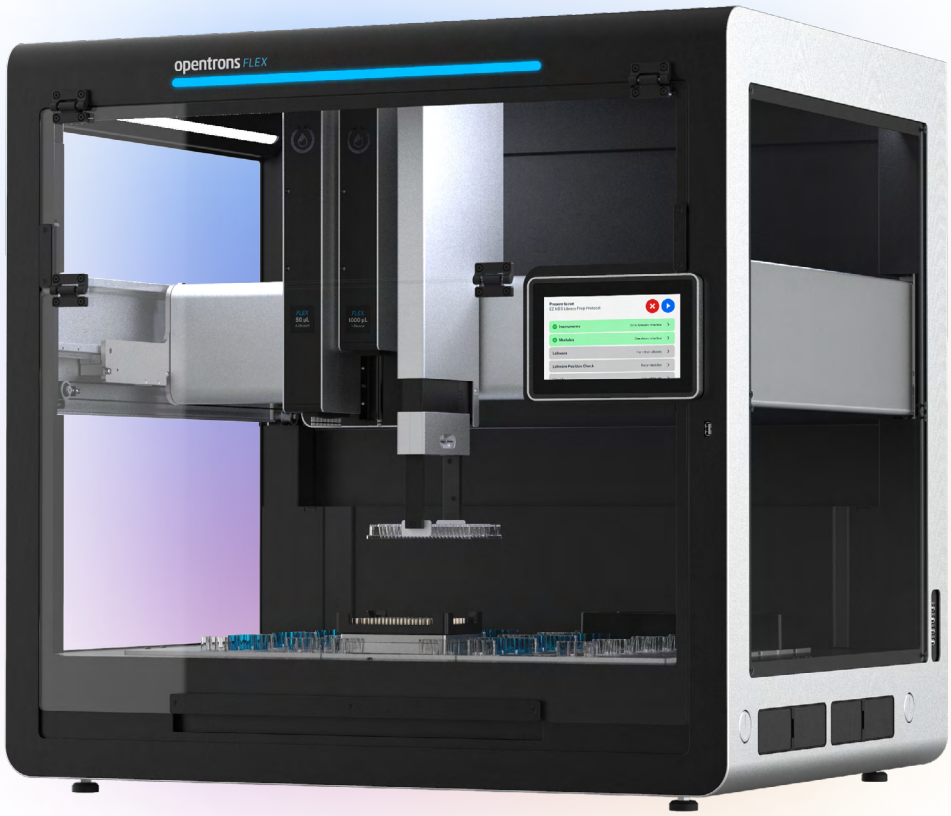
opentrons FLEX™

Opentrons Flex

Maintenance and Service



Opentrons Labworks Inc.

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CHAPTER 1

Maintenance and Service

This chapter covers how to perform routine maintenance on your Opentrons Flex, and what to do if you require service for a problem. You should be able to perform cleaning tasks yourself, whereas service and repairs should be handled by Opentrons Support.

1.1 Cleaning your Flex

Routine cleaning helps keep Flex free of contaminants that can affect your protocols. Cleaning also gives you a chance to inspect the robot for wear and damage. You should review this section for information, instructions, and resources about how to clean your Flex, pipettes, gripper, and modules.

If you have any questions about cleaning your Flex and its related components, contact the support team at support@opentrons.com.

Before you begin

Flex is an electrically powered mechanical device. As a good practice, turn off the power before you start cleaning it and before reaching inside the enclosure. You may even want to unplug the robot as well. These are simple safety steps you can take to make the robot inoperable until you're finished.

Along with turning the power off, remove any instruments, modules, and labware before cleaning the robot. Removing attached items gives you more room to work and provides better access to the deck, gantry, and other spaces.

What you can clean

You can wipe off all the visible and easily accessible surfaces of your Flex. This includes the exterior and interior frame, touchscreen, windows, gantry, and deck. The Flex does not have any internal parts that you need to open or disassemble for this level of maintenance. If you can see it, you can clean it. If you can't see it, don't clean it.

Cleaning solutions

The following table lists the chemicals you can use to clean your Flex. Diluted alcohol and distilled water are our recommended cleaning solutions, but you can refer to this list for other cleaning options. You can also use these chemicals to clean modules, pipettes, and other attached instruments.

> **Warning:** *Do not use acetone*. The robot, pipettes, and modules are made from materials that acetone can damage or dissolve.

Solution	Recommendations
Alcohol	Includes ethyl/ethanol, isopropyl, and methanol. Dilute to 70% for cleaning. Do not use 100% alcohol.
Bleach	Dilute to 10% (1:10 bleach/water ratio) for cleaning. Do not use 100% bleach.
Distilled water	You can use distilled water to clean or rinse your robot.

Frame and window panel cleaning

To clean the exterior and interior frame and window panels of your Flex:

1. Dampen a soft, clean cloth or paper towel with a cleaning solution.
2. Gently wipe off the exposed and easily accessible surface areas.
3. Use a cloth dampened with distilled water for a rinse wipedown.
4. Let the robot air dry.

Deck cleaning

To clean the deck, deck slots, and trash bin:

1. Dampen a soft, clean cloth or paper towel with a cleaning solution.
2. Gently wipe off the deck, deck slots, and trash bin. You can remove the deck slots and trash bin for easier access.

3. Use a cloth dampened with distilled water for a rinse wipedown.
4. Let the deck pieces air dry. Replace any pieces that you removed for cleaning.

Gantry cleaning

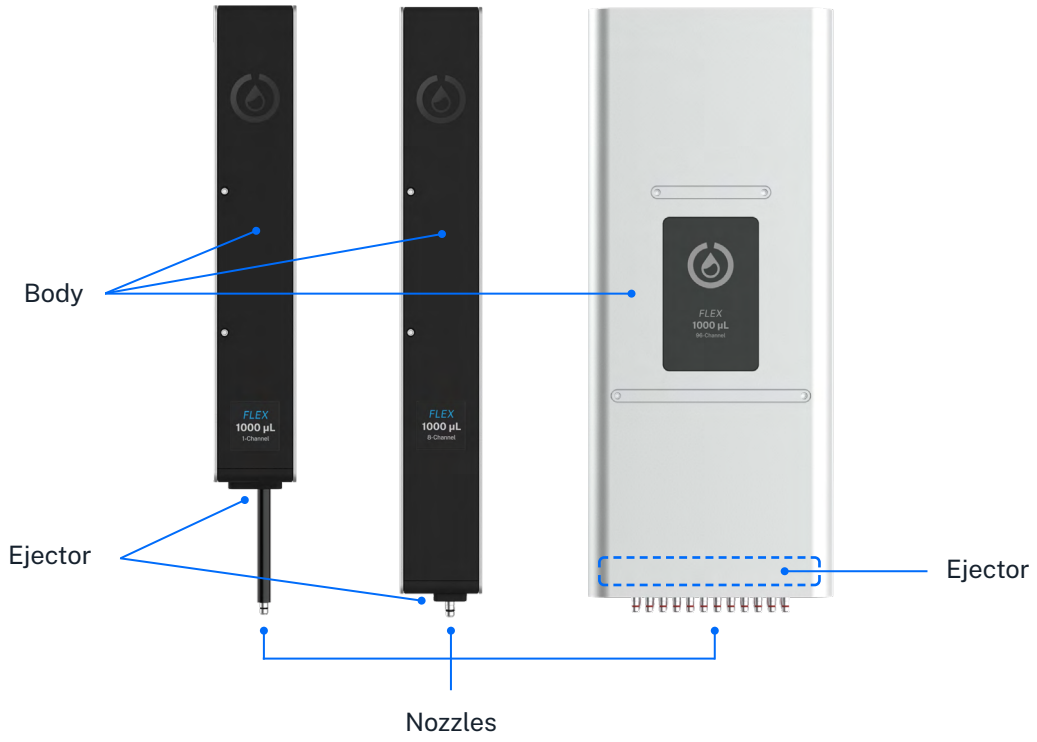
To clean the gantry:

1. Dampen a soft, clean cloth or paper towel with a cleaning solution.
2. Gently wipe off the horizontal and vertical gantry surfaces, and side rails.
3. Use a cloth dampened with distilled water for a rinse wipedown.
4. Let the gantry air dry.

1.2 Cleaning pipettes and tips

To clean a 1-, 8-, or 96-channel pipette:

1. Remove the pipette from the gantry.
2. Dampen a soft, clean cloth or paper towel with a cleaning solution.
3. Gently wipe down the following parts:
   - Body
   - Ejector
   - Nozzles
4. Use a cloth dampened with distilled water for a rinse wipedown.
5. Let the pipette air dry and reattach.



Warning:

- *Do not* disassemble Flex pipettes for cleaning or attempt to clean their internal electronic components.
- *Do not* put Flex pipettes in an autoclave. The high temperatures, pressures, and steam used inside an autoclave can damage the electronics, circuit boards, small electric motors, and other sensitive components.

Pipette decontamination

The routine cleaning steps described above may not clean your pipette if it becomes contaminated with substances like nucleic acids, proteins, or radioactive material. When a pipette becomes contaminated, try the decontamination steps described in this section. You can also contact support if your pipette gets contaminated and these cleaning procedures do not work.

OUTSIDE OF THE PIPETTE

Refer to the following table for recommended cleaning methods, by contamination type.

Contaminant	Cleaning recommendation
Aqueous solutions	Rinse the contaminated parts with distilled water or 70% ethanol and air dry at 15.5 °C (60 °F).
Nucleic acids	Clean the contaminated parts in a glycine/HCl buffer (pH 2) for 10 minutes, rinse with distilled water, and air dry.
Organic solvents	Allow the solvent to evaporate on its own or immerse the pipette *nozzle only* in a detergent, rinse with distilled water, and air dry.
Proteins	Clean the contaminated parts with a detergent, rinse with distilled water, and air dry. *Do not* use alcohol. That will set the proteins.
Radioactive materials	Place the pipette nozzle in a solution like Decon 90, rinse with distilled water, and air dry.

INSIDE THE PIPETTE

Filtered pipette tips help prevent contaminating the barrel or inside of the pipette. But, you cannot disassemble the barrel if it becomes contaminated. If the inside of your pipette gets contaminated, the following steps may help remove the contamination:

1. Inject a small amount of cleaning solution into the barrel using a manual pipette or syringe.
2. Gently shake the pipette to swirl the cleaning solution.
3. Rinse with distilled water.
4. Let the pipette air dry and reattach.

Cleaning pipette tips

Flex pipette tips are disposable items. While you can reuse attached tips if your protocol allows it, they're not designed to be removed, cleaned, and then reattached. Also, cleaning Flex pipette tips in a parts washer or an autoclave can cause them to warp. Discard pipette tips after you no longer need them. You can always buy more at https://shop.opentrons.com/tips-and-labware/.

1.3 Cleaning the gripper

To clean the gripper:

1. Remove the gripper from the gantry.
2. Dampen a soft, clean cloth or paper towel with a cleaning solution.
3. Gently wipe down the following parts:
   - Gripper body
   - Jaws
   - Paddles
4. Use a cloth dampened with distilled water for a rinse wipedown.
5. Let the gripper air dry and reattach.

Warning:
- *Do not* disassemble the gripper for cleaning or attempt to clean its internal electronic components.
- *Do not* put the gripper in an autoclave. The high temperatures, pressures, and steam used inside an autoclave can damage the electronics, circuit boards, small electric motors, and other sensitive components.

GRIPPER PADDLES

The gripper paddles are wear items that require periodic replacement. When cleaning the gripper, inspect the rubber pads for tears, nicks, or other wear. Replace the paddles as needed with the two spares (included with the gripper). If you need additional gripper paddles, contact Opentrons Support at support@opentrons.com.

Note: Aggressive cleaning chemicals may reduce the lifetime of the rubber pads on the gripper paddles.

1.4 Cleaning modules

You can clean the surfaces of any of your Flex modules. The general procedure is the same for all supported modules: Heater-Shaker, Magnetic Block, Temperature, and Thermocycler.

Be sure to turn the module's power off before cleaning it. You can clean the top surfaces of modules while they're installed in a deck slot. However, for better access, you may want to:

- Remove the caddy and module from the deck slot.
- Remove the module from the caddy.
- Disconnect any USB or power cables (if you're cleaning a powered module).

Warning:

- *Do not* disassemble modules for cleaning or attempt to clean their internal electronic components.
- *Do not* put Flex modules in an autoclave. The high temperatures, pressures, and steam used inside an autoclave can damage the electronics, circuit boards, small electric motors, and other sensitive components.

General module cleaning

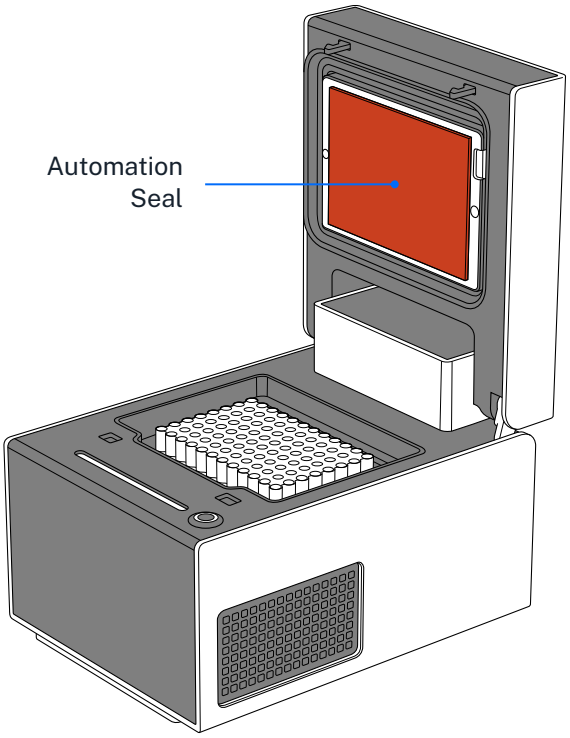
Once you've prepared the module for cleaning:

1. Dampen a soft, clean cloth or paper towel with a cleaning solution.
2. Gently wipe off the module's surfaces.
3. Use a cloth dampened with distilled water as a rinse wipedown.
4. Let the module air dry.

Thermocycler seals

To set up the Thermocycler with a clean seal:

1. Affix a seal to the Thermocycler lid (if one isn't attached already).
2. Wipe the seal with a 1:10 diluted bleach solution.
3. Rinse the seal with molecular biology grade water.
4. Let the seal air dry.



1.5 Autoclave-safe labware

The following table lists labware sold by Opentrons that we have verified as autoclave-safe. If you're using labware from a manufacturer that's not listed here, refer to their website to see whether those items can be autoclaved.

Labware type	Autoclave-safe items
Reservoirs	All NEST reservoirs
Well plates	▪ Thermo Scientific Nunc 96-Well Plate, 1300 µL ▪ Thermo Scientific Nunc 96-Well Plate, 2000 µL ▪ USA Scientific 96 Deep Well Plate, 2.4 mL
Sample vials	Eppendorf Safe-Lock 1.5 mL and 2.0 mL vials (when left open at 121 °C, 20 min)

In general, plastic labware is designed to be consumable. If you aren't sure whether a piece of labware is autoclave-safe, it's best to discard it and replace it with new, clean labware.

1.6 Servicing Flex

Opentrons Flex is designed for years of full-time operation. Unlike cleaning, you should not attempt to service or repair Flex yourself. Opentrons offers multiple levels of service for Flex and related Opentrons hardware, some of which include maintenance and repairs. All Opentrons hardware also has a 1-year warranty, which you can extend to 2 years.

Opentrons services

Opentrons offers two levels of service, Opentrons Care and Opentrons Care Plus, both of which include benefits for onboarding, maintenance, repair, and more. Both services are available in the continental United States; Opentrons Care is also available internationally. Both services include:

- Onboarding with an Opentrons field applications scientist.
- Parts for yearly preventive maintenance.
- Access to a dedicated support engineer.
- Extension of the Opentrons warranty from 1 to 2 years.

In addition, Opentrons Care Plus includes on-site visits for:

- Installation.
- Preventive maintenance, yearly.
- Repairs, as needed.

You can also purchase services a la carte, including installation, protocol development (remote or on-site), repair, relocation, and preventive maintenance. Visit the Services category of the Opentrons Shop, or contact Opentrons Sales for more information.

Installation qualification and operation qualification

Opentrons recommends performing installation qualification and operation qualification (IQ/OQ) after you first set up Flex, after you attach hardware, and after having service performed. IQ/OQ generally verifies:

- The serial numbers of your hardware, including the Flex robot, pipettes, gripper, and modules.
- Software and firmware versions.
- Proper connection of attached hardware.
- Pipette and module calibrations.

Download the Flex IQ/OQ form from the Opentrons Help Center for a complete checklist of IQ/OQ activities to perform.

Preventative maintenance

Opentrons recommends performing basic maintenance tasks — above and beyond cleaning, but not repairs or service — on a regular schedule. These recommendations assume that Flex is in operation 20 hours per week, 50 weeks per year. Adjust the schedule to meet your needs if you use your Flex more or less.

Frequency	Task	Description
Daily	Empty trash	Take the movable trash out of its deck slot, safely discard its contents, and replace it into the deck.
	Inspect working area	Clear the deck of any debris, liquid, or no-longer-needed labware. Check that the plastic labware clips are not damaged.
Weekly	Clean surfaces	Clean the exterior surfaces of the deck, gantry, windows, instruments, and modules, as described above.
Monthly	Power cycle	Turn off Flex and all connected modules. Then turn them back on.
Every six months	Inspect pipettes	Inspect the O-rings on the pipette nozzles for signs of wear (notches, deformation). Replace the O-rings with the provided spares, if needed.
	Inspect gripper	Inspect the rubber pads on the gripper paddles. Replace the paddles with the provided spares, if needed.
	Recalibrate instruments	Run recalibration for the pipettes and gripper.
Yearly	Evaluate pipette performance	Evaluate the overall performance of your Flex pipettes. Replace any pipette that is not performing according to the published accuracy and precision standards.

The annual on-site preventative maintenance visit that is part of Opentrons Care Plus includes performance of all of the tasks listed above, as well as replacement parts.

Warranty

All hardware purchased from Opentrons is covered under a 1-year standard warranty. Opentrons warrants to the end-user of the products that they will be free of manufacturing defects due to part quality issues or poor workmanship and also warrants that the products will materially conform to Opentrons' published specifications. See also the General Terms and Conditions of Sale.

The Opentrons Protect Extended Warranty (1 additional year; 2 years total) is available for purchase from the Opentrons Shop.

Contact us at support@opentrons.com if you have any questions about our warranty.

APPENDIX A

Glossary

This appendix defines terms related to Opentrons Flex. It omits industry-standard terms like “labware” unless the term has a special meaning in relation to Flex. For example, the definition for *pipette* describes the narrower meaning that the term has when using Flex, as opposed to any pipette you might find elsewhere in a lab.

The glossary is formatted to help you navigate within it and to other places in this manual. Words in italics indicate terms that are also defined in the glossary. Extremely common terms like “deck”, “module”, “pipette”, and “protocol” aren’t italicized, to improve readability. Links within definitions take you to the most relevant section that includes additional discussion of the term. And you can always use your PDF reader to search for every occurrence of a term to find even more information.

ABOVE DECK

Space that is on or above the level of the robot’s deck area.

ALUMINUM BLOCK

See *thermal block*.

AMBIENT LIGHTING

LEDs that illuminate the interior of Flex, which you can toggle on and off from the *touchscreen* or the *Opentrons App*.

AUXILIARY PORTS

Ports on the back of the Flex labeled AUX-1 and AUX-2. The port connection type is an IEC M12 metric screw connector. See the Connections section in the System Description chapter.

A1 EXPANSION SLOT

The area of the deck behind slot A1. When its cover is removed, the A1 expansion slot provides enough space to install the Thermocycler Module. See the Deck and Working Area section of the System Description chapter.

APPENDIX A: GLOSSARY

BELOW DECK

The empty area below the robot's *deck slots*. This space provides clearance for module caddies that sit below the deck and allows for below-deck cable routing.

CADDY

See *module caddy*.

CALIBRATION PIN

A metal pin you attach to the *gripper's jaws* during gripper calibration. See the Gripper Calibration section in the System Description chapter.

CALIBRATION PROBE

A metal collar you attach to the *nozzle* of a pipette during pipette and module calibration. See the Pipette Calibration section in the System Description chapter and the Module Calibration section in the Modules chapter.

CALIBRATION SQUARE

The central part of a *removable deck slot* or *module calibration adapter*. The square is made of steel to reduce the chance of surface damage during calibration.

CAMERA

A built-in camera that provides an above-deck view inside the Flex enclosure.

CARRYING HANDLE

One of four aluminum handles that screw into the bottom corners of the robot. The handles help make Flex easier to lift. Lifting the robot requires two people. Using the handles is the best way to pick up Flex and move it.

APPENDIX A: GLOSSARY

CARRYING HANDLE CAP

A flat metal cover that goes over the attachment point for a *carrying handle*. The caps close the handle openings in the *frame* and give the robot a clean appearance. See the Physical Components section in the System Description chapter.

DASHBOARD

The main screen for the robot, accessible by tapping the robot's name in the top left corner of the *touchscreen*. The dashboard gives you quick access to recently run protocols. See the Touchscreen Operation section in the Software and Operation chapter.

DECK

The machined aluminum surface on which automated science protocols are executed. It includes the *working area*, *staging area*, and *A1 expansion slot*. See the Deck and Working Area section in the System Description chapter.

DECK BORDER

The fixed portion of the deck around the four edges of the robot (outside of the area where *deck slot* panels fit). It contains the removable accessory covers.

DECK SLOT

A detachable panel on the deck area. Remove deck slots to install modules and for access to the space below the deck.

EJECTOR

The mechanism that automatically pushes tips off the *nozzle* of a pipette. See the Pipettes section in the System Description chapter.

EMERGENCY STOP PENDANT

An external accessory that you press to stop the robot immediately. Also referred to as the E-stop. See the Emergency Stop Pendant section in the System Description chapter.

APPENDIX A: GLOSSARY

EXPANSION SLOT

See *A1 expansion slot*.

EXTENSION MOUNT

The attachment point on the *gantry* for the Flex Gripper. See the Movement System section in the System Description chapter.

FINISHING CAP

See *carrying handle cap*.

FIRMWARE

The low-level software that controls the Flex robot and all of its peripheral systems. The Flex robot will automatically update the firmware on connected instruments and modules to stay in sync with the robot software version.

FRAME

The outer metal structure of the robot.

FRONT DOOR

The hinged clear panel on the front of the robot.

GANTRY

The robot's positioning system that moves attached *instruments* horizontally (on the x- and y-axis). See the Movement System section in the System Description chapter.

GRIPPER

The Opentrons Flex Gripper, an *instrument* that picks up labware and moves it around the deck automatically.

APPENDIX A: GLOSSARY

HOME GANTRY

The act of moving the *gantry* to a defined position at the back right of the *working area*.

INSTRUMENT

Any component that attaches to the *gantry* and manipulates liquids or labware on the deck. Examples include the 1- , 8- , and 96-channel pipettes, and the gripper.

INSTRUMENT MOUNT

Attachment point for an *instrument*. Examples include the *pipette mounts* and the *extension mount* for the *gripper*. See the Movement System section in the System Description chapter.

JAWS

The moving pincers of the *gripper*. See the Gripper Specifications section in the System Description chapter.

JSON PROTOCOL

A standardized scientific procedure written as a JavaScript object notation file. The Opentrons *Protocol Designer* outputs JSON protocols.

JSON SCHEMA

A set of requirements for the structure and contents of a JavaScript object notation file. For example, all of the Opentrons labware definitions are formatted according to a particular JSON schema, while *JSON protocols* follow another schema.

LABWARE CLIPS

The plastic pieces at the corners of *deck slots*. Labware clips hold labware in place.

APPENDIX A: GLOSSARY

LABWARE CREATOR

The Opentrons Labware Creator is a no-code, web-based tool that uses a graphical interface to help you create a labware definition file to import into the *Opentrons App*. After importing it, your custom labware is available to the Flex robot and the *Python Protocol API*.

LABWARE LIBRARY

The Opentrons Labware Library lists the durable and consumable items you can use with the Flex by default, without customization. It includes things like well plates, reservoirs, tips, tip racks, and tubes.

LABWARE OFFSET

Positional data that is created and stored by running *Labware Position Check*. Flex takes these offsets into account when moving to a particular type of labware in a particular *deck slot*.

LABWARE POSITION CHECK

A guided process to visually check and adjust pipette movement relative to a piece of labware, with a resolution of 0.1 mm. See the Labware Position Check section in the Software and Operation chapter.

LIFT HANDLES

See *carrying handles*.

LIGHTS

See *ambient lighting* or *status light*.

MAINTENANCE POSITION

A specific *gantry* position at the front left side of the *working area*. The gantry moves to this position to facilitate adding or removing *instruments*.

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MODULE

A peripheral that occupies a *deck slot*. Most modules are controlled by the robot via a USB connection. The Heater-Shaker, Temperature Module, and Thermocycler are all powered modules. The Magnetic Block is an unpowered module. See the Modules chapter.

MODULE CADDY

A container that holds a module. It is used to attach modules to the deck area and help with module removal. Caddies place your labware closer to the deck surface and allow for below-deck cable routing.

MODULE CALIBRATION ADAPTER

An adapter that sits on top of a module and is used to automatically calibrate module position.

MOUNTING PLATE

See *96-channel mounting plate*.

NOZZLE

The working end of a pipette. Flex pipettes pick up disposable tips by pressing the nozzles down into them. See the Pipettes section in the System Description chapter.

OPENTRONS APP

Software used to control a Flex (or other Opentrons robots) from a laptop or desktop computer. The Opentrons App is available for Mac, Windows, and Linux. See the Opentrons App section of the Software and Operation chapter.

PADDLE

Part of the *gripper* that grasps and holds labware. Paddles are replaceable wear items. See the Gripper Specifications section in the System Description chapter.

APPENDIX A: GLOSSARY

PINNED PROTOCOL

Protocols you have saved for easy access at the top of the All Protocols tab on the *touchscreen*. See the Protocol Management section in the Software and Operation chapter.

PIPETTE

Opentrons Flex Pipettes are configurable devices used to move liquids throughout the *working area* during the execution of protocols. There are several Flex pipettes, which can handle volumes from 1 µL to 1000 µL in 1, 8, or 96 channels. See the Pipettes section in the System Description chapter.

PIPETTE MOUNT

The attachment point on the *gantry* for a pipette. See the Movement System section in the System Description chapter.

PROFILE

See *Thermocycler profile*.

PROTOCOL

An automated task or procedure you program to run on Opentrons robots, including Opentrons Flex. You can also search for, download, and use ready-made protocols from the Opentrons *Protocol Library*.

PROTOCOL DESIGNER

A web-based, no-code tool for developing *JSON protocols* that run on Opentrons robots, including Opentrons Flex. See the Protocol Designer section in the Protocol Development chapter and https://designer.opentrons.com.

PROTOCOL LIBRARY

A public, searchable library that hosts protocols authored by Opentrons or by members of the Opentrons community. See the Protocol Library section of the Protocol Development chapter and https://protocols.opentrons.com.

APPENDIX A: GLOSSARY

PROTOCOL RUN

A particular instance of Flex performing the actions specified in a protocol file. Only a single protocol run can be active at any given time. Flex stores historical data on the time and outcome of the 20 most recent protocol runs.

PYTHON PROTOCOL

A protocol script written using the Opentrons *Python Protocol API*. See the Writing and Running Scripts section in the Protocol Development chapter.

PYTHON PROTOCOL API

A Python package that exposes a wide range of liquid handling features on Opentrons robots. See the Python Protocol API section in the Protocol Development chapter and the online Opentrons Python Protocol API documentation.

REMOVABLE DECK SLOT

See *deck slot*.

RUN

See *protocol run*.

SIDE COVERS

Detachable panels on the side of the robot, used for module exhaust and external cable routing. See the Connections Section in the System Description chapter.

SIDE WINDOWS

Fixed clear panels on the right and left sides of the robot.

APPENDIX A: GLOSSARY

STAGING AREA

The right-hand side of the deck (column 4), which is only accessible by the *gripper*. This area requires special staging area slots for use. See the Deck and Working Area section in the System Description chapter.

STATUS LIGHT

A strip of color LEDs along the top front of the robot. This light provides at-a-glance information about the robot. Different colors and patterns of illumination can communicate various success, failure, or idle states. See the Touchscreen and LED Displays section in the System Description chapter.

THERMAL ADAPTER

Aluminum blocks that attach to the Heater-Shaker and hold labware. See the Thermal Adapters section in the Modules chapter.

THERMAL BLOCK

Aluminum blocks that attach to the Temperature Module and hold labware to facilitate heating, cooling, and maintaining temperature. See the Thermal Blocks section in the Modules chapter.

THERMOCYCLER PROFILE

A sequence of temperature changes used by the Thermocycler to perform heat-sensitive reactions. See the Thermocycler Profiles section in the Modules chapter.

TIP-RACK ADAPTER

An aluminum bracket used by the 96-channel pipette to attach a full rack of pipette tips. See the Pipettes section in the System Description chapter.

TOUCHSCREEN

The interactive LCD screen mounted to the front of the robot. See the Touchscreen and LED Displays section in the System Description chapter.

TRASH

A removable trash bin. By default, it occupies slot A3 on the deck.

USB PORTS

Connections for Flex accessories, modules, and computers. See the USB and Auxiliary Connections section in the System Description chapter.

USER KIT

A box that contains tools, fasteners, and spare parts. Every Flex robot ships with a User Kit.

WORKING AREA

The physical space above the deck that is accessible for pipetting. See the Deck and Working Area section in the System Description chapter.

WORKSTATION

Opentrons Flex workstations include the Flex robot, instruments, modules, accessories, and labware needed to automate a particular application. See the Flex Workstations section in the Introduction.

Z-AXIS CARRIAGE

The *gantry* component that includes the *pipette mounts* and the *extension mount* for the *gripper*. It moves these *instruments* along the z-axis (up and down) to locate them precisely during protocol execution. See the Movement System section in the System Description chapter.

96-CHANNEL MOUNTING PLATE

A metal frame that mounts to the *z-axis carriage*. It holds the 96-channel pipette to the *gantry*.


opentrons