BenchCel Microplate Handler R-Series

Quick Guide

Original Instructions

Agilent Technologies

Notices

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BenchCel Microplate Handler R-Series Quick Guide

This guide contains the following topics:

- "About this guide" on page 2
- "Safety information" on page 2
- "Hardware components and axes of motion" on page 3
- "Rack-release status lights" on page 6
- "Labware requirements" on page 7
- "Starting up and shutting down" on page 8
- "Handling labware racks" on page 10
- "Filling and emptying labware racks" on page 11
- "Installing and uninstalling labware racks" on page 14
- "Using BenchCel Diagnostics" on page 18
- "Cleaning up after use" on page 27

About this guide

This guide summarizes the operator instructions in the *BenchCel Microplate Handler R-Series User Guide*.

This guide assumes the following:

- The BenchCel Microplate Handler is installed correctly. For installation instructions, see the *BenchCel Microplate Handler R-Series User Guide*.
- The device profile for the specific BenchCel Microplate Handler configuration is already created and the teachpoints are already set. For setup instructions, see the *BenchCel Microplate Handler R-Series User Guide*.
- You are familiar with the VWorks Automation Control software. See the *VWorks Automation Control Quick Start*. For detailed instructions, see the *VWorks Automation Control User Guide*.

  If you are using another lab automation system software, see the user documentation for that software.

For user information about related products, you can search the product knowledge base or download the latest version of a PDF file from the Agilent Technologies website at www.agilent.com/chem/askb.

Safety information

WARNING **Using controls, making adjustments, or performing procedures other than those specified in the user documentation can expose you to moving-parts hazards and hazardous voltage. Before using the BenchCel Microplate Handler, make sure you are aware of the potential hazards and understand how to avoid being exposed to them.**

Before using the BenchCel Microplate Handler, your organization should make sure that you are properly trained in:

- General laboratory safety
- The correct and safe operation of the BenchCel Microplate Handler
- The correct and safe operation of lab automation systems or components used in combination with the BenchCel Microplate Handler

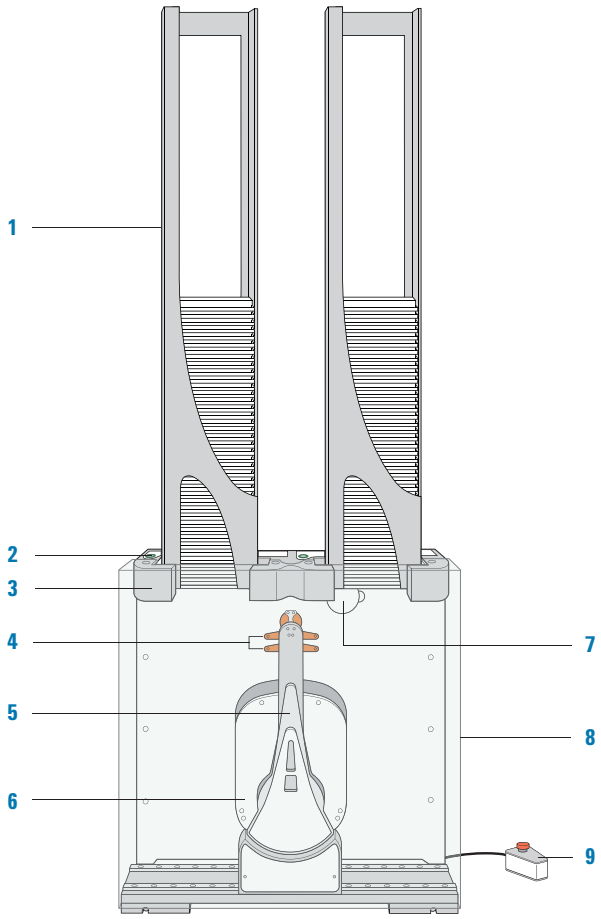
For general safety precautions, intended product use statement, and the list of safety labels, see the *Automation Solutions Products General Safety Guide*. For detailed safety information, see the safety chapter in the *BenchCel Microplate Handler R-Series User Guide*.

Hardware components and axes of motion

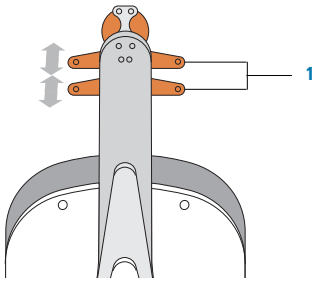
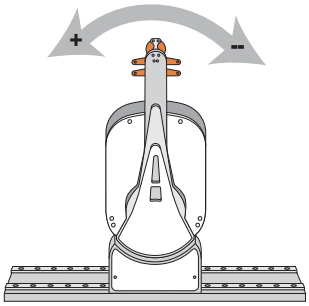
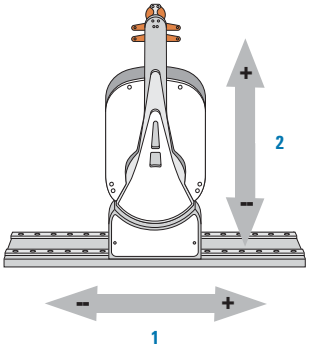
The following figure and table describe the primary hardware components and axes of motion. Note that the figure shows a BenchCel Microplate Handler with two labware racks only. The descriptions are the same for devices with additional labware racks.

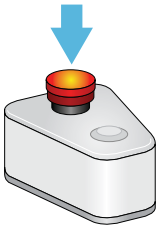
Note: The BenchCel workstation has additional shields and a Light Curtain to protect you from moving-parts in integrated systems. For a description of the safety equipment, see the *BenchCel Microplate Handler R-Series User Guide* and the workstation user documentation.

Figure BenchCel Microplate Handler components (front view)



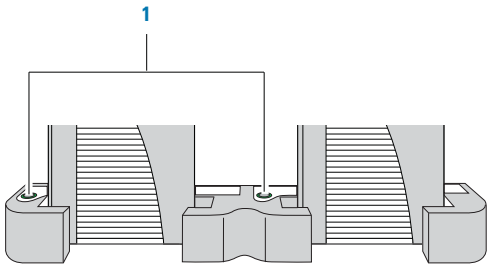
Item	Component	Description
1	Labware rack (with labware)	The accessory that stores labware to be processed in a run.
2	Rack-release button	The button that unlocks the rack for removal. The rack-release button at the top of each stacker head displays different colors to indicate the state of the stacker head. See "Rack-release status lights" on page 6.

Item	Component	Description
3	Stacker head	The structure at which: • A labware rack is loaded. Two sensors inside of each stacker head detect the presence of the racks. • A microplate is checked for type and orientation using sensors. • A microplate is lowered into the stacker grippers to begin a run.
4	Robot grippers	The structures (1) inside the robot arms that close and open to hold and release a microplate. 
5	Robot arms	Two parallel structures that are attached to and rotate about the robot head along the *theta*-axis. 
6	Robot head	The component that moves horizontally along the x-axis (1) and vertically along the z-axis (2). 

Item	Component	Description
7	Air pressure regulator	The knob that you turn to adjust the air pressure inside the device during setup and troubleshooting. Compressed air is used to move components inside the stacker heads. Each regulator controls the air pressure to the two adjacent stacker heads. For details, see the *BenchCel Microplate Handler R-Series User Guide*.
8	Safety shield	The clear panel that is installed on the front of the BenchCel Microplate Handler device to prevent access while it is in operation.
9	Pendant	The component that contains the robot-disable button, which is red, raised, and illuminated. To stop in an emergency, press the red button. The power is cut from the motors, causing all motion to stop. 

Rack-release status lights

The rack-release button (1) at the top of each stacker head displays different colors to indicate the status of the adjacent labware rack. The following table lists the possible colors and the corresponding status description.



Color of indicator light	Meaning
Green	The labware rack is installed correctly on the BenchCel Microplate Handler and the stack of microplates are unloaded. • The stack of microplates are ready for processing. • You can unlock and remove the labware rack.
Green, flashing	The labware rack is unlocked and can be removed.
Blue	A microplate is loaded and the labware rack cannot be removed.
Red	The clamps are open without a rack installed. Do not install a rack until the clamps are closed.

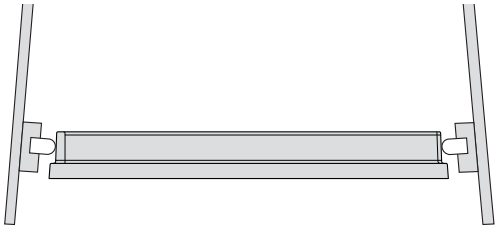
Labware requirements

Acceptable microplates

The BenchCel Microplate Handler is designed to handle labware that meet the American National Standards Institute (ANSI) standards. For the latest labware standards, go to www.sbsonline.org. You can also contact the labware manufacturer to inquire about ANSI-compliant labware. For use of nonconforming labware, please contact Automation Solutions Technical Support.

The BenchCel Microplate Handler typically holds the microplates halfway between the top of the microplate and the top of the microplate skirt (5 to 10 mm above the bottom of the microplate). The following figure shows the gripper-microplate contact point.

Figure Gripper-microplate contact point

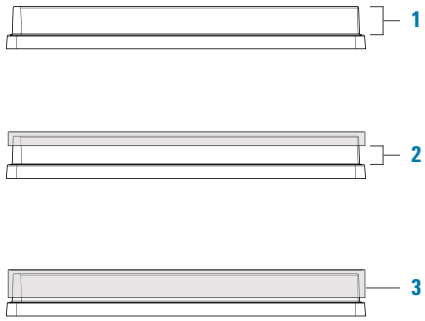


Lidded microplates

Microplates that do not have lids (**1**) or have shallow lids (lids that do not reach the microplate skirt, **2**) provide enough clearance to allow secure and repeatable gripping. Microplates with deeper lids (**3**) can be more challenging, because the microplate must be held by the skirt. If the skirt is too flexible, the stacker grippers will bend the skirt. The bent skirt can grip the microplate lid stacked beneath, inadvertently removing the lid.

Note: Some labware vendors might offer alternative lids that are shallower. Contact the vendor for details.

Figure Lidded microplate examples



Starting up and shutting down

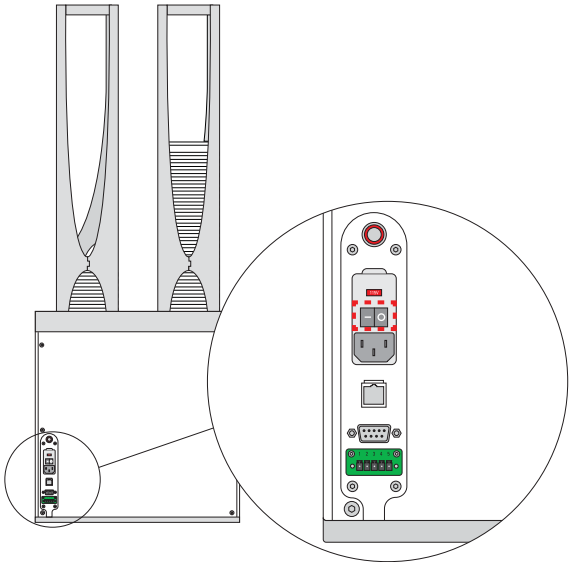
The following procedures describe how to start up and shut down the BenchCel Microplate Handler. For instructions on how start up and shutdown a BenchCel workstation, see the workstation user documentation.

Starting up the BenchCel Microplate Handler

WARNING **Do not touch the BenchCel Microplate Handler as you start the software. The robot head moves when the device initializes.**

To start up the BenchCel Microplate Handler:

1 On the back of the BenchCel Microplate Handler, press the power switch to the on (**I**) position.



Every time you turn on the BenchCel Microplate Handler, the robot homes (the robot is sent to the factory-defined home position for each axis of motion).

2 Turn on the compressed air supply to the BenchCel Microplate Handler.

3 Turn on the controlling computer. See the user documentation from the computer manufacturer.

4 Start the VWorks software. To do this, on the Windows desktop, double-click the **VWorks shortcut icon.** Alternatively, choose **Start > All Programs > Agilent Technologies > VWorks > VWorks.**

For instructions on using BenchCel Diagnostics to operate the BenchCel Microplate Handler, see "Using BenchCel Diagnostics" on page 18. For instructions on running protocols in BenchCel workstations, see the *VWorks Automation Control User Guide*.

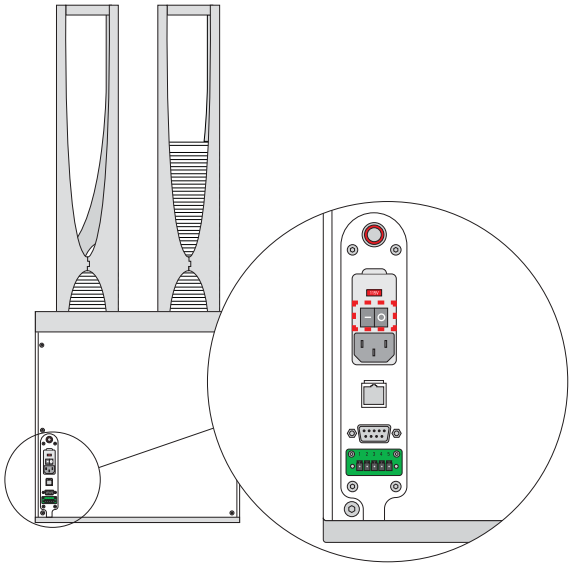
Shutting down the BenchCel Microplate Handler

Shut down the BenchCel Microplate Handler if you intend to:

- Leave it unused for a long period of time.
- Service the device.
- Move it to another location.

To shut down the BenchCel Microplate Handler:

1. Exit the VWorks software.
2. Turn off the compressed air to the BenchCel Microplate Handler.
3. On the back of the device, press the power switch to the off (**O**) position.



Handling labware racks

About this topic

The labware racks store the stacks of labware (microplates, tipboxes, and tube racks) that are processed during a protocol run. This topic describes how to carry labware racks safely.

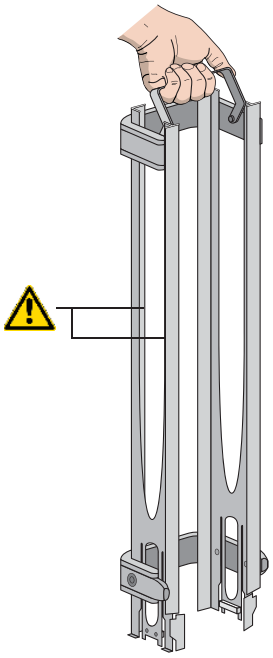
Carrying the labware racks

WARNING **Do not hold a rack by the interior edges. The interior edges can have sharp surfaces that can cause cuts if handled improperly.**

CAUTION A rack that is fully loaded with labware can be heavy. Grasp the rack handle firmly to prevent the rack from slipping or tilting.

To carry a rack, firmly grasp the rack by the handle as shown in the following figure.

Figure Carrying a front-load rack



Filling and emptying labware racks

Before you begin

WARNING **Make sure you understand how to handle the racks safely. See"Handling the labware racks" on page 3.**

CAUTION Before you place labware into a rack that is mounted on the BenchCel Microplate Handler, the clamps in the BenchCel stacker head must be closed (extended). If the clamps are open the stacker grippers will not prevent the stack of labware from dropping. To close the clamps, open BenchCel Diagnostics. On the **Controls** page, click **Stacker** at the top of the rack that you want to remove, and then choose **Close Stacker Grippers**.

Before filling or emptying a labware rack:

- Depending on the rack model, the procedure can vary:
  - *Standard or top-load racks*. Place the rack on a flat, level surface. Although it is possible to fill or empty a mounted rack, the top of a mounted rack can be difficult to access safely.
  - *Front-load racks*. The rack can be mounted on the BenchCel Microplate Handler or placed on a flat, level surface.

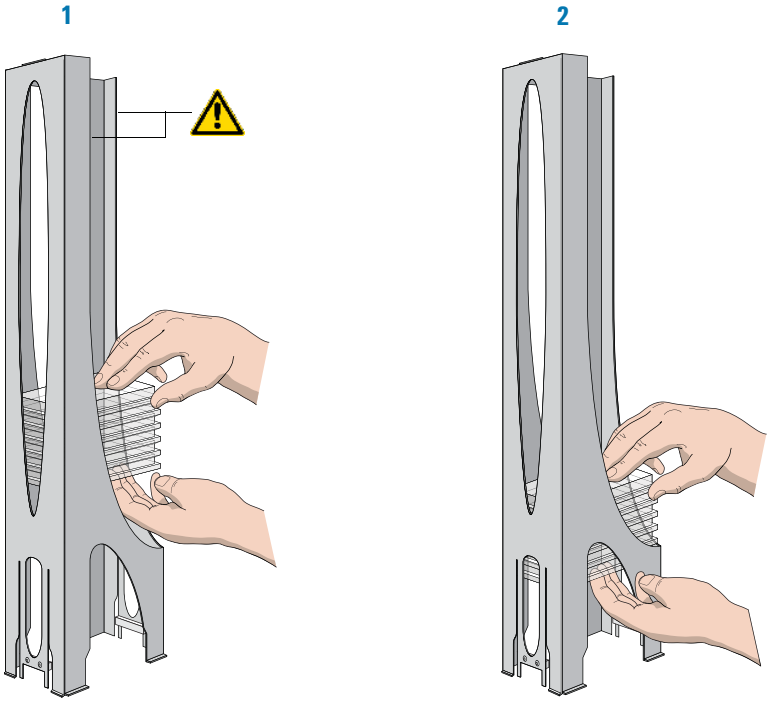
  For details on how to install the racks on or uninstalling the racks from the BenchCel Microplate Handler, see "Installing and uninstalling the labware racks" on page 9.
- Position the rack so that the opening is facing you.
- Determine how the microplates should be oriented in the rack.

Filling the standard and top-load racks

WARNING **Use care to avoid sliding your hand on the interior edges in the rack. The edges can have sharp surfaces.**

The following figure shows how to slide a stack of labware into a standard rack.

Figure Filling a standard rack: sliding the stack down through the top (1), supporting the stack through the bottom slot (2)



To put labware into a standard or top-load rack:

1. Place the rack on a flat, level surface.
2. Using both hands, carefully slide a small stack of labware down through the top of the rack.

   You can use one hand to support underneath the labware stack, while the other hand holds the top of the labware to keep it level. See figure.
3. *Standard racks only*. When you reach the bottom of the open slot, transfer your hand positions so that you continue supporting the labware through the bottom slot.
4. Ensure that the bottom labware in the stack rests on the rack stacker grippers.

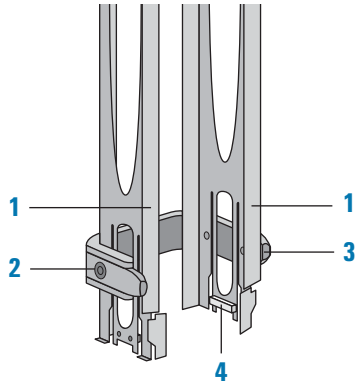
To remove labware from a standard or top-load rack:

1. If possible, remove the rack from the device, and place the rack on a flat, level surface.
2. Carefully slide the labware in small stacks, up and out of the top of the rack.

Filling a front-load rack

The doors (1) on the front-load rack provide easy access for placing labware into the front of a rack that is mounted on a device.

Figure Door mechanism on the front-load rack



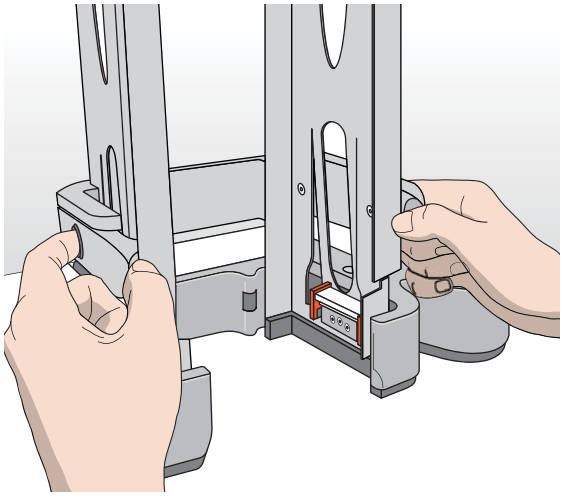
To place labware into a front-load rack:

1. If the rack is mounted on the BenchCel device, verify that the stack is in the unloaded state.

   To unload the stack, open **Diagnostics**. On the **Control** page, click **Stacker**, and then choose **Unload Plates**. Alternatively, you can click **Unload All** to unload all the stacks.

2. On each side of the rack, slide the black door-release buttons (2) forward, while pushing outward on the thumb tabs (3). The rack doors open.

Figure Opening the front-load rack



3. Place the labware directly through the open rack doors (1) so that the bottom labware rests on the rack stacker grippers (4). Ensure the labware is level in the rack.
4. To close the doors, press the thumb tabs inward until the doors snap shut.

To remove labware from a front-load rack:

1. If the rack is mounted on the BenchCel device, verify that the stack is in the unloaded state.

   To unload the stack, open **Diagnostics**. On the **Control** page, click **Stacker**, and then choose **Unload Plates**. Alternatively, you can click **Unload All** to unload all the stacks.

2 To open the rack doors (1), slide the black Door-release buttons (2) forward on each side of the rack, while pressing outward on the thumb tabs.

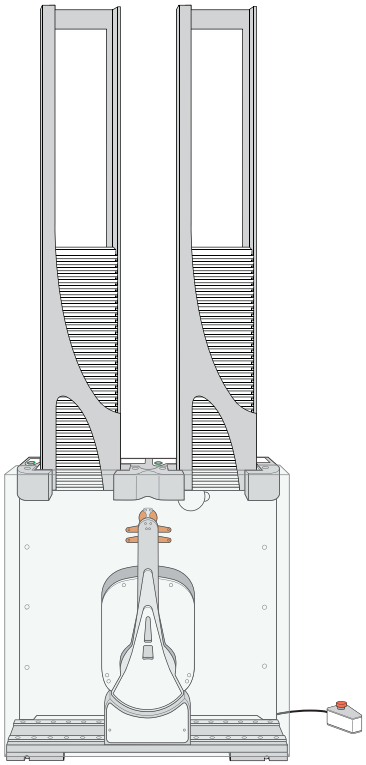
3 Carefully, lift the labware out through the front of the rack.

Installing and uninstalling labware racks

About this topic

This topic explains how to install and uninstall the labware racks on the BenchCel Microplate Handler.

Figure BenchCel Microplate Handler (front) with two labware racks



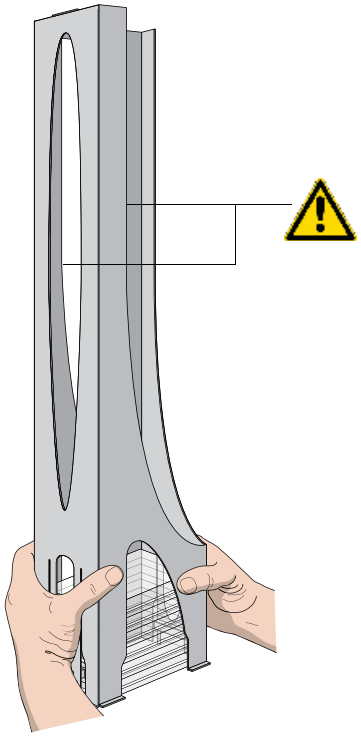
Before you begin

IMPORTANT Make sure the BenchCel Microplate Handler power and compressed air are turned on before you install or uninstall a labware rack.

When lifting the labware rack onto and off of the stacker head, use both hands to grasp the rack securely around the four corners near the base.

WARNING **Avoid touching the interior edges of a rack when lifting the rack. The interior edges can have sharp surfaces.**

Figure Safely lifting a labware rack



Installing labware racks on the BenchCel Microplate Handler

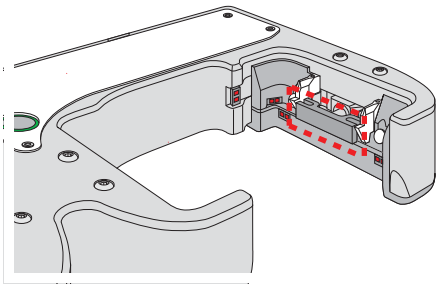
To install a labware rack:

1 At the BenchCel Microplate Handler, verify that the clamps are closed (extended) in the stacker head.

Note: To close the clamps, open **BenchCel Diagnostics**. On the **Controls** page, click **Stacker** at the top of the rack that you want to remove, and then choose **Close Stacker Grippers**.

When you install the rack, the prongs in the labware rack tabs will be inserted into the slots in the clamps. If the clamps are open, the slots will be hidden, and you cannot install the rack.

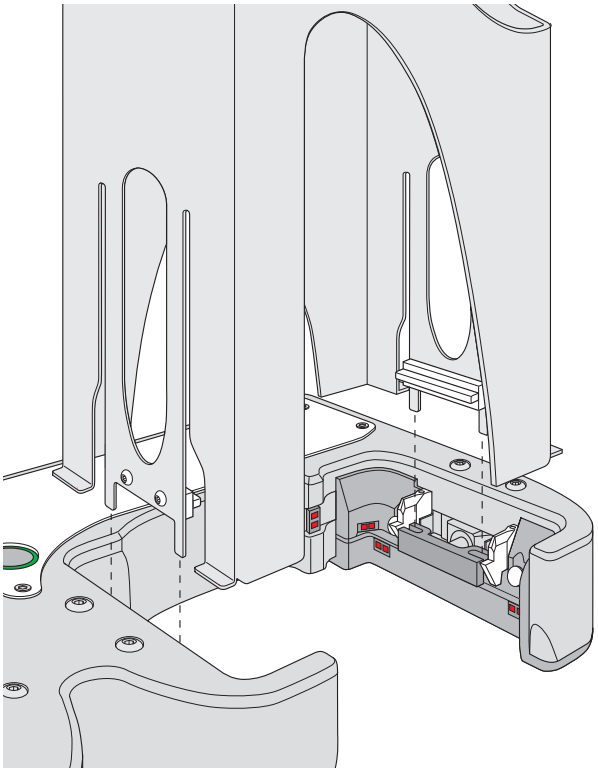
Figure Stacker head with closed (extended) clamps



2 With the rack's open side facing the front, lower the rack onto the stacker head. Make sure the prongs at the bottom of the rack tabs insert into the slots in the extended clamps.

The rack is automatically locked into position.

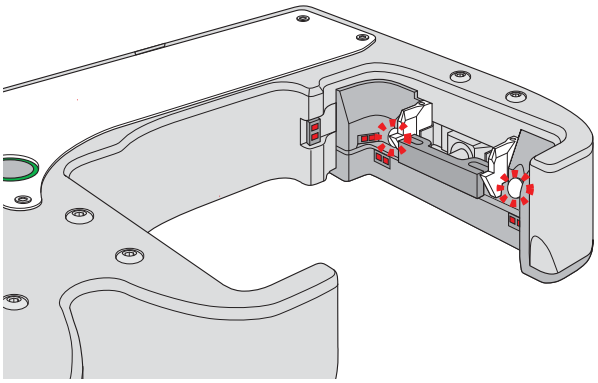
Figure Installing a labware rack on the stacker head (closeup view without labware)



Uninstalling labware racks

Before you can remove a mounted rack, you must first unlock the rack. When you unlock the rack, two pins in the stacker head retract, as the following figure shows.

Figure Stacker head with retracted locking pins



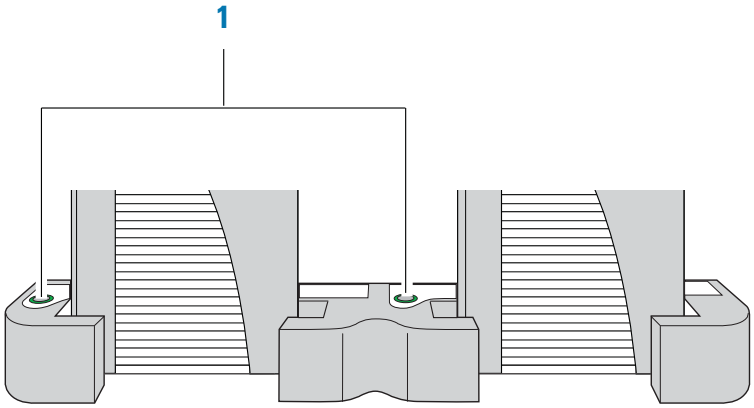
To uninstall a rack from the BenchCel Microplate Handler:

1 At the BenchCel Microplate Handler, verify that the stack is unloaded.

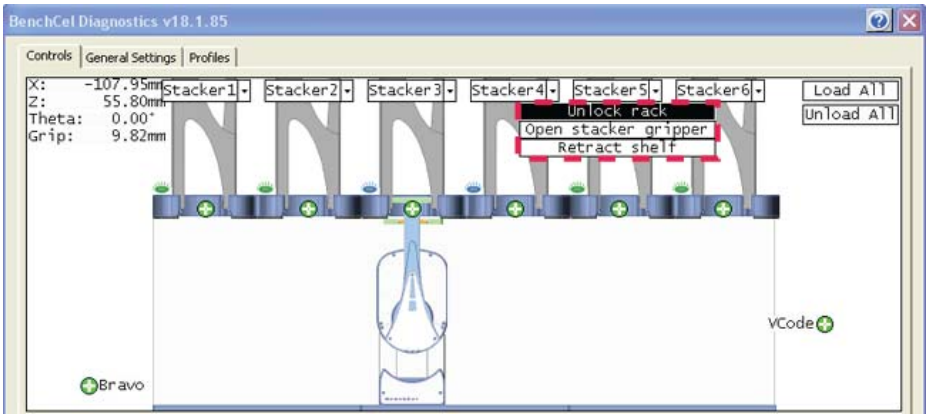
To unload the stack, open **Diagnostics**. On the **Controls** page in the graphical display area, click **Stacker** at the top of the rack that you want to remove, and then choose **Unload Plates**.

2 Unlock the rack by doing one of the following:

- Press the green rack-release button (1) at the top of the stacker head. The green status light flashes for 5 seconds to indicate that the rack is ready for removal. A click sounds as the locks retract. If the green light stops flashing, press the button again.



- In **Diagnostics**, click the **Controls** tab. In the graphical display area, at the top of the rack that you want to unlock, click **Stacker**, and then choose **Unlock rack.** A click sounds as the locks retract.



3 Carefully lift the labware rack from the stacker head.

Using BenchCel Diagnostics

BenchCel Diagnostics has three tabbed pages: Controls, General Settings, and Profiles. You use the commands in the Profiles tab to establish communication with the BenchCel Microplate Handler. You use the commands and parameters in the Controls tab to control or move the device components.

IMPORTANT Some of the BenchCel Diagnostics features are available only if you have VWorks administrator- or technician-level privileges. For details, see your lab administrator.

This topic describes the following:

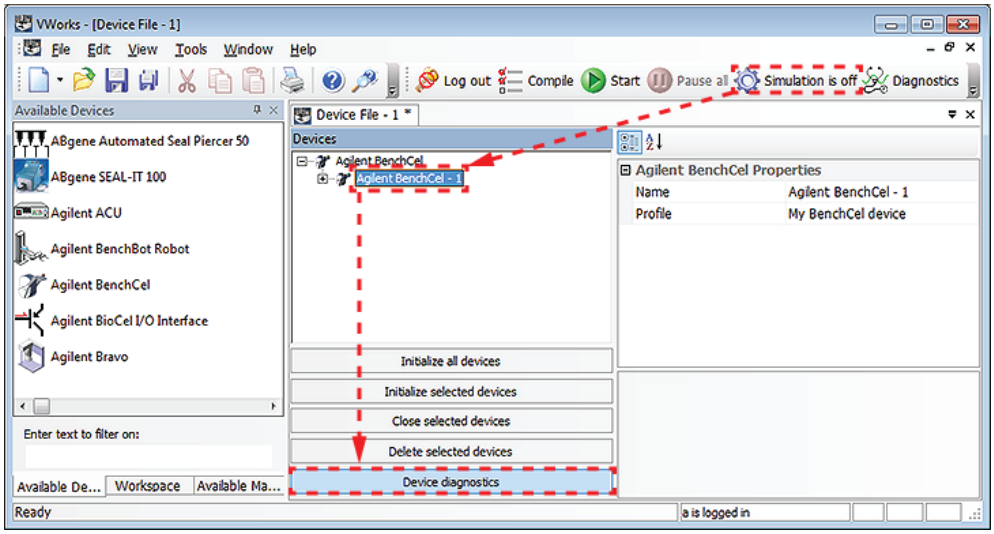
- "Opening BenchCel Diagnostics" on page 18
- "Initializing the BenchCel Microplate Handler in Diagnostics" on page 19
- "Sending the robot to the home position" on page 20
- "Homing the robot" on page 21
- "Disabling and enabling the robot motors" on page 21
- "Jogging the robot" on page 22
- "Changing the robot speed" on page 23
- "Moving plates between teachpoints" on page 23
- "Opening and closing clamps" on page 25
- "Extending and retracting shelves" on page 25

For the description of advanced BenchCel Diagnostics functions, see the *BenchCel Microplate Handler R-Series User Guide*.

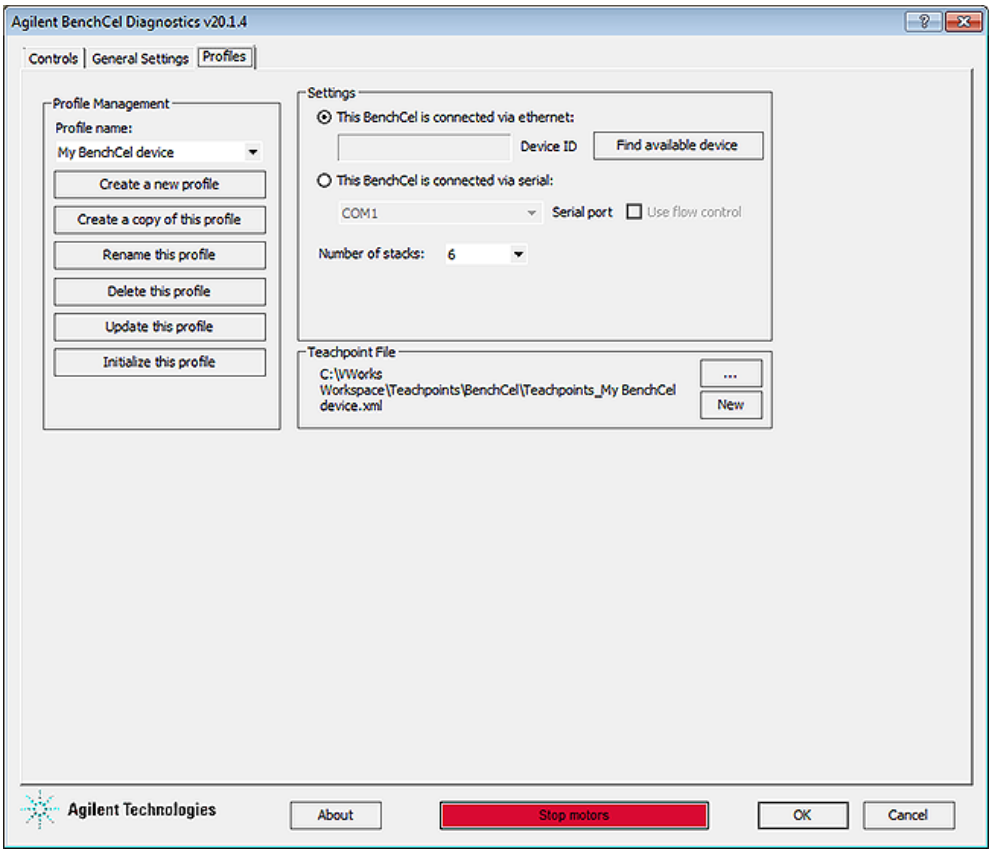
Opening BenchCel Diagnostics

To open BenchCel Diagnostics:

1. In the **VWorks** window, ensure that simulation is off and the correct device file (*.dev) is open.
2. In the **Devices** area, select the BenchCel Microplate Handler device, and then click **Device diagnostics**.



The BenchCel Diagnostics dialog box opens. By default, the Profiles tab is displayed.



Initializing the BenchCel Microplate Handler in Diagnostics

Before you use BenchCel Diagnostics to operate the BenchCel Microplate Handler, you must initialize an appropriate BenchCel profile to:

- Establish communication with the BenchCel Microplate Handler.
- Load the profile information.

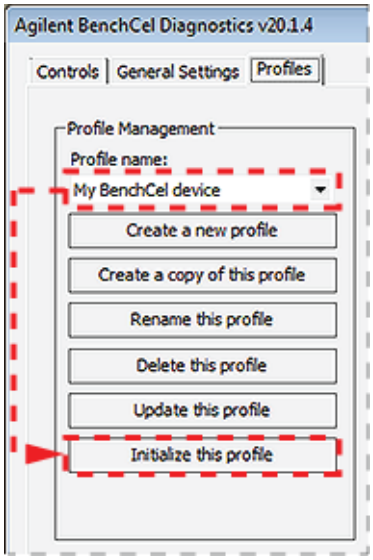
WARNING **When you initialize the BenchCel Microplate Handler, the robot head can move. To prevent potential injury, keep clear of the device while it is in motion.**

CAUTION To prevent potential equipment damage, remove objects in the path of the robot head, arms, and grippers before operating the BenchCel Microplate Handler.

CAUTION Using an incorrect device profile can cause an error or damage the BenchCel Microplate Handler. Ensure that the correct device profile is initialized before operating the BenchCel Microplate Handler.

To initialize a profile in BenchCel Diagnostics:

1. In the **Profiles** tab, select the desired profile in the **Profile name** list.
2. Click **Initialize this profile** to establish communication with the BenchCel Microplate Handler and load the profile information.

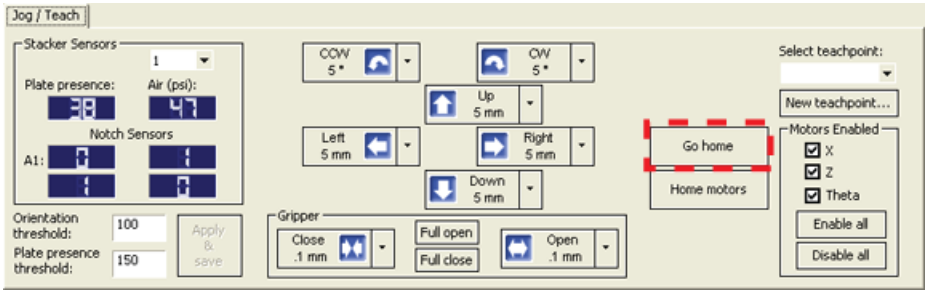


Sending the robot to the home position

The home position is where the robot head is at the center of the BenchCel Microplate Handler and the robot arms are perpendicular to the *x*-axis. You send the robot to the home position if you want the robot out of the way in a safe position.

To send the robot to the home position:

1. On the **Diagnostics Controls** page, click the **Jog/Teach** tab.
2. Click **Go Home.**



Homing the robot

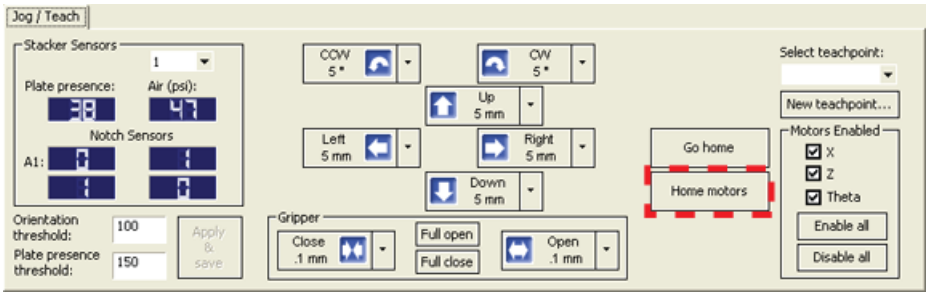
Homing the robot sends the robot to the factory-defined home position for each axis of motion. The homing process recalibrates the robot position along each axis. Home the robot if you notice that the robot is not accurately picking up or placing plates. You might also want to home the robot after recovering from an emergency stop.

Note: If a labware definition is selected when you click Home motors, the robot grippers return to the Gripper open position defined for the selected labware.

To home the robot:

1 On the **Diagnostics Controls** page, click the **Jog/Teach** tab.

2 Click **Home Motors.**



Disabling and enabling the robot motors

Disabling the robot motors allows you to move the robot by hand, making it easier to set and edit teachpoints.

To disable or enable the robot motors:

1 On the **Diagnostics Controls** page, click the **Jog/Teach** tab.

2 In the **Motors Enabled** area, select or click the following:

Option or command	Description
X	Select the option to enable the *x*-axis motor. Clear the check box to disable the *x*-axis motor.
Z	Select the option to enable the *z*-axis motor. Clear the check box to disable the *z*-axis motor.
Theta	Select the option to enable the *theta*-axis motor. Clear the check box to disable the *theta*-axis motor.
Enable All	Click to turn on all the motors.
Disable All	Click to turn off all the motors.

Jogging the robot

Jogging the robot moves the robot and robot grippers in small, precise increments along one of the axes. You can jog the robot to fine-tune its position when creating and editing teachpoints.

To jog the robot:

1. On the **Diagnostics Controls** page, click the **Jog/Teach** tab.
2. Enable the robot motors. See "Disabling and enabling the robot motors" on page 21.
3. In the robot movement area, click to select the jog distance from the corresponding increment list, if applicable.

   CAUTION Use smaller jog increments than you think you need to ensure that the robot does not bump into obstacles in its path (such as the stacker heads and plate stages).

4. Click the directional button:

Command	Description
	Jogs the robot arm counterclockwise from the current position by the specified *theta*-axis increment.
	Jogs the robot arm clockwise from the current position by the specified *theta*-axis increment.
	Jogs the robot head left from the current position by the specified x-axis increment.
	Jogs the robot head right from the current position by the specified x-axis increment.
	Jogs the robot head up from the current position by the specified z-axis increment.
	Jogs the robot head down from the current position by the specified z-axis increment.
	Opens the robot grippers by the specified grip increment.
	Closes the robot grippers by the specified grip increment.
Full Open	Opens the robot grippers to the Robot Gripper Open Position value set in the Labware tab.
Full Close	Closes the robot grippers to the Robot Gripper Holding Stack value set in the Labware tab.

Changing the robot speed

The speed you select in Diagnostics applies only to the robot commands in Diagnostics (Jog, Move, Transfer, and so on). If the robot is holding a microplate, the slower of the following will be applied: the speed you selected in the Labware Editor or the speed you selected in Diagnostics.

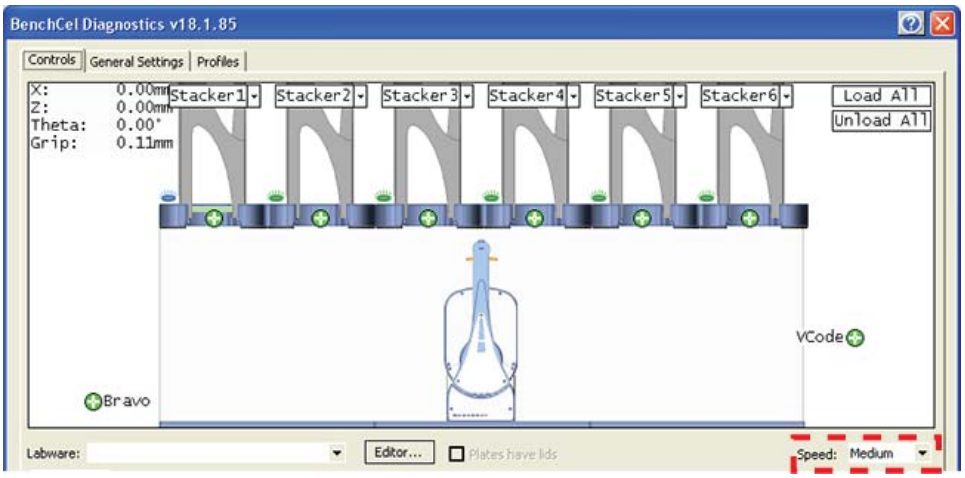
You can select the robot speed to accommodate the task you are performing. For example, you can select the Slow speed when you are creating new teachpoints, creating and testing protocols, or diagnosing problems with the system.

You can adjust the speed setting for the *x*-axis, *z*-axis, and *theta*-axis for each speed (high, medium, or slow) as a percentage of the factory-set maximum speed.

To select the robot speed:

1 In **Diagnostics**, click the **Controls** tab.

2 In the **Speed** list, select **Fast, Medium,** or **Slow**.



Note: During a protocol run, the robot uses the speed selection in the VWorks Tools > Options dialog box. If the robot is holding a microplate, the slower of the following will be applied: the speed in the Labware Editor or the speed in the Tools > Options dialog box. For more information, see the *VWorks Automation Control User Guide*.

Moving plates between teachpoints

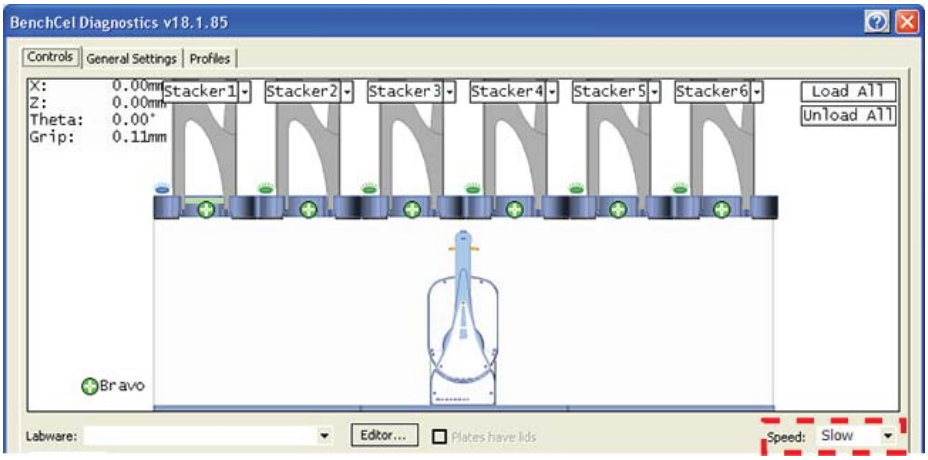
You can move a microplate between teachpoints when you are verifying a teachpoint or to determine whether to home the motors.

CAUTION To prevent collision, remove obstacles in the path of the robot.

To move plates between teachpoints:

1 Manually place a microplate at one of the two teachpoints.

2 In **Diagnostics**, click the **Controls** tab, and then select the **Slow** speed.



3 In the graphical display area, click the plus sign ( ) at either of the following:

- The teachpoint you want to move to
- Two teachpoints between which you want to move a plate

The selected teachpoints should be highlighted in red circles ( ).

4 Rest the pointer on a selected teachpoint. In the command menu that appears, select one of the following:

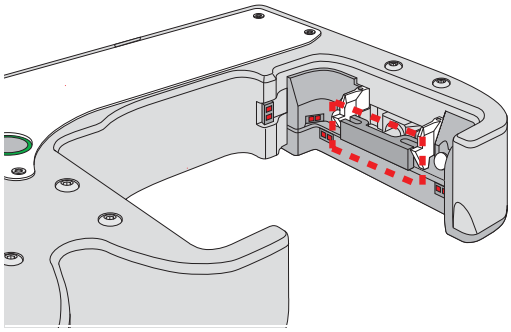
Command	Description
Move to <teachpoint>	Moves the robot from its current position to the selected teachpoint. The robot stays at the teachpoint.
Pick from <teachpoint>	Picks up the microplate from the selected teachpoint and moves the plate to the ready-for-upstack position under the stacker head.
Place at <teachpoint>	Moves the robot from its current position and places the microplate at the selected teachpoint. After placing the microplate, the robot backs away from the teachpoint into the safe zone.
Transfer to <teachpoint>	Moves a microplate from the currently selected teachpoint to the other selected teachpoint. To transfer a microplate from a stack, you must first click **Load Stacker**. During the transfer, the robot downloads the plate, places it at the other selected teachpoint, and then backs into the safe zone. If the robot is transferring a plate from one teachpoint to another, the robot picks up the microplate from the currently selected teachpoint, places the microplate at the other selected teachpoint, and then backs into the safe zone.
Delid from <teachpoint>	*Lidded labware only.* Removes the lid from the labware that is at the selected teachpoint.
Relid to <teachpoint>	*Lidded labware only.* Replaces the lid on the labware that is at the selected teachpoint.

Opening and closing clamps

The clamps in the stacker head close and open the grippers at the bottom of the labware rack to hold and release the first plate in position for the robot grippers. Compressed air is used to move the clamps.

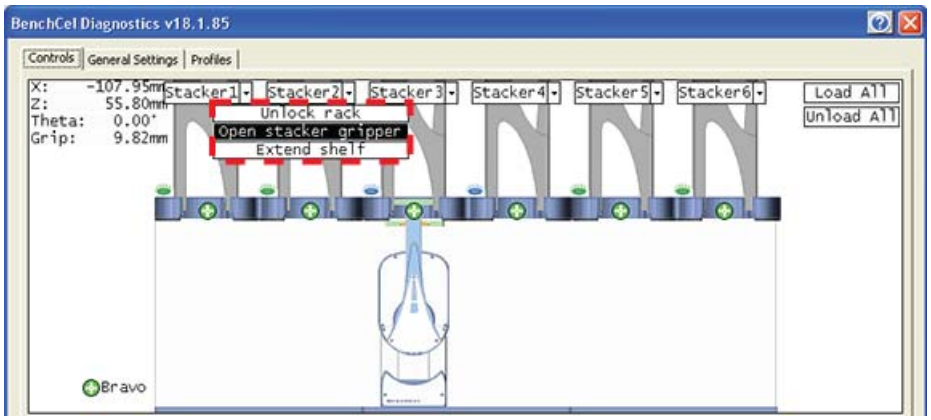
The clamps close and open the stacker grippers automatically during the loading, unloading, downstacking, and stacking procedures. When diagnosing problems or after an aborted run, you can use the commands in Diagnostics to open or close the clamps (stacker grippers). For example, you might want to open the clamps (stacker grippers) to remove a microplate.

CAUTION Opening the clamps (stacker grippers) might cause the microplate or stack of microplates to drop.



To open or close the clamps (stacker grippers):

1. In the **Diagnostics**, click the **Controls** tab.
2. In the graphical display area at the top of the rack, click **Stacker**, and then choose **Open stacker grippers** or **Close stacker grippers.** A click sounds as the clamps (stacker grippers) open or close.

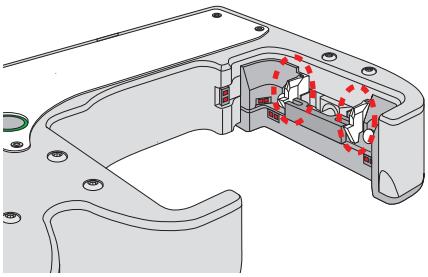


Extending and retracting shelves

The shelves in the stacker head are used to hold the stack of labware temporarily during the downstacking and upstacking processes. Resting the microplates on the shelves levels the microplates, allowing the robot grippers to accurately hold the microplate at the specified offset position. Compressed air is used to move the shelves.

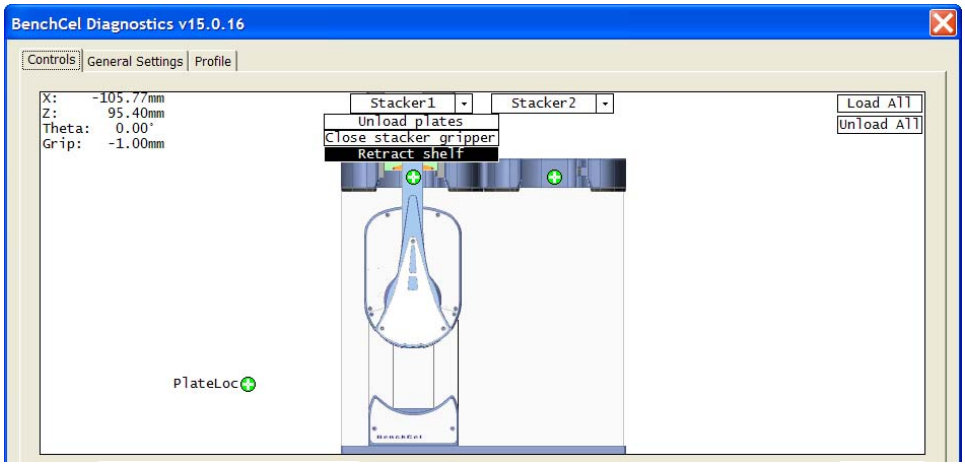
The shelves extend and retract automatically during the downstacking and upstacking processes. When diagnosing problems or after an aborted run, you can use the commands in Diagnostics to extend or retract the shelves.

CAUTION Retracting the shelves might cause the microplate or stack of microplates to drop.



To extend or retract the shelves:

1. In **Diagnostics,** click the **Controls** tab.
2. In the graphical display area at the top of the desired rack, click **Stacker**, and then choose **Extend Shelves** or **Retract Shelves.** A click sounds as the shelves extend or retract.



Cleaning up after use

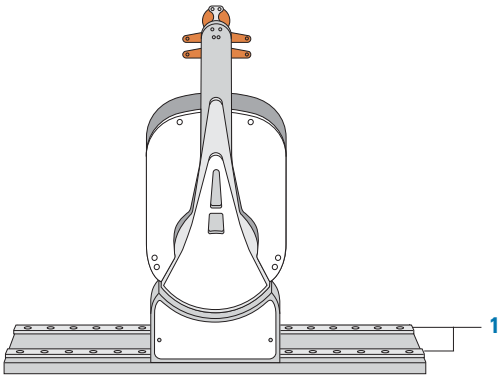
CAUTION Make sure you clean up spilled liquids immediately. Do not use harsh abrasives, corrosive cleaning agents, or metal brushes to clean any BenchCel Microplate Handler component or accessory.

To clean up the BenchCel Microplate Handler after use:

1. If applicable, remove the labware that remains in the robot grippers. You might need to use BenchCel Diagnostics to move the robot head to a convenient position, and then open the robot grippers. For instructions, see "Jogging the robot" on page 22.
2. Unload used labware from the labware racks. See "Filling and emptying the labware racks" on page 5.
3. Uninstall the labware racks from the BenchCel Microplate Handler. See "Installing and uninstalling the labware racks" on page 9.

   IMPORTANT Make sure the power and compressed air are turned on when removing the racks.

4. Make sure the x-axis tracks (1) are free of debris.



5. Use a clean, damp cloth to wipe away spills and dirt on the BenchCel Microplate Handler.

Agilent Technologies

Quick Guide

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