BioCel System

Safety Guide

Original Instructions

Agilent Technologies

Notices

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Safety Notices

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

Contents

Preface

This guide provides safety information for the BioCel System.

This preface contains the following topics:

About this guide

Who should read this guide

This guide is for anyone who operates or services the BioCel 900, 1200, or 1800 System.

What this guide covers

This guide describes the potential safety hazards on the BioCel 900, 1200, and 1800 Systems and how to avoid them.

This guide does not provide instructions for using the BioCel System.

What is new in this guide

Feature and description	See
Emergency stop and interlock — Updated description of system responses and recovery procedure	• "Stopping the system in an emergency" on page 6 • "Recovering from an emergency stop" on page 8 • "Recovering from tripped safety interlock" on page 10
Interlock key settings — Added description of NORMAL and BYPASS settings	"Safety interlock" on page 14
Interlocked doors — Added description of the new interlock key settings	"Interlocked doors" on page 15
Light Curtain — Added description based on the new interlock key settings	"Light Curtain" on page 15
Protective windows on docking tables — Updated description of system responses when window is removed	"Protective windows on docking tables" on page 16
System status indicators — Updated description of the system status indicators	"System status indicators" on page 16
Chemical hazards — Added list of chemicals compatible with the system surfaces	"Chemical and gas hazards" on page 33
BenchBot Robot — Added reference to the robot and associated user documentation	"System robot moving parts and pinch hazards" on page 21

Related guides

Use this guide in conjunction with the following:

- *Automation Control Unit User Guide*. Describes the Automation Control Unit and provides the safety information, specifications and requirements, connection instructions, setup instructions, and troubleshooting information.
- *BioCel System User Guide*. Describes the BioCel System, the operation of the hardware components, and the use of software diagnostics.
- *BioCel Environmental-Control System User Guide*. Describes how to use the BioCel Environmental-Control System.
- *BenchBot Robot user documentation*. Describes the robot, safety information, operating instructions, maintenance procedures, and troubleshooting guidelines.
- *Direct Drive Robot user documentation*. Describes the robot, safety information, operating instructions, maintenance procedures, and troubleshooting guidelines.
- *Lab automation software user documentation*. Explains how to create protocols, and set task parameters for each device in the system.
- *Automation Solutions device user documentation*. Describe safety information, operation of the hardware, and the device diagnostics software.

Information about the 3-Axis Robot and Peak KiNEDx Robot are available in the *BioCel System User Guide*, Revision 01, August 2010.

If you also have third-party devices, see the relevant third-party device guides.

For site preparation and installation requirements, see the site-specific documentation provided by Automation Solutions. The site-specific documents address different system configurations and requirements. If you have questions, contact Automation Solutions Technical Support.

Accessing Automation Solutions user information

About this topic

This topic describes the different formats of Automation Solutions user information and explains how to access the user information.

Where to find user information

The Automation Solutions user information is available in the following locations:

- *Knowledge base*. The help system that contains information about all of the Automation Solutions products is available from the Help menu within the VWorks software.
- *PDF files*. The PDF files of the user guides are installed with the VWorks software and are on the software CD that is supplied with the product. A PDF viewer is required to open a user guide in PDF format. You can download a free PDF viewer from the internet. For information about using PDF documents, see the user documentation for the PDF viewer.
- *Agilent Technologies website*. You can search the online knowledge base or download the latest version of any PDF file from the Agilent Technologies website at www.agilent.com/lifesciences/automation.

Accessing safety information

Safety information for the Automation Solutions devices appears in the corresponding device user guide.

You can also search the knowledge base or the PDF files for safety information.

Using the knowledge base

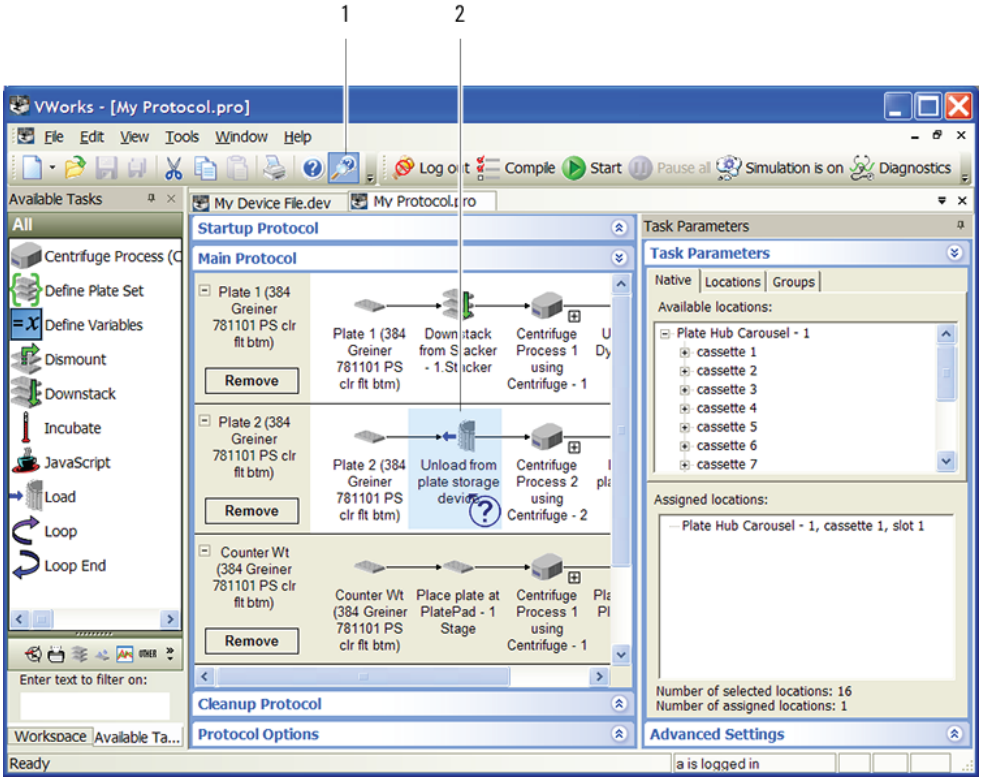
Knowledge base topics are displayed using web browser software such as Microsoft Internet Explorer and Mozilla Firefox.

Note: If you want to use Internet Explorer to display the topics, you might have to allow local files to run active content (scripts and ActiveX controls). To do this, in Internet Explorer, open the Internet Options dialog box. Click the **Advanced** tab, locate the **Security** section, and select **Allow active content to run in files on my computer.**

To open the knowledge base, do one of the following:

- From within VWorks software, select **Help** > **Knowledge Base** or press F1.
- From the Windows desktop, select **Start** > **All Programs** > **Agilent Technologies** > **VWorks** > **User Guides** > **Knowledge Base.**

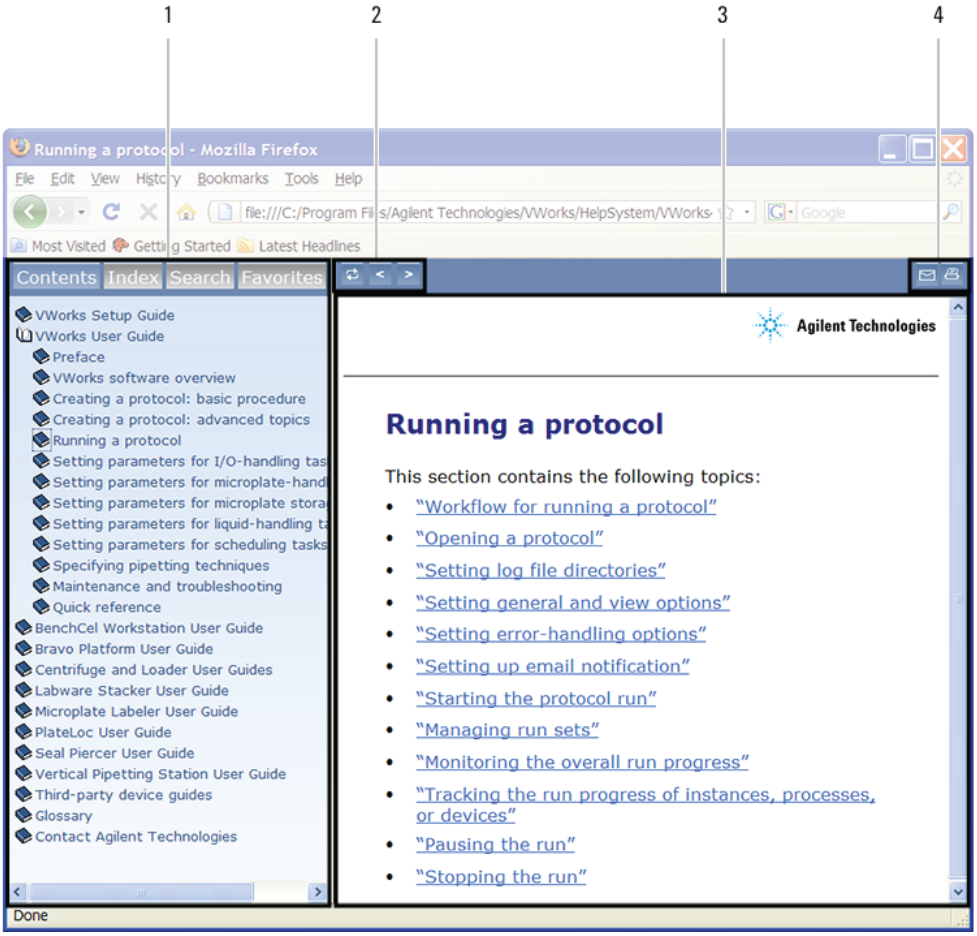
Opening the help topic for an area in the VWorks window



To access the context-sensitive help feature:

1. In the main window of the VWorks software, click the help button  . The pointer changes to  . Notice that the different icons or areas are highlighted as you move the pointer over them.
2. Click an icon or area of interest. The relevant topic or document opens.

Features in the Knowledge Base window



Item	Feature
1	*Navigation area.* Consists of four tabs: • *Contents.* Lists all the books and the table of contents of the books. • *Index.* Displays the index entries of all of the books. • *Search.* Allows you search the Knowledge Base (all products) using keywords. You can narrow the search by product. • *Favorites.* Contains bookmarks you have created.
2	*Navigation buttons.* Enable you to navigate through the next or previous topics listed in the Contents tab.
3	*Content area.* Displays the selected online help topic.
4	*Toolbar buttons.* Enable you to print the topic or send documentation feedback by email.

Reporting problems

Contacting Automation Solutions Technical Support

Note: If you find a problem with the BioCel System, contact Automation Solutions Technical Support. For contact information, see Notices on the back of the title page.

Note: You can also send a software bug report from within the VWorks software.

Reporting hardware problems

When contacting Agilent Technologies, make sure you have the serial number of the device ready.

Reporting software problems

When you contact Automation Solutions Technical Support, make sure you provide the following:

- Short description of the problem
- Software version number
- Error message text (or screen capture of the error message dialog box)
- Screen capture of the About VWorks software dialog box
- Relevant software files

To find the VWorks software version number:

In the VWorks software, select **Help > About VWorks.**

To find the Diagnostics software version number:

1 Open **Diagnostics.**

2 Read the version number on the title bar of the diagnostics window.

To send compressed protocol and associated files in VZP format:

In the VWorks software, select **File > Export** to export and compress the following files:

- Protocol file
- Device file (includes the device profile and teachpoint file)
- Labware definitions
- Liquid classes
- Pipette techniques
- Hit-picking files
- Plate map files
- Barcode files
- Error library
- Log files
- Form file (*.VWForm)

Reporting user guide problems

If you find a problem with this user guide or have suggestions for improvement, send your comments using one of the following methods:

- Click the feedback button () in the online help.
- Send an email to documentation.automation@agilent.com.

1 General safety information

This chapter describes the general safety information for the BioCel System (900, 1200, and 1800 models):

Before operating the BioCel System

The BioCel System is a laboratory automation platform that stores and moves labware for processing. The system is controlled using lab automation software such as the VWorks Automation Control software.

Before using the BioCel System, you must be aware of the potential hazards and understand how to avoid being exposed to them. In addition, make sure you are properly trained in:

- General laboratory safety
- The correct and safe operation of the BioCel System
- The correct and safe operation of other lab automation systems or components used in combination with the BioCel System

Intended product use

WARNING **Do not remove the BioCel System exterior covers or otherwise disassemble the system or integrated devices. Doing so can expose you to hazards that could cause serious injury and damage the BioCel System.**

WARNING **Using controls, making adjustments, or performing procedures other than those specified in the user guide can expose you to moving parts, hazardous voltage, high-pressure gases, and laser radiation. Exposure to these hazards can cause severe injury.**

Agilent Technologies products must only be used in the manner described in the Agilent Technologies product user guides. Any other use may result in damage to the product or personal injury. Agilent Technologies is not responsible for any damages caused, in whole or in part, by improper use of the products, unauthorized alterations, adjustments or modifications to the products, failure to comply with procedures in Agilent Technologies product user guides, or use of the products in violation of applicable laws, rules or regulations. Except as otherwise expressly provided in Agilent Technologies product user guides, any alteration, adjustment or modification to the products will void the product warranty and may invalidate the safety compliance certification.

The BioCel System is not intended or approved for diagnosis of disease in humans or animals. You assume full responsibility for obtaining any regulatory approvals required for such use and assume all liability in connection therewith.

Safety labels

Warnings in the user documentation or on the device must be observed during all phases of operation, service, and repair of this device. Failure to comply with these precautions violates safety standards of design and the intended use of the product. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

The following table lists the common symbols you might find on the system or device. The symbol on the label indicates the risk of danger. A description of the warning and information that will help you avoid the safety hazard are provided in this guide.

Symbol	Description
	Indicates that you must read the accompanying instructions (for example, the safety guide) for more information before proceeding.
	Indicates hazardous voltages.
  	Indicates pinch, crush, or cut hazard.
	Indicates laser hazard.
	Indicates hot surface hazard.
	Indicates protective conductor terminal, which is bonded to conductive parts of an equipment for protection against electric shock in case of a fault and is intended to be connected to an external protective earthing system.
	Indicates frame or chassis terminal, which is bonded to conductive parts of an equipment for safety purposes.
	Indicates that you must not discard this electrical/ electronic product in domestic household waste.

Safety and regulatory compliance

The BioCel System complies with the applicable EU Directives and bears the CE mark. See the Declaration of Conformity for details. The BioCel System is designed to comply with the regulations and standards listed in the following table.

Regulatory Compliance	Standard
EMC	
European Union	EMC Directive 2004/108/EC
	IEC 61326-1:2005 / EN 61326-1:2006
Canada	ICES/NMB-001:2004
Australia/New Zealand	AS/NZS CISPR 11:2004
Safety	
European Union	Machinery Directive 2006/42/EC
	Low Voltage Directive 2006/95/EC
	IEC 61010-1:2001 / EN61010-1:2001
Canada	CAN/CSA-C22.2 No. 61010-1-04
USA	ANSI/UL 61010-1:2004

Electromagnetic compatibility

If the BioCel System causes interference with radio or television reception, which can be determined by turning the device off and on, try one or more of the following measures:

- Relocate the radio or television antenna.
- Move the device away from the radio or television.
- Plug the device into a different electrical outlet, so that the device and the radio or television are on separate electrical circuits.
- Make sure that all peripheral devices are also certified.
- Make sure that appropriate cables are used to connect the device to peripheral equipment.
- Consult your equipment dealer, Agilent Technologies, or an experienced technician for assistance.

Changes or modifications not expressly approved by Agilent Technologies could void the user's authority to operate the equipment.

Sound emission declaration

Sound pressure: Lp < 70 dB according to EN 27779:1991.

Schalldruckpegel: Lp < 70 dB nach EN 27779:1991.

2
Emergency stop

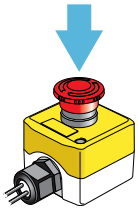
This chapter explains how to stop the BioCel System in an emergency and how to recover the system after an emergency stop. This chapter contains the following topics:

Stopping the system in an emergency

Procedure

In an emergency, press the red button on the emergency-stop pendant. The BioCel System robot and integrated devices stop immediately.

Figure Pressing the red button on the emergency-stop pendant



CAUTION Do not use the emergency stop to pause a protocol. Using the emergency stop might affect the integrity of the interrupted protocol. Instead, use the pause button in the lab automation software to perform routine stops. For instructions, see the lab automation software user documentation.

Note: The emergency stop mechanism is not affected by the INTERLOCK key setting. Pressing the red button on the emergency-stop pendant will stop robots and devices in the system even if the INTERLOCK key is set at BYPASS.

For a description of the interlock key settings, see "Safety features" on page 13 and the *Automation Control Unit User Guide*.

System response

The emergency stop does the following:

- Stops all robots and devices in the system.
- Stops the air supply to the devices.
- Turns on the following light pattern in the multicolor status light: flashing red light only.
- Turns on the red E_STOP light on the Automation Control Unit and generates robot and device errors.
- Turns on the blue blinking RESET light on the Automation Control Unit.

For recovery instructions, see "Recovering from an emergency stop" on page 8.

Tripping the safety interlock

About this topic

This topic explains the following:

- How the safety interlock is tripped
- System response—INTERLOCK key is set at NORMAL
- System response—INTERLOCK key is set at BYPASS

How the safety interlock is tripped

The safety interlock is tripped when you:

- Open a system door
- Interrupt the Light Curtain

IMPORTANT To prevent inert gases from displacing air and causing suffocation, the system doors of an inert environment hood remain locked until all of the gas is safely purged. For details, see "Chemical and gas hazards" on page 33.

CAUTION Do not open a system door or interrupt a Light Curtain to perform a routine stop. The door or Light Curtain interlock is designed to be a safety backup system. Using the interlock to stop the system might affect the integrity of the interrupted protocol. Instead, use the pause button in the lab automation software to perform routine stops. For instructions, see the lab automation software user documentation.

System response—INTERLOCK key is set at NORMAL

WARNING **After you open a system door or interrupt the Light Curtain, some integrated devices might continue to move until they have finished the current task. Wait until all devices are paused before entering the system.**

If the INTERLOCK key is set at NORMAL, tripping the safety interlock does the following:

- Stops all robots and integrated devices that have an emergency-stop circuit.
- Allows remaining integrated devices to finish the current task, and then pauses the devices.
- Turns on the audible alarm (if it is configured to turn on).
- Turns on the following light pattern in the multicolor status light: flashing red light only.
- Turns on the red DOORS light or the red LIGHT CURTAIN light on the Automation Control Unit.
- Turns on the blue blinking RESET light on the Automation Control Unit.
- Displays the Scheduler Paused dialog box in the lab automation software.

Note: The air supply is not affected by the tripped interlock.

For a description of the NORMAL interlock key setting, see "Safety features" on page 13 and the *Automation Control Unit User Guide*. For recovery instructions, see "Recovering from tripped safety interlock" on page 10.

System response—INTERLOCK key is set at BYPASS

WARNING **Access to and use of the interlock key should be controlled. To avoid possible injury, the Interlock Bypass setting should be used only by personnel trained to teach robots and devices in the system or workstation. The interlock key should be removed from the BioCel System when the switch is set at Normal and you are not teaching the robots and devices.**

If the INTERLOCK key is set at BYPASS, the Agilent robots and devices that have an emergency-stop circuit move at a significantly slower speed. Tripping the safety interlock has no effect on the system. All robots and devices continue to move and operate at the reduced speed.

The multicolor status light displays a flashing yellow light. In addition, the blue light on the RESET button remains solid.

For a description of the BYPASS interlock key setting, see "Safety features" on page 13 and *Automation Control Unit User Guide*.

Recovering from an emergency stop

About this topic

After pressing the red button on the emergency-stop pendant, you must restore the system for normal operation.

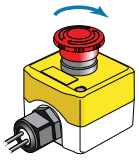
IMPORTANT You cannot resume or recover a protocol run after pressing the red button on the emergency-stop pendant. You will need to rerun the protocol after restoring the system for normal operation.

Procedure

Before you restore the system, make sure you remove labware at teachpoints or other locations.

To restore the BioCel System after an emergency stop:

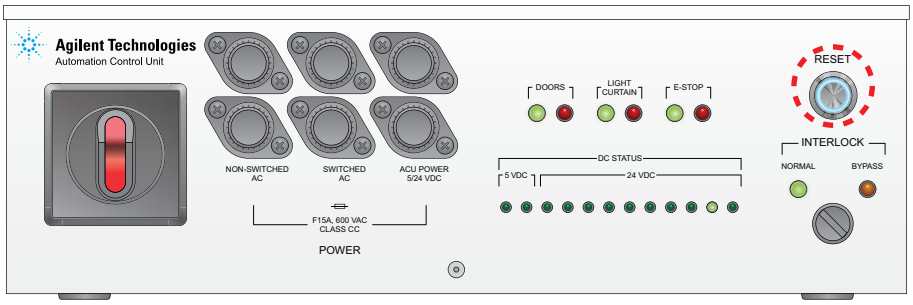
1 At the emergency-stop pendant, turn the red button clockwise. The spring-loaded button pops up.



2 If the BioCel System has the Light Curtain, remove any obstacle that is interrupting the Light Curtain.

3 If the BioCel System has system doors, close the doors.

4 At the Automation Control Unit, press the **RESET** button. The blue light stops blinking and becomes solid.



5 In each of the device dialog boxes opened in the software, select one of the following commands to restore the device for normal operation. For example, you might need to use the device diagnostics software to release labware, replace the lid on a labware, home the robot, or verify the device teachpoint.

Selection	Description
Diagnostics	Opens the device diagnostics dialog box. *Note:* This selection is available only when you are in the middle of a protocol run and not while you are already in the device diagnostics software.
Retry	Attempts to restart the current command or task in the run.
Ignore and continue	Ignores the current command or task and continues to the next command or task in the protocol sequence.
Abort	Aborts the current command or task in the run. Select Abort if you have determined that the protocol run is not recoverable.

6 If there is labware in the robot gripper, use diagnostic commands to move it back to the pickup location. To do this:

a Determine the location from which the labware was picked up.

b In the **Robot Error** dialog box, click **Diagnostics.**

c Use commands to place the labware at the pickup location.

7 Click **Abort Process** in the **Stop** dialog box.

8 Exit and restart the lab automation software. Re-establish communication with the devices by initializing the devices.

Recovering from tripped safety interlock

If you opened a system door or interrupted the Light Curtain during a protocol run, the Scheduler Paused dialog box opens in the lab automation software.

To resume the run or recover the system after opening the system door or interrupting the Light Curtain:

1 In the lab automation software, click one of the following in the **Scheduler Paused** dialog box:

Selection	Description
Bypass interlock	Bypasses the interlock so that you can enter the system. For detailed instructions, see the lab automation software user guide, such as the *VWorks Automation Control User Guide*. Bypass interlock is only available if your system is installed with an Automation Control Unit and the protocol is not running in simulation mode. *Note:* If you click Bypass interlock, you will not be able to open any diagnostics dialog box. When you are finished, close the system door or remove obstacles from the Light Curtain and select one of the other commands in the Schedule Paused dialog box.
Continue	Ignores the current command or task and continues to the next command or task in the protocol sequence.
Diagnostics	Allows you to select the device and opens the device diagnostics dialog box. *Note:* This selection is available only when you are in the middle of a protocol run and not while you are already in the device diagnostics software.
Abort process	Aborts the current command or task in the run. Select Abort if you have determined that the protocol run is not recoverable.

Note: If you have a Centrifuge Loader, click **Diagnostics** to open Centrifuge Loader Diagnostics, and then re-initialize the device to re-establish communication with it.

2 In the **Robot Error** dialog box, click one of the following:

Selection	Description
Diagnostics	Opens the device diagnostics dialog box. *Note:* This selection is available only when you are in the middle of a protocol run and not while you are already in the device diagnostics software.
Retry	Attempts to restart the current command or task in the run.
Ignore and continue	Ignores the current command or task and continues to the next command or task in the protocol sequence.
Abort	Aborts the current command or task in the run. Select Abort if you have determined that the protocol run is not recoverable.

3 If a Vertical Pipetting Station was in motion when the system door was opened or the Light Curtain was interrupted, select a command in the Vertical Pipetting Station Error dialog box. For instructions, see the *Vertical Pipetting Station User Guide*.

3 Safety features

This chapter describes the safety features in the BioCel System:

WARNING **Do not disable or change the BioCel System safety features. Doing so might invalidate the safety compliance and lead to personal injury or equipment damage. In Europe, any changes might invalidate Agilent's Declaration of Conformity and require the person making the changes to assume responsibility as manufacturer of the system or workstation according to the Machinery Directive.**

It is the responsibility of every operator to use the built-in BioCel System safety features and follow warnings and safety labels. If you have questions about the safety features, contact Automation Solutions Technical Support.

Safety interlock

The BioCel System is equipped with safety interlock features that are designed to protect you from moving-part hazards while the system is in operation. The safety interlock circuit must be closed for the system to operate.

Two interlock key settings are available:

- *NORMAL*. The interlock is armed. Opening a system door or interrupting the Light Curtain opens the interlock circuit, thus stopping the robots and devices that are on the circuit. Devices that are not on the circuit will finish the current task before pausing. Under normal operating conditions, the INTERLOCK key should be set at NORMAL.
- *BYPASS*. The interlock is muted (or bypassed). Agilent robots and devices that have an emergency-stop circuit will move at a significantly reduced speed. Opening a system door or interrupting the Light Curtain does not open the safety interlock circuit, so the robots and devices will continue to move. Use the BYPASS key setting if you need to work inside of the system or workstation while teaching robots and devices.

WARNING **Access to and use of the interlock key should be controlled. To avoid possible injury, the Interlock Bypass setting should be used only by personnel trained to teach robots and devices in the system. The interlock key should be removed from the BioCel System when the switch is set at Normal and you are not teaching the robots and devices.**

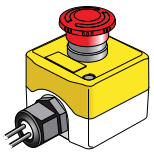
For a detailed description of the two interlock modes, see the *Automation Control Unit User Guide*.

Note: The INTERLOCK key setting does not affect the emergency stop mechanism. Pressing the red button on the emergency-stop pendant will stop robots and devices in the system even if the INTERLOCK key is set at BYPASS.

Emergency-stop pendants

The emergency-stop pendants are single-button devices that enable the operator to stop the system quickly during an emergency. The pendants are part of the safety interlock circuit that must be closed for the system to operate. Pressing the red button on one of the pendants opens the safety interlock circuit and stops the robot and devices.

For more information about stopping the system during an emergency, see "Stopping the system in an emergency" on page 6.

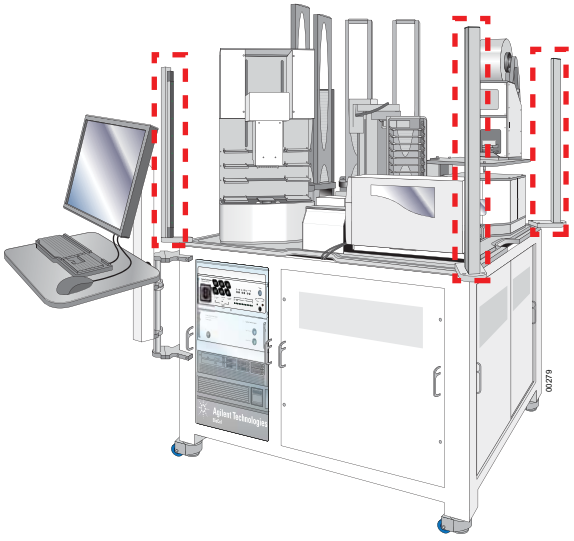


Interlocked doors

Polycarbonate or glass doors surrounding the BioCel 1800 System and BioCel 1200 System prevent the operator from entering the workspace. An interlock sensor is installed at each system door to detect whether the door is open or closed. Under normal operating conditions, opening a system door stops the motion of the robot and devices that are connected to the emergency-stop circuit. Devices that are not connected to the emergency-stop circuit will finish the current task before pausing.

Light Curtain

As part of the safety interlock circuit, the Light Curtain works in a similar manner to the interlocked doors. Lightposts project and reflect light beams around the BioCel 900 System. Under normal operating conditions, interrupting the Light Curtain stops the motion of the robot and devices that are connected to the emergency-stop circuit. Devices that are not connected to the emergency-stop circuit will finish the current task before pausing.



Protective windows on docking tables

Docking tables permit you to add or remove devices in the BioCel System to accommodate different applications. Some docking tables have protective windows that are connected to the safety interlock circuit and function like the BioCel System doors. Under normal operating conditions, opening a protective window during the run stops the motion of the robot and devices that are connected to the emergency-stop circuit. Devices that are not connected to the emergency-stop circuit will finish the current task before pausing.

WARNING **BioCel System administrators. If you bypass the safety interlock system and enter the system, you can be hit or pinched by the robot or devices. Be sure to wear protective eyewear when entering the system.**

Instead of connecting to the safety interlock circuit, some protective windows have tooled locks (require the use of a hex wrench) to prevent operators from entering the system while the system is in motion. The protective window should be locked during system operation.

WARNING **BioCel System administrators. Only fully trained BioCel System administrators should be permitted to unlock and open the protective windows. Unlock or open the windows only after you have set the interlock key switch to Bypass. Be sure to wear protective eyewear when entering the system. Exit the BioCel System and close the windows before setting the interlock key switch to Normal. Keep out of the BioCel System while the interlock is set at Normal.**

WARNING **Although docking tables permit flexible system configurations, non-authorized configuration modifications can result in exposure to new safety hazards and may invalidate safety compliance certification. Contact Automation Solutions for assistance with system modifications and safety consultation.**

System status indicators

Status lights and audible alarms enable you to monitor the current status of the system from a distance.

Multicolor status lights are optional in all BioCel System models. An audible alarm device is supplied with all BioCel System models.

For information about the system status lights and audible alarm device, see the *BioCel System User Guide*.

4 Potential hazards

This chapter contains the following topics:

Overview of potential hazards

The following table lists potential injury hazards for the Automation Solutions devices and accessories that can be part of a BioCel System. For information on how to avoid a hazard, see the corresponding topic in the following sections. General chemical hazards are discussed briefly in "Chemical and gas hazards" on page 33.

Device or accessory	Mechanical: moving parts	Mechanical: sharp edges	Electrical: hazardous voltage	Radiation: lasers	Gas: high-pressure	Gas: oxygen-displacing	Heat hazards
Barcode Reader				X			
Inert Environment Hood	X		X			X	
Liquid handler: Bravo Platform	X		X	X*			
Liquid handler: Vertical Pipetting Station	X		X	X*	X		
Plate Hub Carousel	X	X					
PlateLoc Sealer	X		X		X	X	X
Seal Piercer	X	X	X		X		
Pump Module	X		X				
Robot, system	X		X	X**			
G5404B Microplate Labeler	X		X	X*	X		X
Microplate Centrifuge	X		X				
Microplate Centrifuge with Loader	X		X				
Labware Stacker	X		X				
Labware Racks		X					

* With optional barcode reader only.
** 3-Axis Robot and Staubli Robot with the optional barcode reader only.

Mechanical hazards

The BioCel System contains various devices with moving parts and pinch hazards. Certain parts have sharp edges. This topic describes the potential hazards and how to avoid them:

- System flip-up door injury hazards
- System robot moving parts and pinch hazards
- Plate Hub Carousel moving parts and pinch hazards
- PlateLoc Sealer moving parts, pinch, crush, or cut hazards
- Pump Module moving parts and pinch hazards
- Seal Piercer moving parts, pinch, and pierce hazards
- Microplate Labeler moving parts and pinch hazard
- Vertical Pipetting Station moving parts and pinch hazards
- Centrifuge and Centrifuge Loader moving parts and pinch hazards
- Stacker and Labware Racks hazards

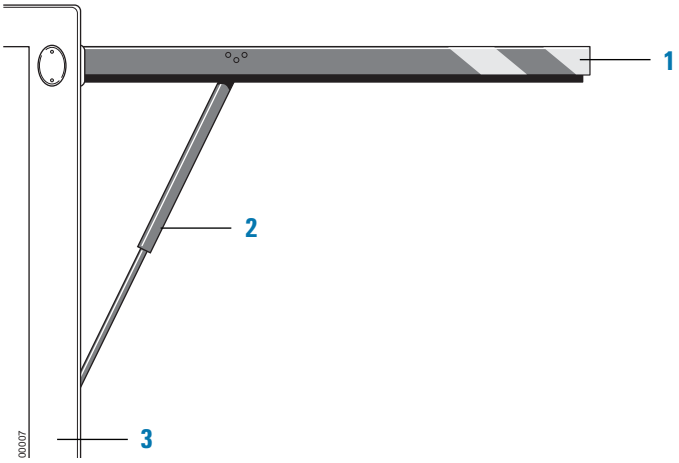
WARNING **Keep your fingers, hair, clothing, and jewelry away from the BioCel System while the system is in motion. The BioCel System has moving parts that can injure you if you deviate from the procedures given in the user guides.**

System flip-up door injury hazards

If you have a BioCel System that has flip-up doors, be aware of the following hazards.

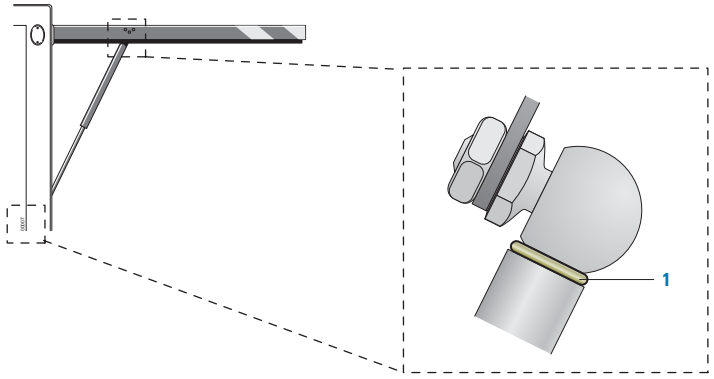
Two gas struts are used to raise and lower each flip-up door. The struts (2) are attached to the flip-up door (1) and the frame (3).

Figure Gas strut attached to the flip-up door and frame



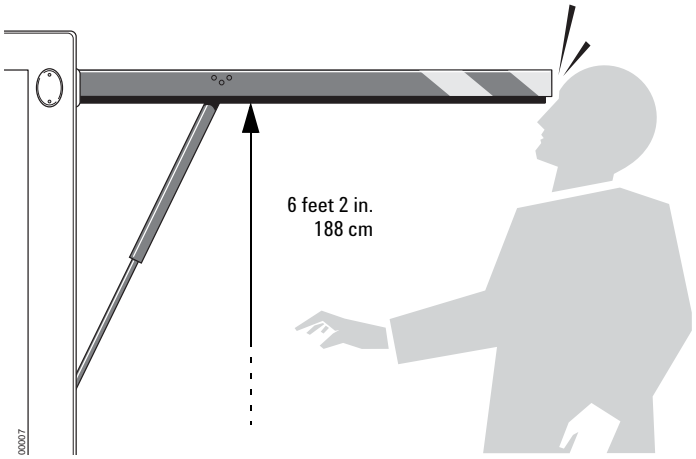
Retention clips prevent the struts from becoming detached from the door and frame. A retention clip (1) is installed at each end of the strut.

Figure Retention clip at the upper and lower end of the gas strut



WARNING **Before operating the system, make sure retention clips are present at the upper and lower ends of each gas strut. Missing clips can cause the struts to detach from either the door or frame, causing the door to fall when opened. If one or more clips are missing, contact Automation Solutions Technical Support immediately. Do not operate the system until the clips are installed.**

WARNING **Opened overhead doors are approximately 188 cm (6 ft 2 in) above the floor. To avoid injury, be aware of the door height and position at all times when working around the BioCel System.**



System robot moving parts and pinch hazards

WARNING **BioCel System administrators. If you override the safety interlock system, you can be hit or pinched by the robot arm while it is moving. Be sure to wear protective eyewear when entering the system. Keep out of the BioCel System while the system is in motion. Serious injury may be possible under some circumstances.**

The BioCel System uses one of the following robots:

- BenchBot Robot
- Direct Drive Robot
- 3-Axis Robot
- KiNEDx Robot
- Staubli Robot

If the BioCel System uses a BenchBot Robot, see the *BenchBot Robot Safety and Installation Guide* for safety information.

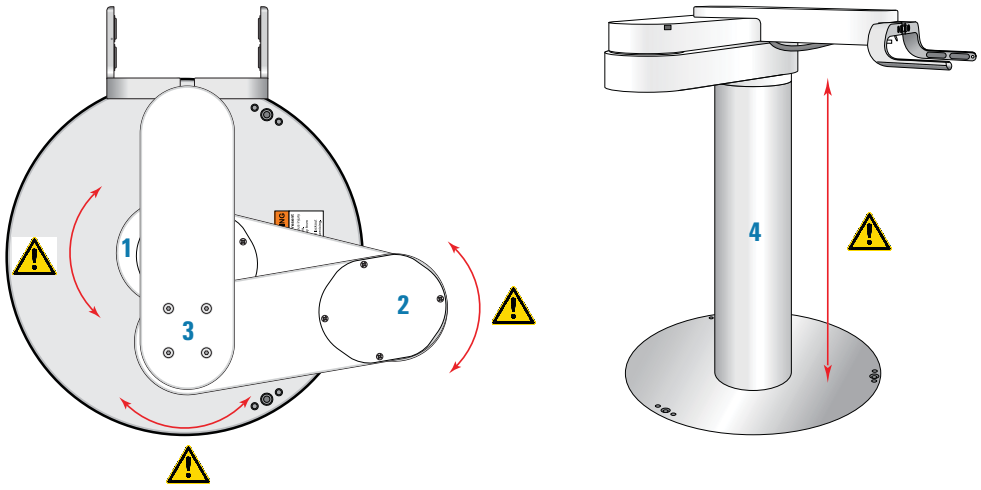
If the BioCel System uses a Direct Drive Robot, see the *Direct Drive Robot Safety Guide* for safety information.

If the BioCel System uses a Staubli Robot, see the Staubli Robot user documentation for safety information.

3-Axis Robot

The 3-Axis Robot can move about its three joints and along its vertical axis, as the following figure shows.

Figure 3-Axis Robot joints (top view) and vertical axis (side view)

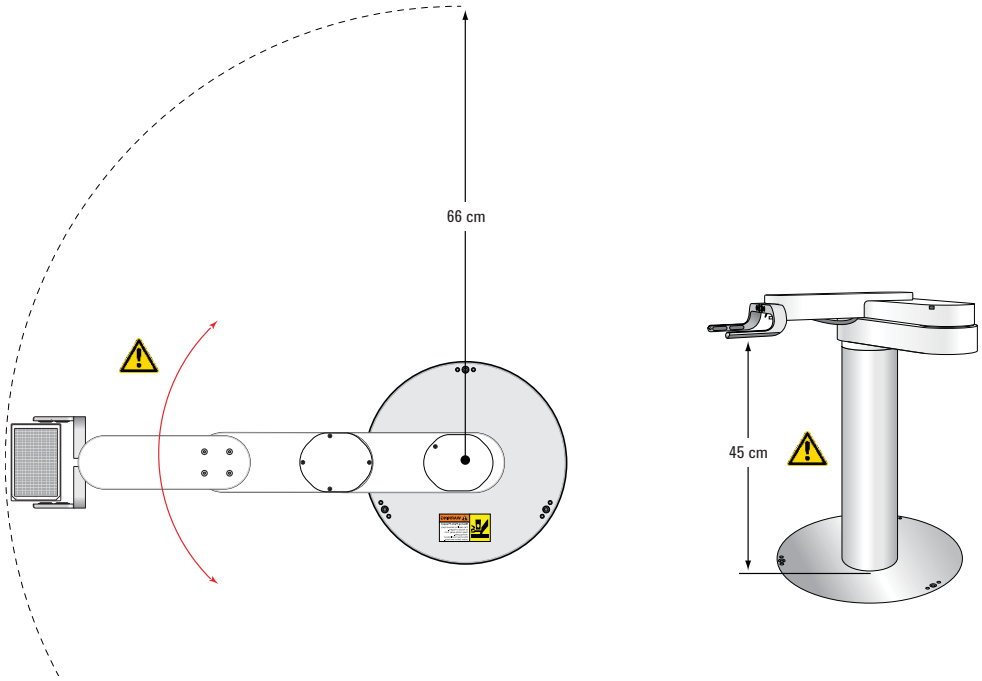


Item	Joint or axis	Description of robot movement
1	Waist	Robot arm rotates 360° about the waist.
2	Lower elbow	Robot lower and middle forearms rotate about the lower elbow.
3	Upper elbow	Robot middle and upper forearms rotate about the upper elbow.
4	Mast	Robot arm moves up and down along the mast.

The following figure shows the robot's maximum radial and vertical reach. The radial reach includes a typical microplate held in landscape orientation.

WARNING **BioCel System administrators. Do not try to predict the robot's movements and reach into the robot's travel space while it is in operation.**

Figure 3-Axis Robot radial (top view) and vertical reach (side view)

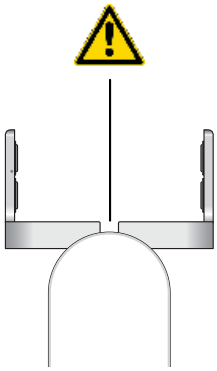


The tapered robot grippers are designed to prevent puncture or other injuries. However, you can be injured if you obstruct the robot while it is in motion.

WARNING **BioCel System administrators. Keep clear of the robot and its grippers while it is in motion.**

WARNING **BioCel System administrators. Do not insert your fingers in the spacing at the back of the robot grippers while the robot motors are on. The grippers can pinch or injure your fingers when it closes.**

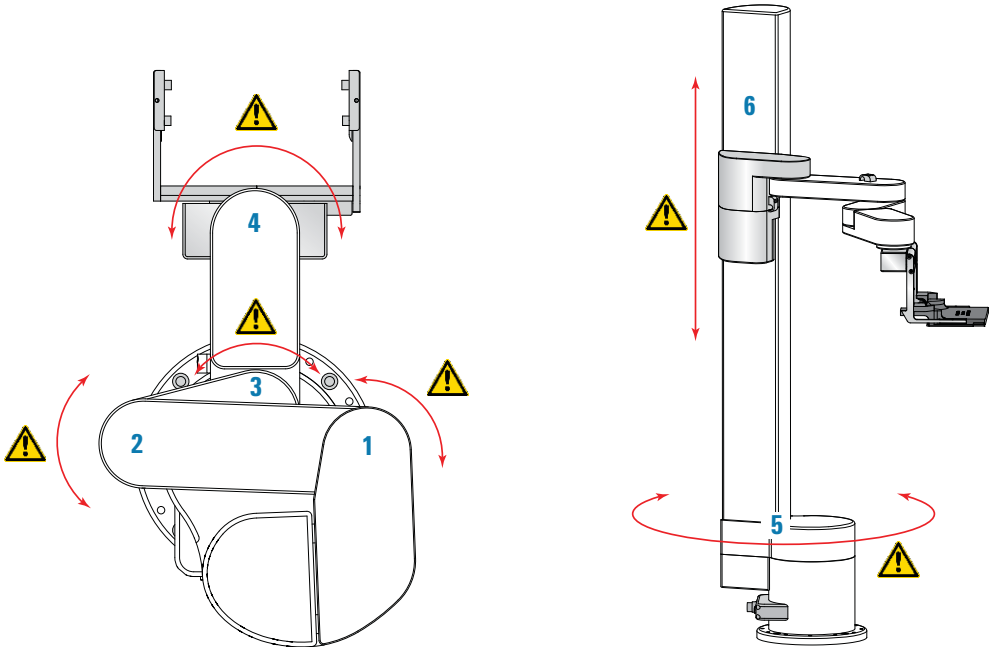
Figure Spacing at the back of the 3-Axis Robot grippers (top view)



KiNEDx Robot

The KiNEDx Robot has six axes of motion, as the following figure shows.

Figure KiNEDx Robot axes of motion (top view and side view)

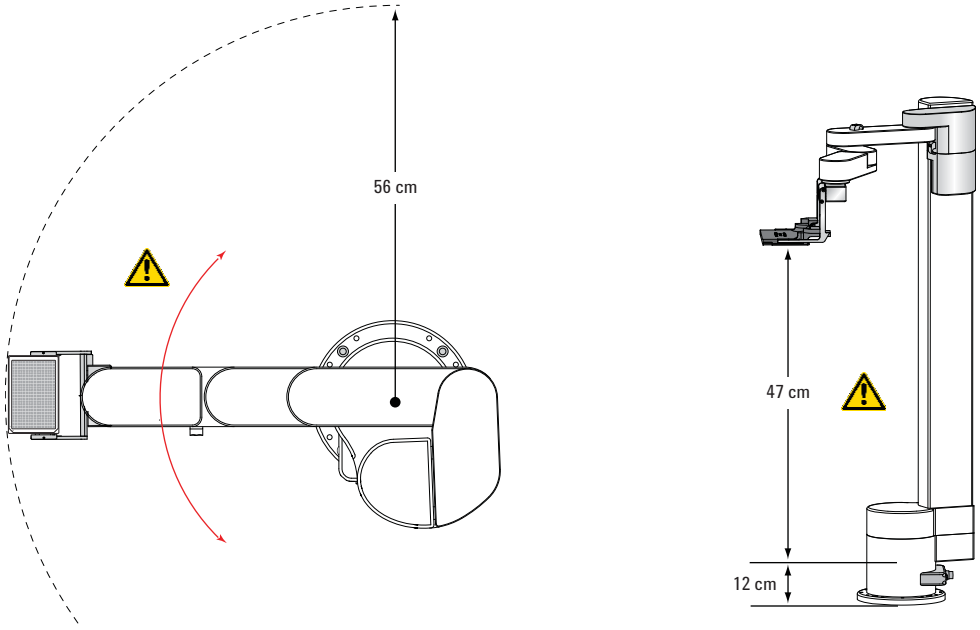


Item	Axis	Description of robot movement
1	Shoulder	Robot forearm (upper segment) rotates about the shoulder joint.
2	Upper elbow	Robot forearm (middle segment) rotates about the upper elbow joint.
3	Lower elbow	Robot forearm (lower segment) rotates about the lower elbow joint.
4	Wrist	Robot hand rotates about the wrist.
5	Waist	Robot arm rotates 360° about the waist.
6	Mast	Robot arm moves up and down along the mast.

The following diagram shows the robot's maximum radial and vertical reach. The radial reach includes a typical microplate held in landscape orientation.

WARNING **BioCel System administrators. The robot does not always move in a straight line between teachpoints. Do not try to predict the robot's movements and reach into the robot's travel space while it is in operation.**

Figure KiNEDx Robot radial (top view) and vertical reach (side view)



The tapered robot grippers and the robot's low inertia are designed to prevent puncture or other injuries. However, you can be injured if you obstruct the robot while it is in motion.

WARNING **BioCel System administrators. Keep clear of the robot and its grippers while it is in motion.**

WARNING **BioCel System administrators. Do not insert your fingers in the spacing at the back of the robot grippers while the robot motors are on. The grippers can pinch or injure your fingers when it closes.**

Figure Spacing at the back of the KiNEDx Robot grippers (top view)

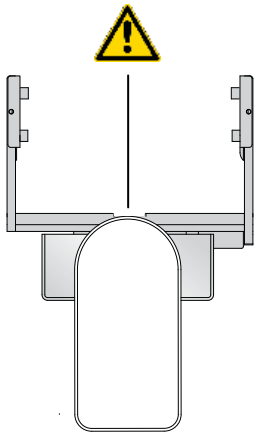


Plate Hub Carousel moving parts and pinch hazards

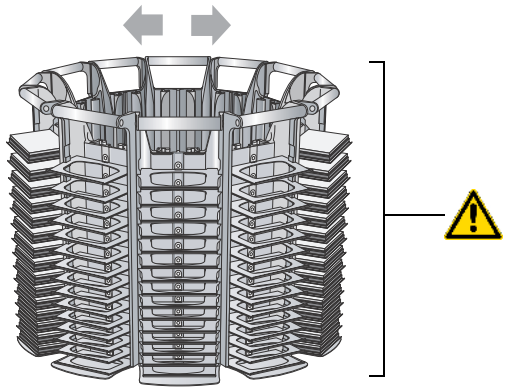
WARNING **The Plate Hub Carousel is an extremely high-powered automated device that can rotate suddenly with great force. You cannot anticipate the movement of the device with certainty, because the software determines when to move the device to achieve the highest throughput. The labware racks on the device have thin edges, and the forceful movement can cause severe injuries.**

WARNING **All operators. Always close the system doors and make sure the interlock is armed before initializing the Plate Hub Carousel.**

WARNING **BioCel System administrators. If you bypass the safety interlock system, be sure to keep out of the BioCel System while the Plate Hub Carousel initializes or when it is powered on. Be sure to wear protective eyewear when entering the system. Do not touch any of the moving parts or attempt to move labware while the device is in operation.**

The Plate Hub Carousel rotates to the left and the right to make the microplates accessible to the system robot.

Figure Plate Hub Carousel moving parts

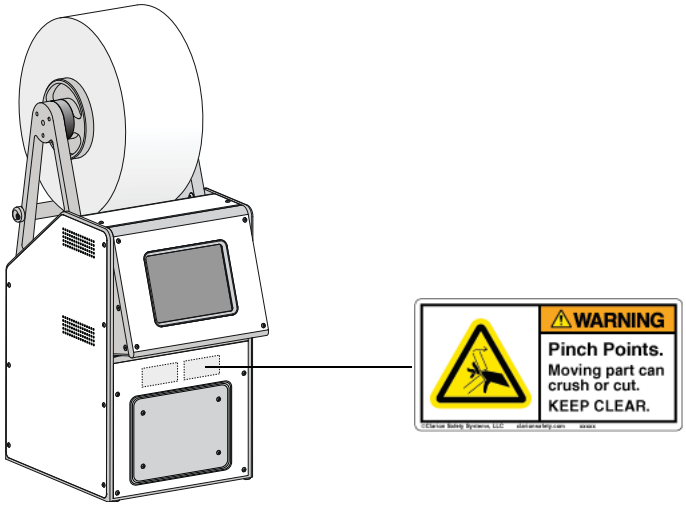


PlateLoc Sealer moving parts, pinch, crush, or cut hazards

WARNING **Do not disable the device door sensor or attempt to access the interior of the device through any other openings. Exposure to the moving parts, such as the heated metal plate (hot plate) or the seal-cutting blade can cause severe injuries.**

A warning label on the front panel warns you of the potential moving parts, pinch, pierce, and cut hazards. The following figure shows the location of the label.

Figure PlateLoc Sealer pinch, crush, or cut hazard label



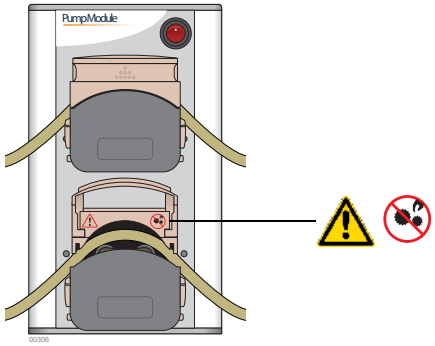
Pump Module moving parts and pinch hazards

WARNING **Ensure that the Pump Module is turned off before lifting the flip-top cover on a pump head. Keep the cover closed while the pump is running.**

WARNING **Pinch hazard! If a cover on a pump head is open, do not allow fingers to contact moving parts.**

In the following figure, the safety labels are visible under the open cover on the bottom pump head.

Figure Pump Module with open pump head cover

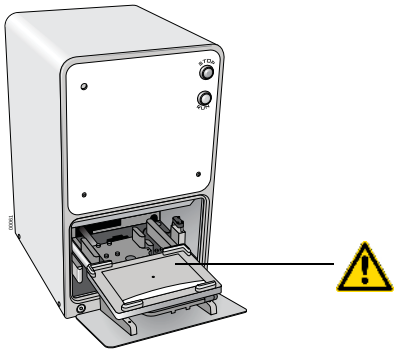


Seal Piercer moving parts, pinch, and pierce hazards

WARNING **BioCel System administrators. Do not reach into the Seal Piercer when the power and air are turned on and the device is connected to the AC outlet. Exposure to the moving parts can cause severe injuries.**

If the Seal Piercer pin plate is in the lowered position, an action can cause it to move upwards with considerable force, resulting in injury if your hand is inside the device.

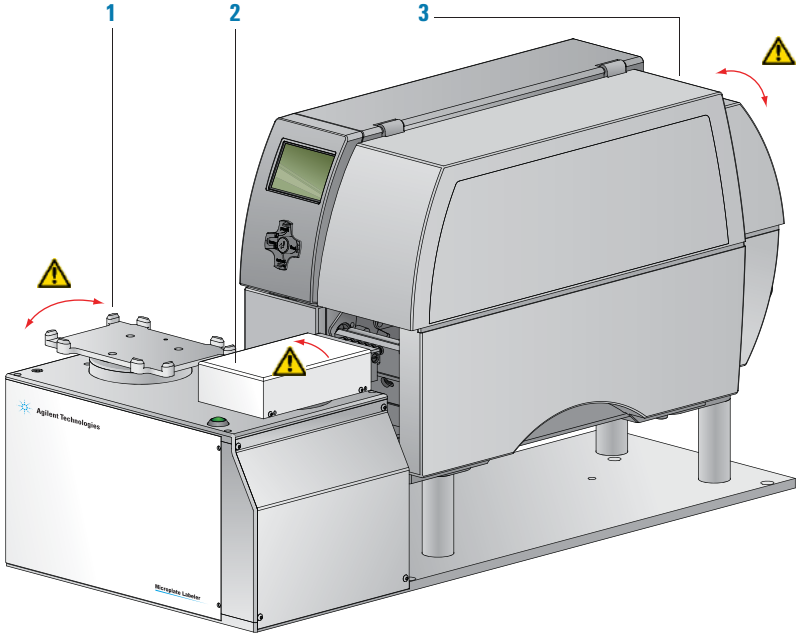
Figure Seal Piercer with lowered pin plate



Microplate Labeler moving parts and pinch hazard

The Microplate Labeler contains the following moving parts.

Figure Microplate Labeler moving parts



Item	Description
1	*Plate stage*. Automatically rotates side to side during labeling to present the long and short sides of a microplate to the applicator head.
2	*Applicator head*. Automatically rotates between the printer and the plate stage to apply the barcode labels.
3	*Printer*. Contains various parts that move automatically during a print run. Keep the cover closed while the device is operating.

WARNING **Pinch hazard. Do not reach between the plate stage and applicator head or between the applicator head and the printer while the device is on.**

WARNING **Pinch hazard. Use care when closing the printer cover. Keep clear of the cover hinges and do not reach into the swivel range of the cover.**

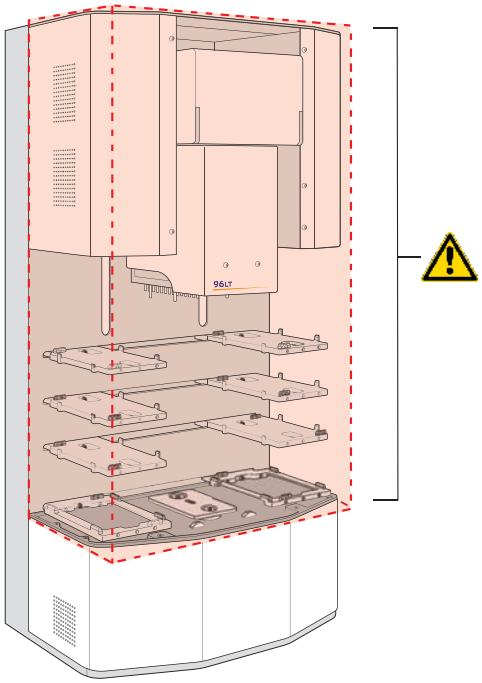
WARNING **BioCel System administrators. If you operate the printer with the cover open or with the cover removed, ensure that you keep clear of the exposed rotating parts.**

Vertical Pipetting Station moving parts and pinch hazards

WARNING **All operators. When you initialize the Vertical Pipetting Station, the pipette head and shelves can move. Always close the system doors and make sure the interlock is armed before initializing the Vertical Pipetting Station.**

WARNING **BioCel System administrators. If you bypass the safety interlock system, be sure to keep out of the BioCel System while the Vertical Pipetting Station initializes or when it is in motion. Be sure to wear protective eyewear when entering the system. Do not touch any of the moving parts or attempt to move labware while the Vertical Pipetting Station is in operation. The device could pinch, pierce, or bruise you.**

Figure Vertical Pipetting Station with shaded areas showing pinch point and pierce hazards



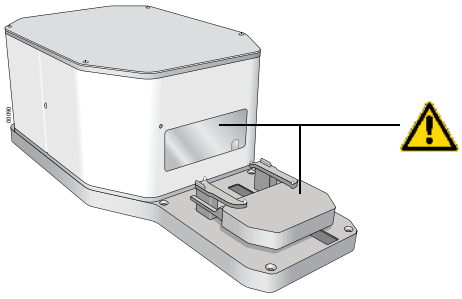
Centrifuge and Centrifuge Loader moving parts and pinch hazards

WARNING **BioCel System administrators. If you bypass the safety interlock system, be sure to keep out of the BioCel System while the Centrifuge or Centrifuge Loader is in operation. Do not attempt to touch any of the moving parts or remove microplates while the Centrifuge or Centrifuge Loader is in operation. If the door of the device is functioning properly, it is not possible to touch the rotor while it is in motion. However, the door can cause possible pinching, piercing or bruising when it closes.**

WARNING **Do not run the Centrifuge or Centrifuge Loader if any components or accessories are damaged or have been modified in any manner not authorized by Agilent Technologies. Discontinue use if the device vibrates or emits noise above normal levels.**

WARNING **Do not operate the Centrifuge or Centrifuge Loader if foreign objects or liquids are trapped within the chamber.**

Figure Centrifuge with Centrifuge Loader moving parts



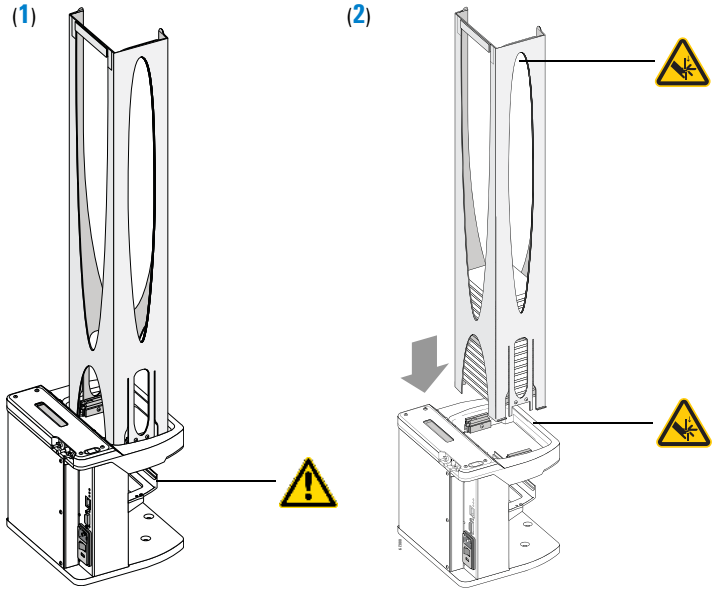
Stacker and Labware Racks hazards

WARNING **All operators. The Stacker microplate stage can move when you turn on the device and when the software is establishing communication with the device. Always close the system doors and make sure the interlock is armed before initializing the Stacker.**

WARNING **BioCel System administrators. If you bypass the safety interlock system, be sure to keep out of the BioCel System while the Stacker is in operation. The moving microplate stage can catch your hands, clothing, jewelry, and so on in the mechanisms, causing injury.**

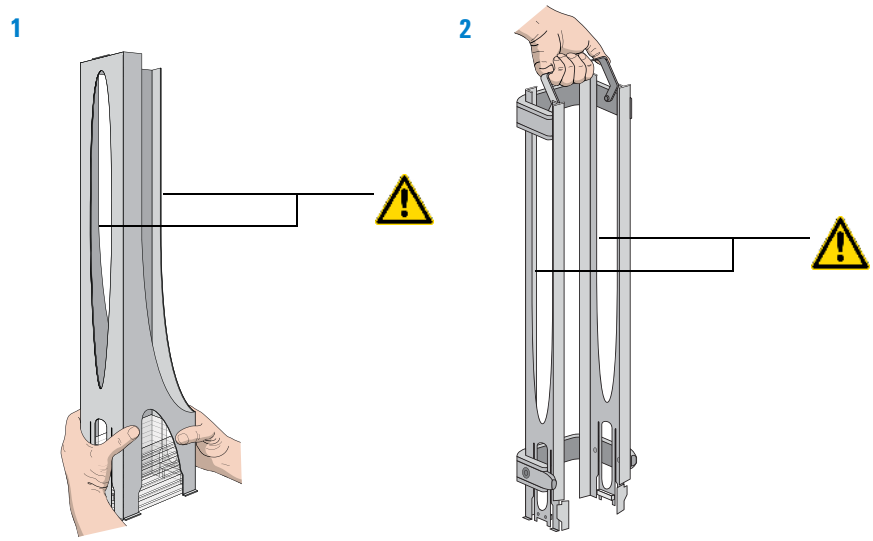
WARNING **Pinch hazard! Keep your fingers out of the path of the Labware Racks when you mount the Racks on the Stacker.**

Figure Stacker (1) moving parts and (2) pinch hazard



WARNING **Use the rack handle to carry the Labware Racks. Do not hold a rack by the interior edges. The interior edges can have sharp surfaces that can cause cuts if handled improperly.**

Figure Correct handling to avoid sharp surfaces on the Labware Racks (1) standard and (2) front load or top load



Electrical hazards

Hazardous-voltage electronics

Hazardous-voltage electronics can be found within the integrated devices on BioCel System. Hazardous-voltage electronics can also be found within the system, power panel, and robot.

WARNING **Do not try to gain access to the interior of any of the system devices. Do not remove a device's panels for any reason. Exposure to the interior electronics of a device can cause severe injury.**

Hazardous-voltage electronics can also be found in the computer. See the computer manufacturer documentation for the hazard warnings. Make sure you follow the instructions on the safe operation of the computer.

WARNING **Ensure that the power cords are in good condition and are not frayed. Use of frayed or damaged power cords can cause injury. Use of incorrect power cords can cause damage to the device.**

About the Automation Control Unit

WARNING **Do not remove the Automation Control Unit covers or disassemble the unit. Doing so can expose you to hazards that could cause serious injury and damage the BioCel System.**

See the *Automation Control Unit User Guide* for detailed safety information.

Radiation hazards

Automation Solutions lasers

WARNING **The BioCel barcode readers use class II lasers. Do not look directly at the laser beam. Looking directly at the laser beam can result in serious eye injury.**

WARNING **Do not disassemble barcode reader sensor heads. Laser emission from the reader is not automatically stopped if the sensor head is disassembled.**

WARNING **Unless you are following a procedure in a Agilent Technologies user guide, do not touch the white test button on the side of the sensor head of an auxiliary barcode reader. The white test button turns on the laser and can result in unsafe exposure to the beam.**

Your BioCel System can contain one or more lasers used to read barcodes. One barcode reader, attached underneath the robot arm, is used to read microplates as they are picked up. Other barcode readers might be included on your system, attached to platepads, Microplate Labeler printers, Vertical Pipetting Station shelves, or the Bravo Platform.

The laser beam will not harm your skin, so there is no danger in exposing your arms or hands to the beam. However, you could damage your eyes if you stare directly into the beam.

Barcode readers emit light for up to 0.5 seconds only when taking a reading. The potential hazard is present only during protocol runs. When a microplate is being read, the beam should not pass beyond the microplate. Operating the BioCel System without microplates, and with the system doors open, increases the risk of exposure.

All readers point downwards to minimize the potential exposure at eye level. The robot barcode reader represents the greatest potential exposure because of its height above the table.

Third-party lasers

Your BioCel System might also contain lasers built into other third-party devices, such as Zeiss Multimode readers and Liconic incubators. For information about laser safety for third-party devices, see the relevant device's documentation.

Chemical and gas hazards

Chemical hazards

General guidelines

Some chemicals used when working with the BioCel System can be hazardous. Make sure you:

- Follow standard laboratory procedures and cautions when working with chemicals.
- Follow your local, state, and federal safety regulations when using and disposing of the chemicals.

Compatible chemicals

The BioCel System surfaces are designed to be compatible with small volumes of aqueous solutions, common biological buffers, solvents, and common reducing agents.

The following chemicals were tested for brief exposures outside the liquid-handling channels:

- Water (deionized, ultrapure type 1)
- Dimethyl sulfoxide (100%)
- Strong acid, such as hydrochloric acid (100 mM HCl) pH 2-3
- Strong base (HPO_4 or sodium hydroxide, 100 mM) pH 12-13
- Ethanol (95% alcohol)
- Methanol (95% alcohol)
- Acetonitrile (100%)
- Chloroform (100%)
- Hydrogen peroxide (35%)
- Tetrahydrofuran
- Dichlormethan
- Toluene
- Acetone

Agilent Technologies recommends that you employ an Environmental Health and Safety professional on site to confirm the compatibility of other chemicals.

Storage and spill detection

In some systems, liquid management components are contained in a liquid cabinet below the system deck. In addition, a spill detection sensor installed in the cabinet can be configured to display spill notifications or pause a protocol when spills are detected.

CAUTION The liquid cabinet is not intended to be a storage cabinet and is not designed to comply with NFPA Code 30 or similar regulations. Do not store explosive, flammable, combustible, or corrosive chemicals in the liquid cabinet.

IMPORTANT The spill-detection sensor is not a safety device. The sensor alerts you in case of spills in the system to prevent loss of materials and allow timely cleanup. It cannot distinguish between different types of chemicals used, and it does not warn you of hazardous conditions.

For detailed information about the liquid cabinet and the spill detection sensor, see the *BioCel System User Guide*.

High-pressure gas

Compressed air is used to move components within some devices that can be integrated with the BioCel System, such as the following:

- Vertical Pipetting Station shelves
- PlateLoc Sealer
- Seal Piercer
- Microplate Labeler

WARNING **Working with open, charged air lines can result in injury. Turn off the compressed air line when disconnecting or reconnecting devices that use compressed air. Contact your facilities department or Automation Solutions Technical Support with questions about setting up the air line.**

Follow the local, state, and federal safety codes for the placement and mounting of gas cylinders. For example, you might have to attach a standard cylinder bracket to a solid permanent structure to meet or exceed all local seismic and safety requirements.

Always use good laboratory practices when handling high-pressure cylinders. Make sure you follow any instructions provided with the cylinders.

Nitrogen gas (Inert Environment Hood only)

The BioCel System Inert Environment Hood uses nitrogen gas to displace air in the system enclosure. Under normal operating conditions you are protected from hazardous exposure to the gas. However, you must be aware of the hazards and how to avoid them.

WARNING **Nitrogen is an odorless, colorless, and nontoxic gas that can cause rapid suffocation by displacing air. Use nitrogen only in a well- ventilated lab area. Turn off the nitrogen source when the BioCel System is not in use.**

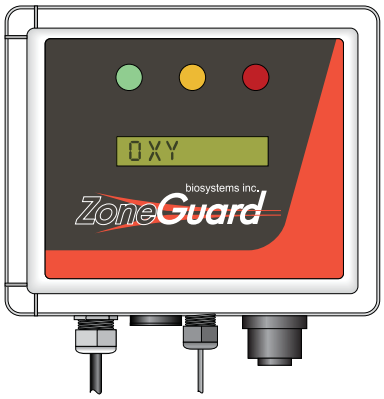
Use nitrogen only in a well-ventilated lab area. Turn off the nitrogen source when the BioCel System is not in use.

The following safety label is placed in the BioCel System to warn you to consult the accompanying user documentation for important safety information, including low-oxygen hazards.

Oxygen monitors

Two oxygen monitors are provided with the system to prevent accidental suffocation: one on the inside of the system, and one on the outside of the system. The oxygen monitors sense and display the percentage of oxygen present.

Figure Example of an oxygen monitor



WARNING **To prevent accidental suffocation, do not remove the provided oxygen monitors.**

To prevent accidental suffocation:

- The internal monitor interacts with the safety interlock system so that when the system chamber contains less than 19.5% oxygen, the doors lock automatically. To open the doors, the system requires that you first purge the nitrogen gas.
- The external monitor interacts with the safety interlock system so that when the air surrounding the BioCel System contains less than 19.5% oxygen, the shutoff valves cut off the gas supply to the BioCel System.

Door locks and safety interlock system

WARNING **Do not disable or defeat the door locks or interlocks.**

The BioCel System has a door-locking and safety interlock system that prevents you from opening the doors and being exposed to high levels of nitrogen gas. When you turn on the gas at the system Environmental Controls panel, the system doors lock automatically. To unlock the doors, you must first purge the nitrogen from the enclosure.

Argon gas (Gas-Purging PlateLoc Sealer only)

The Gas-Purging PlateLoc Sealer uses argon gas to displace air in the sealing chamber before sealing a microplate. For safety reasons, the Gas-Purging PlateLoc Sealer automatically turns off the argon inside the device immediately before the seal is applied. Under normal operating conditions you are protected from hazardous exposure to the gas. However, you must be aware of the potential hazards and how to avoid them.

WARNING **Argon is an odorless, colorless, and nontoxic gas that can cause rapid suffocation by displacing air. Use argon gas only in a well-ventilated lab area. Install an oxygen monitor in the lab area so that an alarm that will sound if the oxygen level falls below the acceptable threshold.**

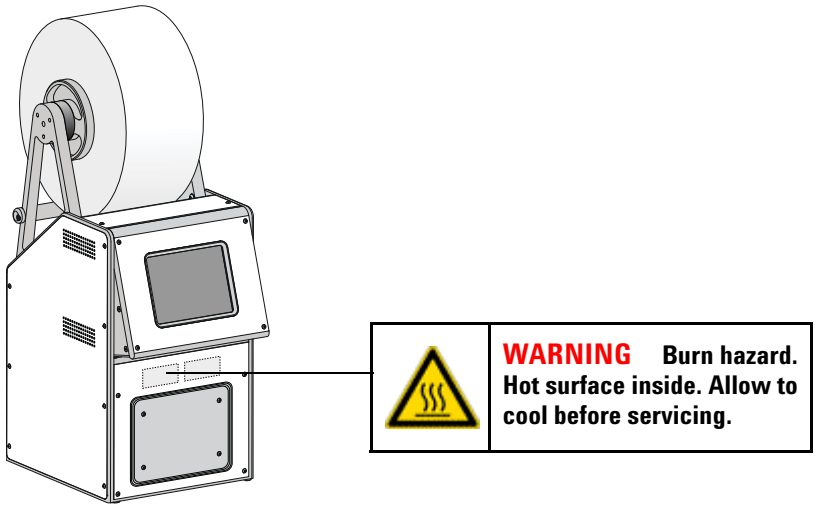
Make sure to turn off the argon source when the Gas-Purging PlateLoc Sealer is not in use.

Heat hazards

PlateLoc Sealer

The PlateLoc Sealer uses a heated metal plate inside the sealing chamber during the sealing process. A warning label on the front panel warns you of the potential burn hazard. The following figure shows the location of the label.

Figure PlateLoc Sealer heat hazard warning label



WARNING **Do not touch the PlateLoc Sealer or pry open the door while it is in operation. The hot surfaces can cause burn injury. Allow the device to cool before servicing.**

Microplate Labeler

WARNING **The printer can become hot while printing. Do not touch the printer components during operation. Allow the printer to cool down before changing the media or cleaning the printer components.**

Agilent Technologies

Safety Guide

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