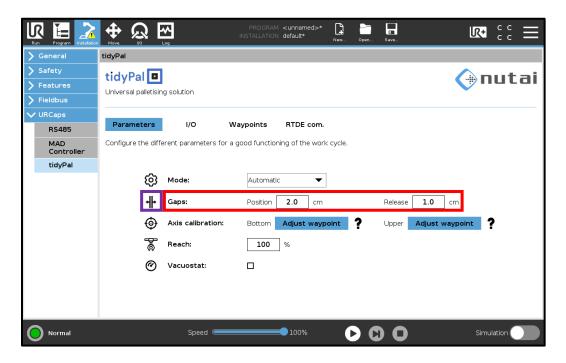


In the last window, general information about the generated mosaic is displayed.

Box	Pallet	Layers	Result
Builder result			
Box size:	300x190x230 mm		
Number of boxes:	40		
Pallet type:	EUR 1 (1200x800 mm)		
Number of layers:	9 (5A   4B)		
Total height:	2086 mm		
Total weight:	320 kg		
Surface usage per layer:	24 %   30 %		
Total volume usage:	25 %		
	🖹 Download con	figuration	



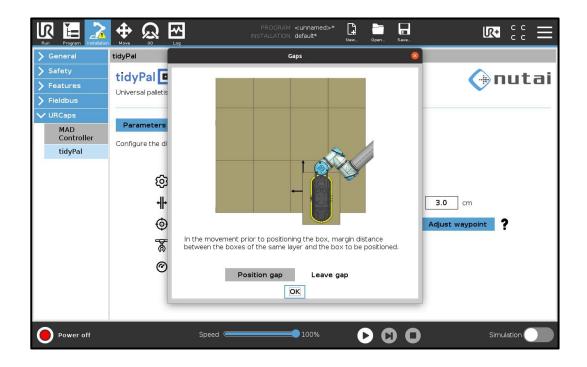
Gaps can be configured to adjust the positioning of the enclosures. These gaps are applied in the movement prior to the final position of the box. (



Button to display pop-up message.

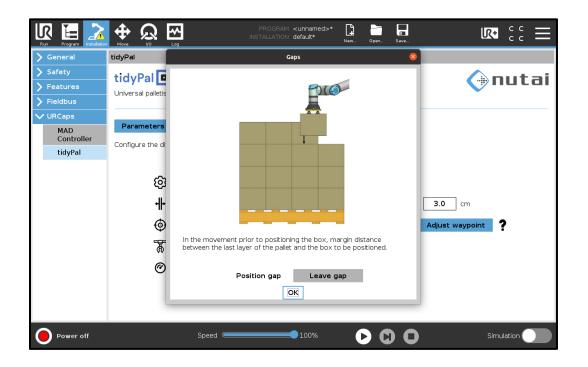


The *position gap* is the margin between boxes of the same layer. This is done to avoid collisions.



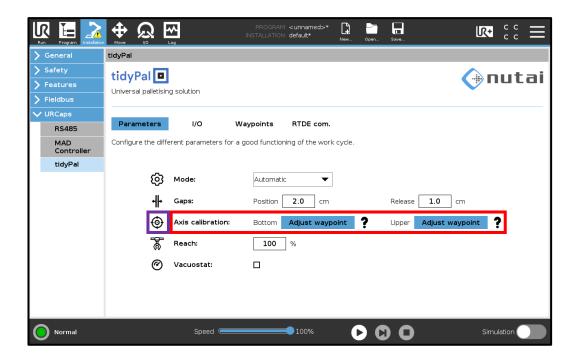


The *release gap* is the margin height between the position of the box and the height of the previous layer.





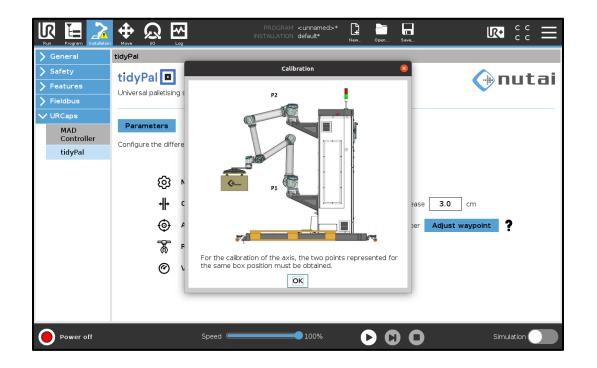
The *calibration of the axis* is carried out by taking two points of pick-up of the box at the same position and with two different positions of the vertical linear axis. (



Button to display pop-up message.

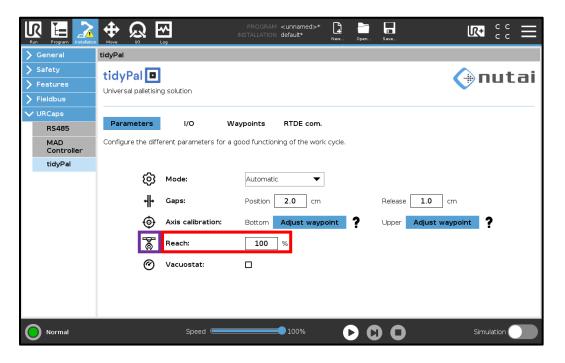


Axis configuration and movement will be discussed later in the manual in the section *Axis configuration*.





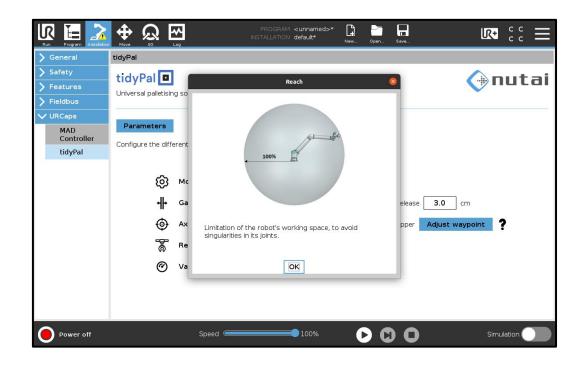
The reach parameter is used to limit the robot's reach to avoid forced movements and singularities.



Button to display pop-up message.

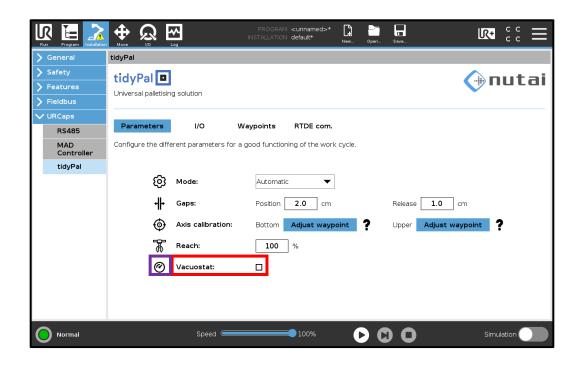


For a good performance it is recommended to select a value between 90 and 100 %.





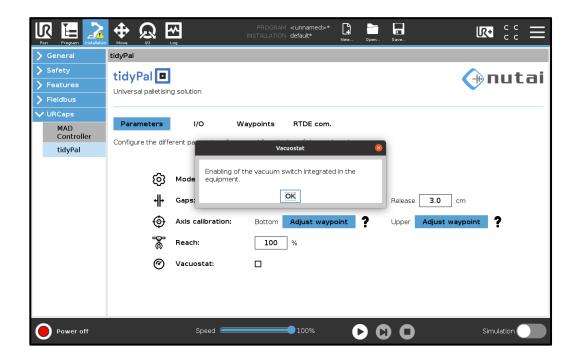
Finally, the integrated vacuum switch can be configured.



Button to display pop-up message.



The vacuum switch provides information on the status of the enclosure during positioning.





In the I/O section, the digital inputs/outputs of the robot will be configured for the use of sensors and actuators. The two available panels are shown below.



Button to display pop-up message.

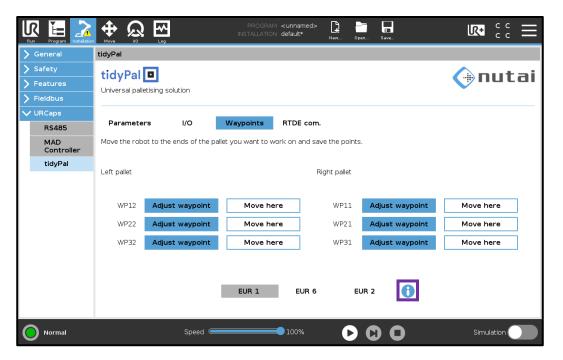


When configuring I/O, avoid repeating the same digital input or output for different functions to avoid malfunctions.





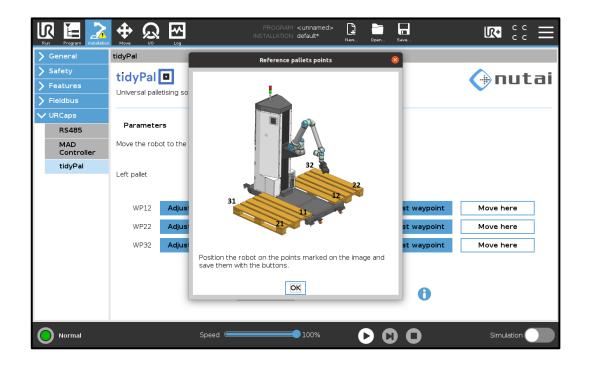
In the Waypoints section, the ends of the different types of pallets are configured to reference them in the system.



Button to display pop-up message.

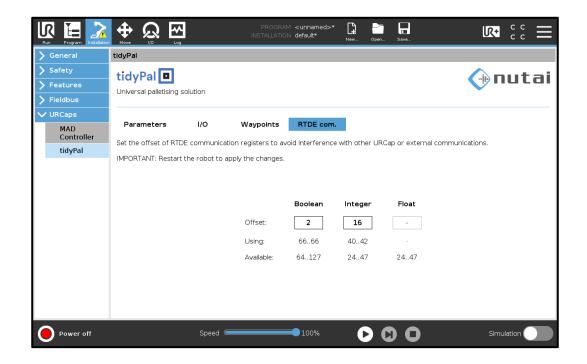


The message shows the points where the robot tool should be placed to obtain the points.





In the RTDE Communication section, the offsets for the RTDE communication registers shall be configured.





In addition we will have two additional windows with advanced parameters, Orientation and Home. To display these parameters, press the tidyPal logo for 3 seconds (□).

			PROGRAM <b><unnam< b=""> INSTALLATION <b>default</b>*</unnam<></b>	ed>		
> General	tidyPal					
> Safety	tidyPal 🗖					Anutai
> Features	Universal palletisin					mutai
> Fieldbus		goolation				
VURCaps RS485	Parameters	I/O	Waypoints RTDE o	om. Orienta	tion Home	
MAD Controller	Adjust different po	pints with the gripper	r above the pallets to confi	gure the orientation	n position.	
tidyPal	Left pallet			Right pallet		
	North	djust waypoint	Move here	North	Adjust waypoint	Move here
	East	djust waypoint	Move here	East	Adjust waypoint	Move here
	South	djust waypoint	Move here	South	Adjust waypoint	Move here
	West A	djust waypoint	Move here	West	Adjust waypoint	Move here
Normal		Speed 🥌	100%	0		Simulation

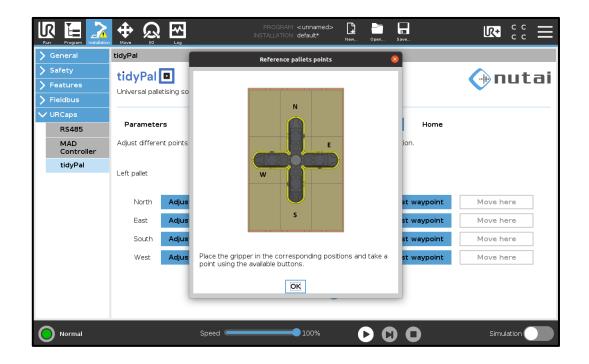


By default, the orientations will be factory set but can be changed by taking a point with the robot with the gripper orientation in the desired position.

		PROGR/ INSTALLATIO	M <unnamed> <b>L</b> N default* <sub>New</sub> o</unnamed>	Dpen Save	
> General	tidyPal				
> Safety	tidyPal 🗖				nutai
> Features	Universal palletising solu	ution			
> Fieldbus					
V URCaps	Parameters	I/O Waypoints	RTDE com. Orier	ntation Home	
RS485					
MAD Controller	Adjust different points v	with the gripper above the pall	ets to configure the orienta	ation position.	
tidyPal	Left pallet		Right pallet		
	North Adjust	waypoint Move h	ere North	Adjust waypoint	Move here
	East Adjust	waypoint Move h	ere East	Adjust waypoint	Move here
	South Adjust	waypoint Move h	ere South	Adjust waypoint	Move here
	West Adjust	waypoint Move h	ere West	Adjust waypoint	Move here
			0		
O Normal		Speed	<b>=</b> 100%	$\mathbf{O}$	Simulation



The following image shows the positions necessary to obtain the correct orientation.





In the last window you can configure the different waypoints of the robot. These are points to ensure a safe trajectory and avoid collisions.

	PROGRAM <unnan INSTALLATION default*</unnan 	
> General	tidyPal	
> Safety	tidyPal 🗖	Anutai
> Features	Universal palletising solution	nutai
> Fieldbus		
✔ URCaps	Parameters I/O Waypoints RTDE	com. Orientation Home
RS485		
MAD Controller	Adjust the different points to configure the home waypoints.	
tidyPal		
	Home Adjust w	Aaypoint Move here
	Right home Adjust w	aypoint Move here
	Left home Adjust w	avpoint Move here
Normal	Speed 🥌 100%	6 🕞 🕒 🕒 Simulation

#### Overview



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- 8 Best practices
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In this section, the URCap **MAD Controller**<sup>1</sup> Will be shown, which will allow us to control the vertical axis of the palletizer. In addition, its different functionalities will be explained, such as axis status and parameters.

With this software you can move up to 4 axes towards points or coordinates in a simple and programming-free way, without the need for other external components such as PLC/HMI.



<sup>1</sup> See all the details about the URCAP in its manual: <u>http://nutai.com/urcaps/madcontroller/urcap-user-manual-es.pdf</u>



You can configure all the features of the URCap from the installation panel. This window has 3 tabs (□): Axes, Parameters and Points:

		PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	New Open	Save	R+	D D D D	$\blacksquare$
> General	MAD Controller						
> Safety							
> Features	Multi Axis Drive Controller & FEST						- 11
> Fieldbus				Axis	Parameters	Points	
✔ URCaps							-
CobotVNC							
MAD Controller		Select the nu					
		1	▼				
			Axis 1				
		IP address:	192.168.0.1				
		Port:	502				
		Units:	mm 🔻				
							_
			((10))				
			((၇))) Scar	1			
Power off	Speed 🥌	100%			Simu	ulation	

□ The information of the configured axes is also displayed: their status and their current position.



From the Axes tab you can select the number of axes you want to work with, assigning each one its IP address, port and position units. In the case of the tidyPal we will only need 1 axis.

		PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	New Open Save		
> General	MAD Controller				
> Safety					
> Features	Multi Axis Drive				
> Fieldbus		1	Ax	is Parameters	Points
✓ URCaps					
CobotVNC					
MAD Controller		Select the nu	umber of axis		
		1	•		
			Axis 1		
		IP address:	192.168.0.1		
		Port:	502		
		Units:	mm 🔻		
			( )		
		Apply	((ဖု)) Scan		
Power off	Speed 🥌	100%		Sim Sim	nulation

Once the axes have beeen indicated, press the Apply button to connect<sup>1</sup> or reconnect to them.



From the Parameters tab you can consult —Read button— and configure —Write button— (□) the most common parameters of the controller.

		PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	New Open	Save	K+	9423 <b>—</b>			
> General	MAD Controller								
> Safety	Axis 1						╵┍╴		
> Features	Multi Axis Drive							Select a parameter	
> Fieldbus	mm			Axis	Parameters	Points		Positioning Velocity 🗸 🗸	1
VURCaps									1
CobotVNC					Other	params		Positioning Velocity	
MAD Controller		Select a parameter						Jog Velocity (Phase 1)	
					De dues d b	1ode 🚯	DCIL	<sup>y</sup> Jog Velocity (Phase 2)	
	Positioning	/elocity	•		Reduced N	iode 🕕		Software End Positions	
					Enable:	<b>N</b>		Positioning Acceleration	
	Velocity (mm/s):		500.0	7	Speed (	%): 20		Positioning Deceleration	
				_				Positioning Torque Limit	
					Home			Maximum motor current	
					Set Ho	ome here		🖬 Read 🛛 🕞 Write	
		Read 🕞 W	rite		Move	to Home			
Power off		Speed 100%	-		<b>D D</b> Sin	nulation			

Warning: modifying the parameters will affect the operation of its components. All parameters (except Reduced Mode) are saved in the motor controller and not in the installation file.



Description of the main configuration parameters:

- 1. Positioning speed: base speed for positioning tasks in direct mode no Jog (limited to the maximum speed allowed).
- 2. Jog speed (phase 1): maximum speed in manual mode (Jog) during the initial phase (limited to the maximum speed allowed).
- **3.** Jog speed (phase 2): maximum speed in manual mode (Jog) during the final phase (limited to the maximum speed allowed).
- **4.** Software position limits: minimum and maximum final position by software (not limited). Plausibility rule: Lower bound ≤ Upper bound.



Description of the main configuration parameters:

- **5. Positioning Acceleration:** Acceleration for direct mode positioning tasks (limited to maximum allowable acceleration).
- **6. Positioning Deceleration:** Deceleration for direct mode positioning tasks (limited to maximum allowable acceleration).
- **7. Positioning torque limit:** torque limit in mNm (not limited). If the axis exceeds this limit, it goes into fault. Value 0 disables torque limitation.



**IMPORTANT:** Changes to any parameter will only persist until the next reboot. For permanent changes, press the Save button (□).

			PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	New	Open	Save	R.	9423 15D1	≡
🖒 General	MAD Controller								
> Safety									
> Features		Axis 1 -155.97							
> Fieldbus		mm				Axis	Parameters	Points	
✔ URCaps									
CobotVNC							Other	params	
MAD Controller			Select a parameter						-
	Positioning Velocity					Reduced M	ode	0	
		I OSICIOTIITI VE	socity	•			Frankla	-	
						1	Enable:	<b>N</b>	
	Velocity	/ (mm/s):		500.0			Speed (S	%): 20	
							Home		
							Set Ho	me here	
	[	Re Re	ead 🛛 🕞 W	rite			Move	to Home	
Power off			Speed 100%	-		C	C O sim	ulation	

Warning: Reading, writing and saving of parameters in the controller may not work correctly inc ase these are any active warnings or errors int he motor controller (which you can consult from the Toolbar).



It is possible to enable and configure the speed of the axes in Reduced mode (□). By enabling this option, if the robot is in Reduced Mode, the maximum positioning speed of the axes will be limited to the configured percentage.

		PROGRAM <b><unnamed></unnamed></b> INSTALLATION default*	New Open	Save	
> General	MAD Controller				
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>	Multi Axis Drive Controller & FESTO			Axis Par	ameters Points
VURCaps CobotVNC MAD					Other params
Controller		Select a parameter			
	Positioning	Velocity	•		Reduced Mode 🚯
	Velocity (mm/s):		500.0		Enable: 🖬 Speed (%): 20
					Home
					Set Home here
	<b>1</b>	Read 🕞 W	rite		Move to Home
Power off		Speed 100%	-		Simulation

Warning: Will apply to all axes ans not just the selected axis. This software functionality does not replace the SLS safety function (Safe Limited Speed, EN 61800-5-2) of the axis, which would require the CAMC-G-S3 safety module.



You can set the current position as Home (□) by using the Set Home Here button<sup>1</sup>. □ Clicking on Move to Home will move the axis to the current zero position.

		PROGRAM <b><unnamed></unnamed></b> INSTALLATION <b>default*</b>	New Open	Save	<b>I</b> № <sup>9423</sup> =
> General	MAD Controller				
> Safety					
> Features	Multi Axis Drive Controller & FESTO				
> Fieldbus				Axis	Parameters Points
V URCaps					
CobotVNC					Other params
MAD Controller		Select a parameter			
	Positioning		•		Reduced Mode
					Enable: 🗹
	Velocity (mm/s):		500.0		Speed (%): 20
					Home
					Set Home here
		Read 🛛 🕞 W	rite		Move to Home
Power off		Speed 100%	-	C	Simulation

<sup>1</sup> For more information consult MAD Controller manual.



From this tab it is possible to move the selected axis in manual mode with the Jog (
buttons. In addition, it is possible to save points although this is not necessary for the tidyPal process.

<ul> <li>Safety</li> <li>Features</li> </ul>		ulti Axis Drive	Axis 1					
Fieldbus		ontroller & FESTO	-155.97 mm		Axis	Parameters	Points	
✔ URCaps		Point No	Description	Position (mm)	Teach	Move		
CobotVNC MAD	Ŵ	Р1	P1	-155.97	Teach P1	Move to P1	•	^
Controller	ŵ	P2		] -	Teach P2	Move to P2		
	Î	РЗ		] -	Teach P3	Move to P3		
	ŵ	Ρ4		] -	Teach P4	Move to P4	•	
	Î	P5		] -	Teach P5	Move to P5	•	
	Ì	P6			Teach P6	Move to P6	•	
	Î	Ρ7		] -	Teach P7	Move to P7		~
		•	Jog -	og +	< Page -	> Page +		



You can access the URCap toolbar<sup>1</sup> from any window ( $\Box$ ) to check the status of the controller and move the axis manually using Jog ( $\Box$ ).

		PROGRAM INSTALLATION	<unnamed> default*</unnamed>	New Open Save	
> General	MAD Controller		CobotVNC	Multi Axis Drive	
<ul> <li>&gt; Safety</li> <li>&gt; Features</li> <li>&gt; Fieldbus</li> </ul>		Axis 1 -155.97 mm			Axis 1
✔ URCaps	Point No	Description P	osition (mm)	Enable	
CobotVNC MAD Controller	<b>m</b> P1	P1	-155.97	Stop Ready	
	P2		-	O Mov. completed	
	рз		-	() Warning	
	<u>р</u> 4		-	Position: -155.97 mm Speed: 0%	
	<u>т</u> Р5		-	Status: Connected	
	<u>т</u> Р6			IP Addr.: 192.168.0.10   Ready FSM: S4   Position	
	<u>т</u> Р7		-	Jog -	jog +
		Jog - 📄 Jog +			
Power off			Speed 100%	•	Simulation

<sup>1</sup> The toolbar is only available on e-Series models.

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This section explains everything related to the safety of the palletising station:

#### 1. Impact test

Validation of robot force and pressure.

#### 2. Integration recommendations

Configuration-dependent aspects of product integration.





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This section presents the conditions when performing the impact test with the Nutai gripper. This process has been carried out in accordance with ISO/TS 15066 to certify that the equipment meets the force and pressure requirements.

Detailed test results are presented in Annex I.

Conditions:

Gripper	Ang. Speed	Ang. Acce.	Lin. Speed	Lin. Acce.
Nutai	180 °/s	800 °/s <sup>2</sup>	1750 mm/s	9000 mm/s <sup>2</sup>



The following images show the process of carrying out the impact test. For this purpose, the KMG-500 force sensor and Fuji Prescale paper were used.







# 2 Integration recommendations

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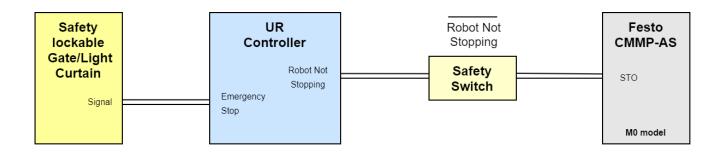
The integration will depend on the customer's requirements, therefore, there may be different configurations for the station.

The following are some integration schemes depending on the level of security required:

- **1. Basic level**: the station is in a fenced area. Both are stopped if the operator enters the fenced area.
- 2. Medium level: the station is NOT in a fenced area. The robot slows down if the operator enters the operating area.
- **3.** Advanced level: the station is NOT in a fenced area. The robot and/or axis slows down or stops if the operator enters the operating area.



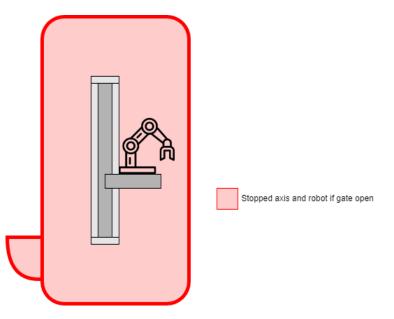
**1. Basic level:** the station is in a fenced area. Both are stopped if the operator enters the fenced area.



Connection diagram



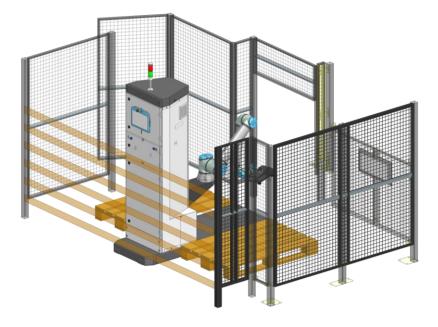
**1. Basic level:** the station is in a fenced area. Both are stopped if the operator enters the fenced area.



Integration scheme



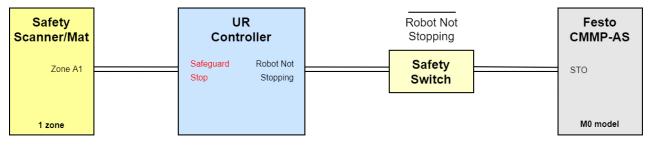
**1. Basic level:** a possible integration with the fence is shown below. In this mode, when the operator enters the working area, the robot and axis will stop.







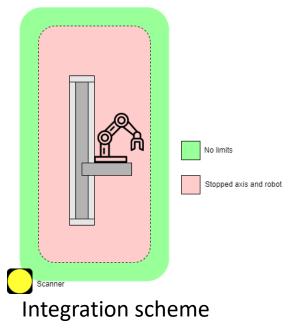
2. Medium level: the station is NOT in a fenced area. The robot and axis stop if the operator enters the operating area.



Connection diagram



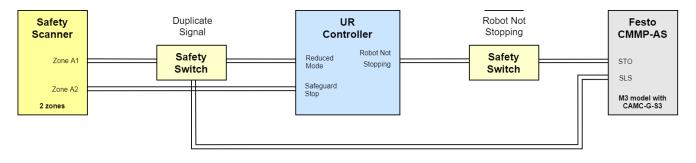
2. Medium level: the station is NOT in a fenced area. When the operator enters the restricted area, the robot slows down, the linear axis will maintain its speed because mechanically it is already limited to a collaborative speed.







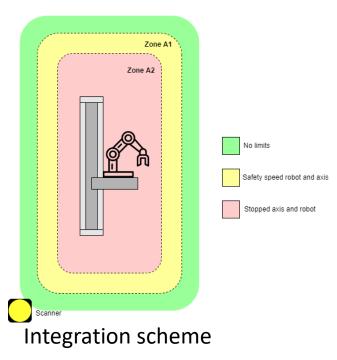
**3.** Advanced level: the station is NOT in a fenced area. The robot and axis slow down if the operator enters the operating area.



Connection diagram



**3.** Advanced level: the station is NOT in a fenced area. A detection in the first zone will slow down the robot, in the second zone robot and axis will stop.



#### Overview



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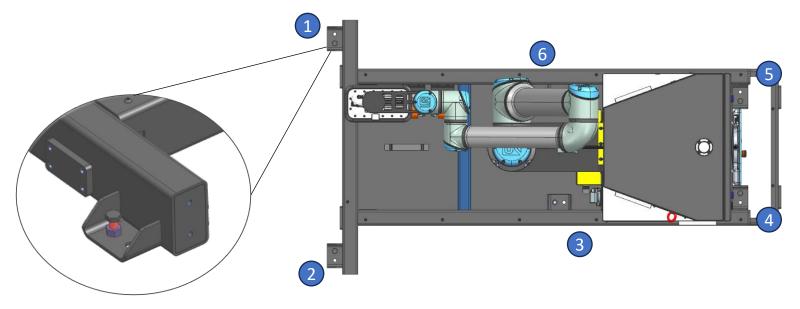


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1. Raise TidyPAL. Tighten the suplied screws M12 at a distance of 12mm to achieve a space to install the wheels. Use 19mm socket. (*The use of an extender is highly recommended for better work*)

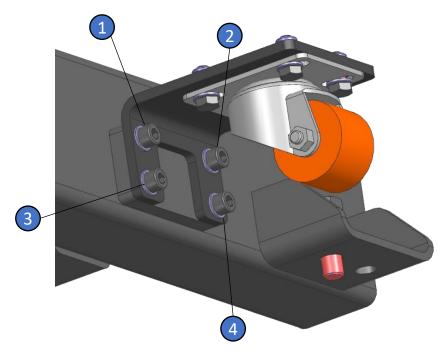
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#### **Caster wheels Asembly**

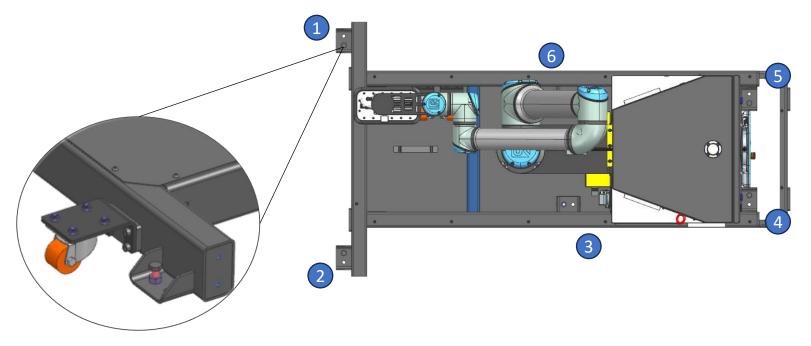
2. Wheels holder installation. Tight the M8x20 screews and washers suplied using the wheels holder. Repeat this step in the 4 points previusly shown.





#### **Caster wheels Asembly**

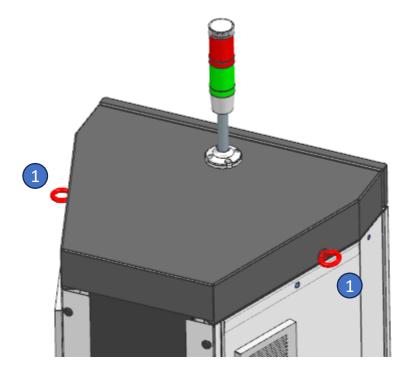
**1. Go down TidyPAL.** Remove the 4 M12 supplied screews until the wheels touch the ground. Use 19mm socket. (*The use of an extender is highly recommended for better work*)





#### Lifting for transport

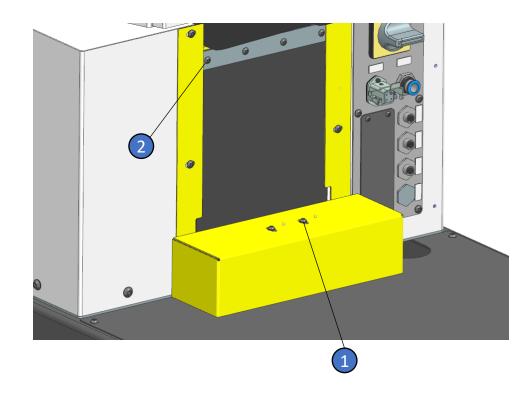
**1.** Lift TidyPAL. There are two lifting point. Use any type of holder like slings or ropes with M10 eyebolt.





- **1. Remove drawer.** Remove M5 screws and washers.
- 2. Loosen plate holder. Remove M5 screews and washer. Be careful with the square before loseen all screews, the spring is tauten.

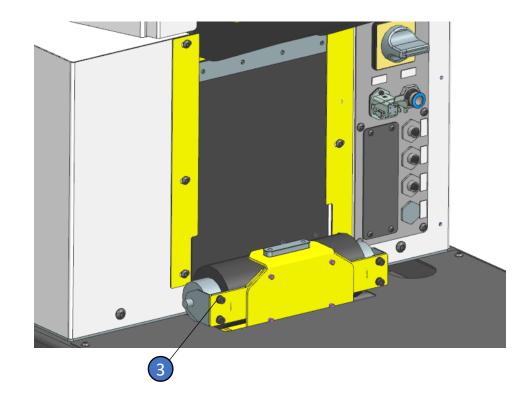
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#### **Remove curtain (Lower)**

**3. Remove plate.** Remove M5 screews, nuts and washers. Be careful with the square of the holder due to the spring is pre-tauten. The square can rotate violently.

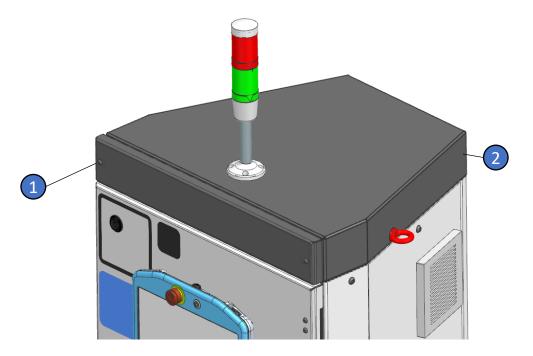
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#### Remove curtain (Top)

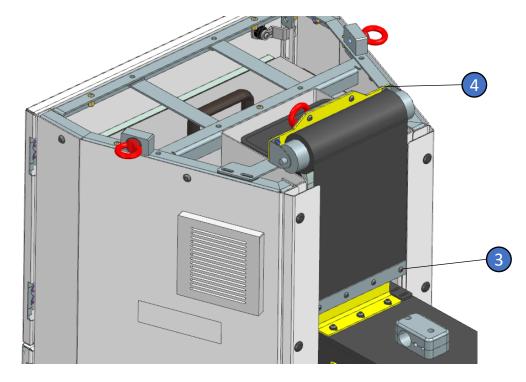
- 1. Remove the front cover. Remove the 2 M6 screws.
- 2. Remove the top cover. Remove the 6 M6 screws on the inside of the cover.





#### **Remove self-retracting bellows (Upper)**

- **3. Remove the plate.** Remove the 4 M5 screws and washers. Be careful when loosening the screws as the spring is pre-tensioned.
- 4. **Remove the bellows plate.** Remove the 4 M5 screws, nuts and washers. When removing the bellows, be careful with the spring tension as once removed from the bracket, the bracket will tend to rotate.





#### Preventive maintenance work

Each maintenance plan for each functional group of the product is detailed below.

			FREQUENCY			
Component	Component Work Measures		Monthly	Quarterly	Half-yearly	Annual
Maintenance unit	Review	Check for condensation. Possibility of air leakage.	x			
General installation	Review	Checking of all sensors and cleaning	х			
General installation	Damages	Check the equipment for the following damage: Paint deterioration Bent components Cracks in components Cracks in welding		x		

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#### Preventive maintenance work

Each maintenance plan for each functional group of the product is detailed below.

			FREQUENCY			
Component	Work	Measures	Monthly	Quarterly	Half-year	Annual
General installation	Loose components	Check tightening torques of bolts and nuts, according to tables on page 116.			x	
Linear guides	Review	Check for dirt and grease. Clean and grease according to manufacturer's specifications.			x	
Vacuum claw	Review	Check the condition of the equipment. In case of damage or deterioration, contact the manufacturer.			x	

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#### Preventive maintenance work

Each maintenance plan for each functional group of the product is detailed below.

	Work	Measures	FREQUENCY			
Component			Monthly	Quarterly	Half-year	Annual
Roll-up bellows	Review	Check the tension of the roller shutter. If tensioning is necessary, follow the manufacturer's instructions.			x	
Components	Check the condition of components such as: • Detectors • Beacons • Light beacons • Pneumatic components	Replacement of worn, damaged or malfunctioning parts.			х	

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#### **Preventive maintenance work**

The tightening torque tables for the fasteners are attached below.

#### Galvanised screws

Tamaño	Par de apriete [Nm]			
de rosca	8.8	10.9	12.9	
M3	1.1	1.58	1.9	
M4	2.6	3.9	4.5	
M5	5.2	7.6	8.9	
M6	9	13.2	15.4	
M8	21.6	31.8	37.2	
M10	43	63	73	
MI2	73	108	126	
MI4	117	172	201	
M16	180	264	309	
M20	363	517	605	
M22	495	704	824	
M24	625	890	1041	
M27	915	1304	1526	
M30	1246	1775	2077	
M36	2164	3082	3607	

#### Blued screws

Tamaño	Par de apriete [Nm]			
de rosca	8.8	10.9	12.9	
M4	3	4.6	5.1	
M5	5.9	8.6	10	
M6	10.1	14.9	17.4	
M8	24.6	36.1	42.2	
MI0	48	71	83	
MI2	84	123	144	
MI4	133	195	229	
MI6	206	302	354	
M20	415	592	692	
M22	567	804	945	
M24	714	1017	1190	
M27	1050	1496	1750	
M30	1420	2033	2380	
M36	2482	3535	4136	

#### Stainless steel screws

Tamaño	Par de apriete [Nm]			
de rosca	50	70	80	
M3	0.37	0.8	1.1	
M4	0.86	1.85	2.4	
M5	1.6	3.6	4.8	
M6	2.9	6.3	8.4	
M8	7.1	15.2	20.3	
MI0	14	30	39	
MI2	24	51	68	
MI4	38	82	109	
MI6	58	126	168	
M20	115	247	330	
M22	157	337	450	
M24	198	426	568	
M27	292	—	—	
M30	397	_	—	
M36	690	-	—	



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### **Best practices**



#### $\overset{\prime}{\square}$ We advise you to follow the recommendations below:

- Before starting a cycle, check that there is no risk of collision.
- Check the operation of the sensors before starting a cycle.
- The components may only be handled by qualified technical personnel.
- During a cycle, position the teach pendant in the cabinet.
- If you replace any components, perform a Home and check their functioning
- Carry out regular maintenance on your mechanical components<sup>1</sup>
- After assembly of the equipment, <u>the vertical axis</u> and <u>the pallet points</u> must be calibrated.

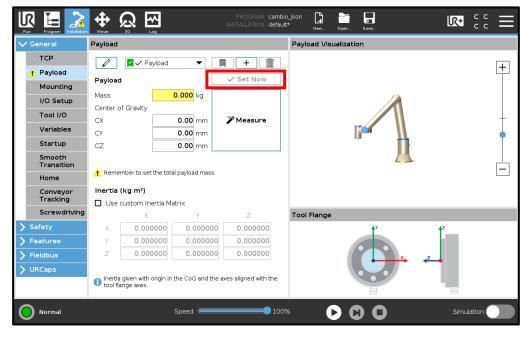
<sup>1</sup> For more information, please visit the manufacturer's website: <u>https://www.festo.com</u>





• In the event of a protective shutdown or sudden stop of the program in progress,

check the robot load on the installation node.



 $(\Box)$  Be sure to apply the load.

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### Support



For more information, contact with:



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