

10.3. Software Safety Configuration

Description

This section covers how to access the robot safety settings. It is made up of items that help you set up the robot Safety Configuration.



WARNING

Before you configure your robot safety settings, your integrator must conduct a risk assessment to guarantee the safety of personnel and equipment around the robot. A risk assessment is an evaluation of all work procedures throughout the robot lifetime, conducted in order to apply correct safety configuration settings. You must set the following in accordance with the integrator's risk assessment.

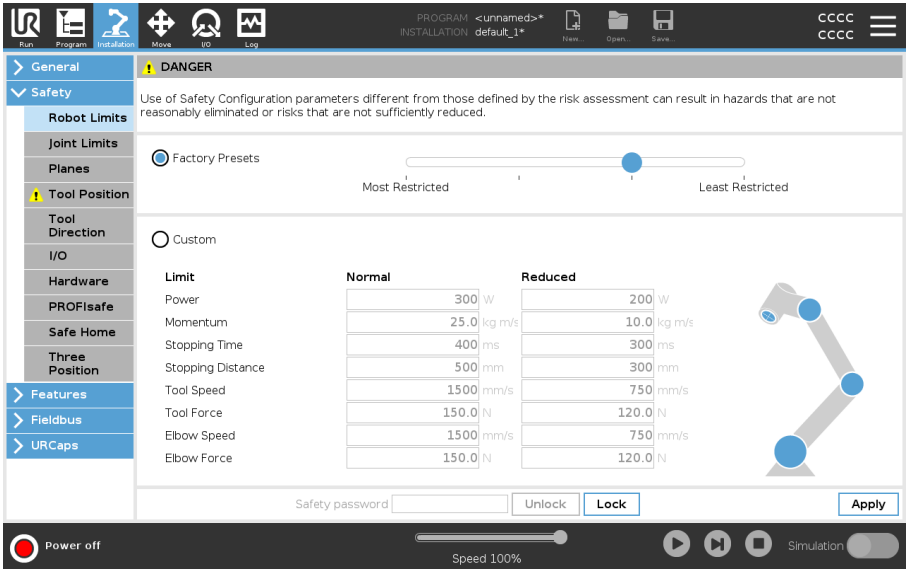
1. The integrator must prevent unauthorized persons from changing the safety configuration e.g. installing password protection.
2. Use and configuration of the safety-related functions and interfaces for a specific robot application.
3. Safety configuration settings for set-up and teaching before the robot arm is powered on for the first time.
4. All safety configuration settings accessible on this screen and sub-tabs.
5. The integrator must ensure that all changes to the safety configuration settings comply with the risk assessment. See Hardware Installation Manual.

Accessing
Software
Safety
Settings

Safety Settings are password protected and can only be configured once a password is set and subsequently used.

To access the software safety settings

- 1. In your PolyScope header, tap the **Installation** icon.
- 2. In the Side Menu on the left of the screen, tap **Safety**.
- 3. Observe that the **Robot Limits** screen displays, but settings are inaccessible.
- 4. If a **Safety password** was previously set, enter the password and press **Unlock** to make settings accessible. Note: Once Safety settings are unlocked, all settings are now active.
- 5. Press **Lock** tab or navigate away from the Safety menu to lock all Safety item settings again.



10.3.1. Setting a Software Safety Password

Description

You must set a password to Unlock all safety settings that make up your Safety Configuration. If no safety password is applied, you are prompted to set it up.

**To set a
Software
Safety
password**

You can tap the **Lock** tab to lock all Safety settings again or simply navigate to a screen outside of the Safety menu.

- 1. In your PolyScope header right corner, press the **Hamburger** menu and select **Settings**.
- 2. On the left of the screen, in the blue menu, press **Password** and select **Safety**.
- 3. In **New password**, type a password.
- 4. Now, in **Confirm new password**, type the same password and press **Apply**.
- 5. In the bottom left of the blue menu, press **Exit** to return to previous screen.

Safety password

Unlock

Lock


10.3.2. Changing the Software Safety Configuration

Description	Changes to the Safety Configuration settings must comply with the risk assessment conducted by the integrator.
Recommended procedure for the integrator:	<div>To change the safety configuration</div> <div><div>1. Verify that changes comply with the risk assessment conducted by the integrator.</div><div>2. Adjust safety settings to the appropriate level defined by the risk assessment conducted by the integrator.</div><div>3. Verify that the settings are applied.</div><div>4. Place following text in the operators' manuals:</div></div> <div>Before working near the robot, make sure that the safety configuration is as expected. This can be verified e.g. by inspecting the Safety Checksum in the top right corner of PolyScope for any changes. (See Safety Checksum).</div>

10.3.3. Applying a New Software Safety Configuration

Description	<p>The robot is powered off while you make changes to the configuration. Your changes only take effect after you tap the Apply button.</p> <p>The robot cannot be powered on again until you select Apply and Restart to visually inspect your robot Safety Configuration which, for safety reasons, is displayed in SI Units in a popup.</p> <p>You can select Revert Changes to return to the previous configuration. When your visual inspection is complete you can select Confirm Safety Configuration and the changes are automatically saved as part of the current robot installation.</p>
-------------	--

Safety Checksum

Description	<p>The Safety Checksum icon displays your applied robot safety configuration.</p> <div data-bbox="278 666 358 740"></div> <p>It could be four or eight digits.</p> <p>A four-digit Checksum should be read from top to bottom and left to right, while an eight-digit Checksum is read left to right, top row first. Different text and/or colors indicate changes to the applied safety configuration.</p> <p>The Safety Checksum changes if you change the Safety Functions settings, because the Safety Checksum is only generated by the safety settings.</p> <p>You must apply your changes to the Safety Configuration for the Safety Checksum to reflect your changes.</p>
-------------	--

10.3.4. Safety Configuration without Teach Pendant

Description

You can use the robot without attaching the Teach Pendant. Removing the Teach Pendant requires defining another Emergency Stop source. You must specify if the Teach Pendant is attached to avoid triggering a safety violation.



CAUTION


If the Teach Pendant is detached or disconnected from the robot, the Emergency Stop button is no longer active. You must remove the Teach Pendant from the vicinity of the robot.

To safely remove the Teach Pendant

The robot can be used without PolyScope as the programming interface. To configure the robot without a Teach Pendant

1. In the Header tap **Installation**.
2. In the Side Menu on left tap **Safety** and select **Hardware**.
3. Input Safety password and **Unlock** the screen.
4. Deselect **Teach Pendant** to use robot without PolyScope interface.
5. Press **Save and restart** to implement changes.

10.3.5. Software Safety Modes

Description	<p>Under normal conditions, i.e. when no robot stop is in effect, the safety system operates in a Safety Mode associated with a set of safety limits ¹:</p> <ul style="list-style-type: none">• Normal mode is the safety mode that is active by default• Reduced mode is active when the robot Tool Center Point (TCP) is positioned beyond a Trigger Reduced mode plane (see Software Safety Restrictions), or when triggered using a configurable input.• Recovery mode activates when a safety limit from the active limit set is violated, the robot arm performs a Stop Category 0. If an active safety limit, such as a joint position limit or a safety boundary, is violated already when the robot arm is powered on, it starts up in Recovery mode. This makes it possible to move the robot arm back within the safety limits. While in Recovery mode, the movement of the robot arm is restricted by a fixed limit that you cannot customize. <div>WARNING<p>Limits for joint position, tool position and tool orientation are disabled in Recovery mode, so take caution when moving the robot arm back within the limits.</p></div> <p>The menu of the Safety Configuration screen enables the user to define separate sets of safety limits for Normal and Reduced mode. For the tool and joints, Reduced mode limits for speed and momentum are required to be more restrictive than their Normal mode counterparts.</p>
-------------	--

10.3.6. Software Safety Limits

Description	<p>In the Safety Configuration the safety system limits are specified. The <i>Safety System</i> receives the values from the input fields and detects any violation if any these values are exceeded. The robot controller attempts to prevent any violations by making a robot stop or by reducing the speed.</p>
-------------	--

Robot Limits

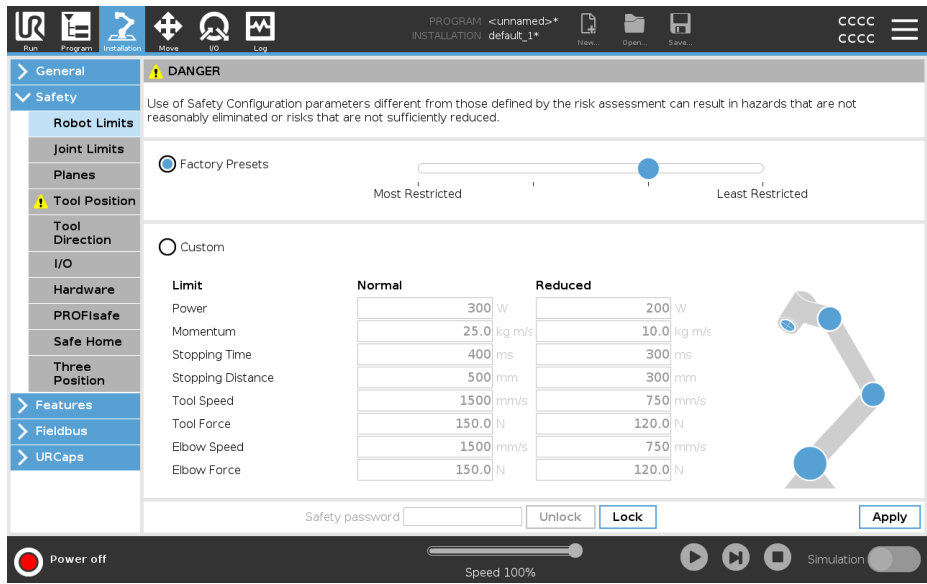
Description	<p>Robot Limits restrict general robot movements. The Robot Limits screen has two configuration options: Factory Presets and Custom.</p>
-------------	--

¹Robot stop was previously known as "Protective Stop" for Universal Robots robots.


Factory Presets is where you can use the slider to select a predefined safety setting . The values in the table are updated to reflect the preset values ranging from **Most Restricted** to **Least Restricted**



Slider values are only suggestions and do not substitute a proper risk assessment.



Custom Custom is where you can set Limits on how the robot functions and monitor the associated Tolerance.

Power	Limits maximum mechanical work produced by the robot in the environment. This limit considers the payload a part of the robot and not of the environment.
Momentum	Limits maximum robot momentum.
Stopping Time	Limits maximum time it takes the robot to stop e.g. when an emergency stop is activated.
Stopping Distance	<div>Limits maximum distance the robot tool or elbow can travel while stopping.</div> <div><div></div><div>NOTICE Restricting stopping time and distance affect overall robot speed. For example, if stopping time is set to 300 ms, the maximum robot speed is limited allowing the robot to stop within 300 ms.</div></div>
Tool Speed	Limits maximum robot tool speed.
Tool Force	Limits maximum force that the robot tool exerts on the environment to prevent clamping situations.
Elbow Speed	Limits maximum robot elbow speed.
Elbow Force	Limits maximum force that the elbow exerts on the environment to prevent clamping situations.

The tool speed and force are limited at the tool flange and the center of the two user-defined tool positions, (see [Tool Position Restriction](#)).

Run

Program

Installation

Move

I/O

Log

PROGRAM <unnamed>+
INSTALLATION default_1*

New

Open

Save

CCCC
CCCC

> General

< Safety

Robot Limits

Joint Limits

Planes

< Tool Position

Tool Direction

I/O

Hardware

PROFIsafe

Safe Home

Three Position

> Features

> Fieldbus

> URCaps

DANGER

Use of Safety Configuration parameters different from those defined by the risk assessment can result in hazards that are not reasonably eliminated or risks that are not sufficiently reduced.

Factory Presets

Most Restricted

Least Restricted

Custom

Limit	Normal	Reduced
Power	300 W	200 W
Momentum	25.0 kg m/s	10.0 kg m/s
Stopping Time	400 ms	300 ms
Stopping Distance	500 mm	300 mm
Tool Speed	1500 mm/s	750 mm/s
Tool Force	150.0 N	120.0 N
Elbow Speed	1500 mm/s	750 mm/s
Elbow Force	150.0 N	120.0 N

Safety password

Unlock

Lock

Apply

Power off

Speed 100%

Simulation



NOTICE

You can switch back to **Factory Presets** for all robot limits to reset to their default settings.

Joint Limits

Description

Joint limits allow you to restrict individual robot joint movements in joint space i.e. joint rotational position and joint rotational speed. Joint limiting can also be called software based axis limiting. The joint limit options are: **Maximum speed** and **Position range**.

Run

Program

Installation

Move

I/O

Log

PROGRAM <unnamed>+
INSTALLATION default_1*

New

Open

Save

148B
DB85

> General

< Safety

Robot Limits

Joint Limits

Planes

< Tool Position

Tool Direction

I/O

Hardware

PROFIsafe

Safe Home

Three Position

> Features

> Fieldbus

> URCaps

Position range

Joints	Range	Normal Mode		Reduced Mode		
		Minimum	Maximum	Minimum	Maximum	
Base	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °
Shoulder	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °
Elbow	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °
Wrist 1	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °
Wrist 2	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °
Wrist 3	-363 — 363 °	-363	363	-363	363	+2 ° / -2 °

Maximum speed

Joints	Maximum	Normal Mode		
		Normal Mode	Reduced Mode	
Base	max: 191 °/s	191	191	-11 °/s
Shoulder	max: 191 °/s	191	191	-11 °/s
Elbow	max: 191 °/s	191	191	-11 °/s
Wrist 1	max: 191 °/s	191	191	-11 °/s
Wrist 2	max: 191 °/s	191	191	-11 °/s
Wrist 3	max: 191 °/s	191	191	-11 °/s

Safety password

Unlock

Lock

Apply

Power off

Speed 100%

250mm/s

Simulation

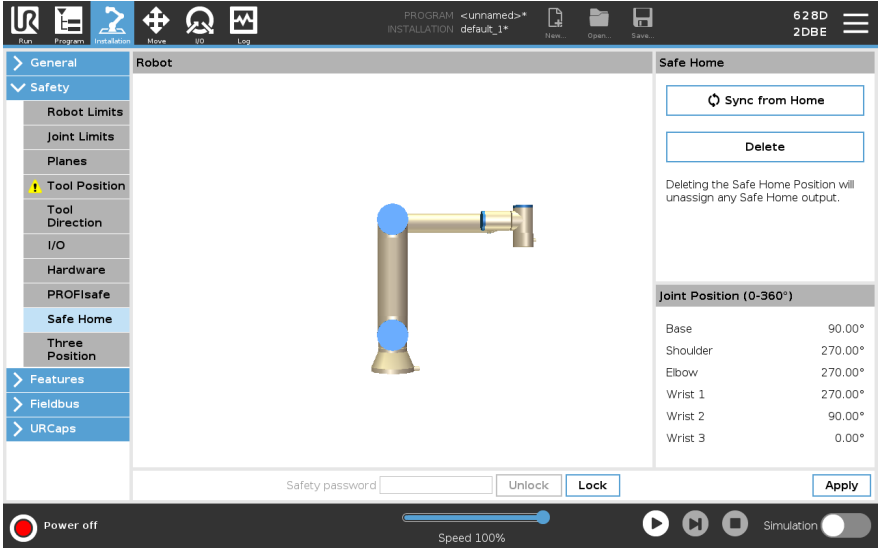
10.3.7. Safe Home Position

Description

Safe Home is a return position defined by using the user-defined Home Position. Safe Home I/Os are active when the Robot Arm is in the Safe Home Position and a Safe Home I/O is defined.

The Robot Arm is in the Safe Home Position if the joint positions are at the specified joint angles or a multiple of 360 degrees thereof.

The Safe Home Safety Output is active when the robot is standing still at the Safe Home Position.



Syncing from Home

To sync from Home

1. In the Header, tap **Installation**.
2. In the Side Menu on the left of the screen, tap **Safety** and select **Safe Home**.
3. Under **Safe Home**, tap **Sync from Home**.
4. Tap **Apply** and in the dialog box that appears, select **Apply and restart**.

Safe Home Output

The Safe Home Position must be defined before the Safe Home Output (see [I/O](#)).

Defining Safe Home Output

To define Safe Home Output

1. In the Header, tap **Installation**.
2. In the Side Menu on the left of the screen, under **Safety**, select **I/O**.
3. On the I/O screen in the Output Signal, under Function Assignment, in drop-down menu, select **Safe Home**.
4. Tap **Apply** and in the dialog box that appears, select **Apply and restart**.

Editing Safe Home

To edit Safe Home

Editing Home does not automatically modify a previously defined Safe Home position. While these values are out of sync, Home program node is undefined.

1. In the Header, tap **Installation**.
 2. In the Side Menu on the left of the screen, under **General**, select **Home**.
 3. Tap **Edit Position** and set the new robot arm position and tap **OK**.
 4. In the Side Menu, under **Safety**, select **Safe Home**. You need a Safety password to **Unlock** the Safety Settings (See Setting a Software Safety Password).
 5. Under **Safe Home**, tap **Sync from Home**
-