PREMIER TECH

TOMA™

# Operating and Maintenance Manual

PAL-0830-N
Palletizer with cobot technology

Revision 1.0 (2025-02-05)

# GENERAL WARNINGS

## FAILURE TO COMPLY WITH THE RULES PUBLISHED IN THIS MANUAL MAY RESULT IN PHYSICAL INJURY OR MATERIAL DAMAGE

This document contains the most up-to-date information available at the time of publishing. Due to Premier Tech's ongoing improvement policy, the company reserves the right to discontinue or update manuals and technical information as it sees fit, without notice and without further obligation on its part.

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**WARNING**

**Only qualified personnel with a thorough knowledge of the equipment and its Operating and Maintenance Manual are authorized to handle, install, operate, adjust, troubleshoot and maintain the equipment.**

**DANGER**

**Always perform the lockout procedure before making any equipment or part maintenance, repair, modification, replacement, assembly or disassembly; or taking any action involving even the slightest risk. The procedure must be performed by each person making any of the above-mentioned action.**

**DANGER**

**Never use this equipment for purposes other than those for which it was intended.**

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**DANGER**

**Make sure no one is within the equipment perimeter before starting up. Watch equipment throughout the startup process.**

**DANGER**

**When the equipment is running, ensure not to come into contact with any part of the equipment.**

**WARNING**

**The operator must know the location and have a thorough knowledge of operating controls and safety devices before using the equipment.**

**WARNING**

**Before starting the equipment, ensure that all protective guards are in place and that the equipment is in good working order.**

**WARNING**

**Never stand under the robot gripper. Risk of falling units.**

**WARNING**

**Be careful when working near unwrapped pallet loads. These loads may be unstable. Stay away from them when they are moving.**

**WARNING**

**Be careful when walking or standing near empty moving pallets.**

**CAUTION**

**Changing proximity and photoelectric sensors original position may result in operating problems or damage to equipment.**

# TABLE OF CONTENTS

# WRITING CONVENTIONS

### TYPOGRAPHY

Each machine and equipment line is composed of a series of modules. Module names are set in SMALL CAPITALS.

Names of operating screens, controls, and parameters are set in **bold type**.

All hyperlinks to sections or chapters are in blue.

### SAFETY NOTICES, TIPS AND NOTES

**DANGER**

**Where this message appears failure to comply with procedures and safety recommendations will result in death or serious injury.**

**WARNING**

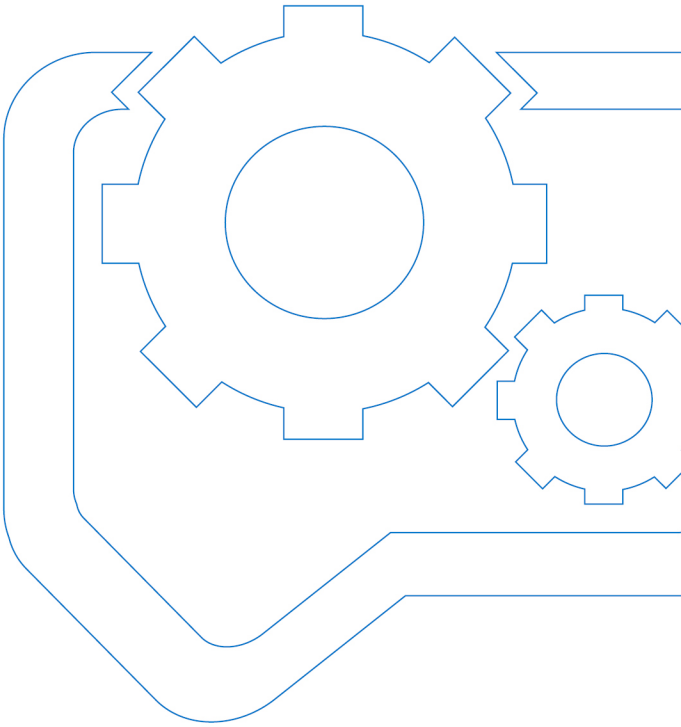
**Where this message appears failure to comply with procedures and safety recommendations could result in death or serious injury.**

**CAUTION**

**Where this message appears failure to comply with procedures and safety recommendations may result in equipment damage.**

Tip providing advice on use or additional information. These are particularly useful for first-time users.

Note warning about the irreversibility of an action or about situations that require special attention.



# 1 Safety

This chapter describes the entire body of safe practices for all items of equipment commercialized by Premier Tech. Therefore, some safe practices may not apply to all items of equipment. The user has to take into consideration only the rules applying to the relevant items of equipment.

#### OBLIGATIONS OF THE EQUIPMENT USER REGARDING SAFETY

- Equipment user is responsible for understanding and complying with applicable local, provincial/state and federal laws and regulations, including those regarding safety, before starting the equipment. The user will no doubt be required to draft more detailed rules than the basic safe practices provided in this manual to comply with local regulations and accommodate specific operating conditions.
- Equipment user has the responsibility to ensure that their company personnel are properly trained, that this manual is handed over or made available to said personnel and that their company personnel have read, understood and complied with all instructions, especially regarding safety.
- Equipment user must refer to and comply with any applicable safety instructions issued by manufacturers of all related modules and all components of the equipment used.
- Equipment user is required to complete a risk assessment and ensure that the risk level is maintained at an acceptable level during handling, installation, operation, adjustment, troubleshooting, maintenance and dismantling of equipment, including all handled products (packaged product, packaging, pallets, slip/top sheets, etc.). Should the user want to further reduce the risk level through equipment design, Premier Tech may offer additional safety devices, mainly for risks associated with possible equipment misuse.
- Any equipment certification remains the responsibility of the user.
- As defined by ISO 10218, the Safety-Related Embedded Software (SRESW) includes any software and program related to the safety system and are not accessible for modification by the user.
- During equipment installation or performance of a special task, Premier Tech can use particular procedures. Only Premier Tech employees and personnel hired by Premier Tech are trained and have the required competences to complete the task safely. It is strictly forbidden to imitate or repeat any said procedures without Premier Tech’s written consent.

- Equipment user is responsible for approving the installation and proper use of the equipment, including proper electrical connections and proper operation.
- Should equipment be moved to another location, or sold to another company, user is responsible for handing over the operation and parts manuals along with said equipment.

## 1.1 Unloading and Handling

**DANGER**

**Equipment is heavy and can cause severe injury or death if it falls.**

When applicable, information about lifting points, weight of modules and center of gravity are indicated on the equipment itself or are provided in the Operating and Maintenance Manual or in the shipping documents.

Certified handling, hoisting and support techniques must be used when moving or lifting the equipment and component parts. These techniques require that the use, maintenance and verification of certified lifting equipment must be done by qualified personnel only.

Lifting hooks provided with equipment are designed to lift the module on which they are installed and should not be used to lift the whole equipment or several modules at the same time. It is important to choose the appropriate lifting method according to the type of hooks on equipment. Never lift with applied load at an angle if hooks are designed for vertical loads only (ex: non-shouldered eye bolts).

**Figure 1-1 Hooks for vertical loads (left) and angular loads (right)**

Do not walk or stand under or near a load suspended by hoisting equipment such as crane, forklift, bridge crane, loader, hydraulic or compressed-air piston, or inclined unloading ramp. The equipment is heavy and can cause severe injury or death if it falls. Where this situation cannot be avoided, ensure that the load is restrained by blocks, posts, stays or beams, for example.

If there is any chance that a load's center of gravity may shift in relation to the device used to hoist or restrain it, secure the load firmly to the hoisting device before hoisting.

Do not stand under a load supported by wheels unless the wheels are blocked to prevent horizontal movement.

Make sure to anchor electrical panels and all parts of equipment. Non anchored parts could fall and cause serious injuries or death.

## 1.2 General Rules

**WARNING**
**Some equipment can start up automatically. Never enter a danger zone without performing the lockout procedure.**

**DANGER**
**Never touch or enter the path of moving components without performing the lockout procedure. Doing so may result in serious injury or death.**

**DANGER**
**Never open an electrical panel with power on. Only qualified personnel wearing appropriate personal protective equipment are allowed to work on an electrical panel with power on. Arc flash and electrical shock hazard.**

**DANGER**
**Possessing multiple safety keys for rearming an interlocking system such as a safety fence door may compromise safety.**

**WARNING**
**Do not stare directly into laser beams.**

**WARNING**
**Never access equipment interiors using areas intended for loading or discharging product, empty bags, filled bags, boxes, containers, empty pallets or pallet loads. Only use areas specifically intended for accessing the equipment.**

**WARNING**
**Areas specifically intended for accessing the equipment allow safe access to this equipment section only. Never try accessing nearby equipment sections without using their own designated access areas.**

**WARNING**
**Never walk on a conveyor. Always use the designated access and circulation areas.**

**CAUTION**
**Modifications to electrical enclosures performed by unauthorized parties may compromise safety and reliability of equipment and could invalidate the certification.**

#### CLOTHING, JEWELRY AND LONG HAIR

Although equipment is fitted with guards to protect operators from moving components, these devices do not always provide complete protection. It is the operator's responsibility to show caution and good sense. The following points are basic safety precautions and should always be obeyed.

- Never wear loose clothing (shirt, sweater, tie, scarf, etc.) that could get caught in the machine.
- Never wear jewelry, except for a medical alert bracelet or necklace.
- Long hair must be confined in a net or otherwise securely confined.

#### PERSONAL PROTECTIVE EQUIPMENT

When working on or around equipment, workers must always wear the following personal safety items: safety glasses, safety helmet, and safety boots. Respirator masks must be worn when working in areas where the air's pollutant or dust content exceeds permissible limits. Hearing protectors (plugs, earmuffs or other) must be worn in work areas where the noise level exceeds permissible limits. A safety harness must also be worn when accessing an elevated, unprotected section of the machine. Anchorage connectors are installed on equipment where height accesses are predictable. When anchorage connectors are present, use them as well as safety harnesses.

Also, long-sleeved overalls, safety helmet, visor and safety boots must be worn at all times when working near a piece of equipment that features a hydraulic unit.

Gloves must be worn at all times when working near a piece of equipment that features a hydraulic unit. Also wear gloves to touch surfaces or tools that have become warm, but do not touch hot surfaces or tools that have become hot (more than 60°C/140°F).

#### LABELING OF CONTROLS AND WARNINGS

Plaques affixed to the equipment are used to label equipment controls, including emergency-stop controls, and provide specific warnings and instructions for safe, efficient use of the

equipment. These plaques must remain in place and must be visible at all times.

All workers who operate the equipment must have a perfect knowledge of the location and function of all controls and must be familiar with the meaning of warnings and instructions.

#### TRAVEL AROUND EQUIPMENT

Use the appropriate entrance areas when going within the equipment's perimeter. Never approach the equipment unnecessarily.

Use catwalks to cross conveyors. Never step on or over a conveyor.

Never access a high, unprotected zone without a safety harness. Anchorage connectors are installed on equipment where height accesses are predictable. When anchorage connectors are present, use them as well as safety harnesses. If a part is hard to reach, use a maintenance platform or other safety equipment instead.

Never run in the workplace.

No one should enter or loiter in a bulk material storage area (bunker) or any other area located under a discharging point. Product or objects may fall and cause severe injuries. Furthermore, care should be taken when walking under or next to conveying equipment. Use the specifically designated areas to move around and under these pieces of equipment.

#### ELECTRICAL CABINET

Never open an electrical panel with power ON: there is an arc flash and electrical shock hazard. When work must be performed on an electrical panel with power ON, a safety perimeter must be set in front of the electrical cabinet. Only qualified personnel wearing appropriate personal protective equipment are allowed to work inside the safety perimeter.

#### CLEANLINESS AND GOOD ORDER

A clean, tidy work area helps reduce the risk of accidents. Each operator is responsible for keeping the work area in good order at all times.

Access to exit doors and electrical panels must remain unobstructed at all times.

Water, oil or another liquid can make a floor slippery and lead to falls, causing serious injuries. Always have the appropriate absorbent materials and tools on hand to keep the floor dry and safe.

#### ERGONOMICS

To lift a load of more than 25 kg (55 lb), use a lifting device or ask for help.

#### COMPRESSED AIR

Incorrect handling of compressed air is dangerous and may result in serious injury, explosions or even death.

Using compressed air may create a combustible dust cloud conducive to explosions. It is therefore highly recommended to clean and remove the dust using suction vacuum (vacuum cleaner, dedusting system, etc.) instead of compressed air.

#### HAZARDOUS PRODUCT HANDLING

When Premier Tech equipment is to be used for handling potentially harmful materials, always refer to the Material Safety Data Sheet (MSDS) provided by the product supplier and follow the handling, storage and disposal safety recommendations.

## 1.3 Operator Training

Safe and effective use of equipment requires an operator who has been specifically trained for the task.

Operator training must include a detailed review of the Operating and Maintenance Manual. The operator must have access to this manual at all times. Special attention must be given to the location and operation of all controls and safety devices, including emergency-stop controls and protective guards. A thorough knowledge of the safe practices in the Operating and Maintenance Manual is indispensable.

Ensure that the operator is fully trained on the equipment prior to being allowed to operate it.

## 1.4 Safe Operation

The operator must follow all Operating and Maintenance Manual procedures.

**WARNING**
**It is strictly forbidden to remove or disable protective guards or other safety devices, except where necessary for adjustment or maintenance purposes.**

**DANGER**
**Make sure no one is within the equipment perimeter before starting up. Watch equipment throughout the startup process.**

**DANGER**

**Make sure no one is inside the equipment before closing a safety door, resetting a safety light curtain, an emergency-stop button or any other safety devices and restarting the equipment.**

Before using the equipment, locate all safety devices and operating controls. Make sure you understand how they work and how to use them. Never take a risk that could cause an injury.

Only use this equipment for the purpose it was designed for.

While operating equipment, the operator may encounter situations not covered in this manual. If this is the case, or if a procedure appears dangerous, the operator must shut down the equipment and immediately advise his supervisor.

If modifications are necessary, both the operator and supervisor must make sure that they understand the consequences of the steps to be taken, ensuring that they will not cause any injury. Think first, stay alert, and exercise caution.

#### RISK OF CONTACT WITH MOVING COMPONENTS

It is strictly forbidden to touch or enter the path of moving components, or components that are likely to start moving, such as conveyors, robots, connecting rods, mobile mechanical components, etc. The lockout procedure must have been performed before any intervention on components which are not immobilized by the activated safety system.

It is also forbidden to climb on equipment or to use a stool, stepladder or ladder to reach an elevated part of equipment when it is in operation.

#### SAFETY DEVICES

It is strictly forbidden to remove or disable protective guards or other safety devices, except where necessary for adjustment or maintenance purposes. Such activities must be performed on a locked equipment and by authorized personnel who will ensure that alternative safety measures are taken and all safety devices are replaced and are functional immediately after these procedures are completed.

Never use equipment if a protective guard, an emergency-stop control or any other safety device is missing. Any operator who notices such a situation must advise his supervisor, who will make sure the machine remains inoperative until the problem is corrected (see Lockout procedure).

Furthermore, if equipment comes with an interlock key, never take the key from a safety door lock to start the machine. Always use the same interlock key to execute the following

sequence of operations: unlock a safety door, lock it again and restart the equipment. Using a duplicate key would bypass this safety system.

Should a secondary safety key released by the access system be included, it must be carried by the person as long as he/she is inside equipment.

In order to keep all door safety mechanisms in good working order, avoid banging the safety doors. To prevent damage, handle all safety mechanisms with care.

Only use an emergency-stop control to stop equipment if there is a risk of worker injury or if equipment must be stopped immediately.

At the beginning of every shift, the emergency-stop circuit and all safety devices must be checked to make sure they are working properly. Refer to the Operation chapter for instructions on testing the emergency-stop circuit. Refer to the electrical diagrams to identify the safety devices.

#### VISUAL INSPECTION OF EQUIPMENT

The operator must always inspect equipment before startup to ensure it is in good working order. If capable, the operator must correct any breakage, blockage, leak or abnormal condition. Otherwise, he must advise his supervisor so the issue can be solved before starting up.

Equipment that is in operation must be stopped immediately if a breakage, blockage, leakage or abnormal condition is noticed. The operator must correct the problem if possible. If he cannot, he must advise his supervisor.

#### RISK OF A SHIFTING OR FALLING LOAD

Moving heavy loads can be necessary during operation of equipment, such as loading a new film roll. See the risks and safety measures at Section 1.1.

#### LOCKOUT PROCEDURE

The lockout procedure is used to prevent accidental injury or death when equipment is inadvertently started up while workers are adjusting, maintaining it or performing any other intervention involving the slightest risk. The lockout procedure also prevents the startup of defective equipment or equipment in need of repair.

**DANGER**

**Always perform the lockout procedure before making any equipment or part maintenance, repair, modification, replacement, assembly or disassembly; or taking any action involving even the slightest risk. The procedure must be performed by each person making any of the above-mentioned action.**

### Access devices versus lockout procedure

Below is a summarized flowchart to indicate when to use an access device and when to lockout equipment.

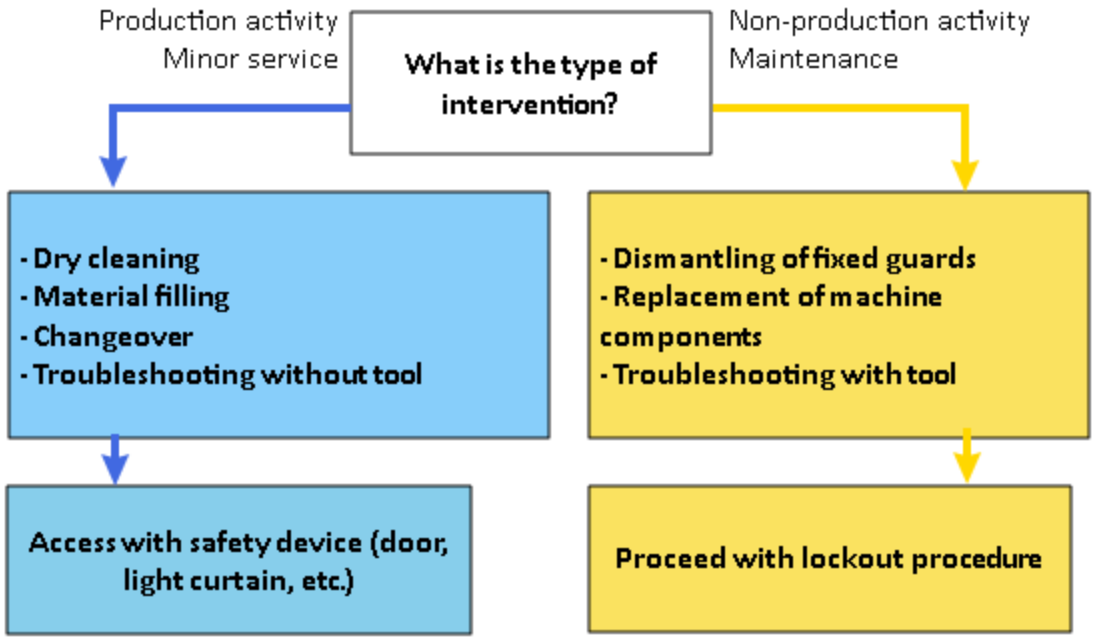



**Figure 1-2 Access devices versus lockout procedure**

### To lockout equipment

1. Advise the equipment operator(s) that a lockout is going to be performed.
2. Identify the machine power source(s):
    - Electrical
    - Compressed air (including tank)
    - Combustion engine
    - Hydraulic (including accumulator)

- Gravity (including pendulum)
- Springs

3. Shut off all possible sources of electrical power to the equipment: either turn off and lock out all disconnect switches, or disconnect equipment from the wall outlet and secure the power plug with an electrical plug lockout. Tag all locks according to your company's safety rules.
4. Keep the key(s) with you throughout the entire work process. Never entrust the keys to anyone else or leave them anywhere.
5. Shut off and lock out any pneumatic supply lines.
6. Release any residual energy in the equipment where applicable (compressed air, springs, hydraulic energy, gravity, etc.).
7. To make sure the equipment lockout is effective, attempt to start the machine. No machine movement should occur.

**To unlock equipment**

1. Advise the equipment operator(s) that power is about to be restored.
2. Make sure the equipment is back to its normal operating condition, with all protective guards and safety devices in place.
3. Perform a visual inspection to ensure that no one can be injured when power is restored.
4. Remove your lock and tag.
5. Put power back ON.

**WARNING**

**Always stand on the side of the panel when turning the main disconnect switch or pushing the main disconnect handle to ON.**

#### EQUIPMENT SHUTDOWN

For an extended stop period, Premier Tech recommends turning the main disconnect switch to off in order to prevent equipment damages.

#### ELECTRICAL COMPONENTS

**DANGER**

**Every housing containing electrical components must remain closed. If a temporary access to the housing is required, equipment must first be locked out.**

Only qualified personnel, i.e. certified electricians, should be authorized to access the equipment.

#### CONFINED SPACES

Access to confined spaces for maintenance, troubleshooting or any other purpose must be done exclusively by authorized qualified personnel. Any access in such confined spaces must be preceded by the lockout procedure and must be compliant with all applicable local, provincial and national rules.

## 1.5 Fire and Explosion Prevention

Flammable, explosive or combustible products represent a risk of fire or explosion. The following safety measures must be taken when Premier Tech equipment may be in contact with products that are flammable, explosive or which generate combustible dust (for example highly powdery products such as flour, sugar, etc.).

Note that equipment user is responsible for identifying any explosion hazards associated with its products and equipment, classifying hazardous locations and providing Premier Tech with all required technical data prior to ordering. At all times, the user is solely responsible for controlling explosion hazards and ignition sources related to its process, equipment and facilities. Where the U.S. Electrical Code applies, the user agrees that it is acting as the “Authority Having Jurisdiction”.

**DANGER**
**Combustible dust accumulation can create a fire or an explosion. Clean daily.**

#### INSPECTION

- Make sure that all pieces of equipment upstream from Premier Tech equipment cannot generate a source of ignition (spark, heat, electrical arc, fireball, etc.).
- Keep open flames or heat source away of Premier Tech equipment.
- Permit and training are required for hot work and electric work near Premier Tech equipment. Clean equipment before work.
- Make sure that all components which can generate an ignition source (bearings, electrical components, chains, valves, actuators, feeding screw, etc.) are in good working order and properly adjusted before starting equipment.
- Make sure all seals are working properly.

- Regularly inspect grounding/bonding with ohmmeter. Reading should be less than 10 ohms. Resistivity greater than 100 ohms greatly increases the risk of discharge.
- Check that all bonding of the mechanical structure are installed and functional before operating equipment.
- Make sure the bonded equipment is properly grounded. Equipment's ground must be connected to the ground of the customer's building. The ground of the electrical cabinet must be connected to the customer's electrical system. Regularly validate the presence and condition of ground wires.
- Shut off power to any damaged electrical circuit in which bare conductor wires are exposed. Repair the damage promptly to prevent sparks or fire.
- Never operate equipment if cables are damaged.
- Corded portable power tools must have a ground wire connected and must be in good working order at all times.

**OPERATIONS**

- Smoking is strictly prohibited around and near Premier Tech equipment.
- A working extinguisher of the appropriate class must always be within reach of the operator. It is highly advisable that you consult your local Fire Department to determine which norms apply to your equipment.
- Make sure all electrical cabinets and boxes are closed during operation of equipment.
- Avoid hot work in the presence of products that are flammable and/or explosive and/or which generates combustible dust.
- Never bring a heat source within 12 yards (11 meters) of the equipment, or near any products that are flammable and/or explosive and/or which generates combustible dust.
- Use antistatic bags to avoid sparks due to static electricity.
- If a dust collection unit is supplied with the equipment, ensure that it is functional at all times and that the flow/pressure requirements are met. Never operate the equipment if dust cannot be collected by the dust collecting system.

**MAINTENANCE**

- Clean any accumulation of product on equipment and its environment (including electrical cabinets and boxes), as well as surrounding equipment, daily.
- If a dust accumulation of more than 3 mm (1/8 in) is predictable during the operating period, a daily cleaning is insufficient. Stop equipment and clean before restarting.

- Any damaged or malfunctioning part must be replaced with a component having the same specifications and certifications as the original one.
- On a weekly basis, check the good working of mechanical components that can cause sparks and overheat due to mechanical friction (butterfly valves, cylinders, bearings, etc.).

## 1.6 Environmental Protection

Protecting the environment from a sustainable development perspective is important to Premier Tech.

#### ENERGY EFFICIENCY

Maintenance of the equipment has a direct impact on its energy consumption. Equipment that is not in good condition, not properly maintained, or has defective parts will experience an increase in energy consumption. It is therefore important to follow the recommendations listed in the Maintenance section of this manual and to replace any worn or broken parts as soon as possible.

#### HAZARDOUS MATERIALS

Some equipment requires the use of materials that are potentially hazardous to the environment (engine oil, hydraulic oil, oil filter, etc.). When these materials need to be replaced, be sure to follow the manufacturer's recommendations as well as applicable local regulations for proper disposal.

#### END OF EQUIPMENT LIFE

When dismantling equipment at the end of its life, be sure to follow all safety instructions described in this chapter. Remember to recycle all materials that are recyclable. Finally, dispose of hazardous materials (oils) according to the manufacturer's instructions and local regulations.

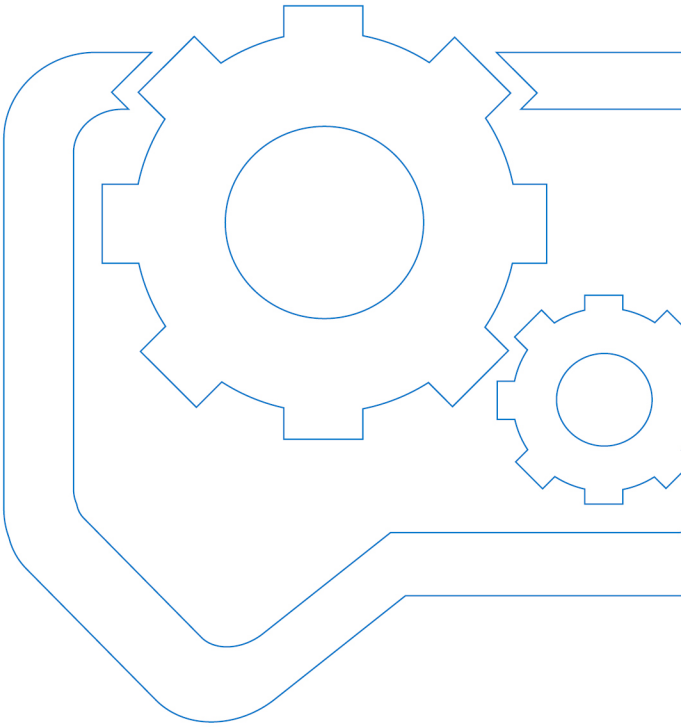
## 1.7 Safety Signs

This section explains the meaning of the various safety signs affixed to Premier Tech equipment.

| | | | |
|---|---|---|---|
|  | MANDATORY ACTION<br>Read and understand the Operating and Maintenance Manual before using this equipment. |  <br>  | MANDATORY ACTION<br>Lockout point. Shut off and lock out this power source during the lockout procedure. |
|  | MANDATORY ACTION<br>Wear Safety Harness. |  | MANDATORY ACTION<br>Wear face protection, ear protection, safety overalls and safety helmet. |
|  | MANDATORY ACTION<br>Grounding or bounding point.<br>Link this point to the ground. |  | LIFT POINT<br>Use this point to attach lifting equipment. |
|  | DO NOT ENTER<br>Authorized personnel only. |  | STAY CLEAR<br>Access limited to authorized personnel only. |
|  | KEEP OUT<br>Danger zone. |  | DO NOT STEP<br>No stepping or standing on surface. |
|  | DO NOT REACH INTO<br>Danger zone inside. |  | Only operate when all protective guards are in place. |
|  | BE ALERT<br>Emergency-stop button nearby |  | Never place hands, arms or other body parts near the zone identified by the black and yellow strips. |

| | | | |
|---|---|---|---|
|  | Equipment starts automatically. |  | DO NOT TOUCH<br>Arc flash and electrical shock hazard. Appropriate personal protective equipment required. |
|  | KEEP CLEAR<br>Moving parts can crush. |  | KEEP CLEAR<br>Moving parts can crush. |
|  | KEEP CLEAR<br>Moving parts can crush. |  | KEEP CLEAR<br>Moving parts can crush. |
|  | KEEP CLEAR<br>Moving parts can crush and cut. |  | KEEP CLEAR<br>Moving parts can crush and cut. |
|  | KEEP CLEAR<br>Moving parts can crush and cut. |  | PINCH POINT HAZARD<br>Keep clear of chain drive. |
|  | PINCH POINT HAZARD<br>Keep clear of belt drive. |  | PINCH POINT HAZARD<br>Keep clear of belt drive. |
|  | PINCH POINT HAZARD<br>Keep clear of rollers. |  | PINCH POINT HAZARD<br>Keep clear of rollers. |
|  | PINCH POINT HAZARD<br>Moving parts can crush or cut. |  | PINCH POINT HAZARD<br>Moving parts can crush or cut. |

| | |
|---|---|
|  PINCH POINT HAZARD<br>Moving parts can crush or cut. |  PINCH POINT HAZARD<br>Auger can crush or cut. |
|  BURN HAZARD<br>Hot surface. Do not touch. |  FALL HAZARD<br>Stay clear of auger area. |
|  FALL HAZARD<br>Do not walk on a conveyor in operation. |  ENTANGLEMENT HAZARD<br>Stand clear of transfer area. |
|  RISK OF FALLING OBJECTS<br>Do not walk or stand near an area where there is a risk of falling units (bags, boxes, etc.) or product. |  LOW CLEARANCE<br>Wear a safety helmet in this area. |
|  RISK OF FLYING DEBRIS<br>Wear safety glasses. |  LASER RADIATION<br>Avoid eye exposure to beam. |
|  Pressurized bottle. | |



# 2 Installation

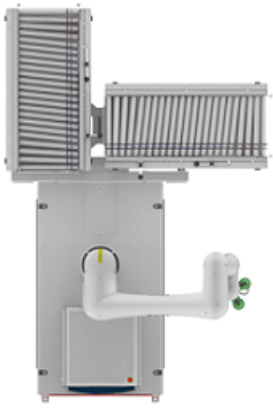
This chapter provides information regarding uncrating, installation and startup of the TOMA PAL-0830-N palletizer. Follow these instructions to prevent any damage during installation, to ensure good operation and to improve lifetime of equipment.

Detailed step-by-step training with videos and requirements is also available on our website: https://www.tomarobots.com/client-services/training.

## 2.1 Possible Configurations

There are several possible TOMA palletizer configurations. Make sure to know the proper configuration of your system before reading the following instructions.

| **A** - No conveyor<br>Palletizer only | **B1** - One conveyor<br>Inline with palletizer |
|---|---|
|  |  |
| **B2** - One conveyor<br>Perpendicular to palletizer (left) | **B3** - One conveyor<br>Perpendicular to palletizer (right) |
|  |  |

| **C1** - Two conveyors<br>Two inline with palletizer | **C2** - Two conveyors<br>Two perpendicular with palletizer |
|---|---|
|  |  |
| **C3** - Two conveyors<br>One inline (right) + one perpendicular (left) | **C4** - Two conveyors<br>One inline (left) + one perpendicular (right) |
|  |  |

## 2.2 Uncrating

Equipment is shipped and delivered in wooden crates. The palletizer crate has an approximate weight of 924 kg (2035 lb). Each optional conveyor has its own separate crate weighing approximately 264 kg (580 lb).

Before starting uncrating, make sure the area is clear from any obstacle, that there is enough space to move with lifting equipment and that all personnel working around has been warned about equipment unloading and installation.

### 2.2.1 Palletizer Unit

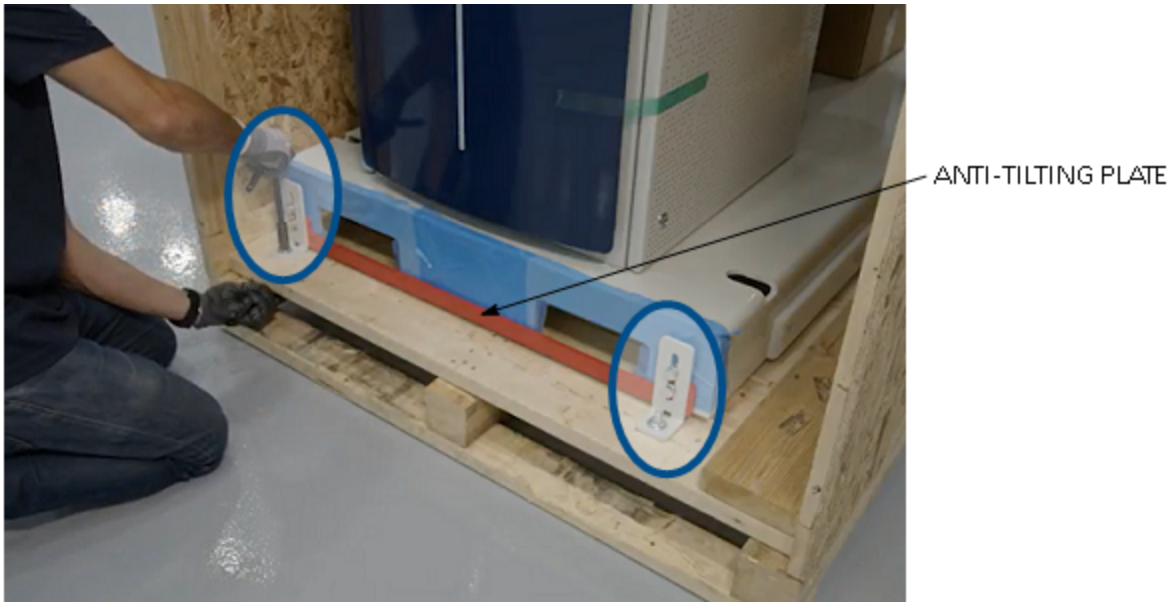
This procedure requires at least 2 persons.

1. Locate the front and rear panels of the wooden crate. The front panel is identified with a ''Front'' mention.


2. Hold and unscrew both panels, then move them away.

3. Unbolt the pallet stopper located on the side of the unit, then remove the stopper from the crate.

4. Unbolt the palletizer base from the shipping support (1 lag screw at each corner).




5. Using a forklift, gently lift and move the unit from the crate. Make sure the red anti-tilting plate is in place on the front of the base.


6. Carefully move the module close to the desired operating position. Make sure there is no hanging cable or anything that could get caught during transport.
7. Lower the fork and gently lay the module to the ground.
8. Remove the red anti-tilting plate from the palletizer base by unbolting it.

We recommend storing the anti-tilting plate under the base for future use if palletizer needs to be moved using a fork lift. The plate is not required if unit is moved using a manual pallet truck.

9. Remove the protective tape, then screw the brackets back on the base if desired (not mandatory, for anchoring purpose only).

### 2.2.2 Conveyor(s) (if present)

**Make sure to lay down the conveyor on a flat surface (not inclined) as it is mounted on free caster wheels.**

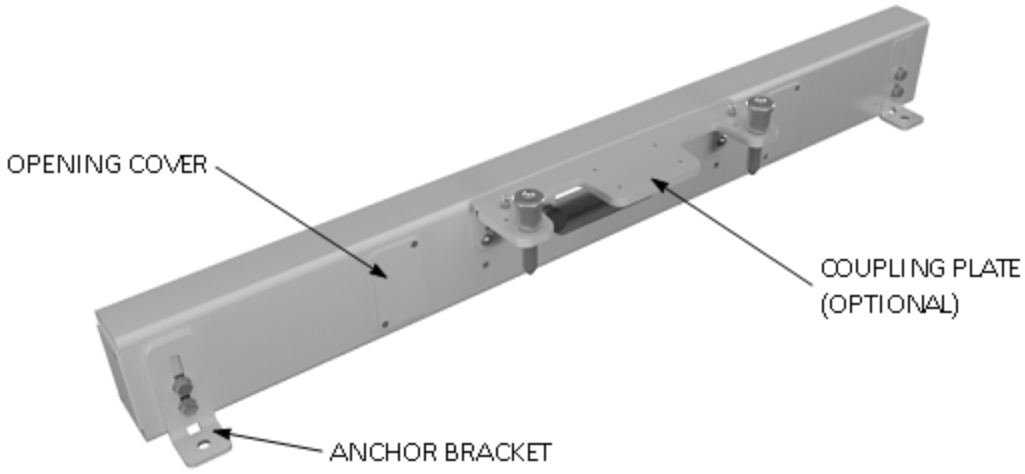
1. Locate the front panel of the wooden crate (longest panel, on either side).


2. Hold and unscrew the panel, then move it away.
3. Cut and remove the two straps around the conveyor.


4. Using a forklift, gently lift and move the conveyor from the crate.


5. Gently lay the module to the ground. The conveyor can now easily be rolled to the desired position.

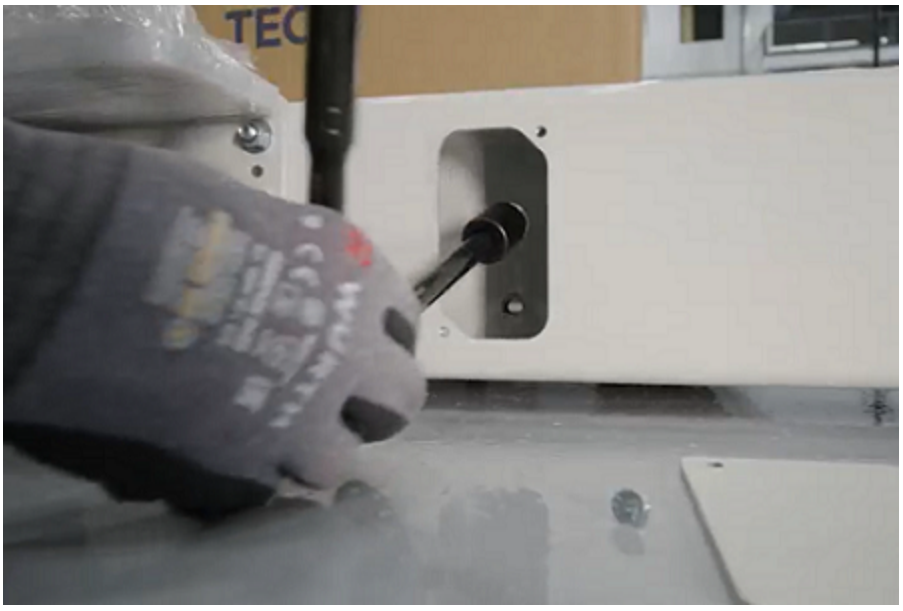
## 2.3 Pallet Stopper Installation




1. Remove the two temporary shipping brackets at the rear of the base and keep the bolt set for later.


2. Place the pallet stopper bar at the end of the palletizer base.
3. Remove both cover plates from the pallet stopper to access the holes.


4. Bolt the stopper in place using the previously removed bolts from the shipping brackets.



5. If applicable, unwrap the locking pins of the coupling assembly and put them in their hole.

## 2.4 Conveyor(s) Installation and Positioning (if present)


This procedure requires two persons. For two infeed conveyor configuration, it must be performed for each conveyor. If the system does not include any Premier Tech conveyor, proceed to next section.

1. Using the caster wheels, move the conveyor to the desired position, aligned with existing infeed system.
2. Remove all accessories (connecting plates), shipping supports (foam under movable guide) and protective tape.
3. Loosen the bolts holding the cover plates and remove the cover on both sides of the conveyor.
4. Loosen the two adjustment knobs on one end of the conveyor (ideally the end next to existing infeed system), then remove the locking pins.

5. Using the lifting handles on the structure, lift the conveyor to the desired height. Note that this step is a rough height adjustment; a more precise adjustment will be done later using the levelling feet.

6. Tighten back the adjustment knobs and insert the pins to block the height adjustment. Knobs can be loosened/tightened again to make sure the frame is properly supported by the locking pins.
7. Repeat for the other end (other two pins).

8. Once finished, put the cover plates back in place and slightly tighten the bolts to secure the plates.

## 2.5 Palletizer Installation and Positioning

**CAUTION**
**Before moving the palletizer unit, make sure to lift the unit enough to clear the support legs to prevent damaging them during transport.**

### 2.5.1 Palletizer Only Configuration

Procedure for a system configuration with a palletizer only (no TOMA™ conveyor).

1. Using lifting equipment, bring the palletizer close to the desired position (near infeed system).
2. Make sure that any part of the existing infeed system does not enter the palletizer operating zone. Otherwise, this could create an interference with the robotic arm.

### 2.5.2 One Conveyor Configuration

Procedure for a configuration with a palletizer and one TOMA conveyor (configurations B1-B2-B3).

Figures illustrate inline configuration (B1) but this procedure also applies to perpendicular configurations (B2 and B3).

1. Remove both locking pins from the palletizer's coupling plate.
2. Using a lifting equipment, bring the palletizer close to the conveyor.

3. Slowly move the palletizer towards the conveyor so that both modules' holes are aligned. If needed, slightly move the conveyor to fine tune alignment with the palletizer base.
4. Insert the locking pins in their hole to couple the modules.

5. The conveyor/palletizer assembly can then be slightly moved if needed to fine tune the positioning.

6. Once modules are properly aligned, completely lower the palletizer unit to the ground and remove the pallet jack or forklift.

### 2.5.3 Two Conveyor Configuration

Procedure for a configuration with a palletizer and two TOMA conveyors (configurations C1-C2-C3-C4).

Conveyor #02 automatically comes with a junction plate (X shape plate with a handle) that is used to connect it with conveyor #01. This plate fits all possible conveyor configurations.


The following figures illustrate the inline configuration (C1) but this procedure also applies to perpendicular or mixed configurations (C2, C3 and C4).

1. Take the junction plate located on the base of conveyor #02 and insert it in the provided holes on both conveyors to fix them together.


2. Remove the locking pins from the palletizer's coupling plate.
3. Using lifting equipment, bring the palletizer close to the conveyors' end.

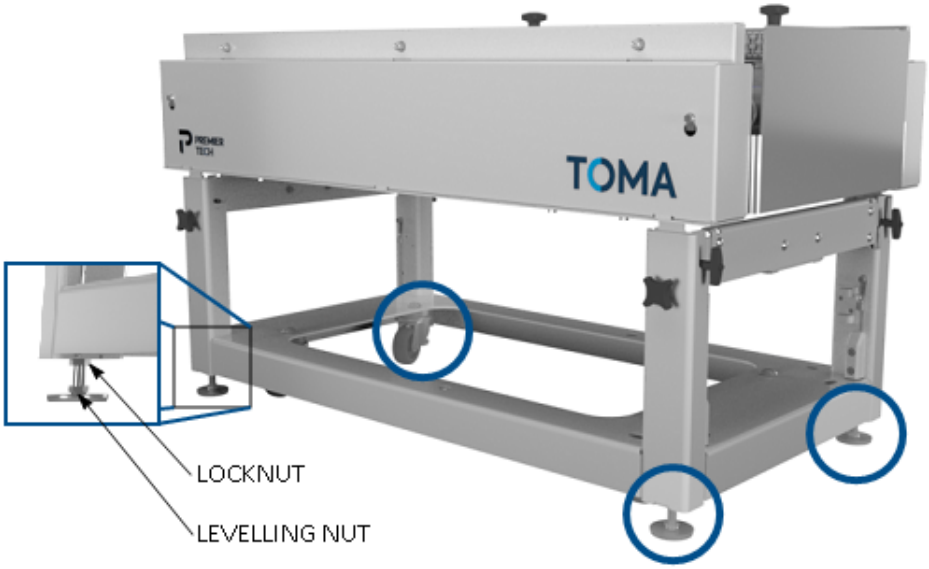

4. Slowly move the palletizer towards the conveyors so that both modules' holes are aligned. If needed, slightly move the conveyors to fine tune alignment with the palletizer base.
5. Insert the locking pins in their hole to attach all three modules.


6. The conveyors/palletizer assembly can then by slightly moved if needed to fine tune the positioning.
7. Once modules are properly aligned, completely lower the palletizer unit to the ground and remove the pallet jack or forklift.

## 2.6 Levelling

### 2.6.1 Conveyor(s) (if present)

Lower the conveyor's four adjustable feet so that it does not rest on its casters anymore.




1. Unscrew a first levelling foot until it rests on the floor. Use a wrench to unscrew a few last turns to properly stabilize the foot. Then proceed with the other foot of the same end.

2. Place a level on top of the conveyor, at the junction with existing infeed system, and adjust levelling feet until the conveyor is levelled with infeed system.

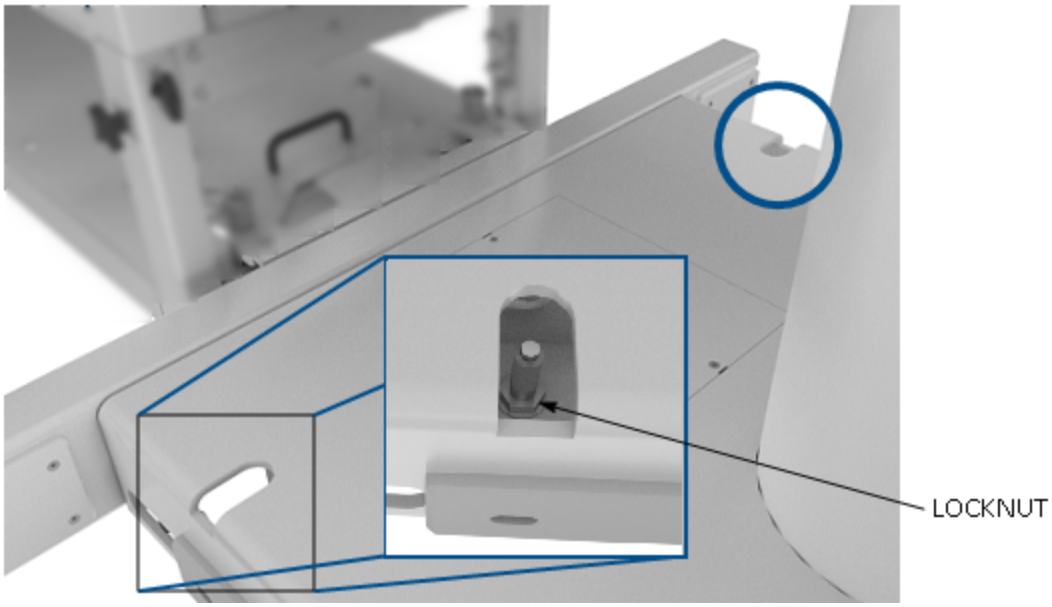

3. Repeat steps with the other two levelling feet.
4. Check the level of the module by placing a level on the structure base.


5. Once the conveyor is properly rested on its levelling feet and leveled, tighten all four locknuts.

6. If desired, the conveyor can be attached to the existing infeed conveyor using the provided small connection plates.

### 2.6.2 Palletizer Unit

**It is not recommended to use levelling feet to raise the robot base to prevent premature wear of the feet thread. To raise the platform, use lifting equipment then lower the adjutable feet until they are in contact with the ground.**




1. Place a level on each side of the palletizer base to check the level.
2. Select a first support feet to be adjusted.
3. Loosen the locknut using a ratchet wrench with 24 mm long socket.

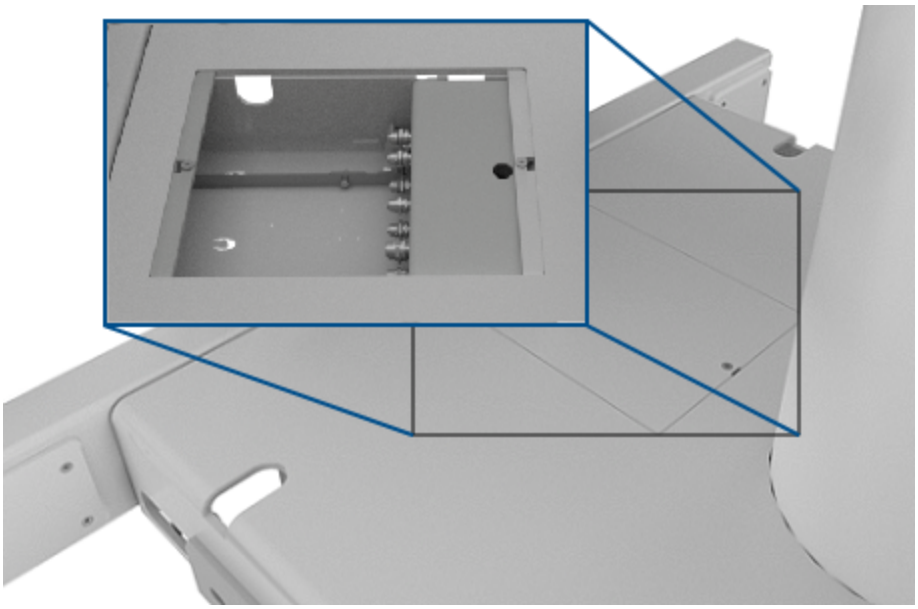
4. Adjust the height of the robot base using the wrench.

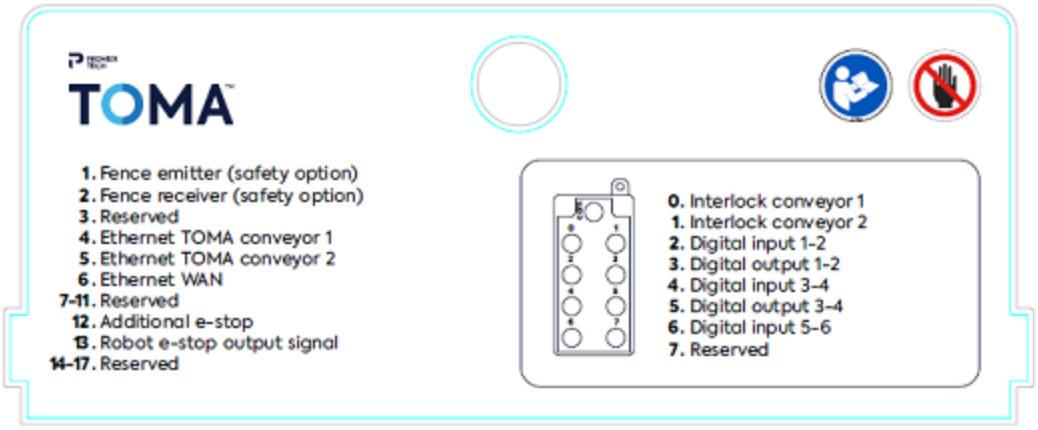
> It is recommended to leave a space of at least 12 mm (1/2 in) between the base and the floor.

5. Once the base is adjusted and leveled, tighten the locknuts.

## 2.7 Equipment Connection

### 2.7.1 Connection Panel



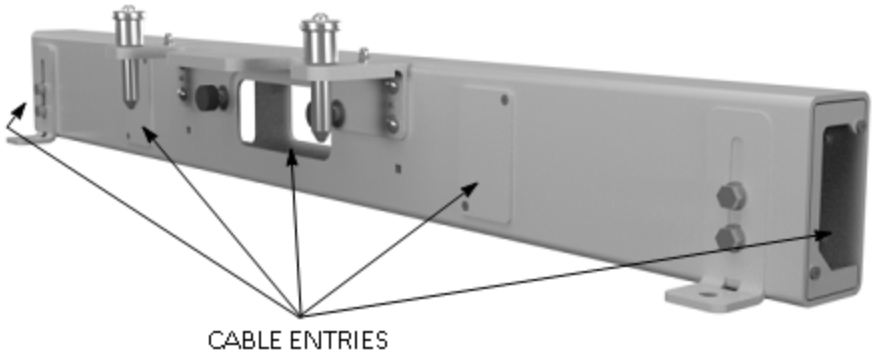



For the detailed mapping of the IO Link module, refer to Installation document in *Appendices* section of the manual.

1. Using an hexagonal wrench (Allen key) and a screw driver, remove the connection panel plate located at the rear of the palletizer base.


### 2.7.2 Pallet Stopper Cable Entry

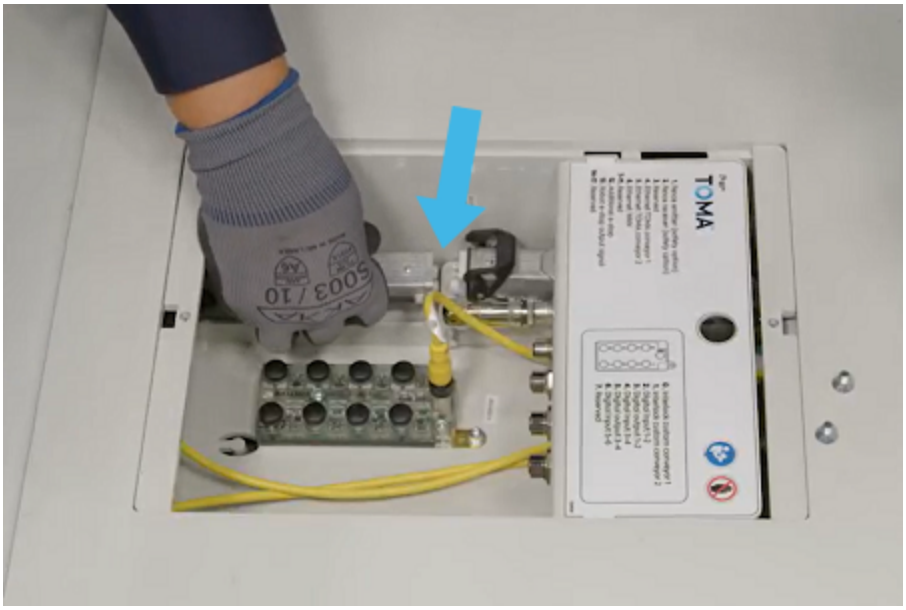
The pallet stopper has several openings which can be used to pass cables and air line hoses to the connection panel: one at each extremity and three on the front side. Use the most convenient openings according to the system's configuration. When all connections are made and the system is ready to operate, close any opening that is not used.




### 2.7.3 Power Supply Connection

1. Cut the cable tie of the palletizer's power cord and unroll the cable.
2. Pass the cable through one of the pallet stopper openings.

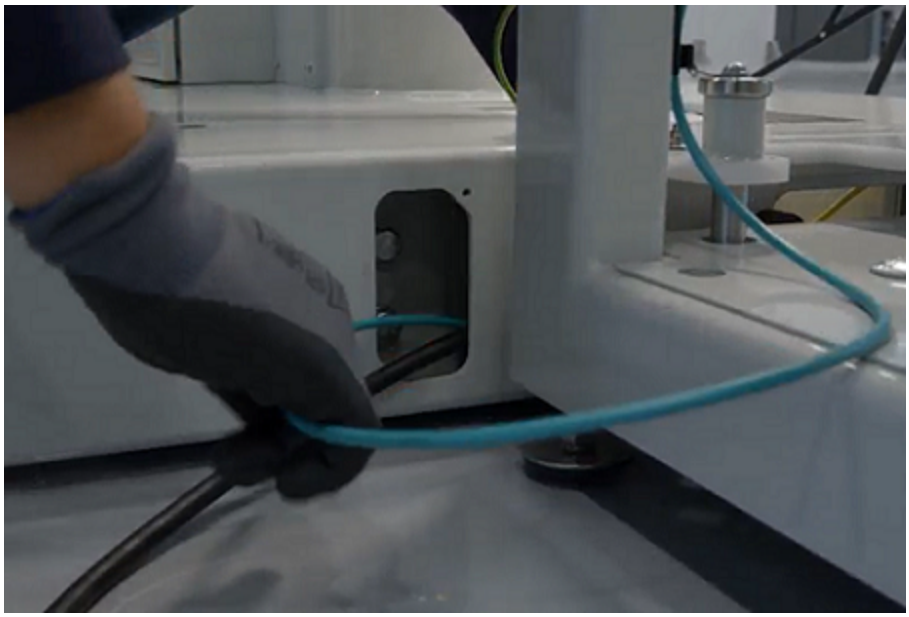
3. Pull the cable inside the connection panel and connect it to the power supply connector. Lower the black locking latch to secure the connection.




**WARNING**
**Do not unplug the electrical power connector when equipment is powered. Unplug equipment power cord from the wall outlet first.**

### 2.7.4 Ethernet Connection

1. Cut the cable tie securing the blue Ethernet cable of the conveyor (if present).
2. Pass the cable(s) through one of the pallet stopper openings.



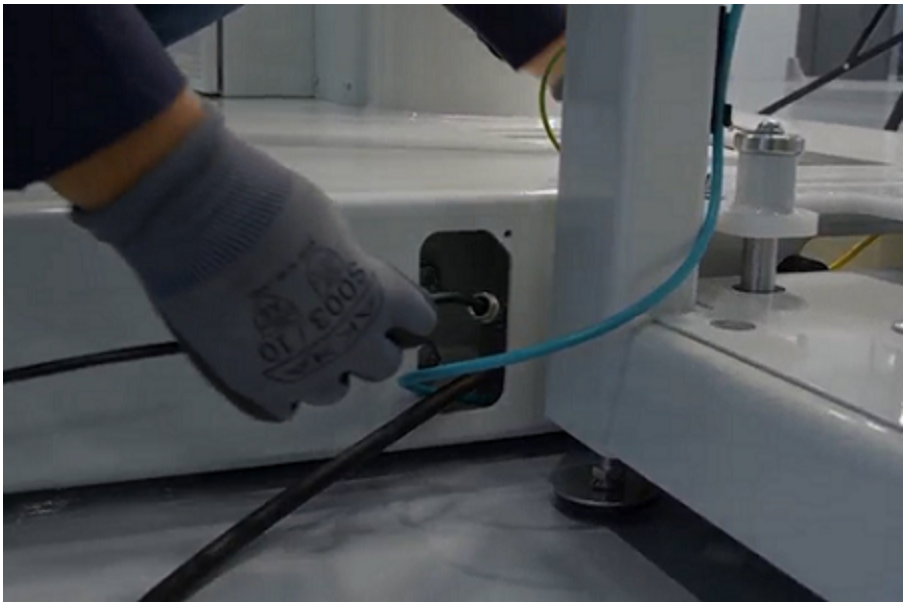
3. The cable can be attached to the black clips located on the conveyor leg.

4. Pull the cable(s) inside the connection panel and connect it(them) to the appropriate Ethernet connector (connector #4 for conveyor #01 and connector #5 for conveyor #02).


### 2.7.5 Network Connection

Follow this procedure if communication is done through Ethernet. If communication is done through the optional wifi antenna, ignore this procedure.

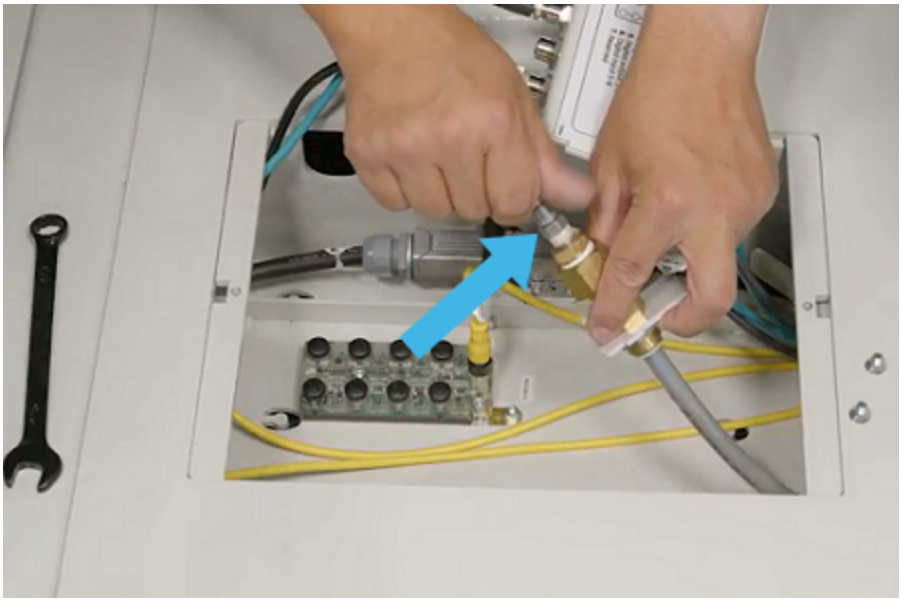
1. Install the provided connector (M12 type) on the plant's network cable.
2. Bring the plant network cable to the palletizer.
3. Pass the cable through one of the pallet stopper openings.



4. Pull the cable inside the connection panel and connect it to the appropriate connector.

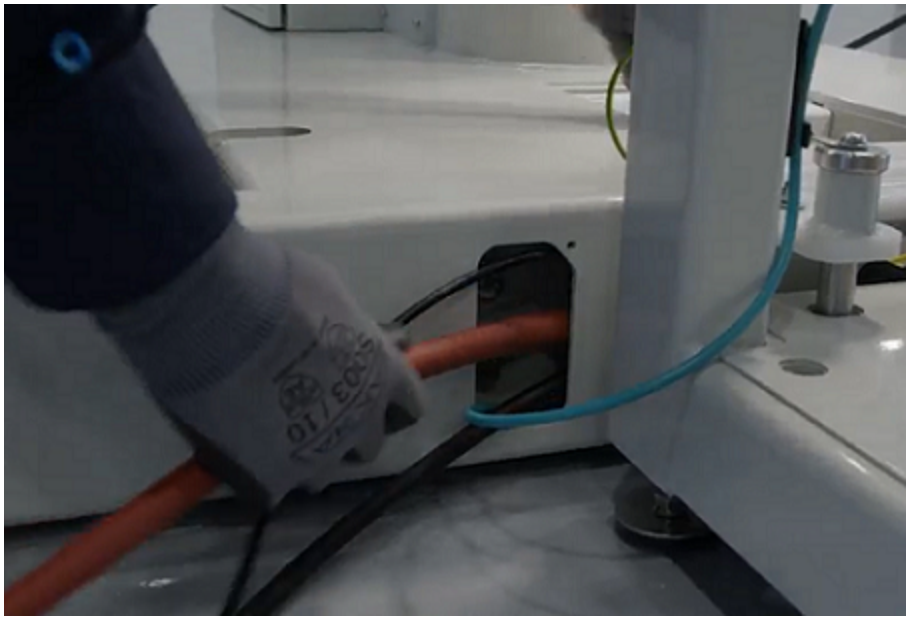

### 2.7.6 Air Supply Connection

1. Remove the connectors plate (with the label on it) from the panel, and pull the air supply connector.
2. Install a quick connect terminal on the air supply connector (male part must be provided by customer). Make sure the terminal is properly tightened.

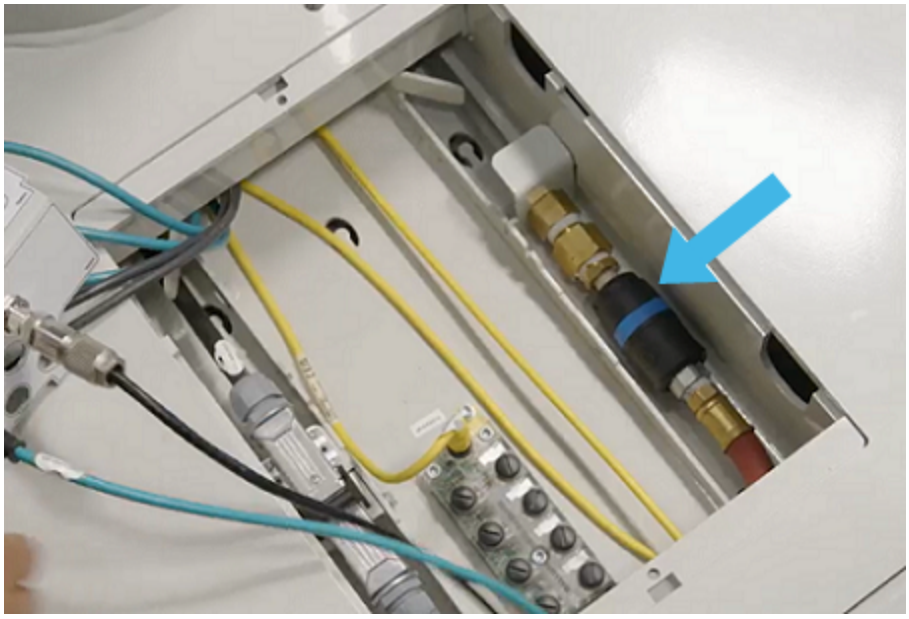


Two sizes of fittings are provided: 1/2 NPT female and 1/4 NPT female.

3. Pass the facility air supply hose through one of the openings of the pallet stopper, then pull the connector inside the connection panel.



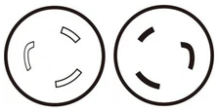
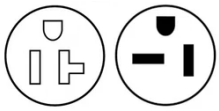
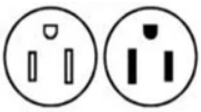
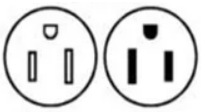
4. Connect the hose to the palletizer's air supply connector.



5. Operating pressure range is 60-90 PSI (4,1- 6,2 bar) and the optimal operating pressure is 80 PSI (5,5 bar).
6. Once the air supply is properly connected, put the connector bracket back in its slot and place the connectors plate back over it.

### 2.7.7 Electrical Power Connection

Each TOMA equipment is provided with an electrical plug which meets local regulation. Make sure your plant is equipped with the appropriate wall receptacle.

| Module | Plug type - Ontario | Plug type - Canada, USA & other |
|---|---|---|
| Palletizer | L5-20R / L5-20P  | 5-20R / 5-20P  |
| Conveyor (optional) | 5-15R / 5-15P  | 5-15R / 5-15P  |

1. Take an electrical cable extension with the appropriate type of socket (see above table) and connect it to the palletizer's power cord.
2. If your system includes a conveyor, connect it to another cable extension.

3. If your system includes a second conveyor, connect it to conveyor #01.

   a. Unroll a part of the cable located underneath conveyor #02.


   b. Using the black clips, run the cable along the legs of both conveyors.

   c. Connect the cable to the power supply of conveyor #01 and secure to frame using a tie wrap.

## 2.8 Powering Up Equipment

1. Open the front panel of the palletizer unit and turn the power switch to ON.

2. The light under the e-stop button should light up, all three status lights (on front and sides of cabinet) should light up and the user interface screen should power up.
3. At the screen, a popup window appears, offering to start the tutorial. This quick step-by-step tutorial explaining how to navigate in the interface to start a production is recommended to get going with the palletizer.

## 2.9 Conveyor Guides Setup


When delivered, the conveyor movable guides are completely pushed towards the center to clear the handles and prevent damage during shipping.

1. Turn the tightening knobs to loosen the connecting rods, then completely retract the adjustable guides.
2. Place a sample unit on the conveyor and have it rest on the stop plate and fixed guides.

3. Using the handle, move the guide so it nearly touches the unit. We recommend testing the unit's travel on the rollers, making sure it is properly guided to the stop plate without being slowed or blocked.

4. If the rod is not long enough to reach the unit, add an extension:

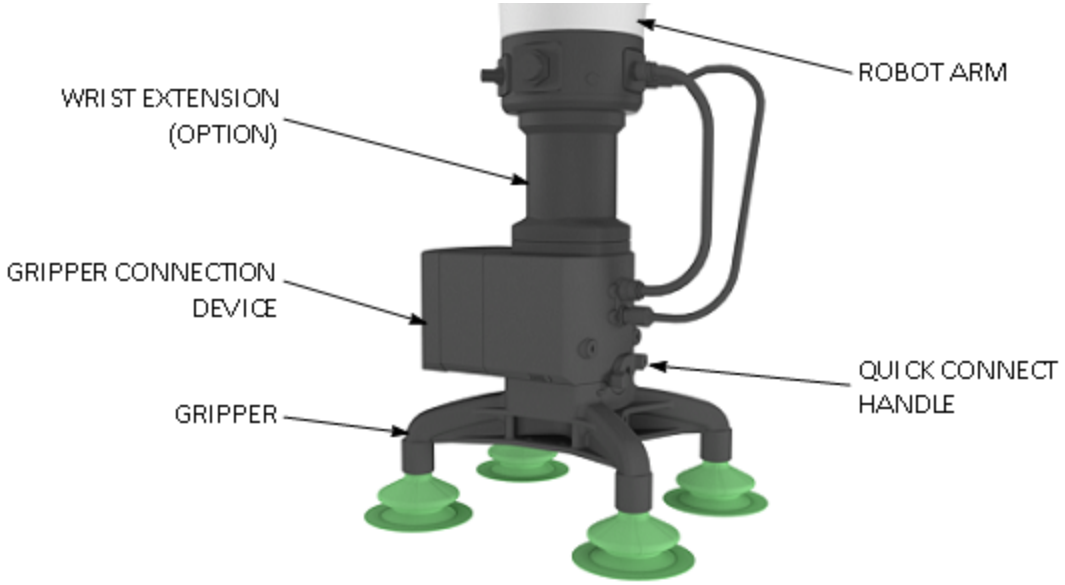
a. Reach under the conveyor top frame and pick a rod extension from the support.

b. Tighten the top knob to block the rotation of the rod, unscrew the handle from the rod and screw the extension.

c. Loosen back the knob to adjust guide position.

5. Once the desired position has been reached, tighten back the tightening knobs.

## 2.10 Gripper Installation




Actual gripper may differ from illustration. If the optional wrist extension is required by the configuration and recipe, it will already be installed on the robot arm.

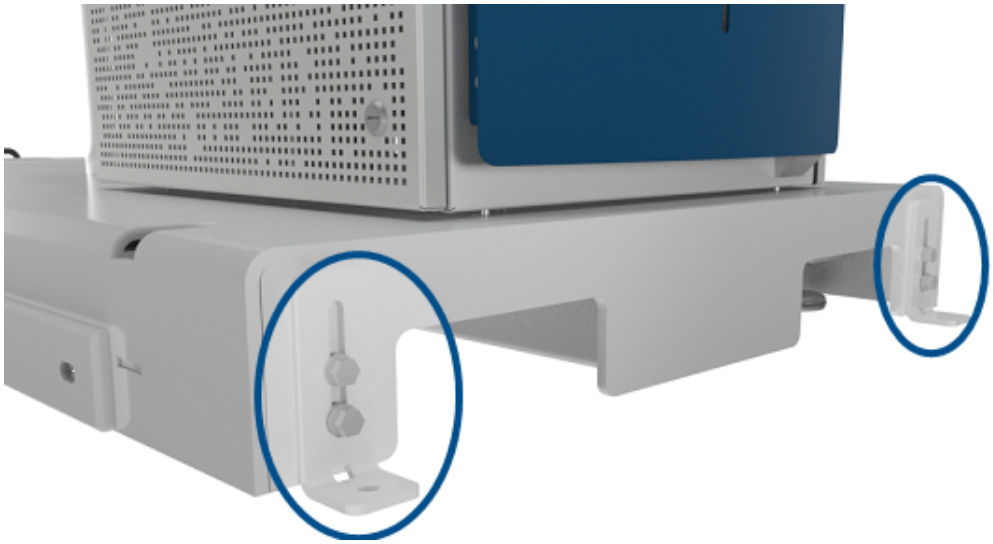
1. Make sure the connection device latch is set to ''unlock'' (arrow facing the unlocked symbol).
2. Insert the gripper in the robot arm's connecting device.

3. Turn the quick connect handle to the locked position. The arrow on the handle should line up with the lock symbol on the connection device and a ''click'' noise/physical locking should be felt when the handle is rotated to the full 190-degree locked position.

## 2.11 Anchoring (optional)

The TOMA palletizer does not require to be anchored to ensure its stability and safe operation in collaborative mode. However, anchor brackets are provided should the customer wishes to make positioning more permanent, for example to prevent accidental displacement which would cause a lost of reference from the robot.

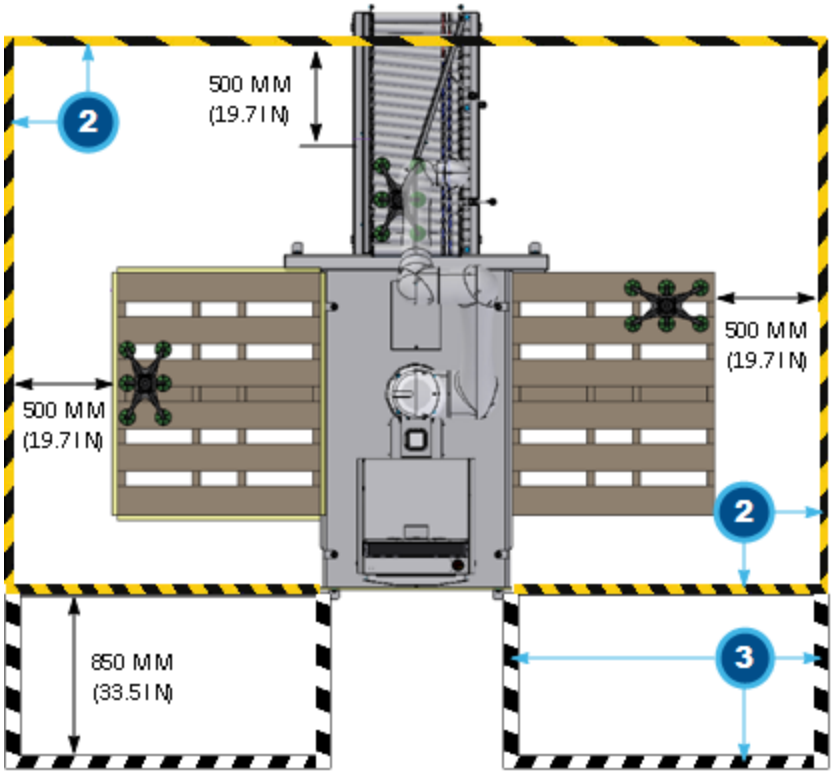
Anchor brackets are located at the front and the rear (pallet stopper) of the palletizer base.



## 2.12 Safety Zones Delimitation

Before powering up the system, it is mandatory to properly delimit the safety zones: palletizer operating space and safe collaborative workspace. For more information about the safety zones, refer to section 2 Installation.

1. Get the two rolls of tape provided with equipment. One is black and yellow, the other is black and white.
2. With the black and yellow striped tape, delimit the palletizer operating space as shown in the image below (see 2). The limit of the operating zone should be at least 500 mm (19.7 in) farther than the end of the gripper when at its maximum reach (the gripper reach usually corresponds to the edge of the pallet).
3. With the black and white striped tape, delimit both safe collaborative workspaces as shown in the image below (see 3). The width limits of the zones should align with the palletizer operating zone and the palletizer unit's side, and the depth should be of 850 mm (33.5 in) from the palletizer unit front side.




Above instructions can be adapted to customer layout if many custom modules are present.

## 2.13 Starting up Equipment

1. Open the front panel and turn the power switch to ON. Close the panel.
2. If desired, follow the tutorial by pressing **Yes** in the **Welcome** window. If not, press **Skip**.

   Refer to the Installation chapter of this manual to get more information about the different pages and features of the user interface.

3. Switch to edition mode by pressing the **Switch mode** key from the dropdown menu in the upper right of the screen. The default PIN to unlock the edition mode is 1-2-3-4. The edition mode is required to add grippers, conveyors (infeed) and pallets and to create recipes.

   The edition mode PIN can be changed in the **Preferences** section of the **Settings** page.

### 2.13.1 Selecting a Gripper

1. In the **Settings** page, **Equipment** subsection, set a gripper as active.
2. To add a custom gripper, press **Add gripper** and follow the procedure explained in section Installation in *Operation* chapter.

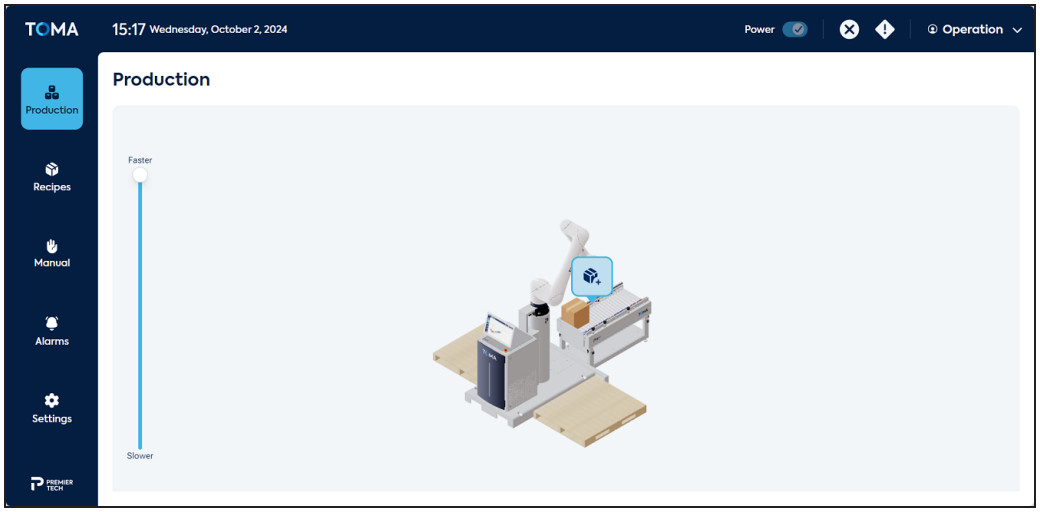
### 2.13.2 Teaching the Infeed

In order to properly pick the units with the robot, the infeed conveyor and unit position must be taught to the robot.

1. Follow the procedure explained in section Installation of the *Operation* chapter.

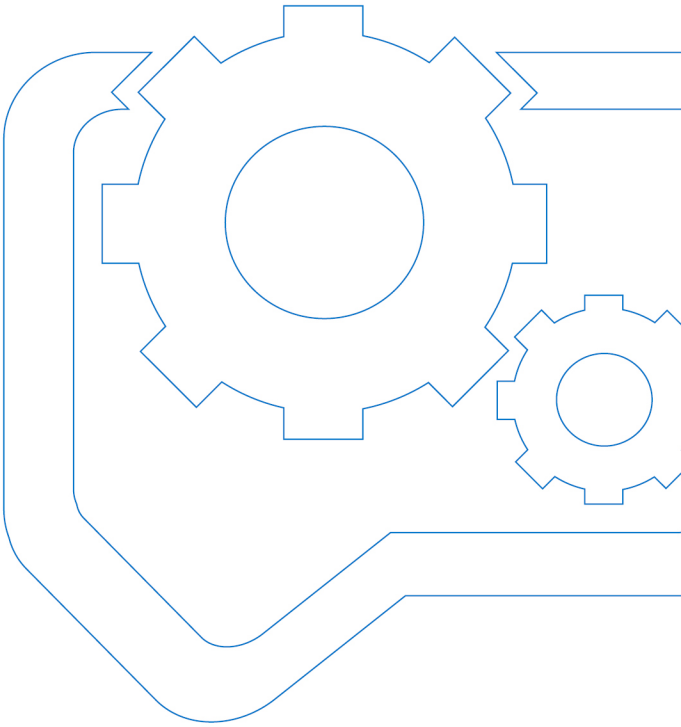
### 2.13.3 Creating/Assigning a Recipe and Starting Production

1. In the **Recipes** page, create a new recipe. Refer to section Installation of the *Operation* chapter.
2. In the **Production** page, press on an infeed icon to assign a recipe.




3. In the slide-in menu, select the desired recipe for the production and the palletizing station (s).
4. Place an empty pallet (of correct size according to selected recipe) in associated palletizing station.
5. Press **Start** to start production (or **Confirm** to save for later). The system will ask the level of completion of the pallet: left the value to 0 and press **Confirm**. The production is now starting.

6. If needed, adjust the speed of the robot to the desired level.
7. If a second infeed is available, repeat the previous steps for this other infeed.



# 3 Description

The PAL-0830-N palletizer with cobot technology is a safe and compact system designed to automatically pick and place rigid units of various sizes (boxes, cases, pails, etc.) on a pallet. Very compact and entirely mobile, the system can be easily moved to a different location using a forklift or a lift truck. It includes a 6-axis collaborative FANUC robotic arm on which can be installed any type of tooling, from a wide variety of TOMA vacuum grippers to any custom gripper.

A few options are also offered such as one or two fully integrated infeed conveyors complete with motorized driven rollers, stop gate and sensors, a wide variety of integrated vacuum grippers with quick connect tool changer, and an internet access for remote support and performance monitoring.

The system is electrically and pneumatically operated, and the user-friendly touchscreen interface powered by MOVN allows easy configuration and operation.


1. Palletizer base
2. FANUC collaborative robot
3. Gripper (optional)
4. Conveyor(s) (optional)
5. Electrical cabinet
6. User interface
7. Palletizing station A
8. Palletizing station B

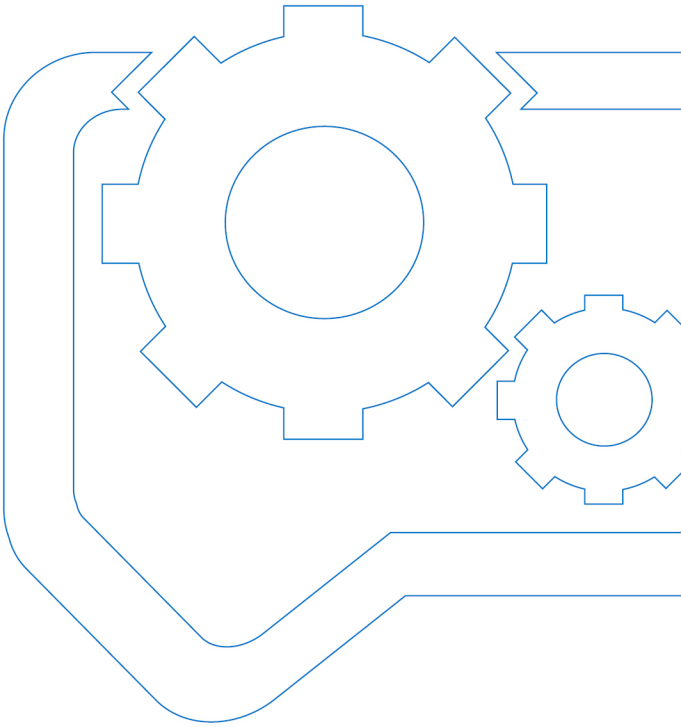
## 3.1 Operating Cycle

At the user interface, the operator selects the desired recipe from the list of configured recipes. The operator then places an empty pallet in the designated PALLETIZING STATIONS. Stoppers are provided to ease the pallet positioning. Once the system is started, units arrive on optional CONVEYOR(S) (or customer conveyor) and stop at the stop plate. The robot GRIPPER then picks the unit from the CONVEYOR and places it on the pallet according to the palletizing pattern configured in the recipe. Layers are completed one after another until the pallet load is full or until the end of production. When a pallet load is complete, the robot automatically switches to the other palletizing station and starts palletizing a new pallet (if same recipe is used for both stations). The operator can then remove the pallet load from the completed station and place a new empty pallet.

## 3.2 Technical Specifications

| | |
|---|---|
| Speed: | Up to 8 cycles/min |
| Payload: | Up to 25 kg (55 lb) |
| Pallet dimensions: | Up to 1.3m (50 in) x 1.3m (50 in) |
| Full pallet height: | Up to 2m (80 in) |
| Weight - main unit: | Approximately 722 kg (1590 lb) / 924 kg (2035 lb) with crate |
| Weight - conveyor: | Approximately 177 kg (390 lb) / 264 kg (580 lb) with crate |
| Connection: | Ethernet (standard) / Wifi (optional) |
| Operating pressure: | 80 psi @ 13 scfm / 5.5 bar @ 368 Nl/min |
| Operating temperature: | 0 °C to 35 °C / 32 °F to 95 °F |

Specifications depend on handled product, equipment configuration and selected options.



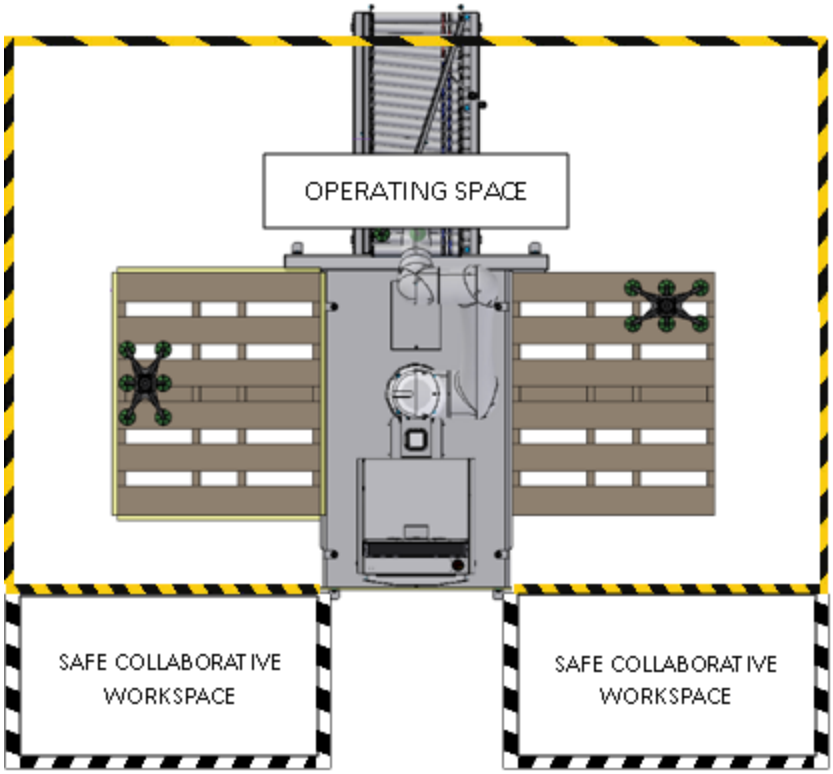
# 4 Operation

## 4.1 Safe Collaborative Workspace

The space around the equipment is divided in two different zones, which should be delimited by black and yellow/white striped tape on the floor (see 2.12 Safety Zones Delimitation).

The safe collaborative workspace is the area where a qualified operator can safely work and operate the equipment. It is mandatory that the operator remains in this workspace during operation to prevent any unintentional contact with moving parts/units. If interventions are required outside of the workspace, specific actions need to be done (see table below).

The operating space is the area where the robot moves to execute its palletizing cycle. The operator must not enter this area without performing specific safety actions first (see table below).

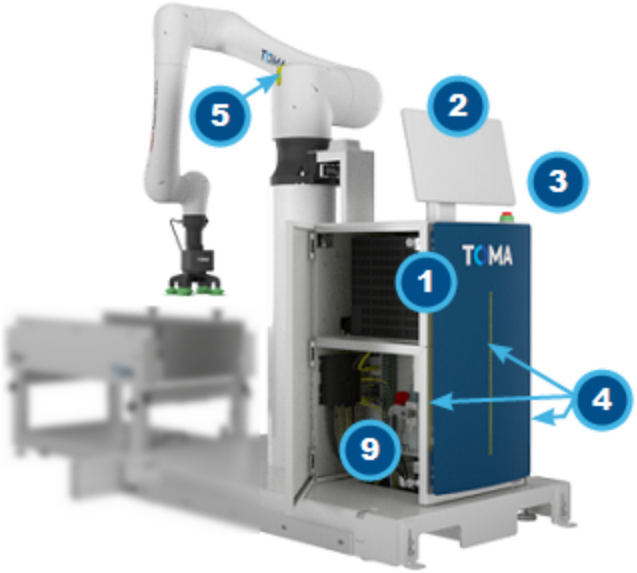



| Intervention | Example | Required action |
|---|---|---|
| Action at the user interface | Selecting recipe, starting/stopping production, checking alarm messages. | No special action required. |
| Intervention on pallet from safe collaborative workspace | Removing a full pallet load, placing a new empty pallet. | Wait for full pallet status (blue status light flashing). |

| Intervention | Example | Required action |
|---|---|---|
| Minor intervention in operating space | Repositionning a unit on pallet, picking-up a fallen unit. | Stop the system. |
| Minor intervention on conveyor | Repositionning a unit. | Stop the system. |
| Major intervention | Adjusting conveyor guides, performing maintenance tasks. | Stop the system and perform the lockout procedure. |

For more information on the collaborative mode of the robot, refer to FANUC online documentation.

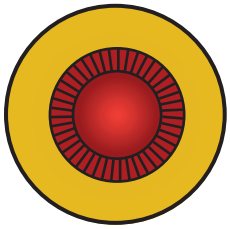
## 4.2 Operating Components and Safety Devices





1. Enclosure
2. User interface
3. Emergency-stop button
4. Status lights
5. Robot status light
6. Tablet teach pendant
7. Power switch
8. Storage for paper documents
9. Pneumatic filter regulator unit
10. Robot controller
11. Electrical panel

### 4.2.1 Emergency-Stop Buttons



The robotic palletizer is equipped with an emergency-stop button which is located on the operating console. An estop device is also available on the Tablet teach pendant (see section 4.2.6).

Pushing an emergency-stop button immediately shuts off electrical power to all actuators (including particular custom options if present). All robot movements are immediately stopped, and no operation is further possible. However, air pressure is not released and remains to prevent any picked unit from falling.

Optional conveyors, if present, will continue to operate as they do not present any risk.

Do not use a safety device for a normal stop of machinery. Use the **Stop** key at the user interface (in **Production** page), which allows the cycle in progress to be completed.

The equipment will not restart if the emergency-stop button is not reset. To reset the button, pull or turn it. To reset the equipment, activate the robot **Power** key (in screen header).

**WARNING**

**Only use an emergency-stop button to stop equipment if there is a risk of worker injury or if equipment must be stopped immediately.**

#### PROCEDURE FOR TESTING THE EMERGENCY-STOP CIRCUIT

At the beginning of every shift, all emergency stop devices must be checked to ensure the emergency-stop circuit is working properly. Perform the following procedure to test each emergency-stop button.

1. At the user interface, activate equipment by pressing the **Power** key.
2. Activate an emergency-stop button. The robot status light should turn to red. A fault notification should appear in the screen header (red dot) and the alarm corresponding to the emergency-stop device being tested should appear.
3. Make sure the equipment is completely stopped and that the robot cannot be moved by activating a manual movement.
4. Reset the emergency-stop button being tested by pulling it.

5. Press the **Acknowledge** key to close the slide-in menu of the **Alarms** screen, then press the **Power** key in the screen header to clear the alarm.
6. Repeat these steps until all devices have been tested.

### 4.2.2 Power Switch

The power switch is used to turn the equipment on or off. It is located behind the cabinet front door. Before performing any major intervention such as equipment maintenance, the power switch must be turned off and the power plug must be unplugged and locked. For more information on the lockout procedure, see Lockout procedure in the Safety chapter.

### 4.2.3 Status Lights

The robot base has three LED status lights that are located on the front and the sides of the enclosure. These lights turn on or flash to indicate the equipment status. The front light indicates the status of the equipment while the side lights give information about each PALLETIZING STATION. The following tables present the different equipment status during operation.

**CENTER LIGHT - EQUIPMENT STATUS**

| Light | | Operating Status |
|---|---|---|
| Red | Solid | Equipment is in fault. Complete and immediate stop of equipment; cycle in progress is interrupted. |
| | Flashing | N/A |
| Green | Solid | Equipment is running (normal operation). |
| | Flashing | Starting or stopping sequence in progress or robot hand guiding mode activated. |
| Blue | Solid | Equipment is idle (no production running, no fault). |
| | Flashing | N/A |

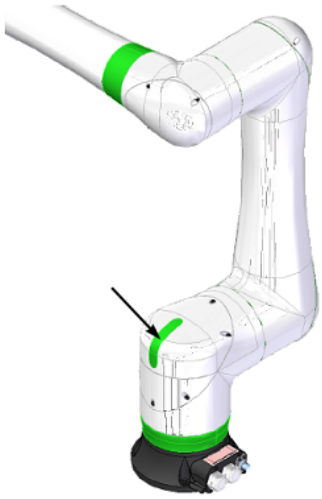
**SIDE LIGHTS - PALLETIZING STATIONS STATUS**

| Light | | Operating Status |
|---|---|---|
| Red | Solid | Equipment is in fault. Complete and immediate stop of equipment; cycle in progress is interrupted. |
| | Flashing | N/A |

| Light | | Operating Status |
|---|---|---|
| Amber | Solid | Pallet is not detected anymore at palletizing station. Either the pallet was moved before completion or sensor is malfunctioning. |
| | Flashing | Pallet replacement in progress: full pallet is being removed and replaced with a new empty pallet. |
| Green | Solid | Equipment is running (normal operation). |
| | Flashing | Robot hand guiding mode activated. |
| Blue | Solid | Equipment is idle (no production running, no active fault). |
| | Flashing | The pallet is full and needs to be removed. |

### 4.2.4 Robot Status Light

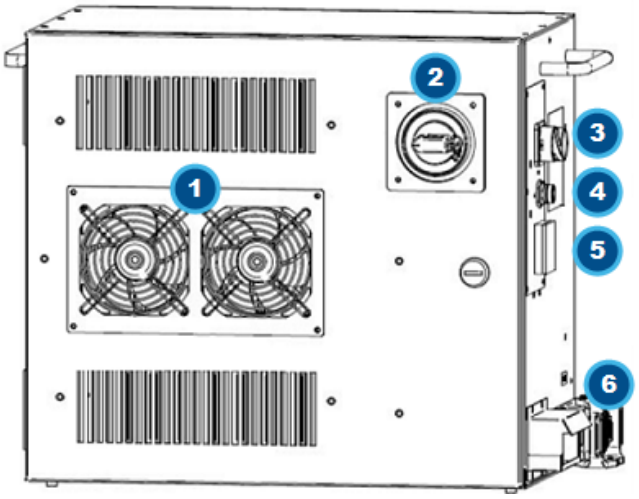
The Fanuc collaborative robot is equipped with a status LED located on its first/second axis joint. The LED color differs depending on the robot status according to the following table.

| LED color | Robot status | LED location |
|---|---|---|
| Green | Collaborative mode. |  |
| Flashing green | Direct teaching. | |
| Yellow | Contact stop function deactivated.<br>Normal during payload change (unit pick and drop). | |
| Red | Alarm occurrence (robot fault). | |

### 4.2.5 Robot Controller

The robot controller includes specific operating controls for the robotic arm. The operator does not have to open this panel to operate the equipment. For more information, refer to the Fanuc R-30iB Mini Plus Controller manuals.

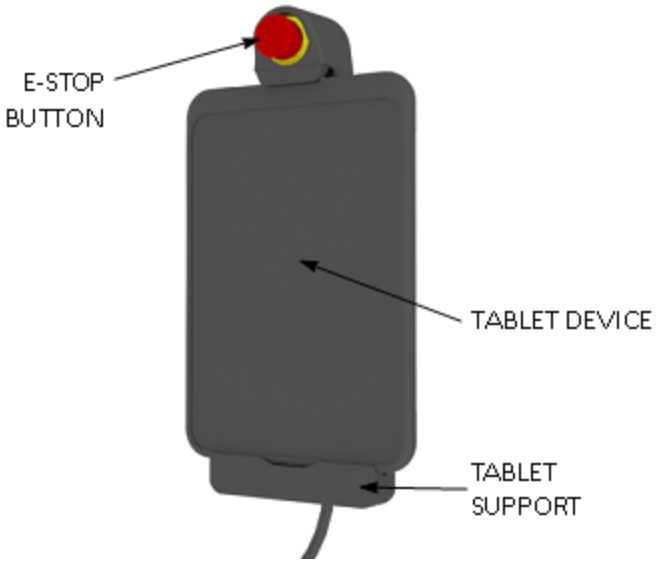
**WARNING**
**Only qualified personnel are authorized to open the robot controller panel(s).**




1. Fan unit
2. Breaker
3. Main power connector
4. Teach pendant connector
5. USB port
6. Robot cable connector

### 4.2.6 Tablet Teach Pendant

The tablet teach pendant is a control device dedicated to the FANUC robotic arm. It is located inside the cabinet front door. The teach pendant is not required during normal operation of the palletizer. The teach pendant is mostly used for troubleshooting (clearing robot-specific faults) or maintenance purposes (moving the robotic arm in manual mode). For more information, refer to the FANUC Tablet UI operator's manual.




When storing the tablet teach pendant in the cabinet, roll the cable around the back of the support before inserting the tablet inside its storing compartment. Avoid having any loose cable to prevent any damage.

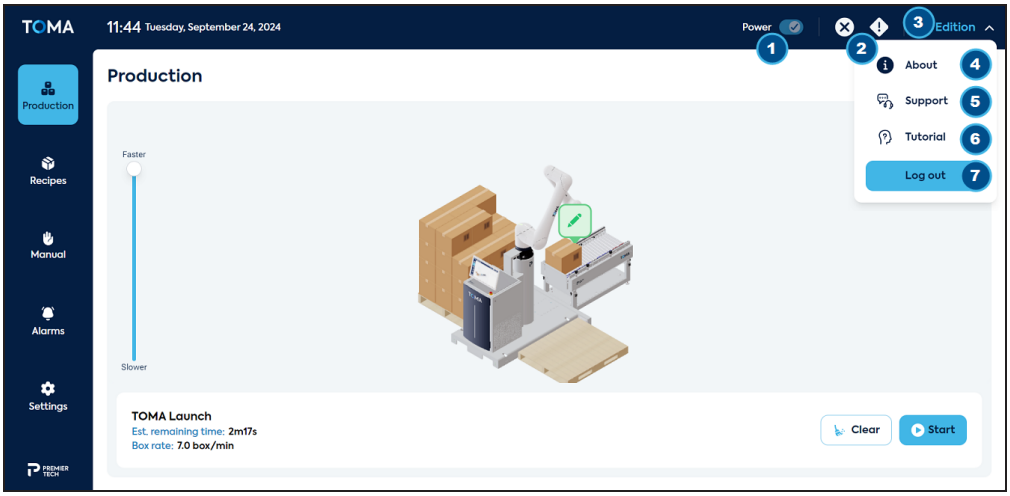
## 4.3 User Interface

The user interface enables communication between the operator and the computer controlling the equipment. This section describes most pages/windows as well as keys, displays and parameters specific to each page.

### 4.3.1 General Description - Common Displays and Navigation

This section describes displays and keys that are common to most pages. Displays and keys that are specific to a particular page/window will be explained in the following sections along with the description of the page.

The user interface is a touch screen: data input and function selection are made by a simple finger movement or pressure on the screen.




**HEADER**

**1** **Robot power status**

Indicates if the robot is powered or not.

**2** **Alarm notifications**

When an error or a warning occurs, a red or yellow dot is displayed next to the alarm or warning icon, with a number indicating the quantity of errors/warnings generated. Pressing this icon displays the **Alarms history** page with the corresponding filter (errors or warnings).

**3** **User and information menu**

Menu which allows changing the access level and getting information about the equipment and Premier Tech aftersales' service.

**4** **About**

Slide-in menu that gives technical information about the equipment.

**5** **Support**

Slide-in menu that gives information about how to reach Premier Tech support.

**6** **Tutorial**

To follow a quick tutorial explaining the main steps to start production. The tutorial launch window automatically appears at the first powering of equipment.

**7** **Switch mode/Logout**

To switch from Operation mode to Edition mode (password required) or to logout of the Edition mode.

#### LEFT NAVIGATION BANNER

The main navigation banner is displayed to the left of the screen. This vertical menu allows accessing the main pages for operation and settings. When a key is pressed, its background color changes to light blue.

**Production**

To display the equipment main page from where normal operation of the machine is done. See section 4.3.2.

> At all times, press on the **TOMA** logo on the upper left corner to reach the **Production** page.

**Recipes**

To display the **Recipes** page from where recipes can be created and edited. See section 4.3.3.

**Manual**

To display the **Manual** page where parts of the equipment can be individually activated. See section 4.3.4.

**Alarms**

To display the **Alarms** page where errors and warnings are listed. See section 4.3.5.

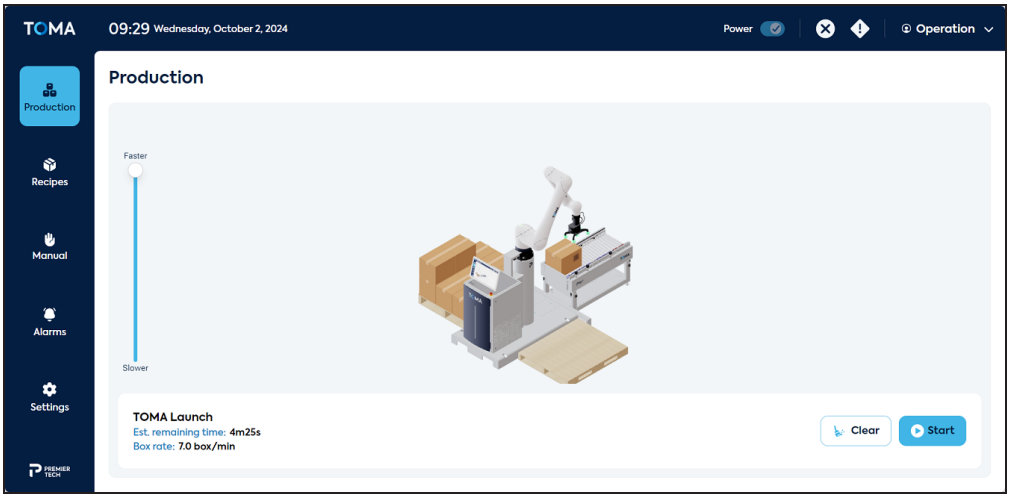
### Settings

To display the **Settings** page where preferences and parameters can be changed and backups/updates can be done. See section 4.3.6.

## 4.3.2 Production Page

The **Production** page is the home page when powering up the system. This page is used to select the desired recipe(s) to produce and to start and stop the palletizing system.

The center image can be rotated and zoomed in/out for a better view of the system.




### Assign recipe

To assign a recipe (from the published recipe list) to the selected infeed line. If, after recipe assignation, the corresponding pallet icon becomes red, this means that a pallet is missing (not detected by the sensor).

### Start

To start production for the selected infeed line. This key is only available when a recipe has been selected.

### Stop

To stop production for the selected infeed line.

### Pause

To pause the robotic arm movement. This function is useful for minor interventions such as repositioning a unit.

### Resume

To resume production that was previously paused.

### Clear

To clear the chosen recipe for the selected infeed line. This key is only available when the line is stopped.

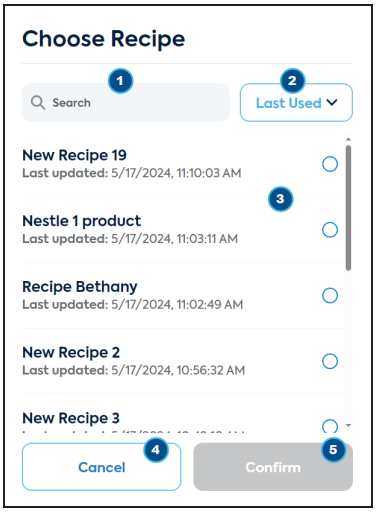
### Speed

To adjust the speed of the robot. This adjustment is made in real time during production.

#### RECIPE AND PRODUCTION INFO

When a recipe is selected, production data is displayed at the bottom of the production page: the recipe name, the estimating remaining time to complete the pallet load and the production rate (cycles per minute).

#### RECIPE SELECTION SLIDE-IN WINDOW




### 1 Search

Allows entering key words to search for a specific recipe.

### 2 Sorting

To sort the displayed recipes according to their name (A to Z), the published date or the last recipes used.

### 3 Published recipe list

List of all published recipes. When a recipe is selected, the white dot besides becomes blue.

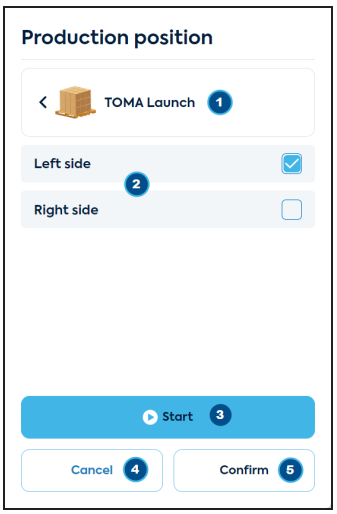
### 4 Cancel

To cancel the recipe selection and go back to the **Production** page.

### 5 Confirm

To confirm the recipe selection and go to the next window.

#### LINE SELECTION SLIDE-IN WINDOW




### 1 Selected recipe

Displays the recipe selected in the previous window.

### 2 Outfeed pallet selection

To select the pallet side to which this recipe will be palletized (left and/or right).

### 3 Start

To start the selected production. The **Confirmation** window will appear.

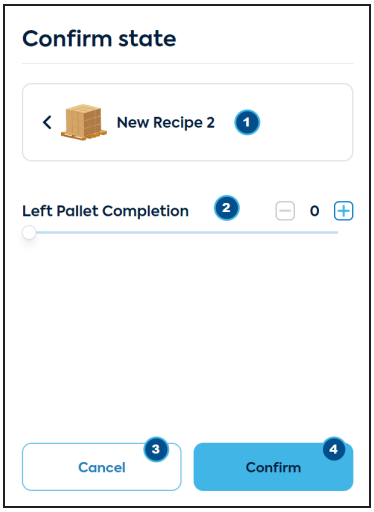
### 4 Cancel

To cancel the line selection and go back to the **Recipe selection** window.

### 5 Confirm

To confirm the recipe and outfeed selection and go back to the **Production** page. Production is selected but will not start until the **Start** key is pressed.

**CONFIRMATION SLIDE-IN WINDOW**




**1 Selected recipe**

Displays the recipe selected in the previous window.

**2 Pallet completion**

To indicate if any number of units are already palletized on the pallet(s). This is useful when production has unexpectedly stopped and the system has lost track of the palletizing progress.

**3 Cancel**

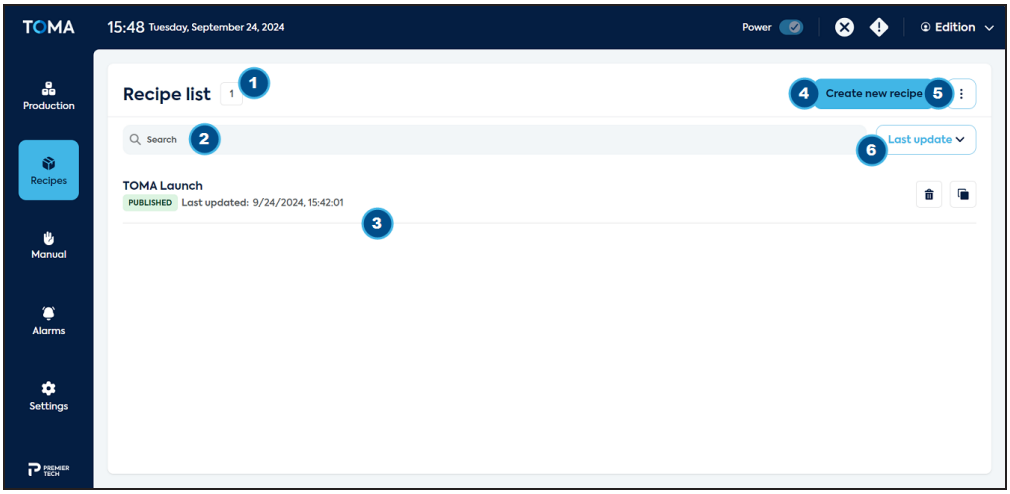
To cancel the completion state and go back to the **Production** page.

**4 Confirm**

To confirm and start production, and go back to the **Production** page.

### 4.3.3 Recipes Page

The **Recipes** page allows creating new recipes and editing or deleting existing recipes. This page is only accessible with in Edition mode.




**1 Quantity**

Displays the number of saved recipes.

**2 Search**

Allows entering key words to search for a specific recipe.

**3 List**

Displays all created recipes.

**4 Create new**

To create a new recipe.

**5 Import/Export**

To import or export a recipe. Select the desired volume to export to or to import from, then confirm.

**6 Sorting**

To sort the displayed recipes according to their name (A to Z), their published date, their creation date or their updated date.

**Delete**

To delete the selected recipe.

**Copy**

To copy the selected recipe and save it as a new one.

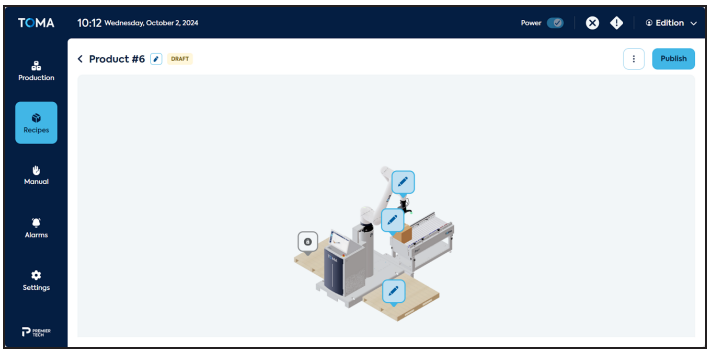
### To create a new recipe

To create a new recipe, it is necessary to set the parameters of the product (units to be picked), the pallet, the gripper and the palletizing pattern.

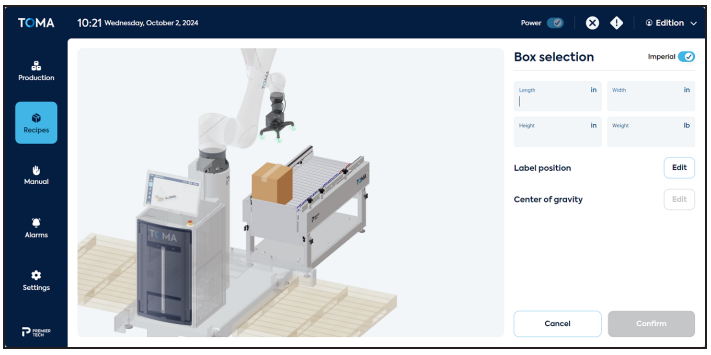
1. Press the **Create new recipe** key in the upper right of the **Recipes** page.
2. In the slide-in window, enter the recipe name, then press **Confirm**.

> The name of the recipe can be changed at anytime in the creation process by pressing the icon next to the recipe name.

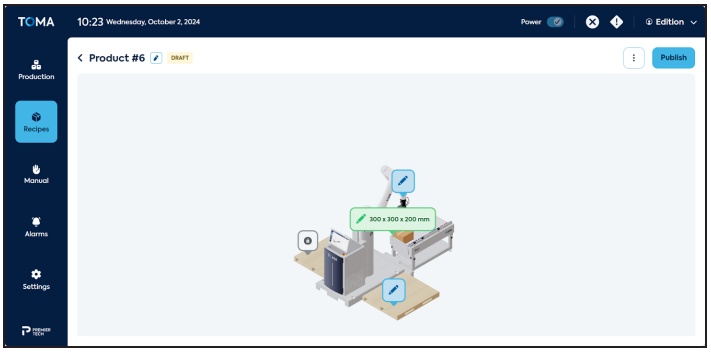
3. The new recipe is then displayed and has the ''draft'' status.



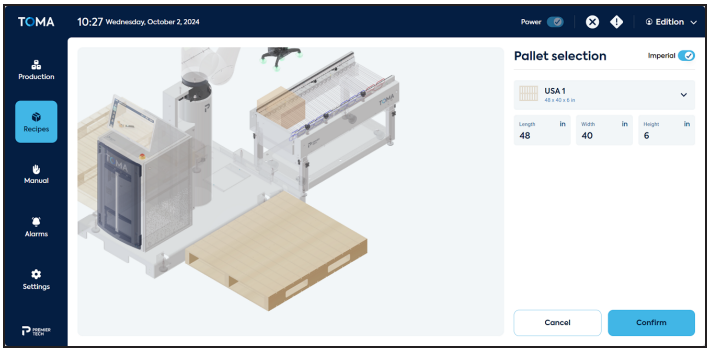

4. Start setting product parameters by pressing the icon on the box (conveyor).
5. In the **Box selection** window, select the system of units to be used (imperial or metric). Enter the dimensions of units and the label position. A mass center point can also be defined in the case the unit weight is off-centered.



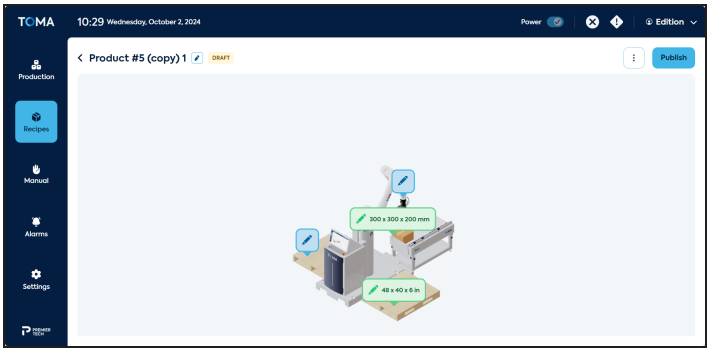

6. When finished, press **Confirm**. The box icon turns green and displays the unit dimensions.



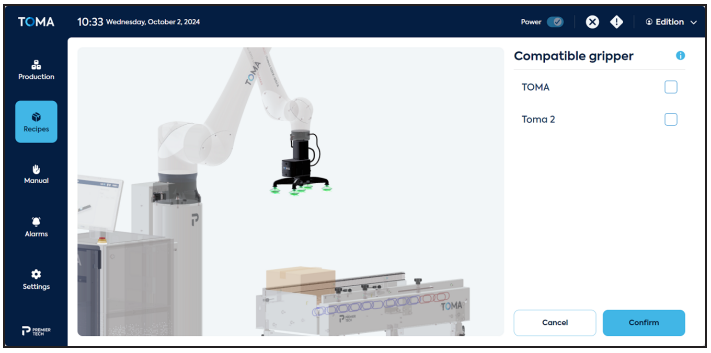

7. Set the pallet parameters by pressing the icon on the pallet.
8. In the **Pallet selection** window, choose the dimension of your pallets. Either select a pre-filled type of pallet from the drop-down list or manually enter the dimensions in the fields below. Make sure the proper system of units is selected.



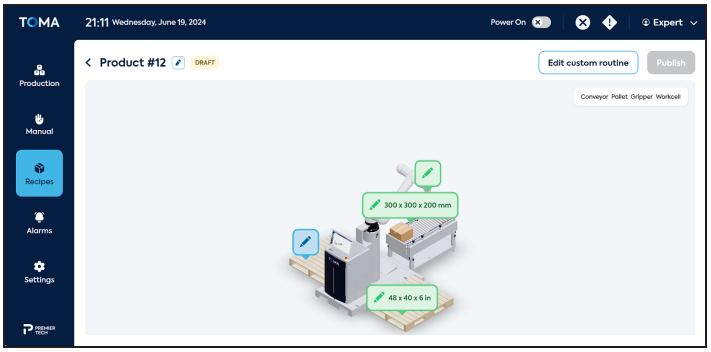

9. Press **Confirm**. The pallet icon turns green and displays the pallet dimensions.




10. Select the desired gripper by pressing the icon on the gripper.




11. Press **Confirm**. The gripper icon turns green.




12. The palletizing pattern can now be determined as the icon is now available. Press the icon.

13. The **Layer selection** window allows defining how layers will be formed.


a. If desired, activate the overhang option. This allows units to slightly exceed the pallet dimensions.

b. Select the desired pattern among the choices given (available choices are all possible options according to the dimensions of units and pallets previously entered).

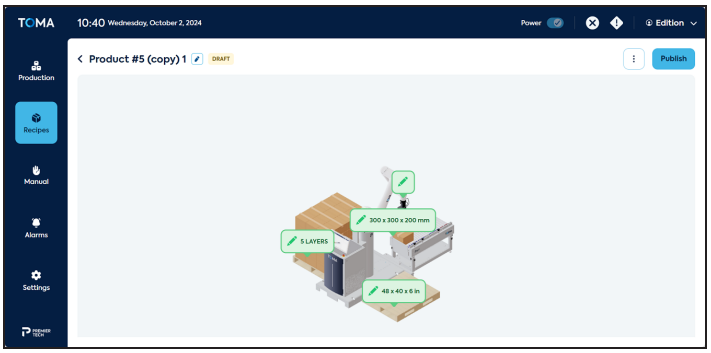
c. Choose the number of layers per pallet.

d. Select the way layers should be alternated (mirror-horizontal / mirror vertical / rotated 90 degrees / no alternation).

e. If slip sheets are required, press **Edit**. Enter the height (thickness) of the sheets, the location (bottom, top, every # of layers) then press **Confirm**.

If the pre-configured patterns and options do not meet the client's needs, it is possible to create a custom pattern by deactivating the **Auto** key in the upper right of the menu. See the following pages for more details.

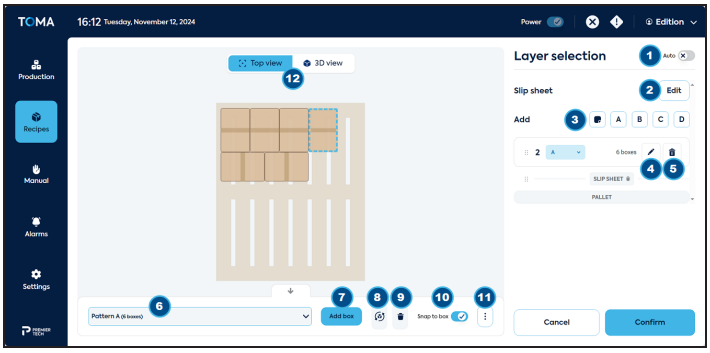
14. Press **Confirm** to confirm layer parameters. The pattern icon turns green and displays the number of layers.




15. When all recipe settings are as desired, press **Publish** in the upper right of the screen. The recipe will now be available for operators.

#### CUSTOM PALLETIZING PATTERN

If the pre-configured patterns and options do not meet the client's needs, it is possible to create a custom pattern by deactivating the **Auto** key in the upper part of the **Layer selection** slide-in menu.




**1 Auto**

To activate/deactivate the automatic pattern suggestion.

**2 Slip sheet edit**

To edit the type of slip sheets used.

**3 Add layer**

To add a layer (slip sheet or layer of units) to the palletizing pattern.

**4 Edit layer**

To edit the layer. Edition is done in central window.

**5 Delete layer**

To delete the layer.

**6 Pattern selection**

To select the pattern to edit (A, B, C or D).

**7 Add box**

To add a unit to the pallet. The unit appears at the screen in red and can be moved anywhere on the pallet.

**8 Rotate**

To rotate the selected unit(s).

**9 Delete**

To delete the selected unit(s).

**10 Snap to box**

To activate/deactivate the **Snap to box** option. When this option is activated, unit positioning is done in a way that each unit is right next to the other.

**11** **More options**

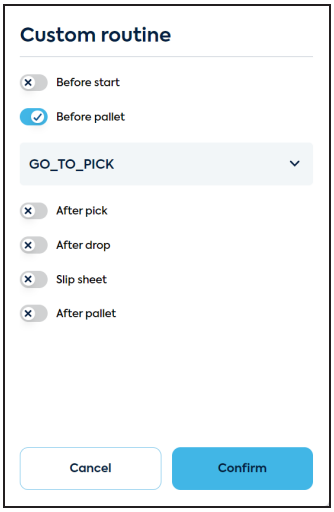
To display additional options.

**12** **View**

To toggle between a top view and a 3D view of the pallet.

**EDIT CUSTOM ROUTINE**

At the top right of the **Recipe** screen, next to the **Publish** button, is a three vertical dot icon to access custom routines. This function enables customizing the robot behavior using customized routines.



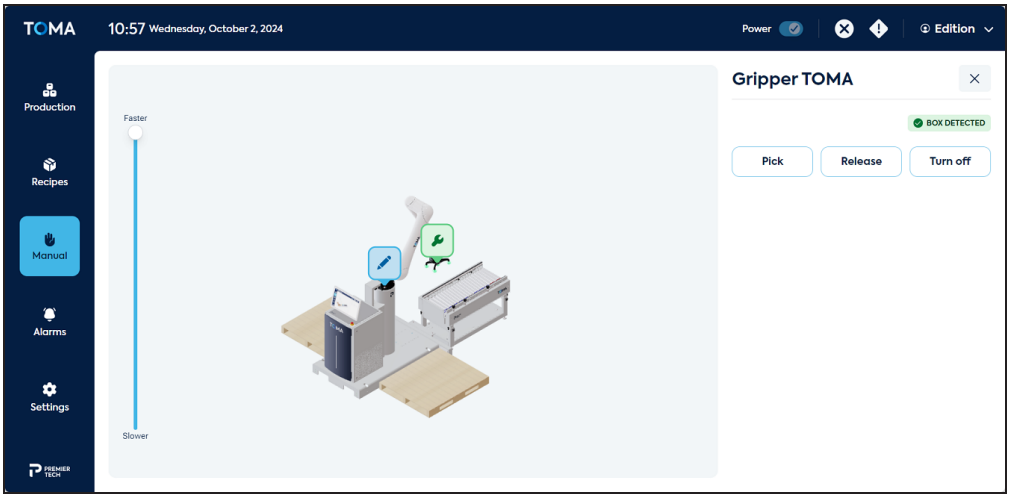

1. Activate the cycle step where a custom action is desired by pressing on the toggle key.
2. From the selection list, choose the desired command.
3. Add as many customized actions as desired.
4. Press **Confirm**.

The list of Numeric Registers used to build custom routines can be found in the Appendix section.

### 4.3.4 Manual Page

The **Manual** page allows activating specific movements of the system such as activating the conveyor or moving the robotic arm.

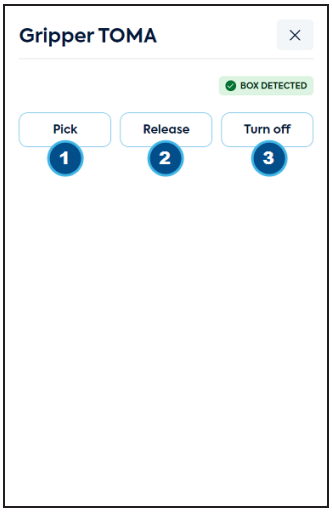
Manual movements are not available when a recipe is currently in production.




### Manual group

Press this icon to display the slide-in window and select the desired manual movement. When selected, the icon changes for a green wrench key.

#### GRIPPER SLIDE-IN WINDOW




### 1 Pick

To execute the pick routine of a unit.

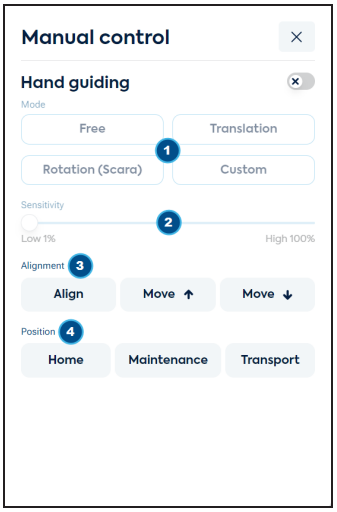
### 2 Release

To activate air blow-off for picked unit release.

### 3 Turn off

To execute the gripper off command.

#### ROBOTIC ARM SLIDE-IN WINDOW




### 1 Mode (Free, Translation, Rotation)

To select the mode or manner in which the robot arm will move. The **Free** mode allows the robot to move in any manner (rotation and translation). The **Translation** mode allows the robot to move on an axis only. The **Rotation** mode allows the robot to rotate only (on its TCP axis). The **Scara** mode allows activating the handguiding as defined on the tablet teach pendant. This mode allows selecting the axis that are to be mobile.

### 2 Sensitivity

To set the sensitivity of the robot arm. The higher the value, the more sensitive the robot will be to a manual push by the operator. Conversely, a low sensitivity will require a stronger push to move the robot.

### 3 Alignment

The **Align** key allows aligning the Z axis of the TCP (Tool Center Point) with the WORLD Z axis. If the gripper Z axis is aligned with the robot wrist, this button will turn the wrist so it is vertically oriented downwards.

The **Move up** and **Move down** keys allow raising and lowering the robot. The movement is executed as long as the key is pressed.

### 4 Position

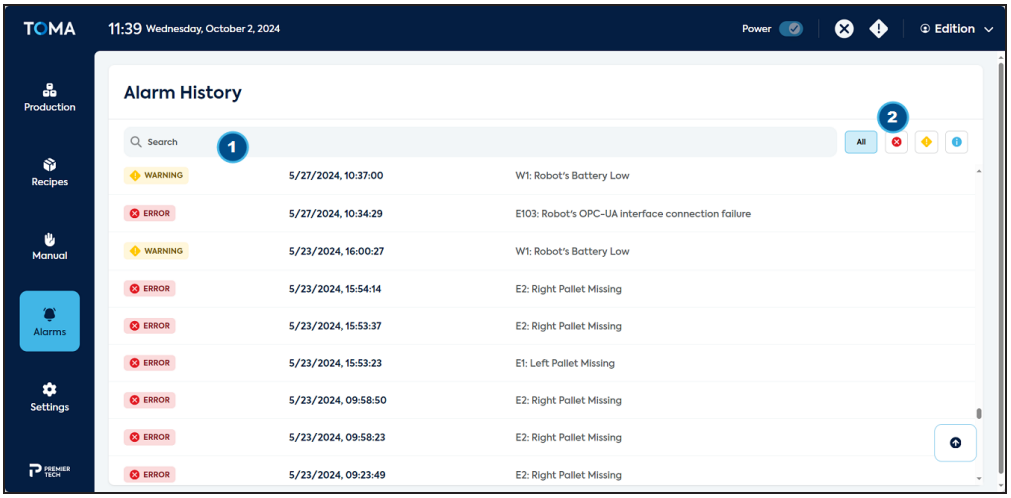
To move the robot to a particular position. **Home** = initial position of the robot when the system is started. **Maintenance** = position which facilitates maintenance on the robot/gripper. **Transport** = position which ensures easy and safe transport (robot is folded on itself in a compact position). Each movement is executed as long as the key is pressed.

**TO PERFORM A MANUAL MOVEMENT**

1. Press **Manual** in the left navigation menu.
2. Press the icon corresponding to the desired module to display the slide-in window. The key icon changes for .
3. Press the key corresponding to the desired movement. The movement is activated until it is completed or until the key is released.

## 4.3.5 Alarms Page

The **Alarms** page enables viewing all triggered errors and warnings.




### 1 Search

Allows entering key words to search for a specific alarm.

### 2 Display mode

To select the way alarms are displayed/filtered. Selecting **All** shows all types of alarms, selecting only displays the error type alarms, selecting only displays the warning type alarms and selecting only displays the information messages.

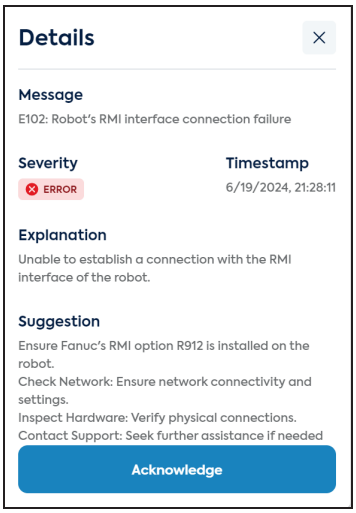
**Top of page**

To go back to the top of the list.

#### ALARM SLIDE-IN WINDOW

When pressing on an alarm, a slide-in window appears to the right. This windows displays the message, the severity (error, warning, info) and the time at which the alarm was triggered, and presents a short explanation of the problem, along with possible solutions to resolve it.

When in production, this slide-in window appears as soon as an alarm is triggered.



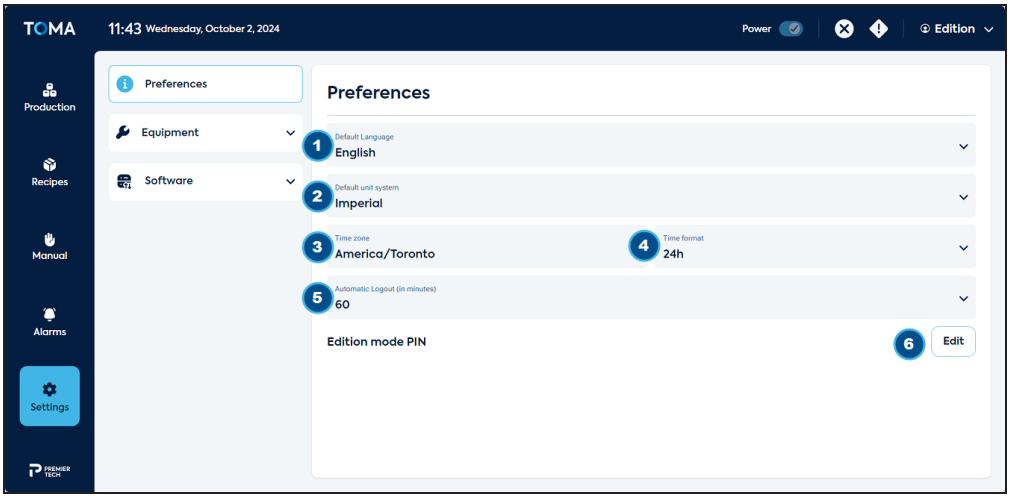

#### TO ACKNOWLEDGE AN ALARM

1. When an alarm occurs, the **Alarm** slide-in window appears to the right of the screen.
2. Read the alarm message, description, and possible solutions and make the necessary corrections.
3. Press **Acknowledge** to clear the alarm.

### 4.3.6 Settings Page

The **Settings** page allows setting a few general preferences as well as managing access levels (modes). Most settings require an Edition mode access to be changed.

### PREFERENCES




**1** **Default language**

To set the default language of the interface. Available languages are English, French and Spanish.

**2** **Default unit system**

To set the default system of units (imperial or metric).

**3** **Time zone**

To choose the appropriate timezone.

**4** **Time format**

To choose the time format (12h or 24h).

**5** **Automatic logout**

To set an automatic logout after a certain time (never or 1 - 5 - 15 - 30 - 60 minutes).

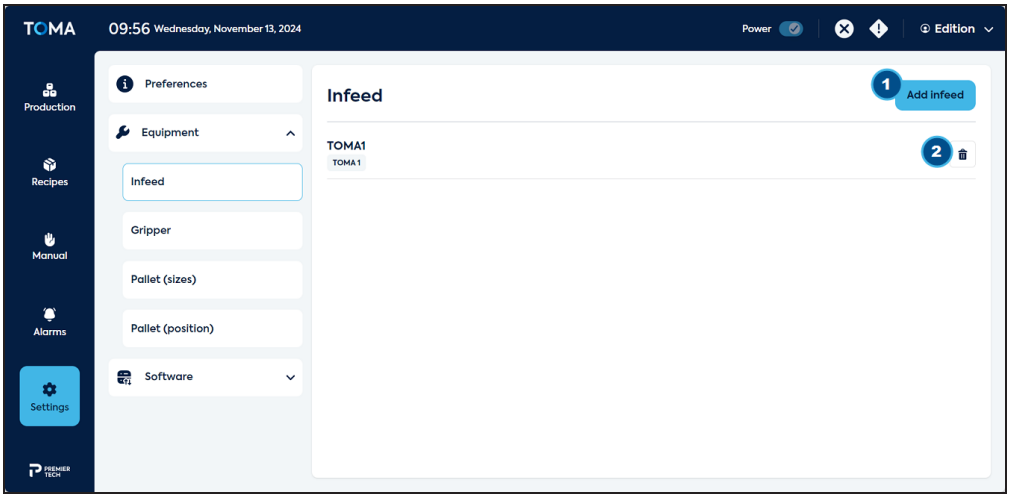
**6** **Edition mode PIN**

To change the PIN to access the edition mode.

### EQUIPMENT - INFEED

This page allows managing infeed conveyors of the system, including teaching conveyor position to allow proper unit picking by the robot.

A maximum of two infeeds can be configured. When two infeeds are displayed, the **Add Infeed** key becomes unavailable.




1 **Add infeed**

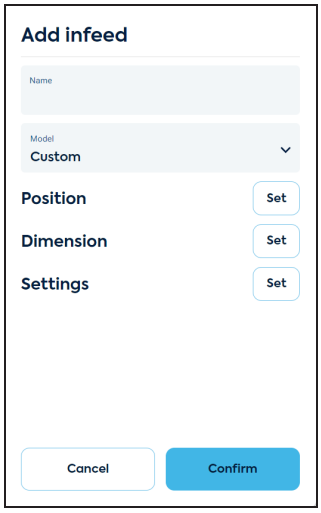
To configure a new infeed conveyor.

2 **Delete**

To delete an infeed conveyor.

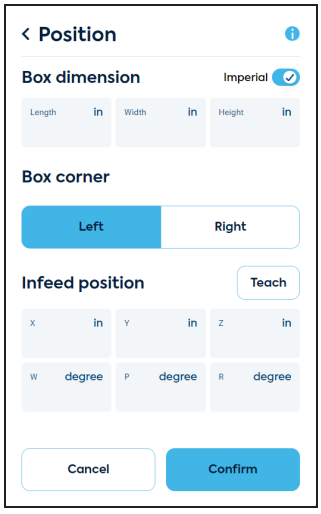
### To configure a new infeed conveyor

1. In the **Settings** page, access the **Infeed** subpage of the **Equipment** section.
2. Press the **Add infeed** key in the upper right of the screen.




3. Choose a name for this new infeed and select the model of conveyor (TOMA conveyor #1, TOMA conveyor #2 or custom conveyor).

4. Set the **Position** of the conveyor.




a. Enter the unit dimension which will be handled by the conveyor. Make sure a unit is physically placed on the conveyor at the desired pick position.

b. Press the **Teach** key to teach the gripper position.

c. In the **Infeed position** window, activate the robot **Hand guiding** and select the movement mode. It is recommended using the **Translation** mode, or **Free** mode if **Translation** does not work.

d. Get near the robot arm and manually move it until the gripper rests on the unit. The gripper should be centered on the unit and the suction cups should be slightly pressed.

e. When the desired position is reached, press **Confirm** to get back to the **Infeed Position** window.

f. Values will appear in the Infeed position section. They can be fine tuned if necessary.

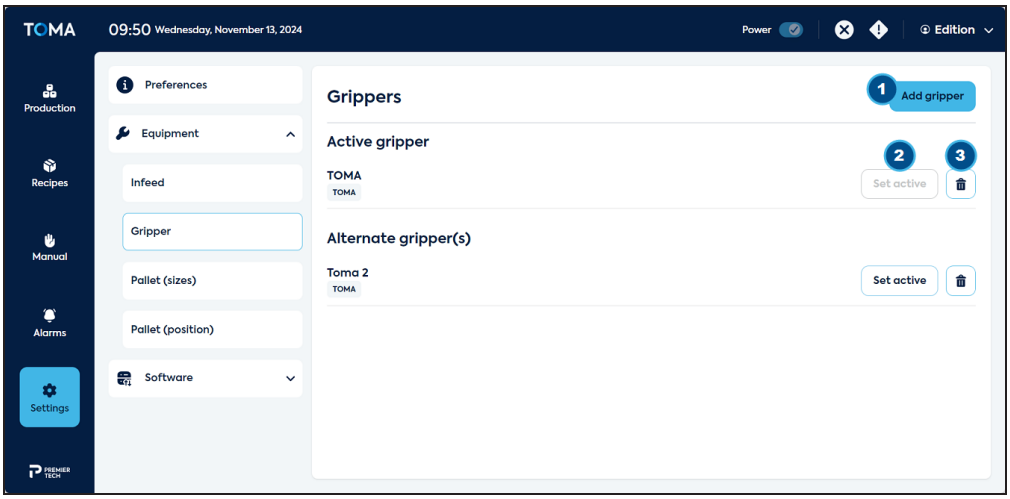
g. Press **Confirm** when finished.

5. If the conveyor model is custom, press the **Dimension** key to enter the height of the conveyor guides. This is to prevent any interference with the gripper and the guides.

6. If the conveyor model is custom, press the **Settings** key to configure the connection with the conveyor. Choose between connector 1 or 2 according to the physical iO Link port to which the conveyor signal is configured.

#### EQUIPMENT - GRIPPER

This page allows saving all grippers available for the system and which can be selected in recipes.




1 **Add gripper**

To add a new gripper.

2 **Set active**

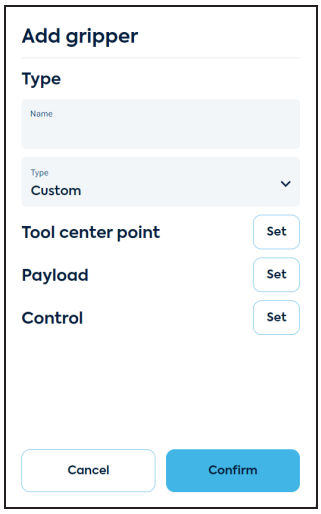
To set the selected gripper as active.

3 **Delete**

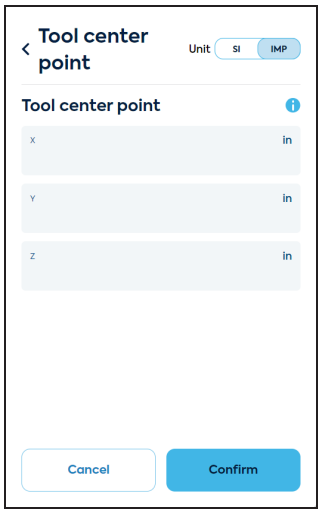
To delete a gripper.

### To add a new gripper

1. In the **Settings** page, access the **Gripper** subpage of the **Equipment** section.
2. Press the **Add gripper** key in the upper right of the screen.




3. Choose a name for this new gripper and select the type (TOMA or custom).
4. Set the **Tool center point** of the gripper.



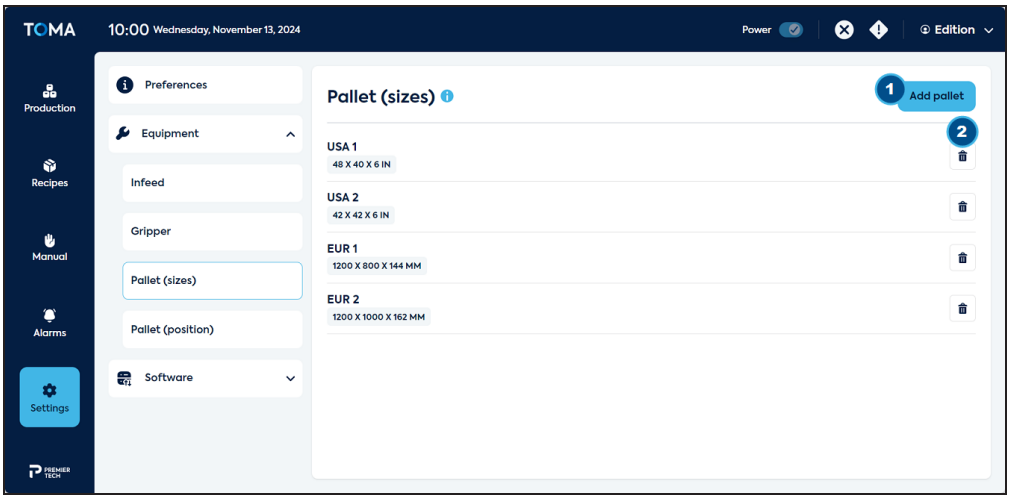

   a. Enter the measurements (X-Y-Z axes) defining the gripper center point. The tool center point is the point on the gripper which will be centered on the unit during the pick.

   b. Press **Confirm** when finished.

5. If the gripper is custom, press the **Payload** key to enter the weight of the gripper and its center of gravity. The center of gravity measurements are defined from the white arrow on the robot wrist. The CoG of a custom gripper can be calculated using a special Fanuc function (refer to Fanuc documentation).
6. If the gripper is custom, press the **Control** key to configure the routines of the gripper. Select a custom routine from the list for the Pick, Blow off and Off functions. If a desired routine is not in the list, create it in the robot program first.

### EQUIPMENT - PALLET (SIZES)

This page enables saving different pallet sizes that can be used in recipes.




1 **Add pallet**

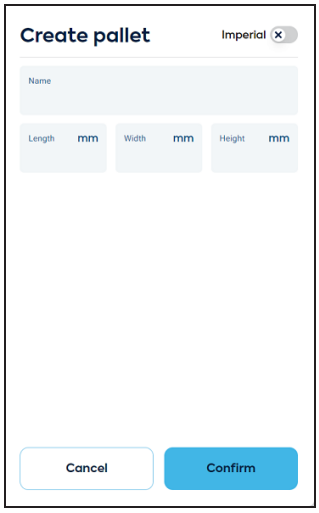
To add a new pallet size.

2 **Delete**

To delete the pallet size.

#### To add a new pallet size

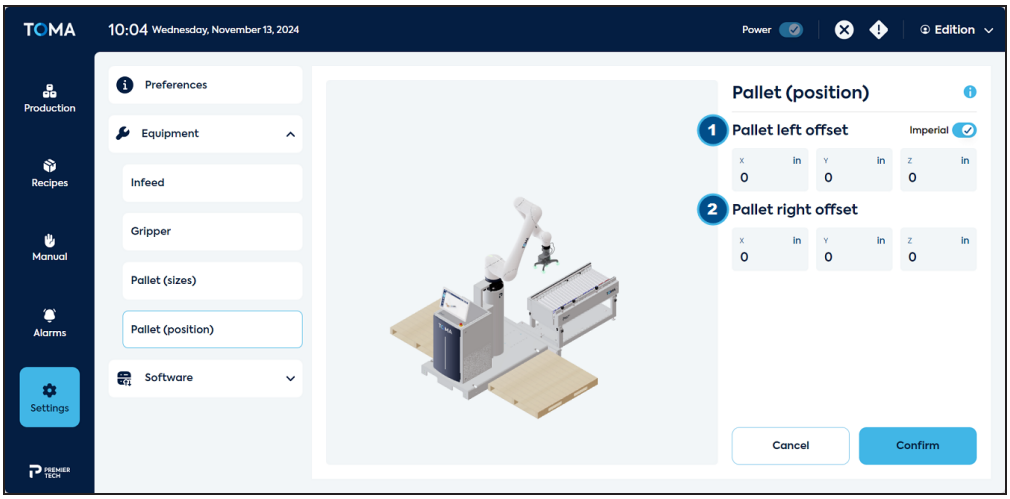
1. In the **Settings** page, access the **Pallet (size)** subpage of the **Equipment** section.
2. Press the **Add pallet** key in the upper right of the screen.




3. Choose a name for this new pallet and enter the dimensions (length, width and height).
4. Press **Confirm** to save the pallet.

### EQUIPMENT - PALLET (POSITION)

This page allows fine-tuning the positioning of pallets in palletizing zones.




**1 Pallet left offset**

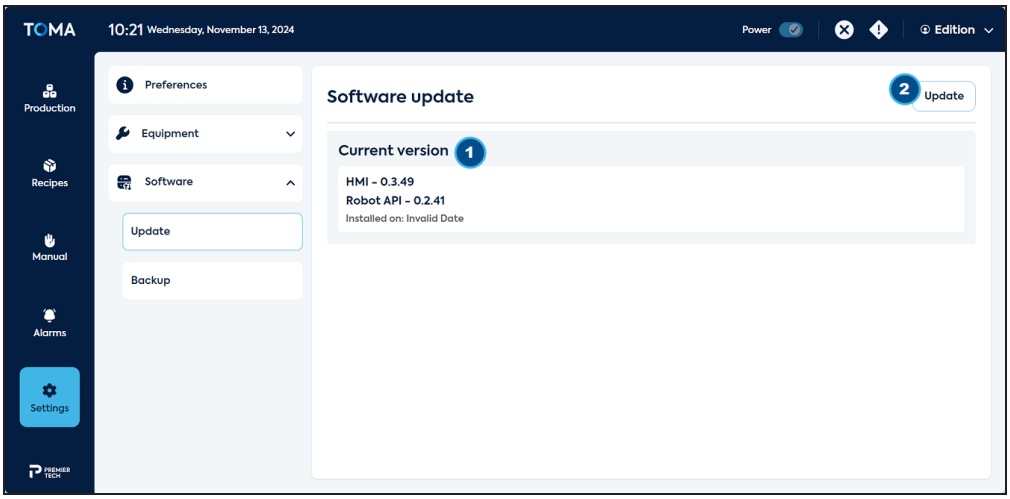
To offset the left pallet position on X, Y and Z axes.

**2 Pallet right offset**

To offset the right pallet position on X, Y and Z axes.

### SOFTWARE - UPDATE

**Prior to installing a new version of the software, it is recommended creating a backup.**



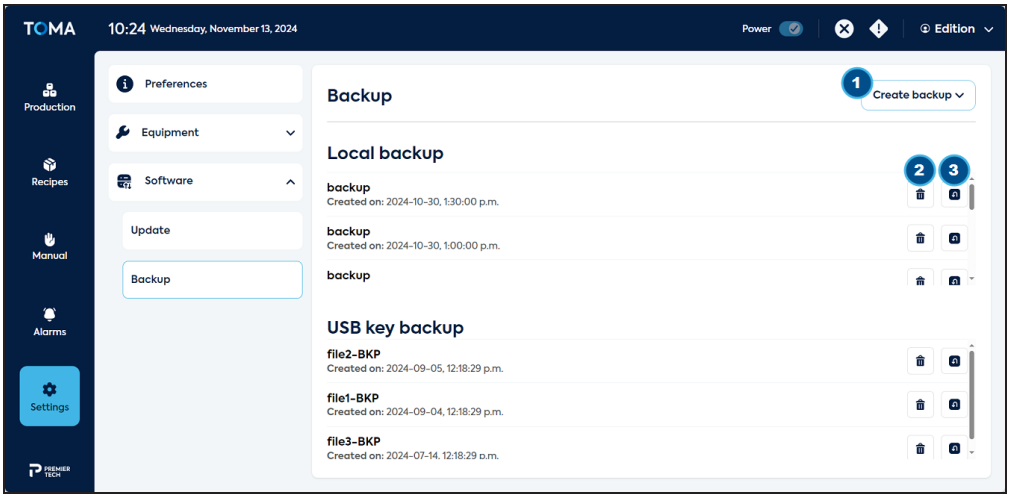

**1** **Current version**

Details about the current version of the software installed on equipment.

**2** **Update**

To get the most recent version of the software.

### SOFTWARE - BACKUP



**1** **Create backup**

To create a new backup of the software. Choose where to save the backup (local, USB key, etc.).

**2** **Delete**

To delete the selected backup.

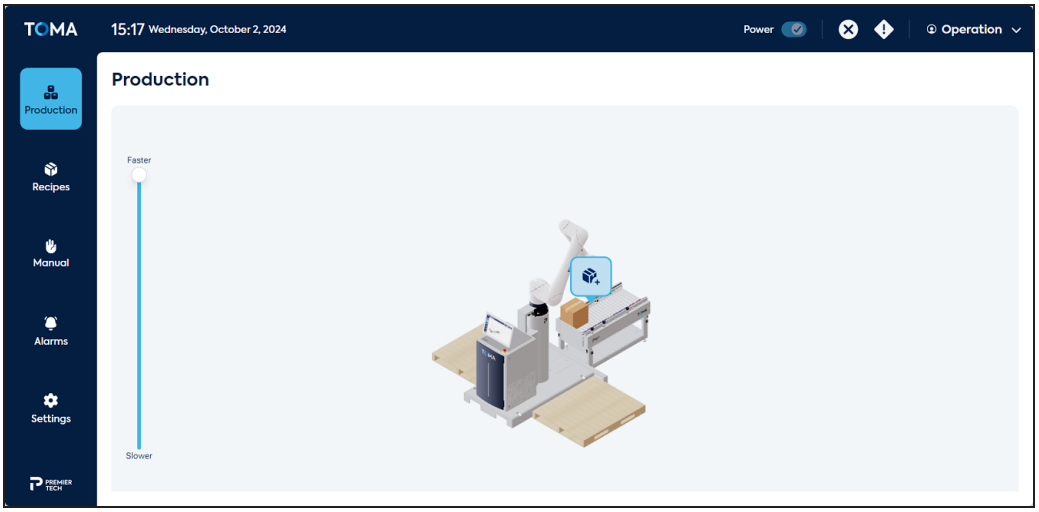
**3** **Restore**

To restore the selected backup.

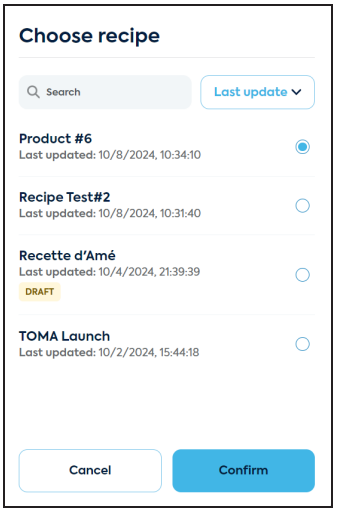
## 4.4 Start and Stop Procedures

**TO START EQUIPMENT**

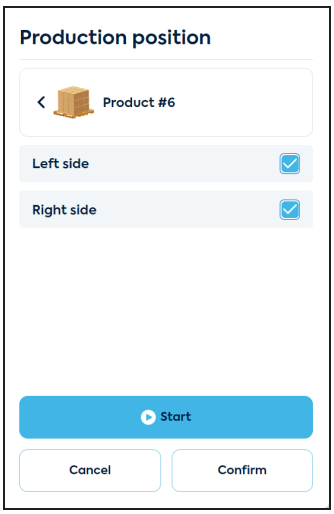
1. Remove the water from the pneumatic system filter bowl.
2. Pressurize the pneumatic system.
3. Switch on electrical power to the equipment (inside cabinet). The base of the estop button lights up.
4. Check the general condition of equipment.
5. Make sure all emergency-stop devices are reset and all alarms have been acknowledged.
6. In the **Production** page of the user interface, press on an infeed icon to assign a recipe.




7. In the slide-in menu, select the desired recipe for the production and the palletizing station(s), then press **Confirm**.




8. Select the palletizing station(s) (left and/or right) where the production is to be done.

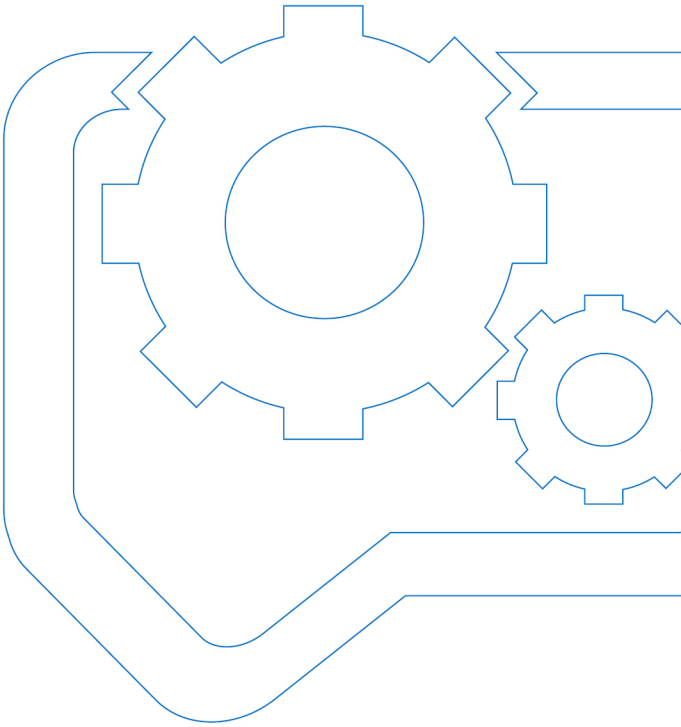



9. Make sure empty pallets (of correct size according to selected recipe(s)) are placed in both palletizing stations.
10. Press **Start** to start **Production** (or **Confirm** to save for later). The system will ask the current level of completion of the pallet: enter the correct value (0 if the pallet is empty) and press **Confirm**. The production is now starting.
11. If needed, adjust the speed of the robot to the desired level.
12. If a second infeed is available, repeat the previous steps for this infeed.

When the system has two infeed lines, each line can be assigned a different recipe and started independently.

### TO STOP EQUIPMENT

For a normal stop of equipment, press the **Stop** key at the user interface (in **Production** page). The cycle in progress will be completed then all modules will come to a stop.



# 5 Adjustments

**CAUTION**

**Changing proximity and photoelectric sensors original position may result in operating problems or damage to equipment.**

## 5.1 Adjusting Conveyor Height

The CONVEYOR height can be adjusted according to the units being handled and the infeed system.

Refer to procedure 2.4 Conveyor(s) Installation and Positioning (if present) in *Installation* section.

## 5.2 Adjusting Conveyor Guides

The CONVEYOR has guides to direct and position units for proper pick-up by the robot. Guides are fixed on one side of the conveyor but the other side can be adjusted according to unit dimensions.

Refer to procedure 2.9 Conveyor Guides Setup in *Installation* section.

## 5.3 Adjusting Sensors

The CONVEYOR is equipped with three photoelectric sensors to manage unit infeed and pick-up. Each sensor has an emitter on one side of the conveyor and a reflector on the opposite side. Make sure sensors are always cleaned and properly aligned with their reflector.

1. **First sensor**

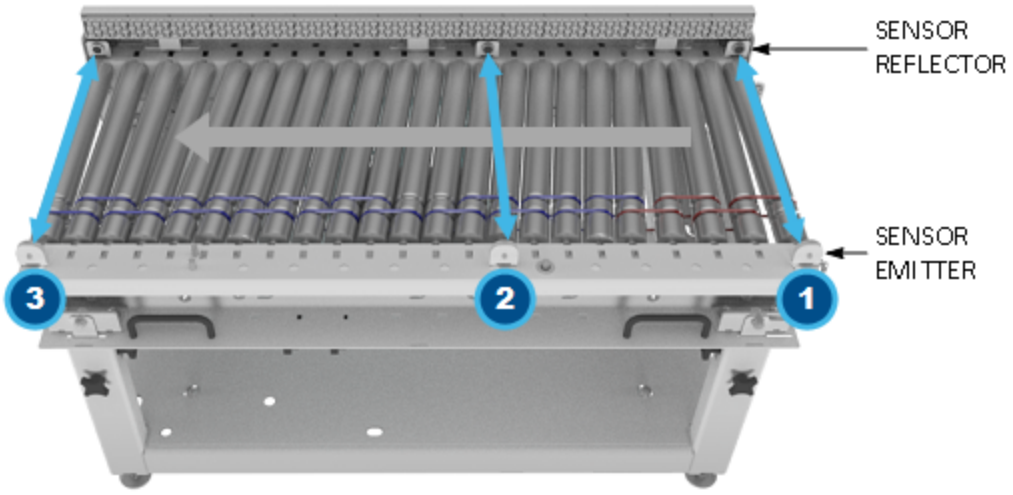
   Detects unit entry and activates rollers in first section.

2. **Second sensor**

   Detects unit entry and activates rollers in second section.

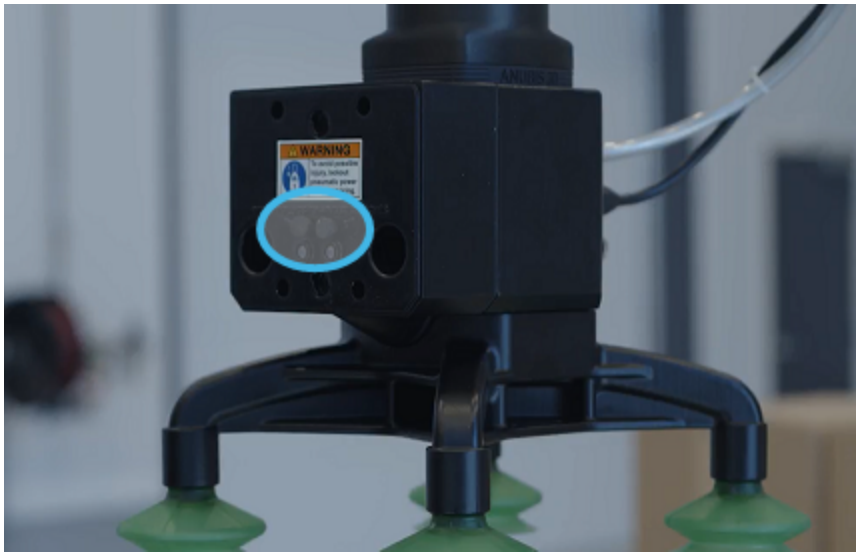
3. **Third sensor**

   Detects unit in pick-up zone.




## 5.4 Adjusting Gripper Vacuum Detection

1. Remove the muffler cover by twisting the knobs to the unlocked symbol.
2. Remove the rubber plugs to access the vacuum sensor dial.

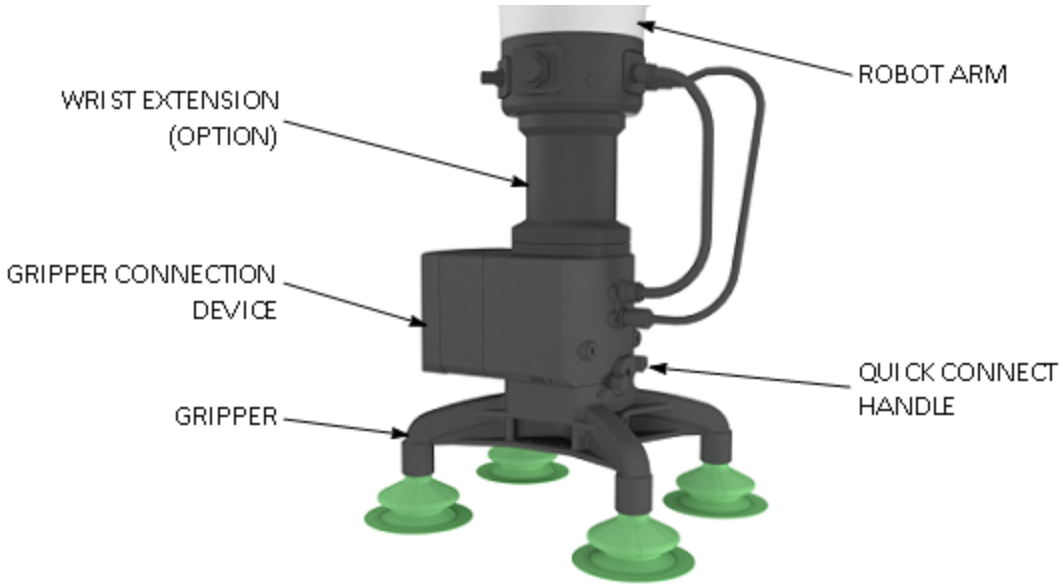



3. Using a screwdriver, rotate the dial on the switch. Rotate clockwise to increase and counterclockwise to decrease.

4. Put both rubber plugs back and replace the cover.

## 5.5 Changing the Gripper

The robot gripper can easily be changed when production requires it.




Actual gripper may differ from illustration.

1. Turn the connection device latch to ''unlock'' (arrow facing the unlocked padlock icon) to release the gripper.

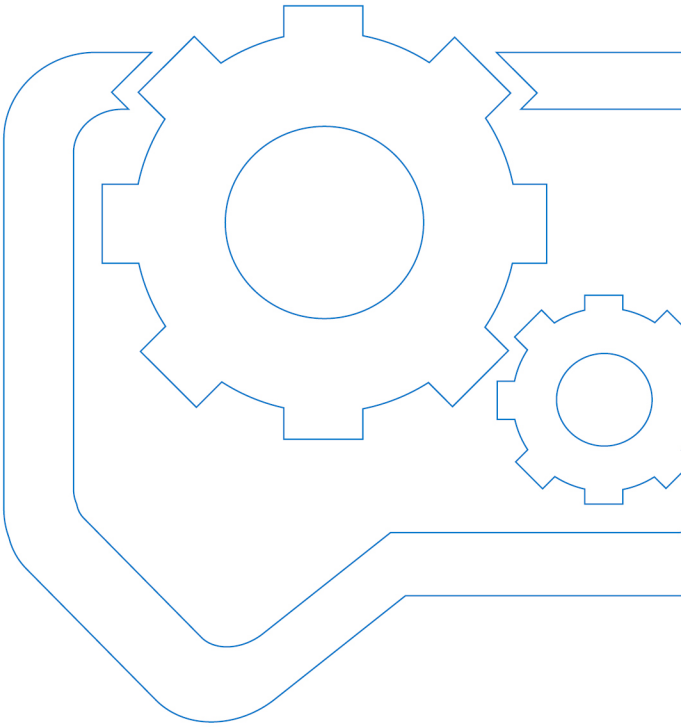
2. Insert the new gripper in the connecting device.

3. Turn the latch to the locked position (arrow facing the locked padlock icon).

## 5.6 Moving the Equipment

When equipment needs to be moved, proceed as follows:

1. Unplug all modules from power and air supply and make sure all modules are disconnected from the palletizer base and that no plug or cable hangs from any modules.
2. Remove all anchors if present.
3. Raise the conveyor's levelling feet so the conveyor rests on its caster wheels.
4. If conveyors are present, uncouple them by removing the pins from the palletizer coupling plate. Also remove any coupling plates with existing infeed system if required.
5. Lift the palletizer base using a forklift or a lift truck (pallet jack). If using a forklift, make sure to reinstall the red anti-tilting plate removed during uncrating.
6. Move the modules to the new location.
7. Reinstall the system by proceeding with Installation steps previously explained.



# 6 Troubleshooting

## 6.1 Common Situations

| Problem | Possible cause | Solution |
|---|---|---|
| System is ON but robot does not power on | Robot controller breaker is off. | Open the right side of the electrical cabinet and put the controller breaker on (see section 4.2.5). |
| Gripper vacuum does not activate | Compressed air is not connected. | Check that the air supply is properly connected to equipment (see procedure in section 2.7.6). |
| | Air valve is closed. | Make sure the valve is open in electrical cabinet. |
| Collision detected by robot when placing units on pallet | Unit dimensions are too high. | Reduce the dimensions of the boxes in the recipe to space them. |

## 6.2 Alarm Messages

The following tables list all alarm messages that can be generated by the controller, along with the actions required to correct them. For the sake of conciseness, these descriptions do not include the steps “Acknowledge alarm” and “Restart equipment” that are required to resume operation after an alarm occurs (except for warnings). For a detailed description of Fanuc robot alarms displayed on the Tablet Teach Pendant, refer to the FANUC eDoc (see Appendix Fanuc Documentation for more details on how to find this documentation).

| # | Title | Description and suggested actions |
|---|---|---|
| E1 | Left pallet missing | The left pallet required for palletizing operations is not detected. Without a pallet in place, the palletizer cannot function properly, which might lead to disruptions in production.<br>• Make sure the left pallet is correctly positioned and securely placed within the designated area for palletizing.<br>• Check for any obstructions or misalignments that might prevent the system from detecting the pallet. |

| # | Title | Description and suggested actions |
|---|---|---|
| E2 | Right pallet missing | The right pallet required for palletizing operations is not detected. Without a pallet in place, the palletizer cannot function properly, which might lead to disruptions in production.<br>• Make sure the right pallet is correctly positioned and securely placed within the designated area for palletizing.<br>• Check for any obstructions or misalignments that might prevent the system from detecting the pallet. |
| E100 | Robot not detected on network | The robot is not detected on the network of the palletizer.<br>• Check network: ensure network connectivity and settings.<br>• Inspect hardware: check physical connections.<br>• Contact support: seek further assistance if needed. |
| E101 | Box not detected on gripper | The gripper has failed to detect the presence of a box during the palletizing process.<br>• Make sure the box is correctly positioned and aligned with the gripper.<br>• Check for any obstruction or interference that might hinder the gripper's ability to detect the box.<br>• Make sure the infeed conveyor's position is teached in the configuration page. |
| E102 | Robot's RMI interface connection failure | Unable to establish a connection with the RMI (Remote Motion Interface) of the robot.<br>• Make sure Fanuc's RMI option R912 is installed on the robot.<br>• Check network: ensure network connectivity and settings.<br>• Inspect hardware: check physical connections.<br>• Contact support: seek further assistance if needed. |
| E103 | Robot's OPC-UA interface connection failure | Unable to establish a connection with the OPC-UA interface of the robot.<br>• Make sure Fanuc's HMI Device option R553 is installed on the robot.<br>• Check network: ensure network connectivity and settings.<br>• Inspect hardware: check physical connections.<br>• Contact support: seek further assistance if needed. |
| E104 | Robot SRVO-198 alarm detected | An unexpected error was detected during robot motion.<br>• If you are using Roboguide as robot, use Roboguide V9 Rev ZM or later.<br>• If you are using a real robot controller, contact support. |

| # | Title | Description and suggested actions |
|---|---|---|
| E105 | Incorrect payload detected | The collaborative robot has detected a discrepancy between the configured packaging weight and the actual weight of the packaging. This may indicate that the box is either underweight or overweight compared to expected parameters.<br>• Check the packaging weight in the recipe configuration.<br>• Make sure content of the packaging is correct and that there are no missing or additional items. |
| E106 | Next packaging placement calculation failure | The palletizer system has failed to compute the inverse kinematics solution for the next packaging placement.<br>• Make sure the target position for the packaging is within the robot's reachable workspace.<br>• Contact support: seek further assistance if needed. |
| 107 | Teach pendant e-stop | The emergency-stop button on the tablet teach pendant is pressed.<br>• Turn the emergency-stop button clockwise to release it. |
| 108 | Palletizer e-stop | The emergency-stop button on the palletizer is pressed.<br>• Twist the emergency-stop button clockwise to release it. |
| 109 | Robot SRVO-508 alarm detected | A large force has been applied to the collaborative sensors of the robot during palletizing process.<br>• Disable collaborative mode and jog the robot out of the collision.<br>• Reboot the robot.<br>• Contact support: seek further assistance if needed. |
| 110 | Palletizer internal software fault | The palletizer system has encountered an internal software fault..<br>• Restart the palletizer.<br>• Contact support: seek further assistance if needed. |
| 111 | Fanuc robot RMI system fault | The Fanuc robot has generated a system fault on the RMI (Remote Motion Interface).<br>• Review the specific alarm code and message generated by the Fanuc robot.<br>• Contact support: seek further assistance if needed. |
| 112 | Failed to resume production | The palletizer system is unable to resume production after a pause.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Contact support: seek further assistance if needed. |

| # | Title | Description and suggested actions |
|---|---|---|
| 113 | Robot's OPC-UA maximum connections reached | Unable to establish a connection with the OPC-UA interface of the robot because all 10 connections are used in the server.<br>• Power off and restart the palletizer.<br>• Contact support: seek further assistance if needed. |
| 114 | IO-Link LED control device bad response | The IO-Link device responsible for LED control has sent back a bad response.<br>• Make sure the LED control IO-Link device is configured and connected.<br>• Contact support: seek further assistance if needed. |
| 115 | IO-Link LED control device timeout | The IO-Link device responsible for LED control has failed to respond within the expected time frame, resulting in a timeout error.<br>• Make sure the LED control IO-Link device is configured and connected.<br>• Contact support: seek further assistance if needed. |
| 116 | LED control device error | The LED control module has generated an error.<br>• Make sure the LED control IO-Link device is configured and connected.<br>• Make sure MQTT broker is running.<br>• Contact support: seek further assistance if needed. |
| 117 | ConveyLinx infeed control device error | The ConveyLinx device responsible for the infeed control has failed to respond.<br>• Make sure the infeed ConveyLinx device is configured and connected.<br>• Contact support: seek further assistance if needed. |
| 118 | Fanuc robot motion cancelled alarm | The robot's motion has been cancelled due to an alarm.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |
| 119 | Fanuc robot motion paused servo-on alarm | The robot's motion has been paused due to an alarm.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |
| 120 | Fanuc robot motion paused servo-off alarm | The robot's motion has been paused due to an alarm.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |

| # | Title | Description and suggested actions |
|---|---|---|
| 121 | Gripper pick routine missing on robot | The specified pick routine has not been found on the robot.<br>• Check for the missing routine in the robot program.<br>• Make sure using custom routines that exist in the robot program. |
| 122 | Gripper blow-off routine missing on robot | The specified blow-off routine has not been found on the robot.<br>• Check for the missing routine in the robot program.<br>• Make sure using custom routines that exist in the robot program. |
| 123 | Gripper off routine missing on robot | The specified off routine has not been found on the robot.<br>• Check for the missing routine in the robot program.<br>• Make sure using custom routines that exist in the robot program. |
| 7015 | RMI_MOVE program selected on Teach pendant | The palletizer could not take control of the robot as the RMI_MOVE program is selected on the teach pendant.<br>• Select robot program "Empty" on the teach pendant. |
| 2556929 | RMIT-001 Internal system error | The RMI (Remote Motion Interface) has generated an internal system error.<br>• Power off to recover.<br>• If problem persists, reload the controller. |
| 2556930 | RMIT-002 Invalid UTOOL number | The user tool number is not valid.<br>• Make sure the tool number is within range. |
| 2556931 | RMIT-003 Invalid UFRAME number | The user frame number is not valid.<br>• Make sure the user frame number is within range. |
| 2556932 | RMIT-004 Invalid position register | The position register number is not valid.<br>• Make sure the position register number is within range. |
| 2556933 | RMIT-005 Invalid speed override | The speed override value is not valid.<br>• Make sure the speed override is set between 1 and 100. |
| 2556934 | RMIT-006 Cannot execute TP program. | The robot controller cannot start the Teach Pendant program execution in AUTO mode.<br>• Make sure the Teach Pendant is disabled and the controller is in AUTO mode.<br>• Clear/reset any error and make sure the controller's servo is ON before sending FRC_Initialize command. |
| 2556935 | RMIT-007 Controller servo is OFF | The robot controller's servo is off.<br>• Clear/reset any error. |

| # | Title | Description and suggested actions |
|---|---|---|
| 2556936 | RMIT-008 Teach Pendant is enabled | The robot controller's servo is off.<br>• Turn off the Teach pendant and put the robot controller in AUTO mode. |
| 2556937 | RMIT-009 RMI not running | The RMI TP program is not running.<br>• Use the FRC_Initialize command to start the RMI again. |
| 2556938 | RMIT-010 TP program not paused | The RMI TP program cannot be paused.<br>• Use commands FRC_Abort to abort the TP program and FRC_Initialize to restart the program. |
| 2556939 | RMIT-011 Cannot resume TP program | The RMI TP program cannot be resumed.<br>• Use command FRC_Initialize to restart the RMI. |
| 2556940 | RMIT-012 Cannot reset controller | The FRC_Reset command cannot clear all errors.<br>• Check robot controller for error that prevents the reset command. |
| 2556941 | RMIT-013 Invalid RMI command | The controller received an invalid command.<br>• Check the RMI manual to make sure the correct RMI command is sent to robot controller. |
| 2556942 | RMIT-014 RMI command fail | The RMI command failed. The RMI command has no effect on the robot controller due to current robot controller status. |
| 2556943 | RMIT-015 Invalid controller state | The controller is in error state when receiving the RMI command.<br>• Make sure the robot controller is in a valid state before sending RMI command. |
| 2556944 | RMIT-016 Cycle power | The RMI does not work when controller has HOT start enabled.<br>• Disable the Hot start for the next cycle start. Cycle power. |
| 2556945 | RMIT-017 Invalid payload schedule | The payload schedule number is invalid.<br>• Make sure a valid payload number is sent to the controller. |
| 2556946 | RMIT-018 Invalid motion option | An invalid motion option is in the motion instruction, or the controller is not loaded with the required option.<br>• Make sure to send the correct motion option to the controller. |
| 2556947 | RMIT-019 Invalid vision register | The input vision register number is not valid.<br>• Make sure the vision register number is within range. |
| 2556948 | RMIT-020 Invalid RMI instruction | An invalid TP instruction was received by the controller.<br>• Check instruction string to make sure the correct RMI instruction is sent to the robot controller.<br>• Make sure the number of executing instructions is less or equal to eight. |

| # | Title | Description and suggested actions |
|---|---|---|
| 2556949 | RMIT-021 Invalid value | The input value is out of acceptable range.<br>• Check the value specified in the text string to make sure it is within range. |
| 2556950 | RMIT-022 Invalid text string | The controller cannot parse the input text string.<br>• Check the text string to make sure it complies with the format specified in the manufacturer's manual. |
| 2556951 | RMIT-023 Invalid position data | The position data is invalid.<br>• Make sure the position data text complies with the specifications defined in the manufacturer's manual. |
| 2556952 | RMIT-024 RMI is in HOLD state | The RMI is in HOLD state due to error in previous instruction packet.<br>• Send the command FRC_Reset to reset the controller before sending new RMI instruction. |
| 2556953 | RMIT-025 Remote device disconnected | The remote device is not connected to the controller.<br>• Send the FRC_ Connect packet to the controller to establish the connection. |
| 2556954 | RMIT-026 Robot already connected | The robot is already connected to an external device.<br>• Make sure there is no other remote device connected to the robot controller.<br>• Or use FRC_Disconnect to disconnect the previous connection. |
| 2556955 | RMIT-027 Wait for command done | The controller is still executing the previous command.<br>• Wait for the controller to complete the current command before sending the next command packet. |
| 2556956 | RMIT-028 Wait for instruction done | The controller is still executing the previous instructions.<br>• Wait for the controller to complete the previous instruction before sending the next instruction packet. |
| 2556957 | RMIT-029 Invalid sequence ID number | The new instruction has an invalid sequence ID number.<br>• Make sure the sequence ID is consecutive and monotonic increasing before sending the next instruction packet. |
| 2556958 | RMIT-030 Invalid speed type | The motion instruction has an invalid speed type.<br>• Make sure the motion instruction includes the correct string for speed type. |
| 2556959 | RMIT-031 Invalid speed value | The motion instruction has an invalid speed value.<br>• Make sure the motion instruction includes the correct string for speed value. |

| # | Title | Description and suggested actions |
|---|---|---|
| 2556960 | RMIT-032 Invalid term type | The motion instruction has an invalid termination type.<br>• Make sure the motion string includes the correct termination type. |
| 2556961 | RMIT-033 Invalid term value | The motion instruction has an invalid termination value.<br>• Make sure the motion string includes the correct termination value. |
| 2556962 | RMIT-034 Invalid LCB port type | The motion instruction has an invalid local condition port type.<br>• Make sure the motion string includes the correct local condition port type. |
| 2556963 | RMIT-035 Invalid ACC value | The motion instruction has an invalid ACC value.<br>• Make sure the motion string includes the correct ACC value. |
| 2556964 | RMIT-036 Invalid destination position | The motion instruction has an invalid destination position.<br>• Make sure the motion string includes the correct destination position data. |
| 2556965 | RMIT-037 Invalid VIA position | The motion instruction has an invalid VIA position.<br>• Make sure the motion string includes the correct VIA position data. |
| 2556966 | RMIT-038 Invalid port number | The instruction has an invalid port number.<br>• Make sure the instruction string includes the correct port number. |
| 2556967 | RMIT-039 Invalid group number | The instruction has an invalid group number.<br>• Make sure the group number in the instruction string is a valid one. |
| 2556968 | RMIT-040 Invalid group mask | The instruction has an invalid group mask.<br>• Make sure the group mask in the instruction string matches the controller's configuration. |
| 2556969 | RMIT-041 Joint motion with COORD | The COORD option does not allow follower with joint motion.<br>• Change the motion type to linear motion. |
| 2556970 | RMIT-042 Incremental motion with COORD | The COORD option does not allow incremental motion.<br>• Remove the INC motion option. |
| 2556971 | RMIT-043 Robot in single step mode | The robot controller is in single STEP mode.<br>• Press the STEP button to disable the step mode. |
| 2556972 | RMIT-044 Invalid position data type | The position data is in a different representation than specified by the instruction.<br>• Change the position data to match the instruction's specification. |

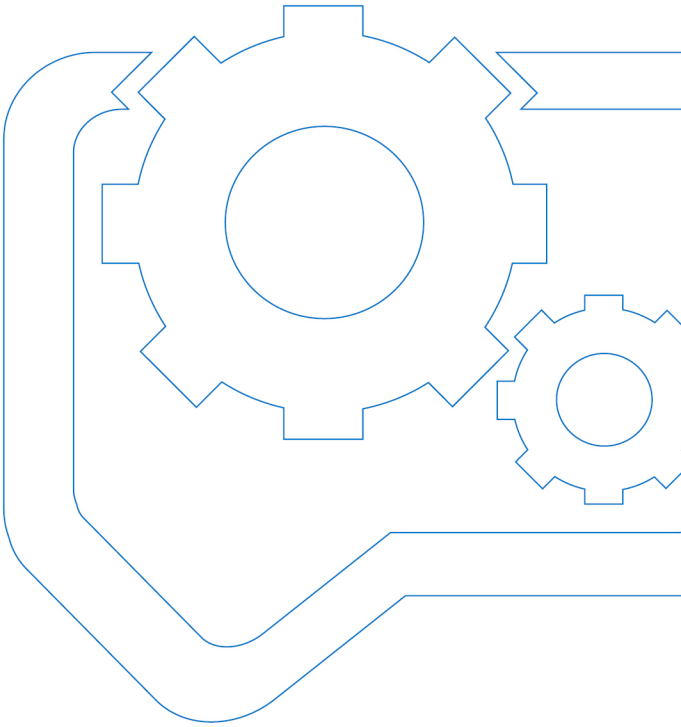
| # | Title | Description and suggested actions |
|---|---|---|
| 2556973 | RMIT-045 Not ready for ASCII packet | The RMI is not ready to receive the next ASCII instruction.<br>• Wait for FRC_AsbnReady before sending the next ASCII instruction. |
| 2556974 | RMIT-046 ASCII conversion failed | The RMI cannot convert the ASCII string to TP instruction.<br>• Check the ASCII string so it matches the text in the /MN section of a LS file. |
| 2556975 | RMIT-047 Invalid ASCII instruction | Some /MN ASCII instructions are not supported in RMI.<br>• Avoid using this ASCII instruction in RMI application. |
| 2556976 | RMIT-048 Invalid number of groups | The number of position data does not match the controller group number.<br>• Make sure the input packet has the correct number of position data that matches the group mask set by the FRC_Initialize command. |
| 2556977 | RMIT-049 Invalid instruction packet | The instruction packet is invalid when $RMI_CFG.$ASBN_ENB = TRUE.<br>• Set $RMI_CFG.$ASBN_ENB to FALSE and recycle power to use the instruction packet. |
| 2556978 | RMIT-050 Invalid ASCII packet | The ASCII packet is invalid when $RMI_CFG.$ASBN_ENB = FALSE.<br>• Set $RMI_CFG.$ASBN_ENB to TRUE and recycle power to use ASCII packet. |
| 2556979 | RMIT-051 Invalid ASCII string size | The ASCII string exceeds the 128 bytes limit.<br>• Make sure the ASCII string does not exceed 128 bytes. |
| 2556980 | RMIT-052 Invalid application tool | The controller has a different application tool setting than the specified tool string in FRC_Initialize packet.<br>• Make sure the TOOL value is compatible with the controller's application tool. |
| 2556981 | RMIT-053 Invalid call program name | The CALL program name is not valid.<br>• Provide an existing and valid TP program name for the CALL instruction. |
| 2556982 | RMIT-054 Joint motion with ALIM | Joint motion does not support ALIM motion option.<br>• Change the motion type to linear motion. |
| 2556983 | RMIT-055 ALIM option is not loaded | The controller does not have the ALIM option loaded.<br>• Load the ALIM (R921) option in the controller. |
| 640091152 | RMIT-016 HOT start enabled | The robot's RMI interface does not work when the controller has HOT start enabled.<br>• Try starting the production again.<br>• If the error is still present, cycle power. |

## 6.3 Warnings

| # | Title | Description and suggested actions |
|---|---|---|
| W1 | Robot battery is low | The battery in the Fanuc robot is either low or dead.<br>• Replace the battery with a new one.<br>• Make sure that the replacement battery is compatible and properly installed.<br>• Contact Support: seek further assistance if needed. |

## 6.4 Information

| # | Title | Description and suggested actions |
|---|---|---|
| I1 | Left pallet full | The left pallet is full and requires replacement with an empty pallet.<br>• Remove the full pallet from the palettizing station and replace it with an empty pallet. |
| I2 | Right pallet full | The right pallet is full and requires replacement with an empty pallet.<br>• Remove the full pallet from the palettizing station and replace it with an empty pallet. |
| I118 | Fanuc robot motion cancelled | The robot's motion has been cancelled due to an alarm.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |
| I119 | Fanuc robot motion paused servo-on alarm | The robot's motion has been paused due to an alarm.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |
| I120 | Fanuc robot motion paused servo-off alarm | The robot's motion has been paused due to an alarm.<br>• Check the specific alarm code and message generated by the Fanuc robot.<br>• Power on the robot to clear the alarm.<br>• Contact support: seek further assistance if needed. |



# 7 Maintenance

This section describes maintenance procedures for the machine. Since the following information has a direct impact on the safety of workers, take the time to read it carefully.

It is the owner's responsibility to maintain the equipment in good working order. Damaged parts must be replaced as soon as possible. Any further damages on the equipment, the product or worker due to not replacing these parts are the owner's responsibility.

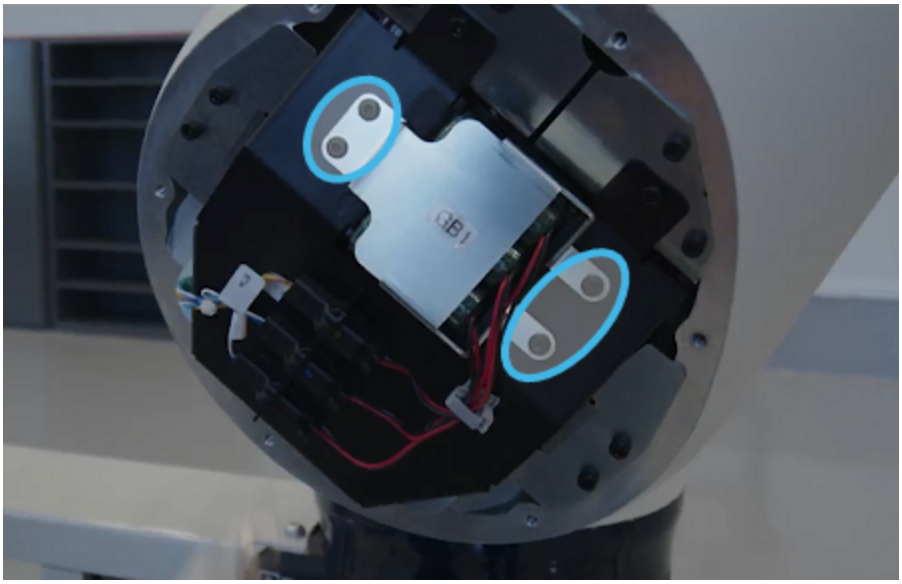
## 7.1 Robot Battery Replacement

**CAUTION**
**When replacing the batteries, be sure that the control power is ON. Otherwise, mastering data loss will occur.**

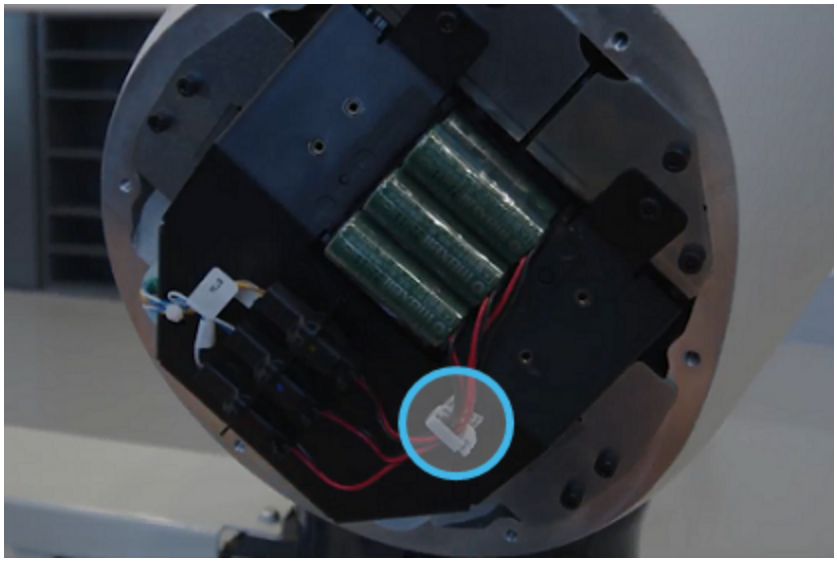
The robot includes three lithium batteries which keep in memory the robot calibration when it is switched to off. When the robot is powered, the batteries are not used because the main electrical panel feeds the robot memory to keep the calibration active. The batteries are located under a cover on the J2 axis part of the robot.

1. Using an hex key wrench (Allen key), unscrew all bolts holding the battery cover panel and remove it.

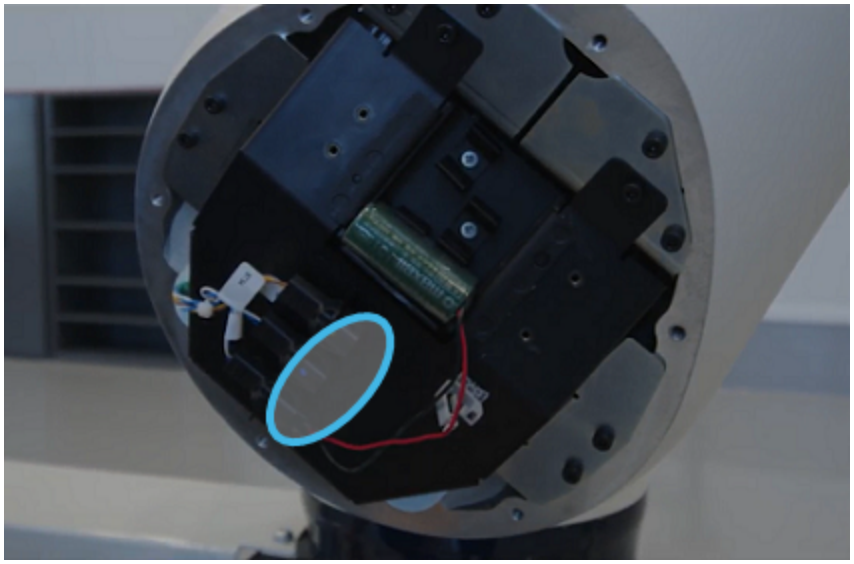
2. Unscrew and remove the battery holding plate.



3. Open the clip securing the wires.



4. Unplug and remove the batteries one by one.

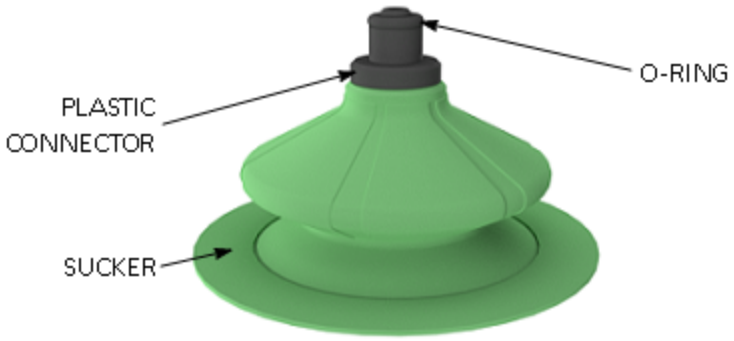


5. Place and plug the new batteries.
6. Insert all battery wires in the plastic clip and lock it.
7. Put the battery holding plate and the cover panel back in place.

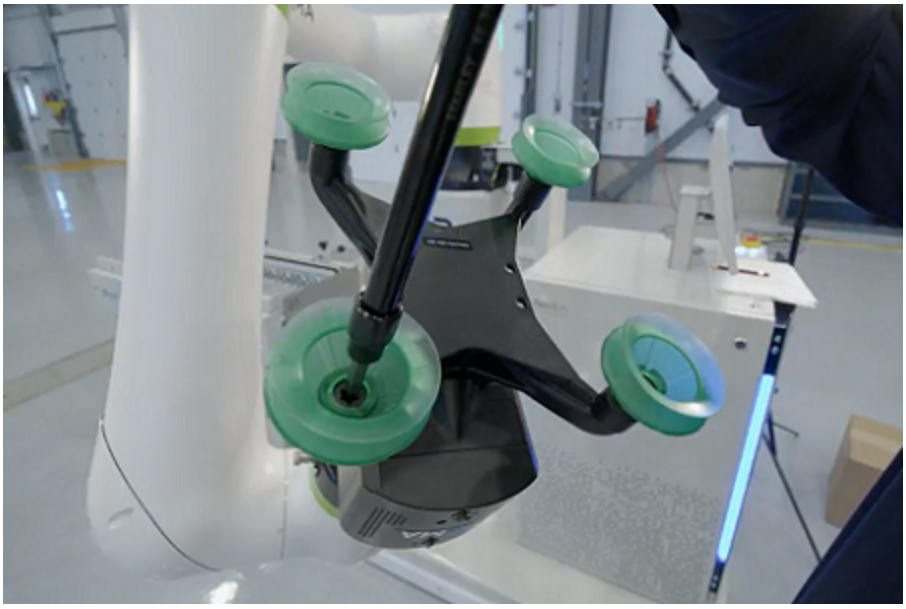
For more details about replacing the battery, refer to the FANUC excerpt included in the Appendices section.

## 7.2 Gripper Suction Cup Replacement

If a suction cup of a gripper is damaged, it can be replaced as follows.



1. Insert a hex key wrench (Allen key) inside the suction cup cavity.



2. Turn 3/4 counterclockwise to unlock and remove the cup. Make sure the o-ring on top of the plastic connector comes off with the cup; if not, remove it from the gripper.
3. Place the new suction cup and screw in place by turning the hex key 3/4 clockwise.

## 7.3 Maintenance Tables

The following tables indicate the preventive maintenance required for each module of the equipment. The frequency of maintenance corresponds to a production schedule of 8 hours a day, 7 days a week and can be adapted to real production hours, mechanical problems encountered, environment, etc. A checklist for the maintenance personnel can also be drawn up using this information.

Inspect all equipment parts to make sure everything is in good working order. Check any sound or vibration that seems suspect. Immediately correct any abnormal situation.

### 7.3.1 At Each Levelling

| Location (module) | Task |
|---|---|
| Levelling feet | Add anti seize on levelling feet when there is no more. |

### 7.3.2 Daily Maintenance

| Location (module) | Task |
|---|---|
| General | Check general condition of equipment. Correct any abnormal situation. |
| Pneumatic system | Inspect the filter bowl and remove condensate. Replace the filter element if necessary. |
| Gripper | Check for any abnormal noise when a unit is picked. |

### 7.3.3 Weekly Maintenance

| Location (module) | Task |
|---|---|
| General | Inspect fan of robot controller. Clean using an air jet. |
| Pneumatic System | Check air pressure and adjust if necessary. |
| Pneumatic System | Inspect pneumatic fittings (check for leakage). Replace if necessary. |
| Conveyor | Inspect and clean elastic roller belts. Replace if necessary. |
| Conveyor | Clean photoelectric sensors. Use an air blast or a dry cloth. |

### 7.3.4 Monthly Maintenance

| Location (module) | Task |
|---|---|
| Conveyor | Inspect rollers. Clean or replace if necessary. |
| Conveyor | Check wear of elastic roller belts. Replace if necessary. |
| Conveyor | Inspect photoelectric sensors. Align, tighten and/or replace if necessary |
| Gripper | Inspect suctions cups and check wear. Clean using a wet soft cloth. Replace if necessary. |
| Gripper | Check if vacuum generators of connecting device are dirty. Clean if necessary. |
| Gripper | Check if muffler of connecting device is dirty (foam inside is off-color). Replace if necessary. |

### 7.3.5 Biannual Maintenance (Every 6 Months)

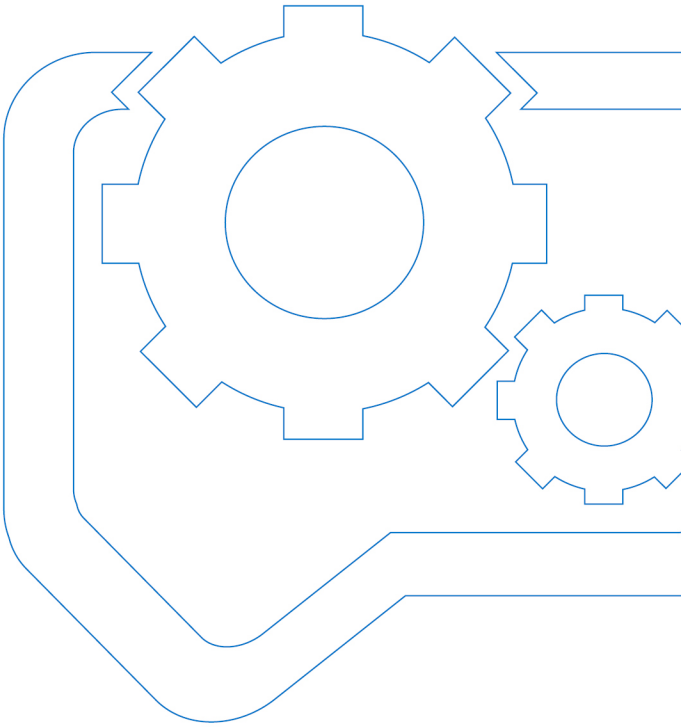
| Location (module) | Task |
|---|---|
| Conveyor | Inspect motor drive rollers. Clean or replace if necessary. |
| Gripper | Check if connections are secure (tubing, electrical cable, suction cups). |

### 7.3.6 Yearly Maintenance

| Location (module) | Task |
|---|---|
| General | Tighten all electric terminals. |
| General | Inspect bolts and tighten if necessary. |
| Pneumatic System | Replace air filters. |
| Pneumatic System | Replace silencer (more often if necessary). |
| Conveyor | Check wear of rollers. Replace if necessary. |

### 7.3.7 Biennial Maintenance (Every Two Years)

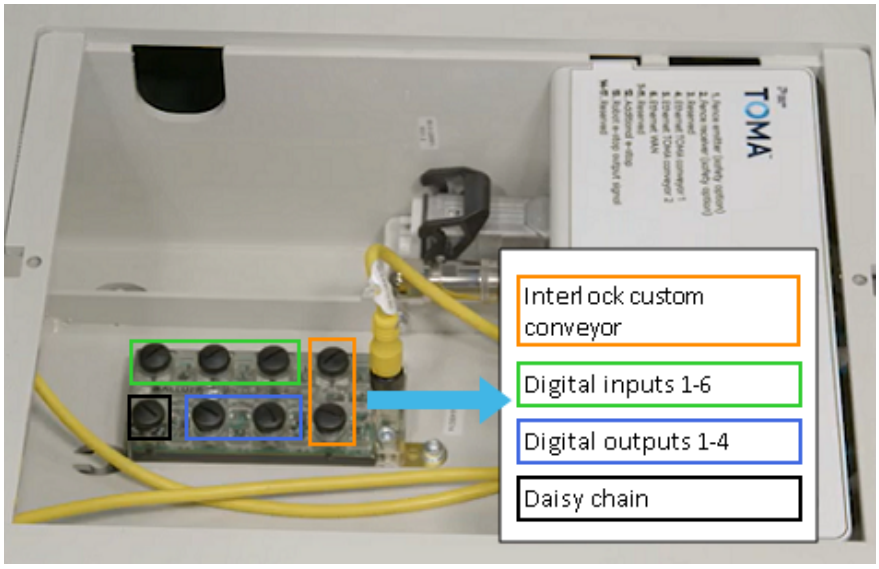
| Location (module) | Task |
|---|---|
| Pneumatic system | Replace the filter element of the filter-regulator unit (or when the pressure drop becomes 0.1 MPa). |



# 8 Appendices

## IO Link Module Mapping

The connection panel includes an IO Link module that is used to setup inputs with the Fanuc robotic arm. Below are listed the various ports of the module and their associated robot input.




| IO link port | Robot digital input | |
|---|---|---|
| 0 | DI[120] | Box ready custom infeed 1 |
| | DO[121] | Ready to receive infeed 1 |
| 1 | DI[122] | Box ready custom infeed 2 |
| | DO[123] | Ready to receive infeed 2 |
| 2 | DI[124] | General input |
| | DI[125] | General input |
| 3 | DO[126] | General output |
| | DO[127] | General output |
| 4 | DI[128] | General input |
| | DI[129] | General input |
| 5 | DO[131] | General output |
| | DO[132] | General output |
| 6 | DI[133] | General input |

| IO link port | Robot digital input | |
|---|---|---|
| | DI[134] | General input |
| 7 | DI[135] | Reserved |
| | DI[136] | Reserved |

## Numeric Registers

Below is the list of all robot numeric registers used by the TOMA palletizer. Some of these registers can be used in custom routines.

| Regis. | Description | Regis. | Description | Regis. | Description |
|---|---|---|---|---|---|
| 1 | Base Height (mm) | 41 | Tool and Packaging Inertia Iy (kg·cm²) | 104 | Left Pallet Packaging Mass (kg) |
| 2 | Left Light State | 42 | Tool and Packaging Inertia Iz (kg·cm²) | 105 | Left Pallet Packaging Center of Mass X (cm) |
| 3 | Center Light State | 43 | Speed Override (%) | 106 | Left Pallet Packaging Center of Mass Y (cm) |
| 4 | Right Light State | 44-50 | Reserved | 107 | Left Pallet Packaging Center of Mass Z (cm) |
| 5-10 | Reserved | 51 | Infeed 1 Reference Pose X (mm) | 108 | Left Pallet Slip Sheet Height (mm) |
| 11 | Next Pick Pose X (mm) | 52 | Infeed 1 Reference Pose Y (mm) | 109 | Left Pallet Packaging Total |
| 12 | Next Pick Pose Y (mm) | 53 | Infeed 1 Reference Pose Z (mm) | 110 | Left Pallet Packaging Counter |
| 13 | Next Pick Pose Z (mm) | 54 | Infeed 1 Reference Pose W (deg) | 111 | Left Pallet Remaining Time (sec) |
| 14 | Next Pick Pose W (deg) | 55 | Infeed 1 Reference Pose P (deg) | 112 | Left Pallet Infeed Type (1/2/3) |
| 15 | Next Pick Pose P (deg) | 56 | Infeed 1 Reference Pose P (deg) | 113 | Left Pallet Infeed Connector (1/2) |
| 16 | Next Pick Pose R (deg) | 57 | Infeed 1 Packaging Ready (0/1) | 114-120 | Reserved |
| 17 | Next Place Pose X (mm) | 58 | Infeed 1 Guardrail Height (mm) | 121 | Right Pallet Reference Pose X (mm) |
| 18 | Next Place Pose Y (mm) | 59-70 | Reserved | 122 | Right Pallet Reference Pose Y (mm) |
| 19 | Next Place Pose Z (mm) | 71 | Infeed 2 Reference Pose X (mm) | 123 | Right Pallet Reference Pose Z (mm) |
| 20 | Next Place Pose W (deg) | 72 | Infeed 2 Reference Pose Y (mm) | 124 | Right Pallet Reference Pose W (deg) |
| 21 | Next Place Pose P (deg) | 73 | Infeed 2 Reference Pose Z (mm) | 125 | Right Pallet Reference Pose P (deg) |
| 22 | Next Place Pose R (deg) | 74 | Infeed 2 Reference Pose W (deg) | 126 | Right Pallet Reference Pose P (deg) |
| 23 | Next Slip Sheet Pose X (mm) | 75 | Infeed 2 Reference Pose P (deg) | 127 | Right Pallet Detected (0/1) |
| 24 | Next Slip Sheet Pose Y (mm) | 76 | Infeed 2 Reference Pose P (deg) | 128 | Right Pallet Dimension Width (mm) |
| 25 | Next Slip Sheet Pose Z (mm) | 77 | Infeed 2 Packaging Ready (0/1) | 129 | Right Pallet Dimension Height (mm) |
| 26 | Next Slip Sheet Pose W (deg) | 78 | Infeed 2 Guardrail Height (mm) | 130 | Right Pallet Dimension Length (mm) |
| 27 | Next Slip Sheet Pose P (deg) | 79-90 | Reserved | 131 | Right Pallet Packaging Dimension Width (mm) |

| Regis. | Description | Regis. | Description | Regis. | Description |
|---|---|---|---|---|---|
| 28 | Next Slip Sheet Pose R (deg) | 91 | Left Pallet Reference Pose X (mm) | 132 | Right Pallet Packaging Dimension Height (mm) |
| 29 | Tool Mass (kg) | 92 | Left Pallet Reference Pose Y (mm) | 133 | Right Pallet Packaging Dimension Length (mm) |
| 30 | Tool Center of Mass X (cm) | 93 | Left Pallet Reference Pose Z (mm) | 134 | Right Pallet Packaging Mass (kg) |
| 31 | Tool Center of Mass Y (cm) | 94 | Left Pallet Reference Pose W (deg) | 135 | Right Pallet Packaging Center of Mass X (cm) |
| 32 | Tool Center of Mass Z (cm) | 95 | Left Pallet Reference Pose P (deg) | 136 | Right Pallet Packaging Center of Mass Y (cm) |
| 33 | Tool Inertia Ix (kg·cm²) | 96 | Left Pallet Reference Pose P (deg) | 137 | Right Pallet Packaging Center of Mass Z (cm) |
| 34 | Tool Inertia Iy (kg·cm²) | 97 | Left Pallet Detected (0/1) | 138 | Right Pallet Slip Sheet Height (mm) |
| 35 | Tool Inertia Iz (kg·cm²) | 98 | Left Pallet Dimension Width (mm) | 139 | Right Pallet Packaging Total |
| 36 | Tool and Packaging Mass (kg) | 99 | Left Pallet Dimension Height (mm) | 140 | Right Pallet Packaging Counter |
| 37 | Tool and Packaging Center of Mass X (cm) | 100 | Left Pallet Dimension Length (mm) | 141 | Right Pallet Packaging Counter |
| 38 | Tool and Packaging Center of Mass Y (cm) | 101 | Left Pallet Packaging Dimension Width (mm) | 142 | Right Pallet Infeed Type (1/2/3) |
| 39 | Tool and Packaging Center of Mass Z (cm) | 102 | Left Pallet Packaging Dimension Height (mm) | 143 | Right Pallet Infeed Connector (1/2) |
| 40 | Tool and Packaging Inertia Ix (kg·cm²) | 103 | Left Pallet Packaging Dimension Length (mm) | 144-250 | Reserved |

## Fanuc Documentation

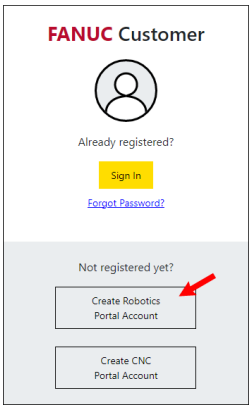
For best use of the FANUC robot included in your system, refer to FANUC eDocs, which are available through an online customer portal.

## Customer Portal Account

FANUC customers in the United States and Canada can log into the online **MyPortal** to view account information, get user manuals and access the iStore to purchase replacement parts.

### To register and create an account

1. Visit https://myportal.fanucamerica.com.
2. Click on **Create Robotics Portal Account**.




3. Fill all required information, including the robot serial number (F#).

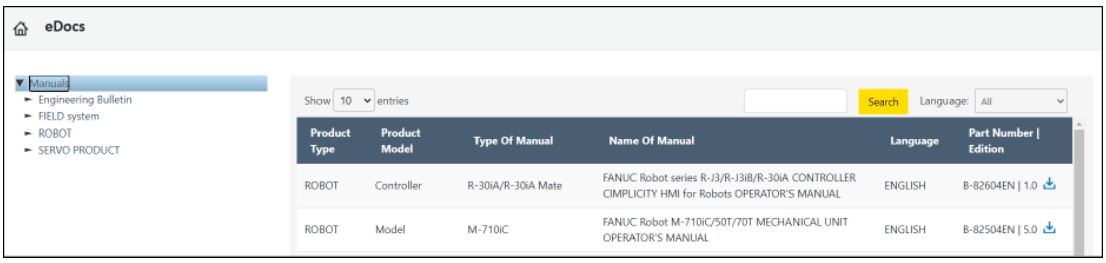
> The F# can be found on the robot itself and is usually hand written on the Inspection Datasheet. Note that the robot must be registered beforehand by Premier Tech for the creation of the account to work.

4. Click on **Submit Form**.

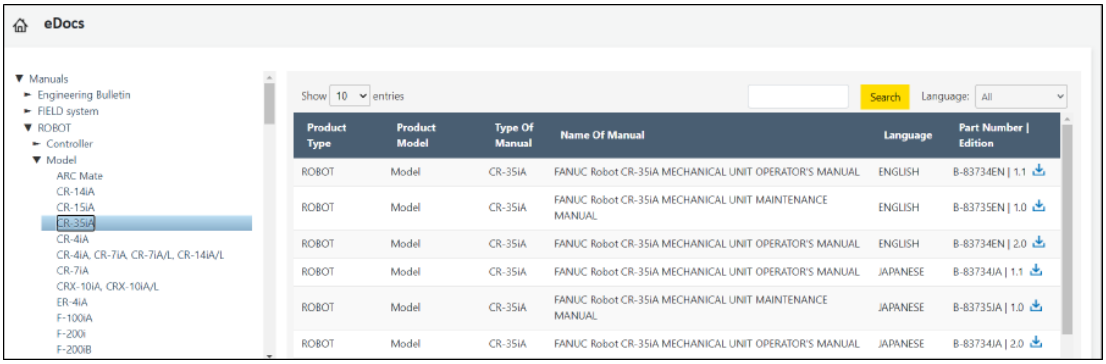
## Finding User Manuals

1. Open eDocs by clicking on **eDocs** in the Customer Portal homepage, or by selecting **Support** > **Support Tools** > **eDocs**.

2. In the navigation tree on the left, click on **Manuals** or on any product name to expand the tree and display the document product listing.




3. Navigate the tree to deeper levels to filter the displayed manual list.




4. Use the **Search** box to refine the filtered results.

> The eDoc search function searches text strings of the manual title or part number. To optimize the search, type a full product name such as R-2000iC or CR-7iA instead of R2000 or CR7.

5. Use the **Find** function (CTRL+F) to highlight an item in the filtered list. For example, press CTRL+F, type JAPANESE and press **Enter** to highlight the Japanese manuals.

6. Use the **Language** box to filter manuals by language.

## Recommended eDocs

We suggest consulting the following Fanuc eDocs to find information complementary to Premier Tech's Operating and Maintenance Manual.

- FANUC Robot series SAFETY HANDBOOK (general safety information that can be found in the **Others** section of the **Manuals** menu).

- FANUC Robot series R-30iB OPERATOR'S MANUAL (robot controller manual that can be found in the **Controller>R-30iB/R-30iB Mate** section of the **Manuals** menu).
- FANUC Robot MECHANICAL UNIT OPERATOR'S MANUAL (robot arm manual, varies according to model, can be found in the **Models** section of the **Manuals** menu).

## eDoc Excerpts

To complete the information about the troubleshooting and/or maintenance of your equipment, a few hints from FANUC's mechanical documentation are presented in the following pages (periodic maintenance, robot mastering, etc.). These documents are only excerpts from the complete FANUC Robotics documentation. Despite our efforts, they might not be up-to-date. Please refer to the above-mentioned eDocs to have the accurate version.

# 7 CHECKS AND MAINTENANCE

Optimum performance of the robot can be maintained by performing the periodic maintenance procedures presented in this chapter. (See APPENDIX A PERIODIC MAINTENANCE TABLE.)

**NOTE**
The periodic maintenance procedures described in this chapter assume that the FANUC robot is used for up to 3840 hours a year. In cases where robot use exceeds 3840 hours/year, adjust the given maintenance frequencies accordingly. The ratio of actual operating time/year vs. the 3840 hours/year should be used to calculate the new (higher) frequencies. For example, when using the robot 7680 hours a year with a recommended maintenance interval of 3 years or 11520 hours, use the following calculation to determine the maintenance frequency: 3 years / 2 = perform maintenance every 1.5 years.

## 7.1 PERIODIC MAINTENANCE

### 7.1.1 Daily Checks

Check the following items when necessary before daily system operation.

| Check items | Check points and management |
|---|---|
| Oil seepage | Check to see if there is oil on the sealed part of each joint. If there is an oil seepage, clean it.<br>**⇒"7.2.1 Confirmation of Oil Seepage"** |
| Air control set | (When air control set is used)<br>**⇒"7.2.2 Confirmation of the Air Control Set"** |
| Vibration, abnormal noises | Check whether vibration or abnormal noises occur.<br>When vibration or abnormal noises occur, perform measures referring to the following section:<br>**⇒"9.1 TROUBLESHOOTING" (symptom : Vibration, Noise)** |
| Positioning accuracy | Check that the taught positions of the robot have not deviated from the previously taught positions. If displacement occurs, perform the measures as described in the following section:<br>**⇒"9.1 TROUBLESHOOTING" (symptom : Displacement)** |
| Peripheral devices for proper operation | Check whether the peripheral devices operate properly according to commands from the robot and the peripheral devices. |
| Brakes for each axis | Check that the droppage of the end effector is within 5 mm when the servo power turned off. If the end effector (hand) drops, perform the measures as described in the following section:<br>**⇒"9.1 TROUBLESHOOTING" (symptom : Dropping axis)** |
| Warnings | Check whether unexpected warnings occur in the alarm screen on the teach pendant. If unexpected warnings occur, perform the measures as described in the following manual:<br>**⇒"CONTROLLER OPERATOR'S MANUAL (Alarm Code List)(B-83284EN-1)"** |

## 7.1.2 Periodic Check and Maintenance

Check the following items at the intervals recommended below based on the total operating time or the accumulated operating time, whichever comes first. (○ : Item needs to be performed.)

| Check and maintenance intervals (Operating time, Accumulated operating time) | | | | | | | Check and maintenance item | Check points, management and maintenance method | Periodic maintenance table No. |
|---|---|---|---|---|---|---|---|---|---|
| 1 month 320h | 3 months 960h | 1 year 3840h | 2 years 7680h | 3 years 11520h | 4 years 15360h | 8 years 30720h | | | |
| ○ Only 1st check | ○ | | | | | | Cleaning the controller ventilation system | Confirm the controller ventilation system is not dusty. If dust has accumulated, remove it. | 9 |
| | ○ | | | | | | Check for external damage | Check whether the robot has external damage due to the interference with the peripheral devices. If an interference occurs, eliminate the cause. Also, if the external damage is serious and causes a problem in which the robot cannot be used, replace the damaged parts. (Perform diary checks for green covers.) | 1 |
| | ○ | | | | | | Check for water | Check whether the robot is subjected to water or cutting oils. If water is found, remove the cause and wipe off the liquid. | 2 |
| | ○ Only 1st check | ○ | | | | | Check for damages to the teach pendant cable, the operation box connection cable or the robot connection cable | Check whether the cable connected to the teach pendant, operation box and robot are unevenly twisted or damaged. If damage is found, replace the damaged cables. | 8 |
| | ○ Only 1st Check | ○ | | | | | Check for damage to the end effector (hand) connection cable | Check whether the end effector connection cables are unevenly twisted or damaged. If damage is found, replace the damaged cables. | 3 |
| | ○ Only 1st check | ○ | | | | | Check the exposed connectors | Check the connection of exposed connectors. **⇒"7.2.2 Check the Mechanical Unit Connectors"** | 4 |
| | ○ Only 1st check | ○ | | | | | Retightening the end effector mounting bolts | Retighten the end effector mounting bolts. Refer to the following section for tightening torque information: **⇒"4.1 END EFFECTOR INSTALLATION TO WRIST"** | 5 |
| | ○ Only 1st check | ○ | | | | | Retightening the external main bolts | Retighten the robot installation bolts (according to procedure in Section 1.2), bolts to be removed for inspection, and bolts exposed to the outside. Refer to the recommended bolt tightening torque guidelines at the end of the manual. An adhesive to prevent bolts from loosening is applied to some bolts. If the bolts are tightened with greater than the recommended torque, the adhesive might be removed. Therefore, follow the recommended bolt tightening torque guidelines when retightening the bolts. | 6 |

| Check and maintenance intervals (Operating time, Accumulated operating time) | | | | | | | Check and maintenance item | Check points, management and maintenance method | Periodic maintenance table No. |
|---|---|---|---|---|---|---|---|---|---|
| 1 month 320h | 3 months 960h | 1 year 3840h | 2 years 7680h | 3 years 11520h | 4 years 15360h | 8 years 30720h | | | |
| | ○ Only 1st check | ○ | | | | | Clean spatters, sawdust and dust | Check that spatters, sawdust, or dust does not exist on the robot main body. If dust has accumulated, remove it. Especially, clean the robot movable parts well (each joint, surroundings of the wrist flange, conduit part, wrist axis hollow part). | 7 |

# 7.2 CHECK POINTS

## 7.2.1 Confirmation of Oil Seepage

Check items

Check there is oil on sealed part of each joint parts. If there is oil seepage, clean them.

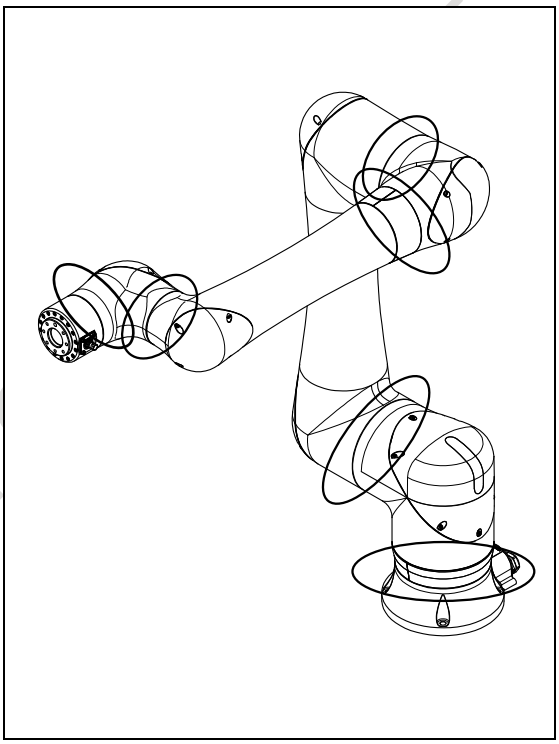


**Fig. 7.2.1 (a) Check parts of oil seepage**

Management

- Oil might accumulate on the outside of the seal lip depending on the movement condition or environment of the axis. If the oil changes to a state of liquid, the oil might fall depending on the axis movement. To prevent oil spots, be sure to wipe away any accumulated oil under the axis components as shown in Fig. 7.2.1 (a) before you operate the robot.

  If you must wipe oil frequently, and opening the grease outlet does not stop the seepage, perform the measures below.

  **⇒"9.1 TROUBLESHOOTING"(symptom : Grease leakage )**

## 7.2.2 Confirmation of the Air Control Set (option)

When an air control set is used, check the items below.

| Item | Check items | Check points |
|---|---|---|
| 1 | Air pressure | Check the air pressure using the pressure gauge on the air control set as shown in Fig. 7.2.2 (a). If it does not meet the specified pressure of 0.49 to 0.69 MPa (5-7 kgf/cm$^2$), adjust it using the regulator pressure-setting handle. |
| 2 | Lubricator oil mist quantity | Check the number of oil drops during operation. If it does not meet the specified value (1 drop/10-20 sec), adjust it using the handle for lubricator adjustment.<br>The lubricator becomes empty in about 10 to 20 days under normal operation. |
| 3 | Lubricator oil level | Check to see that the air control set oil level is within the specified level. |
| 4 | Leakage from hose | Check the joints, tubes, etc. for leaks. Retighten the joints or replace parts, as required. |
| 5 | Drain | Check the drain and release it. When quantity of the drain is remarkable, examine the setting of the air dryer to the air supply side. |

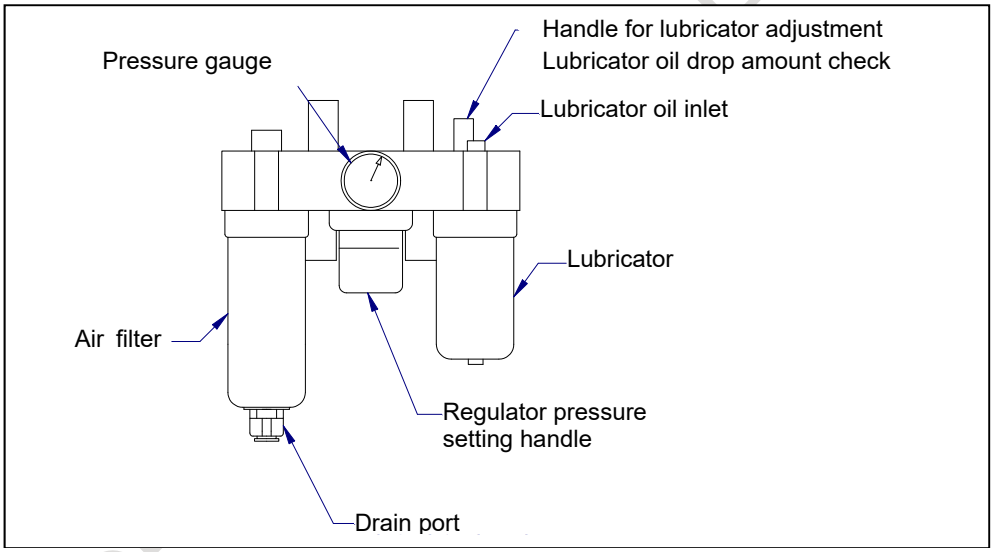



**Fig. 7.2.2 (a) Air control set (option)**

## 7.2.3 Check the Mechanical Unit Connectors

### Inspection points of the connectors

- Robot connection cables, earth terminal and user cables

### Check items

- Circular connector: Check the connector for tightness by turning it manually.
- Earth terminal: Check the terminal for tightness.

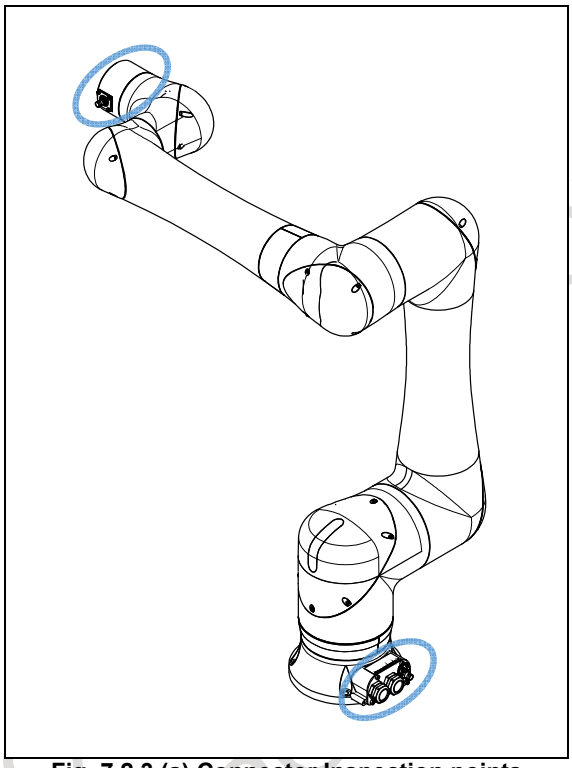


**Fig. 7.2.3 (a) Connector Inspection points**

# 7.3 MAINTENANCE

## 7.3.1 Replacing the Batteries

The position data of each axis is preserved by the backup batteries. Please use the following procedure to replace when the backup battery voltage drop alarm occurs.

### Procedure of replacing the battery (CRX-5iA)

1 Keep the power on. Press the EMERGENCY STOP button to prohibit the robot motion.

> **⚠ CAUTION**
> Be sure to keep the power on. Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, mastering will be required again.

2 Remove the bolts and the J3 arm root side cover.
3 Remove the cable connector of the batteries.
4 Remove cover plate of the battery.
5 Take out the old batteries (3 pcs) from the battery case. Then replace the batteries (3 pcs).
6 Assemble them by reversing the sequence. The gasket is reusable.

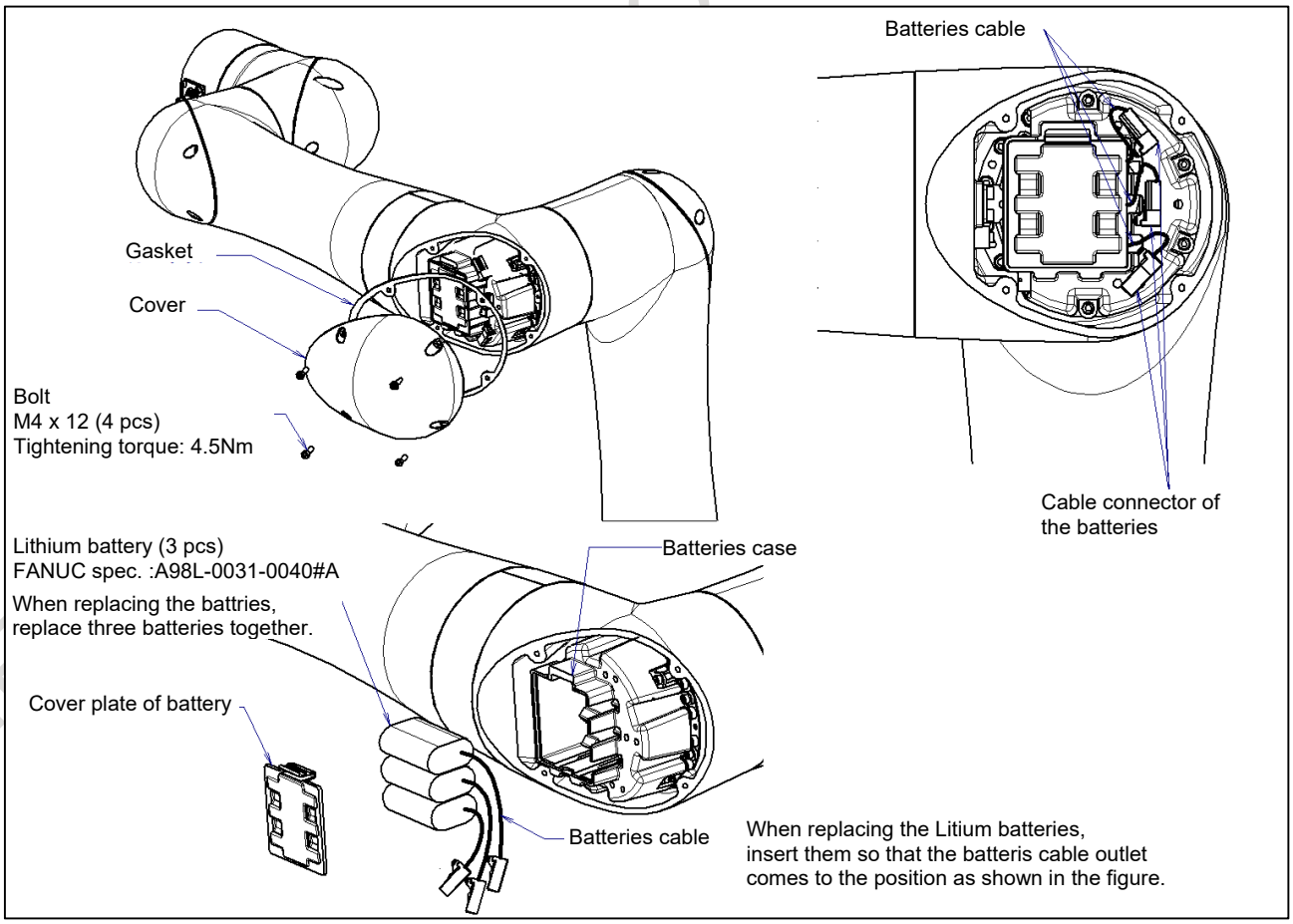



**Fig. 7.3.1 (a) Replacing the battery (CRX-5*i*A)**

## Procedure of replacing the battery (CRX-10*i*A, CRX-10*i*A/L, CRX-20*i*A/L)

1 Keep the power on. Press the EMERGENCY STOP button to prohibit the robot motion.

> ⚠ **CAUTION**
> Be sure to keep the power on. Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, mastering will be required again.

2 Remove the bolts and the J2 arm root side cover.
3 Remove the cable connector of the batteries.
4 Remove bolt s and cover plate of the battery.
5 Take out the old batteries (2 pcs) from the battery case. Then replace the batteries (2 pcs).
6 Assemble them by reversing the sequence. The gasket is reusable.

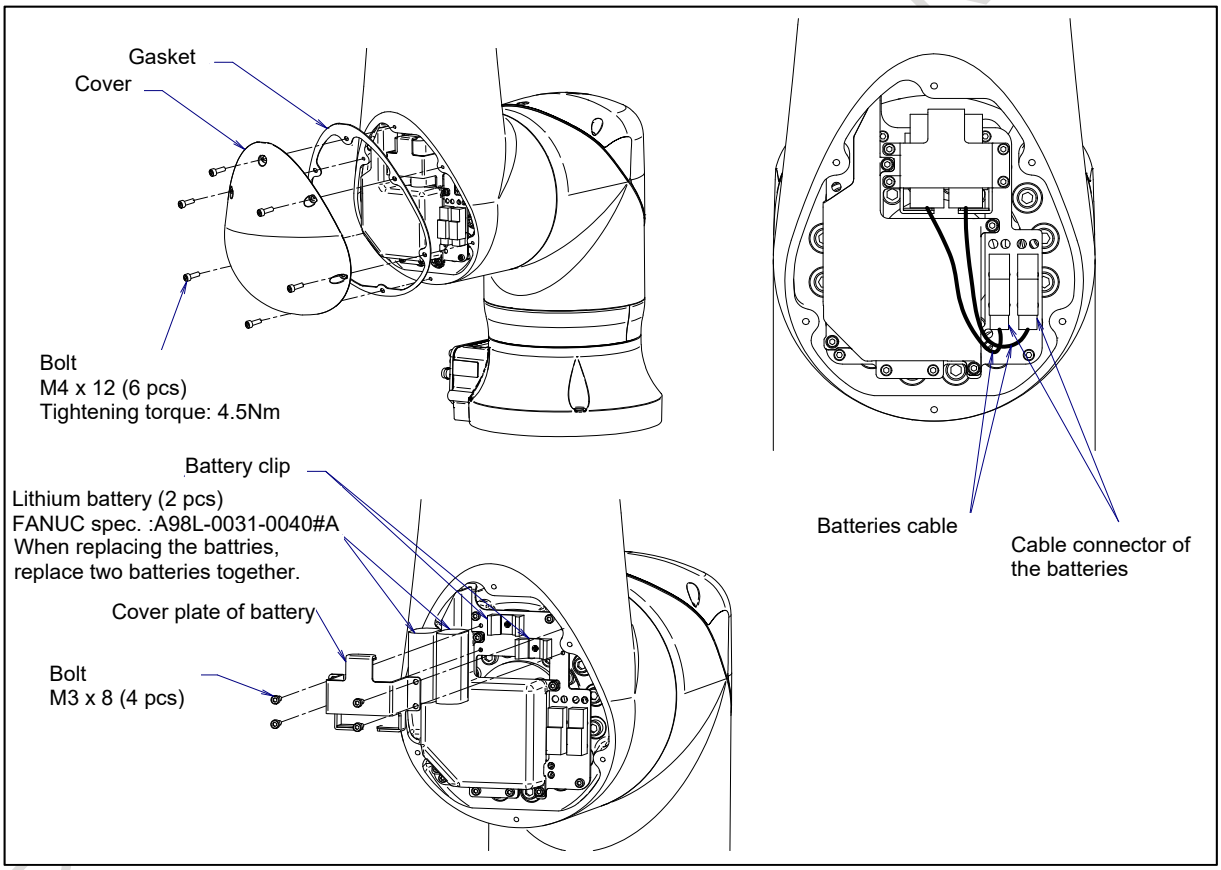



**Fig. 7.3.1 (b) Replacing the battery (CRX-10*i*A, CRX-10*i*A/L, CRX-20*i*A/L)**

## Procedure of replacing the battery (CRX-25*i*A)

1 Keep the power on. Press the EMERGENCY STOP button to prohibit the robot motion.

> **⚠ CAUTION**
> Be sure to keep the power on. Replacing the batteries with the power supply turned off causes all current position data to be lost. Therefore, mastering will be required again.

2 Remove the bolts and the J2 arm root side cover.
3 Remove the cable connector of the batteries.
4 Remove bolts and cover plate of the battery.
5 Open the cable clip and pick out batteries cable.
6 Take out the old batteries (3 pcs) from the battery case. Then replace the batteries (3 pcs).
7 Assemble them by reversing the sequence. The gasket is reusable.

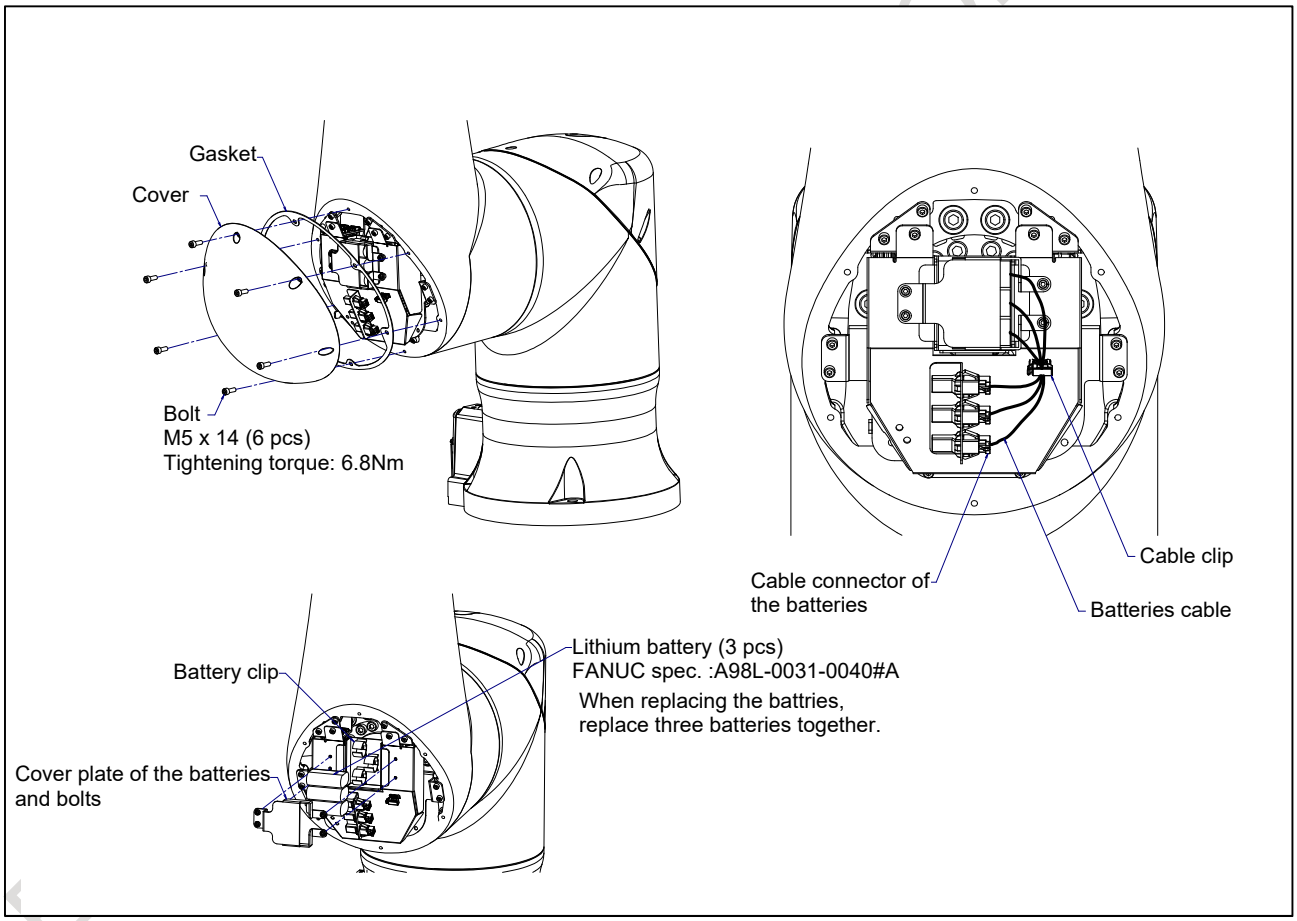



**Fig. 7.3.1 (c) Replacing the battery (CRX-25*i*A)**

# 7.4 STORAGE

When storing the robot, place it on a level surface with the same posture for transportation. (See Section 1.1.)

# 8 MASTERING

Mastering associates the angle of each robot axis with the pulse count value supplied from the absolute Pulsecoder connected to the corresponding axis motor. To be specific, mastering is an operation for obtaining the pulse count value; corresponding to the zero position.

## 8.1 OVERVIEW

The current position of the robot is determined according to the pulse count value supplied from the Pulsecoder on each axis.
Mastering is factory-performed. It is unnecessary to perform mastering in daily operations. However, mastering is required under the following conditions:

- Motor replacement.
- Pulsecoder replacement
- Reducer replacement
- Cable replacement
- Batteries for pulse count backup in the mechanical unit have gone dead

> ⚠ **CAUTION**
> Robot data (including mastering data) and Pulsecoder data are backed up by their respective backup batteries. Data will be lost if the batteries die. Replace the batteries in the controller and mechanical units periodically. An alarm will alert you when battery voltage is low.

### Types of Mastering

There are following mastering methods.

**Table 8.1 (a) Type of mastering**

| | |
|---|---|
| Fixture position mastering | Mastering performed with the mastering fixture. |
| Zero-position mastering (witness mark mastering) | Mastering which performed with all axes set at the 0-degree position. A zero-position mark (witness mark) is attached to each robot axis. This mastering is performed with all axes aligned to their respective witness marks. |
| Quick mastering | This is performed at a user-specified position. The corresponding count value is obtained from the rotation count of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost. (All axes at the same time) |
| Quick mastering for single axis | This is performed at a user-specified position for one axis. The corresponding count value is obtained from the rotation count of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost. |
| Single axis mastering | Mastering which performed for one axis at a time. The mastering position for each axis can be specified by the user. Useful in performing mastering on a specific axis. |
| Mastering data entry | Enter the Mastering data directly. |

This section describes zero-position mastering, quick mastering, quick mastering for single axis, single-axis mastering, and mastering data entry. For more detailed mastering (fixture position mastering), contact your local FANUC representative.

This section describes zero-position mastering, quick mastering, single-axis mastering, and mastering data entry. For more detailed mastering (fixture position mastering), contact your local FANUC representative.

> **⚠ CAUTION**
> 1 If mastering is performed incorrectly, the robot may behave unexpectedly. This is very dangerous. For this reason, the Master/Cal screen is designed to appear only when the $MASTER_ENB system variable is 1 or 2. After performing positioning, press F5, ([DONE]) on the Master/Cal screen. The $MASTER_ENB system variable is then reset to 0 automatically, and the Master/Cal screen will disappear.
> 2 Before performing mastering, it is recommended that you back up the current mastering data.

## 8.2 RESETTING ALARMS AND PREPARING FOR MASTERING

Before performing mastering because a motor is replaced, you must release the relevant alarm and display the positioning menu.

### Alarm displayed

"SRVO-062 BZAL" or "SRVO-075 Pulse not established"

### Procedure

1 Display the positioning menu by following steps 1 to 6.
   1 Press the [MENU] key to display the screen menu.
   2 Press [0 NEXT] and select [6 SYSTEM].
   3 Press F1 [TYPE], and select [SYSTEM Variable] from the menu.
   4 Place the cursor on $MASTER_ENB, then key in [1] and press [ENTER] key.
   5 Press F1 [TYPE], and select[Master/Cal] from the menu.
   6 Select the desired mastering type from the [Master/Cal] menu.

2 To reset the "SRVO-062 BZAL" alarm, follow steps 1 to 5.
   1 Press the [MENU] key to display the screen menu.
   2 Press [0 NEXT] and select [6 SYSTEM].
   3 Press F1 [TYPE], and select [Master/Cal] from the menu.
   4 Press the F3 [RES_PCA], then press F4 [YES].
   5 Turn off the controller power and on again.

3 To reset the "SRVO-075 Pulse not established " alarm, follow steps 1 to 2.
   1 When the controller power is turned on again, the message "SRVO-075 Pulse not established" appears again.
   2 Move the axis for which the message mentioned above has appeared in either direction till the alarm disappears when you press [FAULT RESET].

# 8.3 ZERO POSITION MASTERING

Zero-position mastering (witness mark mastering) is performed with all axes set at the 0-degree position. A zero-position mark (witness mark) is attached to each robot axis (Fig. 8.3 (a)). This mastering is performed with all axes set at the 0-degree position using their respective witness marks.

Zero-position mastering involves a visual check. It cannot be so accurate. It should be used only as a quick-fix method.

## Procedure of Zero-position Mastering

1 Press the [MENU] key to display the screen menu.
2 Select [0 NEXT] and press [6 SYSTEM].
3 Press F1 [TYPE].
4 Select [Master/Cal].

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
     Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA                DONE
```

5 Release brake control, and jog the robot into a posture for mastering.

**NOTE**
Brake control can be released by setting the system variables as follows:
$PARAM_GROUP.SV_OFF_ALL : FALSE
$PARAM_GROUP.SV_OFF_ENB[*] : FALSE (for all axes)
After changing the system variables, turn off the controller power and on again.

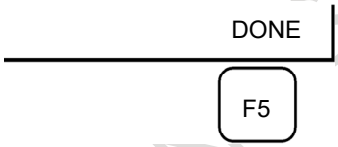
6 Select [2 ZERO POSITION MASTER]. Press F4 [YES].

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
 Robot Mastered! Mastering Data:
    <0> <11808249> <38767856>
    <9873638> <12200039> <2000319>
 [ TYPE ]   LOAD   RES_PCA                DONE
```

7 Select [7 CALIBRATE] and press F4 [YES]. Mastering will be performed automatically. Alternatively, turn off the controller power and on again. Turning on the power always causes positioning to be performed.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
Robot Calibrated! Cur Jnt Ang(deg):
   <    0.0000> <    0.0000> <    0.0000>
   <    0.0000> <    0.0000> <    0.0000>
```

8 After positioning is completed, press F5 [DONE].




9 Return brake control to original setting, and cycle power of the controller.

**Table 8.3 (a) Posture with position marks (witness mark) aligned**

| Axis | Position |
|---|---|
| J1-axis | 0 deg |
| J2-axis | 0 deg |
| J3-axis | 0 deg (When J2-axis is 0 deg.) |
| J4-axis | 0 deg |
| J5-axis | 0 deg |
| J6-axis | 0 deg |

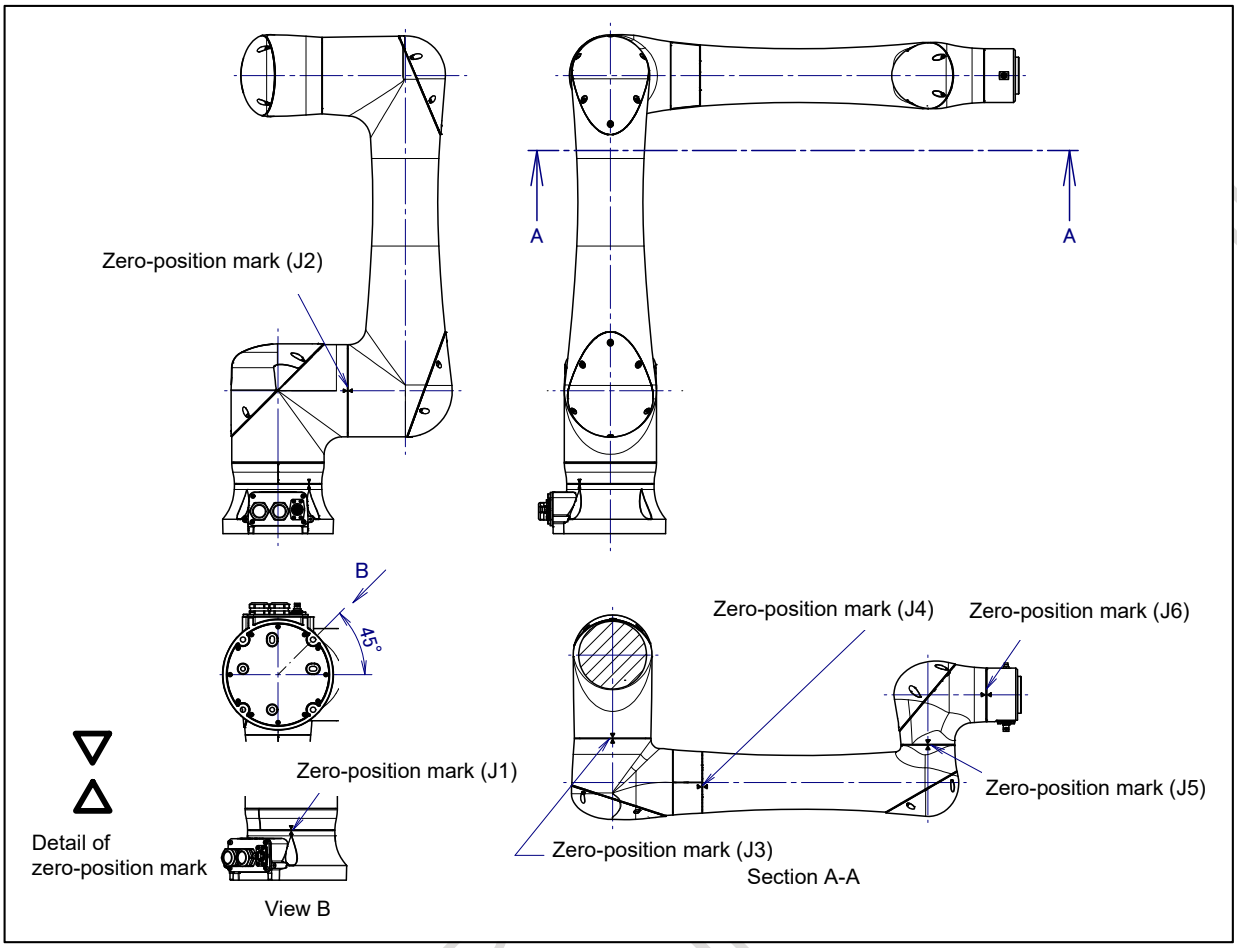



**Fig. 8.3 (a) Zero-position mark (witness mark) for each axis**

# 8.4 QUICK MASTERING

Quick mastering is performed at a user-specified position. The pulse count value is obtained from the rotation speed of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the fact that the absolute value of a rotation angle within one rotation will not be lost.

Quick mastering is factory-performed at the position indicated in Table 8.3 (a). Do not change the setting unless there is any problem.

If setting the robot at the position mentioned above is impossible, you must re-set the quick mastering reference position using the following method. (It would be convenient to set up a marker that can work in place of the witness mark.)

> **⚠ CAUTION**
> 1 Quick mastering can be used, if the pulse count value is lost, for example, because a low voltage has been detected on the backup battery for the pulse counter.
> 2 Quick mastering cannot be used, after the Pulsecoder is replaced or after the mastering data is lost from the robot controller.

## Procedure Recording the Quick Mastering Reference Position

1 Select [6 SYSTEM].
2 Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA                DONE
```

3 Release brake control, and jog the robot to the quick mastering reference position.
4 Select [6 SET QUICK MASTER REF] and press F4 [YES]. Quick mastering reference position will be set.

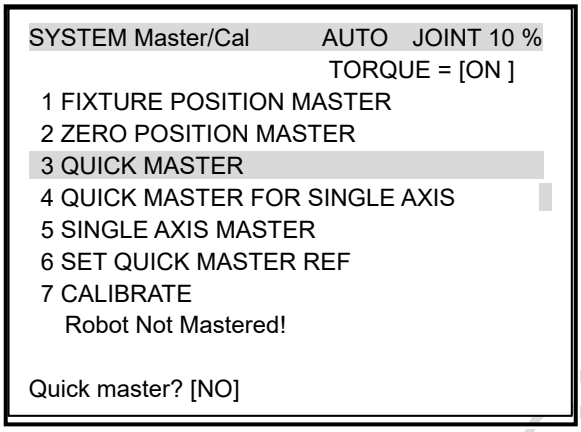
```
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
```

F4

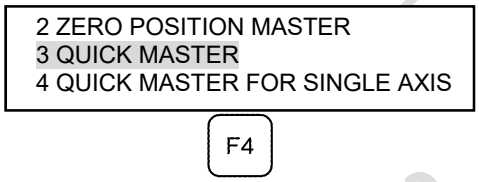
> **⚠ CAUTION**
> If the robot has lost mastering data due to mechanical disassembly or repair, you cannot perform this procedure. In this case, perform Fixture position mastering or zero –position mastering is required to restore mastering data.

## Procedure of Quick Mastering

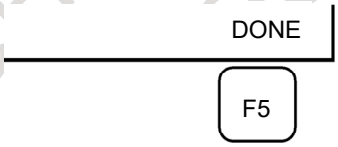
1 Display the Master/Cal screen.




2 Release brake control, and jog the robot to the quick mastering reference position.
3 Select [3 QUICK MASTER] and press F4 [YES]. Quick mastering reference position will be set.




4 Select [7 CALIBRATE] and press the [ENTER] key. Calibration is executed. Calibration is executed by cycling power.
5 After completing the calibration, press F5 [Done].




6 Return brake control to original setting, and cycle power of the controller.

# 8.5 QUICK MASTERING FOR SINGLE AXIS

Quick mastering is performed at a user-specified position for one axis. The pulse count value is obtained from the rotation times of the Pulsecoder connected to the relevant motor and the rotation angle within one rotation. Quick mastering uses the character that the absolute value of a rotation angle within one rotation will not be lost.

Quick mastering is factory-performed at the position indicated in Table 8.3 (a). Do not change the setting unless there is any problem.

If setting the robot at the position mentioned above is impossible, you must re-set the quick mastering reference position using the following method. (It would be convenient to set up a marker that can work in place of the witness mark.)

> **⚠ CAUTION**
> 1 Quick mastering can be used, if the pulse count value is lost, for example, because a low voltage has been detected on the backup battery for the pulse counter.
> 2 Quick mastering cannot be used, after the Pulsecoder is replaced or after the mastering data is lost from the robot controller.

## Procedure Recording the Quick Mastering Reference Position

1 Select [6 SYSTEM].
2 Select [Master/Cal]. The positioning screen will be displayed.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

[ TYPE ]   LOAD   RES_PCA                DONE
```

3 Release brake control, and jog the robot to the quick mastering reference position.
4 Select [6 SET QUICK MASTER REF] and press F4 [YES]. Quick mastering reference position will be set.

```
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
```

F4

> **⚠ CAUTION**
> If the robot has lost mastering data due to mechanical disassembly or repair, you cannot perform this procedure. In this case, perform Fixture position mastering or zero –position mastering is required to restore mastering data.

## Procedure of Quick Mastering

1 Display the Master/Cal screen.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
     Press 'ENTER' or number key to select.

 [ TYPE ]   LOAD   RES_PCA                DONE
```

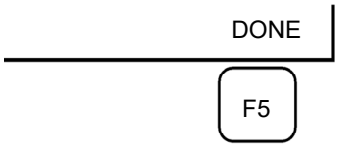
2 Select [4 QUICK MASTER FOR SINGLE AXIS]. The quick master for single axis screen will be displayed.

```
SINGLE AXIS MASTER              AUTO    JOINT 10%
                                                1/9
    ACTUAL   POS    (MSTR POS)      (SEL)    [ST]
J1          0.000   (      0.000)   (0)      [2]
J2          0.000   (      0.000)   (0)      [2]
J3          0.000   (      0.000)   (0)      [2]
J4          0.000   (      0.000)   (0)      [2]
J5          0.000   (      0.000)   (0)      [2]
J6          0.000   (      0.000)   (0)      [0]
E1          0.000   (      0.000)   (0)      [0]
E2          0.000   (      0.000)   (0)      [0]
E3          0.000   (      0.000)   (0)      [0]

                                                EXEC
```

3 Move the cursor to the [SEL] column for the unmastered axis and press the numeric key [1]. Setting of [SEL] is available for one or more axes.

```
SINGLE AXIS MASTER              AUTO    JOINT 10%
                                                1/9
    ACTUAL   POS    (MSTR POS)      (SEL)    [ST]
J5          0.000   (      0.000)   (0)      [2]
J6          0.000   (      0.000)   (0)      [0]

                                                EXEC
```

4 Turn off brake control, then jog the robot to the quick mastering reference position.
5 Press F5 [EXEC]. Mastering is performed. So, [SEL] is reset to 0, and [ST] is re-set to 2.
6 Select [7 CALIBRATE] and press [ENTER] key. Calibration is executed. Calibration is executed by cycling power.
7 After completing the calibration, press F5 Done.




8 Return brake control to original setting, and cycle power of the controller.

# 8.6 SINGLE AXIS MASTERING

Single axis mastering is performed for one axis at a time. The mastering position for each axis can be specified by the user.
Single axis mastering can be used, if mastering data for a specific axis is lost, for example, because a low voltage has been detected on the pulse counter backup battery or because the Pulsecoder has been replaced.

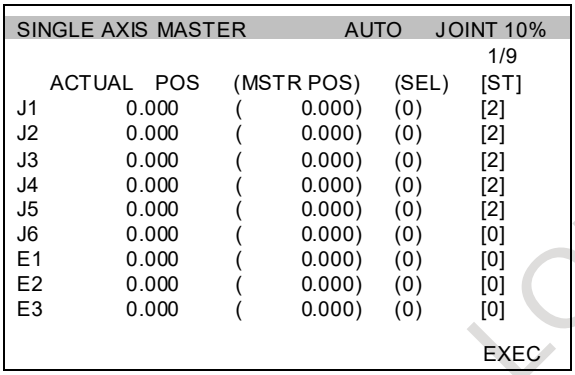
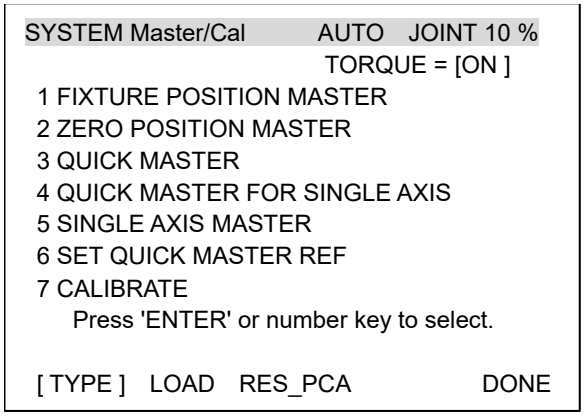



**Table 8.6 (a) Items set in single axis mastering**

| Item | Description |
|---|---|
| Current position (ACTUAL AXIS) | The current position of the robot is displayed for each axis in degree units. |
| Mastering position (MSTR POS) | A mastering position is specified for an axis to be subjected to single axis mastering. It would be convenient if it is set to the 0 degree position. |
| SEL | This item is set to 1 for an axis to be subjected to single axis mastering. Usually, it is 0. |
| ST | This item indicates whether single axis mastering has been completed for the corresponding axis. It cannot be changed directly by the user.<br>The value of the item is reflected in $EACHMST_DON (1 to 9).<br>0 :Mastering data has been lost. Single axis mastering is necessary.<br>1 :Mastering data has been lost. (Mastering has been performed only for the other interactive axes.) Single axis mastering is necessary.<br>2 :Mastering has been completed. |

## Procedure of Single axis mastering

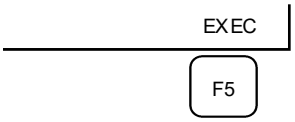
1 Select [6 SYSTEM].
2 Select [Master/Cal].



3 Select [5 SINGLE AXIS MASTER]. The following screen will be displayed.

```
SINGLE AXIS MASTER          AUTO    JOINT 10%
                                          1/9
   ACTUAL   POS    (MSTR POS)    (SEL)   [ST]
J1          0.000 (     0.000)   (0)     [2]
J2          0.000 (     0.000)   (0)     [2]
J3          0.000 (     0.000)   (0)     [2]
J4          0.000 (     0.000)   (0)     [2]
J5          0.000 (     0.000)   (0)     [2]
J6          0.000 (     0.000)   (0)     [0]
E1          0.000 (     0.000)   (0)     [0]
E2          0.000 (     0.000)   (0)     [0]
E3          0.000 (     0.000)   (0)     [0]

                                         EXEC
```

4 For the axis to which to perform single axis mastering, set (SEL) to "1." Setting of [SEL] is available for one or more axes.
5 Turn off brake control, then jog the robot to the mastering position.
6 Enter axis data for the mastering position.
7 Press F5 [EXEC]. Mastering is performed. So, [SEL] is reset to 0, and [ST] is re-set to 2 or 1.

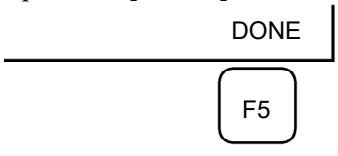



```
SINGLE AXIS MASTER          AUTO    JOINT 10%
                                          6/9
   ACTUAL   POS    (MSTR POS)    (SEL)   [ST]
J1          0.000 (     0.000)   (0)     [2]
J2          0.000 (     0.000)   (0)     [2]
J3          0.000 (     0.000)   (0)     [2]
J4          0.000 (     0.000)   (0)     [2]
J5          0.000 (     0.000)   (0)     [2]
J6         90.000 (     0.000)   (1)     [0]
E1          0.000 (     0.000)   (0)     [0]
E2          0.000 (     0.000)   (0)     [0]
E3          0.000 (     0.000)   (0)     [0]

                                         EXEC
```

8 When single axis mastering is completed, press the previous page key to resume the previous screen.

```
SYSTEM Master/Cal          AUTO   JOINT 10 %
                                  TORQUE = [ON ]
 1 FIXTURE POSITION MASTER
 2 ZERO POSITION MASTER
 3 QUICK MASTER
 4 QUICK MASTER FOR SINGLE AXIS
 5 SINGLE AXIS MASTER
 6 SET QUICK MASTER REF
 7 CALIBRATE
    Press 'ENTER' or number key to select.

[ TYPE ]  LOAD  RES_PCA              DONE
```

9 Select [7 CALIBRATE], then press F4 [YES]. Positioning is performed. Alternatively, turn off the controller power and on again. Positioning is performed.
10 After positioning is completed, press F5 [DONE].



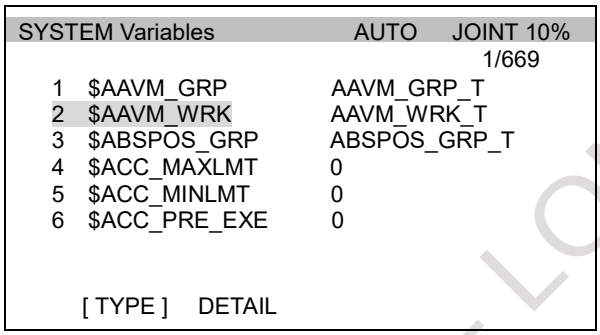

11 Return brake control to original setting, and cycle power of the controller.

# 8.7 MASTERING DATA ENTRY

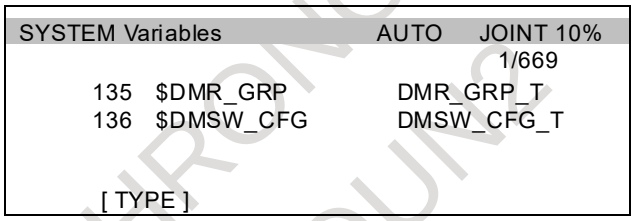
This function enables mastering data values to be assigned directly to a system variable. It can be used if mastering data has been lost but the pulse count is preserved.

## Mastering data entry method

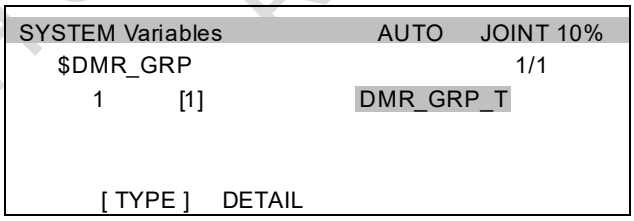
1 Press the [MENU] key, then press [0 NEXT] and select [6 SYSTEM].
2 Press F1 [TYPE]. Select [Variables]. The system variable screen appears.

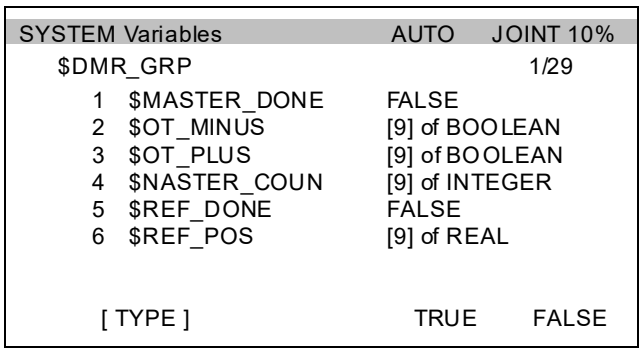



3 Change the mastering data. The mastering data is saved to the $DMR_GRP.$MASTER_COUN system variable.

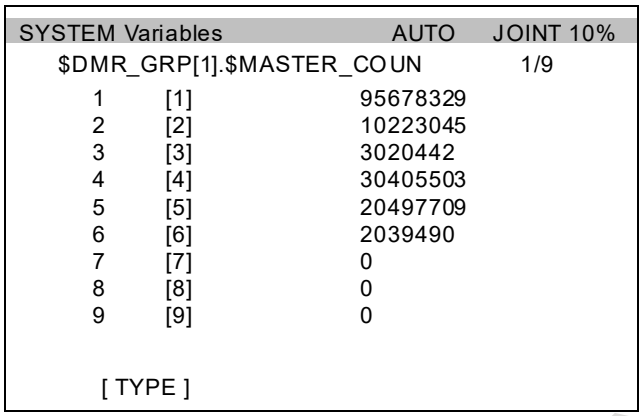



4 Select $DMR_GRP.

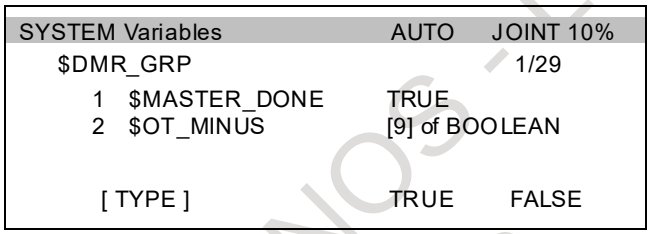


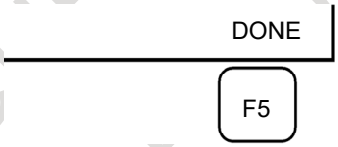
5 Select $MASTER_COUN, and enter the mastering data you have recorded.




6 Press [PREV] key.
7 Set $MASTER_DONE to TRUE.




8 Display the positioning screen, and select [7 CALIBRATE], then press F4 [YES].
9 After completing positioning, press F5 [DONE].



# 8.8 VERIFYING MASTERING

1 How to verify that the robot is mastered properly:
Usually, positioning is performed automatically when the power is turned on. To check whether mastering has been performed correctly, examine if the current displayed position meets the actual robot position by using the procedure described below:
(1) Reproduce a particular point in a program. Check whether the point agrees with the specified position.
(2) Set all axes of the robot to their 0-degree (0 rad) positions. Check that the zero-degree position marks indicated in Section 8.3 of OPERATOR'S MANUAL are aligned. There is no need to use a visual aid.

If the displayed and actual positions do not match, the counter value for a Pulsecoder may have been invalidated as a result of an alarm described in 2. Alternatively, the mastering data in system variable $DMR_GRP.$MASTER_COUN may have been overwritten as a result of an operation error or some other reason.
Compare the data with the values indicated on the supplied data sheet. This system variable is overwritten whenever mastering is performed. Whenever mastering is performed, record the value of the system variable on the data sheet.

2 Alarm type displayed during mastering and their solution method:
(1) BZAL alarm
This alarm is displayed if the Pulsecoder's backup battery voltage decreases to 0 V while the power to the controller is disconnected. Furthermore, if the Pulsecoder connector is removed for cable replacement, etc. this alarm is displayed as the voltage decreases to 0. Confirm if the alarm will disappear by performing a pulse reset (See Section 8.2.). Then, cycle power of the controller to check if the alarm disappears or not.
The battery may be drained if the alarm is still displayed. Perform a pulse reset, and turn off and on the controller power after replacing the battery. Note that, if this alarm is displayed, all the original data held by the Pulsecoder will be lost. Mastering is required.
(2) BLAL alarm
This alarm is displayed if the voltage of the Pulsecoder's backup battery has fallen to a level where backup is no longer possible. If this alarm is displayed, replace the battery with a new one immediately while keeping the power turned on. Check whether the current position data is valid, using the procedure described in 1.
(3) Alarm notification like CKAL, RCAL, PHAL, CSAL, DTERR, CRCERR, STBERR, and SPHAL may have trouble with Pulsecoder, contact your local FANUC representative.

ANUBIS 3D


# IVTC – INTEGRATED VACUUM TOOL CHANGER

OPERATING INTRUCTIONS

## Product Description

**Anubis 3D** Integrated Vacuum Tool Changer **(IVTC)** is an industry shaping technology. Quickly connect and control various tools with **IVTC's** built **Anubis 3D** Tool Changing system. The lightweight 3D printed Nylon body not only acts as a Tool Changer but comes fully equipped with integrated Solenoid Valves, Vacuum Ejectors, Vacuum Sensors, and Electrical to power various types of tools such as **Anubis 3D's** Area Surface Grippers **(ASG)**, Carton Erectors **(ACE)**, External Bottle Grippers **(EBG)**, and opportunities to control your Custom Tooling.

## Anubis 3D FANUC CRX Plug-In

Easily connect to FANUC's line up of CRX cobots using Anubis 3D's Robot Interface Module (RIM). We provide you with customized plug-in software to control your Anubis 3D Integrated Vacuum Tool Changer (IVTC) powered tools easily and innately.

Operating instructions for the Anubis 3D FANUC CRX Plug-in, refer to document "Anubis 3D – ASG FANUC CRX PLUG-IN – Startup Guide".

## Notes

Familiarize yourself with the components of the IVTC and ASG to ensure correct installation and startup of the tool. The images in this document are for illustrative purposes only and may differ from product. Subject to technical changes without notice.

# Contents

# 1.Connections

## 1.1 Connections: Mechanical

The ASG comes equipped with an adapter flange to be installed on to the robot flange. The adapter flange should then be installed onto the IVTC. Using the provided screws and washers, ensure the IVTC is attached securely to the adapter flange once it is installed onto the robot. Once the IVTC is installed onto the robot flange, the ASG can be connected using the quick connection handle.

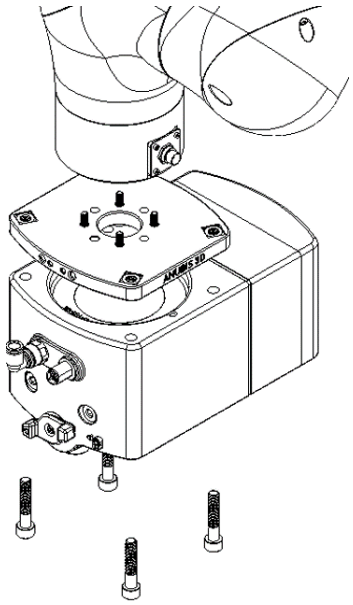


***Figure 1*** *Connect adapter flange to robot flange. Follow tightening specifications per the robot system. Connect adapter flange to IVTC using provided fasteners.*

The quick connect handle rotates 190 degrees. To ensure the Area Surface Gripper is connected to the IVTC, the arrow on the handle should line up with the lock symbol on the IVTC. Additionally, a “click” noise/physical locking should be felt when the handle is rotated to the full 190-degree locked position.

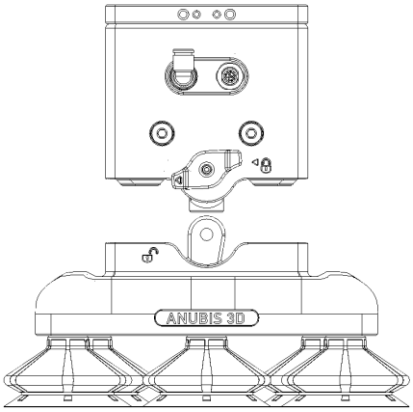



***Figure 3*** *Unlocked position.*

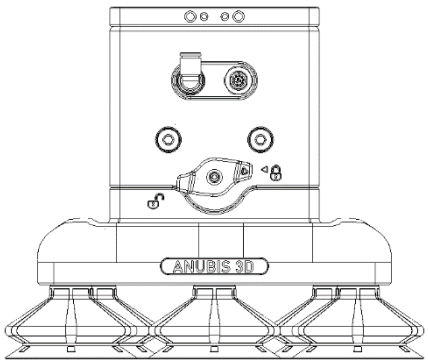
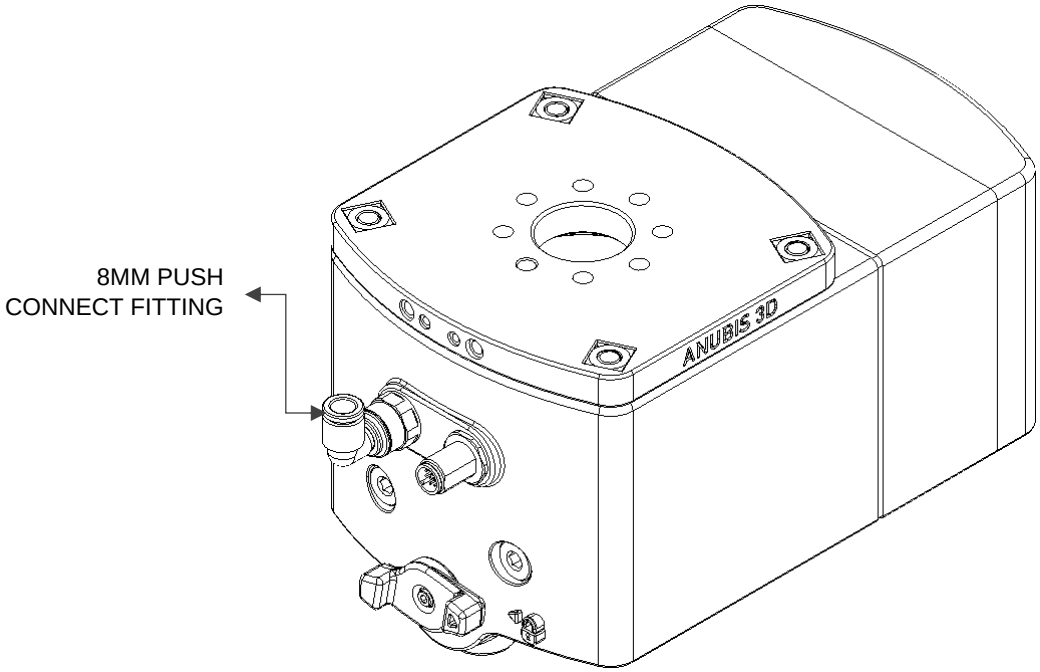



***Figure 2*** *Locked position.*

## 1.2 Connections: Pneumatic

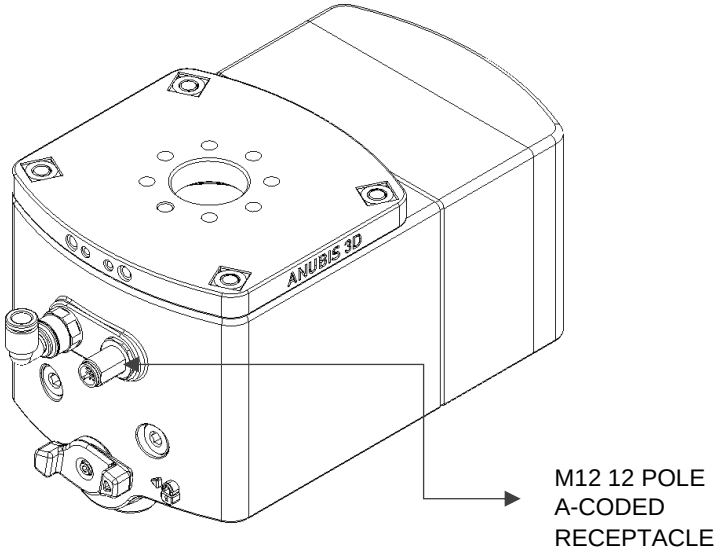
Connect 8mm OD Pneumatic tubing to the push connect fitting located on the IVTC. The operating pressure range is 60-90 PSI. **The optimal operating pressure is 80 PSI**. It is strongly recommended to ensure the air supplied to the IVTC is filtered and strained of any containments and moisture to ensure consistent tool performance.




The IVTC comes equipped with 2 vacuum sensors. In the event the switch point of the vacuum sensors needs to be changed, use an appropriate size screwdriver to turn the setting trimmer. Gently turn the screwdriver to adjust. To prevent damage to the pressure setting trimmer, do not force the trimmer when it comes to a stop. The red LED will turn on when the correct vacuum level is set based on the vacuum level achieved when picking the desired object. The measuring range is 0 to -14.69 PSI.

## 1.3 Connections: Electrical

Connect M12 Female 12 Pole Cable, A-Coded to the receptacle on the IVTC-A/B (Sold separately) and tighten securely. Make sure pins on the receptacle are not bent/damaged when installing the cable. For the wiring diagram, refer to **3. Electrical Diagram** of this document. Follow the wiring instructions to control the DI/O's on the IVTC according to your robot/PLC system. All components in the IVTC operate on 24VDC. For electrical specifications of the devices, refer to **3.3 Electrical Specifications.**




For installation instructions and set up of the Robot Interface Module (RIM), refer to document Anubis 3D – ASG FANUC CRX PLUG-IN – Startup Guide.

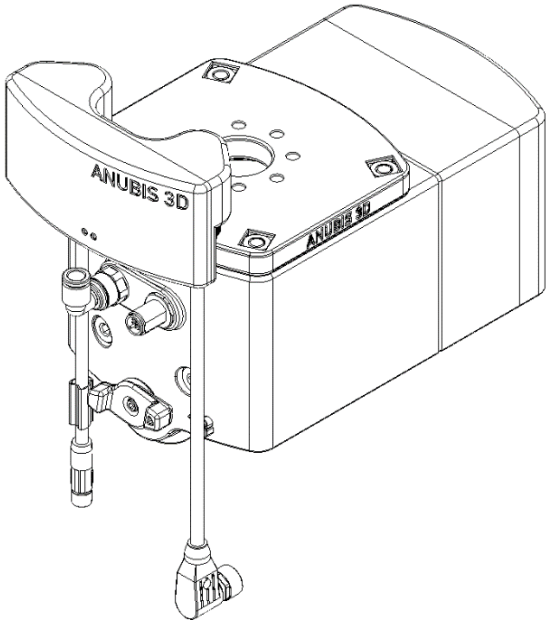
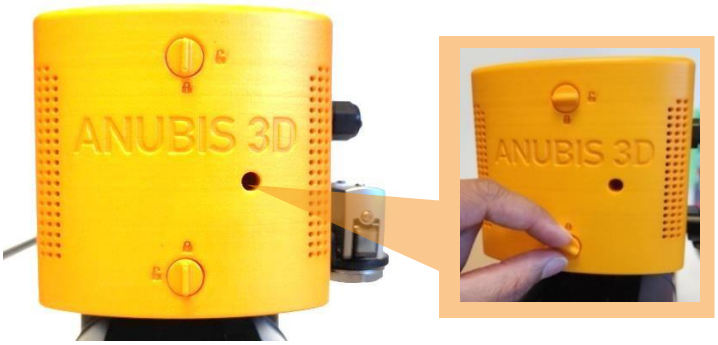


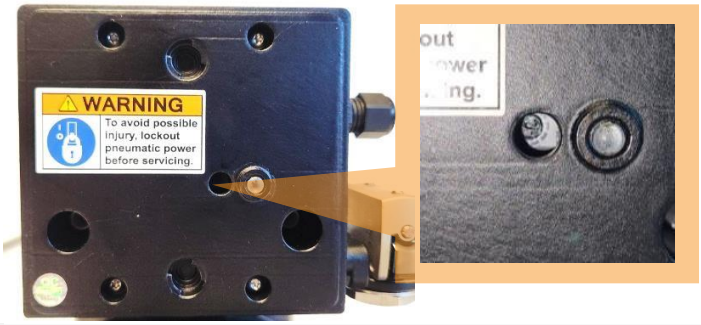

*Figure 4 **IVTC** with Robot Interface Module (**RIM**)*

**Step 1.** Removing the muffler. Twist the two knobs on the muffler by hand to the unlocked positions.

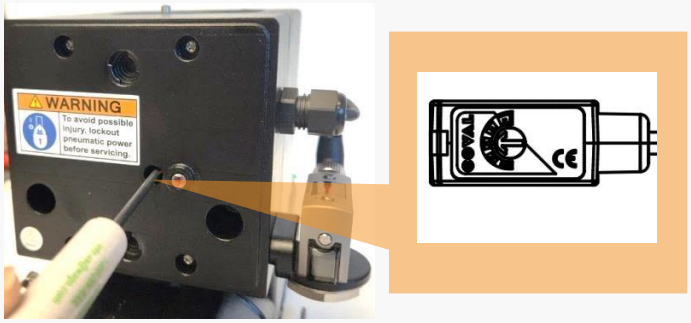



**Step 2.** Temporarily remove the rubber plug to access the vacuum sensor.


**Step 3.** The dial to the vacuum switch is accessible through the electronics cover.




**Step 4**. Gently rotate the switch till the red LED turns on. The vacuum must be on during this step on the tooling must be on the product. To prevent damage to the pressure setting dial, do not force the dial when it comes to a stop

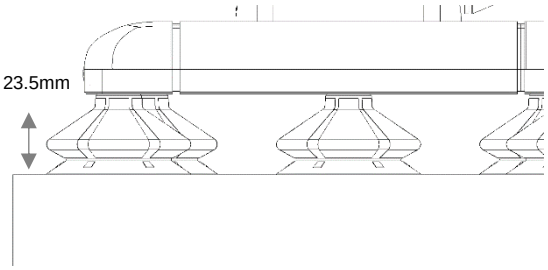



**Step 5.** After confirming the LED turn on when vacuum is applied on the product, place back the rubber plug and muffler.

# 3. Operating IVTC with ASG

The following is the basic operation of operating the IVTC with ASG* for a pick and place application. The operation of the tool varies based on 1) the object being picked, 2) the weight of the object 3) the porosity of the object, 4) the speed and acceleration of the robot movement, 5) placement of the ASG on the object, and other factors that causes possible variability in performance. It is important to test prior to moving the tool to find the optimal pick and place or palletizing sequence.

*ASG Sold separately. Refer to the ASG Manual for maintenance.

| IVTC-A/B & ASG | START UP INSTRUCTIONS |
|---|---|
|  | 1) Before activating vacuum on the IVTC, ensure the suction cups are compressed against the object being picked *(suction cups can compress 23.5mm)* |
| | 2) Once compressed, activate vacuum generators |
| | 3) Lift the object once the suction cups are secured to the object |
| | 4) Test and confirm the optimal speed and acceleration in any transitional movements. |

**In the application of the pick and place of the 20kg Cardboard box, it is recommended that a max speed of 1.5m/s with a 25% acceleration in any transitional movements is used with the robot and operating the IVTC at 80 PSI.*

# 4.Maintenance

| | WEEKLY | MONTHLY | EVERY 6 MONTHS |
|---|---|---|---|
| *CHECK IF VACUUM GENERATORS ARE DIRTY, AND CLEAN IF NECESSARY | | X | |
| IS THE ELECTRICAL CONNECTION STILL SECURE? IS THE CABLE STILL SCREWED IN PLACE? | | | X |
| CHECK ALL CONNECTIONS ARE SECURE (EX. TUBING, SUCTIONS CUPS, ETC.) | | | X |
| ANY ABNORMAL NOISES WHEN A FULL LOAD IS PICKED? | X | | |
| CHECK IF SUCTION CUPS ARE DIRTY AND CLEAN FILTERS | | X | |
| *CHECK IF MUFFLER IS DIRTY AND REPLACE IF NECESSARY (FOAM INSIDE IS OFF-COLOUR) | | X | |
| GENERAL CONDITION OF THE TOOL | | | X |

*Spare mufflers available to order

# 5.Supplementary Documents

The following documents will be enclosed in the zip folder containing this manual to assist with your setup of the IVTC.

- Anubis 3D – ASG FANUC CRX PLUG-IN – Startup Guide *(provided if App Option is selected)*
- Anubis 3D – ASG Maintenance Manual

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