

# 13. Emergency Events

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## Description

Follow the instructions here to handle emergency situations, such as activating the emergency stop using the red push-button. This section also describes how to manually move the system without power.

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## 13.1. Emergency Stop

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### Description

The Emergency Stop or E-stop is the red push-button located on the Teach Pendant. Press the emergency stop push-button to stop all robot motion. Activating the emergency stop push-button causes a stop category one (IEC 60204-1). Emergency stops are not safeguards (ISO 12100).

Emergency stops are complementary protective measures that do not prevent injury. The risk assessment of the robot application determines if additional emergency stop push-buttons are required. The emergency stop function and the actuating device must comply with ISO 13850.

After an emergency stop is actuated, the push-button latches in that setting. As such, each time an emergency stop is activated, it must be manually reset at the push-button that initiated the stop.

Before resetting the emergency stop push-button, you must visually identify and assess the reason the E-stop was first activated. Visual assessment of all the equipment in the application is required. Once the problem is solved, reset the emergency stop push-button.

### To reset the emergency stop push-button

1. Hold the push-button and twist clockwise until the latching disengages.  
You should feel when the latching is disengaged, indicating the push-button is reset.
  2. Verify the situation and whether to reset the emergency stop.
  3. After resetting the emergency stop, restore power to the robot and resume operation.
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## 13.2. Movement Without Drive Power

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### Description

In the unlikely event of an emergency, when powering the robot is either impossible or unwanted, you can use forced back-driving to move the robot arm.

To perform forced back-driving you must push, or pull, the robot arm hard to move the joint. Each joint brake has a friction clutch that enables movement during high forced torque.

Performing forced back-driving requires high force and cannot be performed by one person alone. In clamping situations, two or more people are required to do the forced back-driving. In some situations, two or more people are required to disassemble the robot arm.

See the Service Manual for information about how to disassemble the robot.



### WARNING

Risks due to an unsupported robot arm breaking or falling can cause injury or death.

- Support the robot arm before removing power.



### NOTICE

Moving the robot arm manually is intended for emergency and service purposes only. Unnecessary moving of the robot arm can lead to property damage.

- Do not move the joint more than 160 degrees, to ensure the robot can find its original physical position.
  - Do not move any joint more than necessary.
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# 13.3. Modes

**Description**

You access and activate different modes using Teach Pendant or the Dashboard Server. If an external mode selector is integrated, it control the modes - not PolyScope or the Dashboard Server.

**Automatic Mode** Once activated, the robot can only execute a program of pre-defined tasks. You cannot modify or save programs and installations.

**Manual Mode** Once activated, you can program the robot. You can modify and save programs and installations.

High Speed Manual Mode can be used. It allows both tool speed and elbow speed to temporarily exceed 250 mm/s, while a hold-to-run is used.  
Hold-to-run is performed by continuous contact with the Speed Slider.

The robot performs a Safeguard Stop in Manual mode, if a Three-Position Enabling Device is configured, and either released (not pressed) or it is fully compressed.

Switching between Automatic mode to Manual mode requires the Three-Position Enabling Device to be fully released and pressed again to allow the robot to move.  
When using High Speed Manual Mode, use safety joint limits (see Joint Limits) or safety planes (see Safety Planes) to restrict the robot's moving space.

**Mode  
switching**

Operational mode	Manual	Automatic
Freedrive	x	*
Move robot with arrows on Move Tab	x	*
Edit & save program & installation	x	
Execute Programs	Reduced speed**	*
Start program from selected node	x	
*Only when no Three-Position Enabling Device is configured. ** If a Three-Position Enabling Device is configured, the robot operates at Manual Reduced Speed unless High Speed Manual Mode is activated.		

Notice when switching mode



NOTICE

- Some UR robot sizes might not be equipped with a Three-Position Enabling Device. If the risk assessment requires the enabling device, a 3PE Teach Pendant must be used.



WARNING

- Any suspended safeguards must be returned to full functionality before selecting Automatic Mode.
- Wherever possible, Manual Mode shall only be used with all persons located outside the safeguarded space.
- If an external mode selector is used, it must be placed outside the safeguarded space.
- No-one is to enter, or be within, the safeguarded space in Automatic Mode, unless safeguarding is used or the collaborative application is validated for power and force limiting (PFL).

To Switch Modes: PolyScope

1. In the Header, select the profile icon.
  - **Automatic** indicates the operational mode of the robot is set to Automatic.
  - **Manual** indicates the operational mode of the robot is set to Manual.

Using the Dashboard Server

1. Connect to the Dashboard server.
2. Use the **Set Operational Mode** commands.
  - Set Operational Mode Automatic
  - Set Operational Mode Manual
  - Clear Operational Mode

Three-Position Enabling Device

When a Three-Position Enabling Device is used and the robot is in Manual Mode, movement requires pressing the Three-Position Enabling Device to the center-on position. The Three-Position Enabling Device has no effect in Automatic Mode.

A 3PE Teach Pendant is recommended for programming. If another person can be within the safeguarded space when in Manual Mode, an additional device can be integrated and configured for the additional person's use.

# 13.3.1. Recovery Mode

**Description**

When a safety limit is exceeded, Recovery Mode is automatically activated, allowing the robot arm to be moved. Recovery Mode is a type of Manual Mode . You cannot run robot programs when Recovery Mode is active.

During Recovery Mode, the robot arm is moved to be within joint limits, using either Freedrive or the Move tab in PolyScope.

**Safety limits of Recovery Mode**

Safety Function	Limit
Joint Speed Limit	30 °/s
Speed Limit	250 mm/s
Force Limit	100 N
Momentum Limit	10 kg m/s
Power Limit	80 W

The safety system issues a Stop Category 0 if a violation of these limits appears.



**WARNING**

Failure to use caution when moving the robot arm in recovery mode can lead to hazardous situations.

- Use caution when moving the robot arm back within the limits, as limits for the joint positions, the safety planes, and the tool/end effector orientation are all disabled in recovery.

# 13.3.2. Backdrive

**Description**

Backdrive is a Manual Mode used to force specific joints to a desired position without releasing all brakes in the robot arm. This is sometimes necessary if the robot arm is close to collision and the vibrations that accompany a full restart are not desired. The robot joints feel heavy to move, while Backdrive is in use.

You can use any of the following sequences to enable Backdrive:

- 3PE Teach Pendant
- 3PE device/switch
- Freedrive on robot

### 3PE Teach Pendant

To use the 3PE TP button to backdrive the robot arm.

1. On the Initialize screen, tap **ON** to start the power up sequence.
2. When the robot state is **Teach Pendant 3PE Stop**, light-press, then light-press-and-hold, the 3PE TP button.  
The robot state changes to **Backdrive**.
3. Now you can apply significant pressure to release the brake in a desired joint to move the robot arm.  
As long as light-press is maintained on the 3PE button, Backdrive is enabled, allowing the arm to move.

### 3PE device/switch

To use a 3PE device/switch to backdrive the robot arm.

1. On the Initialize screen, tap **ON** to start the power up sequence.
2. When the robot state is **Teach Pendant 3PE Stop**, light-press, then light-press-and-hold, the 3PE TP button.  
The robot state changes to **System 3PE Stop**.
3. Press and hold the 3PE device/switch.  
The robot state changes to **Backdrive**.
4. Now you can apply significant pressure to release the brake in a desired joint to move the robot arm.  
As long as the hold is maintained on both the 3PE device/switch and the 3PE TP button, Backdrive is enabled, allowing the arm to move.

### Freedrive on robot

To use Freedrive on robot to backdrive the robot arm.

1. On the Initialize screen, tap **ON** to start the power up sequence.
  2. When the robot state is **Teach Pendant 3PE Stop**, press and hold the **Freedrive on robot**.  
The robot state changes to **Backdrive**.
  3. Now you can apply significant pressure to release the brake in a desired joint to move the robot arm.  
As long as the hold is maintained on the Freedrive on robot, Backdrive is enabled, allowing the arm to move.
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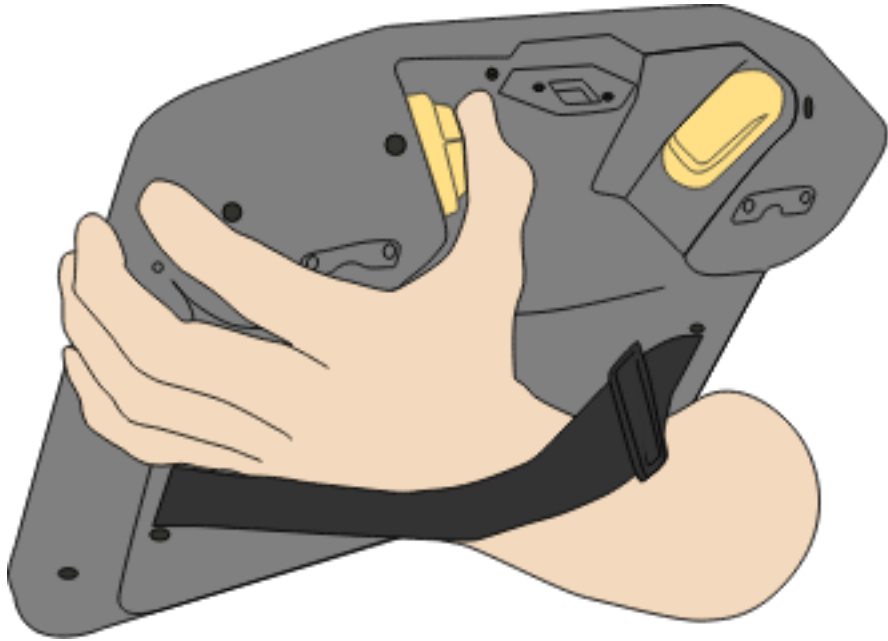
# Backdrive Inspection

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## Description

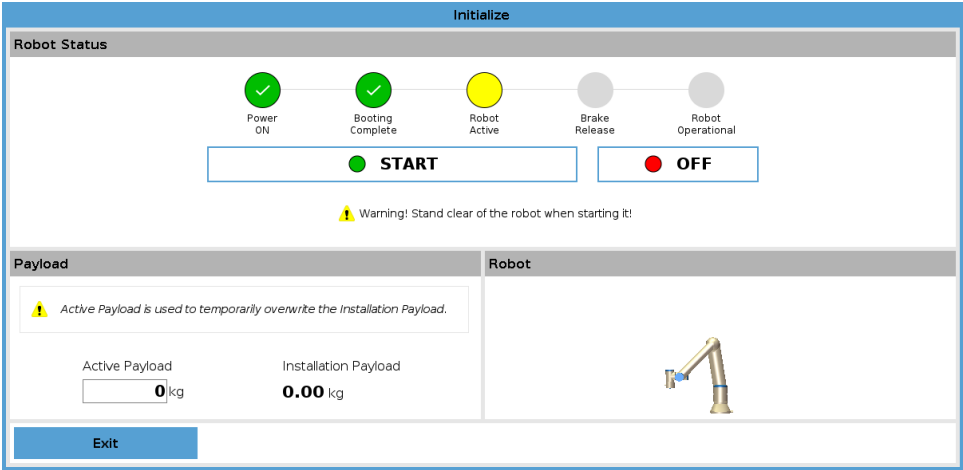
If the robot is close to colliding with something, you can use Backdrive to move the robot arm to a safe position before initializing.

## 3PE Teach Pendant

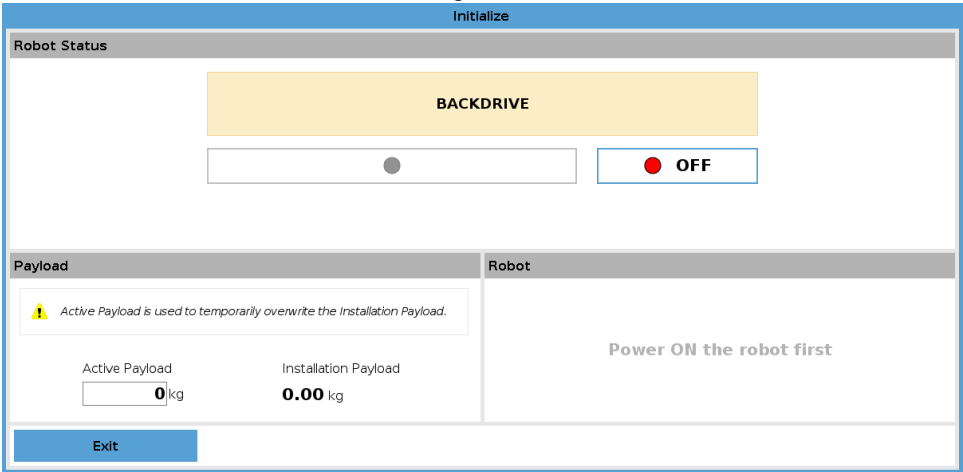


Enable  
Backdrive

1. Press ON to enable power. Status changes to *Robot Active*



2. Press and hold Freedrive. Status changes to *Backdrive*



3. Move robot as in Freedrive mode. Joint brakes are released where needed once the Freedrive button is activated.



**NOTICE**

In Backdrive Mode the robot is “heavy” to move around.

**MANDATORY ACTION**

You must test Backdrive mode on all joints.

**Safety  
settings**

Verify the robot safety settings comply with the robot installation risk assessment.

**Additional  
safety inputs  
and outputs  
are still  
functioning**

Check which safety inputs and outputs are active and that they can be triggered via PolyScope or external devices.



