

KINOVA



TOGETHER IN ROBOTICS

MEET GEN3

RELEASE NOTES

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Overview

The Release Notes contain information about changes to the Kinova® Gen3 Ultra lightweight robot enabled by Kinova® Kortex™ version 2.4.0. The changes are presented from the most recent to the oldest. The information presented discusses six main areas for each release.

- System requirements
- Definitions
- Software / firmware components release versions
- Features introduced
- Bugs fixed in release
- Known issues
- Limitations and workarounds

System requirements

Kortex Web App

The Web App is supported on various operating systems.

- Google Chrome version 64+
- Microsoft Windows 7/10
- Ubuntu LTS 16.04
- Android 8.1 and higher

Kortex development computer platform

The hardware and OS requirements for a development computer are multi-platform.

- Microsoft: Windows 7/10 (32-bit or 64-bit)
- Linux: Ubuntu 16.04 (64-bit)

Third-party software requirements

Third-party software is required for the Modbus protocol.

- Python 3
- pymodbus 2.3.0

Definitions

EXPERIMENTAL:

Feature is available but not fully supported. To be used with caution.

ADVANCED :

Feature is supported but can be dangerous to people and equipment if used incorrectly. Should be used only by users who know exactly what they are doing.

For content that is identified as *EXPERIMENTAL* or *ADVANCED* , users should refer to the robot user guide before attempting to use the feature. Furthermore, users should stay out of the reach of the robot while using advanced and experimental modes.

Safety Information

Users need to review safety and warning information about the Gen3 robot before using it. Safety information for the robot can be found in the introduction section of the *Gen3 Ultralight robot User Guide*.

Compatibility Matrix

Different Gen3 robot hardware configurations are compatible with different software releases.

| Robot / gripper hardware configuration and API version | | Robot firmware version | | | | | |
|--|-----------------------------------|------------------------|-------|-------|-------|-------|-------|
| | | 1.1.7 | 2.0.0 | 2.0.1 | 2.2.0 | 2.3.0 | 2.4.0 |
| 6 DoF (fixed base with or without vision) | | - | - | - | ✓ | ✓ | ✓ |
| 7 DoF | Quick connect base with vision | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | Quick connect base without vision | - | - | - | ✓ | ✓ | ✓ |
| | Fixed base with vision | - | - | - | ✓ | ✓ | ✓ |
| | Fixed base without vision | - | - | - | ✓ | ✓ | ✓ |
| Robotiq 2F-85 gripper | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Robotiq 2F-140 gripper | | - | - | - | ✓ | ✓ | ✓ |
| Recommended Kortex API version* | | 1.1.7 | 2.0.0 | 2.0.0 | 2.2.0 | 2.3.0 | 2.5.0 |

*In order to access the full feature set of the corresponding firmware version

V2.4.0 release

Release Date: 2022-10

Release versions for software and firmware components

| | |
|--------------------|-------|
| Kortex API | 2.5.0 |
| Base firmware | 2.4.0 |
| Actuators firmware | 2.4.0 |

Features introduced or altered in this release

Disable Wi-Fi and Bluetooth®

The user can enable and disable Wi-Fi through the API, as well as by selecting or deselecting the Wi-Fi checkbox on the **Networks** page.

The user can enable and disable Bluetooth® through the API, as well as by selecting or deselecting the Bluetooth checkbox on the **Networks** page.

Automatic loading Gen3 Ultralight

The Base One Piece - Automatic Power On variant of Gen3 Ultralight switches on automatically when it is plugged into an electrical source. With the ease of physically not switching the robot on comes a few drawbacks.

- It is not possible to perform a factory reset by holding the power button. However, it is possible to perform a factory reset using Kortex Web App.
- It is not possible to update the core portion of the operating system on the Base One Piece - Automatic Power On variant of Gen3 Ultralight.

Fixed in this release

Version 2.4.0 fixed one issue.

After being idle for a long period of time, some of the robots indicated there was a network error after rebooting them.

Pending deprecation

`ReachCartesianPoses` is supported for backward compatibility purposes only. It is marked for deprecation in future releases.

For more information about the API, see the API documentation on the Kortex GitHub repository.

V2.3.0 release

Release Date: 2021-05

Release versions for software and firmware components

| | |
|--------------------|-------|
| Kortex API | 2.3.0 |
| Base firmware | 2.3.0 |
| Actuators firmware | 2.3.0 |

Features introduced or altered in this release

Minimal operating voltage

The minimal operating voltage used to be 18V. It is now 21V.

Joint and Cartesian waypoint support

The user can create a sequence of waypoints through the API that can be played without stopping the movement of the arm during the trajectory.

For Cartesian waypoints, a blending radius can be introduced between each waypoint, which causes the arm to deviate from the position of the defined waypoint during the trajectory.

A blending radius of zero cause the arm to reach the waypoint and stop at that point.

Selecting **Optimal blending** maintains the fastest speed at the waypoint while respecting the limits.

Cartesian waypoints replace the old `ReachCartesianPoses`.

For joint waypoints, the user can send joint commands without stopping the movement of the arm between each command. The user can still use `ReachJointPosition`.

Modbus communication protocol support for control commands (slave)

A small set of Kortex commands are now available through the Modbus protocol. The commands support basic features.

- Actions and sequences
- Twist
- Read cyclic data
- Emergency stop
- Stop
- Clear faults

The Modbus watchdog monitors all communication and acts as a fail-safe. When no communication is detected, the internal session closes and Modbus initiates movement stops of the arm.

Improvements to Torque Control

There now is an experimental high-velocity torque control mode that is available only in low-level control. The robot is more responsive and moves at higher speed. Although there is less of a damped feeling, the motion is less smooth. (*EXPERIMENTAL*)

Fixed in this release

Version 2.3.0 fixed several issues.

- The **Stop** button does not stop the gripper action play when **Hold to Play** is disabled.
- Need to clear browser cache after robot upgrade.
- Joint error does not always display on the **Web App > Safeties** page.
- Playing a second action while the first is paused causes the first action to resume.
- Robot reboot using Web App does not work.
- Memory leak in Gen3 caused arm to crash and require a reboot.

Pending deprecation

`ReachCartesianPoses` is supported for backward compatibility purposes only. It is marked for deprecation in future releases.

For more information about the API, see the API documentation on the Kortex GitHub repository.

V2.2.0 release

Release Date: 2020-01

Release versions for the firmware components

| | |
|---------------------------|-------|
| Kortex API | 2.2.0 |
| Base firmware | 2.2.0 |
| Actuators firmware | 2.2.0 |
| Interface module firmware | 2.2.0 |
| Vision module firmware | 2.2.0 |

Features introduced or altered in this release

Support new 6 DoF robot model.

Support for robot with fixed base and no vision module option.

Faster robot movement (up to 50 cm/s).

New **Speed Limits** page in **Web App Configurations** section. Allows configuration of robot speed soft limits from Web App.

Ability to configure, via APIs, soft limits on speed and acceleration as well as desired speeds and accelerations for joystick control modes.

Teaching mode - create sequences easily in Web App Actions page sequence editor. Capture snapshots with wrist buttons in admittance modes.

Improved protection zones management in Web App.

Introduction of internal calibration process to improve precision and repeatability on newly manufactured robots.

Simulink Jetson TX2/XAVIER platform support.

Control device mapping support - ability to edit, create, and delete mappings via API and Web App.

Fixed in this release

Version 2.2.0 fixed several issues.

- The **Stop** button does not stop the gripper action play when **Hold to Play** is disabled.
- Vision module firmware fails to upgrade.
- Need to clear browser cache after robot upgrade.
- Need to restore factory settings after robot software update.
- The gripper has invalid parameters loaded at boot.
- Joint error does not always display on the **Web App** > **Safeties** page.
- Playing a second action while the first is paused causes the first action to resume.
- There are unexpected movements when changing tool, payload, and gravity vector.
- There are issues displaying Wi-Fi network information on the Web App.
- Cannot see errors or warnings on the **Safeties** page.

Notice of pending deprecation

As of this release, a number of API methods have been marked to be deprecated in a future release. For full details, see the API documentation on the Kortex GitHub repository.

V2.0.1 release

Release Date: 2019-09

Release versions for the software and firmware components

| | |
|---------------------------|-------|
| Kortex API | 2.0.1 |
| Base firmware | 2.0.1 |
| Actuators firmware | 2.0.1 |
| Interface module firmware | 2.0.1 |
| Vision module firmware | 2.0.1 |

Features introduced or altered in this release

No new features are introduced in Kinova® Kortex™ Software Package v2.0.1.

Fixed in this release

Version 2.0.0 fixed several issues.

- In **Web App** > **Controllers** > **XBox Mapping**, the table showed internal names rather than user-friendly names for some items.
- When Web App reconnects after rebooting with Cartesian virtual joystick open, Angular joystick commands will not be sent to the robot.
- When editing values in **Network** page of Web App, the backspace key deletes two characters.
- When deleting a Pose card that is used in a Sequence, the user receives the notification `Device Error` and the card is not deleted.
- Web App **Upgrade** page should say Kortex API version rather than Kortex version.
- `build.sh` failed to download `kortex_api` in ROS Kortex.
- `Following Error` warning triggers with no movement from the robot.

V2.0.0 release

Release Date: 2019-08

Release versions for the software and firmware components

| | |
|---------------------------|-------|
| Kortex API | 2.0.0 |
| Base firmware | 2.0.0 |
| Actuators firmware | 2.0.0 |
| Interface module firmware | 2.0.0 |
| Vision module firmware | 2.0.0 |

Features introduced or altered in this release

No new features are introduced in Kinova® Kortex™ Software Package v2.0.0.

Fixed in this release

Version 2.0.0 fixed several issues.

- In **Web App** > **Controllers** > **XBox Mapping**, the table showed internal names rather than user-friendly names for some items.
- When Web App reconnects after rebooting with Cartesian virtual joystick open, Angular joystick commands will not be sent to the robot.
- When editing values in **Network** page of Web App, the backspace key deletes two characters.
- When deleting a Pose card that is used in a Sequence, the user receives the notification `Device Error` and the card is not deleted.
- Web App **Upgrade** page should say Kortex API version rather than Kortex version.
- `build.sh` failed to download `kortex_api` in ROS Kortex.
- `Following Error` warning triggers with no movement from the robot.

V1.1.7 release

Release Date: 2019-04-26

Release versions for the software and firmware components

| | |
|---------------------------|-------|
| Kortex API | 0.0.2 |
| Base firmware | 1.1.7 |
| Actuators firmware | 1.1.7 |
| Interface module firmware | 1.1.7 |
| Vision module firmware | 1.1.7 |

Features introduced or altered in this release

Updated look and organization of Web App.

Interface module expansion (UART, I2C, GPIO, Ethernet) is fully supported.

High-level control improvements are available.

Command individual actuators at high-level with joint speed commands are available.

Send high-level pre-computed joints trajectory command.

Force control - Send Cartesian Wrench commands to tool (*EXPERIMENTAL*).

Torque control - command individual actuators in low-level with torque commands (*ADVANCED*).

Control configuration.

Configure gravity vector in control library to support all static mounting orientations.

Configure tool mass, center of mass, and reference frame in control library.

Configure payload in control library.

MATLAB and Simulink support, including vision support via MATLAB Image Toolbox Adapter.

Introduction of new `matlab_kortex` GitHub repository.

Gazebo and MoveIt! Support added to `ros_kortex` GitHub repository.

Fixed in this release

Version 1.1.7 fixed several issues.

- Reliability of **Hold to Play** button in Web App.
- Web App virtual joysticks and admittance controls cannot be used when pose play is pressed after the robot has already arrived at the pose.
- Robot with Robotiq Gripper may come into contact with robot base.
- Safety information missing in the Web App **Configurations** page **Safety** tab after a local refresh.
- Web App may be improperly rendered on a tablet in portrait orientation.
- Many small sequences cause navigation to Web App **Actions** page to crash Web App.
- Interface minimum voltage safety does not clear when using **Clear all faults** in Web App.
- Web App camera pop-up window is unreliable.

V1.1.6 release

Release Date: 2019-03-29

Release versions for the software and firmware components

| | |
|---------------------------|-------|
| Kortex API | 0.0.2 |
| Base firmware | 1.1.6 |
| Actuators firmware | 1.1.5 |
| Interface module firmware | 1.1.5 |
| Vision module firmware | 1.1.6 |

Features introduced or altered in this release

Users can now set the country in the **Configurations > Base > General** tab of the Web App **Configurations** page.

Redesign of Web App UI and functionality. Various improvements:

- Bottom panel: Page shortcut icons removed. Snapshot controls consolidated into bottom Control Panel.
- Top bar: Users have the ability to hide/show the left menu. The upper right notifications and controls have been updated, including a streamlined notifications panel.
- Left menu: The **Notifications** page has been removed.

Web App performance on mobile devices has been improved.

Web App retrieves assigned IPv4 address when connected to a wireless access point.

Joint admittance tuning has been improved to lower stiffness and offer better stability.

Fixed in this Release

Version 1.1.6 fixed several issues.

- Subnet mask of 255.255.255.255 in Web App locks out other users.
- Long-running sequence stopped because of Web App time-out.
- Base controller RJ-45 LED behavior.
- Robot moves erratically after 'W' key depression in Web App virtual joystick.
- Glitch when admittance mode activated during Web App robot sequence.
- When in admittance mode, robot drifts when robot has no gripper attached.
- Robot can fall during boot sequence.
- `PlayCartesianTrajectory()` does not work as intended.
- Robot shakes when moved manually in Cartesian admittance mode.
- Actuator firmware - persistent following error will not deactivate servoing.
- Segmentation fault when destroying API.
- Actuators sometimes return NaN as torque value for `RefreshFeedback()` calls.
- Torque safeties do not trigger on negative values.
- Communication issues controlling robot over wired Ethernet while video streaming activated.

V1.1.4 release

Release Date: 2019-01-15

Release versions for the software and firmware components

| | |
|---------------------------|-------|
| Kortex API | 1.1.3 |
| Base firmware | 1.1.4 |
| Actuators firmware | 1.1.4 |
| Interface module firmware | 1.1.4 |
| Vision module firmware | 1.1.4 |

Features introduced in this release

Kortex Web App (robot configuration, control and monitoring).

ROS v1 support.

APIs: C++ and Python.

Control modes.

Cartesian.

Joint angles.

Admittance – Cartesian, angular, and null-space.

Control features.

Protection zones.

Singularity avoidance.

Servoing modes.

High-level.

Low-level.

2D and 3D video streaming.

Sequences and Actions.

Event notifications.

Safeties management.

Control device mapping.

Fixed in this release

There were no fixes in Kinova® Kortex™ Software Package v1.1.4.

Known issues

The current version of Gen3 Ultralight has a few known issues. Kinova is working towards to fixing the issues.

- In Cartesian admittance mode, the robot may suddenly shake during some motions when joint six is near its joint limit.
- The **Web App > Actions Hold to Play** and **Loop** parameter values are specific to each Web App instance. A second Web App instance does not show the same values from the first instance.
- Protection zones are only considered in modes that are in Cartesian space. Null space admittance is a mode that is in joint space. The robot does not avoid or stop for protection zones while it is in null space admittance.
- The active mapping will be reset to the default mapping after a reboot. It is therefore inadvisable to change the location of the Emergency Stop button on any user-defined mapping.
- During teach mode, moving the robot using null space admittance between two snapshots does not guarantee that the movement will be the same. A new trajectory will be generated between the two snapshots which may differ.

Limitations and workarounds

| | |
|--|---|
| Availability of protection zones | Protection zones are available only in Cartesian modes. Workaround: None |
| Web App shows base communication only | After rebooting the robot or refreshing the Web App page, the Web App shows communication only on the base. The issue can be seen in the Configurations and Upgrade page of the Web App. Information about the actuators, interface module, and vision are missing. Workaround: Refresh the page. If this does not work, move the robot around and then reboot. |
| Vision module settings unaffected by Web App Restore Factory Settings | The Restore Factory Settings button on the Web App > Configurations page has no impact on Vision module configuration. Workaround: Modify the Vision module parameters manually, as needed. |
| Robot may stop if selected speed constraint speed value is too high | When the speed constraint for a Cartesian pose is too high, the robot stops before attaining the commanded pose. Workaround: Edit the corresponding action and reduce constraint speed value. |
| Robot moves off joint limit endpoint in Cartesian admittance mode after it is released | If the robot is in Cartesian admittance mode and the user attempts to bring it inside its joint limits, the robot may move on its own after the robot is released. Workaround: Be aware of robot joint limits and do not attempt to force the robot joints beyond the limits. |
| Robot drops when doing Set Zero Offset on actuators | The robot may drop if <code>Set Zero Offset</code> is performed when the robot is in an unstable position. Workaround: Use only if robot in stable position. |
| After flash upgrade Web App will not display Web App and Kortex versions completely | The Web App and Kortex API versions are displayed in the Web App Upgrade page. The page may show the wrong information after upgrading the robot. Workaround: Do a force refresh of the Web App by pressing CTRL-F5. |
| IPv4 address not in valid range message sometimes appears while IP address and subnet mask are valid values | Web App may report error when changing both IPv4 address and subnet mask. Workaround: Change one of the two values at a time. |
| Pressing Set Axis Offset Zero in Web App causes warnings and errors. | Pressing the Set Axis Offset Zero from the Web App may cause warnings and errors. Workaround: Clear all faults from Xbox gamepad or Web App, and resume normal operations. |

| | |
|---|--|
| After FW upgrade, Web App may still report old vision module FW version | <p>The vision firmware takes a few minutes to update. The information on the Web App > Upgrades page will refresh quickly while the vision firmware is still in the process of updating.</p> <p>Workaround: Wait several minutes and re-open the Web App.</p> |
| Protection zone limitations due to placement of monitored points | <p>The robot currently detects entry of the robot into protection zones by checking for intersections of a set of discrete checkpoints on the robot with the protection zone volume. This behaves intuitively in most cases, but can produce expected behavior for some protection zones with at least one thin dimension such that the robot can wrap around the zone or the zone can end up between two monitored points.</p> <p>Workaround: Read the User Guide Protection zone information in the "Robot controls" section for more information about the monitored points and limitations of protection zones.</p> |
| ROS MoveIt! - when joint goes over hard limit, it does not move anymore | <p>MoveIt! cannot plan a trajectory when the robot is inside of its joint limits because the robot is not considered to be in a "possible" position.</p> <p>Workaround: Use the virtual joystick of the web app to move away from the joint limits before doing a MoveIt trajectory.</p> |
| Device routing packets are sometimes lost between base and actuators | <p>When communicating with actuators via the Kortex API, a timeout error may be reported on rare occasions when packets are lost.</p> <p>Workaround: Ensure that the client code handles timeouts by placing a retry on timeout.</p> |
| Limitations on interface UART | <p>Sending too large a message via UART can result in lost data or other issues with the interface. Very long messages, such as more than 500 characters, will result in the interface not responding and requiring a reboot of the robot to reactivate.</p> <p>Workaround: Take into account the configured baud rate of the UART and avoid sending more data than this baud rate.</p> |
| In some cases Cartesian trajectories fail to achieve desired pose | <p>Cartesian trajectories may sometimes fail to reach the desired pose if the joint speed limits set are too low or if singularities are present within the trajectory.</p> <p>Workaround: Increase joint speeds or reduce Cartesian speeds. Avoid singularities in your trajectory.</p> |
| For angular trajectories, new default joint speed limits may impact existing trajectories with speed constraints | <p>To ensure that existing unconstrained angular trajectories behave the same after the update, the default joint speeds limit in angular trajectories is set to 25/s. An existing Sequence with a joint speed constraint configured higher than this will become invalid after upgrading to v2.2.0 when attempting to execute the Sequence.</p> <p>Workaround: Using the new Web App Speed Limits page, increase the joint speed limits globally or specifically for angular trajectory control mode. Alternatively, reduce the joint speed constraint in the Sequence.</p> |

| | |
|--|--|
| Web App notifications for triggered warnings and faults for Interconnect safeties are wrong | Notifications displayed in Web App for safeties triggered in Interconnect/Gripper will not specify the correct safety. Workaround: Look at the safety page in the Web App to see the correct Interconnect safety that was triggered. |
|--|--|

Support

If you have any issues, questions or comments, please feel free to contact us.

Access all technical and product resources on the Kinova website.

Contact your Field Applications Engineer if you have questions at support@kinovarobotics.com.

TOGETHER IN ROBOTICS



PROUDLY MADE IN
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