

# Robotic Arm

**DO NOT use this machine unless you are familiar with the operating manual and have been trained in its safe use and operation.**



Safety glasses must be worn at all times in work areas.



Long and loose hair must be contained.



Appropriate footwear must be worn.



Do not wear loose clothing or jewellery when working with the robot.

This Risk Assessment and SOP only covers basic operation of the robot arm (start-up, shutdown, and motion). It does not cover tasks or operation for specific end effector types or robot arm functions.

## EQUIPMENT LIST

1. Robot Arm and End Effector



2. End Effector



3. UR10 Control Panel and Pendant



4. Machine e-stop



## **ELIGIBILITY CRITERIA FOR OPERATOR**

1. Complete local inductions.
2. Read and acknowledge the risk assessment form and UR10 User Manual.
3. Wear all required PPE.
4. Complete a competency assessment and two further jobs (start-up to shutdown) unassisted but under supervision of a trained person.

## **PRE-OPERATIONAL SAFETY CHECKS**

1. Keep machine & surrounds free of clutter and ensure ensure no slip/trip hazards are present in workspaces and walkways. [L] [SEP]
2. Make sure the robot arm and tool/end effector are properly and securely bolted in place.
3. Make sure the robot arm has ample space to operate freely.
4. Locate and ensure you are familiar with the operation of the pendant controller, START/PAUSE functions, ON/OFF buttons and emergency stop. [L] [SEP]
5. Locate general power outlet (GPO) and ensure test and tag is current. [L] [SEP]
6. Use and configuration of safety-related functions and interfaces must be done according to the risk assessment that the integrator conducts for a specific robot application, The integrator is required to ensure that all changes to the safety configuration settings are done in compliance with the integrator's own risk assessment.
7. Make sure that safety measures and/or robot safety configuration parameters have been set up to protect both integrator and bystanders, as defined in the risk assessment.
8. Make sure to warn people to keep their heads and faces outside the reach of the operating robot or robot about to start operating.
9. Faulty equipment must not be used. Immediately report suspect machinery. For example, if joint caps are loose, broken or removed.

## **OPERATIONAL SAFETY CHECKS**

1. Never leave the robot running unattended.
2. Be aware of robot movement when using the teach pendant.
3. If determined by the risk assessment, do not enter the safety range of the robot or touch the robot when the system is in operation.
4. The location of equipment and machinery should not introduce additional hazards. Safety-rated soft axis and space limiting should be used whenever practicable, to reduce the size of the restricted space.
5. Risks associated with whole body trapping or crushing between the robot system and, for example, parts of buildings, structures, utilities, other machines, and equipment, should be eliminated.
6. During collaborative operation, the operator shall have the means to either stop robot motion at anytime by a single action or have an unobstructed means of exiting the collaborative workspace.
7. Never stick fingers behind the internal cover of the controller box.
8. The robot and its controller box generate heat during operation. Do not handle or touch the robot while in operation or immediately after operation as prolonged contact can cause discomfort. To cool the robot down, power off the robot and wait one hour.
9. Different end effectors may require different safety checks. In case of the gripper, do not put your hands inside the gripper when robot is functioning.
10. Do not expose the robot to permanent magnetic fields. Very strong magnetic fields can damage the robot.

## **OPERATION: PENDANT USE & QUICK START PROCEDURE**

1. Press the emergency stop button on the front side of the teach pendant.
2. Press the power button on the teach pendant.
3. Wait a minute while the system is starting up, displaying text on the touch screen.
4. When the system is ready, a popup will be shown on the touch screen, stating that the robot needs to be initialized.
5. Touch the button on the popup dialog. You will be taken to the initialization screen.
6. Wait for the Confirmation of applied Safety Configuration dialog and press the Confirm Safety Configuration button. This applies an initial set of safety parameters that need to be adjusted based on a risk assessment.
7. Unlock the emergency stop button. The robot state changes from Emergency Stopped to Power off.
8. Step outside the reach (workspace) of the robot.
9. Touch the On button on the touch screen. Wait a few seconds until robot state changes to Idle.
10. Verify that the payload mass and selected mounting are correct. You will be notified if the mounting detected based on sensor data does not match the selected mounting.
11. Touch the Start button on the touch screen. The robot now makes a sound and moves a little while releasing the brakes.
12. Touch the OK button, bringing you to the Welcome screen.

## **OPERATION: FIRST PROGRAM**

1. Touch the Program Robot button and select Empty Program.
2. Touch the Next button (bottom right) so that the <empty> line is selected in the tree structure on the left side of the screen.
3. Go to the Structure tab.
4. Touch the Move button.
5. Go to the Command tab.
6. Press the Next button, to go to the Waypoint settings.
7. Press the Set this waypoint button next to the “?” picture.
8. On the Move screen, move the robot by pressing the various blue arrows, or move the robot by holding the Freedrive button, placed on the backside of the teach pendant, while pulling the robot arm.
9. Press OK.
10. Press Add waypoint before.
11. Press the Set this waypoint button next to the “?” picture.
12. On the Move screen, move the robot by pressing the various blue arrows, or move the robot by holding the Freedrive button while pulling the robot arm.
13. Press OK.
14. Your program is ready. The robot will move between the two points when you press the “Play” symbol. Stand clear, hold on to the emergency stop button and press “Play”.

## **OPERATION: TCP CONFIGURATION**

1. To define a new TCP, Go to Installation>TCP Configuration and hit the New button.
2. First tap the Position button.
3. Choose a fixed point in the workspace of the robot.
4. Use the buttons on the right side of the screen to move the TCP to the chosen point from at least three different angles and to save the corresponding positions of the tool output flange.
5. Verify the calculated TCP coordinates and set them onto the selected TCP using the Set button.
6. Then tap the Orientation button.

7. Select a feature from the drop-down list. For additional information about how new features can be defined see the manual.
8. Use the button below to move to a position in which the orientation of the tool corresponding to the TCP coincides with the coordinate system of the selected feature.
9. Verify the calculated TCP orientation and set it onto the selected TCP using the Set button.
10. Add the payload of the tool, and also the center of gravity of the tool.

### **OPERATION: RUN A PROGRAM FROM USB**

1. Running a program from a USB drive is not recommended. To run a program stored on a USB drive, first load it and then save it in the local programs folder using the Save As option in the File menu.
2. Choose the program and then select the play button to run.

### **OPERATION: RUN A PROGRAM FROM A TEMPLATE**

1. A template can provide the overall program structure, so only the details of the program need to be filled in.
2. Choose the template you would like to work in and populate it with commands to write a program. Refer to the UR10 Manual for additional information.

### **OPERATION: HOUSEKEEPING AND SHUTDOWN**

1. Ensure the robot is in home position.
2. Remove any extraneous end effectors and clean work zone (free of slip and trip hazards).
3. Switch off the robot.
4. Leave the machine in a safe, clean and tidy state.
5. Return teaching pendant on its location on the controlbox.

### **POTENTIAL HAZARDS**

- Eye injuries
- Unsecured material being flung around
- Cuts and crushing to hand/fingers
- Manual Handling objects
- Spills and slip injuries
- Sharp edges & burns

### **FORBIDDEN**

- Distracting operator.
- Approaching arm or work zone during operation without the consent of the operator.
- Removal or modification of the safety features.
- Using if unauthorised.
- Placing limbs or body parts in working area when arm operation is in progress in a non-collaborative program.

Date \_\_\_\_\_ Name \_\_\_\_\_ Signature \_\_\_\_\_