BioCel System

User Guide

Agilent Technologies

Notices

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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.

Agilent Technologies

Letter to our Customers

Dear Customer,

The Agilent Technologies acquisition of Velocity11 resulted in the following changes:

- Creation of Agilent Technologies Automation Solutions, formerly Velocity11
- Renaming of some Velocity11 products
- New Customer Service and Technical Support contact information
- New website address for product information

Please make a note of the following changes as they impact this user guide.

Velocity11 product name changes

Velocity11 product name	Changes to ...
Access2 Automated Microplate Loader	Automated Centrifuge Loader
Element Automation System	BioCel 900 System
IWorks Device Driver Programming Interface	VWorks Device Driver Interface
PlatePierce Seal Piercing Station	Microplate Seal Piercer
VCode Barcode Print and Apply Station	Microplate Barcode Labeler
Velocity11 Robot	3-Axis Robot
VHooks Integration Interface	VWorks Hooks Interface
VPrep Pipetting System	Vertical Pipetting Station
VSpin Microplate Centrifuge	Microplate Centrifuge
VStack Labware Stacker	Labware Stacker

New contact information

Documentation feedback: documentation.automation@agilent.com

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Web: www.agilent.com/lifesciences/automation

Content

Introduction

1

This chapter contains the following topics:

Who should read this guide

Job roles

This user guide is for people with the following job roles:

Job role	Responsibilities
Lab manager, administrator, or technician	Someone who is responsible for: ❑ Managing the BioCel ❑ Developing the applications that are run on it ❑ Solving the more challenging problems that might arise ❑ Developing training materials and standard operating procedures for operators
Operator	Someone who performs the daily production work on the BioCel and solves routine problems. Your organization may choose to create its own procedures for operators including the procedures in this guide.

Related topics

For information about...	See...
What this guide covers	“What this guide covers” on page 3
What uis new in this user guide	“What is new in this version of the user guide” on page 4
Accessing Velocity11 user guides and online help	“Accessing Velocity11 user guides” on page 5
Using the BioCel safely	“Safety information about the BioCel” on page 8

What this guide covers

What is covered

This guide covers a description of the BioCel system, the operation of the hardware components, and the use of diagnostics.

What is not covered

This guide does not cover using VWorks, setting up devices, and networking the BioCel.

Hardware version

This guide covers the hardware for the BioCel 1200, 1600, and 1800. This includes accessories such as the Weigh Pad and plate hotel.

BioCel customization

Because the BioCel is a custom product with many options, this guide describes features that might not be included in your BioCel.

Related topics

For information about...	See...
Using VWorks	*VWorks User Guide*
Using diagnostics for a third-party device	*Device Driver User Guide*
Operating a Velocity11 device	The user guide for that device
Networking the BioCel	*VWorks User Guide*

What is new in this version of the user guide

About this topic This topic briefly describes the new features this guide covers.

New Feature

Feature	Description	See...
BioCel 1200	Automation platform that is smaller than the BioCel 1600 and 1800.	"BioCel 1200 external features" on page 17
BioCel 1800	Automation platform that is larger than the BioCel 1200 and 1600.	"BioCel 1600 and 1800 external features" on page 18
Modifications to the BioCel 1600	❑ Changes in the power panel ❑ Changes to the air panel	❑ "Power panel" on page 21 ❑ "Hardware control components" on page 22
Device table	Mobile table that locks into the BioCel	"Docking the mobile device table to the BioCel" on page 34
New accessories	❑ Translator linear robot ❑ PlateHub	❑ "Translator linear robot" on page 38 ❑ "PlateHub" on page 37

Related topics

For information about...	See...
Hardware features	"BioCel overview" on page 13
What this guide covers	"What this guide covers" on page 3
Accessing the online help	"Accessing Velocity11 user guides" on page 5

Accessing Velocity11 user guides

About this topic

This topic describes the different formats of Velocity11 documentation.

Each Velocity11 user guide is delivered to you as:

- ❑ Online help
- ❑ A PDF file
- ❑ A printed book

The information in each format is the same but each format has different benefits.

Where to find the user guides

Online help

The online help is added to your computer with the software installation.

Velocity11 website

You can download the latest version of any PDF file from our website at www.velocity11.com.

All Velocity11 user documentation can be searched from the website at www.velocity11.com.

Online help

The online help is the best format to use when you are working at the computer and when you want to perform fast or advanced searches for information.

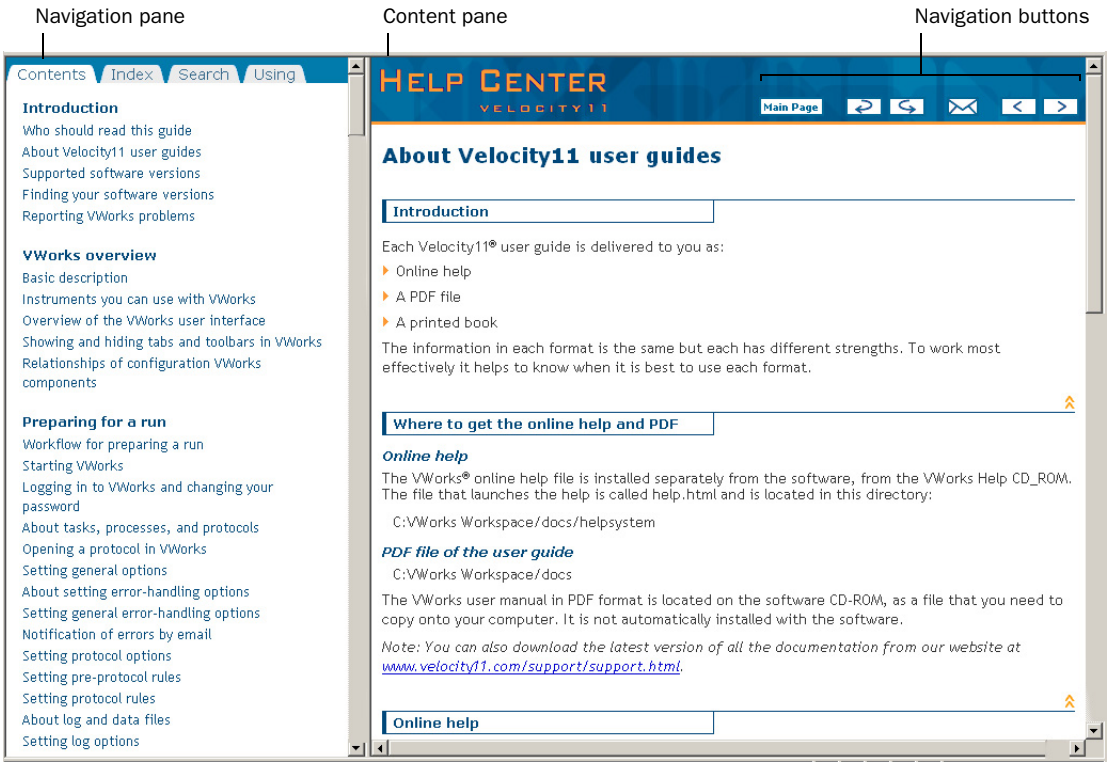
To open the online help:

1. Do one of the following:
   - Select **Help > VWorks Help**.
   - Press F1.
   - Clicking the question mark icon on the toolbar for context-sensitive help.
2. Click on the *BioCel User Guide* link.

Note: If you are not using our software, you can access the help from the Velocity11 website at http://www.velocity11.com.

Main features

The online help includes a navigation pane, content pane, and navigation buttons.



The navigation pane has four tabs, providing four different ways to locate information. The content pane displays the online help topics.

Navigation buttons in the content pane allow you to navigate through the pages.

PDF user guides

Computer requirements

To open a user guide in PDF format, you need an Acrobat viewer. You can either use the viewer that is built into Adobe Acrobat, or you can download the free Adobe Reader application from http://www.adobe.com/support/downloads/main.html.

Printing and searching

We provide user guides in PDF format mainly for printing additional copies. You can use them for simple searches from the Find button, although these searches are much slower than online help searches:

More information

For more information about using PDF documents, see the Adobe Acrobat PDF help system that can be accessed from your Acrobat viewer.

Related topics

For information about...	See...
Hardware features	"BioCel overview" on page 13
What this guide covers	"What this guide covers" on page 3
Contacting Velocity11	"Reporting problems" on page 7

Reporting problems

About this topic

If you have a technical problem that you cannot resolve after reading the chapter on maintenance and troubleshooting, read the information in this topic for how to report problems with the BioCel.

Reporting hardware problems

If you have a problem with a hardware component of the BioCel that you cannot resolve, let us know by:

- ❑ Sending an email to service@velocity11.com or euroservice@velocity11.com
- ❑ Calling Velocity11 Technical Support at 1-800-979-4811 or 1-650-846-6611

Reporting user guide problems

If you find a problem with this user guide or have suggestions for improvement, please use the feedback button in the online help. Your comments will be reviewed promptly and used to write the next version of the guide.

You can also send an email directly to documentation@velocity11.com.

Related topics

For information about...	See...
Reporting software problems	*VWorks User Guide*
Sending files	*VWorks User Guide*

Safety information about the BioCel

About this topic

This topic gives general information about BioCel safety hazards.

Before using the BioCel

Before using a BioCel, your organization should make sure that you are properly trained in:

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

If you are the person in your organization responsible for training others on the BioCel and you have a safety question, please contact Velocity11 Service Center.

Safety labels

Pay attention to any safety labels printed on your BioCel. A safety label, shown below, consists of a warning symbol. A description of the warning and information that will help you to avoid the safety hazard are located in the safety information topic of the user guide.

Chemical hazards

Some chemicals used when working with the BioCel might be hazardous. Make sure you follow the recommendations in the MSDS (Material Safety Data Sheet) for every chemical that you plan to use. The manufacturer of the chemical should provide you with the MSDS.

Waste disposal

Remember to dispose of chemicals in compliance with all applicable regulations.

Product use

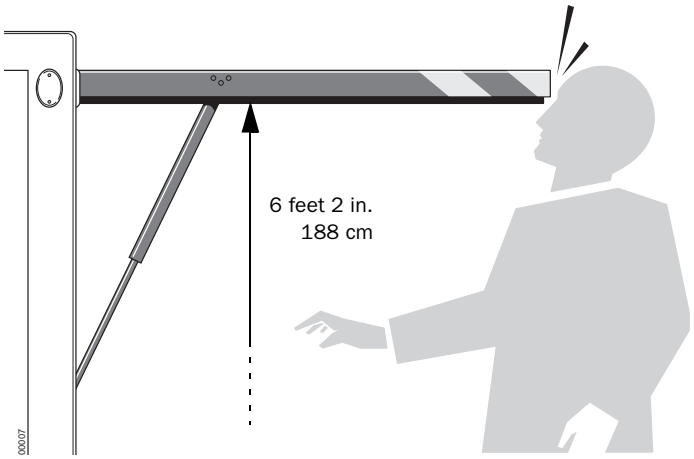
Velocity11's products must only be used in the manner in which we intend, as described in our user guides. Any other use might damage the product or injure you. Velocity11 is not responsible for damages caused, in whole or part, by unauthorized modifications, or by procedures that are not explicitly described in our user guides. Any modifications or changes to products not expressly approved in Velocity11 user guides could void the warranty.

The BioCel is not intended or approved for diagnosis of disease in humans or animals.

Overhead door injury hazards

The overhead door hazards apply only if you have a BioCel 1600 or 1800 that has overhead doors.

!! INJURY HAZARD !! **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.**



!! INJURY HAZARD !! **The pneumatic braces on overhead doors should be adjusted so you can comfortably open and close the doors. If you have to strain to open a door, please contact the Velocity11 Service Center and ask to have the braces adjusted.**

Overhead door damage hazard

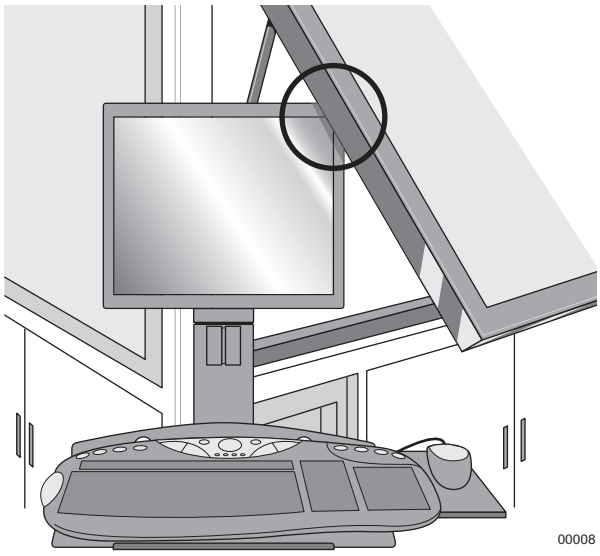
The overhead door hazards apply only if you have a BioCel 1600 or 1800 that has overhead doors.

!! DAMAGE HAZARD !! **Always open and close overhead doors using their handles. Opening and closing overhead doors by pulling and pushing on their corners can crack the glass and damage the pneumatic braces.**

Computer monitor damage hazard

The computer monitor hazard applies only if you have a BioCel 1600 or 1800 that has overhead doors.

!! DAMAGE HAZARD !! **To avoid damage to the computer monitor, make sure that you move the monitor out of the way as you close the overhead doors.**



Lower side door injury hazard

The lower side door hazards apply only if you have a BioCel 1600 or 1800.

!! INJURY HAZARD !! Always close the lower side doors when you finish the operation that led you to open them. Leaving side doors open creates a tripping hazard. It can also block escape routes in a laboratory.

Interlock override injury hazard

!! INJURY HAZARD !! Only fully trained BioCel administrators should have access to, and use of, the safety interlock key. Use the override only when you know how the robot and devices will move during the protocol, when the robot speed is slow, and when you have taken measures to keep away from the areas in which the robot and device parts will be moving.

With the interlock overridden, it is possible to be hit by the robot when it is moving. If this happens, the robot will immediately stop, minimizing injury, and the likely outcome is minor bruising. However, not all circumstances can be foreseen and more serious injury is possible. It is the responsibility of every operator to use the built-in BioCel safety features, follow warnings and safety labels and keep out of the robot's radius whenever it is likely to move.

Laser warnings

BioCel lasers

Your BioCel contains one or more lasers used to read bar codes. One bar code reader, attached underneath the robot arm, is used to read plates as they are picked up. Other bar code readers might be included on your system, attached to platepads, VPrep shelves, or VCode printers.

!! INJURY HAZARD !! The BioCel bar code readers use class II lasers. Before using the BioCel, you should be trained in the safe use of these lasers.

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.

Bar code readers emit light for up to 0.5 seconds only when taking a reading so they are only a hazard during protocol runs. When a plate is being read, the beam should not pass beyond the plate. If you are operating the BioCel without plates, and with the overhead doors open, the risk of exposure is increased.

Before using the BioCel you should identify the locations of all bar code readers and establish the directions in which they point. All readers point downwards to minimize the potential exposure at eye level. The robot bar code reader represents the greatest hazard because of its height above the table. This bar code reader is angled downwards at 15° and has a maximum illumination arc of 60°, centered perpendicularly to the reader. With these measurements you can establish the space that is illuminated on occasions when there is no plate in the robot gripper.

!! INJURY HAZARD !! Class II laser hazard. Do not look directly at the laser beam. Looking directly at the laser beam can result in serious eye injury.

!! INJURY HAZARD !! Do not disassemble bar code reader sensor heads. Laser emission from the reader is not automatically stopped if the sensor head is disassembled.

!! INJURY HAZARD !! Unless following a procedure in a Velocity11 user guide, do not touch the white test button on the side of the sensor head of an auxiliary bar code reader. This button turns on the laser creating the possibility of a long exposure to the beam.

Third-party lasers

Your BioCel 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.

Related topics

For information about...	See...
Reporting problems	“Reporting problems” on page 7
BioCel features	“Basic description” on page 14

BioCel overview 2

This chapter contains the following topics:

Basic description

About the BioCel

The BioCel is a plate-processing automation platform that is used in combination with devices for applications such as:

- ❑ Compound management
- ❑ Sample preparation
- ❑ Plate replication
- ❑ PCR purification
- ❑ High-throughput screening

To operate the BioCel, you should be familiar with the operating procedures in this guide as well as the guides for the devices installed on your BioCel.

Basic BioCel components

Every BioCel includes:

- ❑ A frame
- ❑ A table
- ❑ A robotic arm
- ❑ A controlling computer, a monitor, a keyboard, and a mouse
- ❑ A main power panel and electrical supply circuits
- ❑ Communication hubs and cables
- ❑ A Bio I/O console for managing sensor information
- ❑ One or more uninterruptible power supplies (UPSs)
- ❑ An AC/DC converter (DC power supply)
- ❑ An air system that includes a main air panel, pressure regulators, an air filter, and air lines
- ❑ VWorks software
- ❑ Software for each device

Related topics

For information about...	See...
BioCel features	❑ "BioCel 1200 external features" on page 17 ❑ "BioCel 1600 and 1800 external features" on page 18
BioCel specifications	"BioCel specifications" on page 15
VWorks	*VWorks User Guide*

BioCel specifications

About this topic

This topic describes the physical, electrical, and environmental specifications of the BioCel.

Physical specifications

Dimension	1200 no hood	1600 with hood	1800 with hood
Height	196.8 cm (77.5 in)	259.1 cm (102 in)	259.1 cm (102 in)
Width	205.7 cm (81 in)	152.4 cm (60 in)	182.9 cm (72 in)
Depth	121.9 cm (48 in)	152.4 cm (60 in)	152.4 cm (60 in)
Weight	Approximately 1088.6 kg (2400 lb)	Approximately 2268 kg (5000 lb)	

Electrical requirements for all BioCels

Requirement	System location	
	EU	US
Voltage	230V~	120V~
Frequency	50–60 Hz	50–60 Hz
Current	20 A	30 A
Fuse	20 A	30 A

Air-flow (pressure) requirements

Requirement	All BioCels
Air pressure	100–110 psi (0.62–0.69 MPa)

Equipment rating

The BioCel conforms to the requirements of Council Directive 72/23/EEC relating to electrical safety by application of the following standard:

EN61010-1:1993, including Amendment 2:1995

Environmental specifications

Requirement	1200	1600	1800
Temperature	15–40 °C	15–40 °C	15–40 °C
Relative humidity	10–75% RH	10–75% RH	10–75% RH
Elevation	1–2000 m	1–2000 m	1–2000 m

Related topics

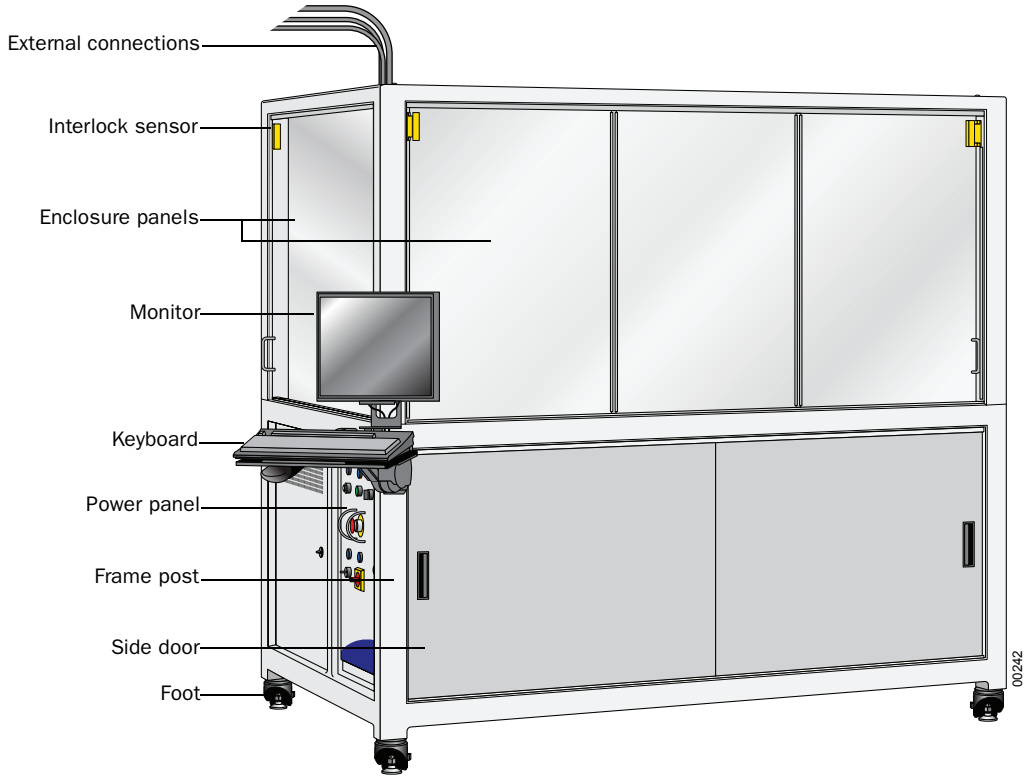
For information about...	See...
BioCel features	❑ "Basic description" on page 14 ❑ "BioCel 1200 external features" on page 17 ❑ "BioCel 1600 and 1800 external features" on page 18
BioCel systems	❑ "Power system" on page 27 ❑ "Air system" on page 30 ❑ "Vacuum system" on page 31
Networking	"Computers and networking" on page 32

BioCel 1200 external features

Diagram

The main external features of the BioCel 1200 are shown in the following diagram.

Note: The exact locations of the components on your BioCel might be different.



Related topics

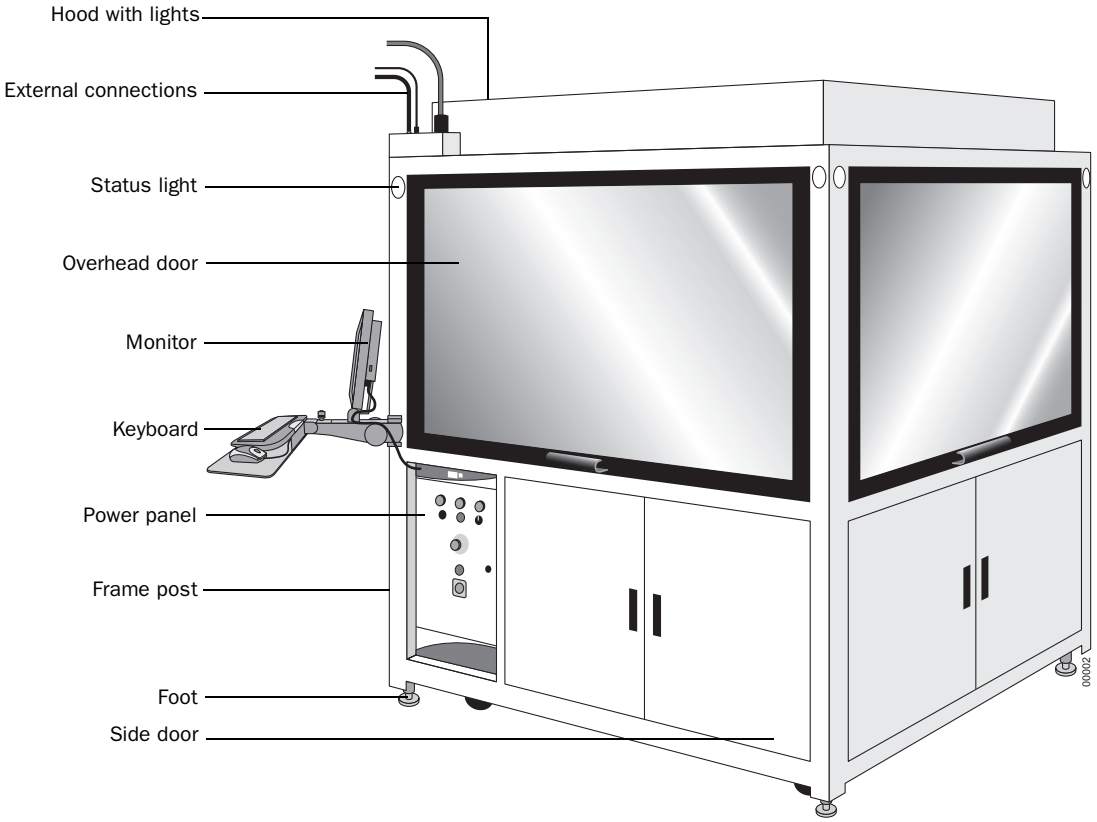
For information about...	See...
BioCel features	❑ "Basic description" on page 14 ❑ "BioCel 1600 and 1800 external features" on page 18
BioCel systems	❑ "Power system" on page 27 ❑ "Air system" on page 30 ❑ "Vacuum system" on page 31
Networking	"Computers and networking" on page 32

BioCel 1600 and 1800 external features

Diagram

The main external features of the BioCel 1600 and 1800 are shown in the following diagram.

Note: The exact locations of the components on your BioCel may be different.



Related topics

For information about...	See...
BioCel features	❑ "Basic description" on page 14 ❑ "BioCel 1200 external features" on page 17
BioCel systems	❑ "Power system" on page 27 ❑ "Air system" on page 30 ❑ "Vacuum system" on page 31
Networking	"Computers and networking" on page 32

Utilities connections

About the utilities connections

There are usually the following connections to external utilities on the BioCel:

- ❑ Main power line
- ❑ Main air line
- ❑ Main vacuum line (optional)
- ❑ Main Ethernet

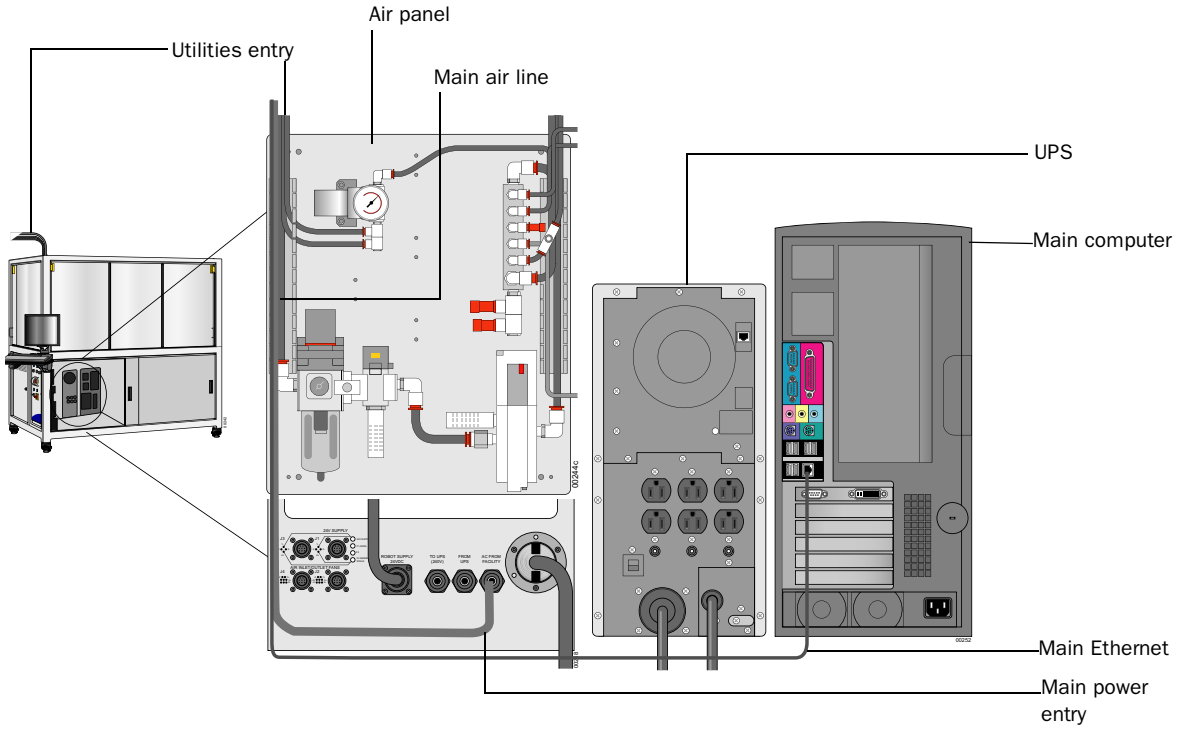
Some BioCels may also have direct plumbing lines for water and waste instead of reservoirs and waste containers.

This topic describes the entry of these connections for the BioCel 1200, 1600, and 1800.

BioCel 1200 utilities connections

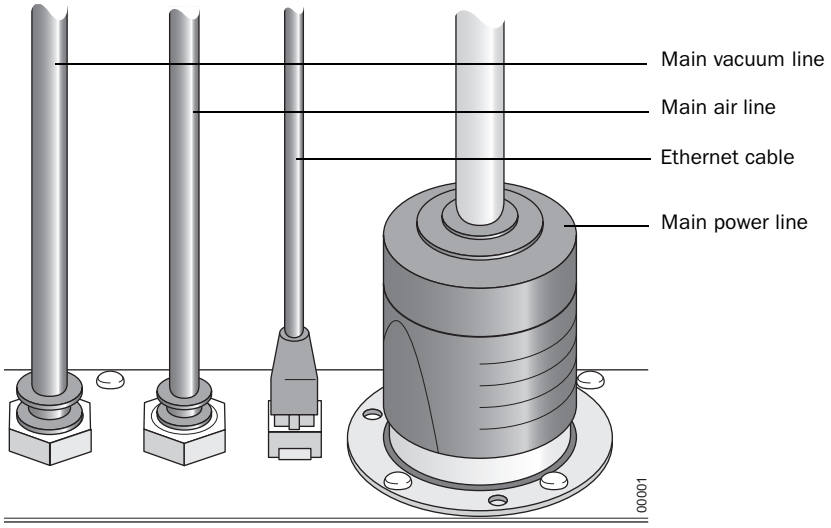
On the BioCel 1200, the connections to the external utilities enter through one of the main frame posts and connect into the BioCel behind the side doors. These connections are visible when you open the side doors on the BioCel.

The illustration below shows where the utilities are connected behind the side doors of the BioCel. The illustration represents one possible configuration. The placement of the UPS and main computer might be different, depending on how your BioCel 1200 is configured.



BioCel 1600 and 1800 utilities connections

On the BioCel 1600 and 1800, the external utilities connections are located on the top of the BioCel, usually above the power panel.



Direct plumbing

Any BioCel can be customized to have direct plumbing from an external water source. In this case, the water lines enter through the frame corners.

Related topics

For information about...	See...
Entry of utilities	❑ "BioCel 1200 external features" on page 17 ❑ "BioCel 1600 and 1800 external features" on page 18
Specifications	"BioCel specifications" on page 15

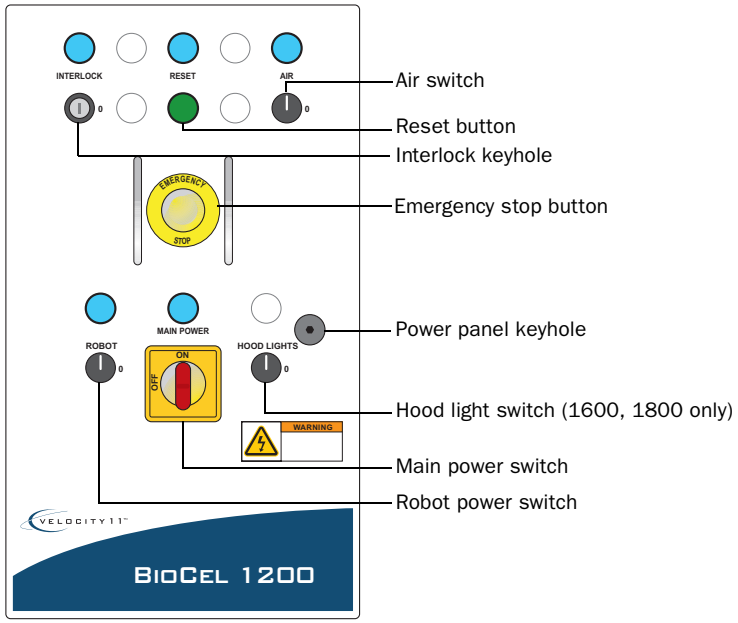
Power panel

About the power panel

The power panel contains the main controls that power the BioCel. This topic describes a typical power panel for a BioCel.

BioCel power panel diagram

The following diagram shows a typical power panel for a BioCel.



Power panel functions

You can use the power panel to perform the following procedures:

Procedure	See...
Turn on and off the main power, air supply, and power to the robot	"Turning on the BioCel" on page 43
Turn on and off the hood lights (if available)	"BioCel 1600 and 1800 external features" on page 18
Override the safety interlock	"Overriding the safety interlock" on page 90
Activate an emergency stop	"Pausing and stopping a run" on page 60
Reset the safety interlock after an emergency stop has been activated	"Emergency stop error recovery" on page 87

About opening the power panel

The fuses to the BioCel are located inside the power panel. If you suspect a blown fuse, contact the Velocity11 Service Center before you attempt to open the power panel.

!! INJURY HAZARD !! **The power panel should only be opened by someone from the Velocity11 Service Center or a BioCel administrator, working under the guidance of Velocity11 service staff. Do not force open the power panel door. It has a safety device to prevent it from opening when the main power switch on the power panel is turned on.**

Related topics

For information about...	See...
Power system configuration	“Power system” on page 27
Overriding the interlock	“Overriding the safety interlock” on page 90
Using the emergency stop	“Pausing and stopping a run” on page 60
Status of the BioCel	“Monitoring the status of a run” on page 63

Hardware control components

About the hardware control components

The main hardware control components include the following:

- ❑ Air panel
- ❑ Main computer
- ❑ Uninterruptible power supply (UPS)
- ❑ Bio I/O
- ❑ Ethernet hub
- ❑ RS-232 hub

Optional components include the following:

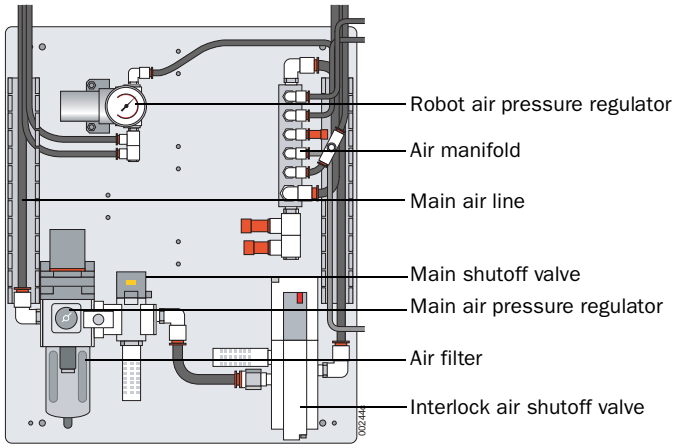
- ❑ Bar code power supply
- ❑ Weigh Pad hub
- ❑ Pump modules

The placement, and in some cases the physical attributes, of these control components depends on how your BioCel is configured. For example, your computer may be mounted in a rack, or it may be a free-standing tower, depending on what other devices and equipment are on your BioCel.

Air panel

The air panel on all BioCels is located behind the power panel. It is accessible by opening one of the side doors.

Some BioCels might have an additional air pressure regulator for a vacuum delidder. The BioCel air panel shown below has only a robot air pressure regulator.



Function

The air panel contains components that control the flow of air to all parts of the BioCel.

Component description

Component	Description
Robot air pressure regulator	Controls how firmly the robot grips a plate.
Air manifold	Houses air supply connectors for the BioCel devices.
Main air line	Directs the external air source.
Main shutoff valve	Controls the air supply. The valve lies between the main air line and the AIR switch on the power panel. *Note:* The AIR switch is usually used to turn the air supply on and off. You should not need to use the main shutoff valve.
Main air pressure regulator	Controls the air pressure. The regulator lies between the main air line and the AIR switch on the power panel.
Air filter	Provides an extra purification step for house air. You should not need to adjust the air gauges.
Interlock air shutoff valve	Shuts off the air to moving parts when the interlock circuit is interrupted.

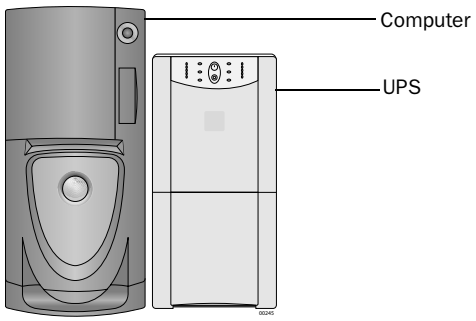
PlateLoc air filter

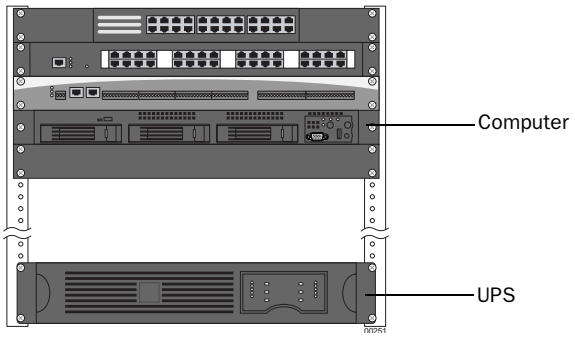
!! IMPORTANT !! PlateLoc devices intended for use with the BioCel do not contain an air filter. If you plan to remove a BioCel PlateLoc for use in stand-alone mode, you must contact Velocity11 Service Center and arrange to have a filter installed. Without a filter your PlateLoc can become damaged.

Main computer and UPS

The location and model of these components depend on how your BioCel is configured. They might be rack mounted, or they might be towers. The model used depends on what other devices and equipment are on your BioCel.

The illustration below shows the two possible models.



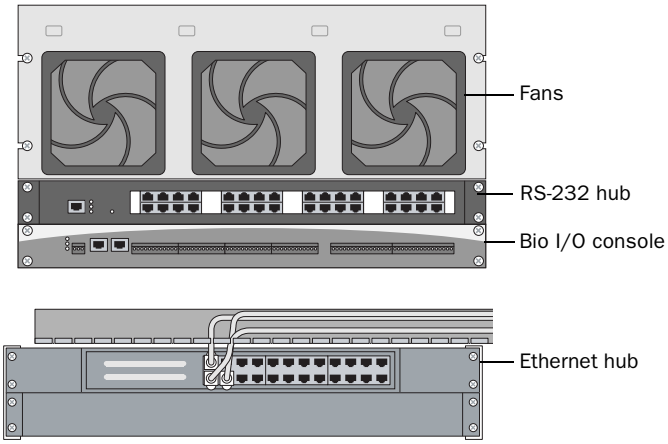


Communication hubs

The Ethernet and RS-232 hubs form communication connections between a single cable connected to the computer and multiple cables going to devices. This allows the BioCel's computer to communicate with many devices at once.

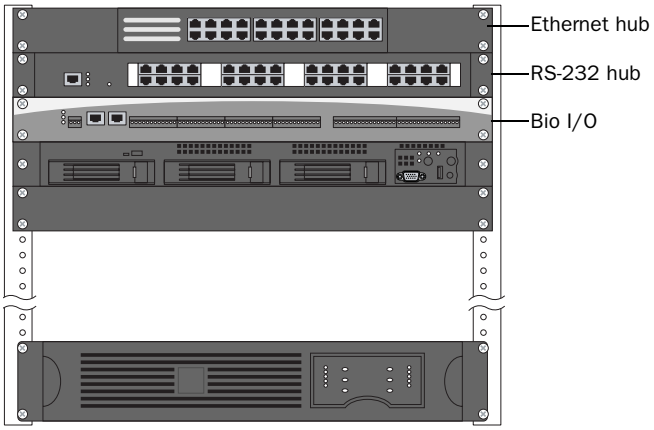
BioCel 1200

Communication hubs are mounted beneath the BioCel deck inside the side doors. The location of the hubs vary, according to your specific design, and they might not be located together.



BioCel 1600/1800

Both communication hubs are mounted beneath the BioCel deck inside the side doors. The location of the hubs might vary, according to your specific design.



Bio I/O console

The Bio I/O console:

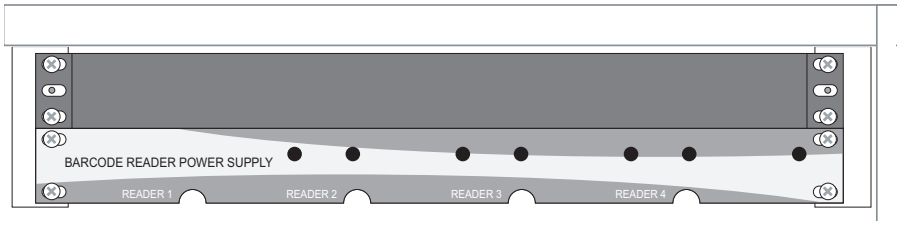
- ❑ Makes information from analog and digital sensors available to the computer.
- ❑ Initiates actions such as turning on the status lights, and opening and closing optional trash and enclosure doors.
- ❑ Provides 24V power to some devices such as the Lid Hotel and Vacuum Delidder.

Many of the thin, gray, low-voltage cables that run through the BioCel go to the Bio I/O.

You should not need to touch the Bio I/O.

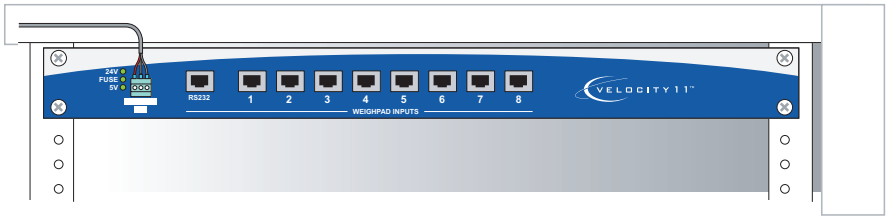
Bar code power supply (optional)

If you have multiple auxiliary bar code readers, you may have a separate power supply for connecting them. The bar code power supply is mounted inside a side door underneath the BioCel deck.



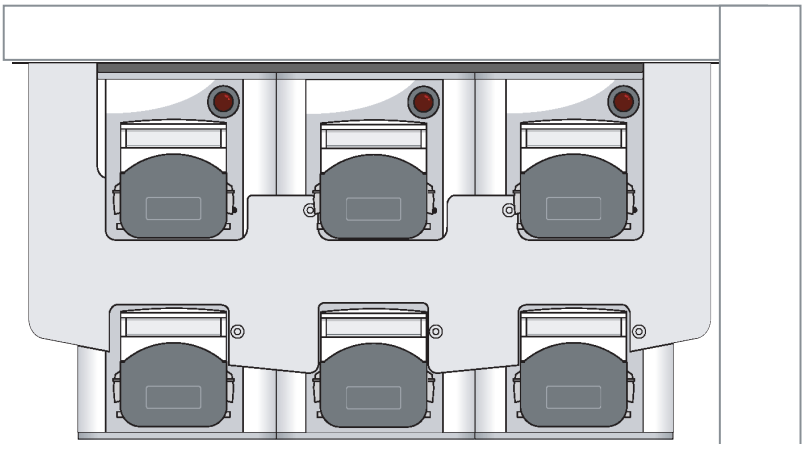
Weigh Pad hub (optional)

If you have Weigh Pads for reservoirs and waste, you may have a hub for connecting the Weigh Pads to VWorks. The hub is usually mounted with the other communication hubs inside a side door underneath the BioCel deck.



Pump modules (optional)

If you have a VPrep configured on your BioCel, the pump modules may be mounted inside a side door underneath the BioCel deck. Here they do not take up deck space and are easily accessible for maintenance.



Related topics

For information about...	See...
The BioCel air system	“Air system” on page 30
Opening Bio I/O Diagnostics	“Using Bio I/O Diagnostics” on page 71
Turning on the BioCel	“Turning on the BioCel” on page 43

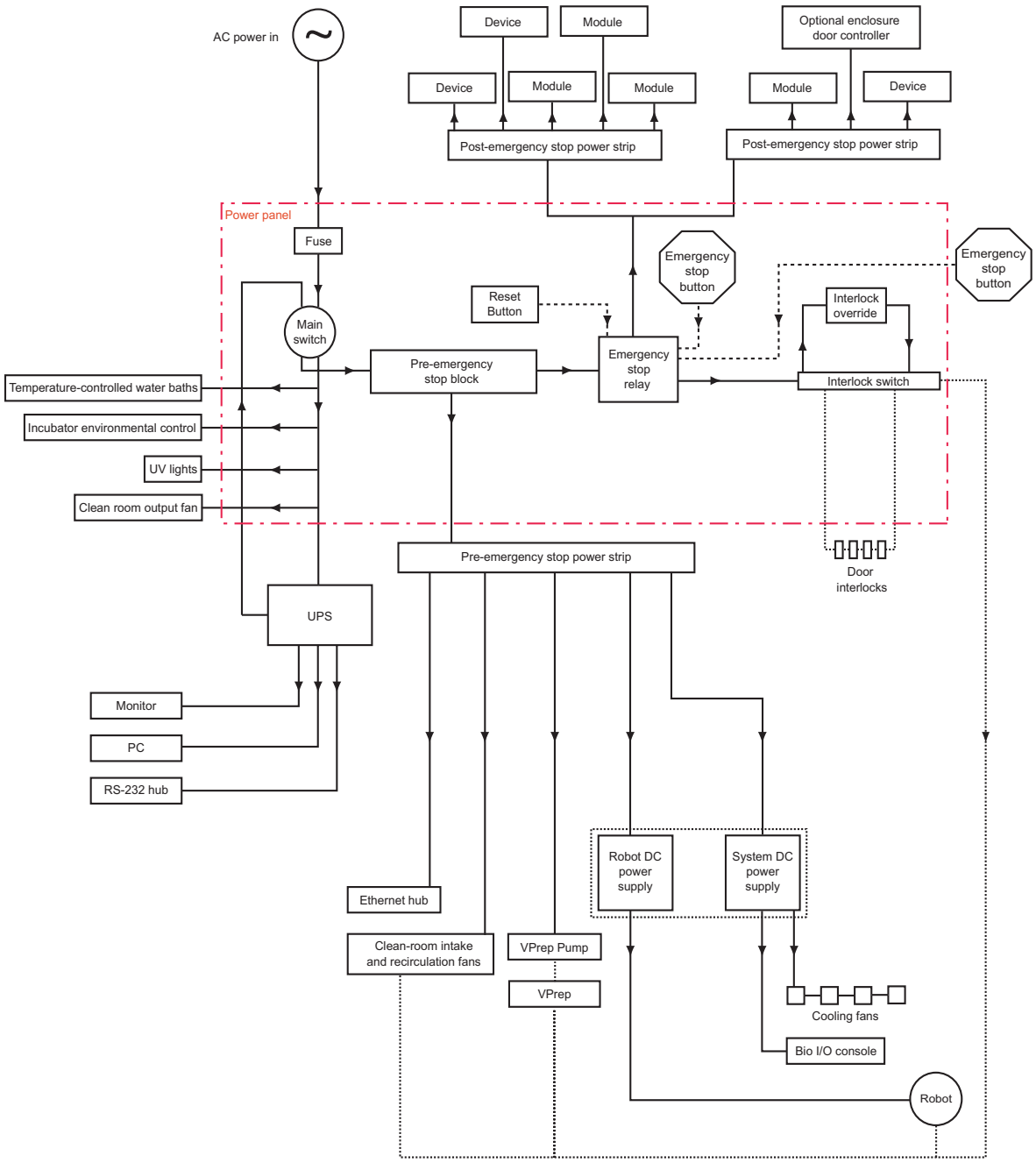
Power system

About this topic

This topic summarizes the power system of the BioCel. Becoming familiar with how your BioCel is wired will help you to understand the behavior of your BioCel and solve problems.

Overview diagram

The power system is summarized in the following diagram.



In the diagram, dotted lines are control enable circuits and solid lines are AC and DC power circuits. The dot-dash line indicates those elements that lie inside the power panel. The dotted line between the robot DC power supply and system DC power supply indicates that the two power supplies are housed in the same box.

Main power

The main AC power enters at the external connections and travels down inside the corner post to the power panel. It passes through a main fuse, through the main switch, and out of the power panel to the UPS.

Pre-UPS, pre-emergency stop current

If your BioCel includes environmental control or a clean room, one or more electrical lines branch off before the UPS. These lines supply current to the following options:

- ❑ Cooling and heating water baths
- ❑ Environmental controller console that houses the iSeries controllers for the main BioCel (not for any separate environmental enclosures)
- ❑ Liconic incubators (environmental control, not transfer mechanism)
- ❑ UV lights and hood lights
- ❑ Clean-room output fan

These options therefore receive pre-UPS, pre-emergency stop current. They are not affected by emergency stops or interlocks but are also not buffered by the UPS from power outages.

UPS connections

If there is more than one UPS, they are connected in series so that current output from UPS 1 supplies the current input for UPS 2. The UPS, or UPSs, provide current backup to the monitor, PC, and communications hubs. If there is more than one computer and more than one UPS, one computer is fed from one UPS and the other computer is fed from the other UPS.

From the UPS, current is passed back into the power panel and through the main switch to the rest of the BioCel. This means that when you turn off the main switch, current is cut to the UPS, but it is also cut between the UPS and the main part of the BioCel, preventing the BioCel and its devices from draining the UPS. The UPS will continue to be drained by the computer, monitor, and communication hubs, which is why the shutdown procedure includes a step for turning off the UPS.

Pre-emergency stop

After the main switch, the electrical line enters a bank of connections in the power panel known as the pre-emergency stop block. A pre-emergency stop power strip is connected to this block. Devices wired from the pre-emergency stop power strip do not have their power cut when an emergency stop is activated. For example, the robot retains power after activation of an emergency stop because its DC power is supplied by the robot DC power supply fed from the pre-emergency stop block.

Emergency stop and interlocks

An electrical line from the pre-emergency stop block enters the emergency stop relay which controls the emergency stop circuit. One output from the emergency stop relay powers an interlock circuit switch. Another output supplies the BioCel power strips from which most of the BioCel devices and system components receive current (exceptions to this are the VPrep, VPrep pumps, Ethernet hub, and clean-room intake and recirculation fans). These devices and system components are all wired after the emergency stop and therefore receive no current when an emergency stop is activated. This includes the Bio I/O and cooling fans, which use DC electricity produced by the system DC power supply.

If an emergency stop is activated, the reset button must be pushed to reset the emergency stop relay to a position that allows current to flow.

The door interlock system is fed AC electricity from the emergency stop relay. If an overhead door is opened during a run, the interlock switch cuts power to the enable wires that lead to the robot, VPrep, VPrep pumps, and clean-room intake and recirculation fans. This stops the robot and VPrep motors and turns on their respective *z*-axis brakes. The brakes make sure that the VPrep head and robot do not drop, preventing damage and eliminating a crushing hazard.

The interlock switch is bypassed when the interlock override switch is activated by turning a key on the power panel. This maintains current in the enable wires even when the overhead doors are open.

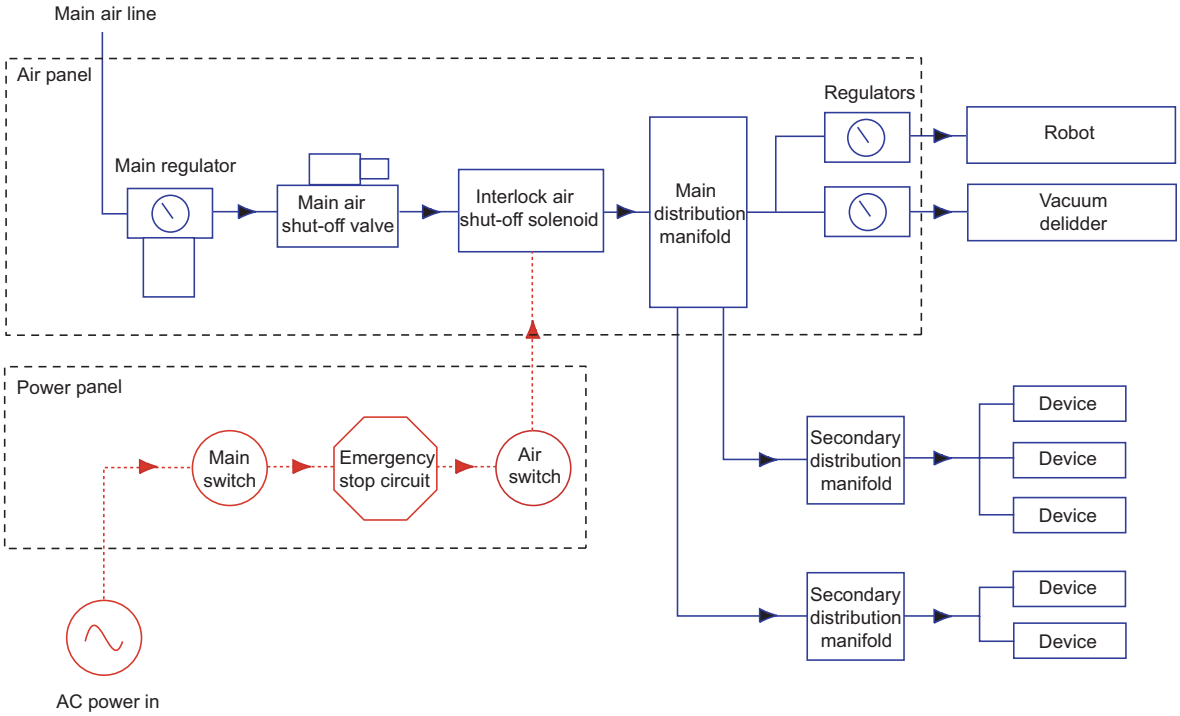
Related topics

For information about...	See...
Systems affected by interlocks and emergency stops	“Comparing interlock and emergency circuits” on page 62
Stopping a run with hardware	“Pausing and stopping a run” on page 60
Turning the BioCel off.	“Turning Off the BioCel” on page 66

Air system

Air and power interaction

The following diagram shows how the air and power systems interact. Becoming familiar with these systems will help you to understand the behavior of your BioCel and solve problems.



Air system description

Air is used on the BioCel to:

- ❑ Move parts, such as the robot gripper, VStack grippers, and VPrep shelves
- ❑ Create vacuums, such as for the suction-based vacuum delidder

The flow of air through the system is controlled by air pressure regulators. Many devices have their own, built-in regulators. Air pressure to other parts is controlled by regulators in the air panel of the BioCel.

The diagram above shows how air to the BioCel can be cut off during a run by:

- ❑ Pressing an emergency stop button
- ❑ Turning off the AIR switch on the power panel
- ❑ Turning off the main air shutoff valve in the air panel
- ❑ Turning off the main power in the power panel

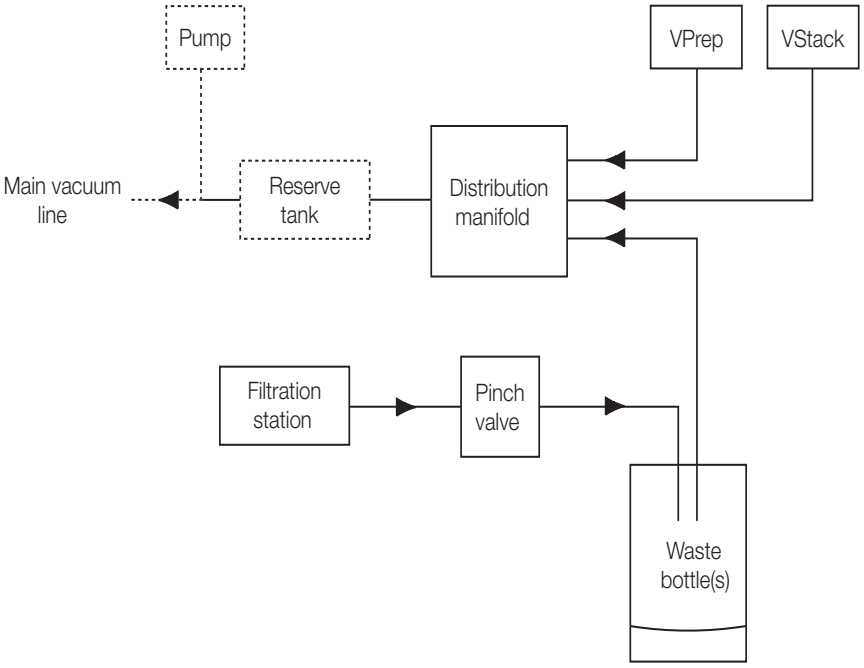
Related topics

For information about...	See...
Power system	“Power system” on page 27
Vacuum system	“Vacuum system” on page 31
Emergency stop	“Pausing and stopping a run” on page 60

Vacuum system

Vacuum flow diagram

The following diagram shows the vacuum flow in the optional vacuum system.



Vacuum system description

A vacuum may be used on the BioCel for:

- ❑ Filtration stations
- ❑ Suction to hold plates flat on a VPrep shelf or VStack stage
- ❑ Third-party devices

The vacuum can be supplied by a pump or house vacuum system. If a house vacuum system is used, the main vacuum line enters the BioCel with the other external connections. If a pump is used, it will be located on the floor of the BioCel.

A reserve vacuum tank may be used to ensure an instantaneous vacuum supply.

Waste liquid produced by filtration stations is collected in one or more waste containers.

Vacuums are also created in devices and accessories using vacuum ejectors that create the vacuum at the site where it is required, such as at the suction-based lid remover.

Related topics

For information about...	See...
Utility connections	"Utilities connections" on page 19
Lid removing devices	"BioCel accessories" on page 36

Computers and networking

Computer functions

The BioCel computer is used to:

- ❑ Control the BioCel and its devices.
- ❑ Input bar code labelling instructions.
- ❑ Store and export log files.
- ❑ Store and export data collected by plate readers.

  Note: Some plate readers have their own computer for storing data.
- ❑ Communicate with other computers on your organization's network for the exchange of files, reporting of errors, and accessing email.

Network cards

If you are an administrator and you need information about the network cards in the BioCel, see the *VWorks User Guide*.

Device computers

If your BioCel has a device that includes its own computer, such as the Zeiss Multimode plate reader, the same monitor is used for both computers. You can switch the monitor display between the two computers.

This feature is a property of the monitor switching device.

To switch the monitor display between two computers:

1. Rapidly press the SCROLL LOCK key on the keyboard twice.

Related topics

For information about...	See...
Networking	*VWorks User Guide*
Log files	*VWorks User Guide*
Using bar codes	❑ *VWorks User Guide* ❑ *VCode User Guide*

Adjusting the keyboard shelf

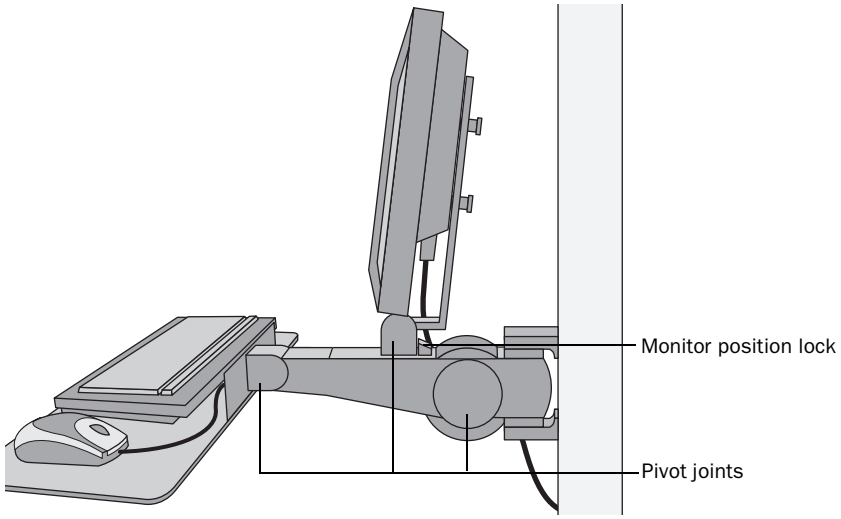
About this topic

This topic describes how to change the position of the computer shelf and monitor by adjusting the shelf at the appropriate pivot joints.

Adjusting the shelf

To adjust the position of the computer shelf:

1. Swivel the shelf at the appropriate pivot joints to make the adjustments. Use the labeled illustration below to locate the appropriate joint for adjusting.
2. To loosen or tighten the joints, pry off the joint covers and use a wrench to make adjustments.



Related topics

For information about...	See...
BioCel computer	"Computers and networking" on page 32
Power to the computer	"Power system" on page 27

Docking the mobile device table to the BioCel

About this topic

Some users might have a Velocity11 mobile device table which holds an external device that exchanges plates with the BioCel. The device is mounted to this mobile table, which in turn is mounted to the BioCel. This ensures the device's position does not change. This topic describes how to dock and undock the mobile table.

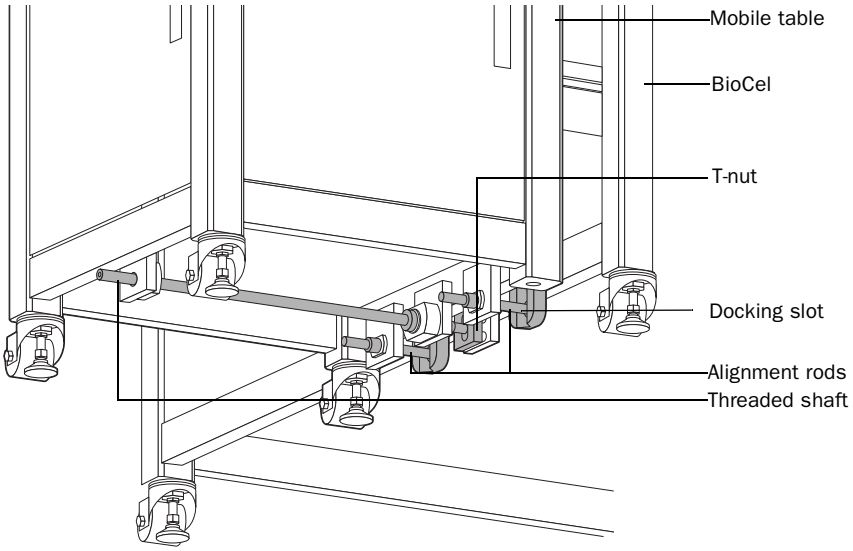
Read this topic if you have a device external to the BioCel and want to integrate it with a BioCel using a Velocity11 mobile table.

Connection description

Two alignment rods and a threaded shaft are all permanently mounted to the mobile table.

Two docking slots that receive the alignment rods and a T-nut that receives the threaded shaft are permanently mounted on the BioCel.

The following diagram shows the table docked.



Procedure

To engage the mobile table:

1. Move the mobile table so the alignment rods on the mobile table are within the docking slots on the BioCel.
2. Check to be sure that the threaded shaft is positioned in front of the T-nut.
3. Insert an 8-mm T-wrench in the end of the center threaded shaft and turn it clockwise to screw it into the T-nut that is bolted to the BioCel.
4. Continue tightening the shaft until it stops.

   The tightening of the threaded shaft will bring the alignment bolts into their proper position.

To disengage the mobile table:

1. Insert an 8-mm T-wrench in the end of the main threaded shaft and turn it counter-clockwise until it comes out of the T-nut.
2. Move the mobile table away from the BioCel.

Related topics

For information about...	See...
Accessories	“BioCel accessories” on page 36
Third-party devices	“BioCel devices” on page 35

BioCel devices

Definition

Devices are individual pieces of equipment that sit on the BioCel table and manipulate or enable the manipulation of plates.

Velocity11 device list

The following Velocity11 devices can be used on a BioCel.

Device	Description and Comments
PlateLoc	Thermal plate sealer
PlatePierce	Seal piercing station
VCode	Bar code print and apply station
VPrep	Pipetting station
VSpin	Plate centrifuge
VStack	Labware stacker
VersaScan	Plate reader

Third-party devices

There are many third-party devices that can be used on a BioCel. For a comprehensive list, see the *Device Driver User Guide*.

If there is product that you would like to add to your BioCel, please contact Velocity11 for customization information.

Related topics

For information about...	See...
BioCel accessories	“BioCel accessories” on page 36
BioCel specifications	“BioCel specifications” on page 15

For information about...	See...
BioCel features	“Basic description” on page 14

BioCel accessories

About this topic

This topic briefly describes the accessories available for the BioCel.

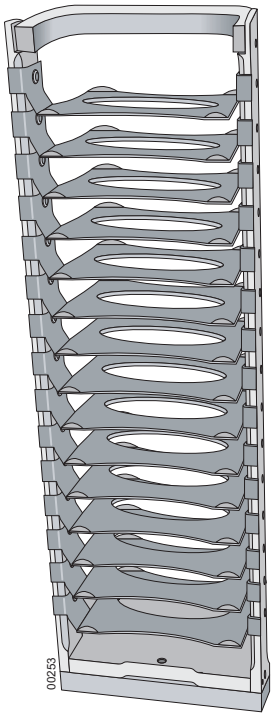
The following is a list of the available accessories for the BioCel. One or more of them may be present on your BioCel.

Accessory	Description and Comments
Auxiliary bar code reader	One or more bar code readers attached to a platepad or other device.
Environmental Enclosure	Glass-enclosed area for controlling temperature and humidity.
Tip box delidder	A static arm with suction cups that removes lids from tip boxes and drops them into the waste bin.
Lid hotel	See “Lid-removal devices” on page 38 for a description.
Plate hotel	See “Plate hotel” on page 36 for a description.
PlateHub	See“PlateHub” on page 37 for a description.
Transfer station	See “Transfer station” on page 37 for a description.
Translator linear robot	See “Translator linear robot” on page 38 for a description.
VShuttle	See “VShuttle” on page 39 for a description.
Weigh Pad	See “Weigh Pad” on page 40 for a description.

Plate hotel

A plate hotel stores a smaller number of plates than a VStack, but unlike the VStack, the robot has immediate, random access to all plates.

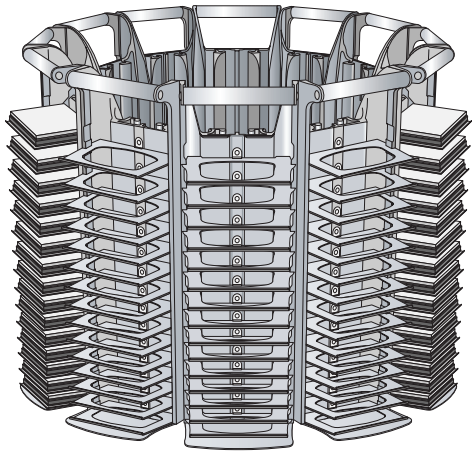
You can remove the hotel from the BioCel to access plates from the front, or leave the hotel in the BioCel and access plates from the back.



PlateHub

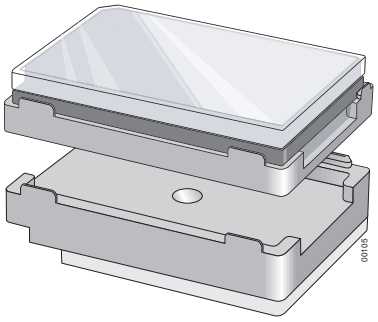
The PlateHub is a twelve-sided plate storage carousel with each side capable of storing up to 8 tip boxes or 16 plates for a total of 96 tip boxes or 192 plates.

The PlateHub must be used with the VWorks inventory management system. For information about setting up and using the VWorks inventory management system, see the *VWorks User Guide*.



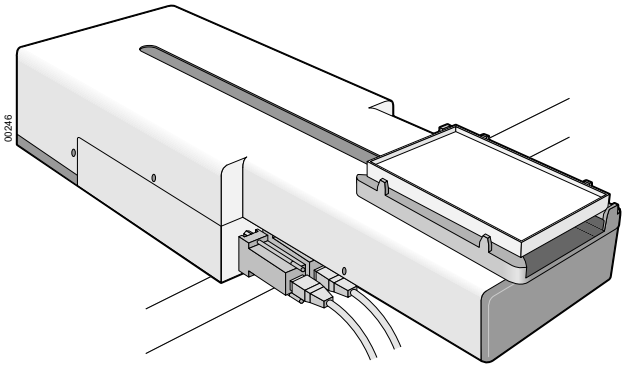
Transfer station

The transfer station is a special platepad used to transfer a plate between the StoreX and the BioCel robot. Some transfer stations, such as the one shown in the following diagram include two platepads.



Translator linear robot

The translator linear robot transports plates, one at a time, from a device (or robot) to a device (or robot). Because it translates plates, the two robots do not need to access the same positions or to define an envelope. The translator linear robot is available in multiple lengths. Adding a rotational motor enables it to turn the plate in any orientation.



Lid-removal devices

The BioCel supports two types of lid-removal device.

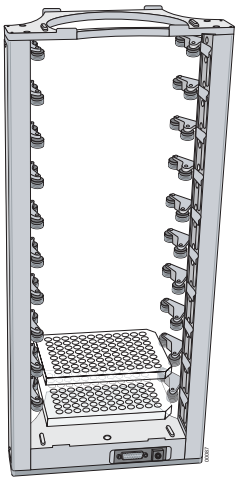
Vacuum-based lid remover

The vacuum-based lid remover sits over the waste opening in the table. It uses one or more suction cups to remove plate lids. The vacuum used to hold the lids is created by a vacuum ejector, which uses an air line rather than a vacuum line.

Lid hotel

The lid hotel is able to store lids so they can be returned to the plates that they were removed from. It includes a sensor at each lid position so the system knows which positions contain lids. Unlike a plate hotel, a lid hotel cannot be easily removed from the BioCel table.

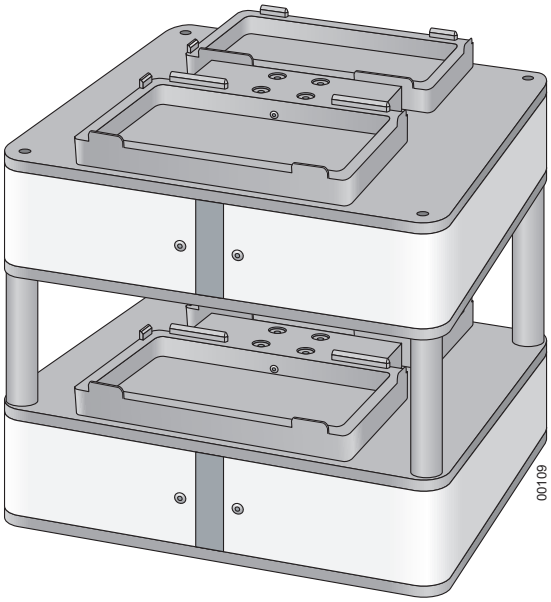
Lidded plates are brought to the lid hotel, so that the lids are held by the rollers. The robot then pulls the plate down, leaving the lid behind.



†*Concept developed by Novartis Pharma AG, NIBR/DT/IAT, Basel, Switzerland*.

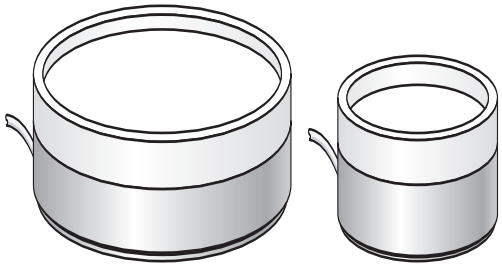
VShuttle

The VShuttle has two decks, each with a pair of rotating plate pads. It allows plates to move between robots while maintaining the same orientation.



Weigh Pad

Weigh Pads are available in different sizes. They report the percentage of liquid in a container that sits on the Weigh Pad.



Related topics

For information about...	See...
Adding and removing plates from the Plate Hotel	"Placing and removing plate hotel labware" on page 50
Using the PlateHub	*Device Driver User Guide*

Preparing for a run

3

This chapter describes how to start the BioCel and prepare it to run an existing protocol. All of the procedures in this chapter can be performed by someone with operator privileges.

This chapter contains the following topics:

Workflow for preparing the BioCel for a Run

Workflow steps

The general workflow for starting the BioCel and preparing for a run is given in the following table:

Step	For this task...	Look here to find the procedure...
1	Starting the BioCel	"Turning on the BioCel" on page 43
2	Logging in to Windows	*VWorks User Guide*
3	Starting VWorks and logging in	*VWorks User Guide*
4	Opening a protocol	*VWorks User Guide*
5	Setting protocol, general, error, and log options	*VWorks User Guide*
6	Performing a ready-state check	"Performing a BioCel ready-state check" on page 45
7	Preparing labware and accessories	"Preparing devices and accessories" on page 46
8	Preparing the plate hotel	"Placing and removing plate hotel labware" on page 50
9	Setting up a VSpin counterweight	"Setting up a VSpin counterweight plate" on page 51
10	Testing the auxiliary bar code reader	"Aligning and testing auxiliary bar code readers" on page 53
11	Setting up the PlateHub	"Setting up the PlateHub" on page 54
12	Performing pre-run checks	"Performing pre-run checks" on page 55

Related topics

For information about...	See...
Using BioCel Diagnostics	"Diagnostics" on page 69
Overriding the interlock	"Overriding the safety interlock" on page 90
Stopping a run	"Pausing and stopping a run" on page 60

Turning on the BioCel

About this topic

This topic describes how to turn on the BioCel.

To better understand what is happening as you turn on the BioCel, refer to the description of the "Power system" on page 27.

Procedure

To turn on the BioCel (part one):

1. Make sure that the main power line, air line, vacuum line (optional) and Ethernet cable (optional) are plugged in.
2. Make sure that external drains and water lines are attached if your BioCel uses them. Make sure the hoses are not kinked and that the hoses go through the appropriate pumps.
3. Make sure that any autofilling reservoirs are plugged in.
4. On the power panel, turn the main power switch to the ON position.

   The main power indicator light on the power panel remains off and this action does not appear to do anything. This is correct.
5. Open the side door next to the power panel.
6. Turn on the UPS (uninterruptible power supply) by pushing the power button.

   The UPS LEDs illuminate to indicate the UPS power status.

   If you have more than one UPS on your BioCel, make sure you turn on all of them. If the UPSs are connected in series, turn on the UPS that is connected to the main power first, followed by the remaining UPSs in the order in which they are connected together. If they are not connected in series, the order you turn them on does not matter.

   The blue light on the main power panel turns on.

   For more information about the operation of the UPS and the meaning of its status lights, see the UPS manufacturer's documentation provided with your BioCel.
7. On the power panel, turn the Robot power switch and System power switch (if your BioCel has one) to the ON position.

   The lights adjacent to the switches turn on.

To turn on the BioCel (part two):

1. Check that the power indicator lights on the Ethernet and RS-232 communication hubs are on.
2. If the computer monitor is off, turn it on.
3. Make sure that all devices are turned on.
4. Push the computer on/off button to start the computer.

   The computer performs self-tests, starts the operating system, and opens the **Welcome to Windows** screen.
5. Log in to Windows.

6. Close the side door.

   !! INJURY HAZARD !! For BioCel 1600 and 1800 users, always close the side doors when you finish the operation that led you to open them. Leaving side doors open creates a tripping hazard. It can also block escape routes in a laboratory.

7. Make sure that the emergency stop button on the power panel and the emergency stop buttons on the tabletop are in the out position.
8. Close the deck enclosure doors. If you have overhead doors, heed the following warnings.

   !! INJURY HAZARD !! Opened overhead doors are approximately 6 feet 2 inches (188 cm) above the floor. To avoid injury, be aware of the door height and position at all times when working around the BioCel.

   !! INJURY HAZARD !! The pneumatic braces on overhead doors should be adjusted so you can comfortably open and close the doors. If you have to strain to open a door, please contact the Velocity11 Service Center and ask to have the braces adjusted.

   !! DAMAGE HAZARD !! Always open and close overhead doors using their handles. Opening and closing overhead doors by pulling and pushing on their corners may crack the glass and damage the pneumatic braces.

9. Press the green reset button on the power panel.
10. If there is a secondary computer, for a third-party device such as a plate reader, turn it on and log in to Windows.

To turn on the BioCel (part three):

1. On the power panel:
   a. Check that the INTERLOCK light is on.

      This indicates that the enclosure doors are closed, provided the interlock override is not in use.

   b. Turn the AIR switch counterclockwise and check that the indicator light is on.

      This turns on air to the devices.

      If the air does not come on or the green reset button does not restore power to the devices, check the emergency stops, doors, and interlock key.

   c. If your BioCel has lights, turn the HOOD LIGHTS switch clockwise to ON.
2. If you use devices that require a vacuum created by a vacuum pump:
   a. Check that the gauge on the vacuum pump indicates a vacuum pressure.
   b. Make sure that the vacuum system is connected correctly.
3. If you use devices that require a gas supply, such as a StoreX incubator, make sure that the supply is turned on.

4. Make sure that all four lights on the power panel are on.

   If you have not previously selected the option to sense the air pressure automatically, check that the operating pressure is 100–110 psi (0.62–0.69 MPa) for the main regulator and 35–60 psi (0.27–0.34 MPa) for the robot regulator.

5. Turn on the devices if they are not already on.

   For more information, see the device's user guide.

Related topics

For information about...	See...
Connections for utilities	"Utilities connections" on page 19
Power panel	"Power panel" on page 21
Vacuum system	"Vacuum system" on page 31
BioCel hazard warnings	"Safety information about the BioCel" on page 8

Performing a BioCel ready-state check

Ready state conditions

When the BioCel is on and ready for a protocol to be opened:

- ❑ The status lights are off. (BioCel 1200 does not have status lights.)
- ❑ All devices are on, pneumatic devices are supplied with air, and a vacuum is supplied where used.
- ❑ The computer is on and ready for a user to log in to the operating system.
- ❑ The UPSs are charged, ready to provide battery backup if the main AC power supply is cut.
- ❑ All doors are closed.
- ❑ The interlock override is off so that opening an enclosure door or pressing an emergency button will activate the emergency stop circuit.

Related topics

For more information about...	See...
Status lights	"Monitoring the status of a run" on page 63
Turning on the BioCel	"Turning on the BioCel" on page 43

For more information about...	See...
Interlock override	❑ "Resolving robot errors" on page 87 ❑ "Overriding the safety interlock" on page 90
Checking the UPS charge	*VWorks User Guide*
How this procedure fits into the overall process of performing a run	"Workflow for preparing the BioCel for a Run" on page 42

Preparing devices and accessories

About this topic

This topic provides a quick reference for use when preparing Velocity11 devices and accessories for use on the BioCel.

For procedures for setting up third-party devices, see the manuals for the individual devices.

The procedures in this topic assume that the devices are already turned on and that you are familiar with the operation of the devices on your BioCel.

When to Use

Prepare devices and accessories after you have become familiar with the protocol.

Set up order

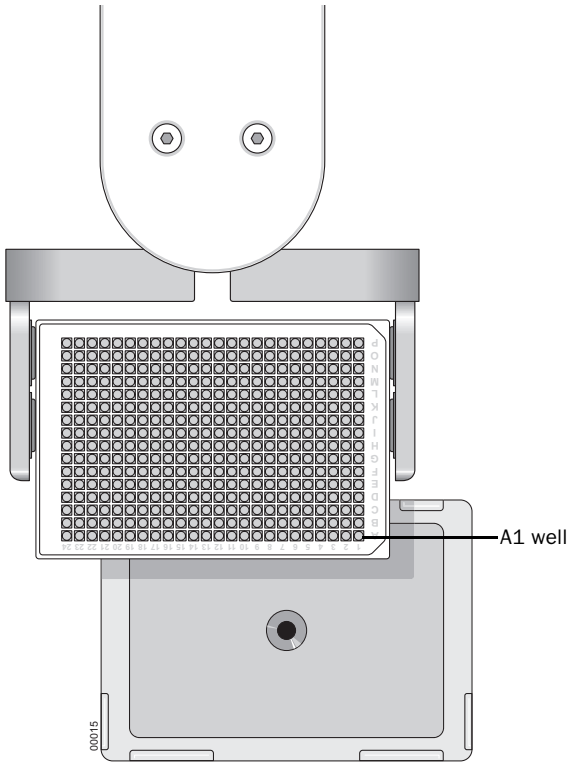
You would typically prepare the BioCel devices and accessories in the order presented in this topic. Using this order you first set up devices and accessories that have no time-sensitive elements, and can therefore be set up the night before the run. Leave the more complex preparations, which might use expensive and unstable reagents, until last.

Note: If the protocol includes User Message tasks to prompt you to perform some setup steps, such as placing counterweight plates, you do not have to include these steps in the setup.

About placing plates

Depending on the protocol you intend to run, you might need to manually place plates, tipboxes, reservoirs, or counterweights onto platepads, hotel shelves, VStacks, VSpin rotors, or VPrep shelves.

Always place plates so that the A1 well is in the top-left corner, as viewed by the robot. The following illustration is from the operator's perspective.



Waste bin set up

Empty the waste bin and replace it under the waste opening in the BioCel table.

!! INJURY HAZARD !! If your BioCel has an automatic door over the waste bin, use caution when removing or replacing the waste bin. If a protocol is running, the automatic door for the waste opening may open or close at any time. Low force is used to open and close the door, so the risk of serious injury is low. However, protect yourself by keeping away from the door mechanism at all times.

To remove the waste bin from its hanger:

1. Open the side door nearest the bin.
2. Hold the bin at the top-right corner with your right hand.
3. Lifting the front side of the bin upwards with your right hand, place your left hand underneath at the bottom-left corner.
4. Supporting the bin with both hands, lift it up and off the hanger, resting it on the BioCel floor.
5. Slide the bin out of the BioCel.
6. Close the side door.

To replace the waste bin on its hanger:

1. Open the side door nearest the bin.
2. Slide the empty bin into the BioCel until it lies underneath the waste opening, with the side of the bin resting against the hanger.

3. Lifting the front side of the bin upwards with your right hand, place your left hand underneath at the bottom left corner.
4. Using both hands, lift the bin up, over the hanger, and down so the hanger supports the underside of the lip.
5. Close the side door.

VStack setup

The general process for loading a VStack with plates for a run is described here. For more detailed procedures, see the *VStack User Guide*.

To set up a VStack:

1. Make sure there is no plate on the stage and then press the load/release button to disengage the plate from the grippers and allow removal of the rack.

   Note: A rack must be present in the VStack for the load/release button to work.
2. Remove the rack.
3. Fill with the correct labware.
4. Return the rack to a VStack that will deliver plates, according to the protocol you will run.

   As the racks can be positioned either way round, make sure that the A1 wells of the plates are in the top-left corner, as viewed by the robot.
5. After opening the protocol, press the load/release button to set the gripper.

PlateLoc setup

The general process of preparing a PlateLoc is described here. For more detailed procedures, see the *PlateLoc User Guide*.

To set up a PlateLoc:

1. Make sure there is enough seal stock on the roll for the run.
2. Make sure that the right support insert is installed for the plates you are using.
3. Open the PlateLoc Diagnostics to set default startup values. (The seal parameters are set in the Task Parameters within the protocol.)

VCode setup

The general process of preparing a VCode for a run is described here. For more detailed procedures, see the *VCode User Guide*.

To set up a VCode:

1. Make sure that there is enough label stock in the label source roll.
2. Make sure that there is enough media stock in the media source roll.

3. If the radius width of the label backing on the take-up roll is more than 1 inch (2.5 cm) wide, remove the label backing from the take-up roll, cut it, and re-attach the end.

   Too much label backing on the take-up roll can interfere with operation of the VCode.

4. Use VCode Diagnostics to perform a plate-labeling test.

VSpin set up

For more detailed information about operating the VSpin manually, see the *VSpin User Guide*.

The VSpin can spin one or two sample plates at the same time. Spinning one sample plate at a time always requires a counterweight plate. The counterweight plate can be added manually or robotically.

To set up a VSpin:

1. Do one of the following:
   - If you are using a manually loaded centrifuge counterweight, place the counterweight into bucket 2, using VSpin Diagnostics to open and close the VSpin door.
   - If you are using robot-loaded counterweights, make sure you have correctly set up counterweights in VWorks, placed the counterweights in the correct plate positions, and checked to make sure the buckets are empty.
   - If you are spinning two protocol plates and not using a counterweight, make sure you have set up the plate loading properly in VWorks and that both buckets are empty.

!! DAMAGE HAZARD !! To avoid a robot crash, always place the counterweight into bucket 2 and leave the door open with bucket 1 at the front. The sample plate will always be moved to bucket 1 by the robot.

Related topics

For more information about...	See...
Setting up a counterweight	"Setting up a VSpin counterweight plate" on page 51
Workflow this procedure belongs to	"Workflow for preparing the BioCel for a Run" on page 42
Testing an auxiliary bar code reader	"Aligning and testing auxiliary bar code readers" on page 53
Placing and removing hotel plates	"Placing and removing plate hotel labware" on page 50
Setting up a PlateHub	"Setting up the PlateHub" on page 54

Placing and removing plate hotel labware

About this topic

You can place plates into a plate hotel and remove plates from a plate hotel by:

- ❑ Removing the plate hotel from the BioCel first (if the hotel is not attached).
- ❑ Leaving the plate hotel on the table.

In general, it is better to add and remove plates while leaving the hotels in place. This way you are less likely to spill liquids in the plate wells, and it will reduce wear on the registration pins (metal dowel pins) and hotel bases.

Removing and replacing a hotel

!! IMPORTANT !! If you remove a plate hotel, you must put it back in the same place to maintain accurate teachpoints.

To remove a plate hotel:

1. Holding the top handle, lift directly upwards.

   The plate hotel lifts off its base.

To replace a plate hotel:

1. Holding the top handle, position the plate hotel above the base so that the dowels are aligned with the dowel holes.
2. Slowly lower the plate hotel onto its base.

Note: On some BioCels, the plate hotels are screwed onto the BioCel deck, in which case they cannot be removed.

Related topics

For more information about...	See...
Plate hotels	“Plate hotel” on page 36
How to orient plates	“About placing plates” on page 46

Setting up a VSpin counterweight plate

About this topic

This topic describes how to set up a counterweight for the VSpin.

A counterweight plate is always required when centrifuging a single plate in a VSpin device on a BioCel.

A counterweight plate is the same as a sample plate except that it is empty, or contains water to provide a more accurate balance. If a counterweight is not used, a load imbalance error will result. The load imbalance tolerance is 10 grams.

Using a counterweight plate and centrifuging one sample plate at a time does not typically increase the length of a protocol run, compared to spinning two sample plates at a time. This is because the centrifuge task is not typically the time-limiting step of a protocol.

If your spin time is short, about 0–45 seconds, the protocol will probably run faster if you load the counterweight by hand. If your spin time is 45 seconds or longer, the protocol will probably run fastest if you load two protocol plates and don't use a counterweight.

Options for loading plates

A counterweight should be the same weight as the sample plate.

You can load counterweights into a VSpin by any of the following methods:

- ❑ By hand, using VSpin Diagnostics software to open and close the centrifuge door and move the rotor.
- ❑ With the robot, using a combination of Robot Diagnostics and VSpin Diagnostics.
- ❑ Automatically, using the robot during a normal run.

  Setting up robotically loaded counterweights is done when creating a protocol.

  Some setup is required by administrators before you can load counterweights robotically.

Manually loading counterweights

To load a counterweight by hand:

1. Open VSpin Diagnostics software.

   The **VSpin Control** dialog box opens.

2. Follow the directions in the *VSpin User Guide* to open the VSpin door and load the counterweight.

   !! DAMAGE HAZARD !! To avoid a robot crash, always place the counterweight into bucket 2 and leave the door open with bucket 1 at the front. The sample plate will always be moved to bucket 1 by the robot.

About robotically loaded counterweights

For the robot to be able to load a counterweight:

- ❑ The platepad containing the counterweight must be associated in VWorks with the type of labware used for the counterweight so the robot knows how to pick it up.

  This association is created by an administrator in the manage counterweights database when creating the protocol.

- ❑ The Centrifuge task that uses the counterweight must specify from which device to pick up the counterweight.

  This is specified by an administrator when creating the Centrifuge task for the protocol.

- ❑ The counterweight plate must be placed by the operator on the platepad specified in the Centrifuge task.

!! IMPORTANT !! It is the operator's responsibility to make sure that the counterweight on the pickup platepad is of the correct type to balance the sample plate. VWorks does not generate an error if the type of counterweight picked up does not match the type of sample plate.

Note: The administrator who creates a protocol can add user messages to the protocol to remind the operator before a run which types of plate to put on which platepad.

Setting up robotically loaded counterweights

To set up robotically loaded counterweights:

1. Identify a process that includes a **Centrifuge** task, look at the plate instance and note the type of plate used for the process.
2. In the same process pane, click the **Centrifuge** task in the process.
3. In the **Protocol Task Parameters** toolbar, note the name of the device defined in the **Select counterweight to use** list.

   If you are unable to select a device, the administrator has not yet defined a counterweight.

   Note: If you have just added a counterweight and it does not appear in the list, click a different task and click back on the Centrifuge task.
4. Repeat the procedure for the remaining **Centrifuge** tasks in the protocol.

   It might help to create a table that looks like this one, which replicates the relevant information from the manage counterweights database:

Plate Type	Platepad
w	1
x	2
y	3

5. Place the counterweights on the platepads with which they are associated.

Related topics

For information about...	See...
Setting user message tasks	*VWorks User Guide*
Centrifuge task parameters	*VWorks User Guide*

Aligning and testing auxiliary bar code readers

About this topic

This topic describes the procedure for testing auxiliary bar code readers. If a device has a bar code reader, you should make sure that it is functioning and correctly aligned before starting runs.

Note: Auxiliary bar code readers are set up in the Device Manager.

Laser warnings

!! INJURY HAZARD !! Class II laser hazard. Looking directly at the laser light might seriously damage your eyes.

!! INJURY HAZARD !! Do not disassemble bar code reader sensor heads. Laser emission from the reader is not automatically stopped if the sensor head is disassembled.

!! INJURY HAZARD !! Unless following a procedure in a Velocity11 user guide, do not touch the white TEST button on the side of the bar code reader sensor head. This button turns on the laser creating the possibility of a long exposure to the light.

Procedure

To align and test a bar code reader:

1. Place a plate labeled with a bar code on the plate pad that has the reader you want to test.
2. Press and hold the white button labelled TEST on the side of the reader for about 4 seconds.

   When you release the button the green light next to the label LASER ON should remain on.
3. Adjust the reader, if needed, to have as many laser lines crossing the bar code as possible.
4. In VWorks, select **Tools > Test bar code reader**.
5. If you have more than one auxiliary bar coder reader, select the appropriate one from the list.
6. Click **Test**.

   The bar code appears in the bottom of the dialog box followed by the percentage read quality. Adjust the bar code reader until the percentage is as high as possible (usually about 50%).
7. Press the test button again to turn the laser off.

Related topics

For information about...	See...
Troubleshooting bar code reader errors	*VWorks User Guide*
Positioning the bar code reader	*VCode User Guide*
Workflow this procedure belongs to	"Workflow for preparing the BioCel for a Run" on page 42

Setting up the PlateHub

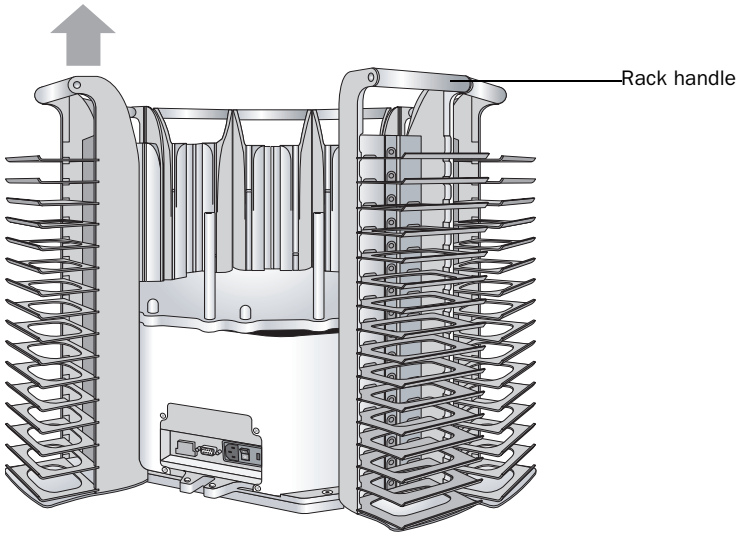
About this topic

This topic describes how to set up the PlateHub.

Procedure

To set up the PlateHub:

1. Make sure that the racks are in the appropriate locations as defined in the PlateHub profile.
2. Remove racks by grabbing the rack handle and pulling up to slide the rack out.
3. Fill the racks and slide them back into position.
4. Make sure rack locations and other PlateHub parameters are set correctly in the PlateHub Diagnostics.



Related topics

For information about...	See...
Changing PlateHub rack locations	*Device Driver User Guide*

For information about...	See...
Workflow this procedure belongs to	"Workflow for preparing the BioCel for a Run" on page 42
Preparing devices for a run	"Preparing devices and accessories" on page 46

Performing pre-run checks

About this topic

After turning on the BioCel, creating a protocol, and preparing the devices you would typically perform a number of pre-run checks. This topic describes the checks to perform.

Procedure

To check that the BioCel is ready for a run:

1. For each VPrep, make sure that any reservoirs and Micro Wash trays are on the correct shelves.
2. Make sure that there are no stray plates or lids in robot-accessible places, which include:
   - Platepads
   - VPrep shelves
   - VStack plate stages
   - VSpin buckets
   - VCode plate stages
   - PlateLoc plate stages
   - Plate hotel shelves
   - PlateHubs
   - Lid hotel bays
   - Lid removal devices
   - Third-party devices

   You can also set the robot to check all accessible positions at the beginning of a run.

   !! DAMAGE HAZARD !! Leaving a stray plate in the system might cause the robot, when holding a plate, to crash into the stray plate. A typical robot crash will damage the plates, spill samples and stop the robot. It might also damage the robot gripper pads.

3. For each VSpin, if you are using the robot to load the counterweight, make sure that the counterweight plate is on the correct platepad in the correct orientation and that the VSpin is empty.

   If you are manually loading a counterweight, make sure that the counterweight is loaded in the VSpin according to the protocol you will run, and that it is oriented correctly.

4. For each VStack, make sure that the stacker contains the plates specified by the protocol and that the labware and plate name displayed on the display panel match:

   - The actual labware in the stacker
   - The labware and plate name in the protocol

5. Make sure that the device air pressures regulators lie within the following ranges:

Device	Air Pressure (psi)	Air Pressure (MPa)
PlateLoc	87–90	0.60–0.62
VCode	85–90	0.56–0.62
VPrep	90–95	0.62–0.65
VStack	40–65	0.28–0.34
PlatePierce	75–80	0.65–0.55

   To find the current incoming air pressure for the PlatePierce, open the PlatePierce Diagnostics software.

6. For each VStack, open the VStack BioNet Diagnostics software to check that the grip pressure is appropriate for the type of plates that you are using.

   For more information about adjusting the grip pressure, see the *VStack User Guide*.

7. If your BioCel is equipped with environmental control, check that environmental settings are within acceptable ranges for the run.

8. Close all doors.

   !! DAMAGE HAZARD !! If running a BioCel 1600 or 1800, make sure that you move the computer monitor out of the way as you close the overhead doors.

9. If the interlock override is on, put the key into the interlock override keyhole in the power panel and turn it to the 12 o'clock position.

   This disables the interlock override and stops the robot if the door is opened.

Related topics

For more information about...	See...
Workflow this procedure belongs to	"Workflow for preparing the BioCel for a Run" on page 42

For more information about...	See...
Setting the robot to check all accessible plate positions	*VWorks User Guide*

Performing a run

4

This chapter describes the hardware procedures associated with performing a run. All of the procedures in this chapter can be performed by someone with operator privileges.

This chapter contains the following topics:

Pausing and stopping a run

About this topic

This topic describes the different ways to pause and stop a run and how the result is different depending on the method you choose.

About stopping a run set

Pausing or stopping a run set is the same as pausing or stopping a run.

Ways to stop a run

You can stop a run by:

- ❑ Clicking Pause in VWorks.
- ❑ Opening an enclosure door, or if the door is open, activating the safety interlock by turning the key.
- ❑ Pushing an emergency stop button. Runs stopped this way cannot be continued.

Before continuing with a stopped run

Before continuing with a run that was stopped, make sure that the system is in a valid state for the point of the protocol at which the run stopped. In other words, make sure that the partial completion of a task has not made changes that will cause an error or cause samples to be switched around when the run continues.

For example, errors can be caused when manually moving a plate to a location that should not have a plate.

Stopping a run using VWorks

Use VWorks to stop a run under normal circumstances, such as when you want to:

- ❑ Add or remove labware from stackers
- ❑ Clean up a spill
- ❑ Add reagent to a VPrep reservoir
- ❑ Diagnose a problem
- ❑ Perform an operation that is not part of the protocol

See the *VWorks User Guide* for a procedure.

Using an emergency stop button

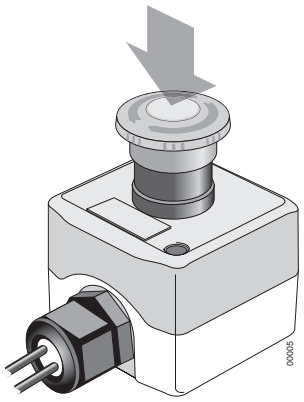
!! IMPORTANT !! You cannot continue with a run after using an emergency stop because VWorks must be restarted. Use this option for emergencies only.

In an emergency situation, you can instantly stop all accessible moving parts (does not include cooling fans) by pressing an emergency stop button. Emergency stop buttons are located on the table and the power panel.

Pressing an emergency stop button:

- ❑ Cuts power to the robot motor
- ❑ Cuts power to the instruments (except for the main power to any VPreps and VPrep pumps)

- ❑ Cuts power to the VPrep motors that move the head, and activates the brake on the head to prevent it from falling
- ❑ Stops the air supply to the instruments



Opening an enclosure door during a run

Provided the interlock circuit has not been overridden, you can open an enclosure door at any time during a run to instantly stop BioCel motion. The interlock light on the power panel will turn off when this happens and generates a robot error, after which you can either continue or abort the run or enter diagnostics.

When you close the door, an error dialog box opens.

If a VPrep was in motion when the door was opened, a VPrep Error dialog box might also be displayed.

!! IMPORTANT !! Do not use the door interlocks to routinely stop a protocol. The door interlocks are designed to be a safety backup system. Instead, use the pause button in VWorks.

Related topics

For more information about...	See...
Working with diagnostics software	“Diagnostics” on page 69
Recovering from an emergency stop	“Emergency stop error recovery” on page 87.
Recovering from an interlock error	“Door interlock error recovery” on page 87

Comparing interlock and emergency circuits

About this topic

This topic provides a table that lists the power circuits that are controlled by the interlock and emergency stop.

If you open an enclosure door during a run, the run will stop. When you close the door, and click Continue in the stop dialog box, the run will resume.

If you press an emergency stop button during a run, you will have to perform a more invasive recovery procedure and you cannot continue with the protocol.

Power components affected by the interlock and emergency stop

The following table shows how different components are affected by the door interlock circuit and emergency stop circuit.

Component	Interlock cuts?	Emergency stop cuts?
Bio I/O power	No	No
Cooling fan power	No	No
Device power, such as platepad bar code reader	No	Yes
Module power	No	Yes (except VPrep)
Robot motor servo power	Yes	Yes
Robot system power	No	No
System air	No	Yes
VPrep motor servo power	Yes	Yes
VPrep pump module motor power	Yes	Yes
Cooling or heating waterbaths	No	No
Liconic incubator environmental control	No	No
UV lights	No	No
Clean-room output fan	No	No

Related topics

For more information about...	See...
Recovering from an emergency stop	“Emergency stop error recovery” on page 87.
Recovering from an interlock error	“Door interlock error recovery” on page 87

For more information about...	See...
Stopping a run	"Pausing and stopping a run" on page 60

Monitoring the status of a run

About this topic

After starting a run, the operation of the BioCel should be monitored. This topic describes how to monitor the status of a run and points to other topics that describe how to monitor specific aspects of a run.

What to monitor

After starting a run, monitor the operation of the BioCel. Exactly what you do to monitor a run depends on the protocol that you are using. For example, you might need to:

- ❑ Compare the motions of the robot to the protocol tasks being completed.

  You can identify the task that is currently being performed from the position of the green ball in the process panes. Because VWorks can schedule more than one task at a time, there might be more than one green ball displayed.

- ❑ Add and remove labware.
- ❑ Empty the waste bin.
- ❑ Empty liquid waste containers.
- ❑ Fill liquid reservoirs.
- ❑ Replace an empty roll of PlateLoc seal or bar code labels.

!! IMPORTANT !! No errors are reported when a liquid waste container becomes full or a liquid reservoir becomes empty unless they are on a Weigh Pad, VPrep WeighShelf, or some third-party devices. To guard against the problem of a full waste container or empty reservoir container, the protocol writer can incorporate User Message tasks into the protocol to remind the operator at the appropriate steps in the protocol. Alternatively, operators can set their own timer alarms to remind them to fill reservoirs and empty a waste containers at the appropriate time.

System monitoring

What information is monitored by the BioCel during a run depends on the options selected for the protocol. For more information, see the *VWorks User Guide*.

Monitoring BioCel status

The BioCels 1600 and 1800 have status lights, located on the frame, that enable you to monitor the current status of the system from a distance. The status of your BioCel is indicated by one of the following status light configurations.

Note: Monitoring the status of a BioCel 1200 is done through VWorks.

Blue status lights

A blue status light is located on each BioCel frame post. Different light patterns indicate different BioCel conditions.

Light Pattern	Status
All on solid	Run progressing normally
All off	Not currently running
All blinking simultaneously	Run error
One light on each post blinking twice, followed by the other light on each post blinking twice	Run progressing normally but with interlock bypass in use
All blinking in circular pattern	Run complete

Traffic light status lights

A single red, yellow and green light fixture is located above one of the BioCel's frame posts. Different light patterns indicate different BioCel conditions.

Light Pattern	Status	Comment
All off	Idle	System is not in operation. VWorks might not be running.
Green	Normal operation	System is in normal, error-free operation.
Yellow	Warning-running	The system has encountered an error. Plates are continuing to process but the error requires attention.
Yellow	Warning-complete	System has completed operation, but errors occurred during the runset resulting in error plates.
Red	Warning-idle	System is idle, but an error was encountered during the compiling of the protocol that will keep the protocol from running.

Light Pattern	Status	Comment
Red	Error	During operation, an error occurred and the system cannot continue without user intervention.
Yellow	Error	During operation, a network or disk space error occurred. The system will stop until the error is fixed.

Related topics

For information about...	See...
Setting error options	*VWorks User Guide*
Monitoring the UPS	*VWorks User Guide*
Troubleshooting an error	❑ "Maintenance and troubleshooting" on page 85 ❑ *VWorks User Guide*
Stopping a run	"Pausing and stopping a run" on page 60
Setting up the waste bin	"Preparing devices and accessories" on page 46
Using the User Message task	*VWorks User Guide*

Cleaning up after a run

About this topic

This topic provides a list of tasks to perform on the BioCel after the last run. For more information about cleaning up after the run, see *VWorks User Guide*.

Procedure

To clean up after a run:

1. Remove sample plates that have been used.
2. Remove manually placed plates from platepads, hotel shelves, VPrep module shelves, and so on.
3. If necessary, remove the counterbalance plate from VSpin devices.
4. Wash all items, such as, reservoirs, tubes and manifolds, that were contacted by liquid.
5. Empty the waste bin.
6. Check run logs.

7. Turn off environmental controls and temperature-controlled water baths.

Related topics

For information about...	See...
Turning off the BioCel	"Turning Off the BioCel" on page 66
Shutting down the software	*VWorks User Guide*
Working with logs	*VWorks User Guide*

Turning Off the BioCel

About this topic

This topic describes how to shut down the BioCel. The procedure for turning off the BioCel is the same as the procedure for turning on the BioCel except that you do not need to press the green reset button.

When to use

Shut down the BioCel when you intend to:

- ❑ Move it
- ❑ Leave it unused overnight or for an extended period of time

Procedure

To shut down the BioCel:

1. Make sure you have performed a clean-up after the last run.
2. Exit VWorks.
3. If you have a secondary computer:
   a. Exit any software running.
   b. Shut down the secondary computer (through Windows).
      Wait for the operating system to shut down.
4. Shut down the main computer through Windows.
   Wait for Windows to exit.
5. Turn off the computer monitor.
6. If you use modules or devices that require a vacuum pump, optionally turn off power at the pump if the pump has an on/off switch.
7. Turn off the **Robot** power on the power panel.
8. Turn off the **System** power on the power panel, if applicable to your BioCel.

9. Push the UPS button that turns off power output to all parts of the system.

   If you have more than one UPS on your BioCel, make sure that you turn them all off. For more information about turning off the UPS, see the user manual for the UPS.

10. On the power panel, turn the main power switch counterclockwise to the off position.
11. If moving the BioCel, unplug the air, Ethernet and main power cables.

Related topics

For information about...	See...
Post-run clean-up	“Cleaning up after a run” on page 65
Stopping a run	“Pausing and stopping a run” on page 60
Monitoring a run	“Monitoring the status of a run” on page 63

Diagnostics

5

This chapter explains how to use diagnostics software to control the robot. For information about how to use the diagnostics software for Velocity11 devices, see the user guide for the device. For information about how to use the diagnostics software for third-party devices and Velocity11 devices not sold as standalone products, see the *Device Driver User Guide*.

This chapter contains the following topics:

About Diagnostics software

Background

The BioCel can be controlled in real time directly through the VWorks Diagnostics software using simple commands.

Diagnostics software is used for:

- ❑ Troubleshooting
- ❑ Setting teachpoints
- ❑ Performing manual operations outside a protocol
- ❑ Creating and editing profiles

For example, if an error occurs during a run that leaves a plate where it should not be and the VStack stage out of its home position, you can use Robot Diagnostics to move the plate and VStack Diagnostics to return the VStack stage to its home position.

Types of diagnostics software

Instruments and robots manufactured by Velocity11 include their own diagnostics software. You can find instructions for using this software in the relevant user guide.

Related topics

For information about...	See...
Diagnostics for Velocity11devices	Relevant Velocity11 device user guide
Diagnostics for third-party devices	*Device Driver User Guide*
Bio I/O Diagnostics	“Using Bio I/O Diagnostics” on page 71
Robot Diagnostics	“Using Robot Diagnostics” on page 72

Using Bio I/O Diagnostics

About this topic

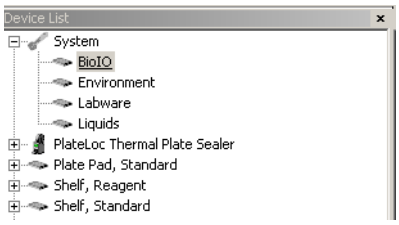
The Bio I/O Diagnostics software is primarily used by Velocity11 personnel for troubleshooting communication problems between VWorks and the BioCel devices. During troubleshooting, Velocity11 personnel might ask you to assist with some tasks in Bio I/O Diagnostics.

This topic describes how to open the Bio I/O Diagnostics in VWorks3 and test an output. If you are running VWorks4, the procedure might be different.

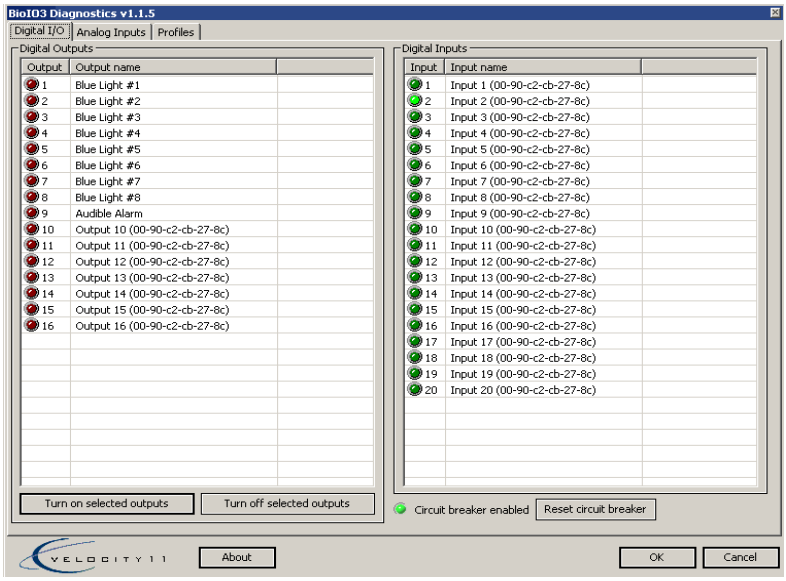
Procedure

***To use the Bio* I/O Diagnostics:**

1. Open the Bio I/O Diagnostics:
   a. Click the **Device Manager** tab.
   b. In the **Device List** expand **System**, if closed, and then double-click **BioIO**.



   The Bio I/O Diagnostics opens.



2. To test an output, select it from the list and then click **Turn on selected outputs**. The indicator next to the output lights up. The output remains on until you turn it off.

Related topics

For information about...	See...
What the Bio I/O does	"Hardware control components" on page 22

Using Robot Diagnostics

About this topic

This topic explains how to move the robot using Robot Diagnostics software.

For general information about diagnostics software, and to learn how to open diagnostics software, see "About Diagnostics software" on page 70.

!! DAMAGE HAZARD !! **Before you use Robot Diagnostics software to move the robot, make sure that there is nothing on the table that the robot can crash into. Move the robot slowly.**

Robot axes

The robot has three axes of movement:

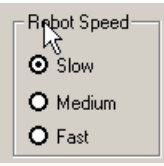
Axis	Description
r	Radial. The horizontal distance, in millimeters, between the back of the robot's gripper in the home position and the back of the robot's gripper in the current position.
t	Angle. The angle, in degrees, between the center point of the robot's gripper in the home position and the center point of the robot's gripper in the current position.
z	Height. The vertical distance, in millimeters, between the center point of the robot gripper at the home position and the center point of the robot gripper at the current position.

Setting robot speed

To set the speed of robot movement:

1. In the **Robot Speed** area, select **Slow**, **Medium**, or **Fast**.

   Note: We recommend using the **Slow or Medium** setting for manual control.

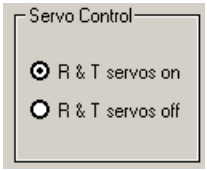


Moving the robot by hand

Robot movement is controlled by motor servos. You can move the robot by hand in the plane of the robot arm, but you cannot change its height.

To move the robot by hand:

1. In the **Servo control** area, select **R & T servos off**.



2. Holding the end effector, which is the last segment of the arm, slowly move the arm to where you want it, in the horizontal plane of motion.
3. Select **R & T servos on** to return control to VWorks.

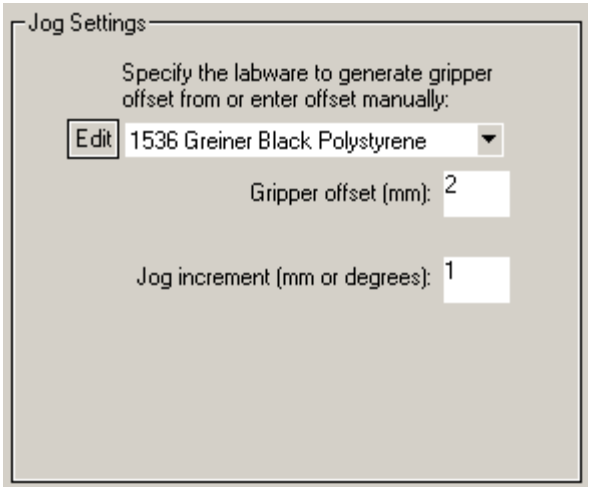
Jogging the robot

You can move the robot in increments, in either the *z*-axis, *r*-axis, or *t*-axis. The process of moving in increments is called jogging.

!! DAMAGE HAZARD !! Before you jog the robot, make sure that there is nothing on the table that the robot can crash into. Move the robot slowly and keep the jog increment small until you are certain that there is no obstruction.

To jog the robot:

1. If you intend to pick up a plate, in the **Jog Settings** area, either:
   - Select a type of labware from the list box, in which case the appropriate value is automatically entered into the **Gripper offset** text box.
   - Enter the value directly into the **Gripper offset** text box.

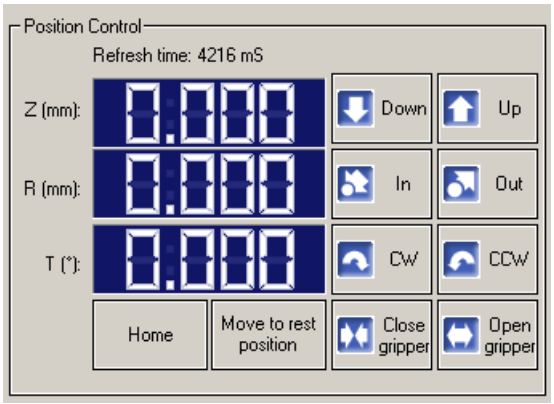


2. In the **Jog settings** area, check, and possibly change, the following settings:

Setting	Comments
Gripper offset	The height above the teachpoint, which is typically 2–3 mm. You will rarely need to change this value from the values automatically entered for the plate type. However, you can type a value into the Gripper offset text box if you need to. Be aware however, that this is a temporary change. To change it permanently, you need to make the change in the labware editor.
Jog increment	The distance or angle to move the robot at each jog.

3. In the **Position Control** area, click one of the following buttons:

Button	Moves the robot...
Down	Down, decreasing the *z*-axis value
Up	Up, increasing the *z*-axis value
In	In towards the center of the robot's radius, decreasing the *r*-axis value
Out	Out from the center of the robot's radius, increasing the *r*-axis value
CW	Clockwise, decreasing the *t*-axis value
CCW	Counterclockwise, increasing the *t*-axis value



The readout displays the current coordinates of the robot in relation to the home position.

Moving the gripper

You can open and close the robot's gripper in a single movement.

To open or close the robot's gripper:

1. In the **Position Control** area, click **Open gripper** or **Close gripper**.

Homing and resting the robot

Homing and resting the robot both move the robot to the home position, but there are some important differences between these two actions.

Homing

Each axis of the robot has a sensor that is triggered when the robot is in a specific position. This position defines the home position for that axis.

When the robot is homed, it moves the *r*-axis, followed by the *t*-axis and then the *z*-axis until the sensors on each axis are in the triggered position. This home position serves as a positional reference for all other points, with *z*, *r*, and *t* coordinates of 0, 0, 0.

You should home the robot after a high-speed crash. The robot homes automatically when you start VWorks.

Resting

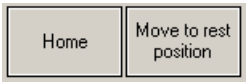
When the robot is moved to the rest position, it takes the shortest path to the *z*, *r*, *t* coordinates of 0, 0, 0. Provided the home coordinates have not changed, this position is the same as the home position.

Resting the robot is faster than homing the robot because it moves at the speed set in Robot Speed and the arm moves faster because it is not using the sensors.

You may choose to move the robot to the rest position to quickly move it out of the way when you are working on the table.

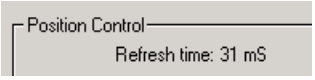
To home or rest the robot:

1. Click **Home** or **Move to rest position**.



Checking communication time

The Position Control group box displays the time interval between the receipt of positional coordinates from the robot. This refresh time should be less than 45 milliseconds. If it is consistently greater than this, contact the Velocity11 Service Center.



Reading a plate's bar code

You can use diagnostics software to read a plate's bar code for troubleshooting purposes.

To read a plate's bar code:

1. Place the plate with the bar code on a platepad.
2. Select the teachpoint from which to pick up the plate in the **Position 1** list.

3. In the **Position 2** list, select **Nowhere**.
4. For Position 1, enter a value for the approach height.

   The approach height is the height to raise the robot gripper above the teachpoint when the robot moves the plate horizontally towards or away from the place plate position.

   Make this value large enough to avoid catching the plate on a lip, or other protuberance, as it is moved from a position, but not so high that the robot hits a shelf or other object above the position.

   This value is device-dependent. For most devices a value of 8–10 mm will work. Start with a value of 6 mm for picking a tipbox from a VPrep shelf or removing a plate from the VSpin when making these settings.

   !! IMPORTANT !! If approach heights are set incorrectly, it could result in a robot crash.
5. Click **Pick & Place 1->2**.

   The robot moves to Position 1 and picks up the plate.

   The bar code is read and displayed in the **Bar Code Testing** group box.

Ignoring robot errors

You have the option of ignoring robot errors when using Robot Diagnostics. You may do this, for example, when you want to simulate the movement of plates without using plates, which would otherwise give a plate sensor error.

This setting only affects the use of Robot Diagnostics. It does not affect VWorks error settings.

To ignore errors when using Robot Diagnostics:

1. Select **Ignore errors**.

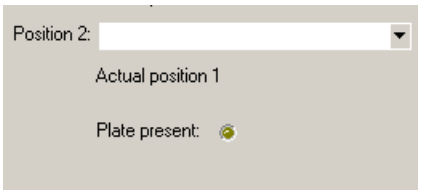
Checking the plate sensor

The plate sensor in the robot gripper might need to be recalibrated if it is not sensing a plate when there is a plate in the gripper.

You can also use the plate sensor indicator to check the function of the plate sensor.

To check the plate sensor:

1. Move the robot to a position that has a plate.
2. Move up by the robot gripper offset for the plate in question.
3. Close the gripper.
4. Look at the **Plate present** indicator.



If the indicator is on, the plate sensor is registering a plate in the gripper.

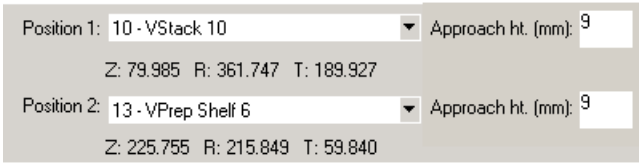
5. Open the gripper.

Moving the robot to a teachpoint

You can move the robot directly to any teachpoint when there is no plate in the gripper.

To move the robot to a teachpoint:

1. From the **Position 1** or **Position 2** list, select the teachpoint to move to.



2. Make sure grippers are open and click **Move to point** for either **Position 1** or **Position 2**, as appropriate.

!! DAMAGE HAZARD !! When you use the Move to point function, the robot does not use the Approach height. Instead, it moves to the point using the most direct path. If there is a plate in the gripper, the plate might contact a lip on the device, causing a robot crash. Also, if there is a plate at the position and the robot grippers are closed, there will be a robot crash.

Moving a plate between teachpoints

You can move the robot from one teachpoint to another, and then back again. If the first teachpoint has a plate, the robot will pick it up and move it to the second teachpoint.

To move a plate between teachpoints:

1. Select one teachpoint from the **Position 1** list.
2. Select the other teachpoint from the **Position 2** list.
3. Set the **Approach ht** for each position.
4. To move a plate from:
   - Position 1 to Position 2, click **Pick & Place 1->2**
   - Position 2 to Position 1, click **Pick & Place 2->1**

Locating the teachpoint file

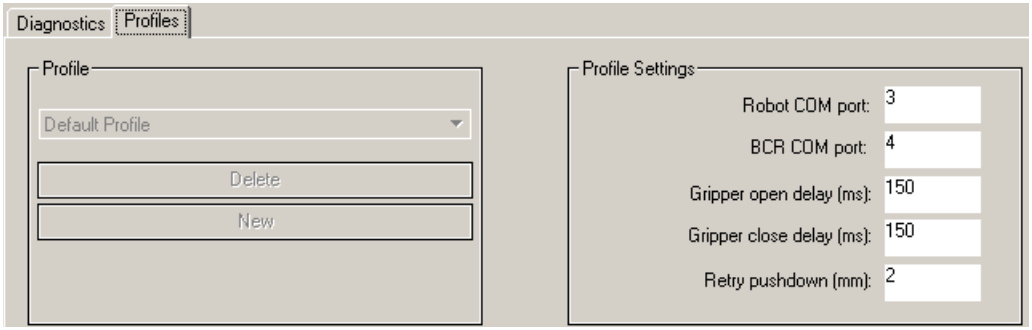
You might need to locate the robot teachpoint file so you can send it to us for troubleshooting purposes.

To locate the teachpoint file:

1. View the path to the file at the bottom of the Robot Diagnostics dialog box.

Changing robot profile settings

Robot-specific settings are grouped into a profile. BioCel platforms with more than one robot use more than one profile. You should rarely, if ever, need to change the robot profile on your BioCel.



!! IMPORTANT !! If you change the robot profile and later click Save & Exit, the values are changed in VWorks, which will affect protocols that you run afterwards.

To change robot Profile Settings:

1. Type the new value into the text box for the parameter you want to change, using the following table as a guide.

Parameter	Description
Robot COM port	The communications port to which the robot is connected.
BCR COM port	The communications port to which the robot's bar code reader is connected.
Gripper open delay	Interval between the time the gripper starts to open and the time the robot starts to depart from a plate. If this value is set too low, the gripper might not have completely released the plate before the robot moves, causing the plate to be dragged.
Gripper close delay	Interval between the time the robot gripper starts to close and the time to departure. If this value is set too low, the plate might be held too high in the gripper.

Parameter	Description
Retry pushdown	Pushdown is a robot action used with filtration stations, vacuum platepads and vacuum shelves on VPrep pipettors. The purpose of the action is to flatten a plate on the stage. If, during operation, the vacuum seal indicator indicates the absence of a seal, the robot will push down on the plate in an attempt to create a seal. The value for this parameter is the distance pushed down in millimeters.

Related topics

For information about...	See...
Robot errors	“Resolving robot errors” on page 87
Moving to a teachpoint	“Moving the robot to a teachpoint” on page 77

About fine-tuning robot teachpoints

Where teachpoints are used

Teachpoints are axis position coordinates needed by:

- ❑ The robot, to be able to accurately pick up and move plates to and from devices
- ❑ VPrep heads, to be able to accurately position pipette tips into plate wells
- ❑ VSpin centrifuges, to be able to accurately position the buckets in relation to the door
- ❑ VStack stackers, to be able to accurately position the plate stage during operation

Teachpoint coordinates are relative to the robot’s or device’s home position and are set up by Velocity11 before shipping and verified at your site on installation. However, you might occasionally need to fine-tune teachpoints.

For information about device teachpoints, see the relevant user manual. This topic covers only robot teachpoints.

Robot teachpoints defined

When teachpoints are initially set at the factory, they are defined as described in the following table.

Axis	Teachpoint position is set when the...
r	Bumper of the plate calibration tool touches the back of the gripper.
t	Plate is centered in the gripper.
z	Top of the plate calibration tool bumper is flush with the top surface of the gripper fingers.

The goal of fine-tuning robot teachpoints

!! IMPORTANT !! Accurate placement of a plate is a property of both the picking position's teachpoint and the placing position's teachpoint. Therefore when you are fine-tuning a teachpoint, always consider the teachpoint of the position that a plate is collected from.

The ability to tolerate a deviation from the optimal teachpoint depends on the tolerance in the geometry of the device that receives the plate.

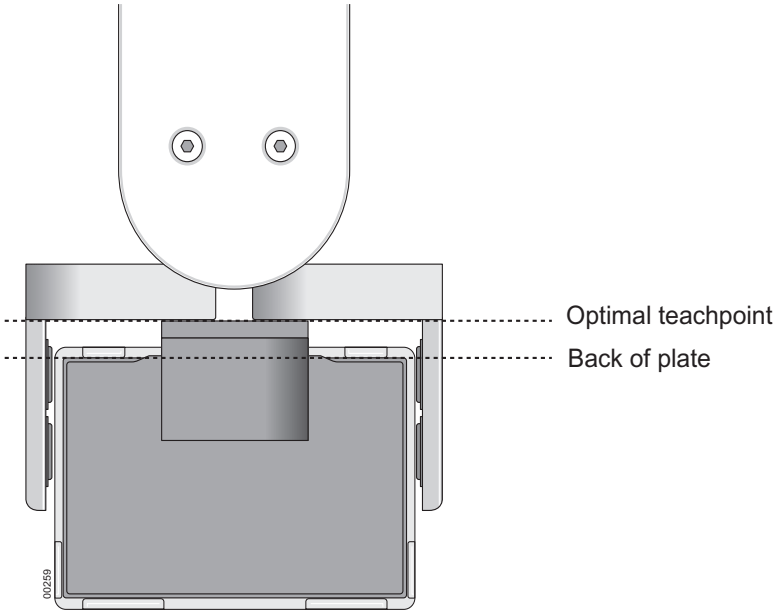
It is less important for the absolute value of the teachpoint for a plate position to be optimal than it is for the teachpoints of the position at which a plate is picked up and the position to which the plate is delivered to work together. To explain further, if the teachpoint at the pick position is 1 mm less than the optimum r-value and the teachpoint at the place position is 1 mm less than the optimum, the end result is that the plate is placed accurately at the position. Also, if the teachpoint of the picking position has an *r*-value that is low by 1 mm and the teachpoint of the placing position has an *r*-value that is high by 1 mm, the combined effect is that the plate is placed 2 mm forward of where should be.

Correct and incorrect teachpoint examples

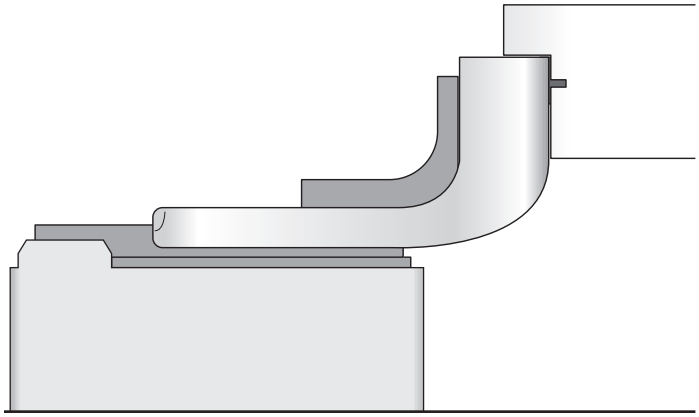
Using the teachpoint plate calibration tool, the following diagrams demonstrate both a correct and incorrect example of a teachpoint.

Correct teachpoint example

The first diagram shows where the gripper picks up the teachplate calibration tool on a platepad when the *r*-teachpoint is set accurately. Notice that the optimal teachpoint is where the inside surface of the gripper back is aligned flush with the back of the teachplate tool.

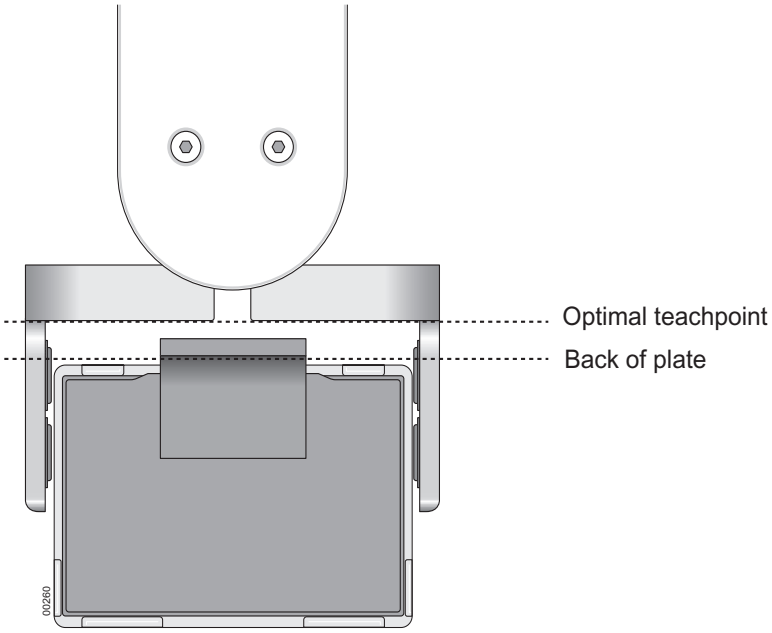


The next diagram shows a side view of the correct teachpoint to illustrate the correct *z*-teachpoint.

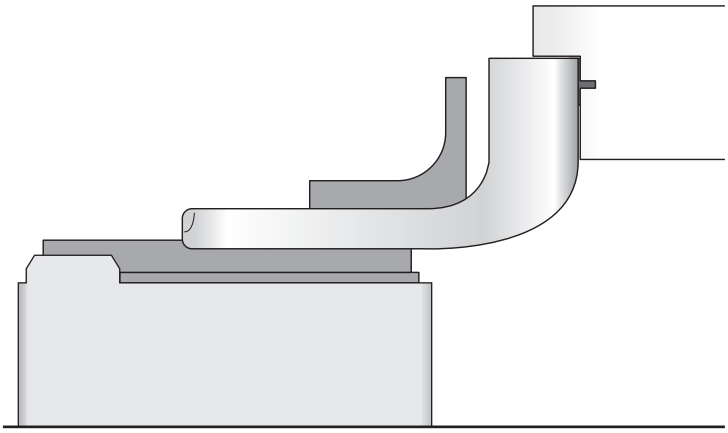


Incorrect teachpoint example

In the next diagram, the teachpoint is incorrect. The back of the robot gripper stops before aligning with the back of the teachplate calibration tool, and the teachplate is held too far back in the gripper. The result is the plate is delivered too far forward and thus does not sit correctly on the platepad.



The next diagram shows a side view of an incorrect *z*-teachpoint.



Related topics

For information about...	See...
Fine-tuning procedure	“Fine-tuning a robot teachpoint” on page 83
Robot Diagnostics	“Using Robot Diagnostics” on page 72

Fine-tuning a robot teachpoint

About this topic

This topic describes how to fine-tune a robot teachpoint using the teachplate calibration tool.

The process of fine-tuning robot teachpoints is empirical. You make small, incremental adjustments until a plate can be accurately picked up and placed at a position.

Note: The smallest increment of movement is 0.05 mm.

!! IMPORTANT !! Accurate placement of a plate is a property of both the picking position's teachpoint and the placing position's teachpoint. Therefore when you are fine-tuning a teachpoint, always consider the teachpoint of the position that a plate is collected from.

!! IMPORTANT !! To help standardize the process, it is imperative to select one platepad to use as a reference picking position for all teachpoints. On most BioCels this is platepad 1.

Teachpoints are manipulated through the Robot Diagnostics software. You should be familiar with the features of this software before working with teachpoints.

Before you start

Before you start, make sure you have a teachplate calibration tool to use for the fine-tuning.

Procedure

To fine-tune a robot teachpoint (part one):

1. Examine the teachpoint coordinates for other devices that you know should be aligned in one or more axes with the device whose teachpoint you are working on.

   For example, all stackers sitting directly on the table and mounted in equivalent hole patterns should have very similar *z*- and *r*-values. This might give you a clue about whether the teachpoint is inaccurate and in which direction.

2. If this is the first time that your BioCel has had its teachpoints fine-tuned, select a platepad to use as your picking reference position.

   If you have fine-tuned teachpoints before, make sure you use the same platepad for the picking reference position.

3. Click **Diagnostics**.

4. Click **Robot**.

   This opens the **Robot Diagnostics** window.

5. In the **Position 1** list, select the reference platepad.

6. In the **Position 2** list, select the device whose teachpoint you want to fine-tune.

   Remember that you should check both the location places to and picked from.

7. Check the values for the approach heights.

   The approach height is the height to raise the robot gripper above the teachpoint before the robot moves the plate horizontally towards or away from the place plate position.

   Make this value large enough to avoid catching the plate on a lip, or other protuberance, as it is moved from a position, but not so high that it hits a shelf or other object above the position.

   This value is device-dependent. For most devices a value of 8–10 mm will work. Start with a value of 6 mm for picking a tipbox from a VPrep shelf when making these settings.

   !! IMPORTANT !! If approach heights are set incorrectly, it could result in a robot crash.

To fine-tune a robot teachpoint (part two):

1. Set the **Robot Speed** to **Slow**.
2. Click **Pick & Place 2>1**.
3. Carefully watch how the robot places the plate and listen to the sounds it makes.

   If the plate catches the lip of the plate position, because the *r*- or *t*-value is incorrect, it can make a double-click sound. If the *z*-value is incorrect the plate will make a dropping sound or a crunching sound, depending on whether the value is too high or low.
4. When you have established the direction and approximate magnitude of the inaccuracy, set the jog increment.
5. Click **Move to Point** for **Position 2.**
6. Click the appropriate jog button to move the gripper, and click **Teach point here** for **Position 2**.

   This temporarily applies the new teachpoint setting. If you click **Cancel** the new setting will not be saved.
7. Using the **Pick & Place** function, move the back plate to the reference position, repeat the move to the place position, and look to see if the accuracy has improved.
8. Continue with this iterative process until the plate is placed correctly.
9. Click **OK** to save the new teachpoint.

Related topics

For information about...	See...
Robot Diagnostics	“Using Robot Diagnostics” on page 72
Teachpoints	“About fine-tuning robot teachpoints” on page 79

Maintenance and troubleshooting

6

This chapter tells you how to keep your BioCel in good working order and what to do when you encounter a problem.

This chapter contains the following topics:

Routine maintenance

About routine maintenance

The BioCel does not require a lot of routine maintenance.

In general, practice good housekeeping by cleaning up spills and following the clean-up procedures.

Once a month, check that the:

- ❑ Robot gripper pads are not torn, cracked or otherwise worn
- ❑ Overhead doors remain at the correct height
- ❑ Liquid handling tubing is not torn, cracked or discolored
- ❑ Air filter is clean
- ❑ Main air pressure reads 100–110 psi (0.62–0.69 MPa)
- ❑ Table top is free of debris, such as pieces of chipped plates and microtubes

Checking the air filter for replacement

If the house air supplied to the BioCel is clean, the air filter should rarely need to be changed.

To check the air filter for replacement:

1. Open the side door behind the air panel.
2. Look at the front of the air filter container.

   If there are any oil droplets or general dirt visible on the filter, the filter should be changed. Contact the Velocity11 Technical Support for instructions.

Device maintenance

For information about routine maintenance of the individual devices, see the relevant device documentation.

Replacing fluorescent tube lights

The interior of the BioCel has standard type fluorescent tube lights that occasionally need to be replaced. We recommend that two people work together to replace a light.

To replace a fluorescent tube light:

1. If your BioCel has a light switch, turn off the lights.
2. At the light itself, unplug the power cord that goes to the light.
3. Remove the screws securing the light cover.
4. With one person working at each end of the light, remove the light cover by sliding the cover up and pulling out at the bottom.
5. Remove the lamp.
6. Install a new, identical lamp.
7. Replace the cover.

Related topics

For information about...	See...
Cleaning up post-run	"Cleaning up after a run" on page 65
Locating the air filter	"Air panel" on page 22

Resolving robot errors

About robot errors

Robot errors are among the most common errors that occur during a run.

Types of robot error

There are four types of robot error.

Error Type	Error Message
❑ Door interlock ❑ Emergency stop	While placing at <*location*> robot emergency stop or door interlock detected
Plate sensor	Failed to sense plate when picking from <*location*>
Servo	While placing at <*location*> a servo error has occurred

Door interlock error recovery

A door interlock error occurs when an overhead door is opened during a run.

To recover from a door interlock error:

1. Make sure that the system is in a valid state for the protocol. In other words, make sure that you have not made changes that will cause a further error, such as moving a plate to a position that should not have a plate, or cause samples to be switched around, such as moving a plate from one VStack to another.
2. Close the overhead door that was opened.
3. Make sure that the interlock light on the power panel is on.
4. In the **Robot Error** dialog box, select **Retry**.

If you are an administrator you can use the interlock override to continue the run with the overhead doors open.

Emergency stop error recovery

With an emergency stop error, power is cut to modules and devices, and VWorks loses information about the state that the modules and devices are in. This prevents VWorks from continuing the protocol.

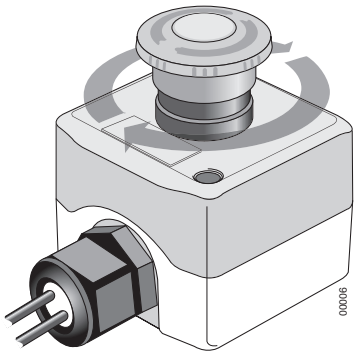
!! IMPORTANT !! You cannot continue the current protocol run after an emergency stop has been activated.

After an emergency stop button is pushed, all device motion stops and error messages are generated in the error log as the scheduler attempts to continue with the protocol.

To recover from an emergency stop:

1. Clean up any spills or debris if necessary.
2. Twist the activated emergency stop button in a clockwise direction.

   The spring-loaded button pops out.



3. Close any open doors.
4. Push the reset button on the power panel.

   A **stop** dialog box opens in addition to the **Robot Error** dialog box that is already open.
5. Activate the interlock override by turning the key in the power panel.
6. If the protocol includes a pipette task, in the **VPrep EStop detected** dialog box, click **Retry**.
7. If there is a plate in the gripper, move it back to the pickup location:
   a. Establish the location that the plate was picked from.
   b. In the **Robot Error** dialog box, click **Diagnostics**.
   c. Gently hold the plate in your fingers, or ask another operator to do the same.
   d. Click **Open Gripper** to release the plate to your hand.
8. Close all overhead doors.
9. Remove the interlock override by turning the key in the power panel.
10. Push the reset button on the power panel.
11. Click **Abort Process** in the **stop** dialog box.
12. Close and restart VWorks.

    When you restart VWorks, communication with the devices that lost power is re-established.

Plate sensor error recovery

Before you can recover from a plate sensor error, you must establish the cause of the error.

To recover from a plate sensor error:

1. If there is no plate in the gripper, establish whether the plate was:
   - Knocked out of the gripper.

     In this case, establish what knocked the plate out of the gripper.
   - Missing from the location that the robot attempted to pick it up from.

     In this case, place the correct plate in the location and click Retry in the **Robot Error** dialog box.
   - Not picked up.

     In this case, there may be a problem with either the labware definition for the plate or a teachpoint. Check the teachpoint at the position where it failed to pick up the plate, and also the teachpoint at the previous position. If there does not seem to be a teachpoint error, contact Velocity11.
2. If the plate is held in the gripper but is not seated correctly, establish whether the plate was positioned correctly at the pickup location.
   - If the plate was not positioned correctly at the pickup location, reposition the plate and click **Retry** in the **Robot Error** dialog box.
   - If the plate was positioned correctly at the pickup location, there may be a problem with the approach or departure height. Alternatively, there might be a problem with the plate, the labware definition for the plate, a teachpoint, or the plate sensor. In this case, you should contact Velocity11.

Servo error recovery

The robot's motion is controlled by a servo system that cuts power to the robot if it encounters resistance to movement that is slightly higher than that expected from just the inertia of the robotic arm holding a plate. Additionally, when the power is cut, a servo error is generated.

The great majority of servo errors occur when the plate being carried crashes into another plate sitting on a device.

To recover from a servo error:

1. Check the BioCel deck to determine the cause of the collision and remove the obstruction. For example, it may be a plate from a previous run.
2. Check the plate being held by the robot to make sure that it has not been damaged or spilled.
3. Check to be sure that the plate did not slip in the grippers during the collision.
4. If the plate has not slipped and was not damaged during the collision, click **Retry**.

5. If the plate has slipped during the collision (or was damaged), click **Diagnostics** and move the plate manually:
   a. Move the robot to a position that is easy for you to access.
   b. While holding the plate with your hand, click **Open gripper** to release the plate from the robot.
   c. Place the plate at the destination location manually.
   d. Close **Diagnostics**.
   e. Click **Ignore and continue**.
6. If the crash was particularly hard, you might need to re-home the robot.

   Click **Home**.

   The robot uses servo motors with encoders that always track the robots position, even during a collision. Only re-home the robot after a severe collision.

Related topics

For information about...	See...
Using the interlock override	"Overriding the safety interlock" on page 90.
Emergency stop circuits	"Power system" on page 27
Power panel	"Power panel" on page 21
Checking teachpoints	"About fine-tuning robot teachpoints" on page 79

Overriding the safety interlock

About this topic

At times you might need to override the safety interlock so you can perform tasks on the BioCel deck. This topic describes how to temporarily override the safety interlock.

This procedure should only be performed by an administrator.

Procedure

!! INJURY HAZARD !! Only fully trained BioCel Administrators should have access to, and use of, the safety interlock key. Use the override only when you know how the robot and VPrep modules will move during the protocol, when the robot speed is slow, and when you have taken measures to keep away from the areas in which the robot and VPrep modules will be moving.

To override the safety interlock:

1. Insert the override key into the interlock key hole on the power panel and turn it clockwise to the zero position.

2. In the **Robot Error** dialog box, select **Retry**.

Related topics

For information about...	See...
Opening a door during a run	"Pausing and stopping a run" on page 60
Safety interlocks and emergency stops	"Comparing interlock and emergency circuits" on page 62

Resolving plate placing errors

About plate placing errors

If the robot does not place a plate accurately on a device, the problem could be with the:

- ❑ Teachpoint for either that device or for the previously scheduled device, including approach height.

  In this case, see for more information about fine-tuning teachpoints.
- ❑ Device, because it was moved or reconfigured by someone else who did not re-teach the teachpoints.
- ❑ Plate.

  In this case, replace the plate with one that is not deformed.

Relate information

For information about...	See...
Fine-tuning teachpoints	"Using Robot Diagnostics" on page 72

Resolving lid removal problems

Vacuum-based lid remover problems

If your BioCel has a vacuum-based lid remover, you may occasionally find that it does not function properly. If this happens, you will need to adjust the vacuum sensor that provides feedback on whether a lid is attached to the suction cups.

This adjustment requires you to turn the air on and off through the Bio I/O Diagnostics software while making incremental adjustments to the screw head that lies in the hole on the side of the station. To do this you have to remove the side panel on the vacuum delidder device.

For help with this procedure, contact the Velocity11 Service Center.

Lid hotel problems

Preventing problems

To prevent problems with a lid hotel, make sure that:

- ❑ The rollers are free of debris and dirt.
- ❑ The robot holds the plates below the lids.
- ❑ Bar code labels are not applied to the lids connecting them to plates.
- ❑ Stacks of labels are not allowed to build up on the plates.
- ❑ The lids are free of sticky residue from labels.

Solving problems

If you receive a lid detection error, try the following:

1. Check that the plate type in the protocol is correct for the plate.
2. Make sure that the sensors are working:
   a. Open the lid hotel diagnostic software.
   b. Depress the delidder arms on the left side of the delidder (from the robot's perspective) and check to see if the green light on the delidder device and in the delidder diagnostics lights for the arm you pressed.
   c. If the green light does not turn on, make sure the delidder is plugged in and configured correctly and that the other arms work (their green lights turn on).

      If one arm does not work, a setscrew may need adjustment. To do this, call Velocity11 Service Center.
3. Check the lid hotel teachpoints to make sure that they are correct.

   If you need help with this, contact the Velocity11 Service Center.

Related topics

For information about...	See...
Using the lid hotel	*VWorks User Guide*

For information about...	See...
Stopping a run	"Pausing and stopping a run" on page 60

Recovering from a power outage

About this topic

This topic describes behavior of the BioCel when the power is cut to it and what to do to recover from the outage.

What happens when the power is cut

If there is a main power outage the following events will occur:

- ❑ The UPS starts to beep while providing power to the devices.

  Note: Power to the environmental control will be cut.
- ❑ VWorks writes an error message to the log, displays an error message on the screen and notifies you are if you have email notification configured.
- ❑ The BioCel continues to run (execute a protocol) until the UPS charge passes the thresholds specified in VWorks at which time VWorks closes and the computer performs an orderly shutdown.

Recommended actions during a power outage

If you are running a protocol and are near the end, you might consider letting it continue until it is finished.

If you have just started running a protocol and/or require environmental control for your protocol and you anticipate a lengthy outage, you might consider stopping the run.

What happens when the power is restored

If the BioCel was not shut down during the power outage, the system will receive power, the UPS recharges, and the protocol (if running) continues.

If the BioCel was shut down during the power outage, it remains off until you turn it on.

Related topics

For information about...	See...
Setting the VWorks UPS threshold	*VWorks User Guide*
Turning on the BioCel	"Turning on the BioCel" on page 43

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Note: You can search our technical documentation on our website at www.velocity11.com

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