FLEXLINK®
a **coesia** company

User instruction

4th Edition

Collaborative Palletizer
RC10 version 2.2

Original instruction
English

User instruction

Collaborative Palletizer
RC10 version 2.2

Preface

FlexLink takes no responsibility for safety issues related to pallet handling.

FlexLink takes no responsibility for safety issues related to cartons falling from pallet.

Description of symbols used throughout the document and on the machine:

Table: Warning and prohibition signs

	No stepping on surface
	Stepping and climbing prohibited
	Access restricted to authorized personnel
	No entry zone
	Warning for electrical hazard
	Warning for burn hazard

Table of Content

1 Machine description

1.1 Scope of delivery

Machine name: Standardized collaborative palletizer RC10

Item number:

Layout Right	5128966
Layout Center-Right	5128967
Layout Center-Left	5128968
Layout Left	5128969

Machine plate location: Conveyor back pulpit.

The machine contains one conveyor and one palletizer with two pallet positions.
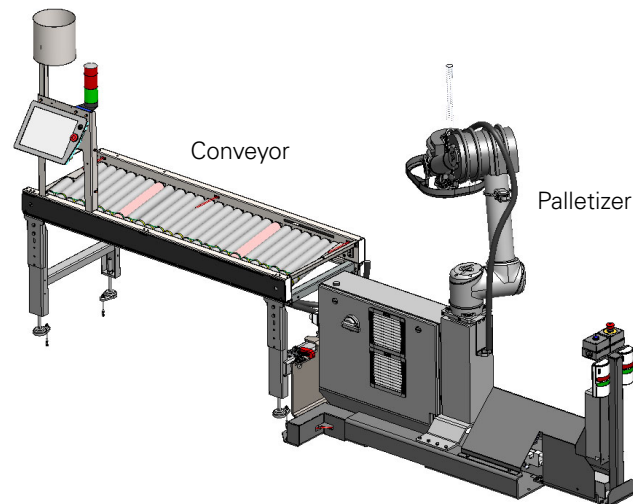
Picture: Machine division

The conveyor receives one carton box at a time and transports it collision-free downstream to end position- picking position.

The palletizer is designed for guiding the pallet into correct position, automatic pallet detection and contains indications for pallet status. Its design enables quick relocation.

Production capacity [pcs/min]: ≤ 8

The robot arm of the palletizer picks one box at a time from conveyor and puts it on pallet in the pattern selected by user. If no pallet is available to receive next box, the gripper awaits above picking position. The manual intervention is to serve the machine with empty pallets and remove the fully loaded pallets.
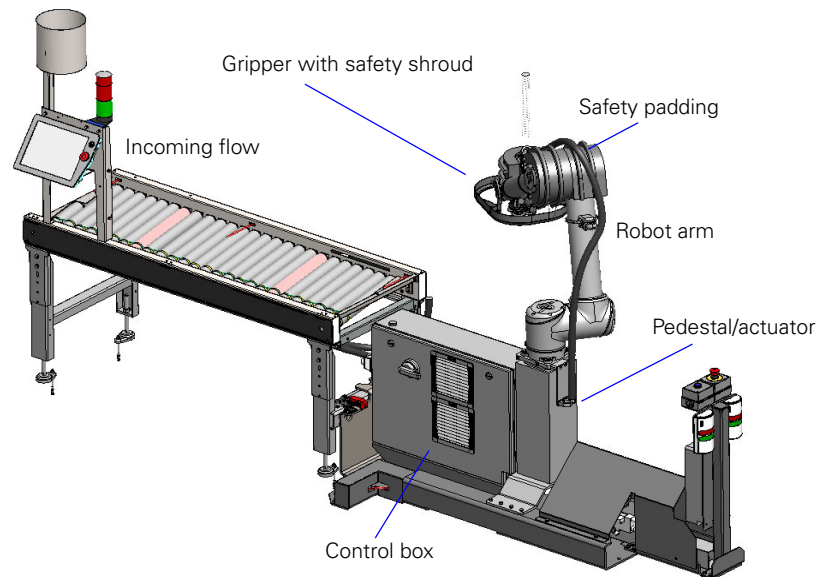
Picture: Machine overview

Labels: Gripper with safety shroud, Safety padding, Incoming flow, Robot arm, Pedestal/actuator, Control box

1.2 Orientation

Labels: Back, Right, Left, Front
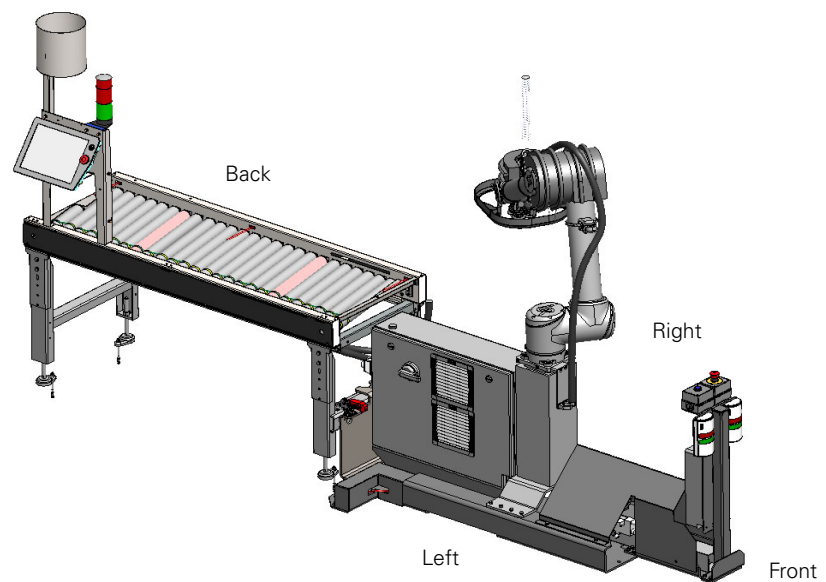
Picture: Machine orientation

1.3 Palletizer

The palletizer is autonomous and transportable. It is easily mechanically disconnectable/connectable to conveyor by the docking unit option. An industrial fast-connector is used for the power and controls signals for conveyor. Docking and transporting is one man work.

Left pallet position

Docking unit

Pallet detection sensor

Pallet status beacons

Right pallet position
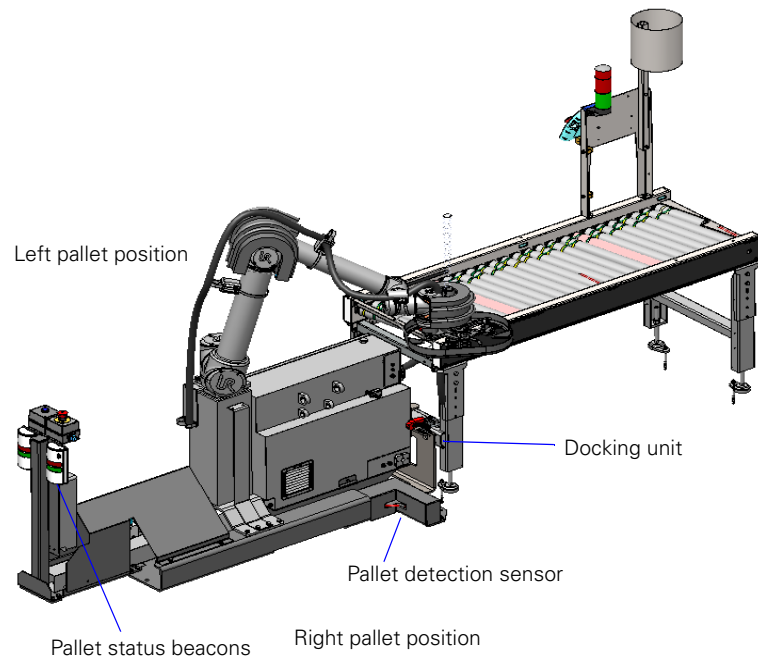
Picture: Palletizer overview

Picking accuracy [mm]:	±10

Palletizer height performance, h [mm]:
    Pedestal: h < 1200
    Actuator: 1200 < h < 1700

Means for floor fixing: Bolt size M10

The palletizer is configured to have a pedestal or a vertical actuator for the robot foot. The vertical actuator provides increased reach.

The palletizer contains sensors for automatic pallet detection.

The power supply enters the control box from the conveyor side. All cables to field components are connected to control box through chassis-mounted industrial fast-connectors to enable quick and easy replacement and maintenance. Spare I/Os are distributed to an industrial M12-connector.

The palletizer contains the teach pendant for the robot which has a cable with sufficient length for the whole robot work area. The normal position and bracket for the teach pendant is located on the back pulpit on the conveyor.

Safety paddings are mounted on robot elbows and robot head for cushioning and are equipped with pressure sensitive devices which safety stop the machine if activated.

1.4 Gripper
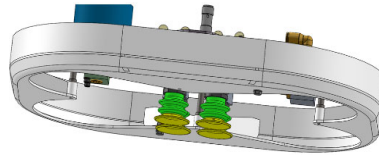
Picture: Gripper
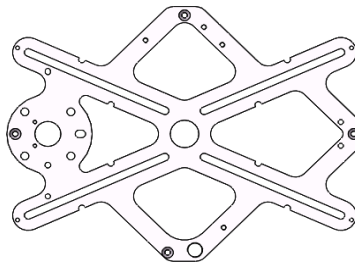
Picture: Gripper mounting plate

The end-effector is of Gripper class, non-mechanical type, holding the work piece with four vacuum suction cups. The gripper is equipped with a safety shroud. If put out of position it will cause an immediate safety stop.

The suction cups are mounted in an X to provide means for adjustment. Wing nuts fastens the suction cups to provide easy adjustment. The suction cups are for cardboard boxes and comes in two different configurable sizes.

Suction cup outer diameter [mm]:

Small size	35
Large size	52

Suction cup mounting slot [mm]:

Width	30 ... 240
Depth	37 ... 130

1.5 Conveyor

The conveyor is configurable for different height and length alternatives and is divided into zones. Each zone carries one work piece. The adjustable conveyor legs simplify levelling. The docking unit option provides fast mechanical connection/disconnection of the palletizer.

5129046-04

Back pulpit

No entry zone
prohibited sign

Stack lights

Teach pendant
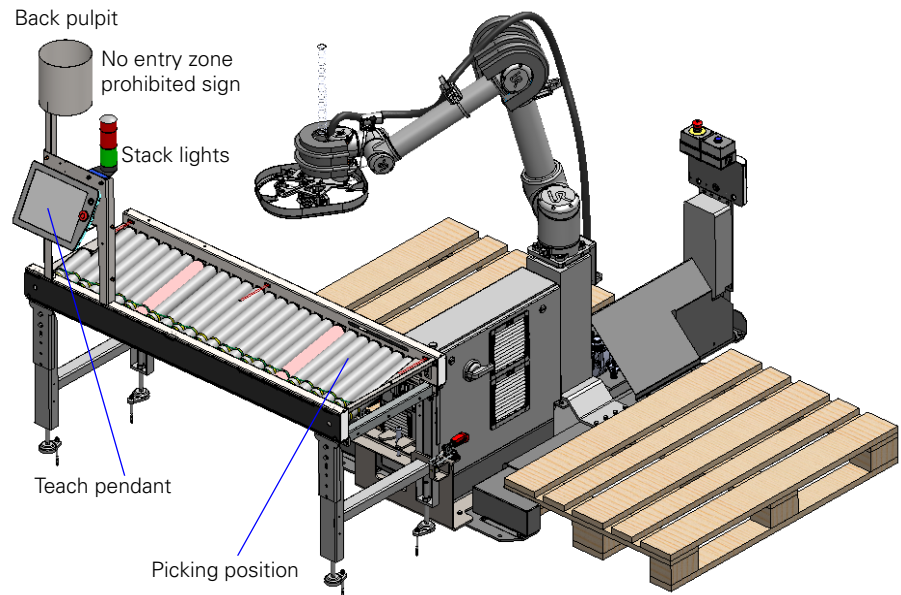
Picking position

Picture: Conveyor overview

| Foot adjustment [mm] | ±40 |
| Means for floor fixing | Bolt size M8 |

The conveyor upstream end has sensor detection for incoming box. Each zone stop position contains an end-position sensor. The picking position's end position sensor signals to robot that a box is ready for picking.

The conveyor back pulpit holds the teach pendant bracket, stack light and No entry zone prohibition sign. The stack lights communicates the general state of pallets.

Start

End

End

End

Box rdy

Four zone conveyor

Three zone conveyor

Two zone conveyor
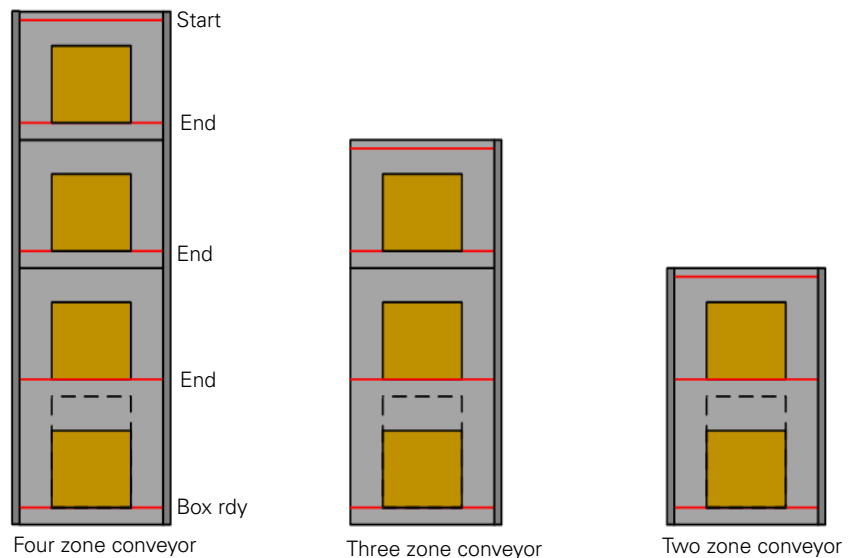
Picture: Conveyor sensor location

1.6   Machine with alignment plate

A machine without docking unit is intended for fixed installation where the frequency of docking the palletizer is low and contains an alignment plate.

The alignment plate is designed for all conveyor position alternatives and is placed under the conveyor to guide the palletizer into the correct position.
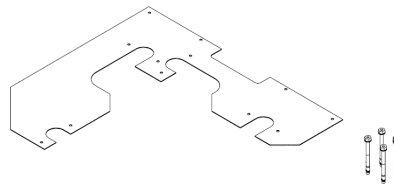
Picture: Alignment plate

1.7   Machine with docking unit

The machine conveyor contains a beam that holds the guiding pin. The beam position corresponds to the conveyor position selected. A conveyor for center position has a short side beam. A conveyor for left or right position has a long side beam.

The palletizer is equipped with the docking unit. The unit contains a guiding fork and a lock on each side for precise locating.

The bumper included is used while moving the palletizer with fork lift for protection against the sharp edges of the locks.
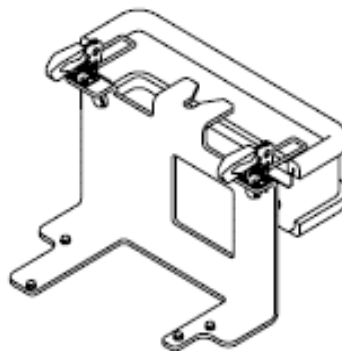
Picture: Docking unit

1.8 Configurable parameters

Conveyor position	[Right], [Center-right], [Center-left], [Left]
Number of conveyors	1
Number of conveyor zones	2 ... 4
Robot foot position	[pedestal], [actuator]
Docking unit	[yes], [no]
Calibration unit	[yes], [no]
Gripper suction cup size	[small], [large]
Conveyor height (mm)	[700], [744], [774], [818], [862]
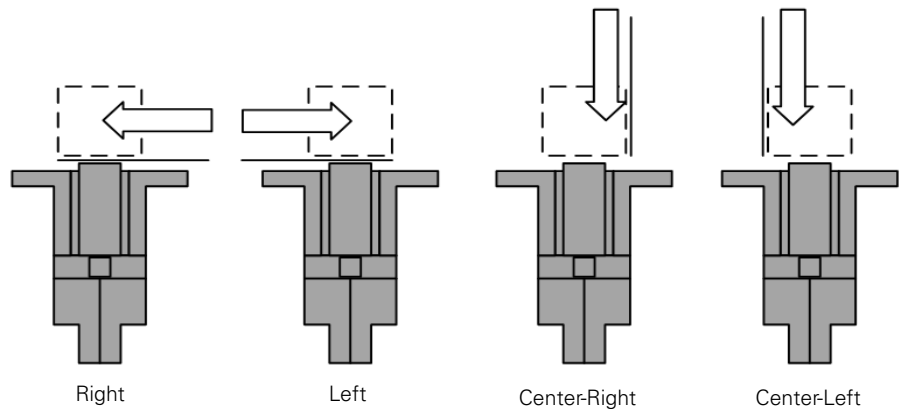
Picture: Conveyor position alternatives

2　Requirements

2.1　Environment requirements

General climate requirement　　　　　Indoor without direct sunlight
Temperature [°C]
　　　Operating ambient temperature:　　10 … 40
　　　Storage temperature:　　　　　　　0　… 40
Humidity
　　　Relative humidity [%]:　　　　　　10 ... 70
Altitude [m]:　　　　　　　　　　　　　0　… 800

Electrical power supply　　　Reference to electrical drawings.
Robot arm IP-class　　　　　54
Robot pendant IP-class　　　20
Control box IP-class　　　　54

2.2 Usage requirements

2.2.1 Intended use

The machine is specifically made for automatic palletizing of carton boxes from a fixed picking position. The boxes should be undamaged, clean and square-shaped.

2.2.2 User requirements

General requirements:

- Adult
- Unskilled or Skilled (for definition- reference to ISO 12100:2010)
- Long hair, loose-hanging clothing and accessories that can get entangled are prohibited.

Skilled:

- Typically electrician, maintenance personnel or specialists
- Definite technical knowledge
- Sufficient knowledge for reading technical information
- Ability to comprehend technical drawings
- Ability to read English text
- High safety awareness, competence and experience for risks associated to the machine
- Authorized to enter No entry zone when safety precautions are met

Operator:

- Can be unskilled
- Limited to actions outside No entry zone
- Successfully trained in machine including User instruction

2.3 Work piece requirements

General	Undamaged, clean and rectangular cardboard box.
Mass [kg]	0.5 ... 8
Width [mm]	150 ... 400
Length [mm]	150 ... 600
Height [mm]	100 ... 500
Lift surface	Flat top-surface, corrugated material
Recommended Cardboard box quality:	EUPS 110, BC-Flute (Double well, 7.0 mm) Brown/ Brown.

2.4 Fork lift requirements

Blade length [mm]	1400
Blade width [mm]	max 160
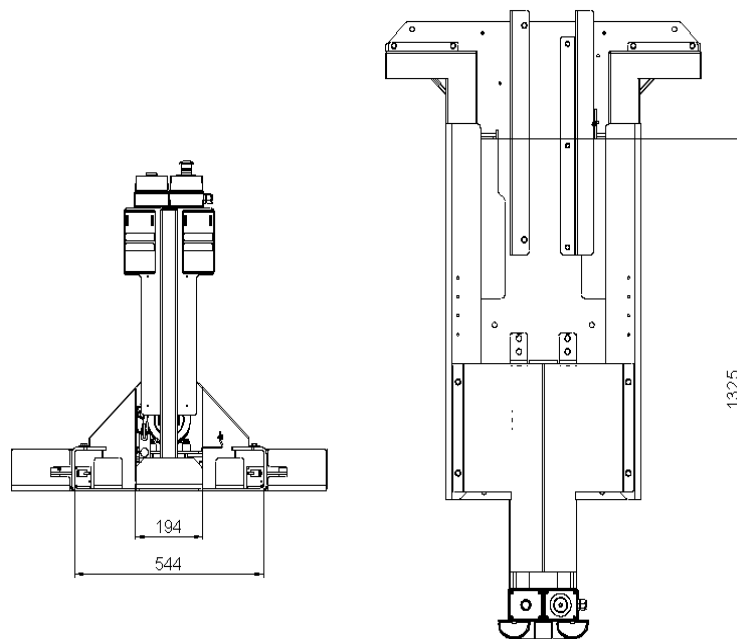
Picture: Machine geometry affecting fork lift selection

5129046-04

2.5 Pallet requirements

Pallet dimension [mm]:

Length	1200 or 1219
Width	800 or 1000 or 1016

Max height of loaded pallet [mm]:

Pedestal version	1200
Actuator version	1700

2.6 Floor requirements

Conveyor top must be horizontal.

Strength	Sufficient for complete application weight
Conveyor floor level [mm]	± 30
Palletizer	Horizontal and flat with max ± 10 mm difference to conveyor

2.7 Electrical power supply requirement

2.7.1 General

Phases	1
Short-circuit current capacity [kA]	10
Connection type	Terminals 2.5 mm^2
Incoming power supply throughput type	Gland

2.7.2 Control box

Control box:

Voltage [V_{AC}]	110 ... 240
Frequency [Hz]	50/60
Nominal current [A_{AC}]	220: < 6.7
	110: < 13.7

2.8 Space requirements

2.8.1 Physical dimensions of robot cell configurations

Palletizer weight [kg]	300 (whereof robot arm 30 kg)
Height for all configurations [mm]	3000 (including robot and gripper and robot hoses)
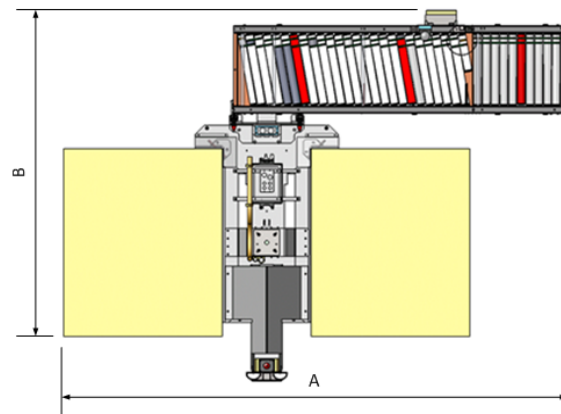
Picture: Machine dimensions sideways conveyor
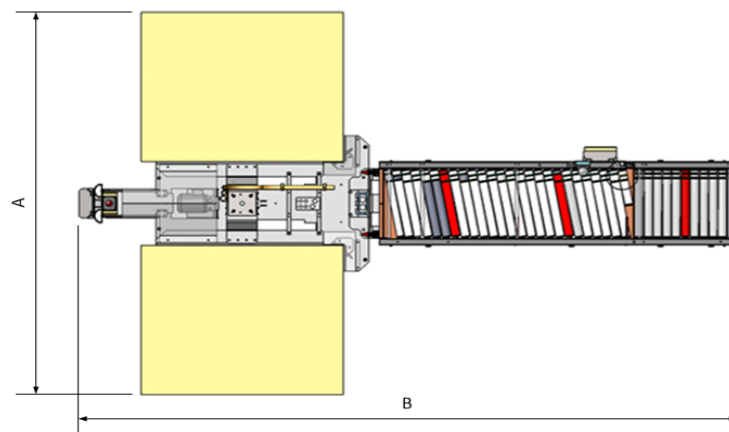
Picture: Machine dimensions straight conveyor

5129046-04

Dimensions based on pallet size 1200x1000 mm

Product	Conveyor type	A Width [mm]	B Length [mm]
Conveyor right	Two zones - 1512 mm	2582	2369
	Three zones - 2117 mm	3187	2369
	Four zones - 2722 mm	3792	2369
Conveyor left	Two zones - 1512 mm	2582	2369
	Three zones - 2117 mm	3187	2369
	Four zones - 2722 mm	3792	2369
Conveyor center-right	Two zones - 1512 mm	2560	3212
	Three zones - 2117 mm	2560	3817
	Four zones - 2722 mm	2560	4412
Conveyor center-left	Two zones - 1512 mm	2560	3212
	Three zones - 2117 mm	2560	3817
	Four zones - 2722 mm	2560	4412

2.8.2   Space requirements for usage and maintenance

Clearances around conveyor:
- 1 m on pulpit side
- 0.2 m on opposite side
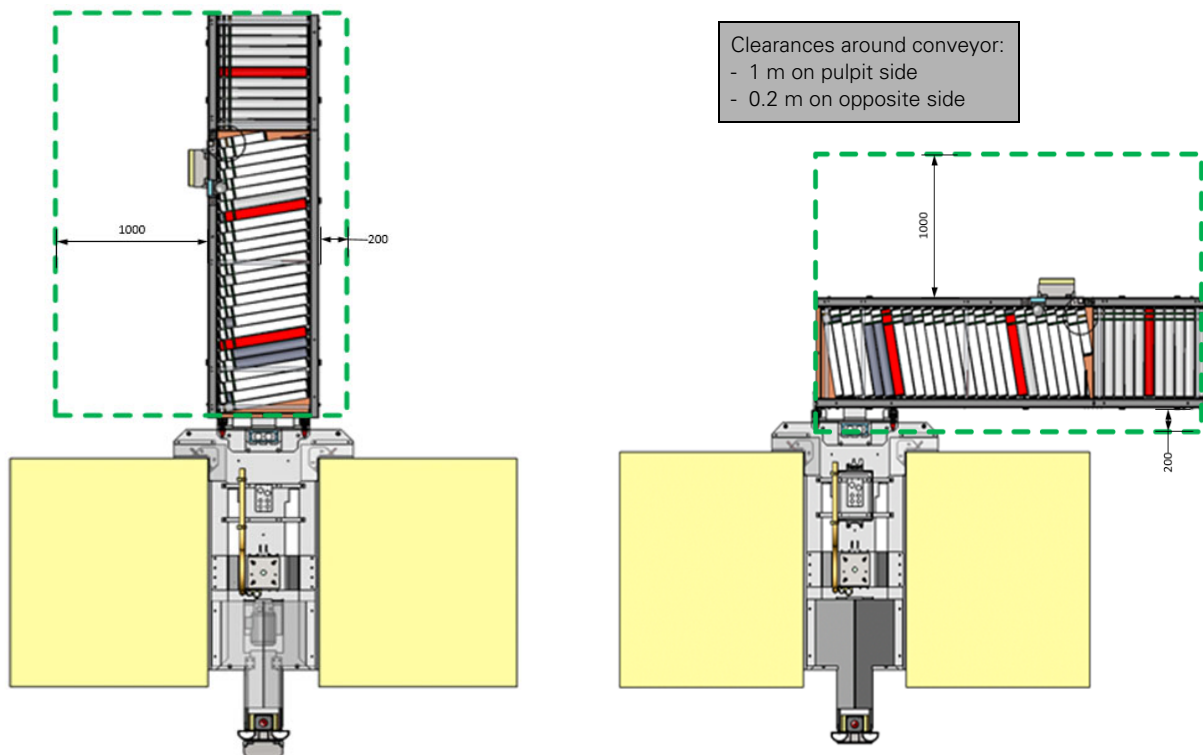
Picture: Clearances for conveyor

Clearances to avoid quasi-static contact for robot:
- 500 mm around pallets
- 500 mm around picking position

500

500

500

500
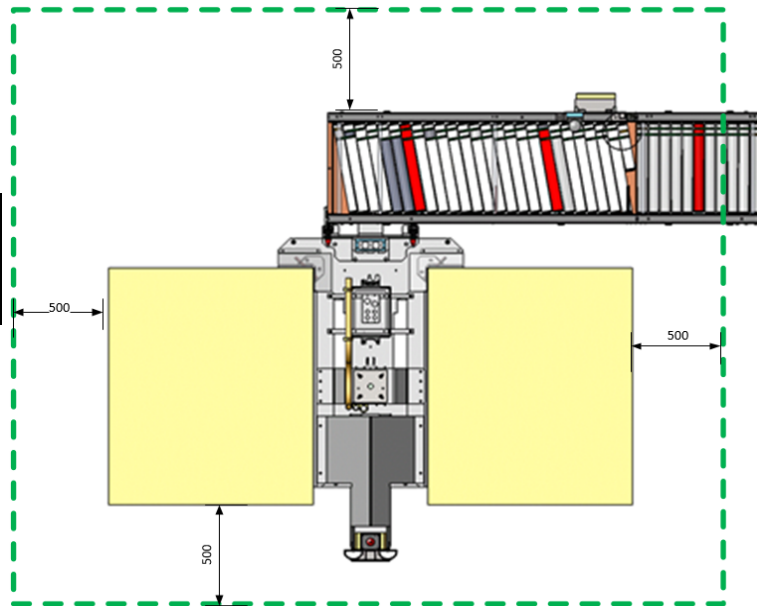
Picture: Palletizer clearances, sideways conveyor

500

500

500

500
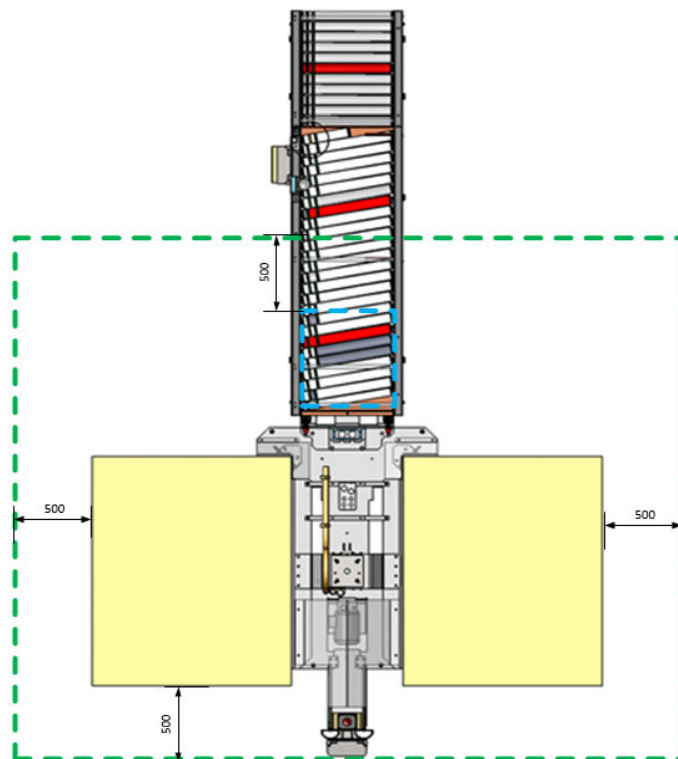
Picture: Palletizer clearances, straight conveyor

5129046-04

> **Recommendation**
> A large open area in front of robot cell enables safe and fast removal and turning of loaded pallets from palletizing positions.
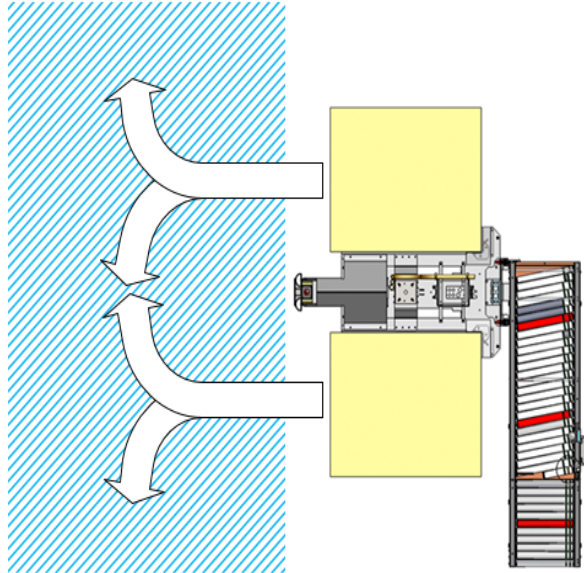
Picture: Recommended open area

3   Safety

Safety performance level: PL_d (ISO 13849-1)

The machine's robot is collaborative:

- The robot is single mode operated and cannot be changed into noncollaborative mode.
- The entire workspace is regarded as collaborative. No devices for detecting human presence to avoid contact are required.

The severity level of the worst case injury is characterized by bruises and grazes and happens if an operator against regulations enter the No entry zone without taking safety precautions and is hit on lower legs by the work piece.

3.1   General

- Robot safety checksum = DD8A.
- Robot safety checksum must be checked before machine start.
- Noise level < 69 dB (EN ISO 4871).
- Fork lifts must be used for lifting/transporting pallets in/out of No entry zone.
- Pallets must be handled in front-to-back direction, never sideways.
- The palletizer is equipped with protective cover to protect user from unhealthy housing temperature of vacuum pump.
- Use gloves or secure that the housing temperature of vacuum pump has decreased to healthy levels before removing protective cover.
- The robot generates heat during operation. Do not handle or touch while in operation or immediately after. To cool down, turn off power and wait one hour.
- The palletizer must be anchored to floor or clamped to conveyor by docking unit to ensure picking accuracy.
- Robot workplace must be kept empty, clean and tidy.
- Conveyor side plates must be mounted to prevent damages to equipment inside conveyor beam.
- In case of emergency - any of the emergency switches on front pulpit or pendant on back pulpit should be used. Main switch should not be used.
- The delineation of the No entry zone must be kept visible and clear through all time.
- Power interruption or turned off main switch will cause lost vacuum which makes the robot drop the work piece.

- Parts of control box contains electrical power also when main switch is turned off.
- The work piece's trajectory, the work piece's low height above objects (h=30 mm) and the work piece's movement direction makes a dropped work piece to be thrown so short it stays within the No entry zone.
- Robot arm must be in transport mode to avoid tilting during lifting and handling.
- The bumper must be used while moving palletizer.

3.2 Prohibitions

- User is not authorized to make changes to robot safety system.
- An invalid robot safety checksum prohibits machine start.
- Access to No entry area is prohibited except for authorized personnel while machine is in safe state and required safety precautions are made that eliminates all risks.
- Stepping or climbing on any machine part is prohibited.
- Stepping or climbing on pallets is prohibited.
- Emergency switches are not allowed to be used for normal stop.
- The main switch should not be used for emergency stopping to avoid long recovery time.
- Electrical loads must be stopped before switching main switch off.
- Connectors are not allowed to be disconnected while electrically loaded.
- The protective cover for vacuum pump is not allowed to be dismounted in order to avoid exposure of unhealthy temperatures of vacuum pump and to protect equipment from stepping and hinder the operator to stand too close to robot arm.
- Cleaning by spraying water on machine is prohibited.

3.3 Position of guards, safety devices and hazards

Safety devices:

- Emergency switches
- Reset button
- Main switch
- Protective cover
- Safety paddings
- Gripper safety shroud
- Bumper (usage during transport)

• Roller guards
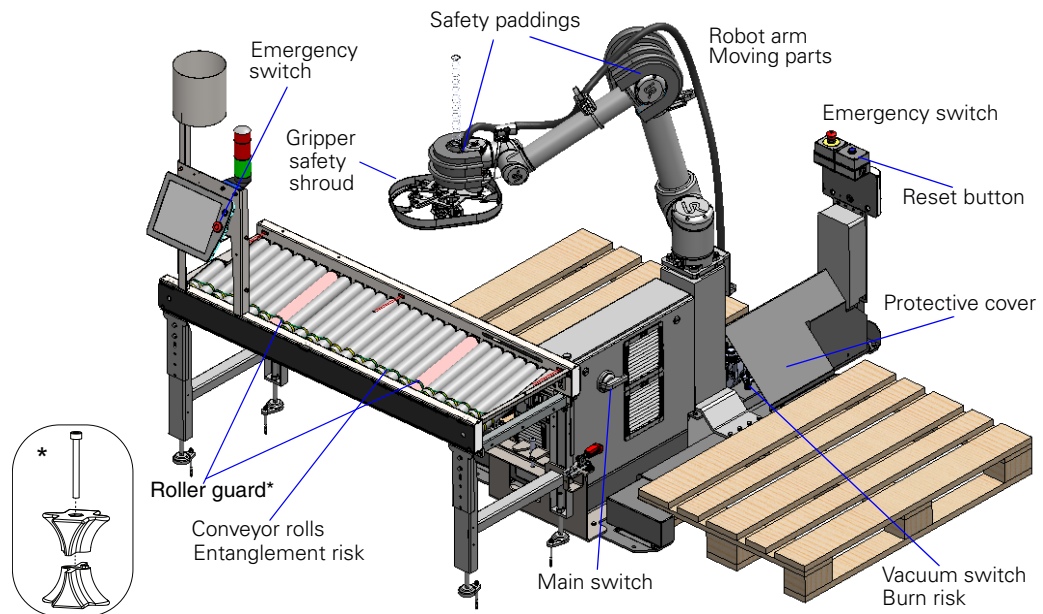
Two plastic inserts next to each drive roller.

Picture: Safety and hazard overview

3.4 Robot safety

Operator safety with regards to unintentional contact is based upon passive and active methods.

3.4.1 Inherent robot safety or UR-robot

The collaborative robot system from UR is classified as a power and force limited collaborative robot and incorporates the following inherently safety-rated limiting functions:

- Inherently safe design of robot geometry (smooth surfaces, rounded edges and corners).

- The torque limitation of the robot arm will cause an immediate safety stop in case of collision.

- Limitation of moving masses and velocities (kinetic energy).

- Use of safety-rated soft axis and space limitation function for certain sectors

- Password-protected settings

- Robot enabling device located on back of teach pendant

- Robot safety settings generates checksum.

3.4.2 Robot system safety

The collaborative robot system is combined with additional safety devices on robot elbows, head and gripper to further decrease the machinery safety risk.

Robot system total reach [mm]	Ø 3600 (Robot: r=1300mm, Gripper and work piece: r<500mm)
Maximum approved torque [kg m/s]	40
Maximum approved velocity [mm/s]	1100
Maximum effective payload mL, Gripper [kg]	10 (of which 8 kg is related to work piece)
Total mass of moving parts of robot M [kg]	47

3.4.3 Safety-rated software space limitations

The robot system is equipped with safety-rated space limiting functions such as safety barriers and software limits.

The safety barriers are permanent and create a cage for the robot to move within. A breach by the robot will cause the robot to stop (stop category 0, IEC 60204-1). The space enclosed must kept as small as possible.

The software limits are dynamic and cause the robot to perform a stop if any of them is passed while active (stop category 2, IEC 60204-1). The dynamic left limit is active while the gripper is in pallet right area. The dynamic right limit is active while the gripper is in the pallet left area. The software limits must set to run along the pallets' long side closest to robot foot.
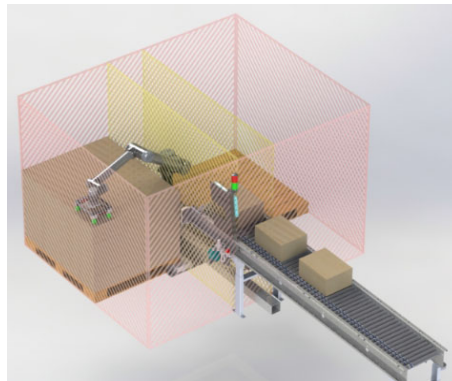
Picture: Safety barriers in red and software limits in yellow
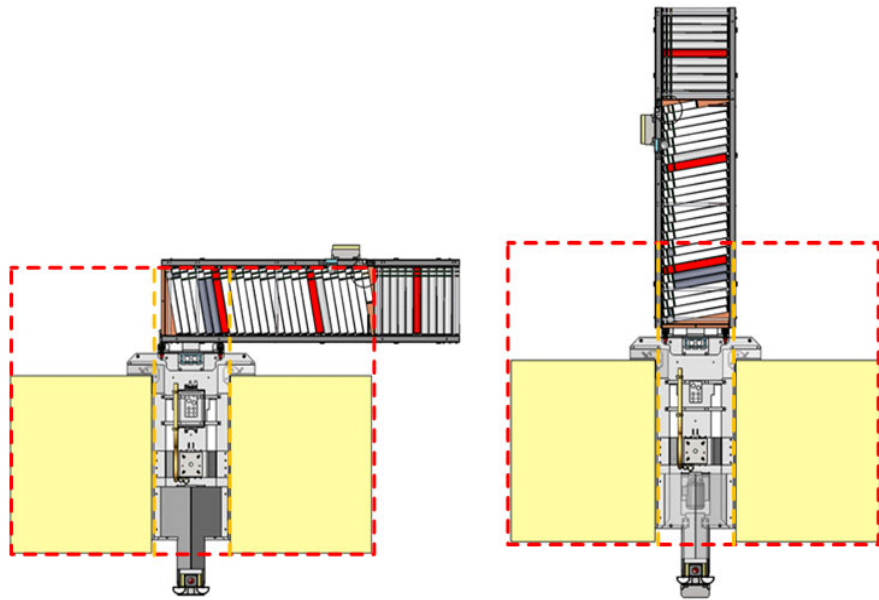
Picture: Layout of software safety limitations

3.5 Personal safety equipment

Personal safety equipment worn by all users:

- Safety shoes
- Safety glasses
- Safety gloves

4 Unpacking, lifting and transporting

4.1 Unpacking

The machine parts are delivered on pallets. Tools required for unpacking: hammer, crowbar, fork lift truck.

Picture: Recommended tools for unpacking

4.2 Lifting and transporting

Palletizer weight [kg]   300

Required tool   Fork lift

Conveyor geometry and weight

Conveyor type	Length [mm]	Weight [kg]	Width [mm]
Two zones	1512	< 300	800
Three zones	2117	< 300	800
Four zones	2722	< 300	800

The robot arm should be in transport mode during all lifting and transport.
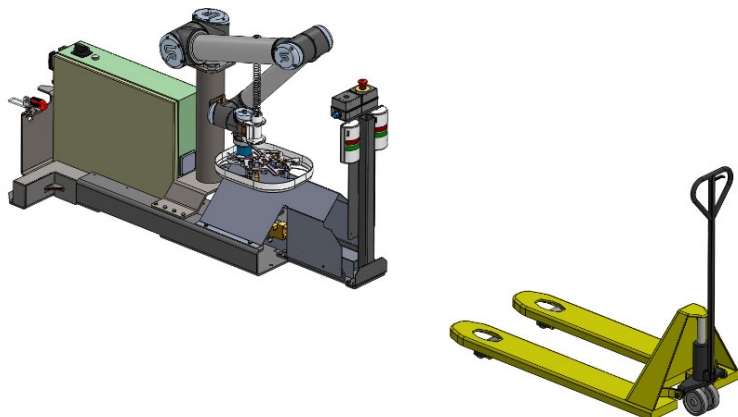
Picture: Palletizer in transport prior to movement

The bumper should be mounted on palletizer to avoid damages on docking unit and human injuries due to sharp edges on the docking unit.
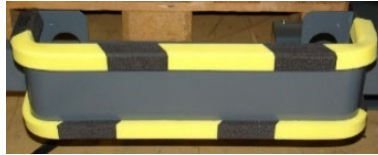
Picture: Bumper

4.3 Transport mode

Transport mode is set using Freedrive mode.

While in transport mode the arm is aligned lengthwise and reduces off-centre of gravity.
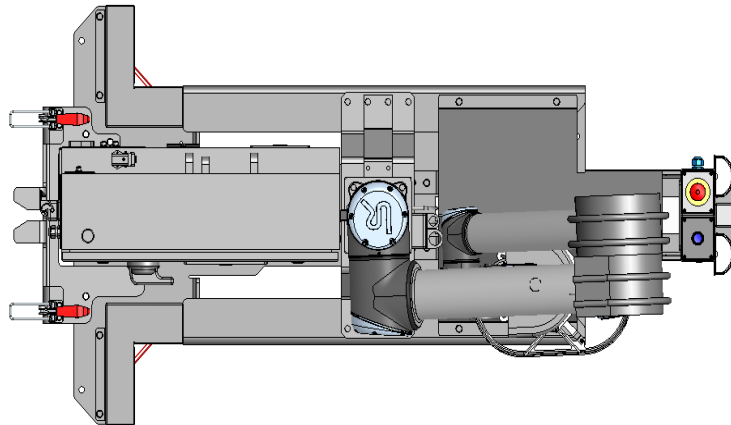
Picture: Palletizer in transport mode from above

4.4 Preparation for relocation of palletizer

Instruction:

1   Secure that the robot arm is in transport mode.

2   Disconnect palletizer from conveyor by disconnecting the electrical connector.

3   Disconnect palletizer from conveyor mechanically.

4   Disconnect palletizer from floor anchoring points.

5   Lift and move palletizer enough to mount the bumper on palletizer.

6   Lift and transport palletizer to new location.

4.5　　Docking with alignment plate

The alignment plate is used for palletizers without docking unit.

The plate is placed on the floor under the conveyor after the conveyor is set and anchored to the floor in the correct position.

The conveyor is levelled before the palletizer is moved into position, guided by the alignment plate.
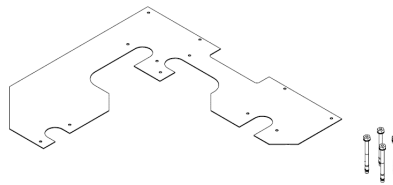
Picture: Alignment plate

4.6　　Docking with docking unit

Machines with docking units has a docking beam on the conveyor and a docking unit mounted on the palletizer. The conveyor is moved into the correct position, anchored to floor and levelled.

The docking unit's locks is preferably used by the operator that moves the fork lift transporting the palletizer to make the guiding fork funnel on the palletizer to hit the guiding pin on conveyor. Locking the palletizer docking unit to the conveyor on each side of guiding pin secures accurate positioning.
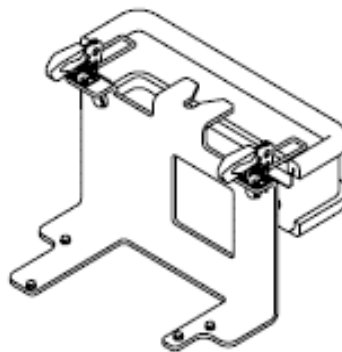
Picture: Docking unit

5 Assembly and installation

5.1 Space and floor preparation

The machine should be mounted in an open space without obstacles. The floor must be in level and floor strength sufficient to withstand the machine weight.
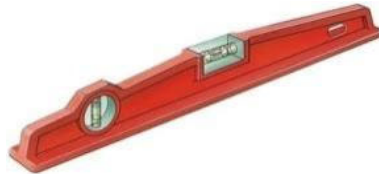
Picture: Spirit-level to secure flatness

5.2 No entry zone delineation

Tape for No entry zone delineation is included.

The size of the No entry zone depends on layout. The delineation shall be taped to the floor and maintained to express the borders of the zone at all time.

The clearance to pallet must be minimum 500 mm.

Picture: Delineation tape

Recommendation
Improve the effect of limits by using belt barriers as complement to tape (not included in delivery).

Picture: Recommended optional equipment for improved delineation

5129046-04

Conveyor back's extension

The backside border runs in line with conveyor backside.

Box

500

500

500
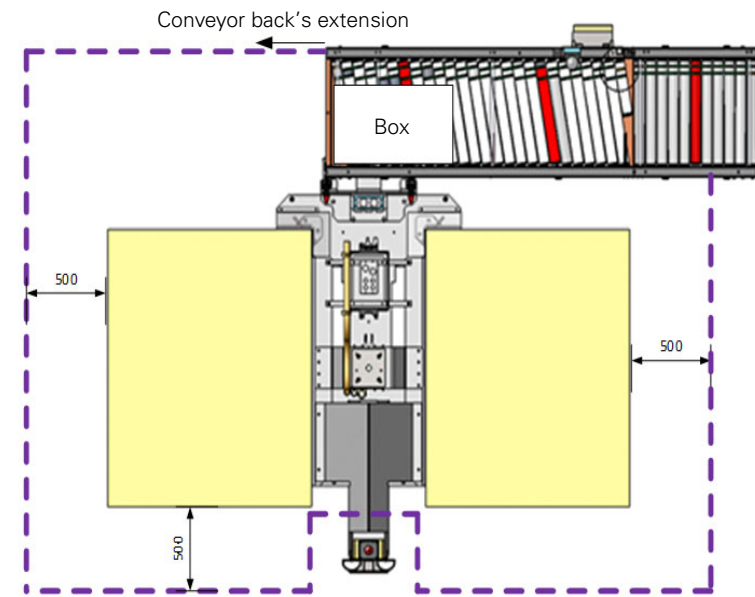
Picture: Delineation geometry for sideways conveyor

The backside border is immediately upstream the picking position.

Box end

Box

500

500

500
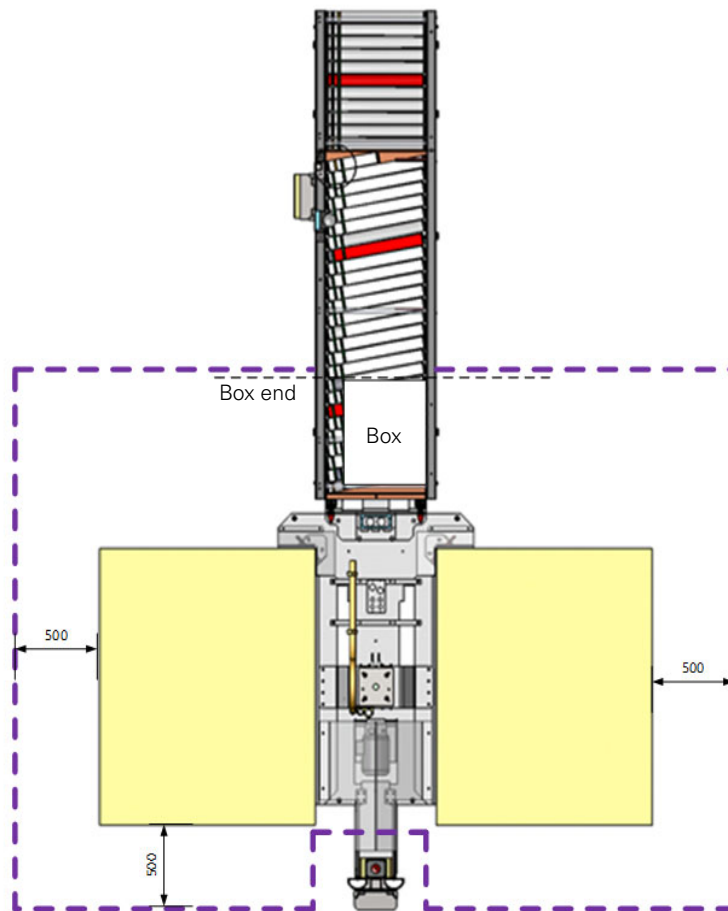
Picture: Delineation geometry for straight conveyor

5.3 Mechanical assembly

Machine delivery form:

- Palletizer front pulpit installed

- Palletizer actuator/pedestal installed

- Robot arm installed

- Gripper installed

- Conveyor legs separated from conveyor top

- Conveyor back pulpit tilted flat

The assembly and installation processes requires space. The mounting area must be kept clear during assembly.

The mechanical assembly is started after the base is assembled in the right position.

When mounted, the conveyor and palletizer must be horizontal. The stability increases if the machine is fixed to floor.

5.3.1 Conveyor

Lift and hold conveyor top flat and make sure no robot hoses are clamped to damage while the legs are raised and mounted.

When the legs are fixed, the conveyor is placed on the floor on its legs. Subsequently, the conveyor leg height is adjusted (700, 744, 774, 818 or 862mm) and the back pulpit is mounted.

The conveyor's height setting must be synchronized with the robot arm picking position geometry settings.

Picture: Adjustable conveyor feet

5.3.2 Robot hoses

Mounting distances [mm]
D1 = 320
D2 = 250
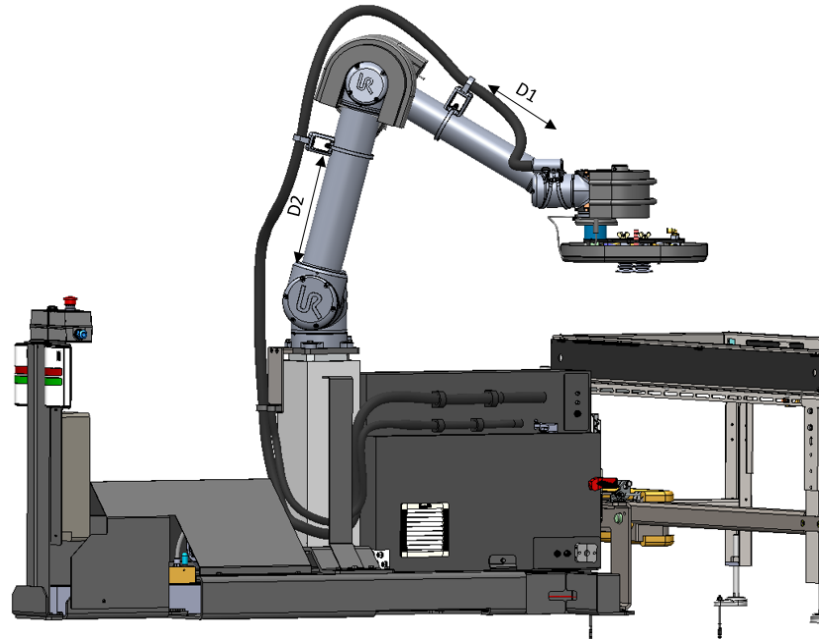
Picture: Conduit bracket assembly
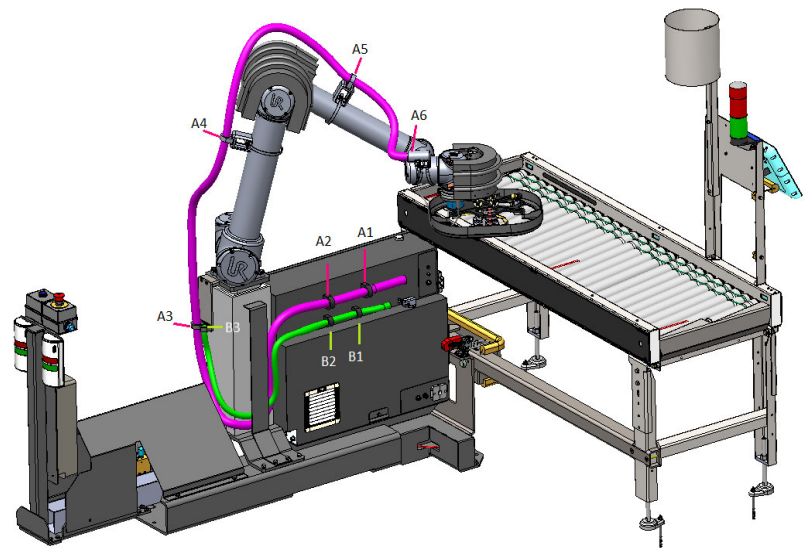
Picture: Robot hose stretch designation

Robot hose stretch lengths

Control box to head (pink)	Control box to foot (green)
A1: 65 mm	B1: 40 mm
A2: 160 mm	B2: 120 mm
A3: 1000 mm	B3: 1000 mm
A4: 900 mm	
A5: 800 mm	
A6: 580 mm	

5.4   Electrical installation

The machine's incoming voltage has a span of 110 to 240V. The vacuum pump is configurable to for either 110 or 220V. The vacuum pump voltage configuration must be verified before power is turned on for machine.

6 Settings

6.1 Motor drive settings

The motor speed can be adjusted on the motor driver. DIP-switches are located behind the cover on the driver on picture below and enables adjustment of speed. Reference to User manual, Interroll, Zone-control.

DIP-switch cover
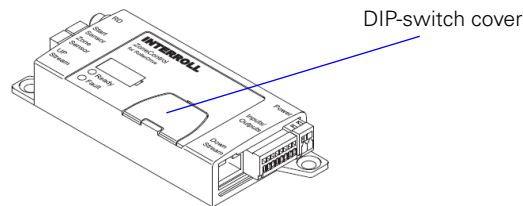
Picture: Conveyor driver

6.2 Actuator parameterizing

This chapter is valid for units with actuator. The actuator controller must be initialized and taught its end-positions by the hand-control unit which is included in delivery.

6.2.1 Initialization of actuator

1   Press the up-arrow button and the down-arrow button simultaneously and hold for minimum 5 seconds until the controller sound alarm is ringing.

2   Release both buttons.

3   Press the up-arrow button to move the pedestal up-wards. A sound alarm will be ringing. Keep pressing until the alarm shuts down.

4   Press the down-arrow button to move the pedestal downwards and keep pressing until the pedestal is in the bottom position.

6.2.2 Position teaching of top bottom positions

1   Press the up-arrow button until the pedestal is in top position.

2   Press the square button + the 1 button. A short beep sounds and the orange lamp lights up.

3   Press the down arrow button until the pedestal is at the bottom position.

4   Press the square button + the 2 button. A short beep sounds and the green lamp lights up.

The hand-control unit's orange lamp is on while the actuator is in top position and its green lamp while in bottom position.

6.3   Vacuum pump

Vacuum pump pressure should be set to maximum.

7   Robot system software set-up

This chapter and its action are for skilled personnel.

The machine must contain the following:

- program file, including:
  - pattern file
- updated Installation file, including:
  - machine configuring variables
  - calibration data
  - robot safety settings

7.1   Robot program

The program (urp-extension) contains the logic behaviour of the machine. Several programs can be stored in the memory whereof one is loaded, adapted (setting machine configuring program variables) and run.

The program is downloaded to the robot system from a tablet with the FlexLink app Robot config. Thereafter the program must be loaded.

7.1.1   Load program

The program must be loaded after it has been downloaded to the machine.

Instruction for loading a program:

1. In main menu, press Run program, which opens the Run page.

2. Press File and thereafter Load to open the file explorer.

3. After pressing Run Program, the Run tab appears. Press File and thereafter Load to open the file explorer.
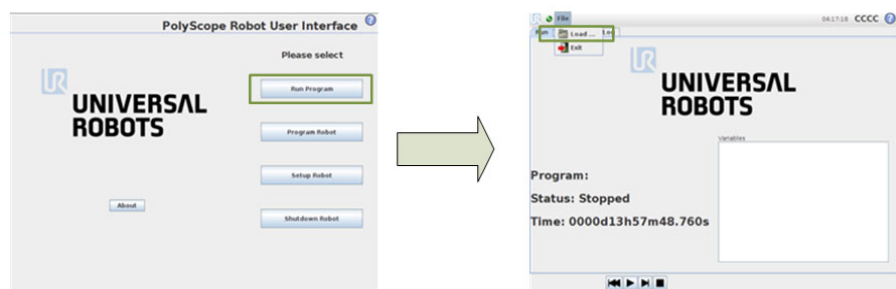
Picture: Load command on Run program screen

4   Select the program of interest and press Open or double-click on program name to load the program, which makes a set of control buttons available.
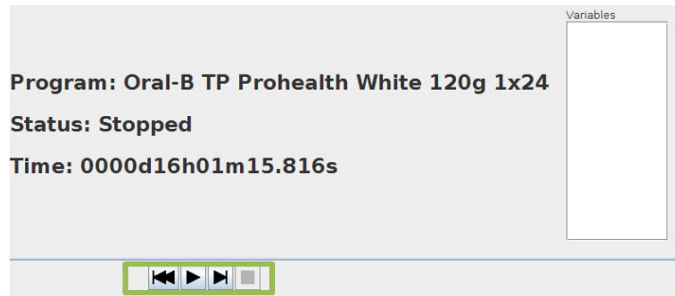
Picture: Set of control buttons

Note
If the current safety settings are different from those used by the opened program, the changes must be applied and the safety board restarted.
Press Apply and restart. The robot must be reinitialized. Follow the steps in the Initialize section.
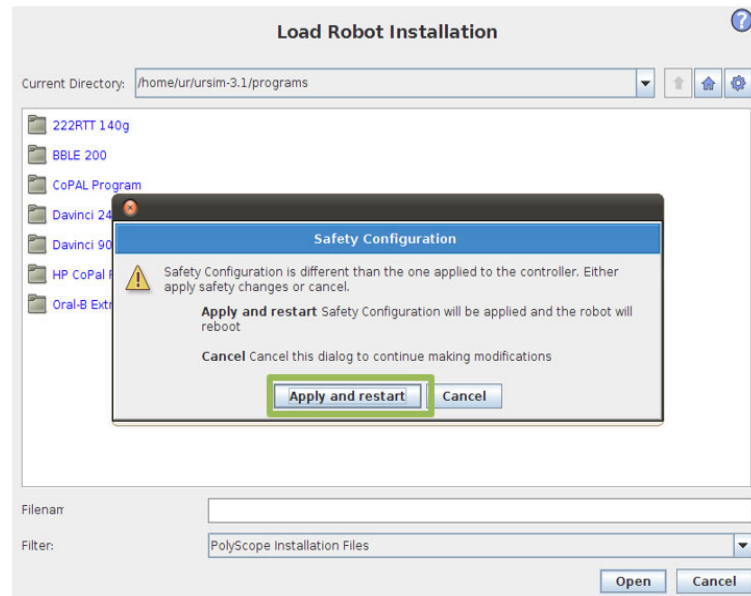
Picture: Information of difference in safety configuration

7.1.2   Pattern file

The pattern file, also called script-file, describes how the carton boxes are placed on the pallet layer by layer.

The pattern file is downloaded to the robot system from a tablet with the FlexLink app Robot config.

7.2 Installation file

The installation file is located in the robot home catalogue. It contains all the application and situation dependent specific configuration parameters such as locations, calibration data, machine configuring variables and safety settings.

The robot program is reading data from an installation file with a specific name stored in a specific location. The robot system can contain several installation files, but the active file must have the name and location that the program expects.

The calibration data of an installation file cannot be extracted and copied into another installation file. Calibration has to be carried out for each individual machine. Reference to Calibration chapter.

Files stored in robot home catalogue:
- default.installation
- default.variables
- popup_language.script
- robot_control_hw_21.txt
- robot_control_hw_21.urp

7.2.1 Machine configuring variables

The program configuring variables must be updated before the robot system software can be set into Run.

The variables which configures the behaviour of the machine and must be set before the machine is started.
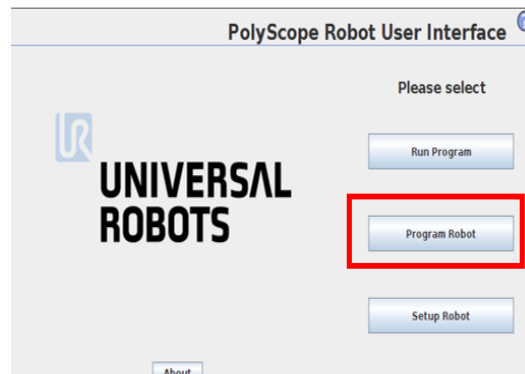
Picture: Program robot button

Setting instruction:

1. From main page, go to Program robot page.

2. Press Variables in the left list.

3. Set values according to tables in next chapter.
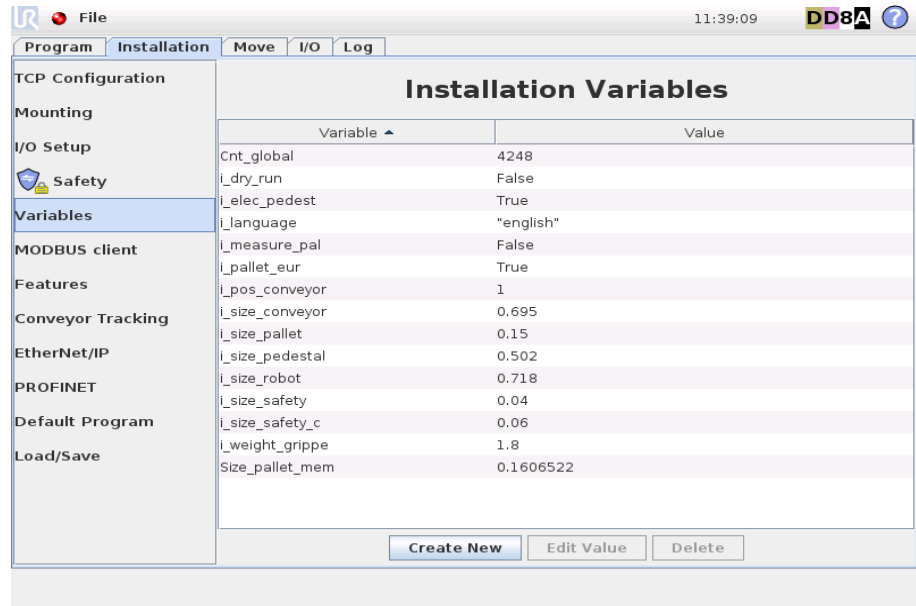
Picture: List of installation variable values

7.2.2   Machine configuring variable setting

Name	Value	Note
Cnt_global	-	Carton box picking counter
i_dry_run	False	Carton box dry on/off
i_size_pallet	0.155	Contains manually filled in pallet height if i_meas_pal=false [m]
i_size_pedestal	0.502	Electric pedestal stroke length [m]
i_size_robot	0.720	Height between floor and robot foot [m]
i_size_safety	0.04	Height between box and gripper on pallet [m]
i_size_safety_c	0.06	Height between box and gripper [m]
i_weight_gripper	1.8	Gripper weight [kg]
Size_pallet_mem	-	Contains result value of executed automatic pallet height detection

Name	Conditional value	
	Manual pallet height setting	Automatic pallet height detection for each new pallet
i_meas_pal	False	True

Name	Conditional value Select language
i_language	English, German, Polish, Portuguese, Swedish, French

Name	Conditional value	
	Fixed pedestal	Electrical actuator
i_elec_pedest	True	False

Name	Conditional value	
	European pallet	US pallet
i_pallet_euro	True	False

Name	Conditional value			
	Layout 1	Layout 2	Layout 3	Layout 4
i_pos_conveyor	1	2	3	4

Conveyor layouts
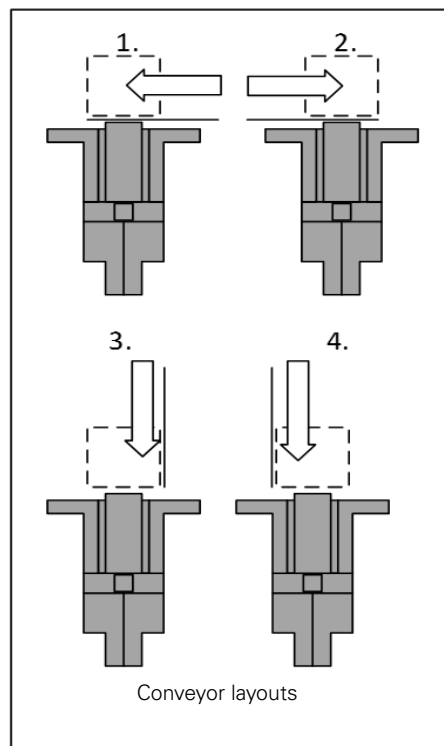
Picture: 1. Right, 2. Left, 3. Left-center, 4. Center-left

Variable i_size_conveyor

> Contains the height H between floor and carton box bottom surface.

Variable Size_pallet_mem

> Contains result value of executed automatic pallet height detection.
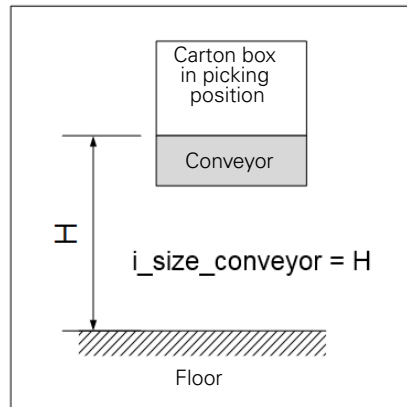
Picture: Distance H

7.2.3   Safety settings

Safety barriers and software limits has to be set (included in default installation file) before the machine is taken into operation.

Instruction for Right and Left layouts

1   Set Safety barriers front, left and right (red) to run along pallet borders.

2   Set Safety barrier in the back (red) to run just along the backside of box in picking position.

3   Set the software limits (orange) to run along the inner pallet borders.

Normal mode	
Force [N]	150
Power [W]	250
Speed value [m/s]	1.1
Momentum (torque) [kg m/s]	40

Reduced mode	
Force [N]	100
Power [W]	200
Speed value [m/s]	0.75
Momentum (torque) [kg m/s]	20
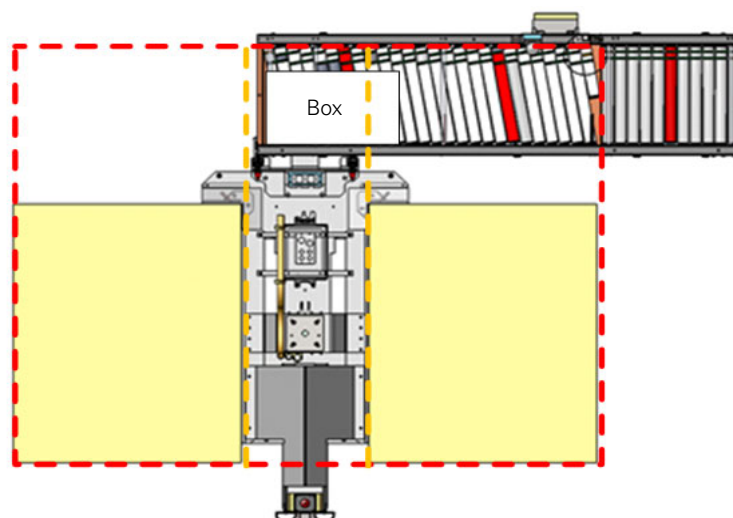
Picture: Safety barriers and software limits of Right or Left layout

Instruction for Center-Right and Center-Left layouts:

1   Set Safety barriers front, left and right (red) to run along pallet borders.

2   Set Safety barrier in the back (red) to run just along the backside of box in picking position.

3   Set the software limits (orange) to run along the inner pallet borders.

Box
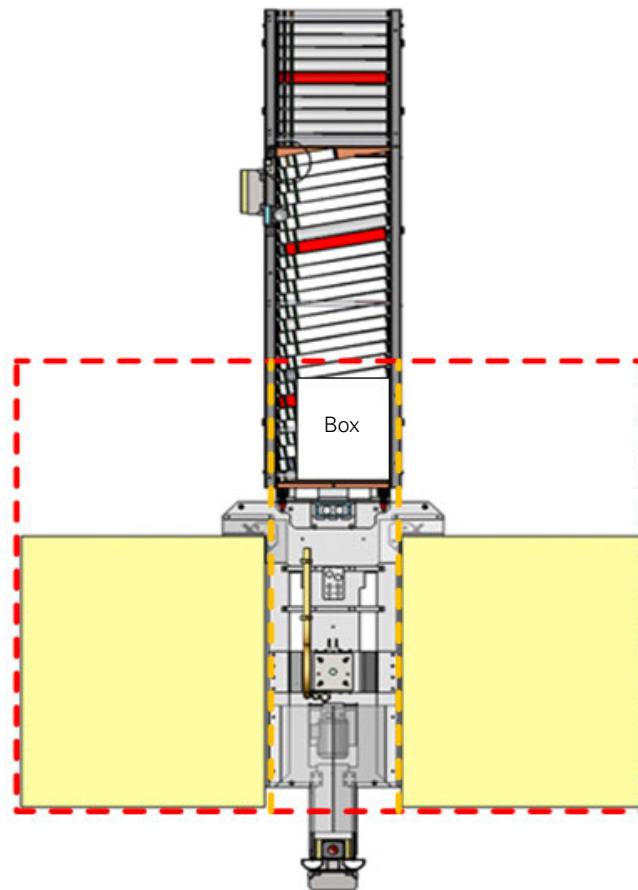
Picture: Safety barriers and software limits for C-L and C-R layouts

8   Calibration

This chapter is advanced and carried out by skilled personnel.
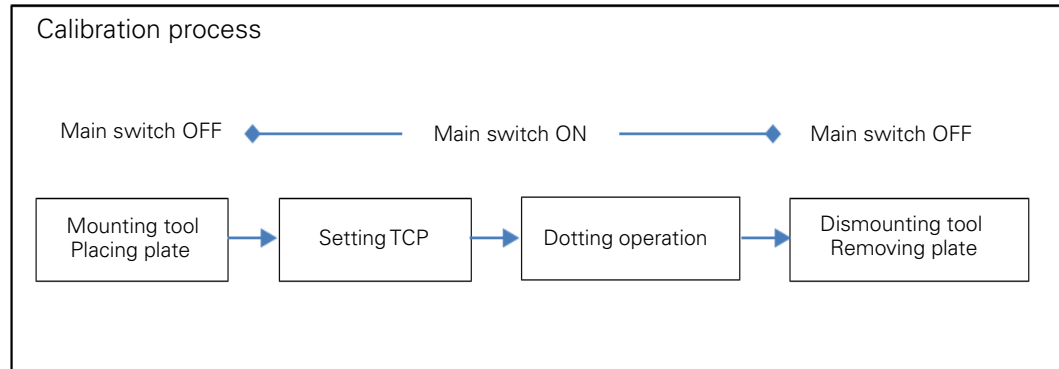
Picture: Calibration process steps

Calibration makes sure the geometrical relation to the picking position is known by the robot system. A calibration has to be executed every time the picking position and robot arm has been moved in relation to one another. Subsequently the robot system will loose picking accuracy when calibration is neglected after the geometrical relation has been changed.

The execution requires entering the No entry zone and measures to secure safety.
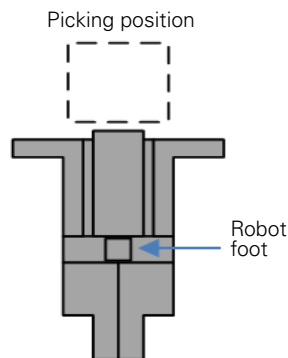
Picture: Foot and picking position relation

The list below of safety precautions for calibration do not hinder additional measures:

- The workspace is cleared from all personnel not participating in calibration process.

- Calibration must be executed by skilled personnel only.

- Main switch must be turned off while mounting/dismounting calibration tool and placing/removing calibration plate.

- Calibration tools are not allowed to be mounted during normal operation.

- Reduced robot speed.

- No other than FlexLink calibration tools designed for the specific machine are allowed to be used.
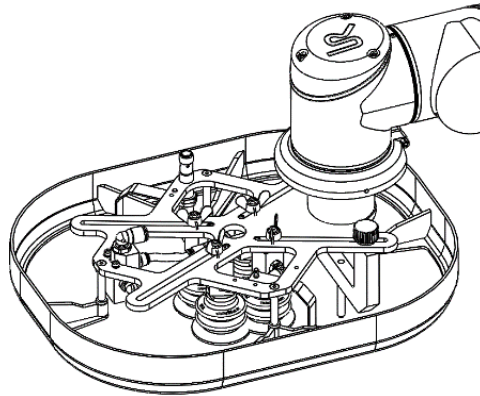
Picture: Gripper with mounted calibration tool

A mounted calibration tool and calibration plate has to be used when calibrating the robot system. The calibration tool is pike-shaped and therefore will the calibration activities have to be carried out with great caution. The tool is mounted before the dotting process is started and is removed when the results of the dotting process are saved.

How to mount the tool depends on the tool selected. Reference to Calibration tool, Assembly instruction.

8.1 Setting the TCP

With reference to the selected calibration tool's Assembly instruction, find the tool's vertical D-value.

The D-value is the distance from the bottom surface of robot head and the tip of calibration tool. Different tools have different designs and are mounted in different ways.
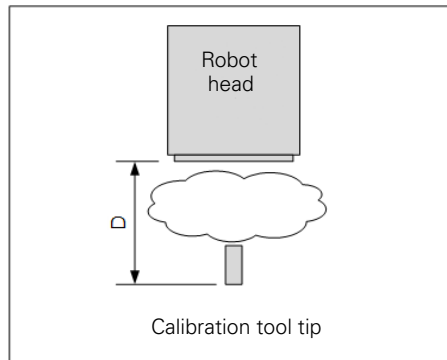
Picture: Distance D

Setting instruction

1. Turn on main switch.

2. Turn on robot controller on the teach pendant.

3. Reset robot safety system.

4. Set the robot system into Normal state (green status lamp on pendant).
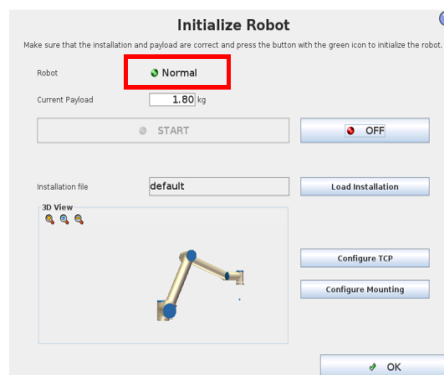
Picture: Normal state

5. Press Program robot button in main menu

6. Select the tab Installation, thereafter TCP Configuration.
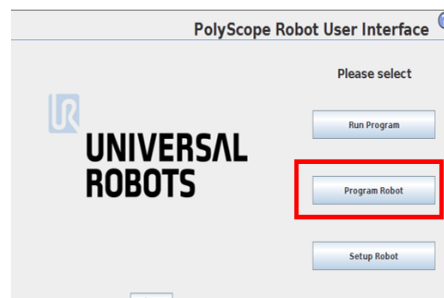
Picture: Program robot button

7   Select the TCP_1 configuration and press Set as default to activate it.

8   Set X-, Y-, Rx-, Ry- and Rz-values to 0.

9   Set Z-value equal to the Calibration tool D-value.

10 Set the payload value to 1.8 kg (Note: picture contains wrong value).
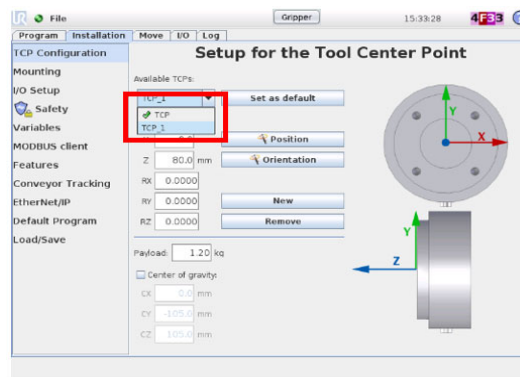
Picture: Scroll down TCP list

8.2   Dotting operation

During the actual calibration the calibrating tool makes "dotting" against the calibration plate in three locations in the picking position and the geometrical coordinate result is stored in the robot system's installation file.

The safety system needs to be kept intact to avoid interrupting the calibration process. The safety shroud on gripper needs extra attention for certain calibration tools.

There are four different directions the carton box can approach the picking position. The carton boxes are aligned against a sliding surface before reaching the end-stop surface to create a well-defined picking position. The alignment surface is always the surface nearest the robot for sideways approach.

The picking position geometry is recorded as a "Feature" named "frPick". The three dotting points:

- Pick_0, crossing between sliding and end-stop surface
- Pick_Y, for the Y axis direction/end-stop surface
- Pick_X, for the X axis direction/sliding surface

The calibration plate must be used. Neglecting the plate will result in a vertical offset error.

The dotting points must be carried out in order:

1   Pick_0
2   Pick_Y
3   Pick_X
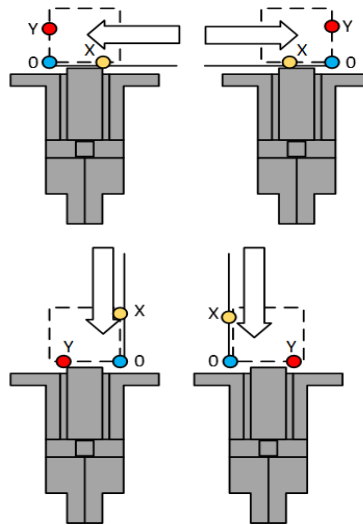
Picture: Dotting points due to layout

Dotting instruction for Pick_0

1   Press the Features tab

2   Press frPick.

3   Press the "Pick_0" point and then Change this point button, which cause the Move-page to appear.
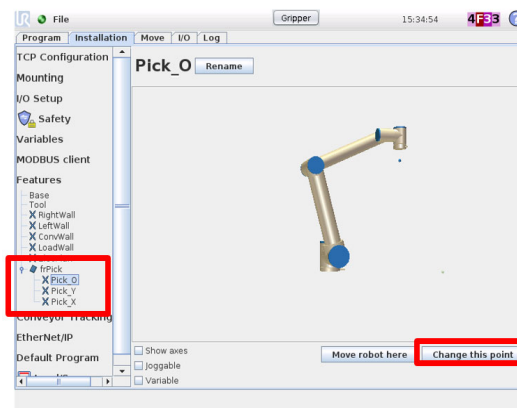
Picture: Dotting point selection

4   On Move page, the arrows can be used for movement and the speed can be reduced to be more precise with the slide bar in the bottom.
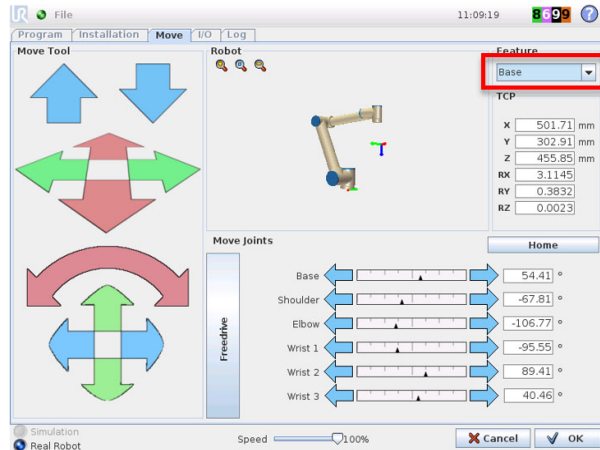
Picture: Feature Base selection

5   Activate Freedrive mode by pressing the black button on the back of pendant.

6   While in Freedrive mode, move the tool manually to position Pick_0 into the corner against the flat calibration plate surface.

7   Execute sub-routine Coordinate mating as below.
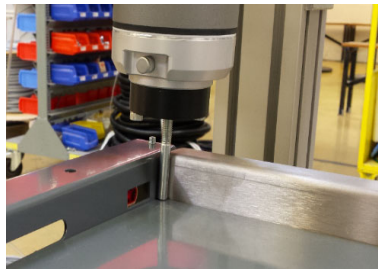
Picture: Pick_0 dotting point

Sub-routine Coordinate mating

1. Set coordinates: Rx=3.14, Ry=0, Rz=0;

In case a pop-up window appears which asks to go to Initialization screen when any of the coordinate fields are selected, it means the robot system never was set to Normal state in the first place.

Press "Go to Initialization screen" and make the robot system go into Normal state before continuing.

2. The robot system assess if the physical position of the gripper is close enough to the filled-in coordinates.

In case the robot system assess the physical position to be too far away from filled-in coordinates, it will open the Move Robot into Position screen.

- Press Auto to run the gripper into position and finish with OK which cause the Move screen to appear.
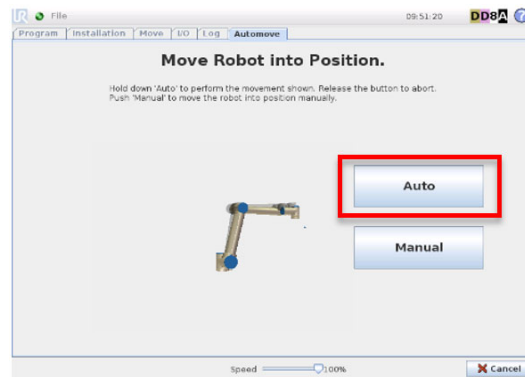
8   On Move screen, press OK when the arm location is correct, to make the Installation screen to re-appear.

Dotting instruction for Pick_Y

1. Under frPick, press the Pick_Y and press the Change this point button which cause the Move page to re-appear.

2. On Move page, move the arm as for Pick_0, to the Pick_Y position along the end-stop surface a minimum of 100mm away from Pick_0 position and make sure the tool tip reaches the calibration plate.

3. Execute sub-routine Coordinate mating.

4. Press OK when the arm location is correct, which will make the Installation page return.
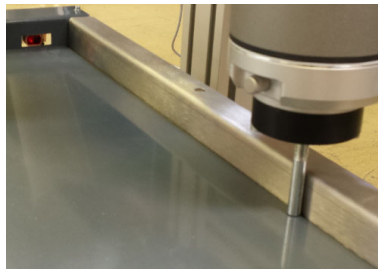
Picture: Pick_Y dotting point

Dotting instruction for Pick_X

1. Under frPick, press Pick_X and press the Change this point button which cause the Move page to re-appear.

2. On the Move page, move the arm as for previous points, top the Pick_X position along the sliding surface a minimum of 100mm upstream the corner Pick_0 position. Make sure the tool tip reaches the calibration plate.

3. Execute sub-routine Coordinate mating.

4. Press OK when the arm location is correct, which will make the Installation page to return.
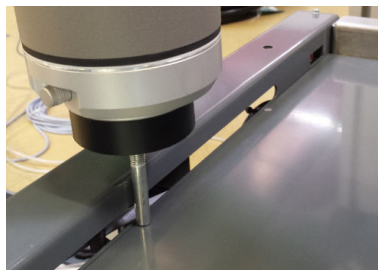
Picture: Pick_X dotting point

Dotting finalization

1   All three coordinates are now found, but unsaved.

2   On Installation screen, press TCP configuration to open the Setup for the Tool Center Point page.

3   Select TCP in the Avaliable TCPs scroll down list and press Set as default.
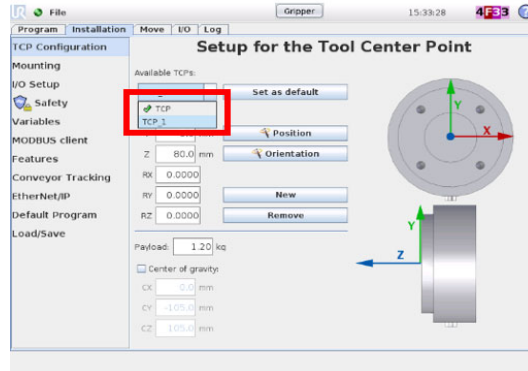
Picture: Setup for the Tool Center point

4   Press Load/Save to the left which opens the Load/Save robot installation to file page.

5   Press the Save button to save the three coordinates into the installation, which disables the button.

6   Leave Program mode.
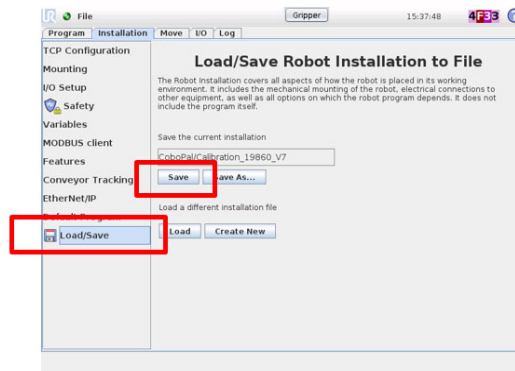
Picture: Load/Save to file

The machine is now calibrated and ready to be turned off for restoring it to normal operation.

9 Testing and validation

The machine is not allowed to start for production (put into service) before validation has been passed successfully. Incorrect settings or incorrect application program can cause dangerous situations. Validation is required before operation. All validation procedures are executed by skilled personnel.

9.1 Validation checklist example

VALIDATION PROTOCOL

Signature   ....

Date   ....

Validated unit   ....

Test points

Test	Failure test/ Safety validation	Expected result	Pass/ Failed	Comments
1	No entry zone delineation	-		
2	Incoming voltage	-		
3	Correct recovery after power loss			
4	Payload setting	-		
5	Robot program loaded			
6	Safety barrier settings	-		
7	Software limits settings	-		
8	Velocity settings	-		Normal and reduced mode
9	Torque settings	-		Normal and reduced mode
10	Acceleration settings	-		Normal and reduced mode
11	Emergency switch front	System emergency stop		
12	Emergency switch back (pendant)	Robot emergency stop		
13	Collision on gripper shroud	System emergency stop		
14	Collision on robot arm	Protective stop		
15	Collision on safety padding elbow 1	Protective stop		
16	Collision on safety padding elbow 2	Protective stop		
17	Collision on safety padding head	Protective stop		
18	No box detected in picking position	Alarm		
19	Suction cup function in general	-		
20	Missing pallets check	Lamp indications		
21	Both pallets full check	Lamp indications		

10 Operation

10.1 No entry zone and operational areas

The No entry zone prohibits access to everyone who is not authorized. A breach is a violation to the regulations of the machine.
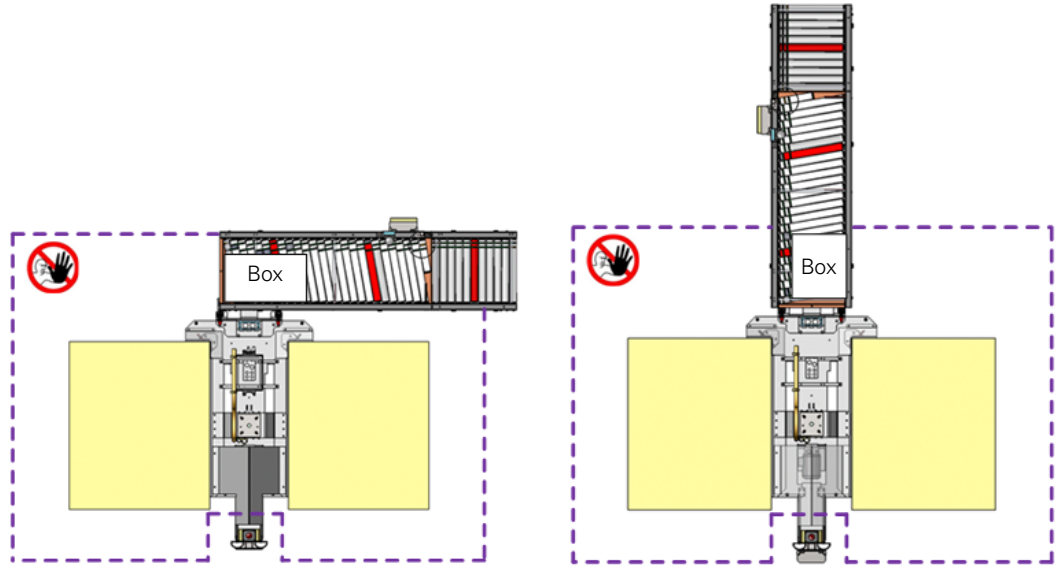
Picture: No entry zone

The operational areas are in the front and back of machine and are related to the removal/insert of pallets and start/stop of machine.
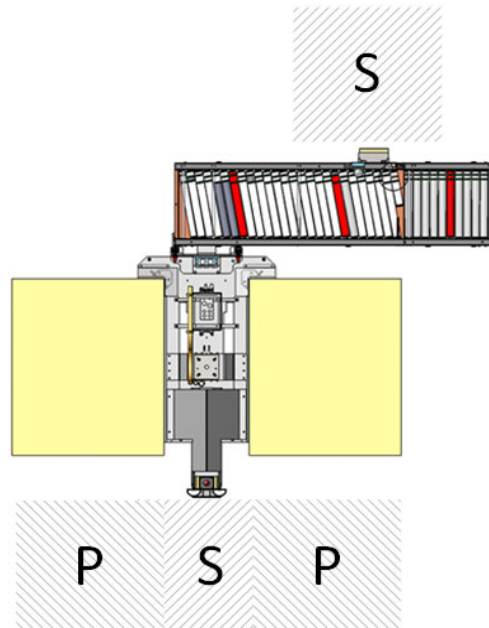
Picture: Operator areas (S=Starting/stopping, P=Pallet handling)

10.2 Unskilled operator tasks

Unskilled operators should in no case enter No entry zone while main switch is on. All tasks to be carried out are located outside No entry zone or when the main switch is off.

Pallets must be inserted and removed by fork lift.

Pallets must be inserted and removed length-wise.
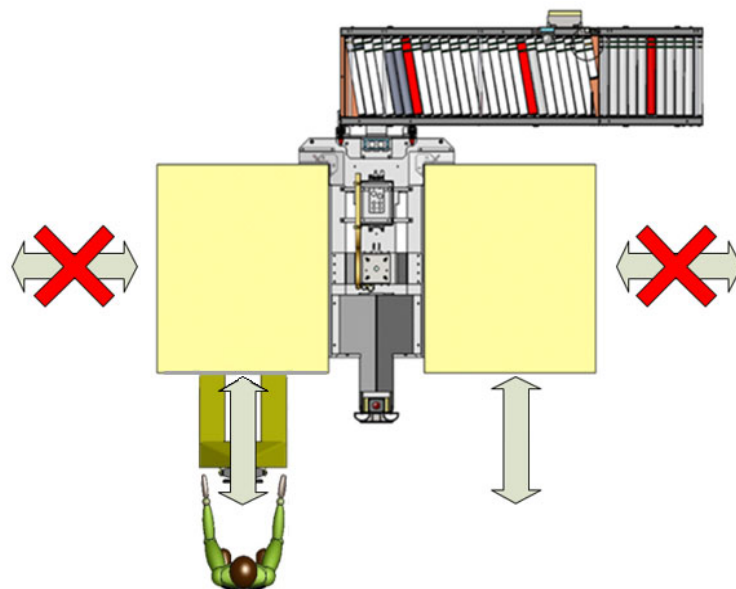
Picture: Fork lift direction restriction

Maintenance, house-keeping/Cleaning

Periodic maintenance tasks are executed on gripper and conveyor while machine is stopped and main switch turned off.

Undocking/docking, lifting and transporting palletizer

Main switch should be off before and during docking, undocking, lifting and transporting.

Actions to solve production hinders inside No entry zone

Unskilled operators calls for skilled, authorized personnel to solve problems inside No entry zone. Examples: stuck carton box, dropped carton box.

10.3   Authorized personnel tasks

Skilled and authorized personnel are approved to enter No entry zone with main switch on when required safety precautions are carried out to eliminate all risks.

Set robot into transport position

The robot needs to be powered and in Freedrive mode to make the axis of the arms possible to move manually into correct transport position.

10.4   Control box user interfaces

Devices:

- Main switch
- POWER ON lamp

The main switch turns off incoming power to machine and hinders the user from entering the box without turning off incoming power. Orange coloured remain powered despite turned off main switch.

The POWER ON white lamp indicates 24VDC power and ventilation fan are powered.

10.5　　Front pulpit user interfaces

The front pulpit contains the front emergency switch and the reset-button.

Picture: Front pulpit initiators

10.6 Machine states

Legend:

◯	Power off	◇	Start
⏻	Standby	│	Power on
⊷◯	Brake release	⊙	Robot system power on
⇅	Automatic run	◡	Ready
✋	Manual run	EN	Freedrive enable
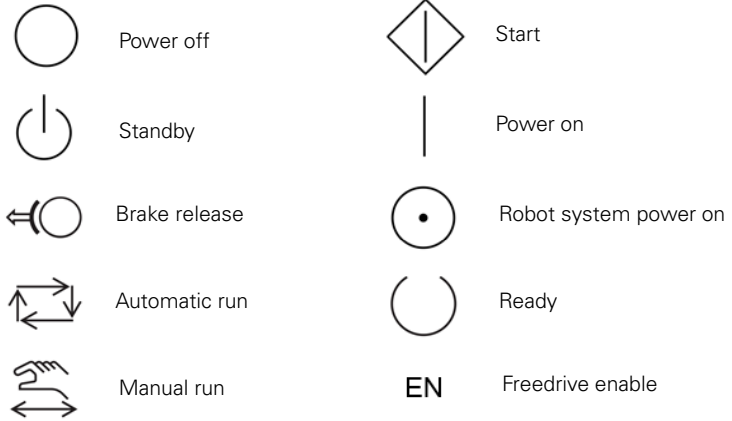
States:
5 - Freedrive
4 - Normal
3 - Idle (Brake release)
2 - Power off
1 - Machine power on
0 - Machine power off
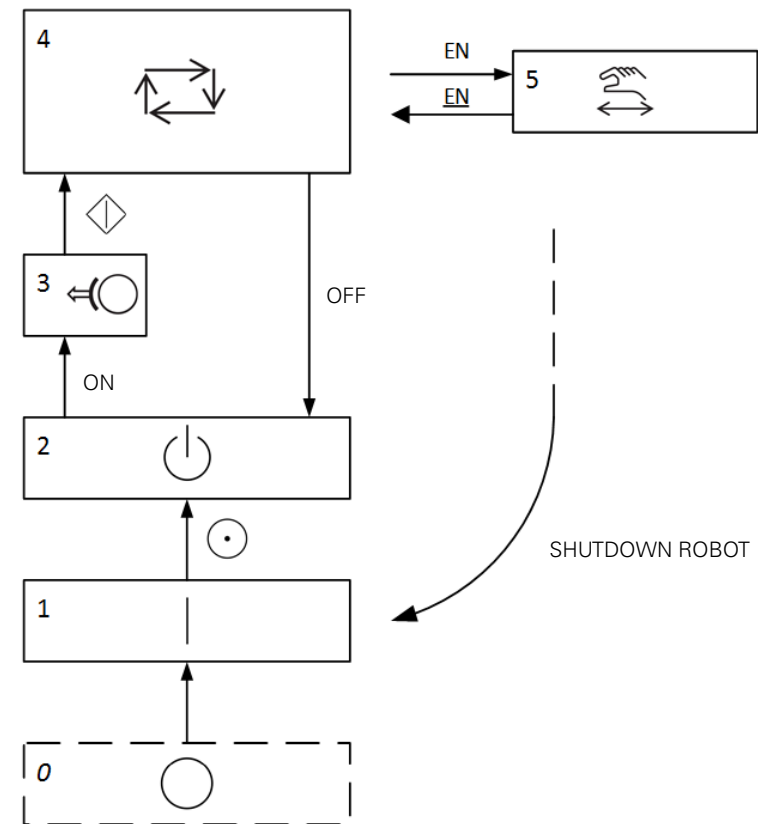
Picture: Machine state diagram

10.7 Emergency stop

To emergency stop the machine, press any of the two emergency switches. When then machine is emergency stopped, all dangerous motions will be immediately put into safe state.

Result: The robot change status to Robot emergency stop. A dialogue window on teach pendant opens. The reset-lamp on front pulpit lights up.

Picture: Pop-up window

Recovery:

1   Release all emergency switches.

2   Press reset, whereas the blue lamp turns off and robot state changes to OFF.

3   Press Go to initialization screen in the dialogue window on pendant.

4   Re-initialize machine.

10.8 Safeguard stop

If the gripper safety shroud is moved out of position or any of the safety paddings are activated, the machine will carry out an immediate safety stop.

Result: The robot changes status to Safeguard stop. The robot stays in state Normal.

Recovery:

1   Put safety shroud back into position and undo pressure on safety paddings.

2   When the reset-button is pressed, the machine will automatically resume.

10.9   Resetting

Emergency stopping, activating safety paddings or moving gripper safety shroud out of position will cause the robot to execute a safety stop.

A safety stop will turn on the blue reset pushbutton lamp.

Before the machine can be reset, the cause of the tripping has to be fixed. Thereafter the reset-pushbutton can be pressed which will make the machine ready for restart.

10.10   Powering ON the robot system

Before the robot is switched on, the safety system must be reset.

Instruction:

- Switch on the robot by pressing the power button on the teach pendant.
- The system takes about one minute to start up.
- The state will change to Booting and thereafter Power off conditioned no alarms are present.
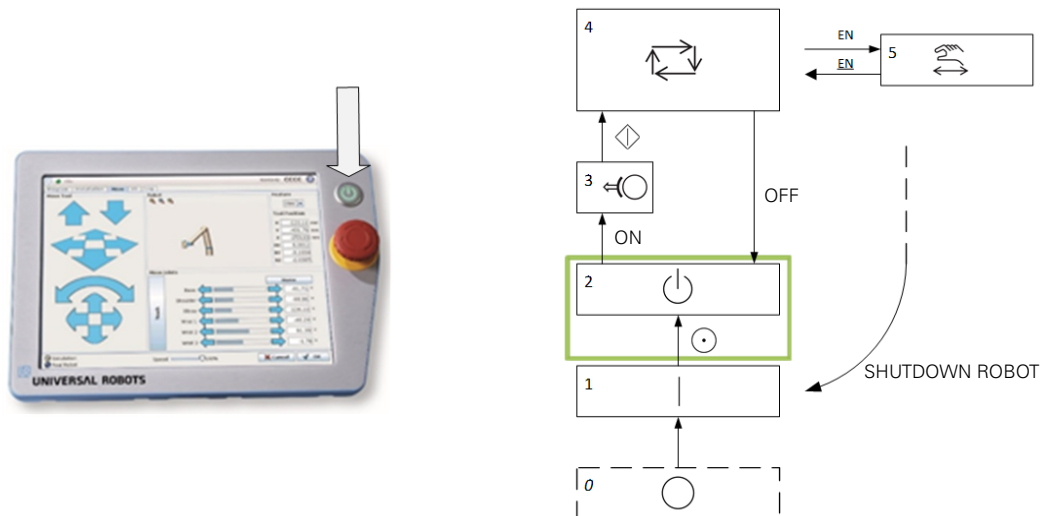
Picture: Turning on the robot system

10.11 Initializing robot arm

10.11.1 Turning ON robot arm

Instruction:

- In state Power off, initialize robot arm by pressing button ON.
- The robot initially changes state to Power on, and thereafter to Idle.
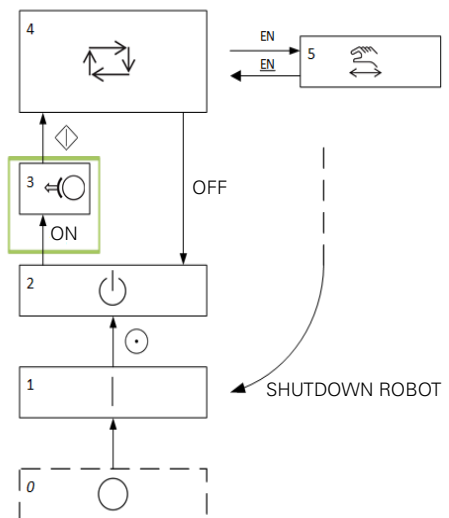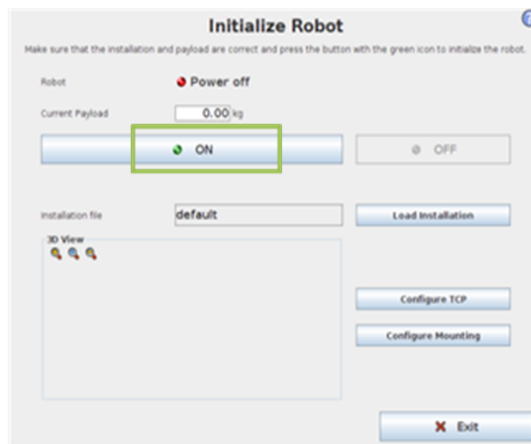
Picture: Safety and hazard overview

10.11.2 Starting robot arm

When in state Idle, the robot is ready to start.

Instruction:

- In state Idle, start the robot by pressing START.
- The robot initially changes state to Brake release while the arm makes small movements (shivering) and thereafter changes state to Normal.
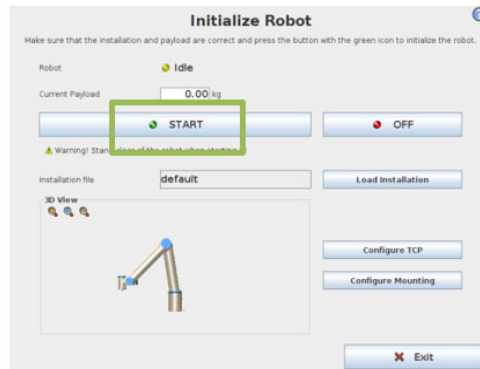
Picture: Initialize robot screen

10.12 State normal

In state Normal, the robot arm is ready to move automatically (automatic palletizing).
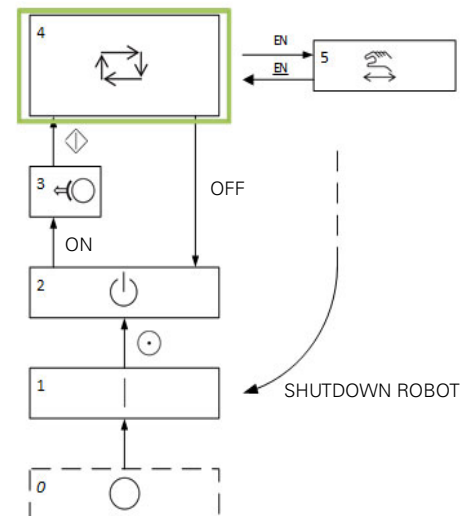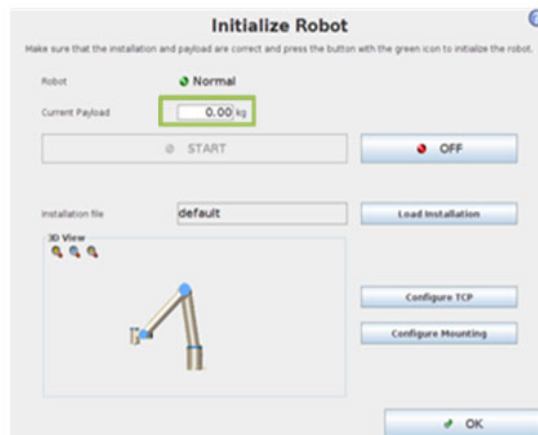
Picture: Normal state (Production state)

A correct payload must be set before the arm is moving. Fill in the correct value in the Current payload field.

To finalize initialization, press OK, which brings back main menu.
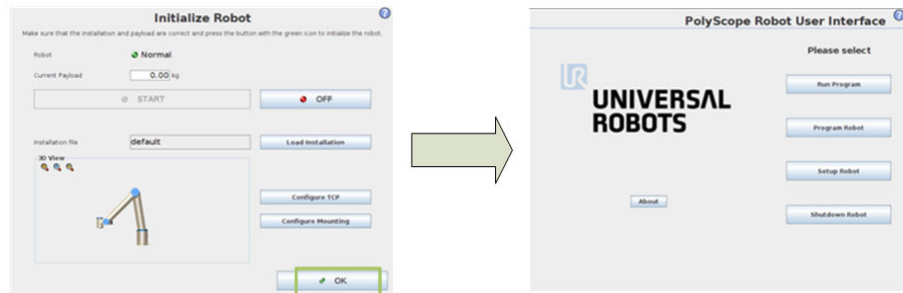
Picture: Initialization finalization

10.12.1   Running a program - Automatic production

Setting a program into run causes the machine to go into automatic production.

The correct way to start running a program is without a box in the gripper. Starting to run a program with a box in gripper will cause an error.

The Pause button is used to pause the program temporarily when it is running. The program execution and the robot arm halts where they are when this button is pressed.

The Play button is used to run the program.

The Stop button is used to stop the program definitively.

Buttons not used during normal operation

Back: Program goes back one step.

Forward: Program forward one step.

Instruction for how to run program

Warning
Pressing the play button more than once may result in the program failing to run.

1   Press the Play button once. The robot controller takes around 5 seconds to launch the program.

2   The first operation in the program is arm initialization. If the robot is not in the home position, the user will be prompted to initialize the arm. The robot arm is moved back to program home position. Press and hold the Auto button to move the arm.
Warning: This first movement of the robot arm must be supervised continuously by the user to avoid hazardous collisions between the arm and its environment.
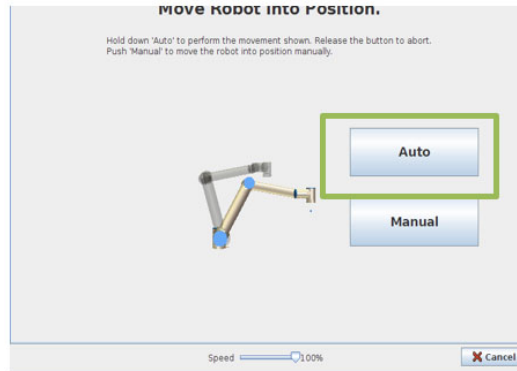
Picture: Automatic movement into position

3   When the robot reaches the home position, the Cancel button disappears and the OK button appears in its place. Press OK to return to the Run Program menu. You must press the Play button again.
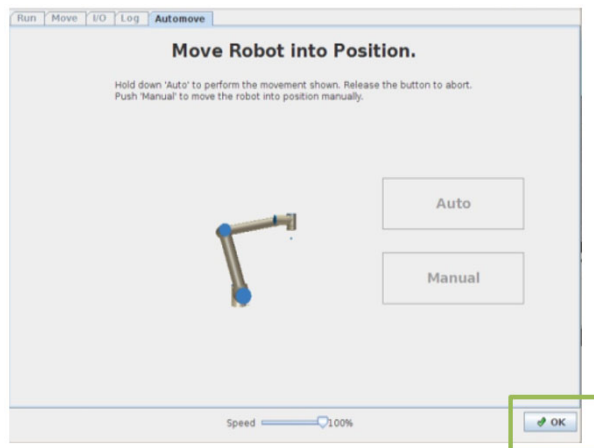
Picture: Robot motion finished

4   Once the Play button is pressed the program starts running.

5   Two prompt screens will appear depending on the machine status.

   - One screen will prompt the operator to enter how many layers are full on the pallets that are in the machine. If there is no full layer on the pallet, enter "0".

   - A second screen will prompt the operator to enter how many boxes are on the top layer which is not full. If all layers are full, enter "0".
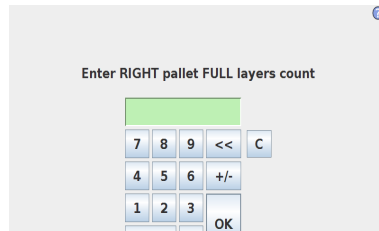
Picture: Number of layers prompt

6   Another prompt screen will appear if two pallets are in the machine when the program starts running. It will ask which pallet the operator wants to complete.

Process for machine starting with one pallet on either side:

- a. Prompt screen asking for full layer count.

- b. Prompt screen asking for number of boxes in incomplete layer.

- c. The machine starts without any further operation.

Machine starting with pallets on both sides:

- a. Prompt screen asking for full layer count on the right pallet.

- b. Prompt screen asking for number of boxes in incomplete layer on the right pallet.

- c. Prompt screen asking for full layer count on the left pallet.

- d. Prompt screen asking for number of boxes in incomplete layer on the Left pallet.

- e. Prompt screen asking on which pallet the robot should place boxes.

- f. The machine starts without any further operation.

When the last prompt has been answered, the robot starts its cycle. The arm moves to the picking area and waits for an available location on the pallet and an available box to pick. When the program is running, a variable tab is available on the Run Program menu. It can be used to check the variable state for debugging.
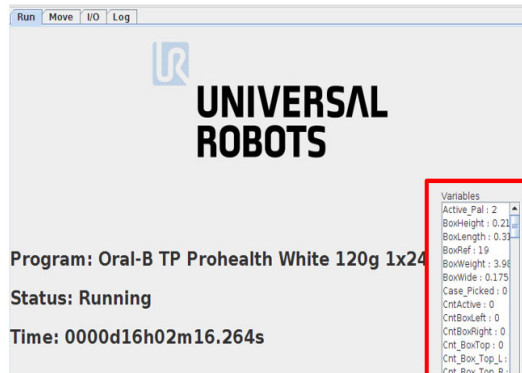
Picture: Variable status

10.12.2 Stopping a program

Instruction:

- Press Stop button on the Run tab screen. The program status will switch to Stopped.
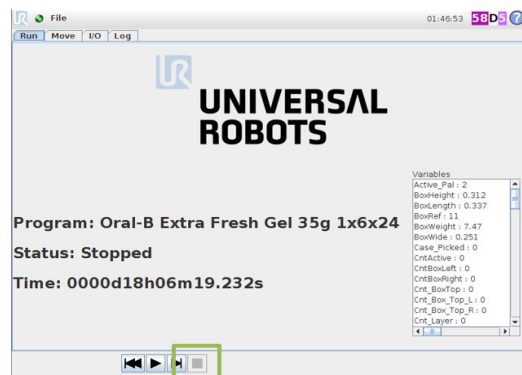
Picture: Stop button

If the program is stopped when the robot has a box in the gripper, the box should be removed and placed back on the box conveyor.

10.12.3 Freedrive

Freedrive mode allows the user to change to position of the robot arm manually. The mode can be activated while in state Normal. The mode is entered by pressing the Enable-button on the backside of teach pendant and left by releasing the button.

10.12.4 Modes

There are four operating modes which are represented by four tabs at the top of the screen.
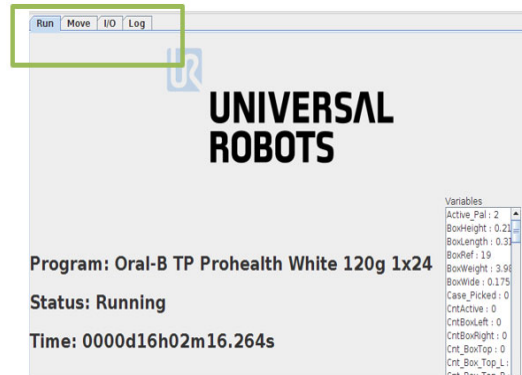
Picture: Tab position

Tabs
- Run tab. Program control handling.
- Move tab. Position data, tool coordinates and manual run control.
- I/O-tab. Input and output status.
- Log tab. Robot settings.
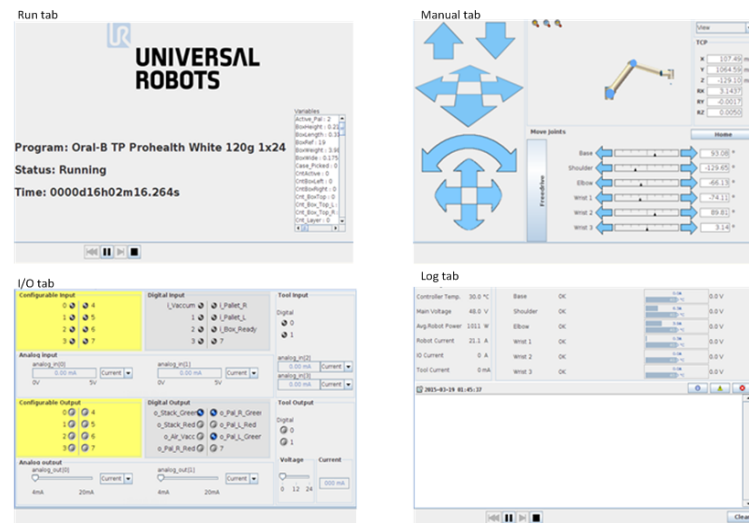
Picture: Tab overview

10.13   Shutdown robot

The command Shutdown robot in the main menu cause the robot to
return to state Machine power on where robot system is switched off.
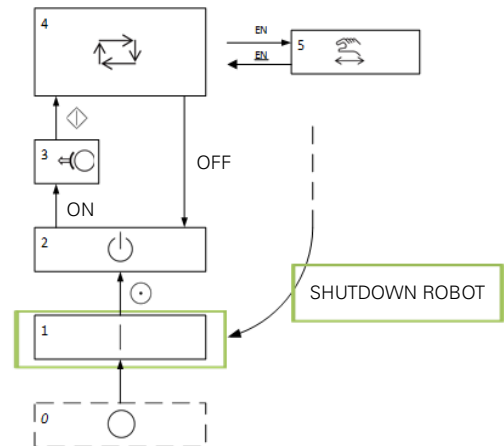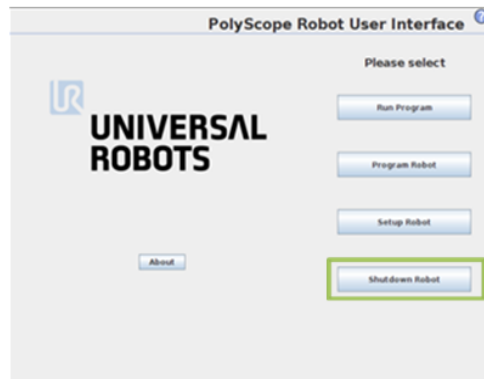
11 User interaction lamps and buttons

Light stack

Light stack

Green	Fixed	2 pallet workable (not full & both present)
	Flashing	1 pallet workable (other full or absent)
Red	Fixed	0 pallets workable (2 full pallets or no pallets present)
	Flashing	-

Pallet status light

Each pallet position has its own pallet status beacon with green and red lamp.

Pallet status light

Green	Fixed	Pallet workable (in progress or empty)
	Flashing	-
Red	Fixed	Pallet not present
	Flashing	Pallet full
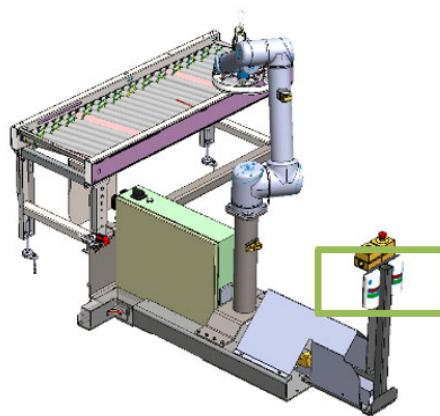
Picture: Pallet status light location

Reset button

Blue lamp ON: Safeguard or emergency stop
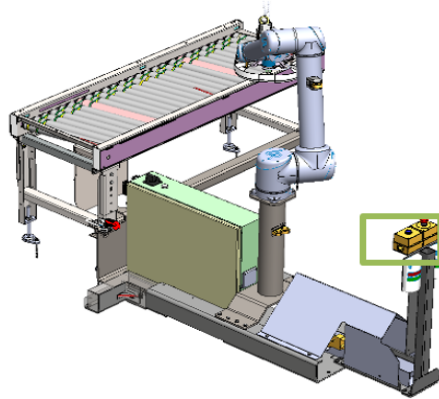
Picture: Reset button location

11.1 Error Codes

11.1.1 No case detected in the Gripper

Situation: This stop usually occurs when the box is dropped during the place to pick cycle.

Possible causes of the fault:

- Torn or damaged suction cups
- Damaged vacuum switch
- Clogged suction cups or vacuum generator
- Holes in the picked box

Reset procedure: Press the Stop Program button and then press the Play button to restart the program. Follow the steps described in the Run a program section of this manual.
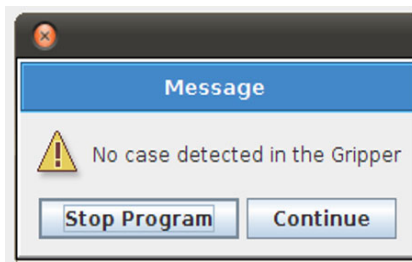
Picture: Alarm message

11.1.2 No Vacuum Detected on Gripper

Situation: This stop occurs when the vacuum switch fails to detect a box in the gripper during the picking operation for 3 seconds.

Possible causes of the fault:

- Torn or damaged suction cups
- Damaged vacuum switch
- Clogged suction cups or vacuum generator
- Holes in the picked box

Reset procedure: Press the Stop Program button and then press the Play button to restart the program. Follow the steps described in the Run a program section of this manual.
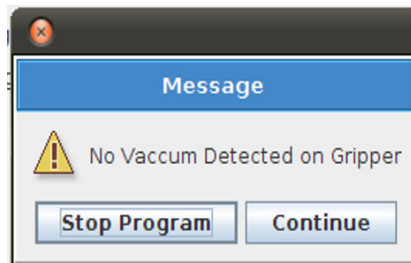
Picture: Alarm message

11.1.3 Please Remove Case From End effector

Situation: This error occurs when the program starts running with a box in the gripper.

Reset procedure: Press the Stop Program button. Remove the box from the gripper and place it in picking position. The vacuum output can be switched off on the I/O tab. Then press the Play button to restart the program. Follow the steps described in the Run a program section of this manual.
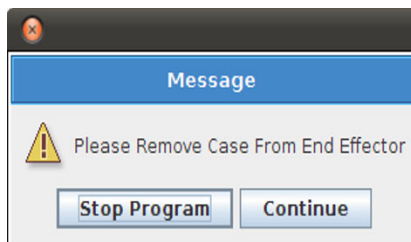
Picture: Alarm message

11.1.4   Robot not allowed in this area

Situation: This fault will only occur when the robot enters an inactive pallet zone.

> Example: If the robot is palletizing the right pallet it is not authorized to enter the left pallet zone. An entry to the left pallet zone will cause the error to trip.

Reset procedure: Press the Stop Program button and then press the Play button to restart the program. Follow the steps described in the Run a program section of this manual.
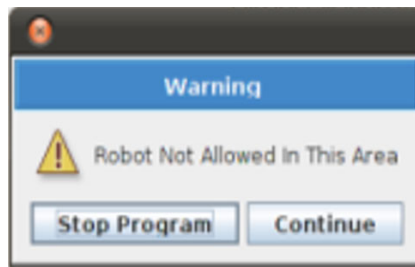
Picture: Alarm message

11.1.5   Protective Stop

Protective stop is also called Force stop.

Situation

> The Protective Stop fault appears when the robot has detected excess resistance on any of its 6 axes.

Reset procedure

> Press the Enable Robot button and then press the Play button to resume the program execution. The robot will continue from where it tripped. Homing is not required for restarting.

If Protective stop occurs during the homing procedure, the robot likely believes a box is in the gripper.

> Measure: Change the payload value on the Initialization screen. Press the File button and then the Initialize button, or press the coloured dot beside the File button.

Picture: Alarm message

12 Maintenance and house-keeping

12.1 Performance

Robot cabling lifetime [cycles]	min. 4 000 000
Required suction cup check interval	10 000 cycles
Vacuum pump filter [months]	3
Control relay type	SSD-type

12.2 Lockout-Tagout procedure

To start maintenance this procedure needs to be performed.

Instruction:

1. If the machine is in automatic production- let the gripper finalize the placing of the carton box.

2. Stop the program when the gripper is empty by pressing the Stop program button.

3. Go to main menu and select Shutdown robot.

4. The robot system will shutdown and machine state change to state Machine power on.

5. Switch off the control box main switch located in the box front.

6. Power supply is disconnected.

7. Wait 5 seconds for the vacuum pressure to disappear.

8. Lock the main switch with padlock in OFF-state.

9. The machine is ready and safe for maintenance.

12.3 General

- Use a damp cloth to clean photo eyes and reflectors.
- Use a dry, clean, non-fluffy cloth to clean conveyor rollers and any machine part in contact with product.
- Keep all parts, in contact with product, clean.
- Use efficient vacuum cleaners to clean dry areas of floors, walls, and machine interior and exterior.
- Clean floors and walls using highly persistent disinfectants.
- Maintain the delineation of robot workplace limits.

RC10 Maintenance plan (UR10)

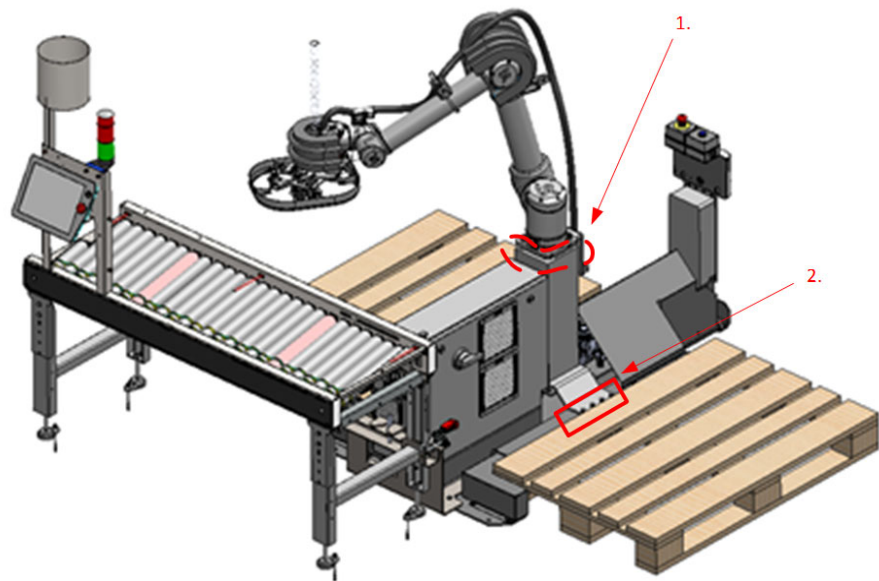| Category	Task	Comments	Duration (min)	Yearly Inspection / Maintenance	4th year Inspection / Maintenance	By Who	Daily Check	Monthly check	960 h 3 months	1920 h 6 months	2880 h	3840 h 1 Year	4800 h	5760 h 1,5 Years	6720 h	7680 h 2 Years	8640 h	9600 h	10560 h	11520 h 3 Years	12480 h	13440 h	14400 h	15360 h 4 years
External check	Check for external damage	No major damage or deformed componenets	2	X	X	Flexlink	●																	
	Check the safety bumpers	Bumper undamaged, showing no wear signs, no visible foam	2	X	X	Flexlink	●																	
	Check condition of the suction cups [1]		2	X	X	Flexlink	●																	
	Check gripper tubing condition	No bended pipes, tight connections	2	X	X	Flexlink	●																	
	Lamps / signal tower test		2	X	X	Flexlink	●																	
	Check system pressure [1]		2	X	X	Flexlink	●																	
	Check poli/cord belt [1]		2	X	X	Flexlink	●																	
	Check gear leakage	Area around the robot joint, and on the vacuum pump	2	X	X	Flexlink	●																	
Cleaning	Clean optical surfaces of all optical sensors		5	X	X	Flexlink	●																	
	Clean optical surfaces of HMI		5	X	X	Flexlink	●																	
	Remove chips		1	X	X	Flexlink	●																	
	General cleaning for chips, debris and dust		5	X	X	Flexlink		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Clean interlayer module		10	X	X	Flexlink		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Clean control cabinet cooling fans		5	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Preventive Inspection	Deep check for external damage	Check for marks on the robot arm	5	X	X	Flexlink		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Check robot joints play	No more than 5 degrees of play when the power is OFF. In the LOG file, no more than 5 Protective stops without external event.	5	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Check robot arm cables	No loose cables, no excessive cable dust.	5	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Check and if necessary, tighten the gripper bolts	Open the robot joint cover to check the bolts	15	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Check robot connection cables		10	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Check and re-tighten robot / pedestal bolts		5	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Maintenance	Check filter/vanes in the vacuum pump	Open the vacuum pump to ensure that all the vanes are in a proper condition	15	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Replace filter in the vacuum pump		5	X	X	Flexlink			●	●	🛠	●	●	🛠	●	●	🛠	●	●	🛠	●	●	🛠
	Replace of solenoid valves		30	X	X	Flexlink																	
	Replace suction cups [2]		15	X	X	Flexlink																	
	Replace conveyor poli/cords [2]		60		X	Flexlink						🛠			🛠				🛠				🛠
	Replace robot pneumatic tubes		240		X	Flexlink																	
	Software updates?	If recommended by FlexLink	/			Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Robot maintenance	Check cables (damaged or kinked)		20	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Tighten tool		5	X	X	Flexlink			🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧
	Tighten covers and main screws		10	X	X	Flexlink			🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧	🔧
	Verify standard and adjustable mechanical stop		10	X	X	Flexlink			●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Clean off dust, splashes, etc.		60	X	X	Flexlink			●														●
	Analyse joint status	Record the joint consumption for 1 standard empty pick and place motion. Ensure that the robot torque in this motion is below 75N	30	X	X	Flexlink					🛠			🛠			🛠			🛠			🛠
Controller	Check mechanical unit cable		20	X	X	Flexlink					🛠			🛠			🛠			🛠			🛠
	Verify teach cable		20	X	X	Flexlink																●
	Complete system backup		10	X	X	Flexlink																●
	Check the supply voltages		20	X	X	Flexlink																🛠

Legend:
- ● Visual check and replace if necessary (Emergency kit)
- Customer maintenance engineer
- Customer operator
- Spare Parts needed
- Flexlink Engineer
- 🔧 Tools needed

[1] Spares Parts included in emergency kit
[2] Spares Parts included in maintenance kit

RC10 Maintenance plan (UR10)

Category	Task	Comments	Duration (min)	Yearly Inspection / Maintenance	4th year Inspection / Maintenance
External check	Check for external damage	No major damage or deformed componenents	2	×	×
	Check the safety bumpers	Bumper undamaged, showing no wear signs, no visible foam	2	×	×
	Check condition of the suction cups [1]		2	×	×
	Check condition of gripper tubing	No bended pipes, tight connections	2	×	×
	Test lamps / signal tower		2	×	×
	Check system pressure [1]		2	×	×
	Check policord belt [1]		2	×	×
	Check gear leakage	Area around the robot joint, and on the vacuum pump	5	×	×
Cleaning	Clean optical surfaces of all optical sensors		5	×	×
	Clean optical surfaces of HMI		1	×	×
	Remove chips		5	×	×
	General cleaning for chips, debris and dust		5	×	×
	Clean interlayer module		10	×	×
	Clean control cabinet cooling fans		5	×	×
Preventive Inspection	Deep check for external damage	Check for marks on the robot arm	5	×	×
	Check robot joints play	No more than 5 degrees of play when the power is OFF. In the LOG file, no more than 5 Protective stops without external event.	5	×	×
	Check robot connection cables	No loose cables, no excessive cable dust.	5	×	×
	Check and if necessary, tighten the gripper bolts	Open the robot joint cover to check the bolts	15	×	×
	Check the robot arm cables		10	×	×
	Check and re-tighten robot / pedestal bolts		5	×	×
	Check water and humidity		15	×	×
	Check filter/ vanes in the vacuum pump	Open the vacuum pump to ensure that all the vanes are in a proper condition	5	×	×
Maintenance	Replace filter / vanes in the vacuum pump		5	×	×
	Replace of solenoid valves		30	×	×
	Replace suction cups [2]		15	×	×
	Replace conveyor policords [2]		60		×
	Replace robot pneumatic tubes		240		×
	Software updates?	If recommended by FlexLink	/		
Robot maintenance	Check cables (damaged or kinked)		20	×	×
	Tighten tool		5	×	×
	Tighten covers and main screws		10	×	×
	Verify standard and adjustable mechanical stop		10	×	×
	Clean off dust, splashes, etc.		60	×	×
	Analyse joint status	Record the joint consumption for 1 standard empty pick and place motion. Ensure that the robot torque in this motion is below 75N	30	×	×
	Replace the vanes of the vacuum pump		30	×	×
	Check mechanical unit cable		20	×	×
	Verify teach cable		20	×	×
	Complete system backup		10	×	×
Controller	Check the supply voltages		20	×	×

Time-interval columns (By Who / Daily Check / Monthly check): 16320 h · 17280 h · 18240 h · 19200 h 5 Years · 20160 h · 21120 h · 22080 h · 23040 h 6 Years · 24000 h · 24960 h · 25920 h · 26880 h 7 Years · 27840 h · 28800 h · 29760 h · 30720 h 8 Years — MAJOR OVERHAUL

Legend (By Who / Spare Parts needed / Tools needed):
- Visual check and replace if necessary
- Customer maintenance engineer
- Customer operator
- FlexLink engineer
- Spare Parts needed
- Tools needed

[1] Spares Parts included in emergency kit
[2] Spares Parts included in maintenance kit

5129046-04

Picture: Task no. 23 in maintenance schedule- Bolt checkpoints

12.5　　　Suction cup condition check

The gripper parts must be regularly checked during the machine's service life to prevent possible damage. A special cycle has been set up in the program. When the system starts, the cycle counter is checked. If more than 10,000 cycles have been performed since the previous check, the cycle is executed.

The robot arm moves to the inspection position (above the conveyor) and a popup appears on the Teach pendant screen. The operator must check the gripper parts.
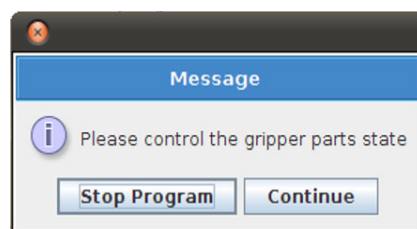
Picture: Check message

Instruction:

- If all the gripper parts are in working order

    1. Press Continue button
    2. Follow the next steps to start the program.

- If some gripper parts are damaged

    1. Press Stop Program button.
    2. Turn off main switch.
    3. Replace the damaged parts.
    4. Switch on main switch and start machine.

13   Definitions

Effective payload	Tooling and work piece mass
Freedrive mode	Mode in which the robot arm's position can be changed manually
Robot Config	Software tool for defining pallet pattern
Safety checksum	Individual number for every possible safety settings combination
TCP	Tool center point

14 Change history

Change history

Edi	Change	Note
1	Document created	
2	General improvements	
3	Roller guards added	For safety reasons /2021-07-14
4	Maintenance schedule added/changed	Improved information/ 2022-07-30

15 References

Reference to technical library on www.flexlink.com which contains downloadable documentation:

http://www.flexlink.com/en/home/support/technical-library

Name	Doc item no.	Note
Declaration	5129045	
Control box	5127921	110V/220V power supply
External connections	5127926	110V/220V power supply
Spare parts instruction	5129047	
Assembly instruction	5129156	Calibration tool kit 5126067
Assembly instruction	5125245	Safety paddings elbows 5129389
Assembly instruction	5125246	Safety paddings robot head 5129390
Assembly instruction	5125244	Gripper 5124176/5124577
Vacuum system	5128037	
User instruction	5129046	English - original
User instruction	5129370	Swedish
User instruction	5129371	Norwegian
User instruction	5129372	Finnish
User instruction	5129373	Danish
User instruction	5129374	German
User instruction	5129375	French
User instruction	5129376	Czech
User instruction	5129377	Polish
User instruction	5129378	Dutch
User instruction	5129379	Italian
User instruction	5129380	Spanish
User instruction	5129381	Hungarian
User instruction	5129382	Portuguese
User instruction	5129383	Chinese
User instruction	5129384	Japanese
User instruction	5129385	Thai
User instruction	5129386	Indonesian
Robot config manual	5129368	