Bravo Automated Liquid-Handling Platform

User Guide

Agilent Technologies

Notices

User Guide Part Number

G5409-90006

December 2009

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Contents

Preface

This guide describes how to use the Bravo Automated Liquid-Handling Platform, also known as the Bravo Platform.

This preface contains the following topics:

- "About this guide" on page viii
- "Accessing Automation Solutions user information" on page ix

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About this guide

Who should read this guide

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

Job role	Responsibilities
Installer	Unpacks, installs, and tests the Bravo Platform before it is used.
Integrator	Writes software and configures hardware controlled by the VWorks software.
Lab manager, administrator, or technician	• Manages the VWorks software • Develops the protocols that are run on it • Manages the Bravo Platform • Develops training materials and standard operating procedures for operators
Operator	Performs the daily production work on the Bravo Platform and solves routine problems.

What this guide covers

This guide covers the description, installation, setup, and operation of the Bravo Platform.

This guide does not provide instructions for the VWorks software or third-party software. For more information about these topics, see the relevant user guides for these products.

Software version

This guide documents Bravo Diagnostics version 16.1.36 or later.

Related guides

Use this guide in conjunction with the following:

- *VWorks Automation Control Setup Guide*. In addition to installation instructions, this guide explains how to define labware and labware classes, liquid classes, and pipetting techniques.
- *VWorks Automation Control User Guide*. Explains how to create protocols, and set task parameters for each device in the system

If the Bravo Platform is a device in a third-party system, see the relevant third-party system guides.

Related information

For more information about...	See...
How to access different formats of this user guide	"Accessing Automation Solutions user information" on page ix
Reporting problems	"Reporting problems" on page 92
Bravo Platform safety information	"Safety guidelines" on page 1

Accessing Automation Solutions user information

About this topic

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

Where to find user information

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

- *Knowledge base*. The help system that contains information about all of the Automation Solutions products is available from the Help menu within the VWorks software.

- *PDF files*. The PDF files of the user guides are installed with the VWorks software and are on the software CD that is supplied with the product. A PDF viewer is required to open a user guide in PDF format. You can download a free PDF viewer from the internet. For information about using PDF documents, see the user documentation for the PDF viewer.

- *Agilent Technologies website*. You can search the online knowledge base or download the latest version of any PDF file from the Agilent Technologies website at www.agilent.com/lifesciences/automation.

Accessing safety information

Safety information for the Agilent Technologies devices appears in the corresponding device user guide.

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

Using the knowledge base

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

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

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

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

Opening the help topic for an area in the VWorks window
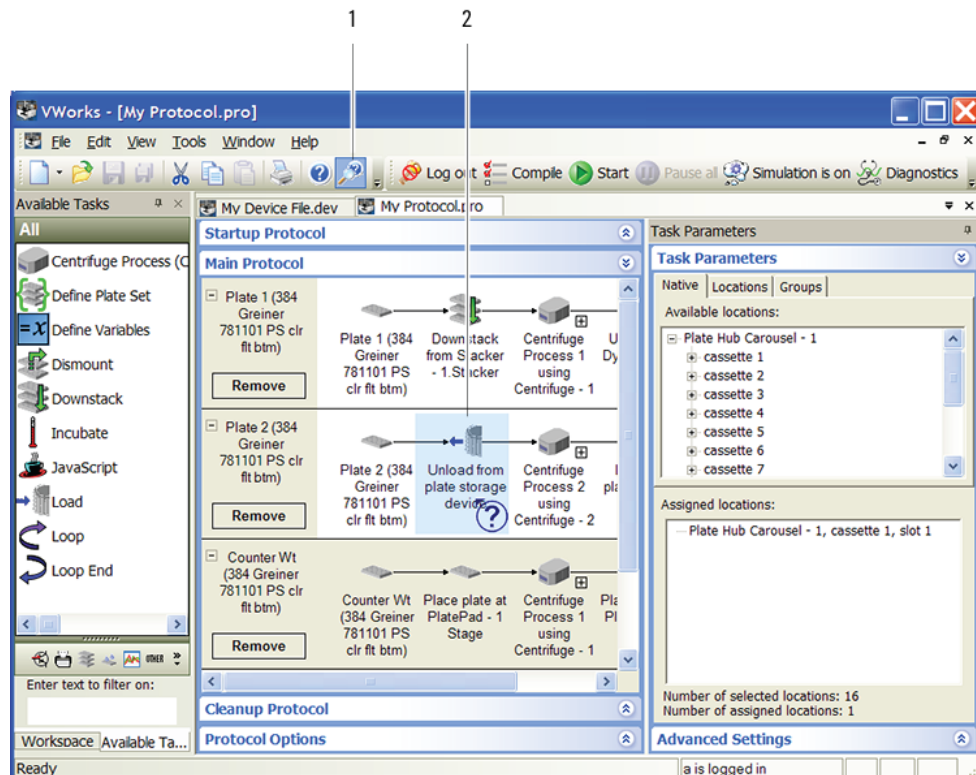
To access the context-sensitive help feature:

1 In the main window of the VWorks software, click the help button.

The pointer changes to . Notice that the different icons or areas are highlighted as you move the pointer over them.

2 Click an icon or area of interest. The relevant topic or document opens.

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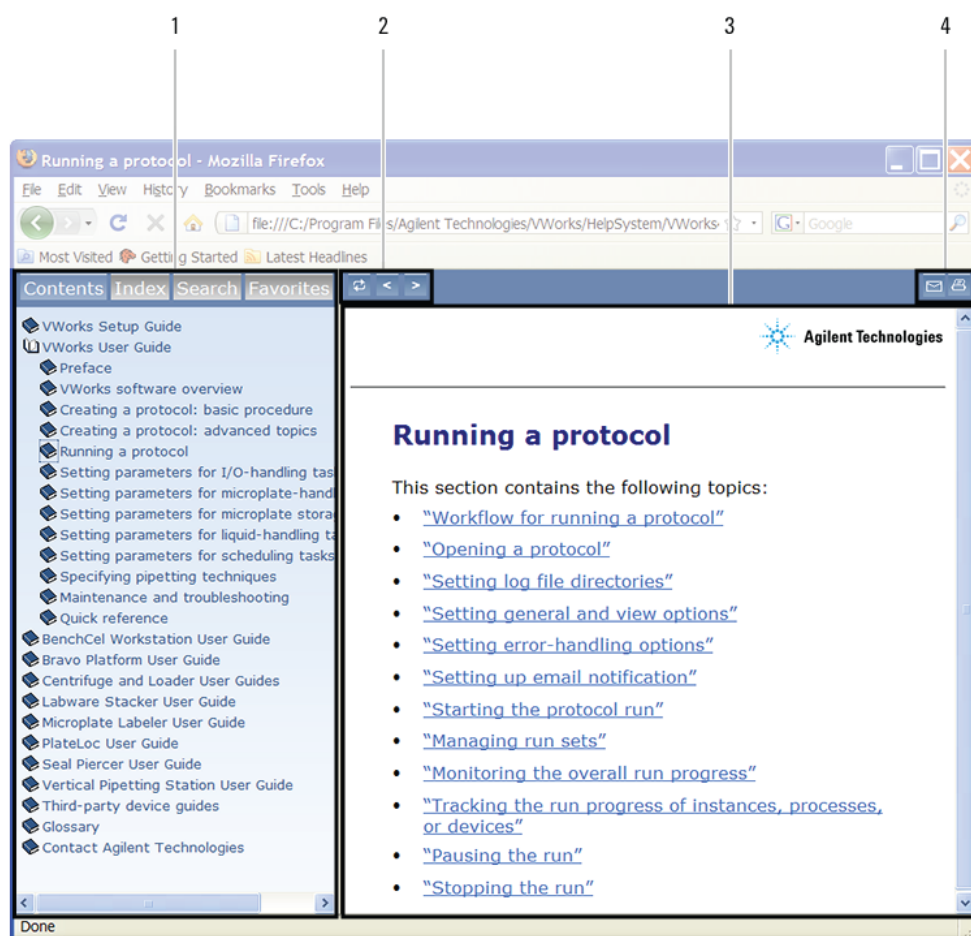
Item	Feature
1	*Navigation area.* Consists of four tabs: • *Contents.* Lists all the books and the table of contents of the books. • *Index.* Displays the index entries of all of the books. • *Search.* Allows you search the Knowledge Base (all products) using keywords. You can narrow the search by product.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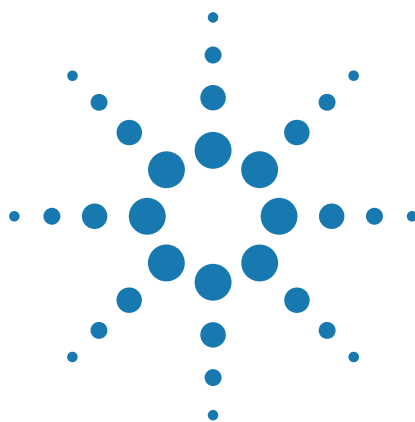
Related information

For more information about...	See...
What this guide cover and who should read it	"About this guide" on page viii
Reporting problems	"Reporting problems" on page 92
Bravo Platform safety information	"Safety guidelines" on page 1

1
Safety guidelines

This chapter gives you an overview of the Bravo Platform and contains the following topics:

- "General safety information" on page 2
- "Stopping in an emergency" on page 3
- "Potential safety hazards" on page 4

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General safety information

About this topic

The Bravo Platform is designed for safe operation. Under normal operating conditions, you are protected from moving parts and hazardous voltage. However, you must be aware of the potential hazards and understand how to avoid being exposed to them.

Before using the Bravo Platform

Before using the Bravo Platform, make sure you are properly trained in:

*   General laboratory safety
*   The correct and safe operation of the Bravo Platform
*   The correct and safe operation of other lab automation systems or components used in combination with the Bravo Platform

Intended product use

> ⚠ **WARNING**   Do not remove the Bravo Platform exterior covers or otherwise disassemble the system or device. Doing so can cause injuries and damage the Bravo Platform.

> ⚠ **WARNING**   Using controls, making adjustments, or performing procedures other than those specified in the user guide can expose you to moving parts, hazardous voltage, and laser radiation.

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

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

Safety labels

Pay attention to any safety labels affixed to your device. A safety label consists of a warning symbol. A description of the warning and information that will help you to avoid the safety hazard are provided in this user guide.

Related information

For more information about...	See...
Safety hazards	"Potential safety hazards" on page 4
Stopping the Bravo Platform in an emergency	"Stopping in an emergency" on page 3
Reporting problems with the Bravo Platform	"Reporting problems" on page 92

Stopping in an emergency

About this topic

This topic describes when and how to stop the Bravo Platform while it is in operation.

When to use this procedure

Use this procedure to:

- Abort a pipette head movement immediately
- Abort a run in an emergency situation

Do not use this procedure to pause and continue a run. If the stop button is pressed while the pipette head is aspirating or dispensing, the pipetting accuracy might be impaired. If you want to pause and then continue a run, use the Pause button in VWorks software.

Procedure

To stop the pipette head motion:

1 Press the red button on the pendant.

This disables the Bravo Platform motors, causing all motion to stop.

2 Release the disable button by turning it clockwise.

3 In the message box, click one of the action buttons to re-enable the motors in the head.

Note: Pressing the go button on the pendant will not re-activate the pipette head.
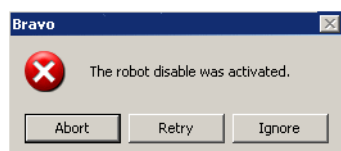
If you want to...	Then click...
Abort the command or task	Abort
Attempt re-execution of the command or task	Retry
Ignore the current command or task and proceed to the next command or task	Ignore

Related information

For information about...	See...
Pausing and continuing a run	*VWorks Automation Control User Guide*
Safety hazards	"Potential safety hazards" on page 4
Reporting problems	"Reporting problems" on page 92

Potential safety hazards

About this topic

This topic describes potential hazards that you can encounter when using the Bravo Platform.

Safety interlock

⚠️ **WARNING** **Operating the Bravo Platform without safety guards or a light curtain connected to the safety interlock circuit increases the risk of injury.**

The Bravo Platform has a safety interlock circuit that must be closed for the system to operate. A jumper can be used to close the safety interlock circuit, but the European directives regarding the safe operation of machinery require that you always connect the safety interlock to a safety guard, Light Curtain, or enclosure.

Moving parts injury hazard

⚠️ **WARNING** **The Bravo Platform has moving parts that can injure you if you deviate from the procedures given in this guide.**

Not all circumstances can be foreseen and more serious injury is possible. It is the responsibility of every operator to follow warnings and safety labels and keep away from the instrument whenever it is likely to move.

⚠️ **WARNING** **Keep your fingers, hair, clothing, and jewelry away from the Bravo Platform while it is in motion.**

> ⚠️ **WARNING**   When you initialize the Bravo Platform, the pipette head can move. Keep clear of the pipette head while it is in motion. Do not touch any of the moving parts or attempt to move labware while the Bravo Platform is in operation. The device could pinch, pierce, or bruise you.

> ⚠️ **WARNING**   Never touch any of the moving parts or attempt to remove or add labware while the Bravo Platform is in operation. There are several places on the Bravo Platform that could pinch, pierce, or bruise you.

Figure   Bravo Platform (top view) with shaded areas indicating pinch point hazards
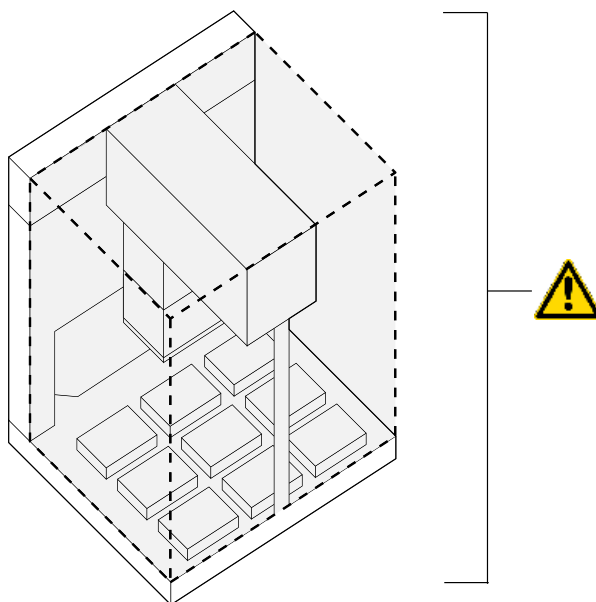
Hazardous-voltage electronics

Hazardous-voltage electronics can be found within the Bravo Platform. Under normal operating conditions, you are protected from exposure to the hazardous voltage.

> ⚠️ **WARNING**   Do not try to gain access to the interior of the Bravo Platform. Do not remove panels for any reason. Exposure to the interior electronics of a device can cause severe injury.

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

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

Chemical hazards

Some chemicals used when working with the Bravo Platform can be hazardous. Make sure you:

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

Improper access or use

CAUTION Improper use of the Bravo Diagnostics by an untrained user could damage the Bravo Platform. For example, a pipette head crash could result if a teachpoint is not defined properly.

Ensure that only fully trained Bravo administrators have access to the user account passwords.

Moving and unpacking the Bravo Platform

Before moving a Bravo Platform, verify that the new location meets the laboratory setup requirements.

WARNING **The Bravo device weighs 52.163 kg (115 lb). Do not attempt to move the Bravo device without assistance. Use proper lifting techniques when lifting the Bravo device.**

CAUTION Agilent Technologies is not responsible for damage if the Bravo Platform is incorrectly packaged and moved by someone other than a Agilent Technologies employee.

Related information

For more information about...	See...
General safety	"General safety information" on page 2
Stopping the Bravo Platform in an emergency	"Stopping in an emergency" on page 3
Site requirements for the Bravo Platform	"Laboratory setup requirements" on page 25
Reporting problems with the Bravo Platform	"Reporting problems" on page 92

2
Introduction to the Bravo Platform

This chapter gives you an overview of the Bravo Platform and contains the following topics:

- "About the Bravo Platform" on page 8
- "Hardware overview" on page 10
- "Indicator lights" on page 15
- "Connection panel description" on page 16
- "Pipette heads and pin tools" on page 18
- "Software overview" on page 21

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About the Bravo Platform

About this topic

This topic provides a brief description of the Bravo Platform.

Product description

The Bravo Platform is a versatile liquid handler with a nine plate-location platform that is suitable for handling 96-well, 384-well, and 1536-well microplates (plates). The Bravo Platform is controlled by the VWorks Automation Control software. The platform uses interchangeable fixed-tip or disposable-tip pipette heads or pin tools.

Figure Bravo Platform front view with optional gripper holding a microplate
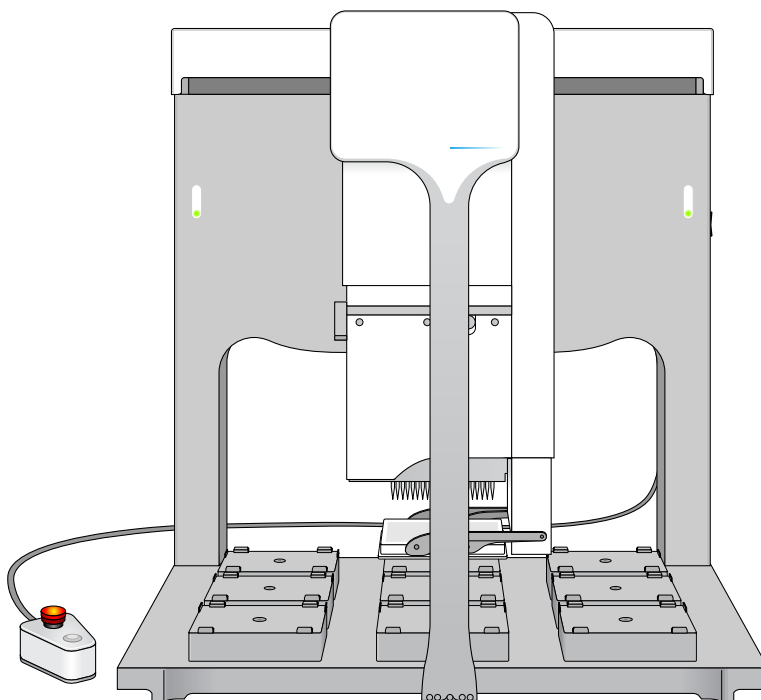
Ways to use the Bravo Platform

The Bravo Platform can be used in the following ways:

- As a single device controlled by a computer
- Integrated with other devices in a lab automation system

For example, when used as a single device, it can be placed in a laminar flow hood for use with cell-based applications or handling potentially hazardous materials.

As an integrated device in a lab automation system, it can be used to prepare microplates for high-throughput screening or other automated process. Note that when used with other devices, you can take advantage of the gripper feature to automate microplate pickup and placement.

Related information

For information about...	See...
Pipette head	"Pipette heads and pin tools" on page 18
Components	"Hardware overview" on page 10
Accessories	"Accessories overview for the Bravo Platform" on page 118
Laboratory requirements	"Laboratory setup requirements" on page 25
Safety	"Safety guidelines" on page 1

Hardware overview

About this topic

This topic provides illustrations and descriptions of the Bravo Platform hardware features.

Front view

The following figure shows the front view of the Bravo Platform, and the following table describes the hardware features.

> **CAUTION**   Do not pull the tie bar or try to lift the Bravo Platform by the tie bar. Doing so could damage the device.

Figure   Bravo Platform components (front view)
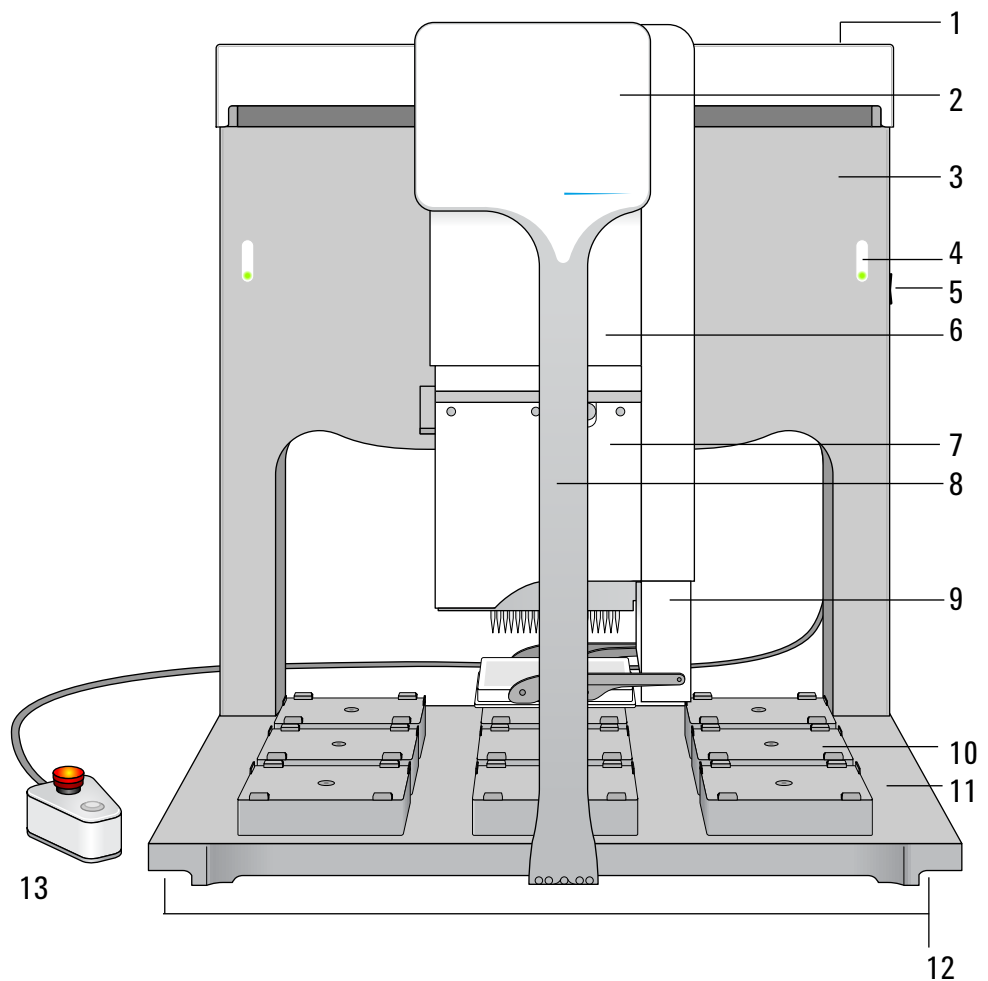
Item	Feature	Description
1	Top cover	The cover that lies along the Bravo Platform x-axis.
2	Face plate	The white plate that is attached with magnets. It displays the Bravo name and the Agilent Technologies logo.
3	Back plate	The vertical support for the head mount that houses the controlling electronics.
4	Indicator lights	The two light panels that show the status of the Bravo Platform. Each light panel has four colors: red, orange, green, and blue.
5	Power switch	The switch on the right side of the device that turns on and off the Bravo Platform.
6	Head mount	The fixture to which the pipette head mounts along the x- and y-axes. You can physically move the head mount while the Bravo Platform is turned off.
7	Pipette head	The Bravo Platform-compatible pipette head that aspirates and dispenses fluid. The platform uses interchangeable fixed-tip or disposable-tip pipette heads or pin tools
8	Tie bar	The bar that runs vertically at the front of the device to add structural support to the Bravo Platform.
9	Gripper	An optional gripper that extends from the head mount to below the pipette head tips. The gripper is able to pick up and place labware based on specified deck locations.
10	Deck location	The location on the deck that holds a platepad or an accessory. The Bravo Platform ships with nine platepads, one on each location. You may remove a deck-mounted platepad to install certain accessories.
11	Deck	The area that is accessible by the pipette head. Made of aluminum, it supports nine deck locations.
12	Handles	The indentations on the base that you use if lifting the Bravo device, for example, if placing the device onto the lab bench or table.
13	Pendant	The small pendant that has two control function buttons: • Bravo robot disable button, which is red, raised, and illuminated • Go button, which is silver and flush with the top surface of the pendant

Item	Feature	Description
	Arm cover (not shown)	The cover that lies along the Bravo Platform y-axis and extends behind the face plate.
	Connection panel (shown on back view)	The panel on the back of the Bravo Platform that contains AC power entry, the fuse holder, and the Ethernet, serial, and pendant ports.

Back view

The following figure shows the back view of the Bravo Platform. The connections on the back of the Bravo Platform are described in "Connection panel description" on page 16.

Figure Bravo Platform back view

Ethernet port

Serial and disable pendant ports

Power input

Pump I/O port
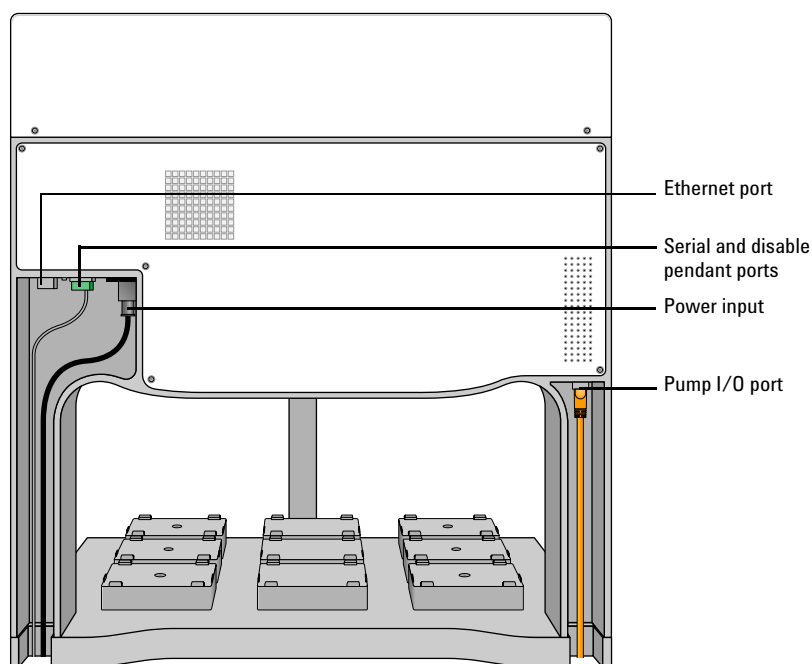
Deck locations

The deck locations are numbered 1–3, 4–6, and 7–9 from left to right as you face the front of the Bravo Platform.

Figure   Bravo Platform deck locations (top view)
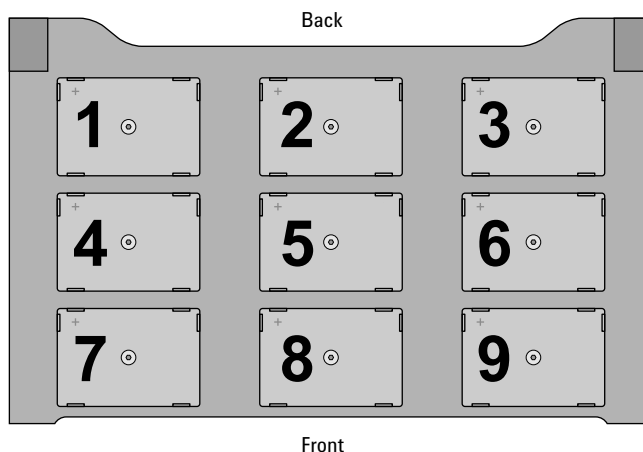
Axes of motion

The pipette head axes of motion are referred to throughout this guide. The following figure shows the axes.

The w-axis is the displacement of the pipettor inside the pipette head.

Figure   Pipette head axes of motion
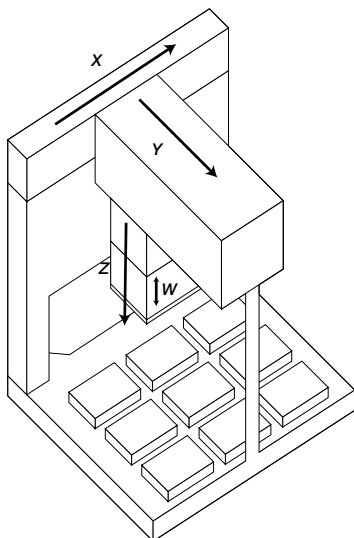
If the Bravo Platform is fitted with a gripper, the gripper moves with the pipette head. In addition, the gripper has the following axes of motion:

- G-axis. The opening and closing distance of the gripper arms, which enable the gripper to grip and release labware.

- Zg-axis. The vertical distance the gripper moves, which enables the gripper to extend beyond the pipette head.

Figure   Bravo gripper axes of motion
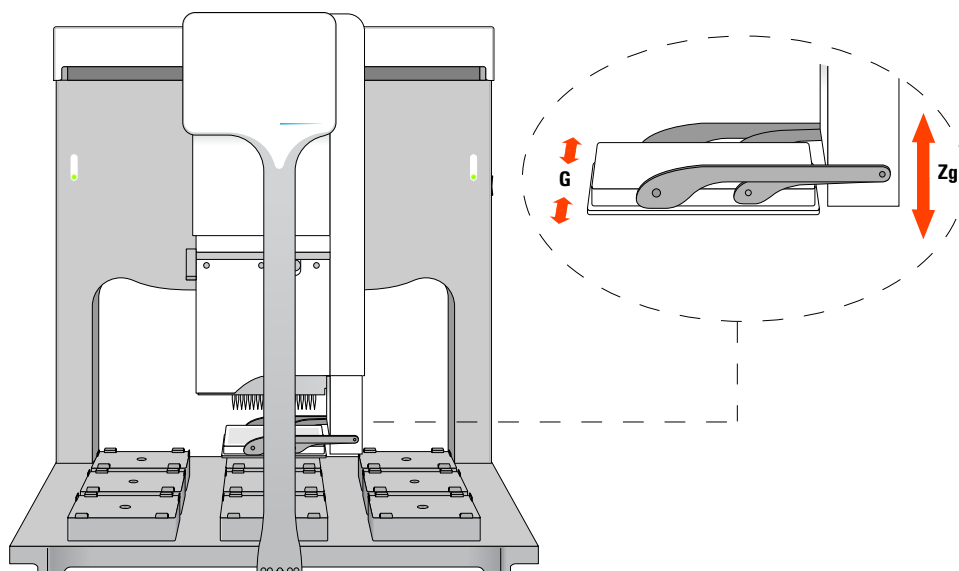
Accessories

Bravo Platform accessories are optional components that can be added to the device to enhance existing functions and facilitate operation. For a list and descriptions of the accessories, see "Accessories overview for the Bravo Platform" on page 118. To order an accessory or to obtain the latest list of accessories, contact Customer Service.

Related information

For information about...	See...
Pipette head	"Pipette heads and pin tools" on page 18
Indicator lights	"Indicator lights" on page 15
Accessories	"Accessories overview for the Bravo Platform" on page 118
Laboratory requirements	"Laboratory setup requirements" on page 25

Indicator lights

About this topic

This topic describes the Bravo Platform indicator lights and their meaning.

Indicator light meaning

Two lights on the front of the Bravo Platform display different colors to indicate the status of the device. The following table lists the possible colors and the corresponding status description.

Light color	Status	Meaning
Solid blue	Standby	The Bravo Platform is powered on.
Flashing green	Protocol	The software is running a protocol.
Flashing orange	Initialized and in Bravo Diagnostics	The software has initialized the Bravo Platform and Bravo Diagnostics is open.
Flashing red	Error in protocol	The software has encountered an error while performing a protocol.

Related information

For information about…	See…
The location of the indicator lights	"Hardware overview" on page 10
Resolving a problem	"Reporting problems" on page 92

Connection panel description

About this topic

This topic describes the connection panel inputs and outputs on the Bravo Platform.

Connection panel features

The following figure shows the features of the connection panel at the rear of the Bravo Platform. The table below describes the connections in detail.

Figure Connection panel on back of Bravo Platform

Ethernet port   Serial port   Pendant port   Fuse holder   AC power entry
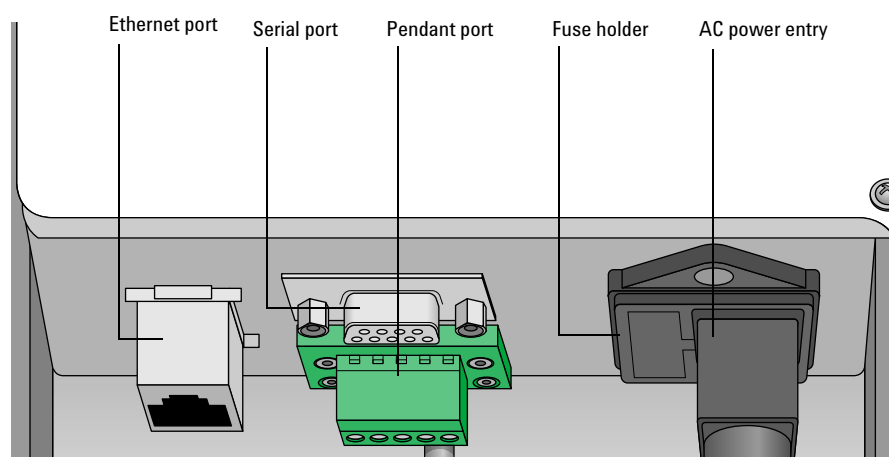
Feature	Description
Serial port	An RS-232 serial port that provides serial connection to the Bravo Platform.
	If you connect the Bravo Platform using the serial port, you do not need to connect using the Ethernet port.
Ethernet port	An Ethernet port that provides an Ethernet connection to the Bravo Platform.
	If you connect the Bravo Platform using the Ethernet port, you do not need to connect using the serial port.

Feature	Description
Pendant port	The port that connects the pendant to the safety interlock circuit. The safety interlock circuit must be closed for the Bravo Platform to operate. The pendant's disable button interrupts this circuit.
	The safety interlock circuit can also be fitted with a light curtain to shut off power to the Bravo Platform if the light boundary is breached. Light curtains are available from Agilent Technologies as a custom option.
AC power entry	The port that connects the Bravo Platform power cord to an AC outlet with a grounded circuit.
Fuse holder	The enclosure that contains the main fuse and a place for a spare fuse. For details on the fuse type, see "Laboratory setup requirements" on page 25.

Pump I/O port

The following figure shows the Pump I/O port on the back of the Bravo Platform. The table below describes the Pump I/O port in detail.

Figure   Pump I/O port (Bravo back view)
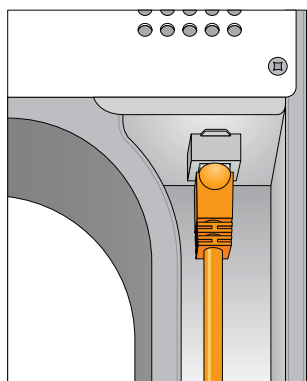
Feature	Description
Pump I/O port	An RJ-45 I/O port that enables you to connect a peristaltic pump to the Bravo Platform. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable.
	This is not an Ethernet port and should only be used to connect Automation Solutions accessories to the Bravo Platform.

Related information

For more information about...	See...
Connecting the Bravo Platform	"Connecting the Bravo Platform" on page 32
The pendant disable button	"Stopping in an emergency" on page 3
Installing a Light Curtain	"Installing the Light Curtain" on page 123

Pipette heads and pin tools

About this topic

The Bravo Platform uses interchangeable pipette heads that can dispense fluid into entire microplates at once, or into a single column or row.

There are several different pipette heads that use either disposable tips or fixed tips. This topic describes the pipette heads that are available for the Bravo Platform.

The Bravo Platform can also mount a variety of pin tools for performing low-volume transfers of fixed volumes. Contact Customer Service for details.

Disposable-tip pipette heads

Disposable-tip pipette heads allow you to change pipette tips during a run to prevent cross-contamination. The Bravo Platform can use either of the following types of disposable-tip pipette heads:

- The Series II 96- and 384-barrel pipette heads can dispense fluid into all the wells in a microplate simultaneously. The Series II pipette heads can be upgraded to a Series III pipette head.

  If the Bravo has a gripper attachment, the types of tips you can use with a Series II pipette head are limited. Contact Customer Service for upgrade details.

- The Series III 96- and 384-barrel pipette heads can dispense fluid into all the wells in a microplate simultaneously or into a single column, single row, or single well in the microplate. The Series III pipette heads are shipped with the Bravo Platform.

Both Series II and Series III pipette heads can use large transfer (LT) tips to dispense up to 250 µL per well or small transfer (ST) tips to dispense up to 70 µL per well.

The following table lists the Series II and Series III pipette heads available for the Bravo Platform.

Head type	Max volume	Dispense into...
8LT	250 µL	96-well, 384-well microplates; single column (8 wells)
16ST	70 µL	384-well, 1536-well microplates; single column (16 wells)
96LT	250 µL	96-well, 384-well microplates; single column (8 wells) or row (12 wells)
96ST	70 µL	96-well, 384-well, 1536-well microplates; single column (8 wells) or row (12 wells)
384ST	70 µL	384-well, 1536-well microplates; single column (16 wells) or row (24 wells)

IMPORTANT The microplate compatibility and maximum volume for a given pipette head is tip dependent, for example, the ST 70 µL tip is not compatible with a 1536-well microplate. For more details on the tips available for each type of pipette head, go to www.agilent.com/lifesciences/automation.

Figure Series III 384-well disposable-tip pipette head

Retainer pin

Pipette barrel

Tip box stripper pins
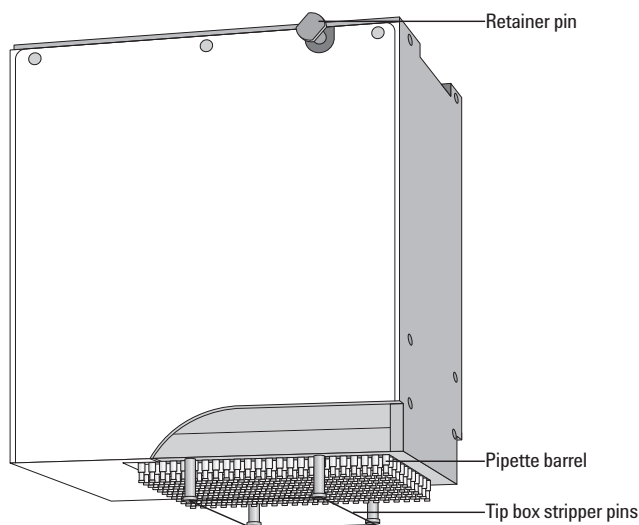
Fixed-tip pipette heads

The fixed-tip pipette heads are fitted with non-disposable dispensing pins and can dispense fluid into an entire microplate simultaneously. They cannot be used to dispense fluid into single columns or single rows. The following table lists the fixed-tip pipette heads available for the Bravo Platform.

Head type	Max volume	Dispense into
96F50	50 µL	96-well, 384-well microplates
384F50	50 µL	384-well, 1536-well microplates

Serial dilution capabilities

You can use the Series III 96- and 384-barrel pipette heads for serial dilution tasks because these pipette heads can dispense fluid into single columns or single rows of a microplate. You do not need to change pipette heads during the task.

Note: When using the pipette heads in serial-dilution mode, certain deck locations are not vaccessible.

Controlling the pipette heads and pin tools

You use the VWorks software to control the pipette heads and pin tools for performing such tasks as:

• Calibrating volumes

• Controlling pipette speed

• Enabling tip touching

• Enabling dynamic tip extension and retraction

Related information

For more information about...	See...
Serial dilution	*VWorks Automation Control User Guide*
Installing a pipette head	"Installing the pipette head or pin tool" on page 36
Removing one pipette head and mounting a different head	"Changing the pipette head or pin tool" on page 77
Controlling pipette heads	"Using Bravo Diagnostics" on page 95

Software overview

About this topic

This topic provides a brief overview of the VWorks software and explains how to operate the Bravo Platform.

VWorks software

The VWorks software enables you to:

- *Set up the Bravo Platform*. See "Workflow for setting up the Bravo Platform" on page 42.

- *Set up user accounts and privileges*. You can set up different user accounts to enforce access policies. For instructions, see the *VWorks Automation Control Setup Guide*.

- *Define labware*. Labware definitions describe the labware you will use during protocol runs. For instructions, see the *VWorks Automation Control Setup Guide*.

- *Create protocols*. Protocols determine the sequence of tasks you want to automate in a run. For protocol-writing instructions, see the *VWorks Automation Control User Guide*.

- *Run, pause, monitor, and stop protocols*. You can start, pause, monitor, and stop a protocol run from the controlling computer. For details, see the *VWorks Automation Control User Guide*.

Bravo Diagnostics

The Bravo Platform has its own diagnostics interface within the VWorks software that enables you to:

- *Create, edit, save, and load profiles*. These are registry settings that contain communication, head type, and teachpoint settings that the VWorks software uses to execute protocols. The profiles also store deck location configuration information.

- *Home and jog*. You can use the jog buttons to move the pipette head incrementally and the home buttons to move the head to the home position.

- *Create teachpoints*. These are instructions that tell the pipette heads exactly where to move to perform a task.

- *Configure deck locations*. For example, you can specify that a location on the Bravo Platform deck is a MicroWash Station. The location information is stored in the profiles.

- *Run individual tasks*. Tasks that are performed in a protocol (such as Tips Off, Tips On, Aspirate, and Dispense) can be performed individually through Bravo Diagnostics.

- *Adjust the gripper*. If the Bravo Platform is fitted with a gripper, you use the Gripper tab in Bravo Diagnostics to adjust the gripper teachpoints.

Related information

For more information about...	See...
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42
Using Bravo Platform Diagnostics	"Using Bravo Diagnostics" on page 95
VWorks automation control software	• *VWorks Automation Control Setup Guide* • *VWorks Automation Control User Guide*

3
Installing the Bravo Platform

This chapter contains the following topics:

Agilent Technologies

Workflow for installing the Bravo Platform

About this topic

This lists the procedures and the order in which to perform them to install the Bravo Platform.

Workflow

See the following topics for the procedures to install the Bravo Platform.

Step	For this task…	See…
1	Verify that the installation location meets the site requirements.	"Laboratory setup requirements" on page 25
2	Unpack the Bravo Platform.	"Unpacking and inspecting the Bravo Platform" on page 27
3	Connect the Bravo Platform.	"Connecting the Bravo Platform" on page 32
4	Install the pipette head.	"Installing the pipette head or pin tool" on page 36
5	If not already installed, install the VWorks software.	*VWorks Automation Control Setup Guide*

Laboratory setup requirements

About this topic

This topic describes the space and bench requirements for the Bravo Platform. Read this topic and "Electrical requirements" on page 26 before you unpack and install the Bravo Platform.

Space and bench requirements

Place the Bravo Platform where there is:

- Proximity to power
- Enough space to accommodate the Bravo Platform, computer, monitor, pendant, and accessories
- A fixed bench (without wheels) that can support the weight of the Bravo Platform without excessive shaking or movement
- Easy access so that you can quickly disconnect the power to the Bravo Platform if the need arises

Physical specifications

Dimension	Standard Bravo Platform	SRT Bravo Platform
Height	69.7 cm (27.4 in)	61.7 cm (24.3 in)
Width	64.8 cm (25.5 in)	64.8 cm (25.5 in)
Depth	43.8 cm (17.2 in)	43.8 cm (17.2 in)
Weight	52.1 kg (114.9 lb)	52.1 kg (113.5 lb)

Figure   Dimensions of a standard Bravo Platform
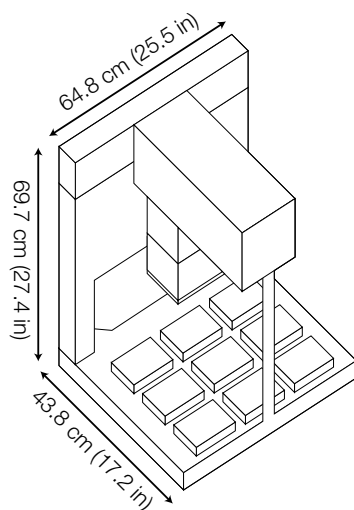
Electrical requirements

The Bravo Platform has the following electrical requirements:

Requirement	Value
Voltage	100–240 V$^{\sim}$
Frequency	50–60 Hz
Current	11.5 A @ 115 V$^{\sim}$ 6.5 A @ 230 V$^{\sim}$
Fuse	250 V, 10 A, 5 mm x 20 mm, fast acting

Environmental operating requirements

Requirement	Value
Temperature	0–40 °C
Relative humidity	0–95% RH, non-condensing
Elevation	1–2000 m

Computer requirements

The Bravo device is shipped with a computer that controls the Bravo Platform operations. The computer has all the necessary software and is configured to operate the Bravo Platform.

IMPORTANT   Agilent Technologies recommends that you use the supplied computer, because it is set up and tested for Bravo Platform operations.

If your organization uses a computer other than one configured by Agilent Technologies, make sure the computer meets the following minimum requirements:

- Computer system
  - Microsoft Windows XP with Service Pack 3 or
    Microsoft Windows Vista with Service Pack 1
  - 2 GHz or faster 32-bit (x86) processor, multicore preferred
  - 2 GB system memory
  - 40 GB hard drive capacity with 10 GB free space
  - 1280 x 1024 pixel screen resolution
  - Microsoft Internet Explorer 6.0 or Mozilla Firefox 1.0 with JavaScript enabled (required for using the context-sensitive help and knowledge base)
  - A PDF viewer, such as Adobe Reader (required for opening the user guide PDF files)

- Communications interface using one of the following:
  - Dedicated 10BaseT or faster Ethernet card (two network cards if connecting to your local area network)
  - RS-232 DB9 serial port, if you are connecting via serial

To facilitate the setup process, a software installation CD is supplied. You can use the CD to install the necessary software and setup configurations.

Related information

For information about...	See...
Unpacking the Bravo Platform	"Unpacking and inspecting the Bravo Platform" on page 27
Installing the Bravo Platform	"Workflow for installing the Bravo Platform" on page 24

Unpacking and inspecting the Bravo Platform

About this topic

This guide describes how to unpack the Bravo device from the shipping crate.

Shipping containers

The Bravo Platform ships in the following containers:

- *Bravo crate*. Contains the Bravo device.
- *Peripherals box*. Contains the following:
  - Bravo utilities
  - Pipette head
  - Computer

Depending on the configuration ordered, additional packages or items can be included, such as accessories.

Before you start

Verify the following:

1 *Bravo utilities*. At a minimum, the utilities include:
   - Pendant
   - Power, serial, and crossover Ethernet cables
   - Software CD-ROM
   - *Bravo Automated Liquid Handling Platform User Guide*

2 *Site specifications.* Ensure the installation site meets the requirements. See "Laboratory setup requirements" on page 25.

3 *Tools and equipment.* Obtain the following:

- Cross-tip screwdriver
- 3-mm hex wrench
- 2.5-mm hex wrench
- Cart for moving the Bravo device

4 *Personnel requirements.* Make sure two people are available to lift the Bravo device from the crate.

⚠️ **WARNING** **The Bravo device weighs 52.163 kg (115 lb). Do not attempt to move the Bravo device without assistance. Use proper lifting techniques when lifting the Bravo device.**

Unpacking the device and removing the shipping stops

⚠️ **WARNING** **Do not remove the exterior covers of the Bravo Platform, except to remove the shipping stops as described in the following procedure. Removing the exterior covers can cause injuries and damage the device.**

CAUTION The packing materials and shipping container were designed to protect the device. Packing the Bravo device using other materials might damage the device and void your warranty. Save the packing materials and shipping container in case you are required to move or ship the Bravo device.

To unpack the Bravo device:

1 Open the latches and remove the front of the crate.
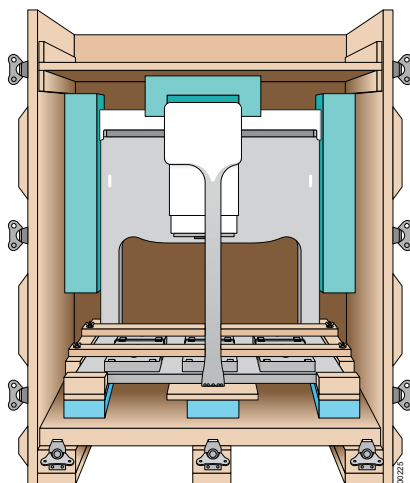
2 Remove the sides and top from the crate.

3 Unscrew the wing nuts and remove the slats that hold the Bravo device to the crate base.
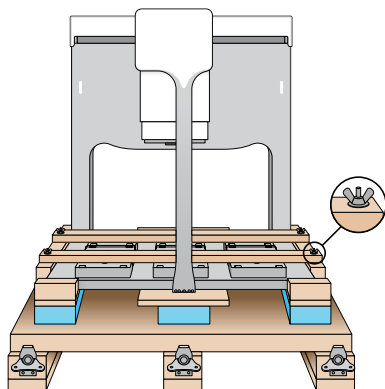
4 Remove the four crosshead screws on the side and back of the Bravo top cover, and remove the cover.
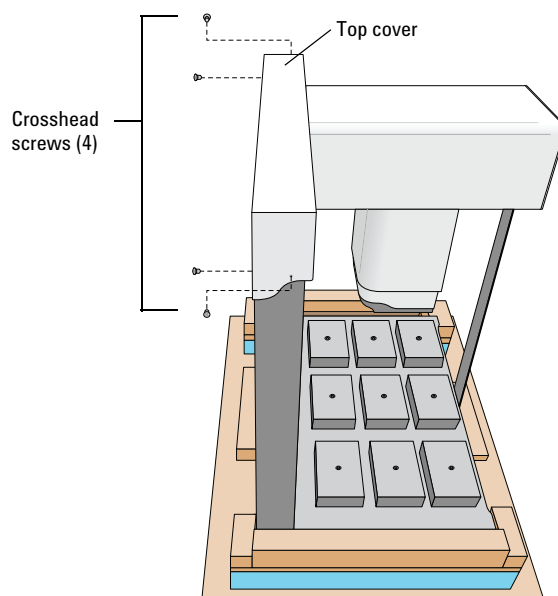
5 Remove the two shipping stops under the top cover. Each stop is held in place with an M4 screw.
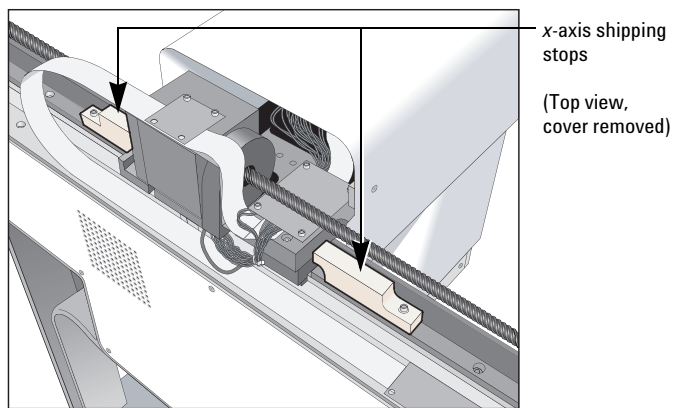
Note: These shipping stops prevent the head mount from moving in the *x*-axis during shipping.

6 Replace the top cover.

7 Remove the shipping stop at the front of the head mount. The stop is held in place with two M3 screws.

y-axis shipping stop

(Head mount, side view)
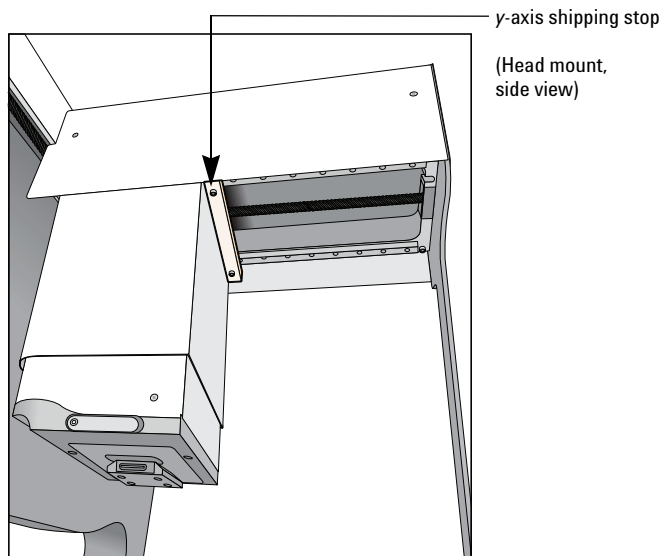
Note: This shipping stop prevents the head mount from moving in the *y*-axis during shipping.

8 Using the following lift points, lift the Bravo device onto the lab bench or table.
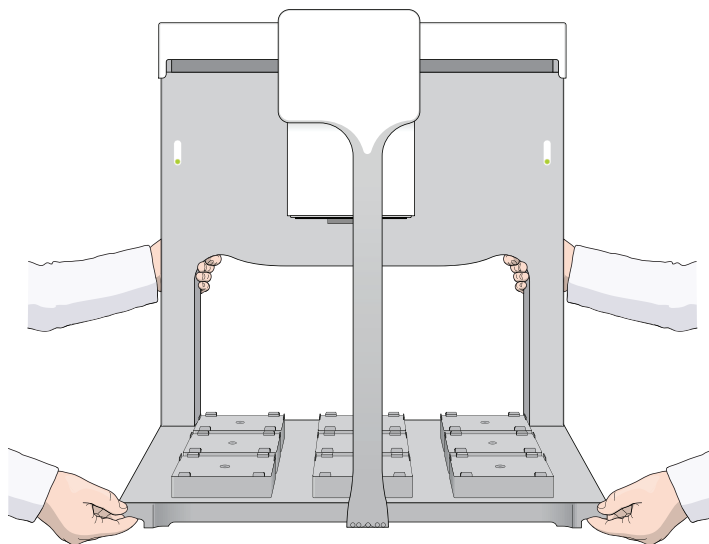
CAUTION Do not pull on the tie bar or try to lift the Bravo Platform by the tie bar. Doing so could damage the device.
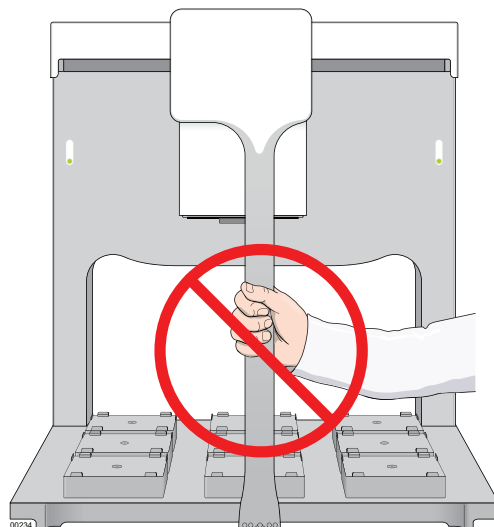
Bravo Platform layout

Unpack the computer from its box according to the instructions included with the computer, and place it near the Bravo device.
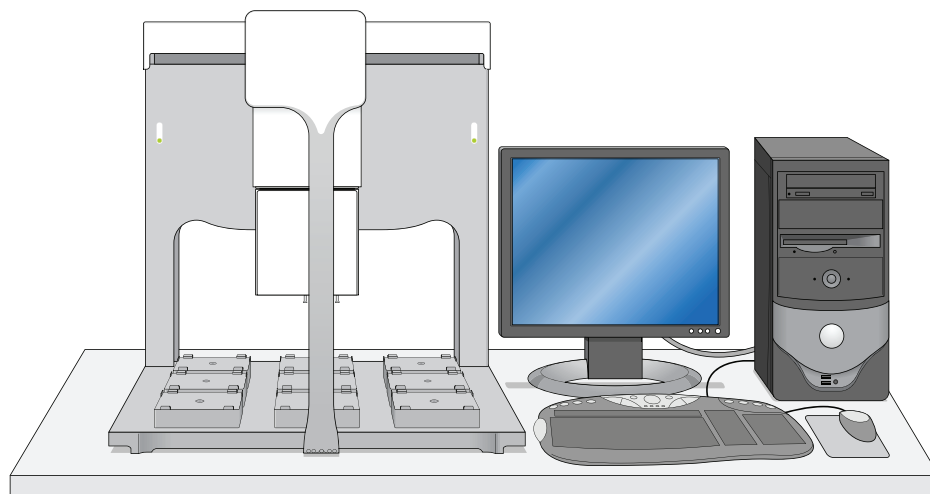
Related information

For information about...	See...
The workflow that this procedure belongs to	"Workflow for installing the Bravo Platform" on page 24
What to do next	"Connecting the Bravo Platform" on page 32
Set up requirements	"Laboratory setup requirements" on page 25

For information about...	See...
Hardware components	"Hardware overview" on page 10
Connection panel description	"Connection panel description" on page 16
Installation workflow	"Workflow for installing the Bravo Platform" on page 24

Connecting the Bravo Platform

About this topic

This topic provides instructions on how to connect the Bravo Platform to a grounded power source and to its controlling computer.

Before you start

- Make sure the laboratory setup requirements have been met.
- Follow the instructions included with the computer for setting up the computer. Ensure that the computer and Bravo Platform are turned off.
- Make sure you have the supplied RS-232 DB9 serial cable or the Ethernet cables.

Connecting the power and pendant

To connect the Bravo Platform:

1 Plug one end of the power cord into the AC power port on the back of the Bravo Platform. Plug the other end of the cord into an AC outlet with a grounded circuit.

2 Plug the pendant into the pendant port on the back of the Bravo Platform.

Figure   Power and communication ports on the Bravo Platform (back view)

Ethernet port

Serial and disable
pendant ports

Power input
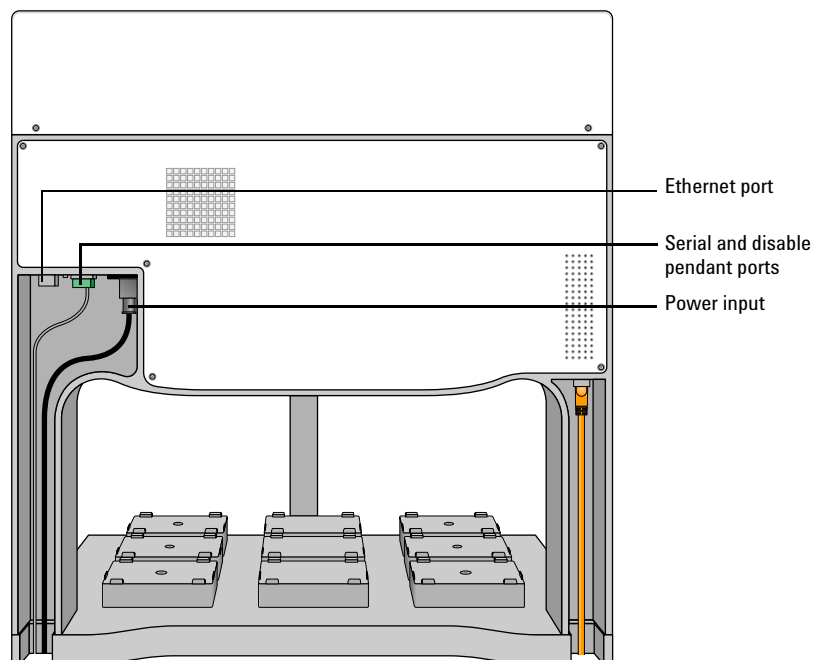
Connecting the Bravo Platform to the controlling computer

You can connect the computer to the Bravo Platform using either of the
following:

- *Serial connection.* If using a serial connection:

  Connect one end of the supplied RS-232 DB9 serial cable to a COM port
  on the computer, and connect the other end of the cable to the serial port
  on the back of the Bravo Platform.

- *Ethernet connection.* If using an Ethernet connection, see "Using an
  Ethernet connection" on page 34.

Bravo power cable   Serial or Ethernet cable   PC power cable

00223
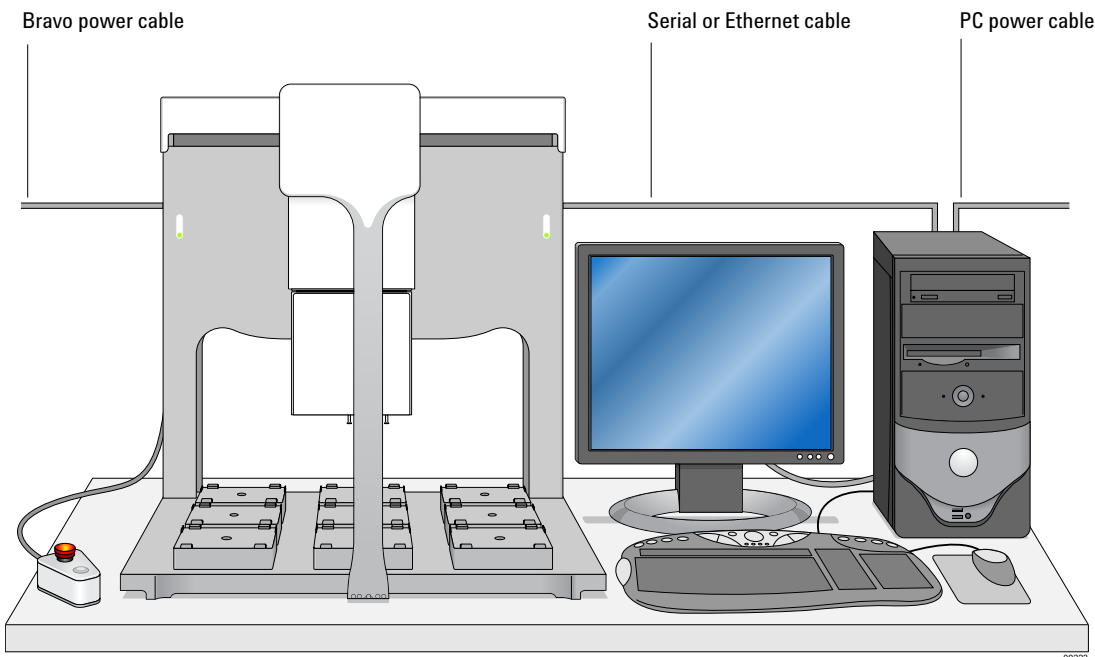
Using an Ethernet connection

You can use Ethernet to connect a Bravo Platform to the computer:

- Directly
- Through an Ethernet switch

If you are setting up a standalone Bravo Platform, you can use either method. If you are setting up a local area network (LAN) that has other devices on it, use an Ethernet switch.

The Automation Solutions configured computer has two Ethernet ports. You can use one port to connect to the Bravo Platform and the other port to connect to your company network.

Connecting directly to the computer

A red crossover Ethernet cable is provided for connecting the computer directly to the Bravo Platform.

To connect directly to the computer using Ethernet:

1 Connect one end of the red crossover Ethernet cable to the Ethernet port on the Bravo Platform.

2 Connect the other end of the cable to the Ethernet port of the computer.

Connecting through an Ethernet switch

An Ethernet switch connects the single cable from the computer to one or more cables that lead to one or more devices.

IMPORTANT Do not use a crossover cable with an Ethernet switch. The switch performs the crossover function.

If you are adding the Bravo Platform to an existing LAN, step 1 of the following procedure should already be done.

To connect through an Ethernet switch:

1 Connect the switch to the computer as follows:

  a Connect the power cord to the switch.

  b Connect one end of the Ethernet cable (black) into any Ethernet port on the switch, and connect the other end of the cable to an Ethernet port on the computer.

2 Connect the Bravo Platform to the switch as follows:

  a Connect one end of a second Ethernet cable to a port on the Ethernet switch.

  b Connect the other end of the cable to the Ethernet port on the Bravo Platform.

Connecting additional devices

You can connect as many devices to the network as there are Ethernet ports available.

> ⚠️ **WARNING** **Connecting the Bravo Platform to a company or general network can potentially cause injury. Remote computer operators might accidently initiate an operation that causes the robot to move unexpectedly, possibly injuring nearby lab personnel.**

About configuring the computer's network card (Ethernet only)

The Automation Solutions configured computer is already set up to communicate with the Bravo Platform. No change to the network card IP address is required.

If you are using a computer other than an Automation Solutions configured computer, make sure the value of the network card IP address and subnet mask are as follows:

- IP address: 192.168.0.1
- Subnet mask: 255.255.255.0

If your computer will be connected to your LAN, make sure the computer has a second network card. The second network card can have a dynamic IP address.

Related information

For more information about...	See...
The controlling computer requirements	*VWorks Automation Control Setup Guide*
The Ethernet switch	Ethernet switch user documentation
IP addresses	Microsoft Windows user documentation
Installing the pipette head	"Installing the pipette head or pin tool" on page 36
How to set up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Installing the pipette head or pin tool

About this topic

This topic describes how to mount the pipette head or pin tool when you first set up the Bravo Platform.

To change a pipette head or pin tool that is already installed on the device, see "Changing the pipette head or pin tool" on page 77.

About the pipette head mount

The pipette heads are mounted to the Bravo head mount with an angled dovetail interface. Two head-retainer pins and a head lock secure the pipette head to the Bravo Platform.

Familiarize yourself with the dovetail features both on the top of the pipette head and underneath the head mount before mounting the pipette head.

Figure Bravo head mount with the angled dovetail and head lock

Head lock   Dovetail

Figure   Series III pipette head

Retainer pin   Dovetail interface

Retainer pin

96LT
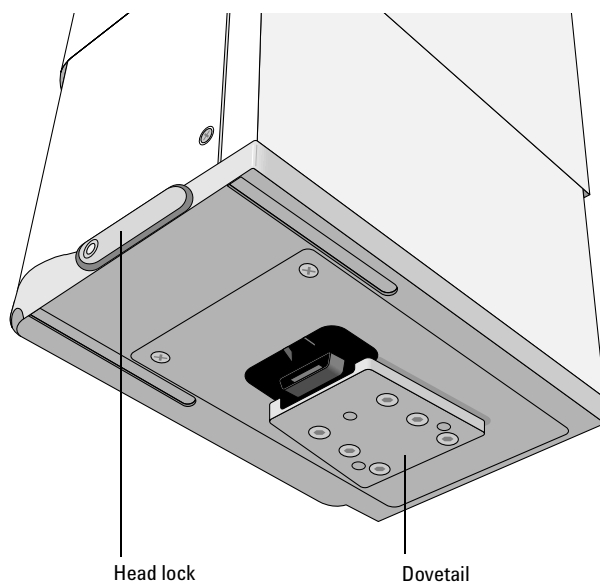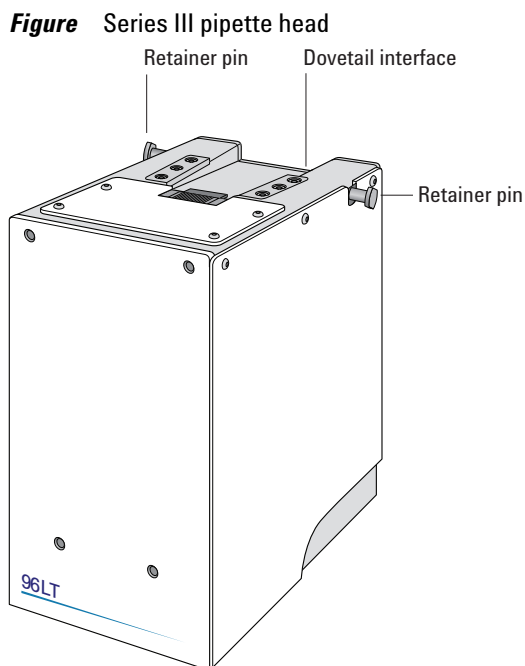
Procedure

> **CAUTION**   Always turn off the Bravo Platform before mounting or removing a pipette head
> or pin tool. Failure to turn off the Bravo Platform before changing the pipette head or pin tool
> can damage the pipette head or pin tool electronics.

To mount a Bravo Platform pipette head:

1 Make sure that the head mount is in its home position above deck
location 5. If it is not, use the **Home XYZ** command in Bravo Diagnostics.

2 Ensure that the Bravo Platform is turned off.

3 Carefully remove the pipette head and protective stand from the packaging.
While the pipette head is seated in the stand, pull out and twist the two
head-retainer pins one-quarter turn so that they remain retracted.

> **CAUTION**   Do not rest the bottom of the pipette head or pin tool on any surface.
> Doing so can damage the barrels or pins.

> **CAUTION**   Do no touch the pipette head barrels or tips with your hands.

4 Slide the pipette head out of the head stand.
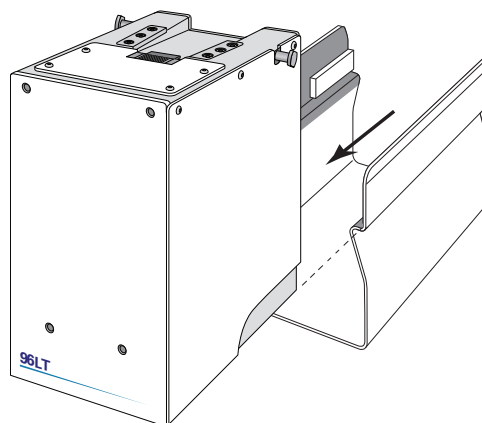
5 Slide the pipette head onto the head mount from left to right.

Head lock
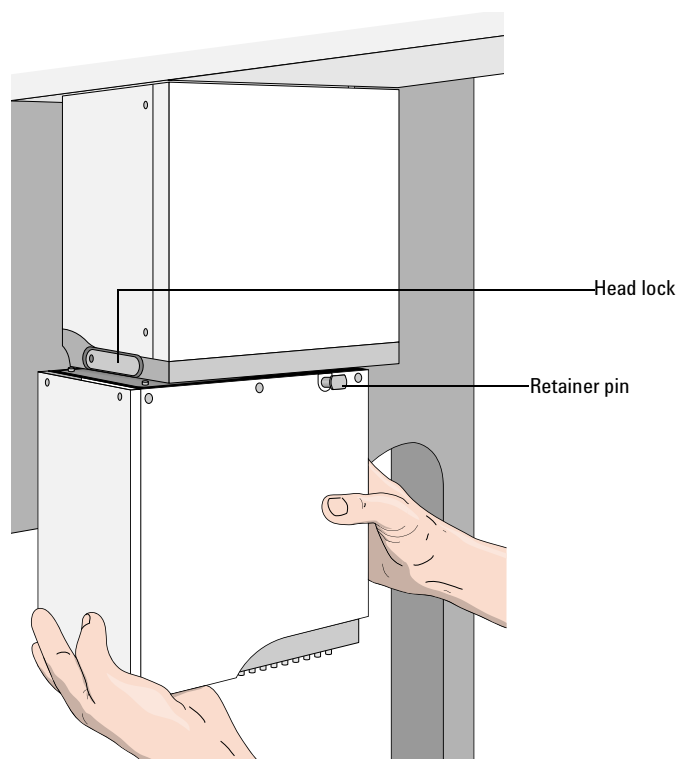
Retainer pin

6 Rotate the head lock clockwise until it reaches its hard stop.

This ensures that the head is fully seated and does not shift position during operation.

7 Twist the two head-retainer pins so they snap in, securing the pipette head on the mount.
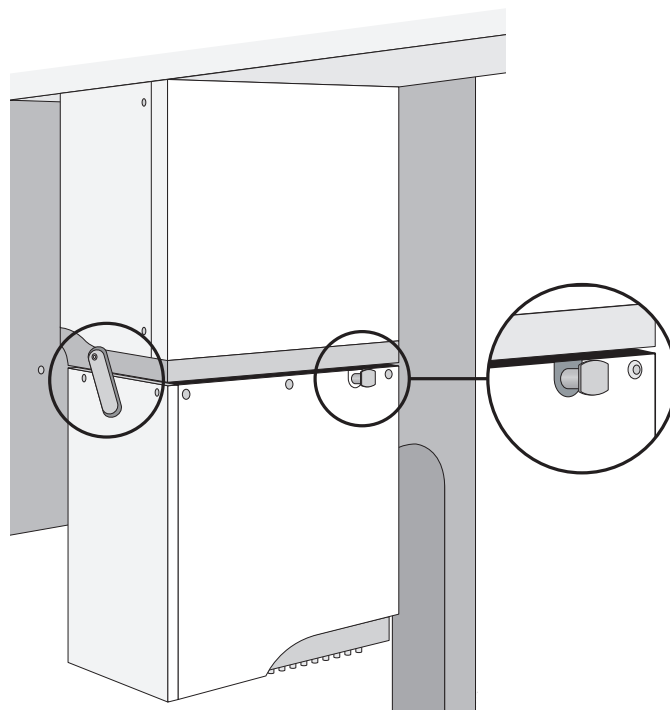
Related information

For information about…	See…
Homing the head mount	"Homing the pipette head" on page 99
Available pipette heads	"Pipette heads and pin tools" on page 18
Removing a pipette head and installing a different pipette head	"Changing the pipette head or pin tool" on page 77
Location of power switch, head mount, and so on	"Hardware overview" on page 10
Controlling the pipette head	"Using Bravo Diagnostics" on page 95
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Setting up the Bravo Platform

Read this chapter after unpacking and installing your Bravo Platform.

This chapter contains the following topics:

Agilent Technologies

Workflow for setting up the Bravo Platform

About this topic

This topic outlines the procedures you need to follow to set up the Bravo Platform.

Workflow

The general workflow for setting up the Bravo Platform is as follows:

Step	Procedure	See...
1	Start up the Bravo Platform.	"Starting up and shutting down" on page 43
2	Establish communication with the Bravo Platform.	• "Creating or adding a Bravo device" on page 45 • "Opening Bravo Diagnostics" on page 49 • "Creating and managing profiles" on page 51
3	Edit or set teachpoints.	"Setting teachpoints" on page 61
4	If the Bravo Platform includes a gripper, verify the gripper setup.	"Verifying the gripper setup" on page 68
5	Configure accessories, such as an autofilling reservoir.	"Accessories overview for the Bravo Platform" on page 118
6	Create protocols and set task parameters.	*VWorks Automation Control User Guide*
7	Prepare to run a protocol.	"Preparing the Bravo Platform for a run" on page 70

Starting up and shutting down

About this topic

This topic describes how to turn on and turn off the Bravo Platform.

Starting up the Bravo Platform

To start up the Bravo Platform:

1 Ensure that the main power cable and Ethernet or serial cables are plugged into the connection panel.

2 Turn on any accessories, for example, Pump Modules.

3 Turn on the computer and the monitor, and start the Microsoft Windows operating system.

4 On the side of the Bravo Platform, press the power switch to the **on (|)** position.

The green light on the switch is illuminated when the Bravo Platform is on.

Power switch
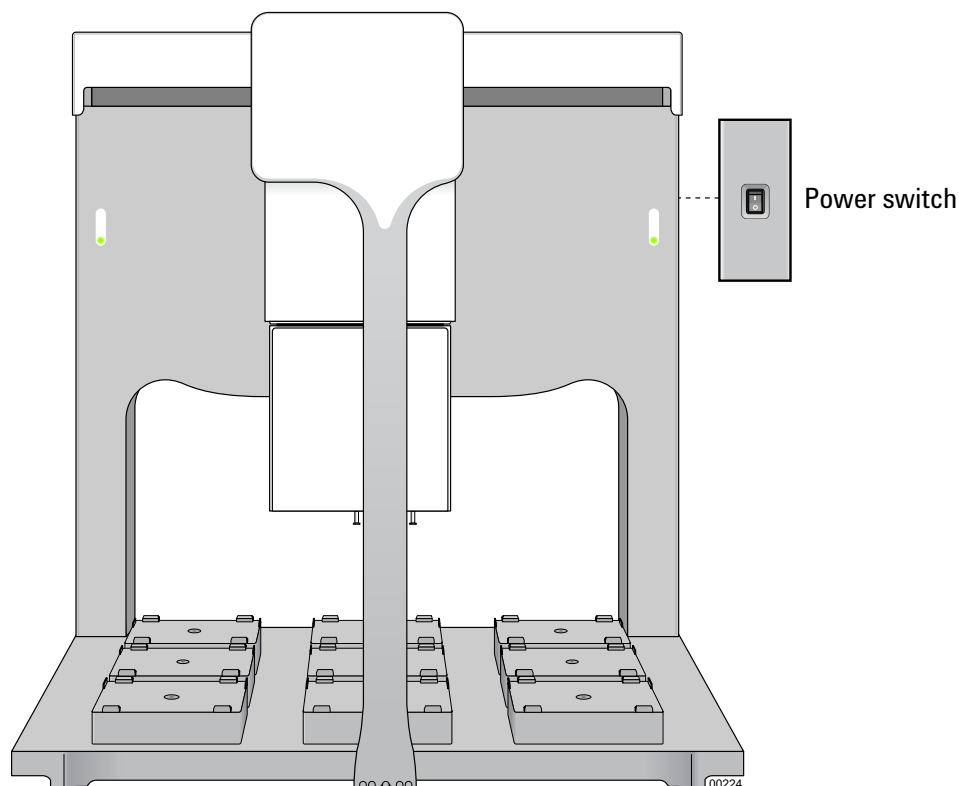
5 Start the VWorks software.

Shutting down the Bravo Platform

Shut down the Bravo Platform before you:

- Clean the Bravo Platform
- Change the pipette head
- Install accessories
- Move the Bravo Platform

To shut down the Bravo Platform:

1 Make sure that the post-run clean up procedure was followed after the last run.

2 Optionally, home the pipette head.

3 Shut down the computer.

4 Turn off any accessories, for example, Pump Modules.

5 If using an Auto Filling Reservoir, disconnect the bottles to prevent siphoning.

6 On the side of the Bravo Platform, press the power switch to the **off (o)** position.

Related information

For information about...	See...
Indicator lights	"Indicator lights" on page 15
The connection panel	"Connection panel description" on page 16
Cleaning up after a run	"Cleaning up after a run" on page 76
Homing the pipette head	"Homing the pipette head" on page 99
Turning on or off Bravo accessories	"Accessories overview for the Bravo Platform" on page 118
Setting up Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Creating or adding a Bravo device

About this topic

Read this topic if you are an administrator responsible for managing Agilent Technologies devices that are running the VWorks software. This topic describes how to add and delete new Bravo devices in the VWorks software.

The VWorks software uses the information in a device file to communicate with and operate devices within the lab automation system.

- *If your computer was configured by Automation Solutions.* The correct device configuration is already set up for communication with the Bravo Platform. You are not required to create a new Bravo device in the software unless you want to reference different profiles. To establish communication, you must initialize the device.

- *If you configured your own computer.* You must add a device in the VWorks software for each Bravo Platform in the system.

For detailed information about device files and associations with profiles, teachpoints, and labware definitions, see the *VWorks Automation Control User Guide*.

Devices and device files defined

A device is an item in your lab automation system that has an entry in a VWorks software device file. A device can be a robot, an instrument, or a location in a lab automation system that can hold a piece of labware.

The device file (*.dev) stores information for all the devices in an integrated system, including:

- Type of device (for example, Bravo device)
- Device configuration information (for example, approach height, allowed or prohibited labware, and so on)
- Profile to use

Creating a device file

If you are setting up the Bravo Platform for the first time, you will create a device file. You add the Bravo device and the external devices to the device file.

To create a device file:

1 Log in to the VWorks software as an Administrator.

2 In the **VWorks** window, choose **File** > **New** > **Device.**

A Device File tab appears in the **VWorks** window.

3 Choose **File** > **Save**. In the **Save As** dialog box, type a file name (*.dev), and click **Save**. By default the file is located in the following folder:

C:\VWorks Workspace\Device Files
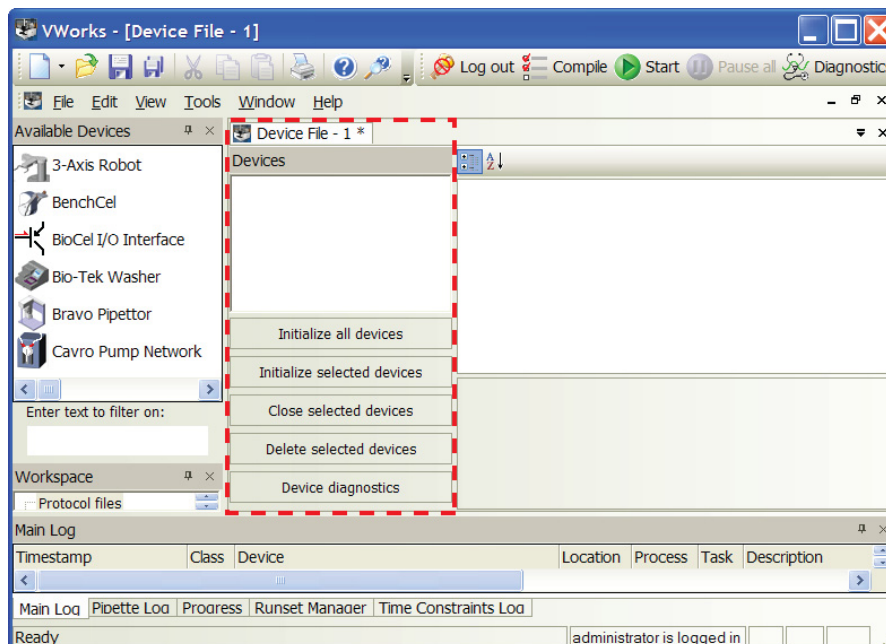
Adding the Bravo Platform to a device file

Before you begin:

- Ensure that any devices are physically networked to the computer.
- Turn on the devices.

To add devices to a device file:

1   In the **VWorks** window, verify that the correct device file is open.

To open a device file, choose **File** > **Open**. In the **Open** dialog box, select your device file (*.dev), and then click **Open**. By default, the file is in the following location:

C:\VWorks Workspace\Device Files

2   In the **Available Devices** area, double-click the **Bravo** icon. Or, drag the **Bravo** icon to the **Device File** tab.

Note: To show or hide the list of available devices, choose **View > Available Devices**.
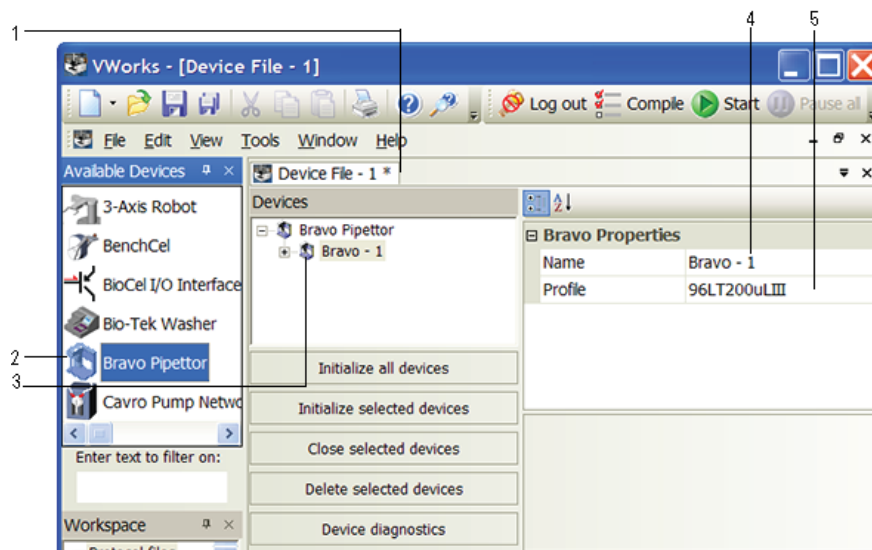
3   In the **Device File** tab, select the **Bravo-*n*** icon.

4   Under **Bravo Properties**, type a **Name** for the device. By default, the software assigns Bravo-*n*, and increments the number for each Bravo device that you add.

   To identify the specific Bravo, the device name should include the device serial number.

5   In the **Profile** list, select a profile for the device.

   If the **Profile** list is empty, open Bravo Diagnostics and create a profile. Then return to the **Profile** list under **Bravo Properties** and select the new profile.

6   On the **Device File** tab, expand the **Bravo** device icon to show the list of deck locations, and then click the location **1** icon. The corresponding location properties appear.
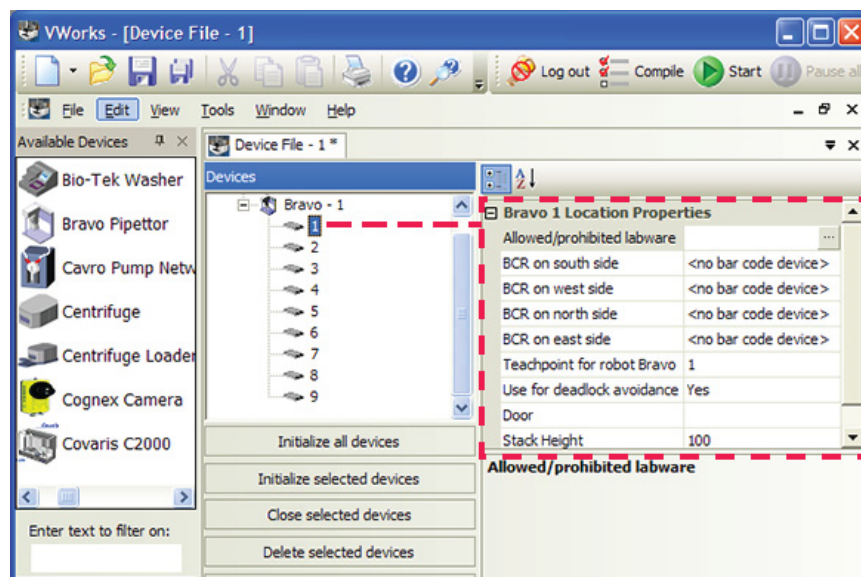
Set the desired values for the following properties. Use the default values for the remaining properties.

Property	Description
Allowed/prohibited labware	(Optional) Click [...] if you want to specify labware restrictions for this location. The Allowed/prohibited labware dialog box appears. For details on the labware classes, see the *VWorks Automation Control Setup Guide*. *Note:* If the [...] button is not visible, click the empty field.
BCR on side	If a barcode reader is set up at this location, you specify the side.
Stack Height	Type the maximum height (mm) for a labware stack at this location.

IMPORTANT   Do not change the default value of the Teachpoint for robot Bravo property. For example, the deck location 1 teachpoint identity is 1, the identity of deck location 2 is 2, and so forth.

Repeat this step for each deck location.

7   Select **File** > **Save**.

If you are creating a new device file, the Save As dialog box appears so that you can specify a name and location for your device file. Ensure the file type is ***.dev**.

Alternatively, you can select **File** > **Save All** to save the device file and the current protocol file at the same time.

Related topics

For more information about...	See...
Initializing the device	"Initializing the Bravo Platform" on page 58
Device files and associations with profiles, teachpoints, and labware	*VWorks Automation Control User Guide*
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Profiles	"Creating and managing profiles" on page 51

Opening Bravo Diagnostics

About this topic

This topic describes how to open Bravo Diagnostics from a device tab displayed in the VWorks software window. Alternatively, you can use the Diagnostics button on the toolbar to open Bravo Diagnostics. In either case, you must have an open device file.

Procedure

To open Bravo Diagnostics:

1 In the **VWorks software** window, ensure the correct device file is open.

To open a device file, choose **File > Open**, and then select the appropriate device file (*.dev) in the **Open** dialog box.

2 In the **Devices** area of the opened device file tab, highlight the device icon, and then click **Device diagnostics**.

Alternatively, you can double-click the device icon.
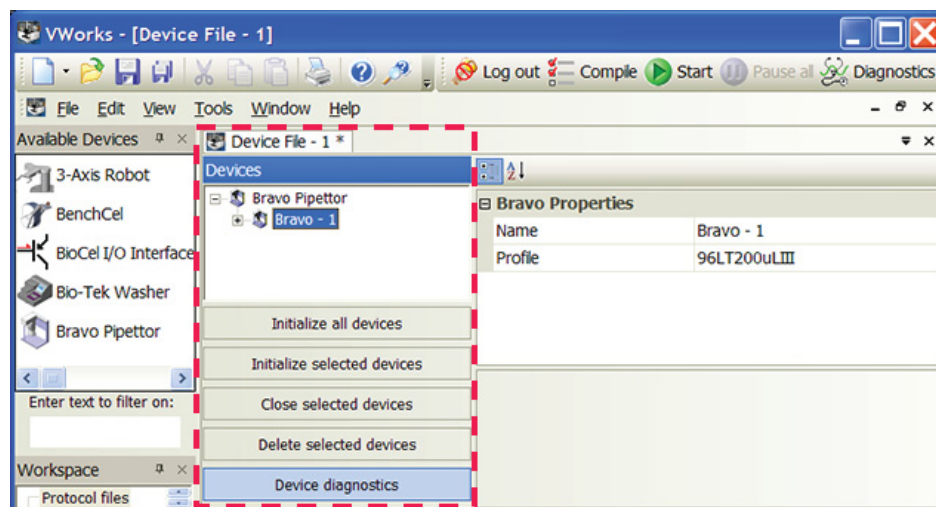
The device's diagnostics dialog box opens.

Figure   Bravo Diagnostics dialog box
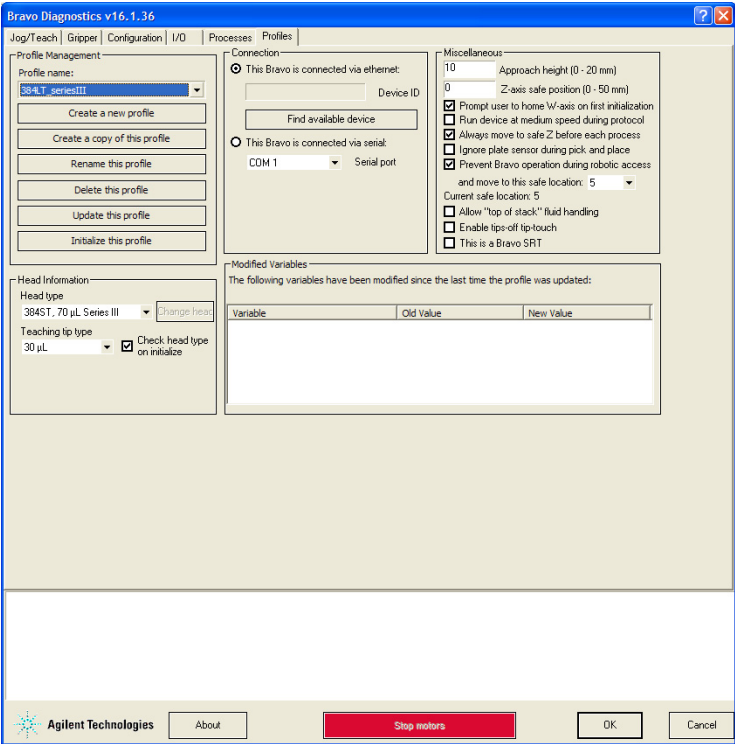
Related information

For information about...	See...
Profiles	"Creating and managing profiles" on page 51
Teachpoints	"Setting teachpoints" on page 61
Bravo Diagnostics	"Using Bravo Diagnostics" on page 95

Creating and managing profiles

About this topic

VWorks software users with Administrator or Technician privileges (advanced users) can create and manage profiles for the Bravo Platform.

> **CAUTION**   Using the wrong profile or an improperly created profile can damage the Bravo Platform.

Profiles defined

Profiles enable the VWorks software to:

- Identify and communicate with the Bravo Platform
- Determine which pipette head is being used
- Store teachpoints

Every Bravo Platform setup that requires different teachpoints requires a profile for that set of teachpoints. For example, if you add an accessory such as a Weigh Station to the Bravo deck, you must modify the profile or create a new profile that includes the new teachpoint for the Weigh Station.

Similarly, each pipette head requires a profile. If you move a pipette head from one Bravo Platform to another, you must create a profile for each combination of pipette head and base. You cannot use the same profile for different Bravo devices.

Example of four configurations that require four profiles

Base A		Base B	
Head 1	Head 2	Head 1	Head 2
Profile 1:	*Profile 2:*	*Profile 3:*	*Profile 4:*
base A head 1	base A head 2	base B head 1	base B head 2

Before you start

The device file must be open before you can create a profile.

> **CAUTION**   Each profile can be used by multiple protocols. Deleting, renaming, or changing the parameters for a profile based on one protocol can invalidate other protocols that use the profile.

About managing profiles

You use the Profiles tab in the Bravo Diagnostics to manage the Bravo profiles.

Figure Bravo Diagnostics Profiles tab

The Profiles tab enables you to:

- Create a new profile
- Copy a profile to use for creating a profile
- Rename, update, or delete a profile
- Initialize a profile

Note: Unless you login to the VWorks software as an Administrator or Technician, only the Profile name list and the Initialize this profile button are available in the Profile Management area of the Profiles tab.

Creating a profile

The following procedure describes how to create a new profile from an existing profile that has similar settings.

To create a new profile from a copied profile:

1 In **Bravo Diagnostics**, click the **Profiles** tab.

2 Click **Create a new profile**.
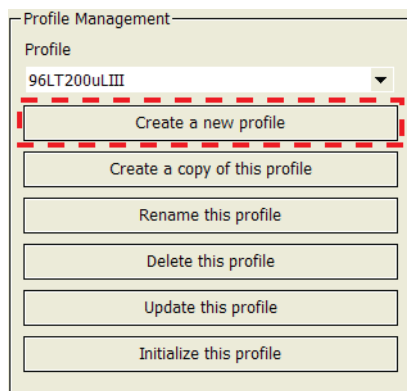
3 In the **Create Profile** dialog box, type a name for the new profile, and click **OK**.

Use a profile name that identifies the specific configuration. For example, include the pipette head type and the pipette head serial number in the profile name. If this computer controls multiple Bravo Platforms, also identify the device, for example, the device serial number.

4 Under **Connection**, select one of the following types:

- *Ethernet*. Select **This Bravo is connected via Ethernet**, and then continue with step 5.

- *Serial*. Select **This Bravo is connected via serial**, and then select which **COM** port on the computer you are using. Go to step 6.
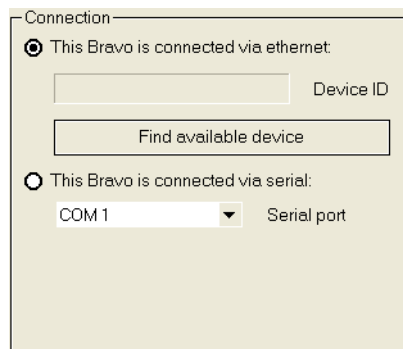
5 *Ethernet connection only.* Click **Find available device** to select the device to associate with the profile.

In the **Discovered BioNet Devices** dialog box that appears:

a Click the **Select the Ethernet adapter to use from the list below**, and select the correct adapter for the device connection.

b In the list of devices that appear, select the Bravo device. If multiple Bravo devices are on the network, use the **MAC Address** to identify the Bravo device for this profile. To successfully communicate with the Bravo device, the **Status** column must display **New** or **Matched**.

c Click **OK**.
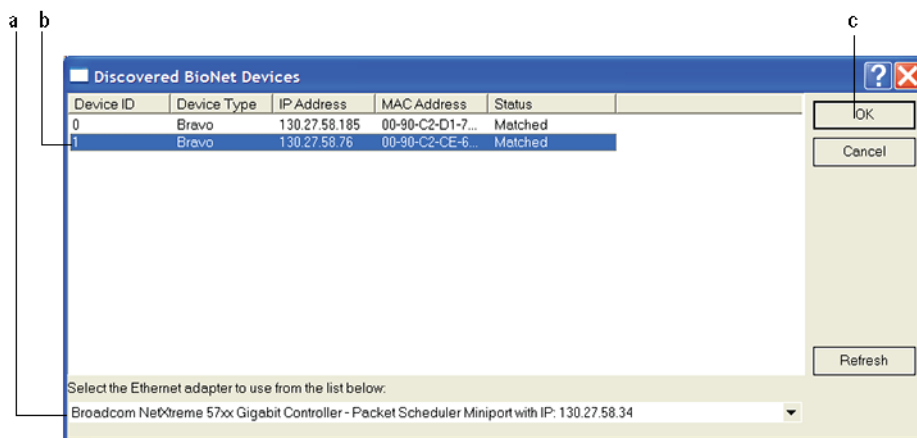
6 Under **Head Information**, configure the pipette head settings:

a Select the **Head type** from the list.

b *Disposable tips only.* Select the **Teaching tip type** from the list. This must be an Automation Solutions brand tip.

> **CAUTION** Failure to select the correct Teaching tip type can result in a pipette head crash.

c Ensure that the **Check head type on initialize** check box is selected.

7 *Optional.* In the **Miscellaneous** area, verify the settings to be applied during a protocol run. If you are unsure of which values to set, start with the default values. You can change them later if necessary.

For more details, see "Miscellaneous area" on page 220.

8 Click **Update this profile** to save the current selections and settings.

9 To initiate communication with the Bravo Platform using the new profile, click **Initialize this profile**.

> ⚠️ **WARNING** **When you initialize the Bravo Platform, the pipette head can move. Keep clear of the pipette head while it is in motion. Do not touch any of the moving parts or attempt to move labware while the Bravo Platform is in operation. The device could pinch, pierce, or bruise you.**

The Bravo Platform must be initialized before you edit teachpoints.

Related information

For information about...	See...
The workflow this procedure belongs to	"Workflow for setting up the Bravo Platform" on page 42
The next step	"Setting teachpoints" on page 61
What to do if the Bravo Platform device does not appear in step 5	"Troubleshooting hardware problems" on page 89
Concurrent motion settings for an integrated Bravo Platform	"Bravo concurrent motion features for integrated systems" on page 56
Profiles tab in Bravo Diagnostics	"Profiles tab quick reference" on page 219
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49

Bravo concurrent motion features for integrated systems

About this topic

To increase throughput, you can integrate the Bravo Platform with a plate-handling system (such as the BenchCel Workstation) or a lab automation system (such as the BioCel System or a third-party system). The integration allows you to transfer a large number of microplates to and from the Bravo Platform for processing.

This topic describes the features you can use in the integration:

- Concurrent operation
- Safe location

Using the features

To use the concurrent operation or the safe location feature, you must:

- Set up the teachpoints for the locations that the Bravo Platform and the other lab automation system robot will access. For instructions, see the relevant user documentation: *BenchCel Microplate Handling Workstation User Guide*, the *BioCel System User Guide*, or the user documentation for the third-party lab automation system.
- Select the appropriate option in your Bravo profile.

Concurrent operation feature

The concurrent operation feature is used in the Bravo-BenchCel Workstation system only. The feature enables the Bravo Platform to perform pipetting tasks while allowing the BenchCel robot to access another deck location concurrently. For example, the Bravo Platform can aspirate or dispense liquid at deck location 2 while the BenchCel robot is placing or removing a microplate at deck location 3.

If the Bravo Platform is in the middle of a task and the BenchCel robot needs to access the same deck location, the BenchCel robot will wait for the Bravo to finish before approaching. After completing the task, the Bravo pipette head will move to another deck location to perform the next task or move to deck location 5 to avoid collision.

Note that the BenchCel robot always approaches the Bravo Platform from the left side or the right side. In addition, the BenchCel robot can access only the left-most and right-most deck locations. Therefore, the Bravo Platform will move its pipette head to deck location 5 (center deck location) when avoiding collision.

Figure   Bravo deck (top view) and locations accessible by the BenchCel robot

Deck locations that the BenchCel accesses

Bravo deck (top view)
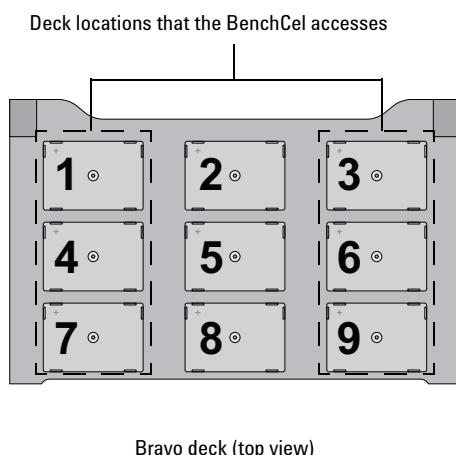
Safe location feature

The safe location feature is used in the Bravo-BioCel System or when the Bravo Platform is integrated in a third-party lab automation system. The feature:

- Allows one robot to access the Bravo deck at any given time. For example, if the Bravo Platform is performing a liquid-handling task, the BioCel robot or third-party robot will wait for the Bravo Platform to finish before approaching the deck. If the BioCel robot or third-party robot is placing or removing a microplate from one of the deck locations, the Bravo Platform will wait for the robot to finish.

- Enables the Bravo Platform to move to a specified deck location (safe location) whenever the BioCel robot or a third-party robot approaches the deck to perform a task. For example, if you specified deck location 1 as the safe location, the Bravo pipette head will always move to deck location 1 whenever the BioCel robot or third-party robot approaches.

   IMPORTANT   You can specify any deck location as the safe location. However, you should determine the relative position of the BioCel robot or third-party robot and its approach direction before specifying the Bravo safe location.

Use the following figure to facilitate the planning of the integration and safe-location specification.

Figure Bravo deck locations (top view)
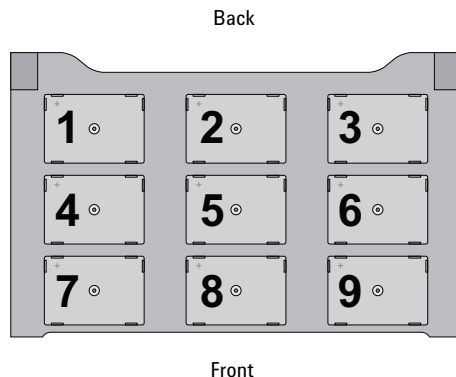
Back

Front

Related information

For information about...	See...
Profiles	"Creating and managing profiles" on page 51
The next step	"Setting teachpoints" on page 61
Opening diagnostics	"Opening Bravo Diagnostics" on page 49

Initializing the Bravo Platform

About this topic

To establish communication between the computer and the Bravo Platform, you initialize the Bravo device in the VWorks software.

Procedures

⚠️ **WARNING** **When you initialize the Bravo Platform, the pipette head can move. Keep clear of the pipette head while it is in motion. Do not touch any of the moving parts or attempt to move labware while the Bravo Platform is in operation. The device could pinch, pierce, or bruise you.**

You can initialize the Bravo Platform in either of the following ways:

* Initialize the profile in Bravo Diagnostics
* Initialize the device in the VWorks software window

To initialize a profile in Bravo Diagnostics:

1 In the **Profiles** tab, select the profile from the **Profile name** list.
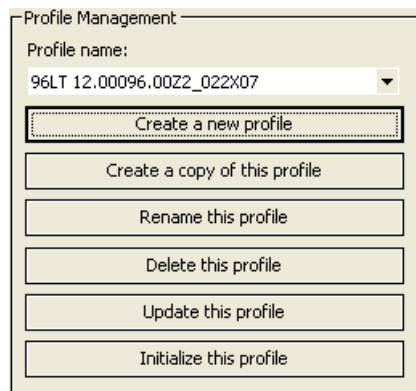
2 Verify that the selected **Head type** matches the pipette head mounted on the Bravo Platform.

For example, if you installed a Series III pipette head, you must select a Series III head type.

3 Click **Initialize this profile**.

To initialize the device from the VWorks software window:

1 In the **VWorks** window, choose **File > Open**. In the **Open** dialog box, select the ***.dev** file type, navigate to the device file, and then click **Open**.

A list of the devices appears in the Device File tab.

2 In the **Devices** area, highlight the device or devices that you want to establish communication with, and verify that the correct profile is selected in the **Bravo properties** area.

3 Click **Initialize selected devices**.
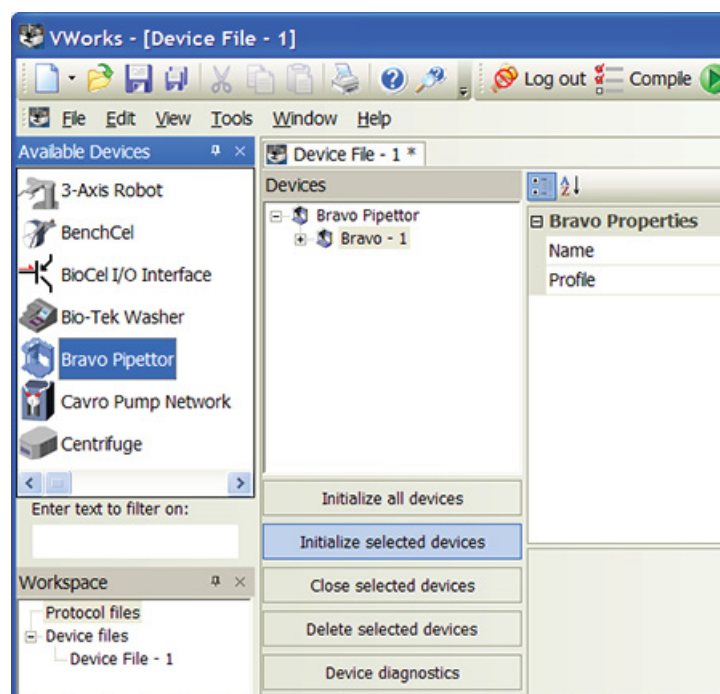
IMPORTANT   If a message appears warning you that fluid might be in the tips, but no fluid is in the tips, choose the Retry option to continue homing the w-axis. If you choose Ignore, you must home the w-axis before beginning a protocol.

IMPORTANT   If a message appears warning you that a microplate is in the gripper, choose the Ignore option to continue the homing process.

Related information

For information about...	See...
Adding more devices to a device file	"Creating or adding a Bravo device" on page 45
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Profiles	"Creating and managing profiles" on page 51

Setting teachpoints

About this topic

This topic explains how to set teachpoints. You must set or edit teachpoints anytime the following occurs:

- You are using a new pipette head or a pin tool for the first time

  IMPORTANT   For pin tools, you set the teachpoints as you would for a fixed-tip pipette head. See the workflow for non-tipbox locations.

- The existing teachpoint files are lost or damaged
- You first set up your Bravo Platform
- You change the teaching tip type in the profile for a disposable-tip pipette head
- You add an accessory

Teachpoint defined

A teachpoint is a set of axial coordinates that define a location to which the pipette head moves. Each of the nine locations on the Bravo deck has a default teachpoint that can be edited in Bravo Diagnostics. The default teachpoints are set so that well A1 is at the back left corner of each deck location.

Before you start

Make sure you do the following:

- Remove all labware from the Bravo deck locations.
- Verify that the correct pipette head or pin tool is installed and the corresponding profile is initialized.

Workflow for non-tipbox locations

Step	For this task...	See...
1	Set the first teachpoint. Use a deck location that is easy to access, for example, deck location 1, 4, or 7.	

Step	For this task...	See...
2	Set teachpoints for the remaining locations by doing one of the following:	"Setting other teachpoints based on one teachpoint" on page 65
	• Automatically set the remaining teachpoints based on the first teachpoint.	
	• For more precise teachpoints (384- or 1536-well plates), repeat step 1 for each deck location.	"Setting the first teachpoint" on page 63
3	Verify each teachpoint.	• "Verifying teachpoints for disposable-tip pipette heads" on page 66
		• "Verifying teachpoints for fixed-tip pipette heads or pin tools" on page 67
4	Edit the teachpoint, as required, for any accessory locations, such as the Weigh Station or an Orbital Shaking Station.	The procedure can vary depending on the accessory. For details, see "Accessories overview for the Bravo Platform" on page 118.

CAUTION   To prevent the pipette head from crashing into an accessory, be sure to start the accessory teaching process from the safe *z*-axis point above the accessory location. This is especially important if you use the **Set all teachpoints based upon selected teachpoint** feature.

Workflow for a tipbox location

Pressing tips on the pipette head requires a high degree of precision in the positioning of the tipbox relative to the pipettor head, especially for 384-well tipboxes.

Step	For this task…	See…
1	Determine the platepad requirements for the tipbox location:	
	• Standard Bravo Platform – *ST tipbox.* Use an Alignment Station instead of a standard platepad at the deck locations where you perform tipbox operations. The Alignment Station helps provide greater tip-loading precision.	"Installing an Alignment Station" on page 156
	– *LT tipbox.* If using a 250-µL tipbox, you can use a standard platepad or an Alignment Station. *Note:* If using a 200-µL tipbox, use a standard platepad and an LT insert for tip loading.	–
	– *Nested tipbox.* Install and configure the Nested Rack Insert.	"Setting up a Nested Rack Insert" on page 158
	• SRT Bravo Platform – *ST tipbox.* Use ST platepad. – *250-µL tipbox.* Install the 250-µL platepad and configure the deck location.	"(Bravo SRT only) Setting up an LT tipbox location" on page 167
2	Set the teachpoint for the location.	"Setting the first teachpoint" on page 63
3	*ST tipbox locations.* Verify the labware definition for the tipbox.	"Verifying teachpoints for disposable-tip pipette heads" on page 66
4	Verify the teachpoint. If tipbox operations are not precise enough, repeat this step.	"Verifying teachpoints for disposable-tip pipette heads" on page 66

Setting the first teachpoint

If you are using a fixed-tip pipette head or a pin tool, set the teachpoint according to the A1 needle. If you are using a pipette head with disposable tips, place a tip on the A1 barrel to set the teachpoint.

To set the first teachpoint:

1   In **Bravo Diagnostics**, click the **Profiles** tab, and initialize the desired profile.

2   (Disposable tips only) Place a tip firmly on the pipette head barrel that corresponds to the A1 well of the labware you are using.

> **CAUTION**   Make sure the disposable tip is an Automation Solutions tip and is the same type that you specified as the Teaching tip type in the profile.

3 Click the **Jog/Teach** tab.

4 In the **Location** list, select the deck location. If you are setting up the first teachpoint, select location **1**, **4**, or **7**.

5 Set the **Approach height above teachpoint** to a safe distance, such as 20 mm, and then click **Approach.**
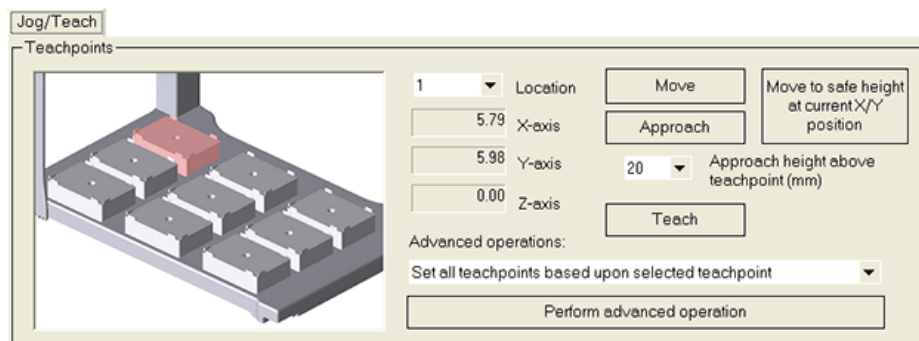
6 Use the **Jog Axes** controls to move the pipette head to the correct teachpoint as follows:
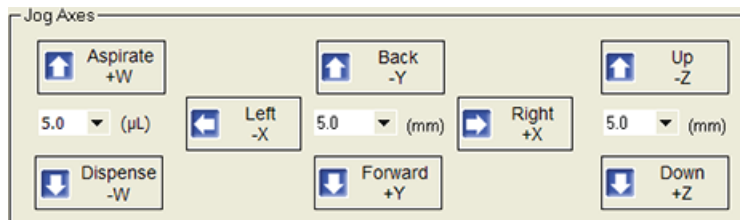
> **CAUTION** Be careful not to jog the head down too far, especially for a fixed-tip head. Jogging the head down too far will damage the tip.

> **CAUTION** When jogging down in the z-axis, a warning might appear stating that you are about to exceed the set teachpoint, which could cause a crash. Before you click OK, verify that enough space remains to continue jogging down.

a Jog the pipette head down (z-axis) until the A1 tip is approximately 2 mm above the platepad.

Reduce the increment value when the tip gets close to the deck.

b Jog the pipette head in 0.05 mm increments in the x and y directions, until the tip is positioned directly above the crosshair mark on the platepad.

c To achieve paper-thin z-axis clearance, slide a sheet of paper between the tip and the platepad. Set the z-axis increment to 0.05 mm increments. Jog the pipette head down until the paper is barely pinched, and then jog up by 0.05 mm.

7 When the tip is in the correct position (directly over the crosshair mark with paper-thin clearance), click **Teach.**

Verify the information in the message box before you click **OK.**

Figure   Pipette tip A1 position over the platepad crosshair mark
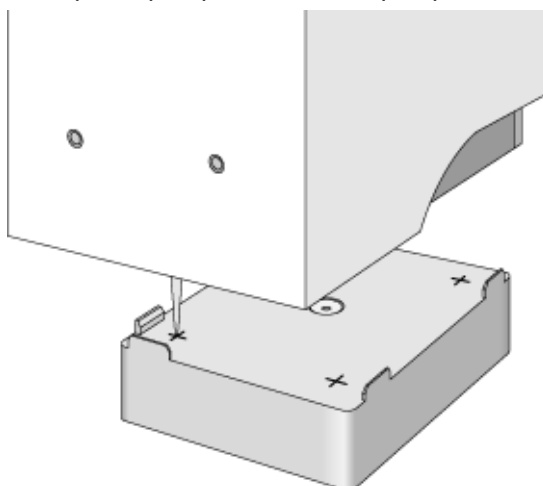
8   To save the teachpoint, click the **Profiles** tab and click **Update this profile.**

Setting other teachpoints based on one teachpoint

After setting the first teachpoint, you can have the VWorks software calculate the other eight teachpoints based on the selected teachpoint. Typically, this is done upon initial setup of a new pipette head.

IMPORTANT   For optimal performance, teach each of the nine locations independently using the procedure, "Setting the first teachpoint" on page 63.

To set the other eight teachpoints:

1   In the **Jog/Teach** tab, verify that the teachpoint you just taught ("Setting the first teachpoint" on page 63) is set in the **Location** list.
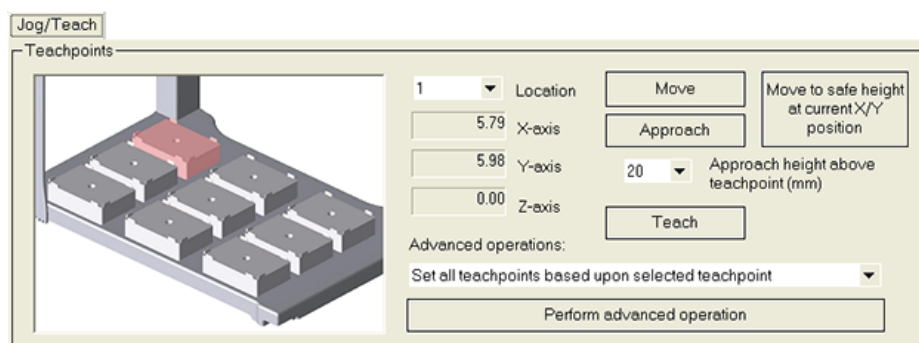
The teachpoint for the other locations will be set based on this one.

2   In the **Advanced operations** list, select **Set all teachpoints based upon selected teachpoint**.

3   Click **Perform advanced operation.**

The VWorks software calculates the teachpoints for the other eight locations, keeping the z-axis coordinate the same and changing the x and y coordinates according to their spacing.

4 Readjust the *z*-axis height for any positions that are taller than a standard platepad, such as the Orbital Shaking Station.

5 To save the teachpoints, click the **Profiles** tab and click **Update this profile.**

Verifying teachpoints for disposable-tip pipette heads

For disposable-tip pipette heads, verify the following:

- The labware definition for the tipbox contains the correct column-wise and row-wise teachpoint-to-well values.
- The teachpoint is accurate for proper tips-on and tips-off operations.

To verify the tipbox labware definition:

1 Open the **Labware Editor**.

2 In the **Pipette/Well Definition** tab, verify the following values for the tipbox labware definition:

Large transfer (LT) tips	Small transfer (ST) tips
Row-wise teachpoint to well (mm) = 0	Row-wise teachpoint to well (mm) = 2.25
Column-wise teachpoint to well (mm) = 0	Column-wise teachpoint to well (mm) = 2.25

To verify the teachpoint accuracy:

> **CAUTION** For disposable-tip pipette heads, make sure you use a full set of tips to verify each teachpoint.

1 Open **Bravo Diagnostics**, and click the **Jog/Teach** tab.

2 Click **Move to safe height at current X/Y position** to move the pipette head up so that you have enough room to remove the single pipette tip from the head barrel.

3 Place a tipbox full of tips on the tipbox location that you are verifying. Make sure the tipbox is sitting level on the platepad.

4 Perform a tips-on operation as follows to ensure the tips are loaded properly:

    a Click the **Processes** tab.

    b In the **Command to Execute** list, select **Tips On**.

    c Click **Execute Command**. The pipette head presses down to install the tips, and then moves back up.

5 Remove the empty tipbox from the deck location.

6 In the **Jog/Teach** tab, click **Move**. The pipette head moves to the teachpoint you set in "Setting the first teachpoint" on page 63. You might notice that the A1 tip is not quite in the correct position.

7 Use the **Jog Axes** controls to move the pipette head A1 tip to the correct position (directly over the crosshairs with paper-thin clearance).

8 When you are finished, click **Teach**. Verify the information in the message box before you click **OK**.

9 Repeat step 6 to step 8 for each deck location.

10 To save the changes, click the **Profiles** tab and click **Update this profile**.

Verifying teachpoints for fixed-tip pipette heads or pin tools

After setting and saving teachpoints, you should verify each teachpoint.

To verify a teachpoint:

1 In the **Jog/Teach** tab, set the **Location** field to the location you want to check.

2 Click **Approach**.

3 Use the following table to decide your next step:

If the A1 tip is ...	Then ...
Above the crosshairs at the approach height	**a** Click **Move** to move the tip to the teachpoint. **b** Visually check the position of the pipette tip. It should be directly over the crosshairs with a clearance of about the thickness of a sheet of paper. (If it is not, repeat "Setting the first teachpoint" on page 63.)
Not above the crosshairs or appears to be closer to the deck than the approach height	There is a problem with the teachpoint. Repeat "Setting the first teachpoint" on page 63.

4 Repeat the above steps for each teachpoint.

Related information

For information about...	See...
The workflow this procedure belongs to	"Workflow for setting up the Bravo Platform" on page 42
Opening Diagnostics	"Opening Bravo Diagnostics" on page 49
Creating and initializing a profile	"Creating and managing profiles" on page 51 (step 9)
Installing accessories	"Accessories overview for the Bravo Platform" on page 118
Changing the pipette head	"Changing the pipette head or pin tool" on page 77
The Jog/Teach diagnostics tab	"About the Jog/Teach tab" on page 96

Verifying the gripper setup

About this topic

If the Bravo Platform includes a gripper, you should verify that the gripper performs the pickup and placement of labware smoothly before running a protocol. This topic describes how to check the gripper performance, and if required, adjust the y-axis offset.

Before you begin

Make sure you have labware definitions for the labware that you are using.

Procedures

To pickup and place labware correctly, the y-axis offset gripper arms must be positioned at equal distances from the sides of the labware. You can use the Gripper tab in Bravo Diagnostics to check the gripper.

Figure Bravo Diagnostics Gripper tab
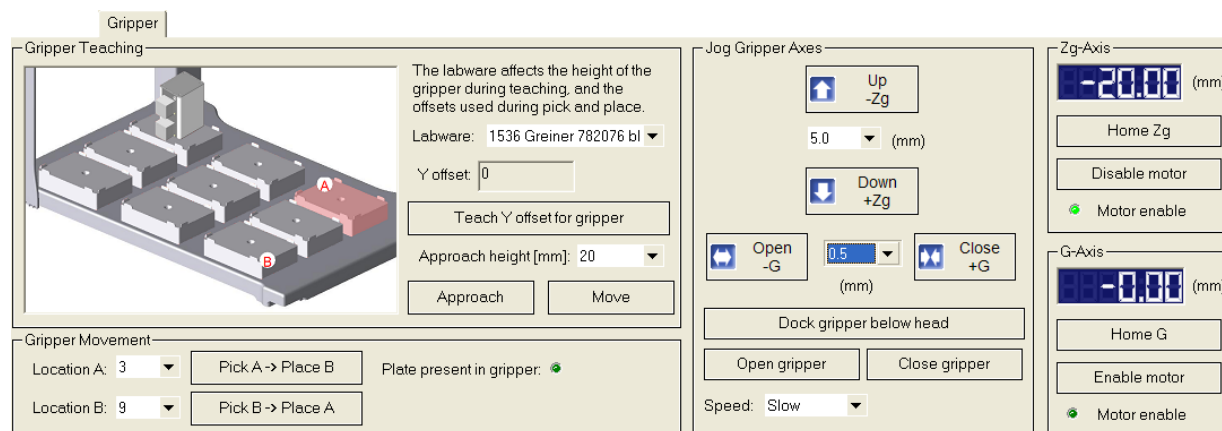
To check the gripper pick-and-place operations:

1 In **Bravo Diagnostics**, click the **Gripper** tab.

2 Select the **Labware** from the list.

3 In the **Location A** list, select a deck location.

4 In the **Location B** list, select a deck location.

5 Place a test microplate on deck location A or B, and then click one of the following:

- **Pick A -> B** to pick up the microplate from deck location A and place it on deck location B.

- **Pick B -> A** to pick up the microplate from deck location B and place it on deck location A.

6 Make sure that the gripper holds the microplate securely and keeps it level while moving the microplate from location to location.

If the gripper performs the operation without problem, no further adjustment is required.

If the gripper does not hold the microplate level, use the following procedure to adjust the y-axis offset.

To adjust the gripper y-axis offset:

1   Place a test microplate on an easily accessible deck location.

2   In the **Gripper** tab in **Bravo Diagnostics**, click select the **Labware** from the list.

3   Ensure the **Approach height** is set to a safe value, for example 20 mm, and then click **Approach**.

4   Visually check the y-axis clearance of each gripper arm to ensure that the arms will clear both sides of the microplate. Click **Move** to move the gripper to the previously saved teachpoint.

5   Check to see if the gripper arms are at equal distances (y-axis) from the sides of the microplate.

If necessary, you can close the gripper arms slightly to verify that they are equal distances. In the **Jog Gripper Axes** area, set the G increment to 0.5 mm, and then click **Close +G**.

6   If the gripper arms are not at equal distances, adjust the y-axis as follows:

> **CAUTION**   Make sure you use small enough jog increments to prevent any gripper collisions, which could damage the gripper.

   a   In the **Jog/Teach** tab, set the y-axis increment to 0.5 mm, and then use the **Back -Y** and **Forward +Y** buttons to position the gripper so that the arms are at equal distances around the microplate.

   b   In the **Gripper** tab, click **Teach Y offset for gripper**.

   c   In the **Profiles** tab, click **Update this profile**.

   d   Re-check the gripper pick-and-place operation.

Related information

For information about...	See...
The workflow this procedure belongs to	"Workflow for setting up the Bravo Platform" on page 42
Opening Diagnostics	"Opening Bravo Diagnostics" on page 49
Gripper tab	• "Fine-tuning the gripper movements" on page 107 • "Gripper tab quick reference" on page 217
Setting teachpoints	"Setting teachpoints" on page 61
Reporting problems	"Reporting problems" on page 92

Preparing the Bravo Platform for a run

About this topic

This topic explains how to prepare the Bravo Platform for a run.

Run description

A run is a single protocol that is performed one or more times in a series.

Before you start

Make sure:

- The Bravo Platform is turned on and the correct pipette head is installed.
- The VWorks software is set up.

Procedure

To prepare the Bravo Platform for a run:

1 Initialize the profile for the specific hardware configuration.

2 Place microplates, tipboxes, and other labware in their correct locations on the Bravo deck.

   To avoid variability problems, use only Automation Solutions brand tips.

3 If you are using an accessory, such as a Pump Module or Weigh Station, make sure the reservoirs are filled, the waste bottles are empty, and all tubing is correctly connected.

4 Empty the Tip Trash, if installed.

5 Compile the protocol, and ensure no errors or warnings appear.

6 Run the protocol in simulation mode to identify possible conflicts or errors.

   If you encounter errors or warnings, you can use the VWorks software log to determine the cause of the problem.

Related information

For information about...	See...
Installing and setting up the Bravo Platform	• "Workflow for installing the Bravo Platform" on page 24 • "Workflow for setting up the Bravo Platform" on page 42
Installing and setting up the VWorks software	*VWorks Automation Control Setup Guide*
Initializing the Bravo Platform	"Initializing the Bravo Platform" on page 58

For information about...	See...
Removing one pipette head and installing a different head	"Changing the pipette head or pin tool" on page 77
Performing a protocol run	*VWorks Automation Control User Guide*

5
Maintaining the Bravo Platform

This chapter tells you how to keep your Bravo Platform in good working order through cleaning, inspection, and maintenance. It also explains what to do when you encounter a problem.

This chapter contains the following topics:

Agilent Technologies

Routine maintenance

About this topic

Preventive maintenance is an important part of keeping the Bravo Platform running smoothly and error free. This topic describes the periodic routine maintenance you should perform.

Practice good housekeeping by cleaning up spills immediately and routinely cleaning the Bravo Platform and pipette head after use. Contact Automation Solutions Technical Support if you are unable to resolve problems.

Routine inspection and maintenance

Periodically, perform the routine maintenance listed below. Your schedule might vary depending on the frequency of Bravo Platform use.

Maintenance task	Schedule	Symptoms
Clean the Bravo Platform.	Weekly or as needed	Dust, grime, or chemical deposits on exterior
Verify teachpoint accuracy for each deck location.	Bimonthly	Inaccurate dispensing at a particular deck location
Calibrate the Weigh Station, if applicable.	Bimonthly	Deterioration of liquid-level accuracy in reservoir
Inspect the Bravo Platform for wear.	Monthly	Corrosion and loose screws and bolts
Inspect the Pump Module tubing. Change out the tubing as necessary.	Monthly	Tube deterioration, or liquid fails to pump or fails to drain properly
Inspect moving parts to ensure they are not rubbing against each other.	Monthly	Rub marks or noises that might indicate rubbing

Related information

For information about...	See...
Safety guidelines	"Safety guidelines" on page 1
Cleaning between protocol runs	"Cleaning up after a run" on page 76
Cleaning the Bravo Platform	"Cleaning the Bravo Platform" on page 75
Setting teachpoints	"Setting teachpoints" on page 61
Reporting a problem	"Reporting problems" on page 92

Cleaning the Bravo Platform

About this topic

This topic provides guidelines for periodic routine cleaning of the Bravo Platform to remove dust, grime, or chemical deposits on the exterior.

Procedure

> ⚠️ **WARNING**   **Disconnect the power and communication cables before cleaning.**

> **CAUTION**   Do not use harsh abrasives, corrosive cleaning agents, or metal brushes to clean any Bravo Platform component or accessory.

To clean the Bravo Platform:

1 Shut down the VWorks software.

2 Disconnect the power cable and communication cable.

3 Use standard laboratory wipes and a mild detergent or ethanol to clean the painted white surfaces and the aluminum surfaces.

Related information

For more information about…	See…
Routine maintenance	"Routine maintenance" on page 74
Cleaning up after a run	"Cleaning up after a run" on page 76
Safety guidelines	"Safety guidelines" on page 1
Reporting a problem	"Reporting problems" on page 92

Cleaning up after a run

About this topic

This topic describes the post-run tasks you perform after a protocol run before running the next protocol.

Cleaning up after a run

To clean up the Bravo Platform after a run:

1 Ensure the tips are clean or fresh:

- *Fixed-tip pipette head.* Use the wash-tips task in Bravo Diagnostics to wash the pipette tips.

- *Disposable-tip pipette head.* Use the tips-off task in Bravo Diagnostics to remove the pipette tips.

2 If a message appears and asks whether to release all racks, click **Yes**.

3 Ensure all pipette head movement has stopped, and then remove any manually placed labware, and clean up any spills or debris.

4 Wash the liquid reservoirs and wash trays.

5 If the system has a Pump Module:

a *Optional.* Wash the tubing and reinstall the reservoirs or wash trays. Ensure that the tubing is connected to the correct pumps.

b Fill the fluid reservoir bottle, replace the cap, and attach the fluid line that pumps towards the Bravo Platform to the cap connector.

c Empty the waste container, replace the cap, and attach the fluid line that pumps away from the Bravo Platform to the cap connector.

d To prime the fluid lines between the pump and reservoirs, use Bravo Diagnostics to fill the lines with the appropriate fluid.

6 Check the run log file for errors. For details on the run log, see the *VWorks Automation Control User Guide*.

7 *Weigh Station only.* Recalibrate the Weigh Station if:

- Moving the reservoir, wash station, and Weigh Station
- Changing the tubing connected to the reservoir or wash station
- Changing the liquid type used in the reservoir or wash station
- More than two weeks have elapsed since the last Weigh Station calibration

Related information

For information about...	See...
Running logs, saving protocols, or using the Log toolbar	*VWorks Automation Control User Guide*
Running a task	"Performing a task using Bravo Diagnostics" on page 113

For information about...	See...
Shutting down	"Starting up and shutting down" on page 43

Changing the pipette head or pin tool

About this topic

Use the procedure in this topic to remove a mounted pipette head or pin tool and install a different one.

Before you begin

IMPORTANT If a pipette head or pin tool is being used for the first time, make sure you have a profile specifically for that pipette head or pin tool. If necessary, create a new profile before starting the following procedure. For details, see "Creating and managing profiles" on page 51.

If there are disposable tips on the currently installed pipette head, use the **Tips Off** command in Bravo Diagnostics to remove the tips.

Changing a pipette head or pin tool

IMPORTANT If you are changing the currently installed pipette head for the same type of pipette head and want to edit the profile, you may use the Change head wizard. Otherwise, use the following procedure.

To change a pipette head or pin tool:

1 Make sure that the head mount is in its home position above deck location 5.

If the head mount is not in the home, click the **Jog/Teach** tab in **Bravo Diagnostics,** and then click **Home XYZ** to reposition the head mount.

2 In **Bravo Diagnostics**, click the **Profiles** tab and select the profile for the pipette head or pin tool.

You will initialize the profile later in this procedure.

3 On the side of the Bravo Platform, press the power switch to the **off (o)** position.

> **CAUTION** Always turn off the Bravo Platform before removing a pipette head or pin tool. Failure to turn off the Bravo Platform before changing the pipette head can damage the pipette head electronics.
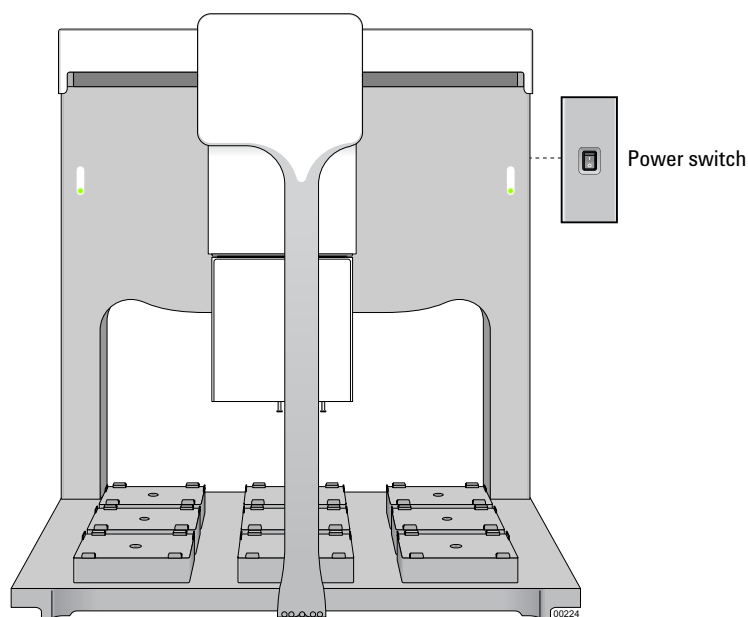
4 To unlock the pipette head:

  a Pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

  b Turn the head lock counterclockwise until it clicks into position.

Head lock

Retainer pin
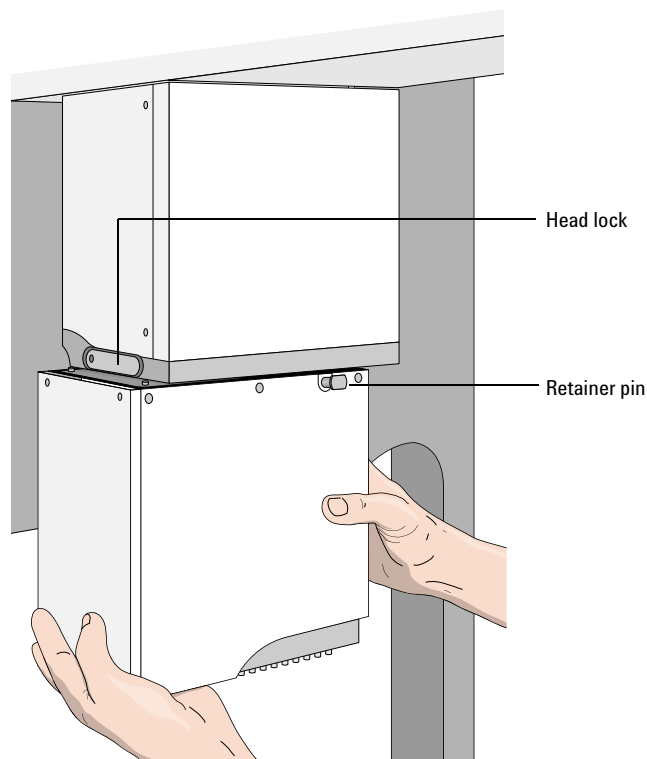
5 Grasp the pipette head firmly using care not to touch the tips or barrels. While supporting the head with your hands, use your thumbs to push the head from side to side and slide it out of the Bravo head mount.

> **CAUTION**   Support the pipette head or pin tool carefully without touching the barrels, tips, or pins. Dropping the head or bumping the barrels, tips, or pins will damage the head.

6 Carefully slide the pipette head into the head stand to protect the barrels and tips for storage.
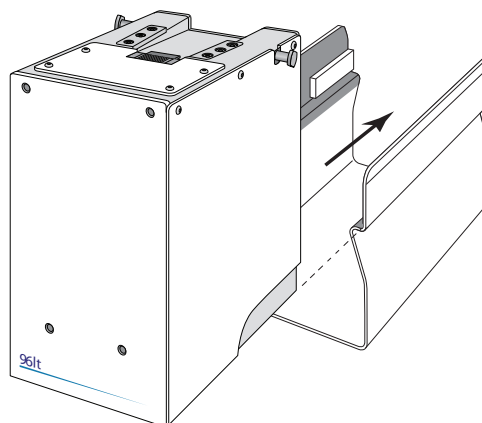
7 On the pipette head to be mounted, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

8 Slide the pipette head onto the Bravo head mount. Press the pipette head firmly into place to ensure the head is plugged into the connector receptacle on the head mount.

9 To lock the pipette head:

   a Rotate the head lock clockwise until it reaches its hard stop.

      This ensures that the head is fully seated and does not shift position during operation.

   b Twist the two head-retainer pins so they snap in, securing the pipette head on the mount.
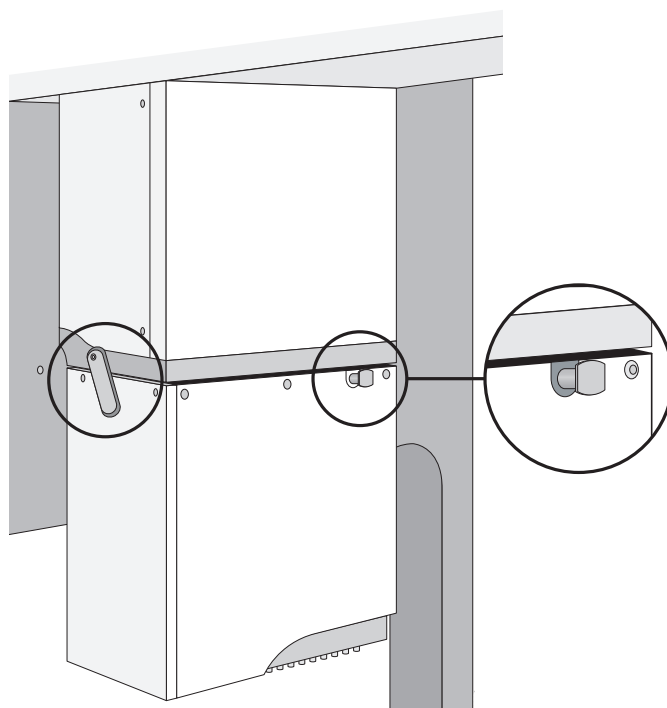
> **CAUTION**   Do no touch the pipette head barrels or tips or the pin tool pins with your hands.

> **CAUTION**   If the pipette head or pin tool is not properly secured in place, it could drop unexpectedly. Dropping the pipette head or pin tool, or bumping the barrels, tips, or pins will damage the head. Contact Automation Solutions Technical Support if you suspect a damaged pipette head.

10 On the side of the Bravo Platform, press the power switch to the **on (–)** position.

11 In **Bravo Diagnostics**, ensure that the correct profile for the pipette head or pin tool is selected in the **Profiles** tab, and click **Initialize this profile**.

Adjusting VWorks software settings

After mounting a different pipette head or pin tool, you must ensure that the Bravo device in the VWorks software is linked to the correct profile.

To adjust VWorks software settings for a new pipette head or pin tool:

1 In the **VWorks** window, ensure the correct device file is open for this Bravo device, and then ensure that the profile selected under **Bravo Properties** is correct.

> **IMPORTANT** If this is the first time to use this pipette head or pin tool with this device, you must create a profile for the new pipette head or pin tool.
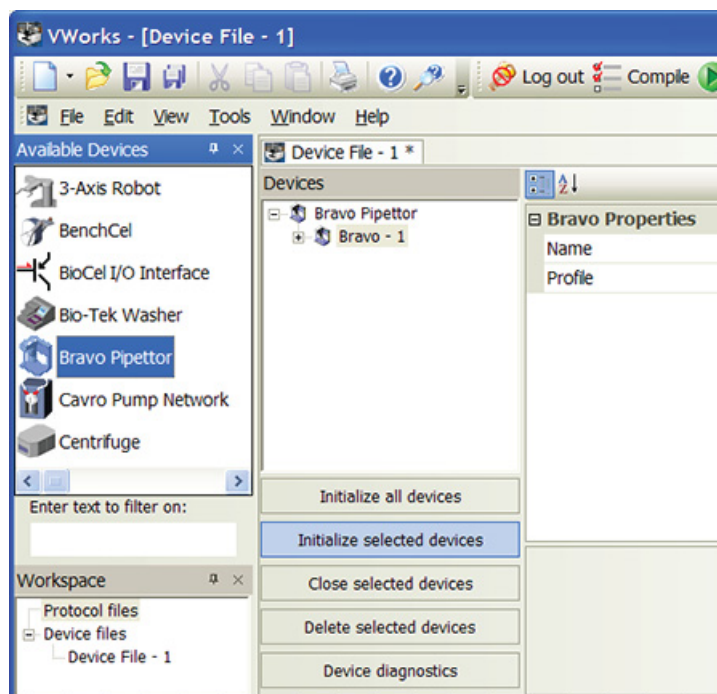
2 To initialize the Bravo Platform, click **Initialize selected devices** in the device file.

3 Open **Bravo Diagnostics**, and in the **Jog/Teach** tab, make sure that a value is displayed for each axis.

This confirms communication between the Bravo Platform and VWorks software.

4 If you opened an existing device file in step 1, go to the **Configuration** tab and verify that the location configuration graphic matches what you actually have on the Bravo deck.

Related information

For information about...	See...
Tips Off task in Bravo Platform Diagnostics	"Performing a task using Bravo Diagnostics" on page 113
Initializing the Bravo Platform	"Initializing the Bravo Platform" on page 58

For information about...	See...
Homing the pipette head	"Homing the pipette head" on page 99
Available pipette heads	"Pipette heads and pin tools" on page 18
Turning on the Bravo Platform	"Starting up and shutting down" on page 43
Changing the profile	"Creating and managing profiles" on page 51

Replacing the fuse

About this topic

This topic describes how to replace the main fuse in the Bravo Platform.

Before you begin

> **CAUTION** A blown fuse can indicate more serious problems. If the new fuse blows after replacement, contact Automation Solutions Technical Support.

> **CAUTION** Using an incorrect fuse can damage the Bravo Platform.

Use only the specified fuse type: 10 A, 250 V, 5 mm x 20 mm, fast acting. You can order fuses from Agilent Technologies.

Procedure

To replace the fuse in the power switch:

1   Shut down the Bravo Platform, and unplug the power cable from the rear panel connector.

2   At the rear panel power switch enclosure, use a small flat-head screwdriver (2.5 mm) to pry open the tab on the fuse enclosure and open the enclosure cover.

Figure Fuse enclosure location
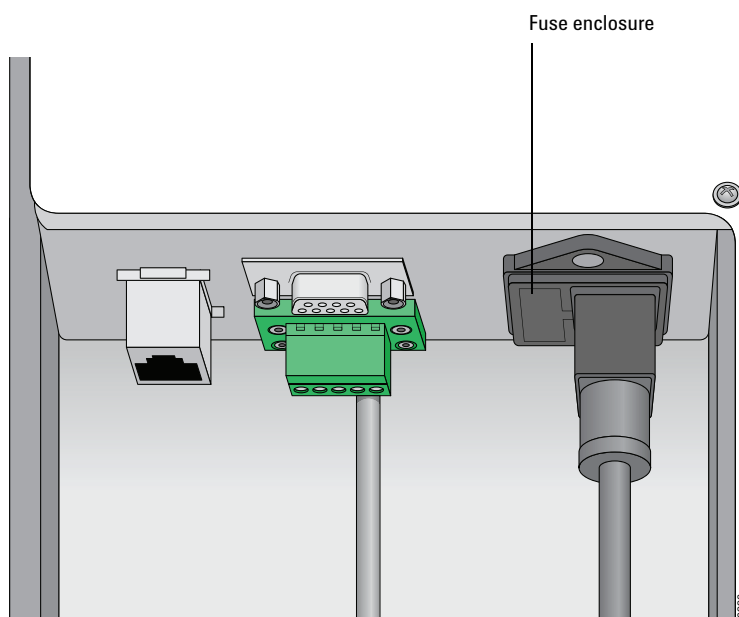
Fuse enclosure

3 Insert the screwdriver head in the enclosure notch to dislodge the fuse cartridge. Slide the fuse cartridge all the way out of the enclosure.

4 Replace the fuse in the cartridge.

5 Slide the fuse cartridge back into the fuse enclosure.

6 Press the enclosure cover securely into the closed position.

7 Plug in the power cable at the rear panel connector, and then start up the Bravo Platform.

Related information

For information about…	See…
Hardware components	"Hardware overview" on page 10
Safety	"Safety guidelines" on page 1
How to report a problem	"Reporting problems" on page 92

Retracting tip-box stripper pins

About this topic

This topic describes how to retract and release the stripper pins on a disposable-tip pipette head. Read this topic if you are using the pipette head to pipette in single rows.

Stripper pins described

The disposable-tip pipette heads have four stripper pins that prevent the tipbox from raising off the deck when tips are being applied.

However, you can retract the stripper pins to perform a task where the pins will interfere. For example, if you are using a 96ST pipette head in a 384-tipbox, it can help prevent tips from touching other tips during a tips-on task.
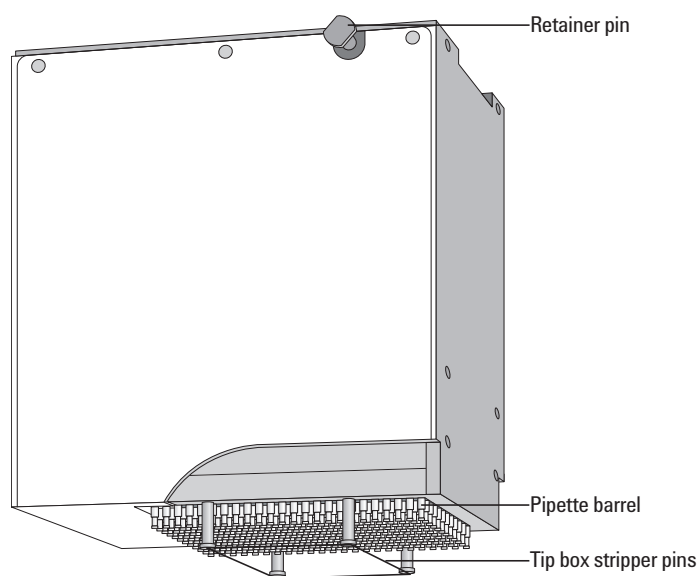
Retracting tipbox stripper pins

To retract the tipbox stripper pins:

1 Put the pipette head upside down on a stable surface, so that the barrels are facing up.

2 Insert the end of a 2-mm hex wrench into the head of one of the pins.

3 Push the pin into the pipette head until you feel it stop.

It should be nearly flush with the surface. If it is not flush, twist the pin counterclockwise in quarter-turn increments, pushing in after each twist.

4 When the pin is properly seated, twist it counterclockwise no more than 180° until it locks.

5 Repeat step 2 to step 4 for the other pins.

Releasing tipbox stripper pins

To release the retracted tipbox stripper pins:

1   Insert a 2-mm hex wrench into the pin head.

2   Turn the wrench clockwise to release the pin.

3   Repeat step 1 and step 2 for the other pins.

Related information

For information about...	See...
Using the serial dilution task	*VWorks Automation Control User Guide*
Setting the head mode to pipette by row	• *VWorks Automation Control User Guide* • "Performing a task using Bravo Diagnostics" on page 113
Removing and installing a pipette head	"Changing the pipette head or pin tool" on page 77

Moving the pipette head manually

About this topic

This topic describes how to disable all servo motors, so that you can move the pipette head manually in the x-$axis$ and y-axis. For example, you might want to move the head position when changing pipette heads or cleaning the Bravo Platform.

Procedure

> **CAUTION**   Moving the pipette head in any of its axes without first disabling the servo motors can damage the device.

To move the pipette head manually:

1   Press the red button on the pendant.

This disables the Bravo motors so that it is safe to move the pipette head by hand.

Alternatively, click **Disable all motors** on the **Jog/Teach** tab.

2   Use your hands to gently move the pipette head along the x-$axis$ and y-axis.

3   When you are finished moving the pipette head, release the disable button by turning it clockwise.

Related information

For information about…	See…
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42
Moving the pipette head using Bravo Diagnostics	• "Homing the pipette head" on page 99 • "Jogging the pipette head" on page 101 • "Using the Move and Approach commands" on page 105

Recovering from a head collision

About this topic

Occasionally, the Bravo Platform pipette head might collide with an accessory or labware on a deck location because the accessory or labware has been misplaced or mistaught.

This topic describes what to do after a head collision has occurred.

Before you start

Before you start the inspection of the Bravo Platform, clean up any spills that might have occurred as a result of the collision.

Procedure

To inspect the Bravo Platform:

1   Inspect the impacted parts for visible signs of damage.

Look carefully for any subtle signs of damage.

2   If contact was made to the pipette barrel or tip:

a   Compare the impacted region to the surrounding barrels or tips.

Dented barrels can affect tip sealing.

b   Replace damaged tips or barrels if disposable.

c   If fixed tips are damaged, contact Automation Solutions Technical Support.

Be ready to describe how the collision occurred.

3   If contact was made to a standard platepad, make sure the alignment tabs did not become damaged and still allow plates to be easily picked or placed.

If the operation is hindered, contact Automation Solutions Technical Support.

4   If contact was made to an Alignment Station, make sure the rollers and springs are not damaged and still allow plates to be easily picked and placed.

If operation is hindered, contact Automation Solutions Technical Support.

5   If contact was made to other deck locations, make sure the alignment tabs are not damaged and still allow plates to be easily picked and placed.

Make sure the specific functionality of the deck location is not compromised. If the operation is hindered, contact Automation Solutions Technical Support.

To verify system components are still working:

1   Jog each axis back and forth and listen for any new noise.

If new noises are present or if any axis movement is impaired, contact Automation Solutions Technical Support.

2   Make sure the Bravo Platform alignment was not compromised:

a If the pipette head was impacted side-to-side, re-install the head.

b Attach the correct tip type.

c Move to the location you taught (typically location 5).

d Check the alignment of the x- and y-axes.

If the x- of y-axis are not aligned, contact Automation Solutions Technical Support.

Misalignment could be the result of a shift in the x or y screw in their mounts. Re-homing would reset the teach positions correctly but the mounts would still need to be retightened.

3 If the contact occurred in the vertical direction:

a Attach the correct tip type

b Move to location 8.

c Check the alignment of the z-axis.

If the z-$axis$ is out of alignment, contact Automation Solutions Technical Support.

The tie bar may need adjustment to align the y arm to be parallel with the deck.

Related information

For information about…	See…
Removing and installing a pipette head	"Changing the pipette head or pin tool" on page 77
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
How to report a problem	"Reporting problems" on page 92

Troubleshooting hardware problems

About this topic

This topic lists some potential hardware problems, the possible causes, and ways to resolve the problems.

Hardware problems

Locate your problem in the table and try the solution. If the problem persists after you try the solutions, contact Automation Solutions Technical Support.

Problem	Possible cause	Solution
The Bravo Platform does not turn on.	Your lab does not meet the electrical requirements.	Make sure your lab meets the electrical requirements.
	The power cord is damaged or is not connected to the power source.	Ensure the power cord is in good condition and is connected to the Bravo Platform and the power source.
	The Bravo Platform fuse is bad.	Replace the fuse. A bad fuse could be indicative of other problems. If the fuse blows again, contact Automation Solutions Technical Support.
The Bravo Platform does not dispense accurately at a particular deck location.	The teachpoint is incorrect.	Verify the teachpoint.
	The pipette head barrels or o-rings are bad.	Contact Automation Solutions Technical Support.
The pipette head will not disengage from the head mount.	The pipette head is locked.	Verify that the head retainer pins are retracted (96- or 384-channel head), or the head lock is in the unlocked position (8- or 16-channel head).
Liquid fails to pump into or drain from an autofilling reservoir.	The Pump Module tubing has deteriorated or is not connected properly.	Inspect the tubing and the connections, and replace, if necessary.
The liquid in the wash trays or reservoirs is overflowing causing flooding.	The tubing is kinked or the Weigh Station might require recalibration.	Inspect the tubing. If necessary, recalibrate the Weigh Station.

Related information

For information about...	See...
Power and communication connections	"Connecting the Bravo Platform" on page 32
Laboratory requirements	"Laboratory setup requirements" on page 25
Changing a fuse	"Replacing the fuse" on page 82
Setting teachpoints	"Setting teachpoints" on page 61
Accessories	"Accessories overview for the Bravo Platform" on page 118
Safety guidelines	"Safety guidelines" on page 1
Stopping in an emergency	"Stopping in an emergency" on page 3
Reporting a problem	"Reporting problems" on page 92

Troubleshooting hardware-related error messages

About this topic

This topic describes the most common error messages that might be encountered with the Bravo Platform and provides some possible solutions.

Troubleshooting table

Error message/problem	Cause	Recommended actions
Error message related to communication problems or failure.	Communications are interrupted.	• Turn off the Bravo Platform off, and then turn it back on. • Initialize the Bravo Platform.
The Bravo Platform does not appear in the Discovered BioNet Devices dialog box. (Bravo Diagnostics > Profiles > Find available device).	Bravo Platform is not communicating with VWorks software.	***To re-establish communication:*** **1** Click **Refresh** in the Discovered BioNet Devices dialog box. **2** Turn off the Bravo Platform, and then turn it back on. **3** Click **Refresh** again. If the problem persists, try one or more of the following. • Check the Ethernet cables between the Bravo Platform and computer (and to and from hub if applicable). • On the computer (and the hub, if applicable), check that the link light next to the Ethernet cable is on and green. • In the Discovered BioNet Devices dialog box, check that the Select the Ethernet adapter... list is set appropriately. • Make sure the Ethernet firewall is turned off. If the problem persists, contact Automation Solutions Technical Support.
Motor power fault error.	Problems with the Bravo servo motors	***To clear the fault:*** **1** Turn off and then turn on the power switch. **2** Initialize the device. If the problem persists, contact Automation Solutions Technical Support.

Related information

For information about...	See...
Discovered BioNet Devices dialog box	"Creating and managing profiles" on page 51
Turning on or off the Bravo	"Starting up and shutting down" on page 43
Preparing the Bravo for a run	"Preparing the Bravo Platform for a run" on page 70
Hardware components	"Hardware overview" on page 10
Connecting Ethernet cables	"Connecting the Bravo Platform" on page 32

Reporting problems

About this topic

If you have a technical problem that you cannot resolve after reading the maintenance and troubleshooting instructions, read the information in this topic for how to report hardware, software, and user guide problems.

Contacting Automation Solutions Technical Support

If you find a problem with the Bravo Platform, contact Automation Solutions Technical Support at one of the following:

Europe

Phone: +44 (0)1763853638

email: euroservice.automation@agilent.com

US and rest of world

Phone: 1.800.979.4811 (US only) or +1.408.345.8011

email: service.automation@agilent.com

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

Reporting hardware problems

When contacting Agilent Technologies, make sure you have the serial number of the device ready. You can find the serial number on the Bravo Platform serial number label.

Reporting software problems

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

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

To find the VWorks software version number:

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

To find the Bravo Diagnostics software version number:

1 Open **Bravo Diagnostics.**

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

To send compressed protocol and associated files in VZP format:

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

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

Reporting user guide problems

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

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

Related information

For information about...	See...
Troubleshooting problems	"Troubleshooting hardware problems" on page 89 "Troubleshooting hardware-related error messages" on page 91

For information about...	See...
Software error messages	*VWorks Automation Control User Guide*
Stopping in an emergency	"Stopping in an emergency" on page 3
Shutting down	"Starting up and shutting down" on page 43

6
Using Bravo Diagnostics

This chapter explains how to use the Bravo Diagnostics software to control the Bravo Platform. Only administrators and experienced personnel should use the procedures in this chapter to diagnose errors with the Bravo Platform.

This chapter contains the following topics:

Agilent Technologies

About the Jog/Teach tab

About this topic

This topic briefly describes the features of the Jog/Teach tab in Bravo Diagnostics.

Contents of the Jog/Teach tab

The Jog/Teach tab enables you to:

- Control the Bravo Platform motion
- Edit teachpoints
- Home the pipette head and adjust its speed
- Move the pipette head incrementally in each of its axes
- View real-time location of each axis
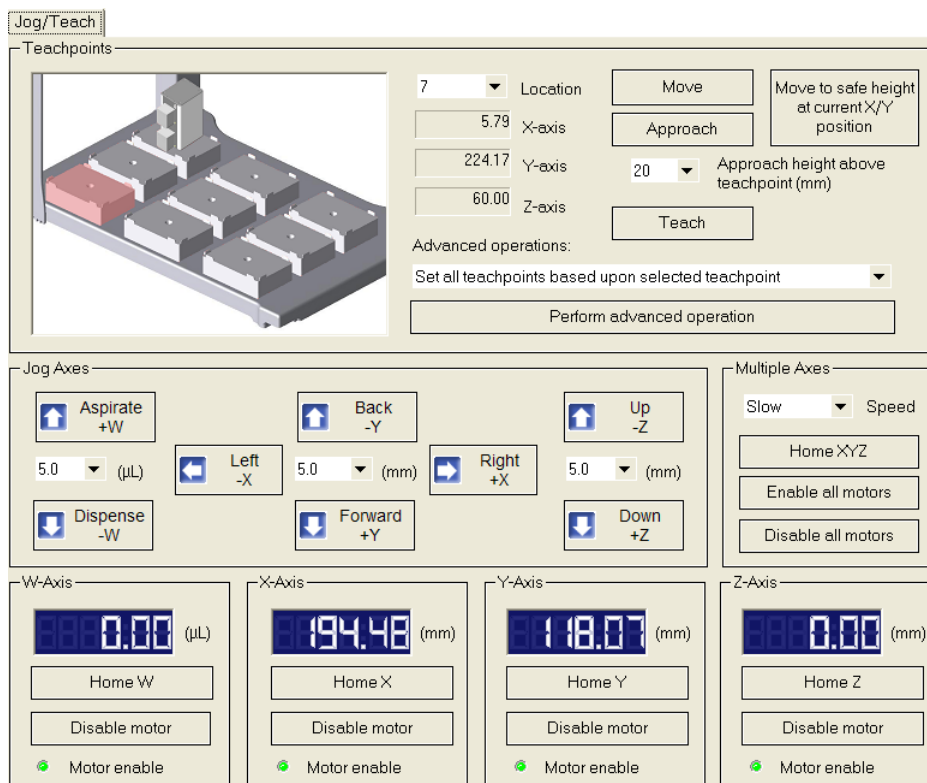
The Bravo deck graphical display

The Bravo deck graphical display provides a visual way to control the Bravo Platform and monitor the pipette head movement. The highlighted plate location indicates the location of the pipette head. You can move the head in real time by right-clicking a location and selecting a command. Rest the pointer on a location to display the deck location number.

Typically, the display is used for moving the pipette head and defining teachpoints.
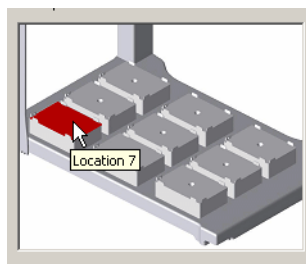
Pipette head control procedures

The following are procedures you can perform from the Jog/Teach tab:

Procedure	See…
Home the pipette head	"Homing the pipette head" on page 99
Disable all pipette head motors	"Moving the pipette head manually" on page 86
Edit teachpoints	"Setting teachpoints" on page 61
Change the speed of the pipette head	"Changing the pipette head speed" on page 103
Jog the pipette head	"Jogging the pipette head" on page 101

Pipette head axes

You can control the pipette head's movement in four directions:

Axis	Description
X	The horizontal distance (left-to-right) in millimeters, along the rail from the x-axis home position.
Y	The horizontal distance (front-to-back), in millimeters, along the rail from the y-axis home position.
Z	The vertical distance, in millimeters, from the z-axis home position.
W	The vertical distance, in microliters, from the w-axis home position.

Related information

For information about…	See…
Setting teachpoints	"Setting teachpoints" on page 61

For information about...	See...
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 99 • "Jogging the pipette head" on page 101 • "Using the Move and Approach commands" on page 105
Moving the pipette head manually	"Moving the pipette head manually" on page 86
The four axes of the Bravo instrument	"Hardware overview" on page 10

Homing the pipette head

About this topic

This topic describes when and how to home the pipette head.

About homing

The pipette head has a defined home position for each axis of motion. Homing sends the pipette head to the home position for the axes. Home the pipette head to reset the axes. For example, if you notice the Bravo Platform is not moving to locations or teachpoints accurately, home the pipette head.

Homing the pipette head is typically done automatically on first initialization after startup.

There are four homing axes.

Homing in this axis ...	Moves the ...
X	Pipette head to its home position in the horizontal (left-right) axis. This position is near the middle of the x-axis range.
Y	Pipette head to its home position for the horizontal (forward-backward) axis. This position is near the middle of the y-axis range.
Z	Pipette head to its home position in the vertical (up-down) axis. This position is near the top of the z-axis range.
W	Internal pipette head to its home position in the vertical aspirate-dispense axis. This position is near the low-to-mid w-axis range.

Homing the pipette head

⚠ **WARNING**   **Keep away from the Bravo Platform when the pipette head is moving or about to move, especially in the *z*-axis direction. The pipette head might not stop immediately in a collision and a pipette tip could pierce your hand.**

To home the pipette head:

1 In **Bravo Diagnostics**, click the **Jog/Teach** tab.

2 To home the pipette head for all axes, click **Home XYZ**.

The pipette head moves to the home position.

The axis order of homing is $z–> x–> y$.

Note: To home the pipette head in a single axis, click **Home** [*axis*]. Make sure you home the z-axis first so that the pipette head avoids the labware.
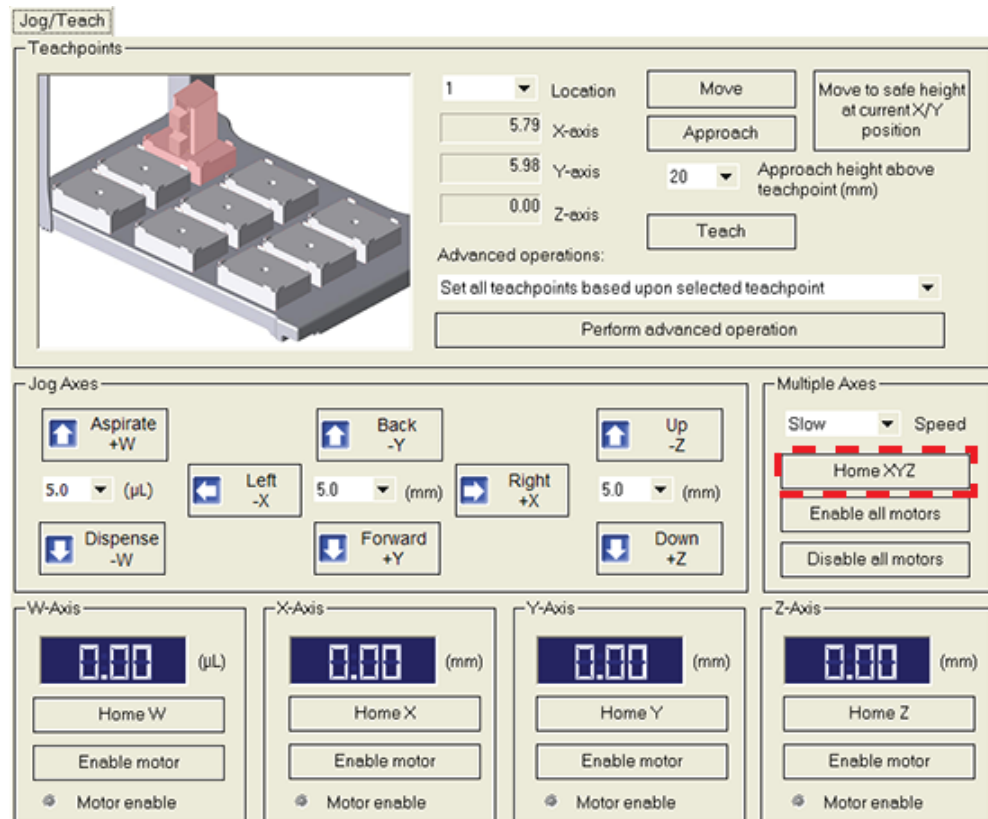
Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 99
	• "Jogging the pipette head" on page 101
	• "Using the Move and Approach commands" on page 105
Moving the pipette head manually	"Moving the pipette head manually" on page 86
Changing the pipette head	"Changing the pipette head or pin tool" on page 77

Jogging the pipette head

About this topic

Jogging the pipette head moves it in small increments. You can jog the pipette head in the x-$axis$, y-$axis$, z-$axis$, or w-axis.

Jogging is useful when setting teachpoints and performing maintenance activities.

> **CAUTION** To prevent damage to the gripper and other hardware components, do not dock the gripper if you want to jog the pipette head along the y-axis and z-axis.

Jogging the pipette head

> **WARNING** Keep away from the Bravo Platform when the pipette head is moving or about to move, especially in the z-axis direction. The pipette head's z-axis motor is particularly powerful. It might not stop immediately in a collision and a pipette tip could pierce your hand.

> **CAUTION** Before you jog the pipette head, remove objects from the pipette head path. Move the pipette head slowly and keep the jog increment small until you are certain that there is no obstruction.

To jog the pipette head:

1 Open **Bravo Diagnostics** and click the **Jog/Teach** tab.

2 In the **Jog Axes** area, select the jog increments in the appropriate list.
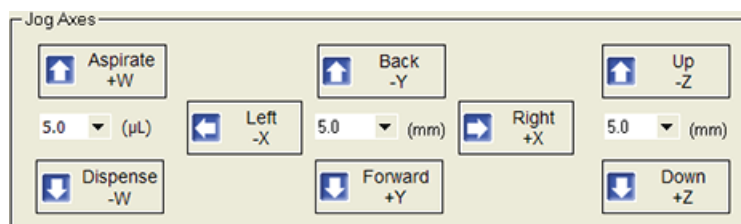
3 Click a direction button to move the pipette head.

4 Monitor the current position of the pipette head by checking the **X-Axis**, **Y-Axis**, and **Z-Axis** displays, or by viewing the fields under the **Location** list. The position is displayed as the distance (mm) that the pipette head is from the home position.
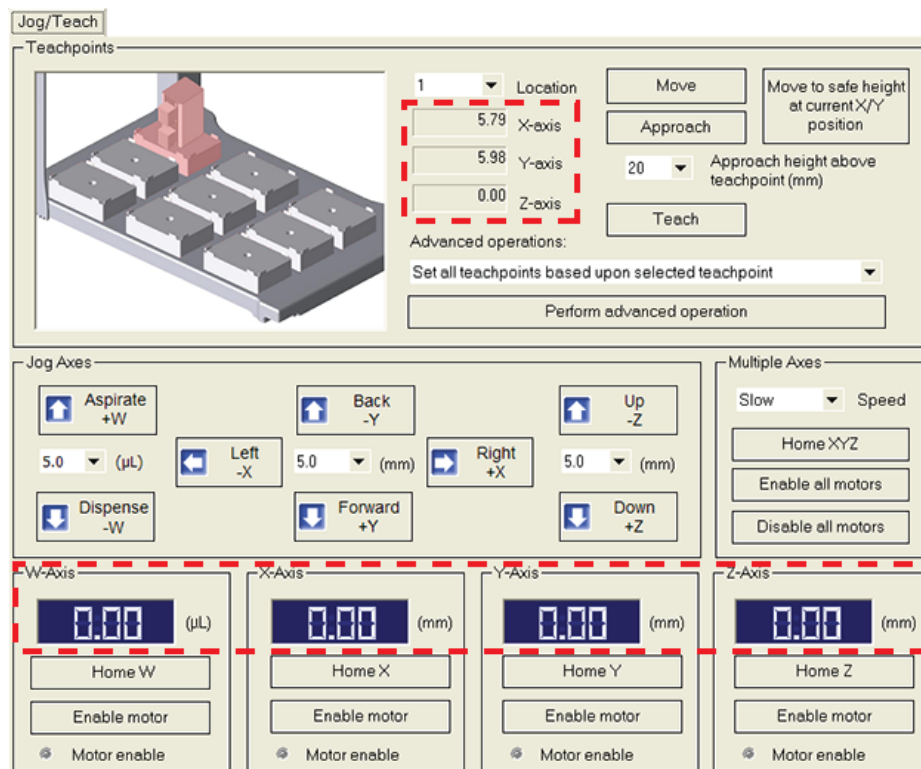
Related information

For information about...	See...
Teachpoints	"Setting teachpoints" on page 61
Opening diagnostics	"Opening Bravo Diagnostics" on page 49
Jog/Teach tab	"About the Jog/Teach tab" on page 96
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 99 • "Using the Move and Approach commands" on page 105
Moving the pipette head manually	"Moving the pipette head manually" on page 86
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Changing the pipette head speed

About this topic

You can change the pipette head speed when creating new teachpoints or troubleshooting a problem.

This topic describes how to change the pipette head speed in Bravo Diagnostics.

Procedure

This procedure describes how to change the speed that the pipette head moves in the x-axis, y-axis, and z-axis while in diagnostics.

To change the pipette head speed:

1 Open **Bravo Diagnostics**, and then click the **Jog/Teach** tab.

2 In the **Speed** list, select Slow, Medium, or Fast.
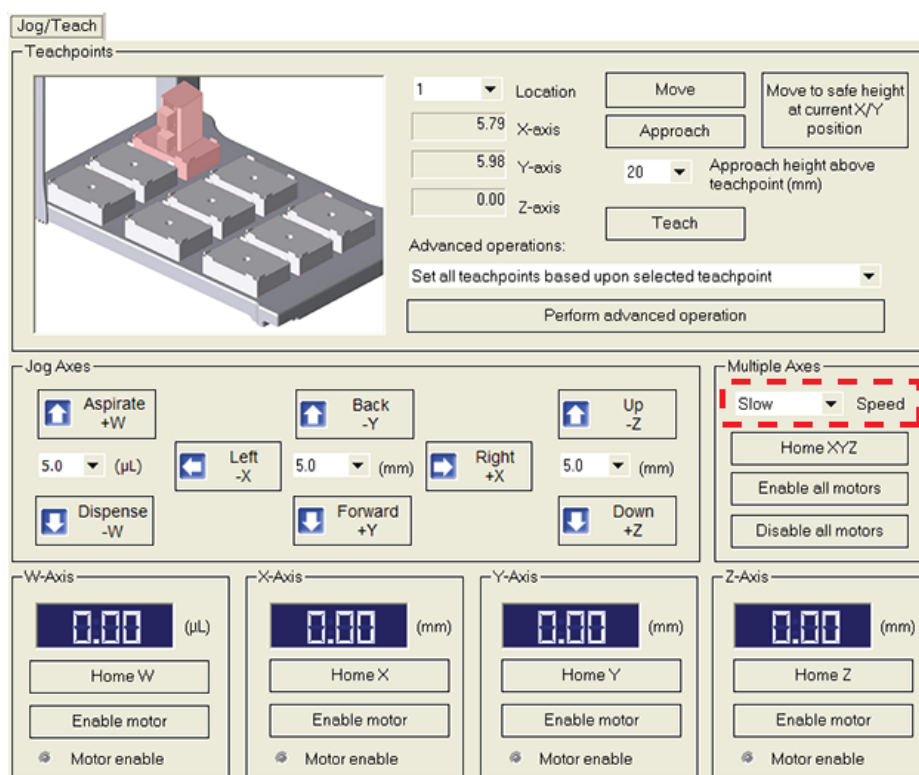
3 Click **OK** at the bottom of the **Jog/Teach** tab for the changes to take effect.

The speed settings apply only when using Bravo Diagnostics.

Related information

For information about...	See...
Jog/Teach tab	"Jog/Teach tab quick reference" on page 213
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing a teachpoint	"Setting teachpoints" on page 61
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Using the Move and Approach commands

About this topic

The Bravo Move and Approach commands let you quickly move the pipette head to any of nine locations on the deck.

Typically, these commands are used when editing teachpoints. This topic describes how to move to and approach locations on the Bravo deck using these commands.

Commands defined

- *Move.* Instructs the pipette head to move to the teachpoint for the selected location.
- *Approach.* Instructs the pipette head to move to the teachpoint for the selected location, with a vertical offset equal to the value specified in the Approach height above teachpoint box.

  Note: The Approach height parameter in the profile is the height above the labware when pipetting.

Before you start

Make sure no labware is on the Bravo deck and that the pipette head has been taught with the same type of tips used in the profile.

⚠️ **WARNING**   **Before you command the pipette head to move, make sure that everyone is clear of the Bravo Platform.**

CAUTION   Before using the Move or Approach command, make sure the pipette head path is clear of any obstacles that you have not defined in the profile. The move-to-position commands present a higher damage risk to the pipette head, because the pipette head can move in large increments.

Procedure

To use the Move command:

1   Open **Bravo Diagnostics**, and then click the **Jog/Teach** tab.

2   Select a deck location from the **Location** box.

Locations correspond to the nine available on the deck.

3   Click **Move**.

The pipette head moves to the teachpoint for the selected location.

To use the Approach command:

1   Repeat step 1 and step 2 from the above procedure.

2   If necessary, change the **Approach height above teachpoint** value.

3   Click **Approach**.

The pipette head moves to the selected location's approach height.

Related information

For information about...	See...
Jog/Teach tab	"Jog/Teach tab quick reference" on page 213
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 99
	• "Jogging the pipette head" on page 101
Moving the pipette head manually	"Moving the pipette head manually" on page 86
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing a teachpoint	"Setting teachpoints" on page 61
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Fine-tuning the gripper movements

About this topic

If your Bravo Platform has a gripper, read this topic about how to fine-tune gripper movements using the Gripper tab in the Bravo Diagnostics.

About the Gripper tab

Under normal operating conditions, you do not need to adjust the gripper. If you are troubleshooting the gripper or verifying teachpoints, use the Gripper tab in Bravo Diagnostics to:

*   Specify the labware when editing teachpoints
*   Adjust the y-axis offset for the profile
*   Use the Move and Approach commands
*   Verify that the gripper is able to pick up and place labware based on specified deck locations
*   Incrementally jog the gripper on the G-axis (opening and closing distance) and the Zg-axis (vertical distance)
*   Verify that the gripper is able to open and close
*   Change the gripper speed when using Bravo Diagnostics
*   Home the gripper
*   Dock the gripper below the pipette head
*   Disable the gripper motors
*   Verify that the plate sensor is working
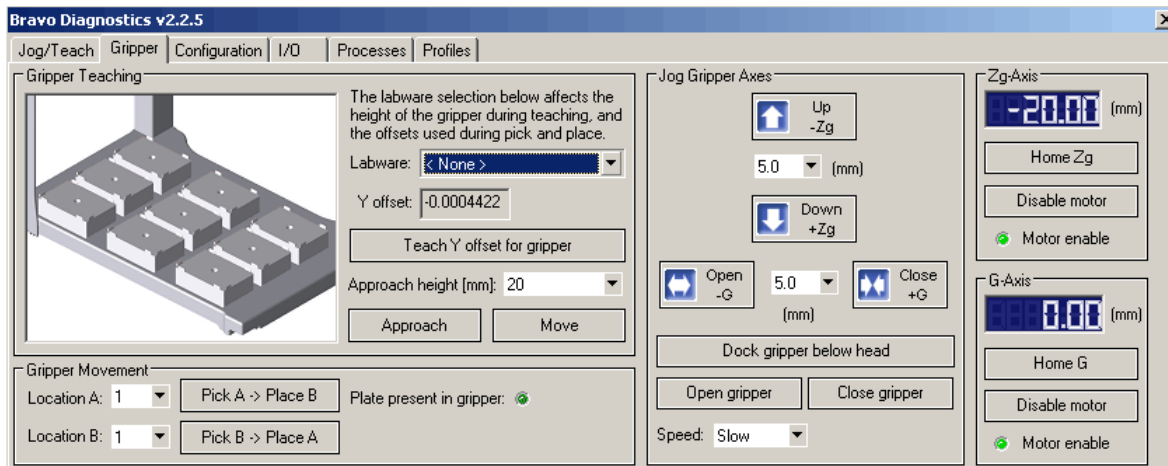
Specifying the labware

When you run pick-and-place trials, you must specify the labware that you want to use for the trial.

To specify the labware:

In the **Gripper Teaching** area, select the desired labware in the **Labware** list.
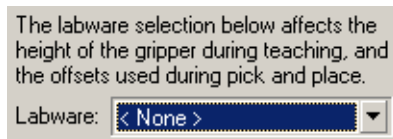
Adjusting the y-axis offset

Under normal operating conditions, the Bravo Platform is able to predetermine offset distances based on the pipette head selection and other settings. Further adjustments are not required. However, during troubleshooting you might want to fine-tune the y-axis offset. See "Verifying the gripper setup" on page 68.
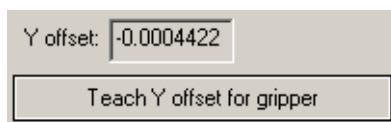
Using the Move and Approach commands

The gripper Move and Approach commands are used when verifying teachpoints. In the Gripper Teaching area:

- Click **Move** to quickly move the pipette head to a teachpoint above a selected deck location and lower the gripper to the surface of the platepad.
- Select the **Approach height (mm)**, and then click **Approach** to lower the gripper to the approach (offset) height. The offset height is the distance above the teachpoint.
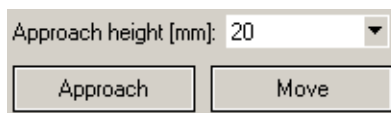
Picking up and moving labware
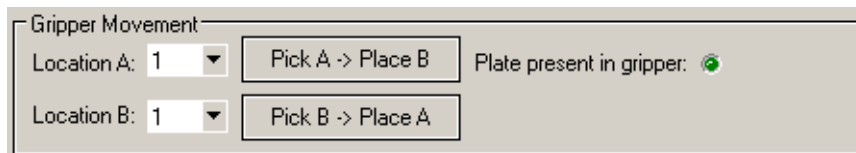
To verify that the gripper is able to pick up and place labware, in the **Gripper Movement** area:

- In the **Location A** list, select a deck location.
- In the **Location B** list, select a deck location.

Place a test plate on either deck location A or B, and then click one of the following:

- **Pick A -> B** to pick up the plate from deck location A and place it on deck location B.
- **Pick B -> A** to pick up the plate from deck location B and place it on deck location A.

Check the **Plate present in gripper** indicator light to make sure the gripper picked up the plate as specified.

Jogging the gripper

Before you edit teachpoints, you can jog the gripper on the G-axis (opening and closing distance) and the Zg-axis (vertical distance).

To jog the gripper:

1 In the **Jog Gripper Axes** area, specify the distance (mm) to jog.

2 Click the direction button to move the gripper.

3 In the **Zg-Axis** and **G-Axis** areas, check the new distance from the home position.

Opening and closing the gripper

To verify that the gripper is able to open and close properly, in the **Jog Gripper Axes** area, click **Open gripper** and **Close gripper.** Watch the gripper movement as you do so.

Changing the gripper speed

Under normal operating conditions, you do not need to change the gripper speed. However, for troubleshooting purposes, you might want to change the speed when you check other gripper functions.

To set the gripper speed:

In the **Jog Gripper Axes** area, select the desired speed (Slow, Medium, or Fast) in the **Speed** list.

Note: The speed setting applies only for Bravo Diagnostics and does not apply to the closing grip action.

Homing the gripper

The gripper has a defined home position for each axis of its motion. Homing sends the gripper to the home position of the axes.

Homing the gripper is done automatically during startup. However, you might want to home the gripper during troubleshooting processes.

To home the gripper:

In the **Zg-axis** or **G-axis** areas, click **Home Zg** or **Home G.** The gripper moves to the predefined position on the corresponding axis.
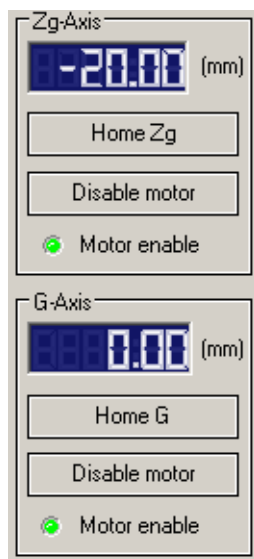
Docking the gripper

During troubleshooting or verification procedures, you might want to dock the gripper so that it rests in the recess of the Series III pipette head or under the Series II pipette head.

To dock the gripper:

In the **Jog Gripper Axes** area, click **Dock gripper below head.** The gripper moves upward and rests in the recess under the pipette head.

Disabling the gripper motors

You can turn off the gripper motor that operates in either the Zg-axis (vertical direction) or the G-axis (opening-closing direction). The gripper motor remains disabled until a command is issued to enable the gripper motor.

To disable the gripper motors:

In the **Zg-Axis** or **G-Axis** areas, click **Disable Motor**. The Motor enable light goes out.
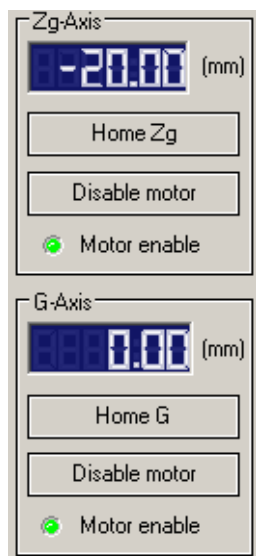
Related information

For information about...	See...
Gripper tab	• "Verifying the gripper setup" on page 68 • "Gripper tab quick reference" on page 217
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 99 • "Jogging the pipette head" on page 101 • "Using the Move and Approach commands" on page 105
Moving the pipette head manually	"Moving the pipette head manually" on page 86
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing a teachpoint	"Setting teachpoints" on page 61
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42

Clearing motor faults and checking the head type

About this topic

This topic describes how to clear motor faults and check the head type.

Clearing motor faults

Occasionally, during use, an error might occur that results in either disabling the pipette head movement or the pipette head motor.

To clear a robot disable or motor power fault:

1 In **Bravo Diagnostics**, click the **I/O** tab.

2 Click **Clear motor power fault** to restore the power and pipette head function.

3 If step 2 does not clear the faults, turn off and then turn on the Bravo Platform to ensure proper function.

Head detection indicator

In the Bravo Diagnostics I/O tab, the Head Detection area contains a Head present indicator that lights to indicate that a pipette head is attached to the device. The Head type box displays the type of head that the software detects in the head mount.

Related information

For information about...	See...
IO tab	"IO tab quick reference" on page 211
Defining labware	*VWorks Automation Control User Guide*
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42
Troubleshooting motor fault error and power cycling	"Troubleshooting hardware problems" on page 89
Reporting problems	"Reporting problems" on page 92

Performing a task using Bravo Diagnostics

About this topic

You can use Bravo Diagnostics to perform tasks, such as Aspirate, Mix, and Dispense. Performing these tasks in can be useful for development and troubleshooting purposes.

Before you begin

Do the following:

- Initialize the profile.
- Verify that the correct labware is positioned on the Bravo deck.

Procedure

Performing a task requires that you:

- Choose a location
- Select a task and task parameters
- Select labware

To perform a task:

1 Open **Bravo Diagnostics**, and then click the **Processes** tab.

2 To select a location, do one of the following:

- Click the location in the graphical display
- Select from the **Location** list.
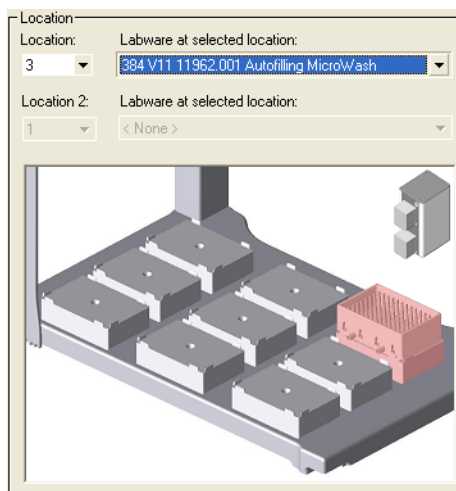
3 Select the labware from the **Labware at selected location** list.

4 If the task involves two locations, repeat step 2 and step 3.

For example, if you select the Assemble Vacuum task for a Vacuum Filtration Station, you could have a collection plate at Location 1 and a filter plate at Location 2.

5 *Series III pipette heads only.* To pipette using one row or column of barrels instead of all barrels on the pipette head:

a Click **Set head mode**.

b In the **Head Mode Selector** dialog box, select the barrels, and then click **OK**.
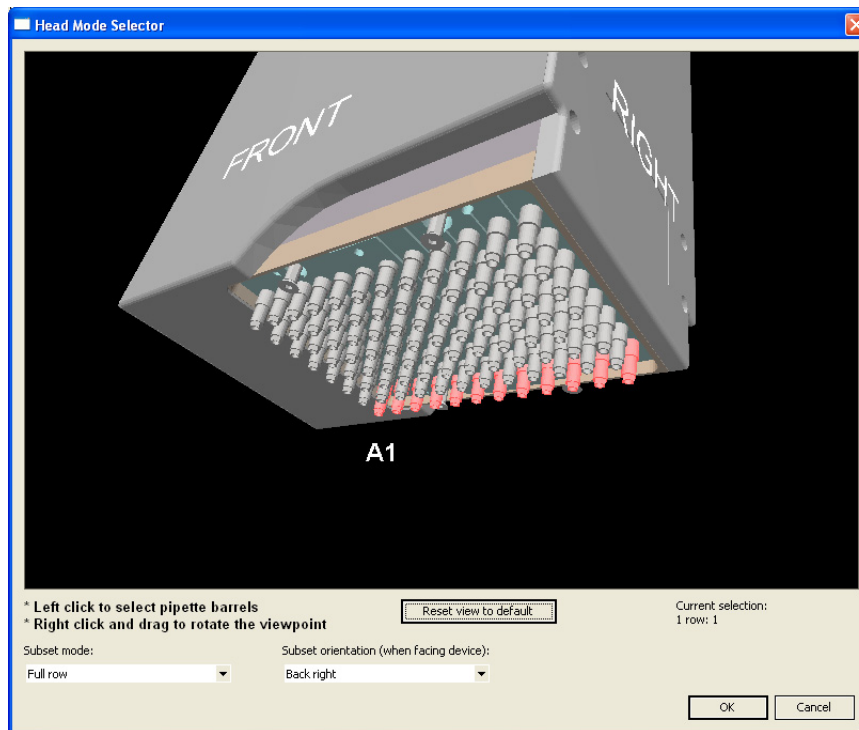
Note: If you select a single row, make sure you retract the pipette head stripper pins.

6 If you are using the pipette head in serial mode or the pipette head has fewer tips than the plate has wells, select the quadrant or quadrants in the **Well Selection and Head Mode** area.

Click a representative well in the plate graphic to select the corresponding quadrant of wells. The selection appears below the plate graphic.
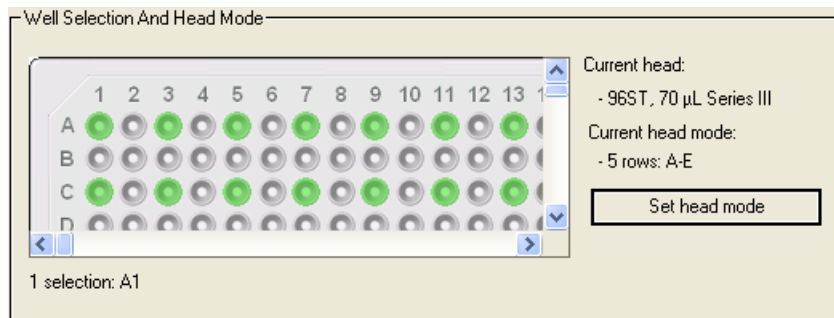
7 In the **Command Parameters** area:

a Select the process from the **Command to execute** list.

b Set the parameter values for the command.

– *Aspirate*. See "Aspirate task parameters" on page 226.

- **Assemble Vacuum.** See "Vacuum Filtration Station task parameters" on page 240.

- **Disassemble Vacuum.** See "Vacuum Filtration Station task parameters" on page 240.

- **Dispense.** See "Dispense task parameters" on page 229.

- **Mix.** See "Mix task parameters" on page 231.

- **Pump Reagent.** See "Pump Reagent parameters" on page 237.

- **Shake.** See "Shake task parameters" on page 238.

- **Tips On or Tips Off.** These commands have no parameter settings.

- **Move and Filter Plate.** See "Vacuum Filtration Station task parameters" on page 240.

- **Wash Tips.** See "Wash Tips task parameters" on page 234.

- **Pin Tool.** If the profile specifies a pin tool head type, the only task available is the Pin Tool task. See "Pin Tool task parameters" on page 242.

c To start the process, click **Execute command**.

IMPORTANT If you must stop a process before completion, click **Stop motors** to stop the pipette head movement. To re-enable the motors, click **Enable all motors** on the **Jog/Teach** tab.

Related information

For information about...	See...
Bravo task parameters	• "Processes tab quick reference" on page 224
	• *VWorks Automation Control User Guide*
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 42
Retracting the stripper pins	"Retracting tip-box stripper pins" on page 84

A

Accessories and platepads

This chapter describes the accessories platepads that can be used with the Bravo Platform and provides the installation and removal procedures.

This chapter contains the following topics:

Agilent Technologies

Accessories overview for the Bravo Platform

About this topic

This topic describes the accessories and platepads that are available for the Bravo Platform.

Description

You can add accessories to the Bravo Platform to enhance existing functions and facilitate operation. The accessories and platepads include:

Accessory	Description	See...
Accessories Hub	Provides a central connection unit for some of the Bravo accessories and the controlling computer.	"Installing the Accessories Hub" on page 120
Alignment Station	Positions 1536-well microplates for precise pipetting and ST tipboxes for precise tips-on operations. The Alignment Station can also be used for 384-well microplates.	"Installing an Alignment Station" on page 156
Autofilling accessories	Consists of the following: • Pump Module • Auto Filling Reservoir, MicroWash Reservoir, or Open Wash Tray • Weigh Station (optional)	"Autofilling accessories" on page 171.
Barcode Reader	Consists of a platepad with a barcode reader and a mirror that can be installed in place of a platepad at any deck location.	"Setting up the Barcode Reader" on page 193
Delidding option (Bravo Diagnostics)	Enables you to configure a platepad to accept a lid in a delidding process.	"Configuring a platepad for delidding" on page 155
Evaporator	Uses air to evaporate the contents of a microplate.	Contact Automation Solutions Technical Support for details.
Light Curtain	Pauses or stops the operation if the operator reaches into the Bravo Platform during a run.	"Installing the Light Curtain" on page 123
Magnetic bead option (Bravo Diagnostics)	Enables you to configure a platepad for use with your magnetic bead accessory.	Contact Automation Solutions Technical Support for details.

Accessory	Description	See...
Manual Fill Reservoir	Supplies reagents to 96- and 384-tip pipette heads. This reservoir requires manual refilling and emptying.	"Using the Manual Fill Reservoir" on page 161
Microplate Vacuum Alignment Station	Uses vacuum to hold PCR plates flat to ensure reliable pipetting in every well.	"Setting up a Microplate Vacuum Alignment Station" on page 132
Nested Rack Insert	Provides stability for a stack of nested tipboxes to ensure precision during a tips-on process.	"Setting up a Nested Rack Insert" on page 158
Orbital Shaking Station	Mixes labware contents using a shaking motion.	"Setting up the Orbital Shaking Station" on page 137
Sonic Tip Wash Station	Uses sonication during tip washing to increase cleaning efficiency.	"Setting up the Sonic Tip Wash Station" on page 162
SRT platepad for 250-µL tipboxes	Enables tips on and tips off tasks using the 250-µL tipbox on the shorter platform Bravo SRT.	"(Bravo SRT only) Setting up an LT tipbox location" on page 167
Tip Trash	Accepts used pipette tips during operation.	"Setting up the Tip Trash" on page 165
Vacuum Filtration Station	Uses vacuum to filter the contents of a microplate.	"Setting up the Vacuum Filtration Station" on page 144

Related information

For information about...	See...
Pipette heads	"Pipette heads and pin tools" on page 18
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing the Accessories Hub

About this topic

This topic describes the Accessories Hub, explains its use, and provides the installation and removal instructions.

Description

The Accessories Hub is a central electrical and communication connection point for a number of Bravo Platform accessories and the controlling computer. You can customize the hub by installing the desired accessory modules to feed power or communication signals to the corresponding accessories. You use the VWorks software to configure and control the hub and the accessories.

The following accessories can be connected to the Accessories Hub.

- Light Curtain (optional)
- Barcode Reader (optional)
- Orbital Shaking Station (optional)
- Microplate Vacuum Alignment Station (required)
- Vacuum Filtration Station (required)

Note: The hub is required for operating the Microplate Vacuum Alignment Station and the Vacuum Filtration Station.

The accessory modules are installed on the front of the hub.

Figure Accessories Hub with accessory modules

Modules for
other accessories

Module for the Light Curtain
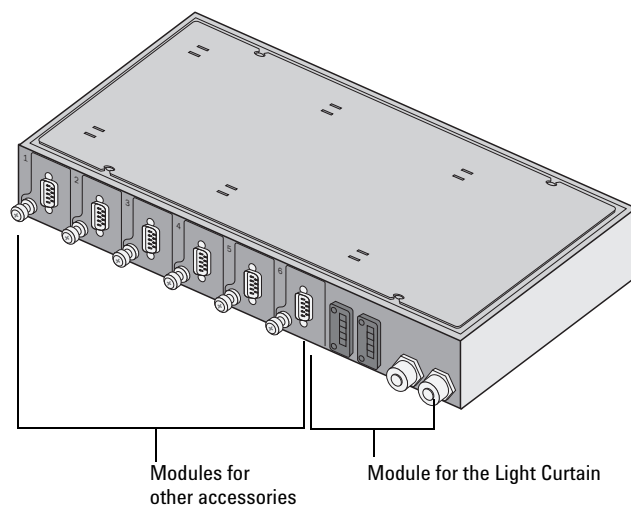
Before you start

Make sure you have the following:

- Accessories Hub
- USB cable (supplied with the Accessories Hub)

- Power cord (supplied with the Accessories Hub)

Procedure

⚠️   **WARNING**   **Turn off the Bravo Platform before you install or remove any accessory.**

To install the Accessories Hub:

1 Connect the one end of the USB type A cable to the back of the Accessories Hub.

2 Connect the free end of the USB type A cable to the Bravo computer.

3 Connect the power cord to the back of the Accessories Hub.

4 *Optional.* Connect the USB type B cable from another Accessories Hub to the back of the Accessories Hub.

5 Connect the power cord to an AC outlet with grounded circuit.

6 Follow the instructions for the accessory to connect the accessory to the hub.

The following figure shows the back of the Accessories Hub. Note the locations of the power socket, USB type A port, and USB type B port.

Figure   Accessories Hub (rear view)
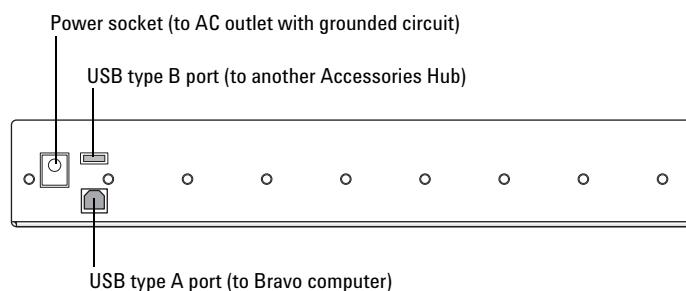
Figure   Accessories Hub connections
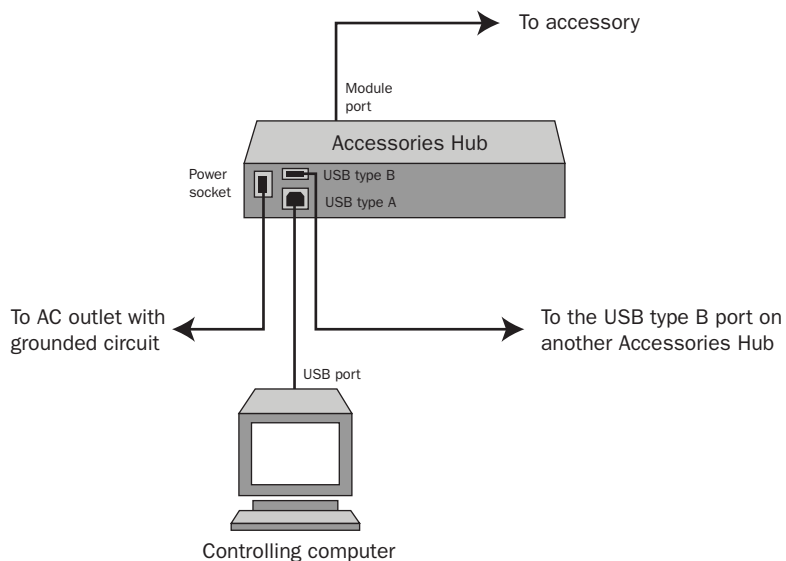
To remove the Accessories Hub:

1 Follow the instructions for the accessory to disconnect the accessory from the Accessories Hub.

2 Disconnect the power cord from the AC outlet.

3 Disconnect the power cord from the Accessories Hub.

4 (Optional*)* Disconnect the USB type B cable from another Accessories Hub.

5 Disconnect the USB type A cable from the Accessories Hub.

6 Disconnect the USB type A cable from the Bravo computer.

Related information

For information about...	See...
Light Curtain	"Installing the Light Curtain" on page 123
Barcode Reader	"Setting up the Barcode Reader" on page 193
Microplate Vacuum Alignment Station	"Setting up a Microplate Vacuum Alignment Station" on page 132
Orbital Shaking Station	"Setting up the Orbital Shaking Station" on page 137
Vacuum Filtration Station	"Setting up the Vacuum Filtration Station" on page 144
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing the Light Curtain

About this topic

This topic describes the Light Curtain, explains its use, and provides the installation and removal instructions.

Description

The Light Curtain acts as a safety guard on the front of the Bravo Platform to protect you from moving-part hazards while the device is in operation. As part of the safety interlock circuit, the Light Curtain works in a manner similar to the robot-disable pendant. Mounted at the front of the Bravo Platform, two light posts project light beams across the front of the device. If an object disrupts the light beams, the safety interlock circuit disables the pipette head motors.

The following figure shows the installed Light Curtain, and the table lists the components.

Figure   Bravo Platform with Light Curtain (front view)
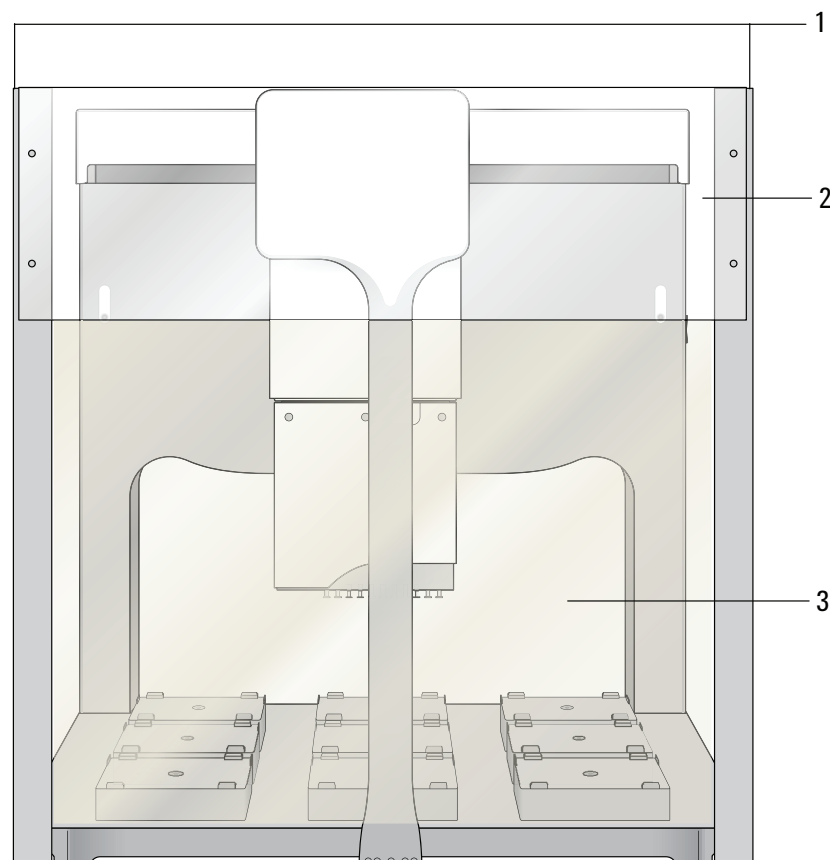
Item	Name	Description
1	Light posts	Project the light beams that form the invisible light shield across the front of the Bravo platform. The two light posts, which mount on each end of the Bravo base, project the light beams, detect disruptions in the beam, and transmit signals to the safety interlock circuit.
2	Front shield	Provides a safety guard to prevent access at the Bravo top front. The shield attaches to the two light posts.
3	Light shield	Generated after the Light Curtain is installed and powered on. The invisible light shield spans the area between the two light posts across the front of the Bravo Platform.
4	Side shield (not shown)	Provides a safety guard to prevent access to the top side of the Bravo platform. The side shield attaches to a light post and the Bravo back plate.
5	Junction box or Accessories Hub (not shown)	Provides the electrical and communication connection point for the Light Curtain posts, and connects to the robot-disable pendant to and integrate the Light Curtain in the Bravo safety interlock circuit.
6	Cable, extension (not shown)	Connects the Bravo pendant port to the junction box or the Accessories Hub.

Before you start

Safety warnings and caution

> **WARNING** **Turn off the Bravo Platform before you install or remove any accessory.**

> **WARNING** **Do not replace the pendant with the Light Curtain. The Light Curtain is an additional safety feature to be used with the pendant.**

> **WARNING** **The light beams extend across the front of the Bravo Platform only. Access from the sides or back of the device may be possible and cannot be detected by the Light Curtain.**

> **CAUTION** Handle the light posts with care to prevent any damage to the glass panels. Avoid touching the glass panels with your fingers. Fingerprints or dirt on the glass can interfere with the Light Curtain operation.

Required components and tools

Make sure you have the following:

- Light Curtain components (light posts, front shield, side shield, extension cable)

- Junction box (provided with the Light Curtain) or Accessories Hub
- M3 hex wrench

Workflow overview

Make sure you perform the procedures in the following order:

Step	Procedure
1	Install the light posts on the Bravo Platform.
2	Connect the Light Curtain to the Bravo Platform.
3	Align the light beams.
4	Install the shields.

Installing the light posts

To install the vertical light posts:

1 Position the left light post on the Bravo front left base handle. The glass panel of the light post should face the Bravo right front end.

2 Ensure that the light post foot inserts onto the Bravo base handle completely without any gaps in space.

3 Install the setscrew in the outer side of the light post foot to lock the post into position.

4 Repeat step 1 to step 3 to mount the light post on the Bravo front right base handle.

Figure   Installing a light post on the Bravo Platform (side view)
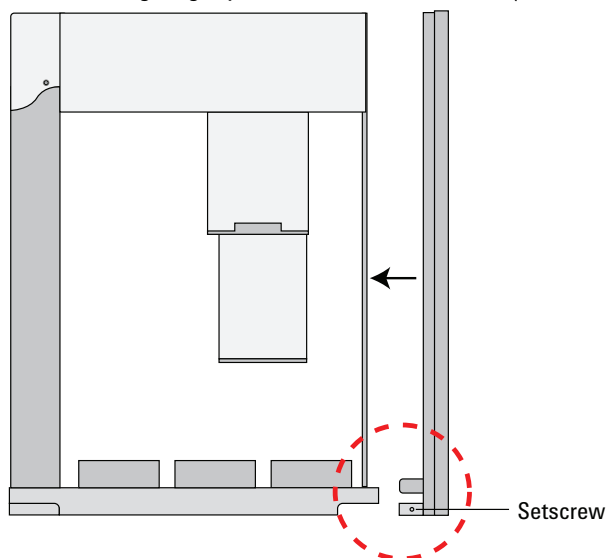
Connecting the Light Curtain

To connect the Light Curtain to the Bravo Platform:

1 Disconnect the pendant from the back of the Bravo Platform and connect it to the PENDANT port on the back of the junction box or on the front of the Accessories Hub.

2 Connect the two light post cables to the corresponding ports on the junction box or the Accessories Hub:

    a Connect the black cable to the RX connector (receiver).

    b Connect the gray cable to the TX connector (transmitter).

3 Connect one end of the extension cable to the pendant port on the back of the Bravo Platform. Connect the other end of the cable to the Bravo port on one of the following:

- *Junction box.* See "Using a junction box to connect the Light Curtain" on page 126.
- *Accessories Hub.* See "Using an Accessories Hub to connect the Light Curtain" on page 127.

Using a junction box to connect the Light Curtain

The ports for the pendant cable and the two light post cables are on the front of the junction box. The Bravo port for the extension cable is on the back of the junction box.

Figure Junction box (front view)

To Light Curtain posts

To pendant
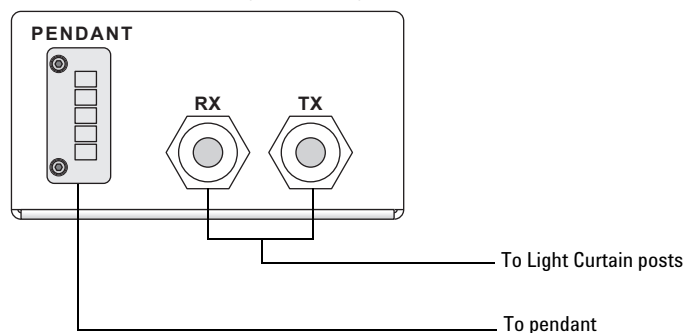
Figure Junction box (back view)

To Bravo pendant port
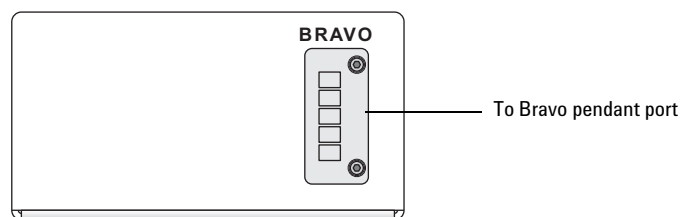
Figure   Light Curtain connected to a junction box
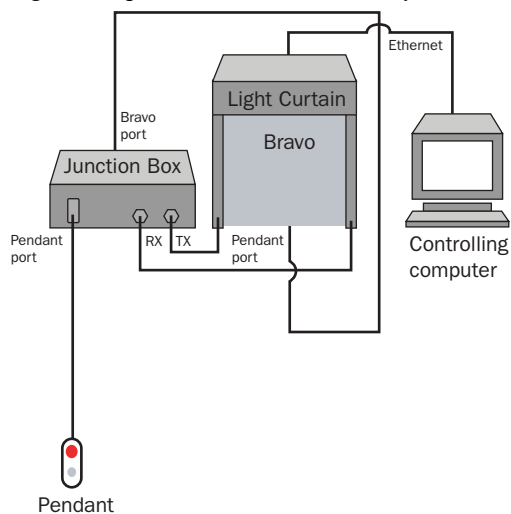
Using an Accessories Hub to connect the Light Curtain

The following figures show the Accessories Hub and the ports relevant to the Light Curtain.

Figure   Ports on the Accessories Hub (front view)
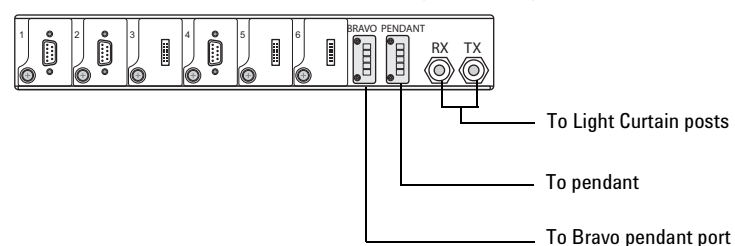
Figure   Light Curtain connected to an Accessories Hub
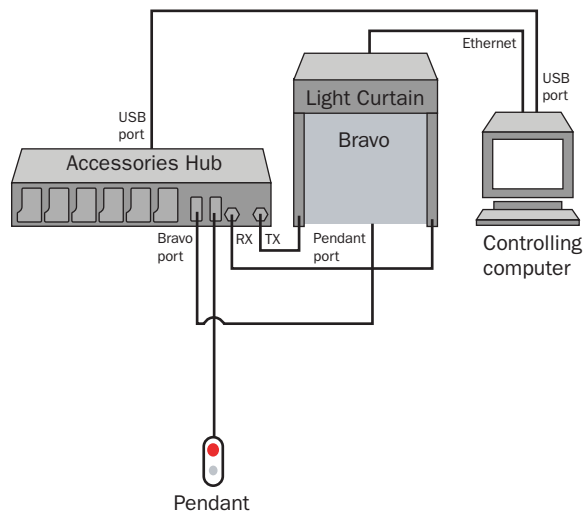
Aligning the light beams

To align the light beams:

1   On the side of the Bravo Platform, press the power switch to the **on (|)** position.

The two indicator lights on the front of the Bravo back plate illuminate, indicating that the Bravo Platform is on, and the Light Curtain activates.

2   On the inside lower panel of each light post, verify that the column of lights (LEDs) turn on.

Figure   Light post interior panel with green LED lights
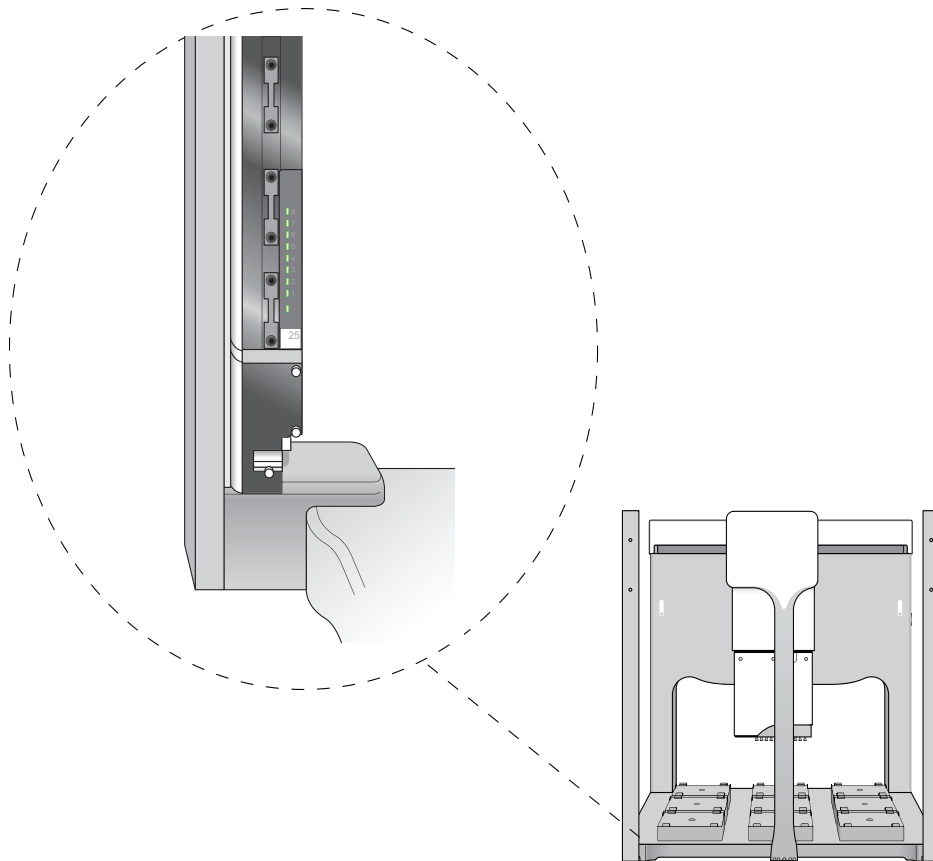
3   While facing the front of the Bravo Platform, carefully grasp the exterior of both posts with your hands. Avoid touching the interior glass panel of the light posts.

4   Slowly rotate the light posts as far as possible, so that the interior glass panels are angled to face toward you.

The LED lights at the bottom of the posts turn red, indicating that the light beams are not aligned.

5   Slowly, rotate the light posts backwards again just until the entire column of LEDs on each light post turns solid green, indicating that the light beams are aligned. The two indicator lights on the front of the Bravo back plate turn blue.

IMPORTANT   If any of the LEDs on the light post are partial green or green, but blinking, the light beams are not completely aligned. On the front of the Bravo back plate, the two indicator lights are red if the light beams are not aligned.

Figure   Rotating the light posts to align the light beams
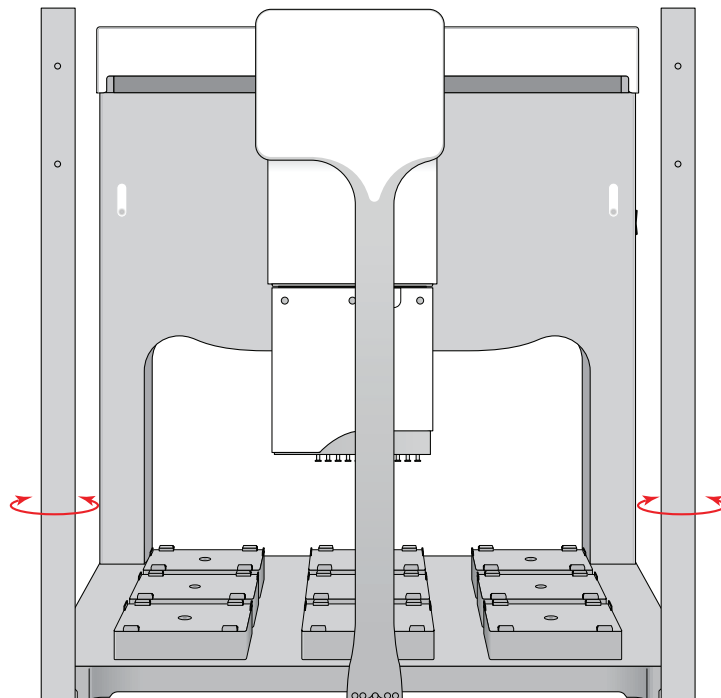
6   At the interior side of each light post, use a 2.5-mm hex wrench to tighten the two adjustment screws located near the top and bottom of the light post.

Figure   Light post interior bottom adjustment screw
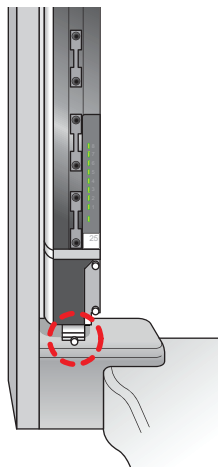
7   To verify the adjustment:

a   Press the Bravo power switch to the **off (o)** position, wait a minute, and then press the power switch to the **on (|)** position.

> **b**   Verify that the entire column of LEDs on each light post are solid green and not blinking.

Installing the shields

To install the front and side shields:

1   At the Bravo Platform front side, mount the front shield to the two light posts using the four screws provided.

Figure   Bravo Platform with front shield
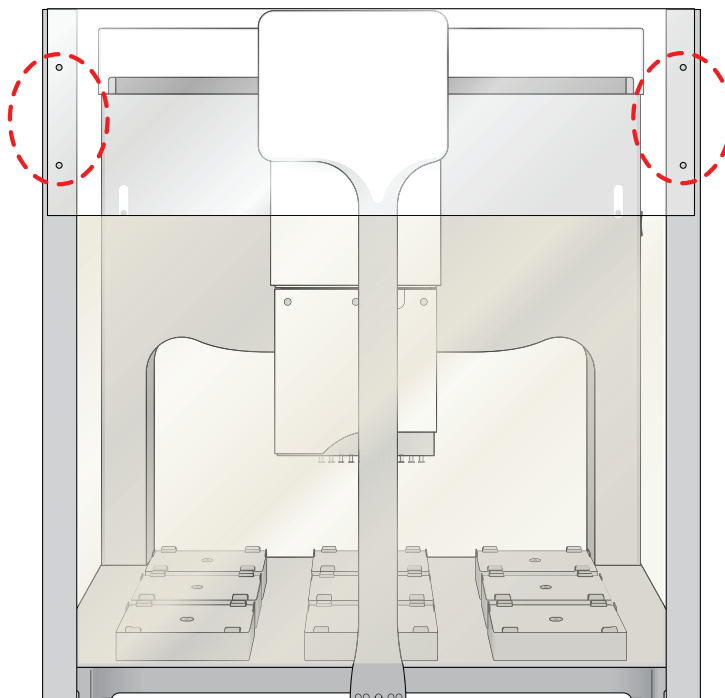
2   To mount the side shield:

   a   Remove the screw that attaches the Bravo top cover to the back plate.

   b   Use the screw from step a to secure the side shield to the Bravo top cover.

   c   Secure the shield to the light post using the screw provided.

Figure   Bravo Platform side view
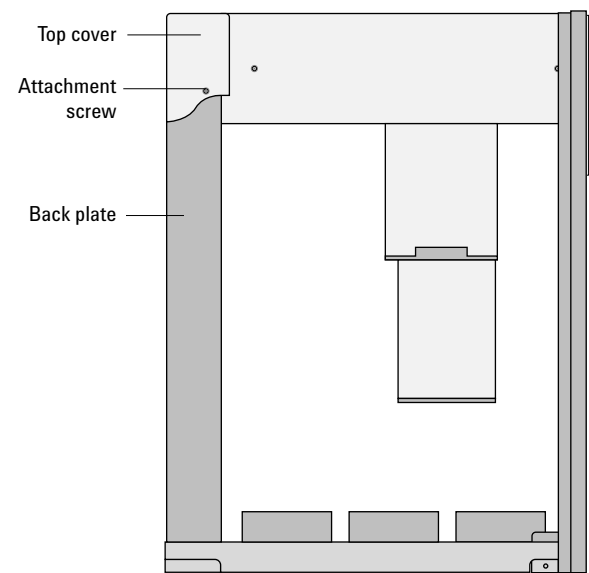
Top cover

Attachment
screw

Back plate

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Connection port locations on the back of the Bravo Platform	"Connection panel description" on page 16
Installing the Accessories Hub	"Installing the Accessories Hub" on page 120
Safety information	*VWorks Automation Control User Guide*

Setting up a Microplate Vacuum Alignment Station

About this topic

This topic describes the Microplate Vacuum Alignment Station, explains its use, and provides the installation and removal instructions.

Description

The Microplate Vacuum Alignment Station is a device that uses a vacuum to hold microplates that tend to warp. Designed to be used with the Accessories Hub, the Microplate Vacuum Alignment Station can be installed in place of a platepad at any deck location.

IMPORTANT Install the station only on the outermost deck locations (1, 3, 4, 6, 7, or 9) so that the ports face either left (locations 1, 4, or 7) or right (locations 3, 6, or 9).

The following figure shows the air-input and vacuum connections on the Microplate Vacuum Alignment Station.

Figure Microplate Vacuum Alignment Station: front-right view (left) and back view (right)

Vacuum

Air input

Vacuum on/off

Vacuum sensor
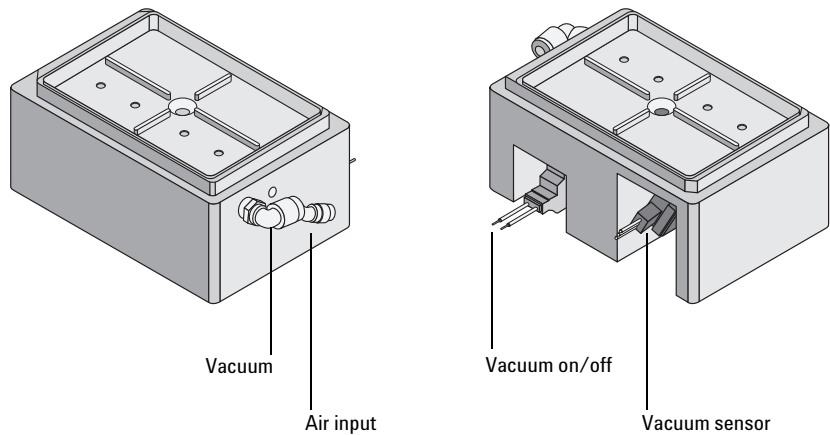
Setup workflow

Step	Procedure	See...
1	Ensure that your site can provide the compressed air and vacuum requirements.	"Requirements for compressed air and vacuum" on page 133
2	Install the Microplate Vacuum Alignment Station.	"Installing or removing the Microplate Vacuum Alignment Station" on page 133

Step	Procedure	See...
3	Configure the station in Bravo Diagnostics.	"Configuring the Microplate Vacuum Alignment Station in Bravo Diagnostics" on page 135
4	Adjust the teachpoint if you have not already done so.	"Setting teachpoints" on page 61
5	Test the station to verify that it is properly connected and configured.	"Testing the Microplate Vacuum Alignment Station" on page 135

Requirements for compressed air and vacuum

The Microplate Vacuum Alignment Station has the following air and vacuum requirements:

Requirement	Value
Compressed air supply	Quality: Clean, compressed, oil-free Source: House, cylinder, or portable pump Flow rate: 28 Lpm (1.0 cfm) Pressure: 0.55 MPa (80 psi) *Note:* Compressed air is used to actuate the vacuum valve.
Vacuum	Flow rate: 18 Lpm (0.65 cfm) Vacuum: 0.2 MPa or greater (6 in Hg or greater) *Note:* Vacuum is used to hold microplates that tend to warp.

Installing or removing the Microplate Vacuum Alignment Station

Before you start

Make sure you have the following:

- Microplate Vacuum Alignment Station
- Flathead cap screw that holds the Vacuum alignment Station to the deck (supplied with the Microplate Vacuum Alignment Station)
- M4 hex wrench
- Tube for the vacuum port
- Accessories Hub

⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove any accessory.**

Procedures

The following figure shows the Microplate Vacuum Alignment Station connections to the Accessories Hub. Note that a Y-splitter cable connects the vacuum on/off and vacuum sensor to a single Accessories Hub port.

Figure   Microplate Vacuum Alignment Station connections to the Accessories Hub
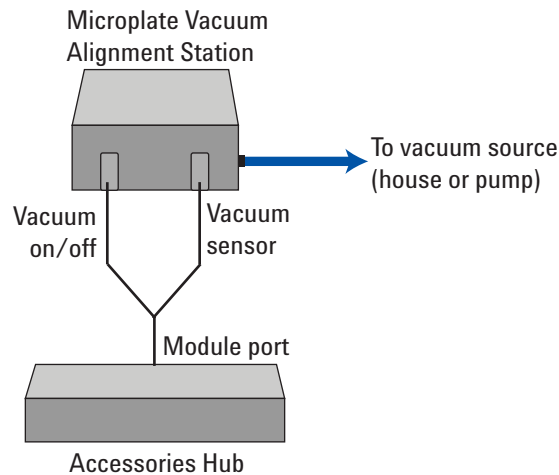
To install the Microplate Vacuum Alignment Station:

1   Using the M4 hex wrench, remove the screw in the center of the platepad.

2   Remove the platepad. Make sure the dowel pins under the platepad remain in the deck.

3   Place the Microplate Vacuum Alignment Station on the same deck location.

4   Insert the supplied flathead cap screw in the center of the station and use the M4 hex wrench to tighten the screw.

5   Connect one end of the vacuum tube to the Microplate Vacuum Alignment Station.

6   Connect the free end of the vacuum tube to the vacuum source (house or pump).

7   Connect the vacuum on/off switch cable and the vacuum sensor cable from the back of the station to the corresponding ports on the Accessories Hub.

8   Configure the Microplate Vacuum Alignment Station in Bravo Diagnostics.

To remove the Microplate Vacuum Alignment Station:

1   Disconnect the vacuum on/off switch cable and the vacuum sensor cable from the Accessories Hub.

2   Disconnect the vacuum tube from the vacuum source.

3   Disconnect the vacuum tube from the Microplate Vacuum Alignment Station.

4   Using the M4 hex wrench, remove the screw from the center of the station.

5   Remove the Microplate Vacuum Alignment Station.

6   Place the platepad on the same deck location.

7   Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Configuring the Microplate Vacuum Alignment Station in Bravo Diagnostics

To configure the Microplate Vacuum Alignment Station:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.

3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4 Follow the instructions in the Accessories Wizard to:

   • Choose the **Location** at which the station is installed.

   • Select the **Microplate Vacuum Alignment Station** accessory.

   • Select the **Serial Port** (communications port) on the Accessories Hub to which the serial cable is connected.

   • Click **Next**, and then click **Finish**.

5 When the accessory configuration message appears, click **Yes** to initialize the accessory.

6 In the **Profiles** tab, click **Update this profile**.

> **CAUTION**   Verify the accuracy of the teachpoint for the Microplate Vacuum Alignment Station. See *"Verifying teachpoints for fixed-tip pipette heads or pin tools" on page 67*.

Testing the Microplate Vacuum Alignment Station

To test the Microplate Vacuum Alignment Station:

1 At the Bravo Platform, verify the following:

   a The tubing is securely connected to the vacuum port on the rear panel and the vacuum source is turned on.

   b A microplate is in position on the Microplate Vacuum Alignment Station.

2 In **Bravo Diagnostics**, click the **Configuration** tab.

3 In the **Accessory Configuration** area, highlight **Microplate Vacuum Alignment Station**, and then click **Diagnose accessory**.
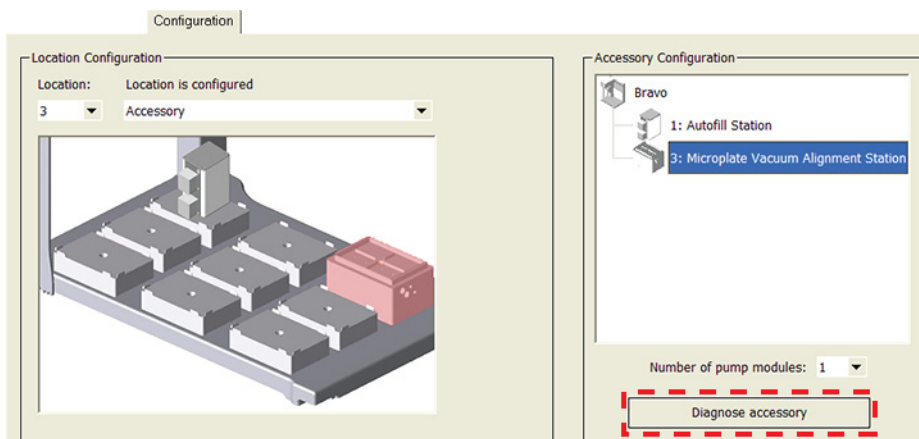
4   In the **Accessory Diagnostics** dialog box, click **Vacuum On** to open up the vacuum supply to the Microplate Vacuum Alignment Station.
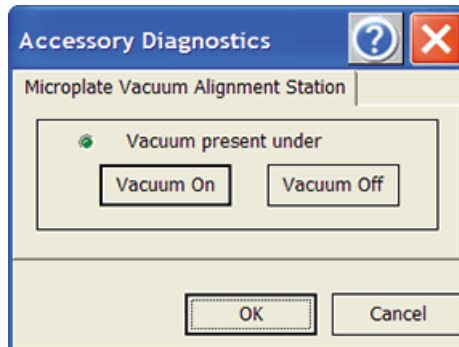
5   Verify that the **Vacuum Present** indicator is green.

If the indicator is red, the Microplate Vacuum Alignment Station cannot establish a vacuum with the microplate. Verify that the vacuum is turned on at the source and that the vacuum tubing and connections are in good condition.

6   To interrupt the vacuum supply to the Microplate Vacuum Alignment Station, click **Vacuum Off**.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Accessories Hub	"Installing the Accessories Hub" on page 120
Editing teachpoints	"Setting teachpoints" on page 61
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Setting up the Orbital Shaking Station

About this topic

This topic describes the Orbital Shaking Station, explains its use, and provides the installation and removal instructions.

Description

The Orbital Shaking Station is a microplate shaker that can be installed in place of a platepad in any deck location. For a full description of the Orbital Shaking Station, see the manufacturer's documentation.

Orbital Shaking Station

Adaptor pad
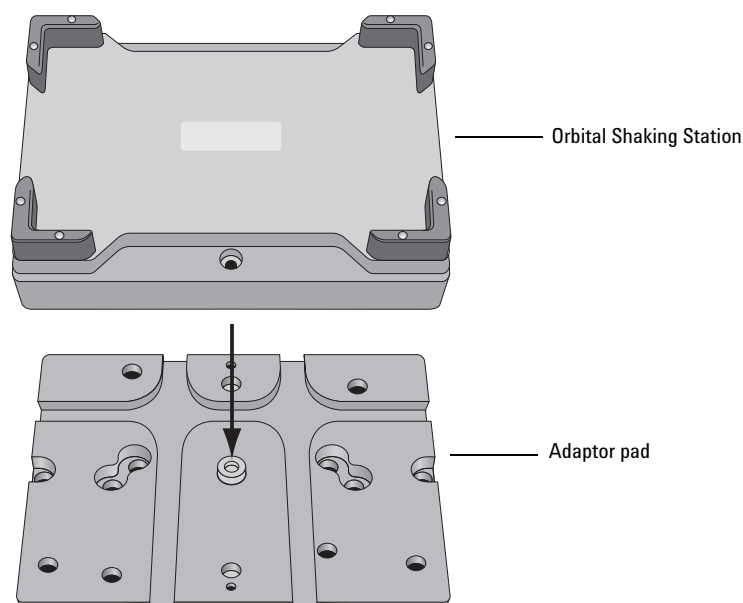
Setup workflow

Step	Procedure	See...
1	Install the Orbital Shaking Station.	"Installing the Orbital Shaking Station" on page 138
2	Configure the station in Bravo Diagnostics.	"Configuring the Orbital Shaking Station in Bravo Diagnostics" on page 140
3	Edit the teachpoint using the teach plate. Be sure to consider the 10‑mm thickness of the teach plate when you edit the teachpoint.	"Editing the teachpoint for the Orbital Shaking Station" on page 141
4	Test the station operation.	"Testing the Orbital Shaking Station" on page 142

Installing the Orbital Shaking Station

Before you begin

Make sure you have the following:

- Orbital Shaking Station
- Adaptor pad (supplied with the Orbital Shaking Station)
- Sockethead screw that holds the adaptor pad to the deck (supplied with the Orbital Shaking Station)
- Hex wrenches: M2, M4, and M5
- Accessories Hub (optional)

Procedures

> ⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove the accessory.**

To install the Orbital Shaking Station:

1 Using the M4 hex wrench, remove the screw in the center of the platepad and remove the platepad.

2 Place the adaptor pad in the same deck location.

The adaptor pad can be in any orientation. Make sure the adaptor pad sits level on the deck.

3 Insert the larger sockethead screw into the center of the adaptor pad and use the M5 hex wrench to tighten the screw.

4 Place the Orbital Shaking Station on top of the adaptor pad.

The station can be in any orientation. Make sure the station sits level on the adaptor pad.

5 Insert the two smaller sockethead screws into the holes at the front and back end of the adaptor pad and use the M2 hex wrench to tighten the screws.

> **CAUTION**   The Orbital Shaking Station can shift slightly when tightening. Ensure that the sides of the Orbital Shaking Station are parallel to the sides of the adapter plate. If the Orbital Shaking Station is rotated, it could cause the Bravo gripper to crash.

6 Connect the serial cable using one of the following options:

- *Connect to the controlling computer directly.* Connect the serial cable from the speed control (on the power cord) to the serial port on the Bravo computer.
- *Connect to the Accessories Hub.* Connect the serial cable from the speed control (on the power cord) to a serial port on the Accessories Hub
- *Connect multiple Orbital Shaking Stations.* At the first station, connect the serial cable from the speed control (on the power cord) to the RS-232 port on the speed control of the second station. Repeat this step for each station in the series.

The following figures show each of the options.

7 At the Orbital Shaking Station speed control (on the power cord), turn the speed dial to PC RS232 to turn off the speed and allow VWorks software to control the Orbital Shaking Station.

8 Connect the Orbital Shaking Station power cord to an AC outlet with grounded circuit.

9 Configure the Orbital Shaking Station in Bravo Diagnostics.

Figure Connecting to the controlling computer (A) or Accessories Hub (B)
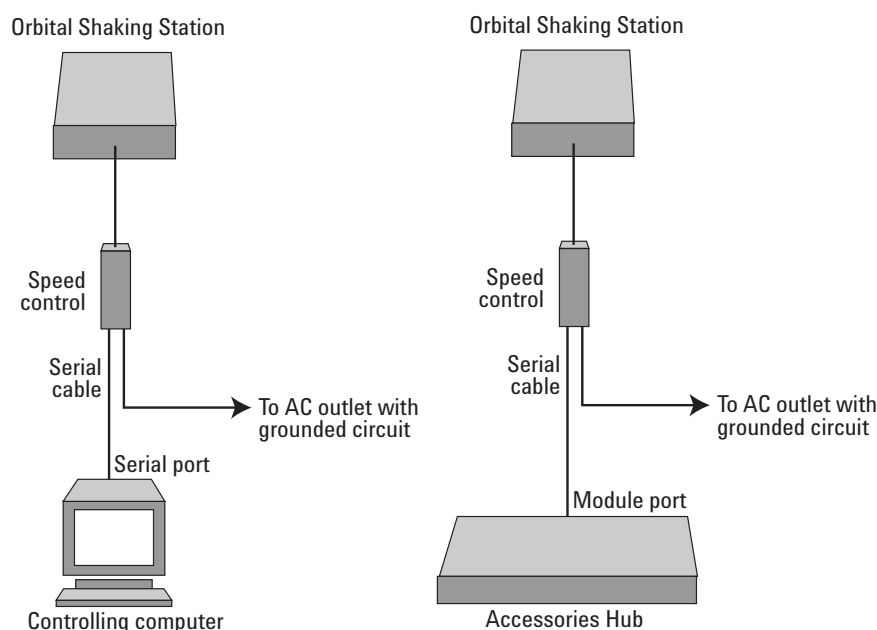
Figure Connecting multiple Orbital Shaking Stations
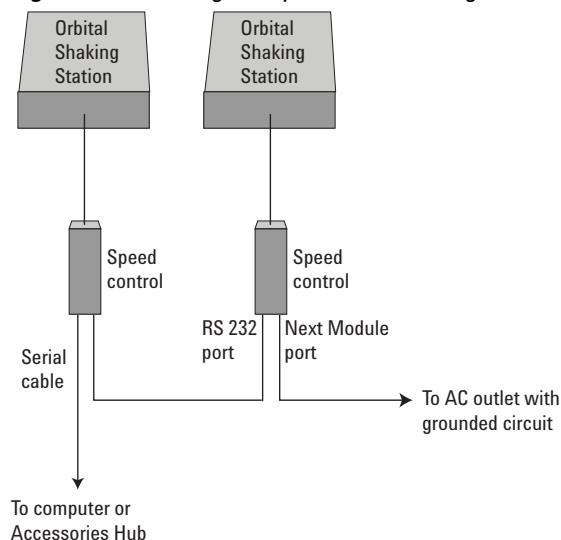
To remove the Orbital Shaking Station:

1 Disconnect the Orbital Shaking Station power cord from the AC outlet.

2 Disconnect the serial cable from the speed control (on the power cord) from the Bravo computer or the Accessories Hub.

3 Using the M2 hex wrench, remove the two sockethead screws in the Orbital Shaking Station.

4   Remove the Orbital Shaking Station from the adaptor pad.

5   Using the M5 hex wrench, remove the sockethead screw in the center of the adaptor pad.

6   Remove the adaptor pad.

7   Place the platepad on the same deck location.

Make sure the teachpoint crosshairs are in the upper left corner and the platepad is level on the deck.

8   Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

9   In **Bravo Diagnostics**, select the appropriate profile, and then click the **Configuration** tab and reconfigure this location.

10 Adjust the teachpoint of the location.

Configuring the Orbital Shaking Station in Bravo Diagnostics

To configure the Orbital Shaking Station:

1   In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2   Click the **Configuration** tab.

3   In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4   Follow the instructions in the **Accessories Wizard** to:

a   Specify the **Location** of the installed Orbital Shaking Station.

Note: Your selection in the Accessories Wizard overrides the default selection in the Configuration tab.

b   Choose the **Orbital Shaking Station** accessory.

c   Select the controlling computer **Serial Port** that connects to the Orbital Shaking Station.

d   Select the **Module number** that indicates the position of the Orbital Shaking Station you are configuring.

For example, select 1 if the station is connected directly to the controlling computer or Accessories Hub. Select 2 for a station that is connected to the first station, and so on.
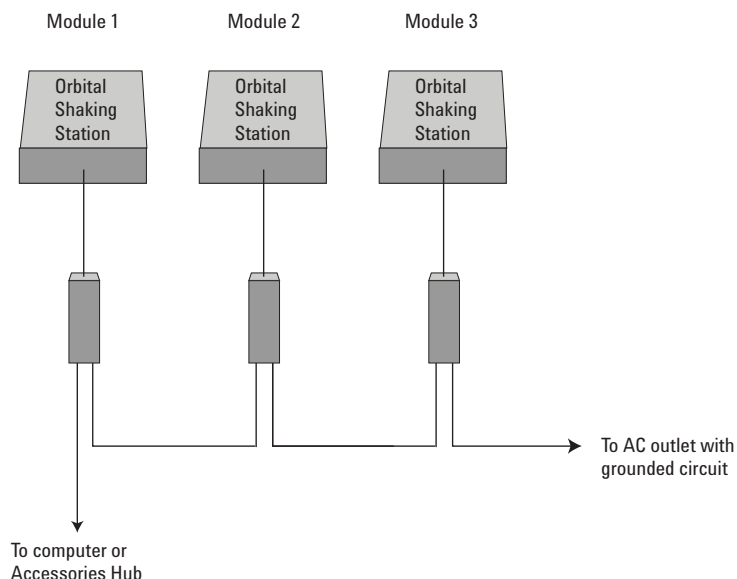
5 Click **Finish**.

6 When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height. You must set the teachpoint after completing this procedure.

7 In the **Profiles** tab, click **Update this profile**.

Editing the teachpoint for the Orbital Shaking Station

IMPORTANT   When setting teachpoints for the Orbital Shaking Station, use a teach plate.

The teach plate is 10 mm thick. When editing the teachpoint for the Orbital Shaking Station, you must account for the teach plate height before setting the teachpoint.

To edit a teachpoint using the teach plate:

1 Place the teach plate on the Orbital Shaking Station.

2 In **Bravo Diagnostics**, click the **Jog/Teach** tab.

3 In the **Location** list, select the deck location of the Orbital Shaking Station.

4 In the **Jog/Teach** tab, use the controls to jog the pipette head so that the A1 pipette tip is in the correct position (directly over the crosshairs with paper-thin clearance). For details, see "Setting the first teachpoint" on page 63.

5 Jog the pipette head up in the z-axis so that you have enough room to remove the teach plate.

6 Remove the teach plate.

7 In the **Jog/Teach** tab, use the controls to jog the pipette head down in the z-axis until there is paper-thin clearance between the end of the tip and the top of the orbital shaking station.

8 Click **Teach** to set the teachpoint.

9 In the **Profiles** tab, click **Update this profile**.

Testing the Orbital Shaking Station

To test the operation of the Orbital Shaking Station:

1   Verify that the Orbital Shaking Station is installed on the target deck location.

2   In **Bravo Diagnostics**, click the **Configuration** tab.

3   In the **Accessory Configuration** area, highlight **Orbital Shaking Station**, and then click **Diagnose accessory**.
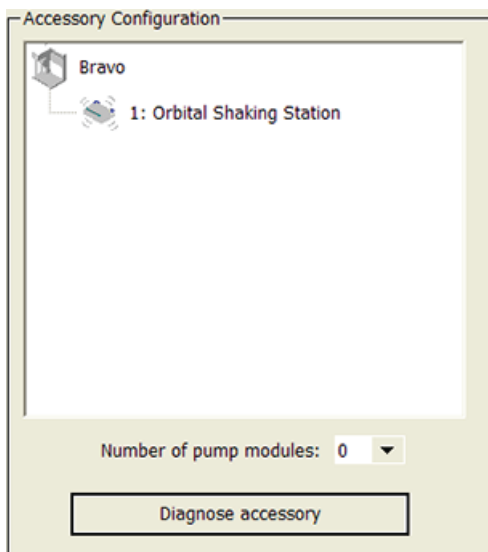
4   In the **Accessory Diagnostics** dialog box, set the following parameters.

a   In the **RPM** box, type the shaking speed.

b   In the **Stir direction** box, select an option from the list.
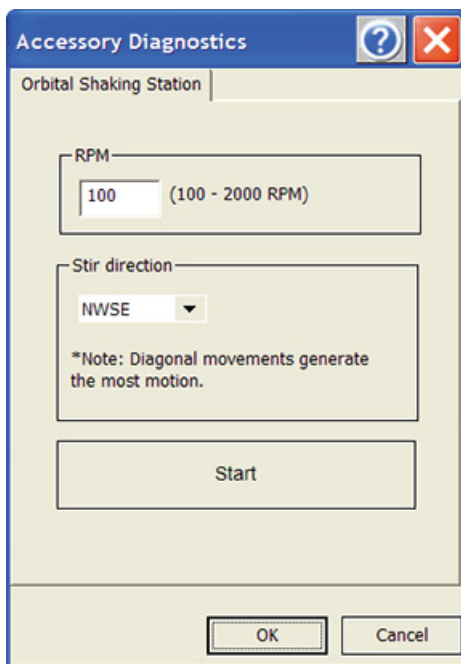
5 Click **Start**.

6 At the device, verify that the accessory operates correctly.

7 In the **Accessory Diagnostics** dialog box, click **Stop**, and then click **OK**.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Accessories Hub	"Installing the Accessories Hub" on page 120
Editing teachpoints	"Setting teachpoints" on page 61
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up the Vacuum Filtration Station

About this topic

This topic describes how to set up the Vacuum Filtration Station on the Bravo Platform. The topic contains the following information:

*   Description
*   Supported configurations
*   Automation workflow
*   Installing and removing the station
*   Configuring the station
*   Testing the station operation

Description

The Vacuum Filtration Station is a container that holds microplates and applies vacuum to filter the microplate contents. Designed to be used with the Accessories Hub, the Vacuum Filtration Station can be installed on the platepad at deck locations 1, 2, or 3 for optimum tube routing. For a full description of the Vacuum Filtration Station, see the manufacturer's documentation.

Figure   Vacuum Filtration Station front (left) and back (right)
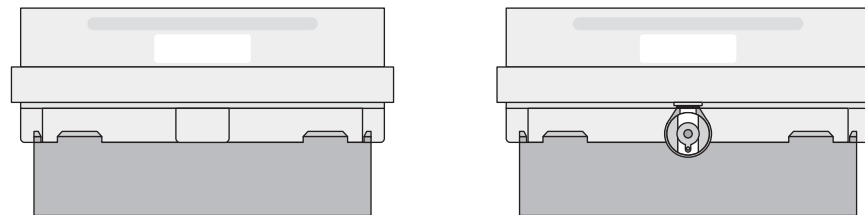
Supported configurations

In addition to the basic Vacuum Filtration Station configuration (station base and station collar only), the Bravo Platform can support two other common configurations. Using the latest VWorks software, you have the option of automating the assembling and disassembling process for these two types of stations during a protocol run.

The configuration options are as follows:

*   *Configuration A*. The filter microplate is part of the station assembly. The assembly process can be automated during the protocol run.
*   *Configuration B*. The filter microplate is not part of the station assembly. The assembly process can be automated during the protocol run. The robot will move the filter microplate to the station after the assembly process is finished.

- *Configuration C.* The filter microplate is not part of the station assembly. The station should always be assembled before a protocol run (assembly is not automated). The robot will move the filter microplate to the station during the protocol run.

A	B	C
Collar	Filter microplate	Filter microplate
Filter microplate	Collar	Collar
Collection microplate	Collection microplate	Base
Base	Base	Bravo platepad
Bravo platepad	Bravo platepad	
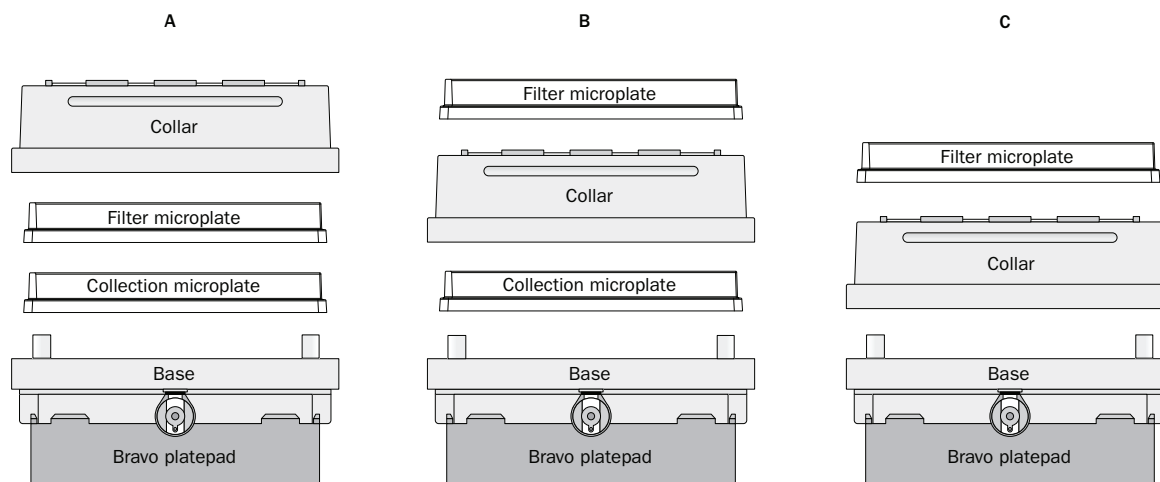
Automation workflow

The following table presents the workflow for automating the assembling and disassembling processes for Vacuum Filtration Stations that have configurations A and B.

Step	For this task...	See...
1	Install the Vacuum Filtration Station.	"Installing the station" on page 145
2	Configure the Vacuum Filtration Station in Bravo Diagnostics.	"Configuring the Vacuum Filtration Station" on page 149
3	Add one or more pairs of the vacuum assembly and disassembly tasks in the protocol.	*VWorks Automation Control User Guide*
4	Set the robot gripper offset for labware that will be placed on the Vacuum Filtration Station during a protocol run.	*VWorks Automation Control Setup Guide*

Installing the station

Before you start

Make sure you have the following:

- Accessories Hub (required)
- Vacuum Filtration Station
- Vacuum Filtration Station kit (contains a pinch-valve module, tubes, waste bottle, and filter)

- M1.5 hex wrench
- Vacuum source (house or pump)

⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove the accessory.**

Procedure

To install a Vacuum Filtration Station:

1 Place the Vacuum Filtration Station on the Bravo platepad at deck location 1, 2, or 3.

   The station can be in any orientation. Make sure the station sits level on the platepad.

2 Insert the setscrew and use the M1.5 hex wrench to tighten the screw.

3 Connect the Vacuum Filtration Station as required for the type of vacuum source:

   - House vacuum with pinch-valve module
   - Vario pump

Connecting the Vacuum Filtration Station using a pinch-valve module

The following figure shows the connections from the Vacuum Filtration Station to a vacuum source via a pinch-valve module.

Figure   Vacuum Filtration Station connections for a pinch-valve module
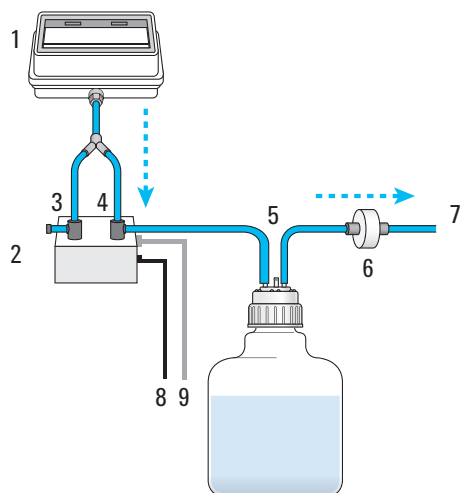
Item	Description
1	Vacuum Filtration Station
2	Pinch-valve module
3	Vent port on pinch-valve module
4	Valve port on pinch-valve module
5	Waste bottle connections

Item	Description
6	Filter
7	House vacuum or pump
8	Power cord to AC outlet
9	Communications cable to comm port on the controlling computer or module port on the Accessories Hub

To connect the Vacuum Filtration Station to a vacuum source via the pinch-valve module:

1 Make sure the Vacuum Filtration Station is in position on the device.

2 Connect the tubing as follows:

    a Connect the tube with the quick-disconnect fitting to the port on the Vacuum Filtration Station.

    b Connect the other end of the tubing to the pinch-valve module using the two-way connector. One tube connects to the vent port, and the second tube connects through the valve port to the waste bottle.

    c Connect the output tubing from the waste bottle to the vacuum source.

3 Connect the communications cable from the pinch-valve module to a module port on the Accessories Hub.

4 Connect the power cable from the pinch-valve module to an AC outlet.

5 Configure the Vacuum Filtration Station in Bravo Diagnostics.

Connecting the Vacuum Filtration Station to the Vario pump

The following figure shows the connections for a Vacuum Filtration Station that uses the ME4C Vario Vacuum Pump Unit.

Figure   Vacuum Filtration Station connections for a Vario Vacuum Pump Unit
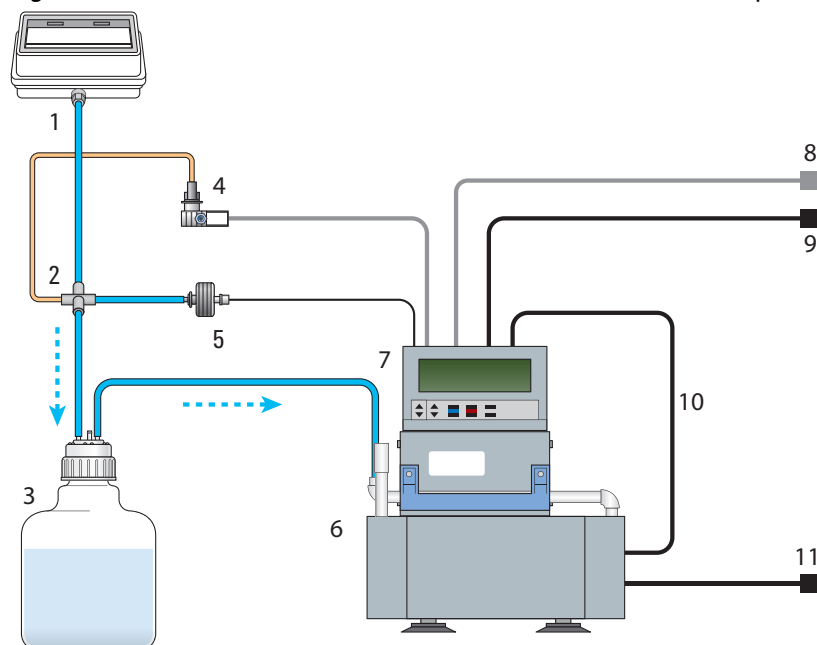
Item	Description
1	Vacuum Filtration Station
2	Four-way tubing connector
3	Waste bottle
4	Valve
5	Sensor
6	Pump unit
7	Gauge with display
8	Communications cable, connects to comm port on the controlling computer or module port on the Accessories Hub
9	Gauge power cord, connects to AC outlet
10	Communications cable, connects pump unit to gauge
11	Pump unit power cord, connects to AC outlet

To connect the Vacuum Filtration Station to the Vario pump:

1   Make sure the Vacuum Filtration Station is in position on the device.

2   Using the four-way tubing connector:

a Connect the tubing with the quick-disconnect fitting to the port on the Vacuum Filtration Station and connect the other end to the four-way connector.

b Connect the input tubing from the waste bottle to the four-way connector.

c Connect the tubing from the sensor port to the four-way connector.

d Connect the tubing from the valve port to the four-way connector.

3 Connect the output tubing from the waste bottle to the pump.

4 At the pump gauge, connect the following:

a Communications cable from the pump.

b Cable from the valve.

c Cable from the sensor.

5 Connect a communications cable from the pump gauge to a module port on the Accessories Hub.

6 Connect the power cables from the pump and the gauge to an AC outlet.

7 Configure the Vacuum Filtration Station in Bravo Diagnostics.

Removing the Vacuum Filtration Station

To remove the Vacuum Filtration Station:

1 Turn off the vacuum.

2 Disconnect the pump gauge or pinch-valve module communications cable from the Accessories Hub.

3 If applicable, disconnect the pinch-valve module from the vacuum source.

4 Disconnect the tube from the Vacuum Filtration Station.

5 Remove the set screw that is holding the Vacuum Filtration Station to the platepad.

6 Remove the Vacuum Filtration Station from the platepad.

Configuring the Vacuum Filtration Station

To configure the Vacuum Filtration Station in Bravo Diagnostics:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.

3 In the **Locations** list, select the deck location of the Vacuum Filtration Station base.

4 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

5 In the **Location** list, confirm the deck location of the Vacuum Filtration Station base, and then click **Next.**

6 In the **Accessory** list, select **Vacuum Filtration Station,** and then click **Next.**

7 In the **"Vacuum Filtration Station" properties** table, set the following:

    a **Serial Port** (module port) on the Accessories Hub to which the communications cable from the pinch-valve module or the pump connects.

    b **Pump connected**. The options are Standard, which uses the pinch-valve module, or ME4CVario.

8 Select one of the **Configuration** options:

- **Always assembled**. The station consists only of the base and the collar, or the robot will not assemble or disassemble the station components during a protocol run.

  If you select **Always assembled**, select the **Collar type** (standard or deep), click **Next**, and then go to step 10.

- **Start disassembled.** The station components are at different deck locations and you want to use the Assemble Vacuum and Disassemble Vacuum tasks during a protocol run.

  If you select **Start disassembled**, click **Next**, and proceed to step 9.

9 *Starts disassembled configuration only.* Select the following:

    a In the **Location for Vacuum Filtration Collar** box, select the deck location at which the collar is located, and then click **Next.**

    b In the **"Vacuum Filtration Collar" properties** table, select the **Collar type** (standard or deep), and then click **Next.**

10 Click **Finish.** When a message appears and asks whether to move the teachpoint to a safe Z height, click **Yes**.

If you verified the accuracy of the platepad teachpoint before installing and configuring the Vacuum Filtration Station, no further adjustment to the teachpoint should be required.

11 In the **Profiles** tab, click **Update this profile**.

Testing the Vacuum Filtration Station

Testing the Pump Standard option

If you selected the Standard connection option when configuring the Vacuum Filtration Station, use the following procedure to test the vacuum supply to the station.

To test the Standard connection for a Vacuum Filtration Station:

1 Verify that the pre-assembled Vacuum Filtration Station is in place on the target deck location and connected via the pinch-valve module.

2 In **Bravo Diagnostics**, click the **Configuration** tab.

3 In the **Accessory Configuration** area, highlight **Vacuum Filtration Station**, and then click **Diagnose accessory**.
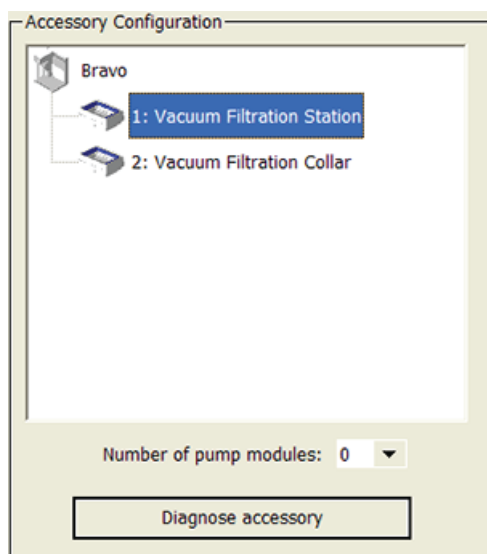
4 In the **Accessory Diagnostics** dialog box, start the vacuum as follows:

a Set the **Vent valve** to **Closed**.

b Set the **Vacuum valve** to **Open**.

c Click **Execute**.

Figure   Accessory Diagnostics dialog box for the Standard connection
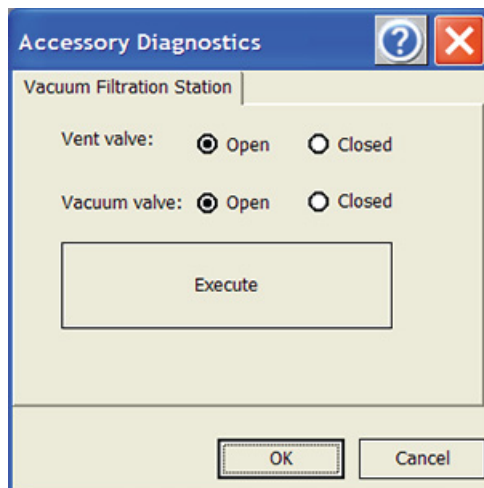
5   To stop the vacuum:

   a   Set the **Vent valve** to **Open**.

   b   Set the **Vacuum valve** to **Closed**.

   c   Click **Execute**.

6   Click **OK**.

Configuring the ME4C Vario pump and testing the vacuum

If you selected the ME4CVario connection when configuring the Vacuum Filtration Station, use the following procedure to configure the pump settings and test the vacuum supply to the station.

For more details on the ME4C Vario pump, see the manufacturer's user guide.

To configure the ME4C Vario pump and test the station:

1   Verify that the pre-assembled Vacuum Filtration Station is in place on the target deck location and connected to the Vario pump.

2   In **Bravo Diagnostics**, click the **Configuration** tab.

3   In the **Accessory Configuration** area, highlight **Vacuum Filtration Station**, and then click **Diagnose accessory**.
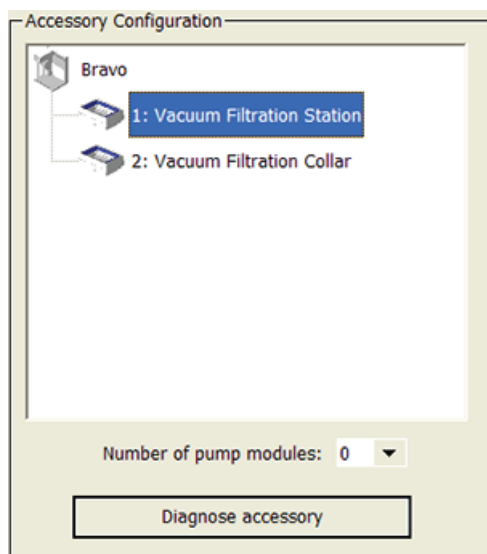
4   To configure the pump:

   a   Set the **Vent valve** to **Open**.

   b   Set the **Pump** to **Off**.

   c   Type the **Target pressure**. Use the same unit of measure (mbar, Torr, hPa) that you selected when connecting the pump.

   d   Click **Set baseline pressure**.

Figure   Accessory Diagnostics dialog box for the ME4C Vario pump
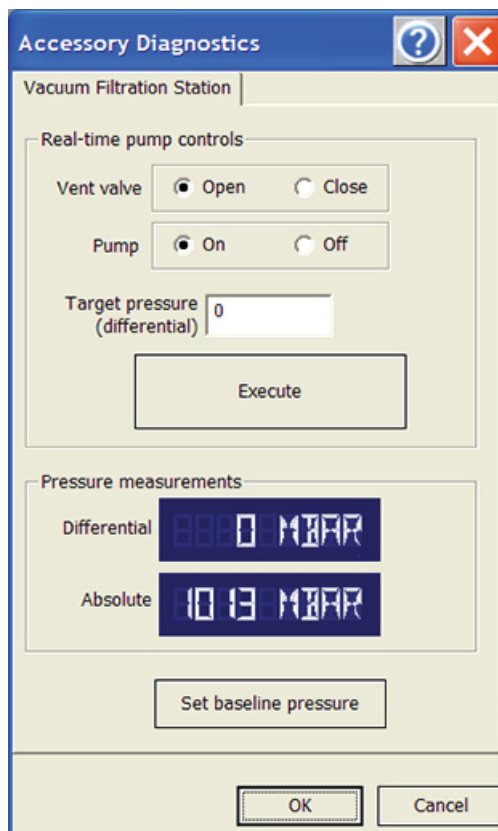
5 To start the vacuum:

    a Set the **Vent valve** to **Closed**.

    b Set the **Pump** to **On**.

    c Set the **Target pressure**.

    d Click **Execute**.

6 To stop the vacuum:

    a Set the **Vent valve** to **Open**.

    b Set the **Pump** to **Off**.

    c Click **Execute**.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Accessories Hub	"Installing the Accessories Hub" on page 120
Editing teachpoints	"Setting teachpoints" on page 61
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Configuring a platepad for delidding

About this topic

This topic explains how to configure a platepad to accept a lid in a delidding process.

Before you start

- Make sure you install a platepad at the desired deck location.
- Do not install another accessory at this deck location.

Configuring a platepad for delidding

To configure a platepad for delidding:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.

3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4 Follow the instructions in the Accessories Wizard to:
- Choose the **Location** on which you want to place the microplate lid.

  Note: Your selection in the Accessories Wizard overrides the selection in the Configuration tab.

- Select the **Lid hotel** accessory to indicate that you want to use the Delidding and Relidding tasks.

  Note: Because you can place only one lid on the designated platepad, **Number of Slots** is set to **1**.

5 When the accessory configuration message appears, do one of the following:
- If you have not yet edited the teachpoint, click **Yes**. After the software initializes the accessory, edit the teachpoint.
- If you have already verified the teachpoint, click **No**.

6 In the **Profiles** tab, click **Update this profile**.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing teachpoints	"Setting teachpoints" on page 61
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing an Alignment Station

About this topic

This topic describes the Alignment Station, explains its use, and provides the installation and removal instructions.

Description

The Alignment Station is a platepad that has three springed rollers on two of the sides. The springed rollers are designed to push a microplate into the opposing corner, securing the microplate position and ensuring precise pipetting.

The Alignment Station is for use with 1536-well microplates, ST tipboxes, and any other microplate requiring precision location. The station can be installed in place of a platepad on any of the nine deck locations.

Crosshair mark for
setting teachpoint
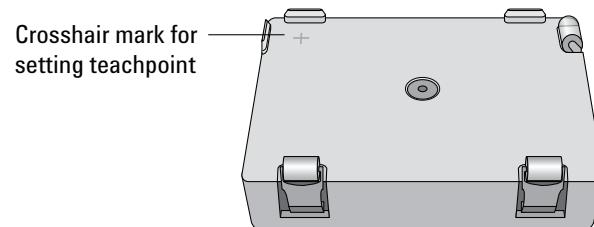
Before you start

Make sure you have the following:
- Alignment Station
- M4 hex wrench

Procedure

⚠️ **WARNING** **Turn off the Bravo Platform before you install or remove the accessory.**

To install an Alignment Station:

1 Using the M4 hex wrench, remove the screw in the center of the platepad.

2 Remove the platepad. Make sure the dowel pins under the platepad remain in the deck.

3 Place the Alignment Station on the same deck location. Make sure the crosshairs are toward the back side of the Bravo Platform and the Alignment Station sits level on the deck.

4 Insert the supplied flathead cap screw into the center of the Alignment Station and use the M4 hex wrench to tighten the screw.

5 If you removed another accessory from this deck location immediately before installing the Alignment Station, edit the teachpoint for this location. If you removed a platepad before installing the Alignment Station, you do not need to edit the teachpoint.

To remove the Alignment Station:

1   Using the M4 hex wrench, remove the screw in the center of the Alignment Station.

2   Remove the Alignment Station.

3   Place the platepad on the same deck location. Make sure the crosshairs are toward the back side of the Bravo Platform and the platepad sits level on the deck.

4   Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Editing teachpoints	"Setting teachpoints" on page 61

Setting up a Nested Rack Insert

About this topic

You should install the Nested Rack Insert if you are using nestable tip racks on the Bravo Platform. The insert ensures the stability of a nestable tip rack during tips-on and tips-off tasks. Up to five nestable tip racks can be stacked on a single platepad using the Nested Rack Insert.

After you install the Nested Rack Insert, you configure the software to automatically select the location in VWorks during tips-on and tips-off tasks.

This topic describes how to install and configure the Nested Rack Insert.

Figure   Nested Rack Insert installed on a Bravo platepad
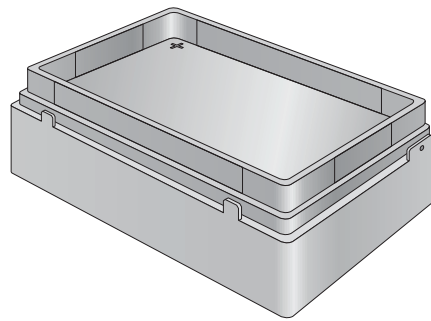
Before you begin

Make sure you do the following before installing the Nested Rack Insert:

- Ensure that the labware definition specifies a nested tipbox as follows:

  In the **Labware Editor**, click the **Plate Properties** tab. In the **Requires insert** list, select **Nested Rack Insert**.

- Set the teachpoints for all deck locations.

- Verify that the gripper y-axis offset is correct. See "Verifying the gripper setup" on page 68. In Bravo Diagnostics, perform a place plate task to move a nested tipbox and ensure the gripper y-axis offset is correct.

- Obtain a 1.5 mm hex wrench for installing the insert.

Installing and configuring the Nested Rack Insert

To install the Nested Rack Insert:

1 On the Bravo deck, locate the platepad where you plan to do tips-on and tips-off tasks. Place the Nested Rack Insert on the platepad, making sure to align the insert's crosshair (**1**) directly above the platepad's crosshair.

2 To secure the Nested Rack Insert, use a 1.5 mm hex wrench to tighten the platepad screw (**2**).
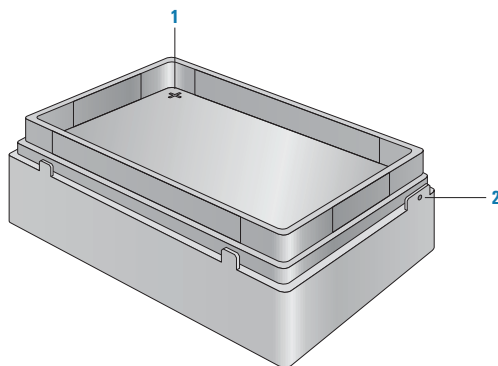
To configure the Nested Tip Rack Insert:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and verify that the correct profile is initialized.

2 Click the **Configuration** tab.
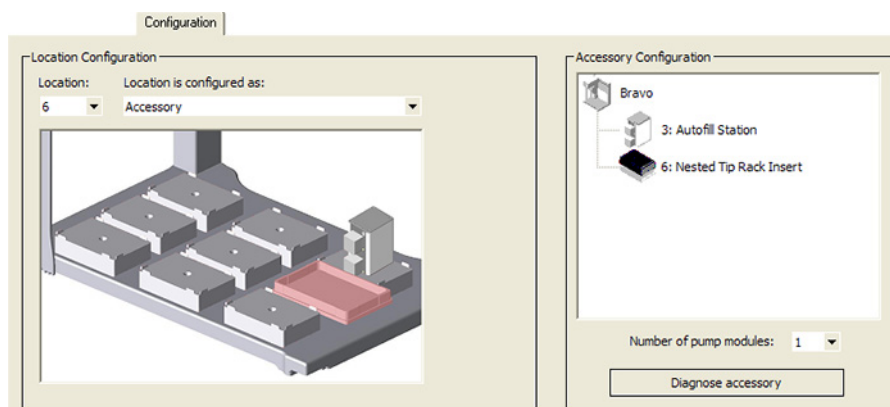
3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

4 Follow the instructions in the **Accessories Wizard** to:

a Specify the **Location** of the installed insert.

Note: Your selection in the Accessories Wizard overrides the default selection in the Configuration tab.

b Choose the **Nested Tip Rack Insert**.

5 When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height.

6 Set the teachpoint for the Nested Rack Insert using the same procedure that you would for a platepad.

The Nested Rack Insert is approximately 5 mm taller than a standard platepad.

7   In the **Profiles** tab, click **Update this profile**.

8   To verify the setup, perform a tips-on task.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Gripper y-axis offset	"Verifying the gripper setup" on page 68
Editing teachpoints	"Setting teachpoints" on page 61
Setting up labware definitions	*VWorks Automation Control Setup Guide*
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Using the Manual Fill Reservoir

About this topic

This topic describes the Manual Fill Reservoir.

Description

The Manual Fill Reservoir is an open tray that you can install on a platepad to supply reagents to 96- and 384-channel pipette heads. You must manually refill and empty the reservoir.

Automation Solutions reservoirs are approved for use with most reagents and solvents. If you have questions on the use of a particular chemical or solvent in a Automation Solutions reservoir, contact Automation Solutions Technical Support prior to use.

Figure   Two types of Manual Fill Reservoirs: 96-well and 384-well options

96-well   384-well
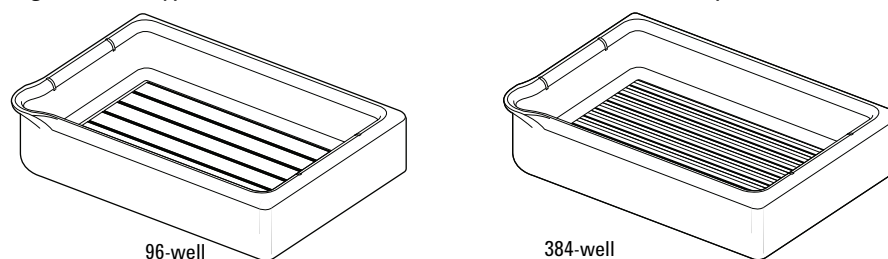
Using the reservoir

Before using the reservoir:

1   In the **Labware Editor**, ensure a labware definition is set up with the Reservoir base class. See *VWorks Automation Control Setup Guide*.

2   Specify the deck location as configured labware in the VWorks software. See *VWorks Automation Control User Guide*.

⚠️   **WARNING**   **Before you place labware on the deck, ensure that the pipette head is not moving.**

To use a Manual Fill Reservoir:

1   Fill the reservoir and place it on a deck location. The reservoir can be in any orientation.

2   To empty the reservoir, lift it from the deck location and discard the fluid according to applicable regulations.

Related information

For information about...	See...
Safety guidelines	"Safety guidelines" on page 1

For information about...	See...
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up the Sonic Tip Wash Station

About this topic

The Sonic Tip Wash Station enables thorough cleaning of the pipette tips during a pipetting protocol. The wash station uses sonication to increase the cleaning efficiency. You can use the Sonic Tip Wash Station to clean the pipette tips on a fixed-tip or disposable-tip pipette head.

This topic describes how to install the Sonic Tip Wash Station using the Bravo A/C Relay and how to configure the software.

Before you begin

Make sure you have the following:

- Sonic Tip Wash Station
- Bravo A/C Relay

The Bravo A/C Relay is required to connect the power source to the Sonic Tip Wash Station. A serial connection between the controlling computer and the Bravo A/C Relay enable the VWorks software to control the Sonic Tip Wash Station.

You can use the Sonic Tip Wash Station with or without a Pump Module. If a Pump Module is used, the inlet and outlet ports of the Sonic Tip Wash Station must be plumbed to the Pump Module.

CAUTION   If the Sonic Tip Wash Station is used without a Pump Module, you must plug the inlet and outlet ports of the Sonic Tip Wash Station to prevent spillage of solution onto the Bravo deck.

Make sure you do the following:

- In the VWorks Labware Editor, create a labware definition that specifies the correct base class. If you are using the Sonic Tip Wash Station:
    - *Without a Pump Module*. In the **Labware Editor**, under **Base Class**, select **Reservoir**.
    - *With a Pump Module*. In the **Labware Editor**, under **Base Class**, select **MicroWash Reservoir**.
- Set the teachpoints for all deck locations.

    Note: The Sonic Tip Wash Station has a VWorks labware definition similar to a manual reservoir or MicroWash Reservoir. Therefore, reteaching the location is not required.

Installing the Sonic Tip Wash Station

To install the Sonic Tip Wash Station:

1 On the front of the Bravo A/C Relay, verify that the power switch is set to **off (o)**.

2 Connect one end of the power cord to the AC IN power port on the Bravo A/C Relay. Connect the other end of the power cord to an appropriate, grounded electrical socket.

3 Connect the power cord from the Sonic Tip Wash Station to the AC OUT port on the Bravo A/C Relay.

4 Connect one end of a serial cable to the COMM IN port on the Bravo A/C Relay, and connect the other end of the serial cable to the computer that controls the Bravo Platform.

5 On the Bravo deck, place the Sonic Tip Wash Station on the desired platepad.

6 If you are using a Pump Module to autofill the Sonic Tip Wash Station, see "Setting up a Pump Module for the Bravo Platform" on page 177.

Configuring the VWorks software

You must add a Generic IO device to your device file before you can use the VWorks software to control the Sonic Tip Wash Station.

To add the Generic IO device to the VWorks device file:

1 In **VWorks** window, ensure the device file that contains your Bravo device is open.

2 In the **Available Devices** area, double-click the **Generic IO** icon.
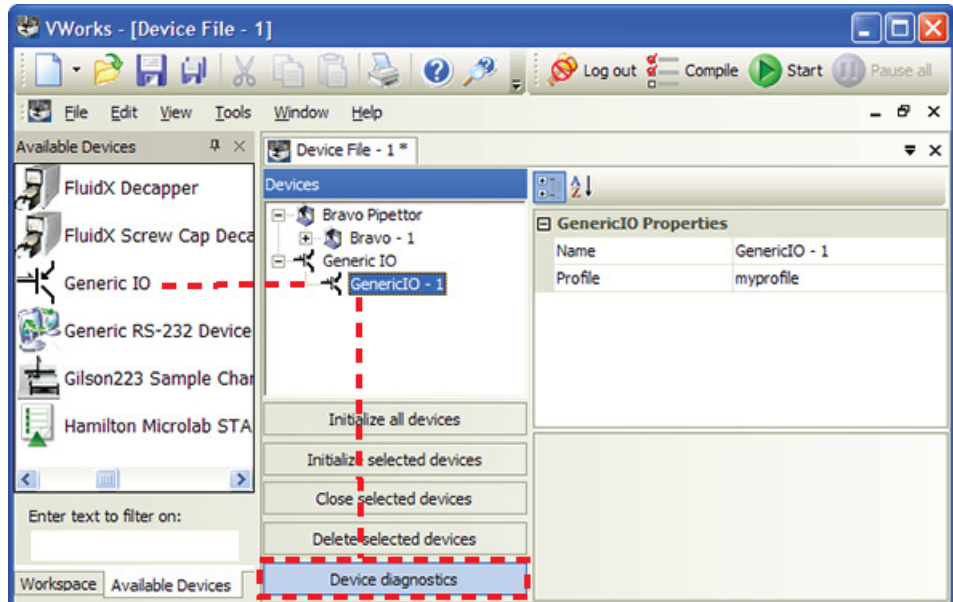
3   In the **Devices** area, select the **Generic IO** device, and then click **Device diagnostics**. The GenericIO Diagnostics window appears.
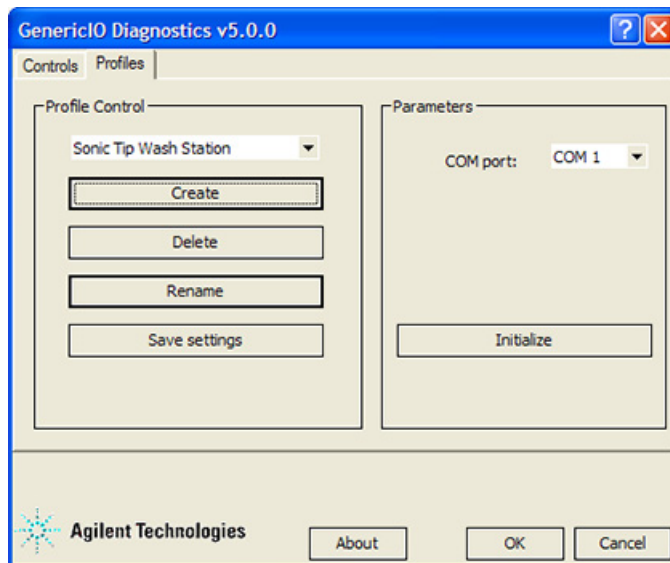
4   Create an new profile for the Sonic Tip Wash Station as follows:

   a   In the **Profiles** tab, click **Create**, type a name for the profile, and click **OK**.

   b   In the **COM port** list, select the computer COM port to which the Bravo A/C Relay is connected.

   c   Click the **Controls** tab, and in the **Output number** box, type 9.

   d   In the **Profiles** tab, click **Save settings**, and then click **OK**.

5   In the **VWorks** window, under **GenericIO Properties**, select the profile that you created in step 4.

In the VWorks software, when you create a protocol that includes the Sonic Tip Wash Station, you use the following tasks:

- Turn On (GenericIO) and Turn Off (GenericIO) tasks to turn on and off the the Bravo A/C Relay.
- Wash task, if using a Pump Module, to perform a wash using the Sonic Tip Wash Station.
- Mix task, if no Pump Module is connected, to perform a wash using the Sonic Tip Wash Station.

Related information

For information about...	See...
Safety guidelines	"Safety guidelines" on page 1
A/C Relay	*Bravo A/C Relay User Guide*
Setting up a Pump Module	"Setting up a Pump Module for the Bravo Platform" on page 177
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up the Tip Trash
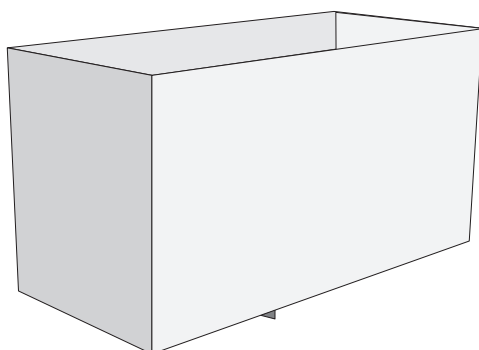
About this topic

This topic describes the Tip Trash, explains its use, and provides the installation and removal instructions.

Description

The Tip Trash is a receptacle for used pipette tips. The Tip Trash should be installed in place of three platepads at deck locations 1, 4, and 7 (left side of the deck) or locations 3, 6, and 9 (right side of the deck).

Figure   Tip Trash

Before you start

Make sure you have an M4 hex wrench.

Procedures

⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove any accessory.**

To install the Tip Trash:

1 Using the M4 hex wrench, remove the screw in the center of the platepads at deck locations 1, 4, and 7 or locations 3, 6, and 9.

2 Remove the dowel pins under the platepads.

3 Place the Tip Trash in the same deck locations by aligning the dowel pins under the Tip Trash with the dowel-pin holes in the deck.

4 Configure the Tip Trash in VWorks software:

   a In the **Labware Editor**, ensure a labware definition is set up with the base class **Tip trash bin**. See *VWorks Automation Control Setup Guide*.

   b Specify the deck location as configured labware in the VWorks software. See *VWorks Automation Control User Guide*.

To remove the Tip Trash:

1 Remove the Tip Trash from the deck.

2 Insert the platepad dowel pins in the deck.

3 Place the platepads on the deck locations.

4 Insert a supplied flathead cap screw into the center of each platepad and use the M4 hex wrench to tighten the screw.

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Other accessories	"Accessories overview for the Bravo Platform" on page 118
Using an accessory in a protocol	*VWorks Automation Control User Guide*

(Bravo SRT only) Setting up an LT tipbox location

About this topic

Read this topic if you have a Bravo SRT Platform and you are using the 250-µL tips. The height limitation on the Bravo SRT requires a special platepad and a deck location configured for the 250-µL tipbox operations.

Before you begin

> **CAUTION**   To prevent potential hardware crashes when using 250-µL tips, make sure you understand the following limitations of the *z*-axis clearance on the Bravo SRT.

- Be aware that the Bravo SRT has insufficient clearance to move labware if the 250-µL tips are installed on the pipette head. The Bravo SRT can move labware only if 250-µL tips are not on the pipette head.
- Limit tips on and tips off tasks to deck locations where an SRT 250-µL tipbox platepad is physically installed and configured in the Bravo Diagnostics software. This special platepad provides additional *z*-axis clearance, and is designed for a tipbox that holds 96 250-µL tips.
- Use labware classes for each deck location so that the 250-µL tipbox operations are not attempted at deck locations with insufficient *z*-axis clearance.
- Use VWorks Task Groups to ensure that tips on and tips off tasks are performed before plate movement tasks in the protocol.

Ensure that you have the following:
- M4 hex wrench for removing a standard SRT platepad
- SRT platepad for 250-µL tipbox
- Star-head screw and wrench for installing the SRT 250-µL tipbox platepad

Workflow

Step	For this task...	See...
1	Install an SRT platepad for 250-µL tipboxes at any deck location where you plan to do tips on and tips off tasks.	"Installing the 250-µL tipbox platepad on the Bravo SRT" on page 168
2	In Bravo Diagnostics, configure the location and set the teachpoint.	"Configuring the platepad in Bravo Diagnostics" on page 168

Step	For this task…	See…
3	In the Labware Editor, set up appropriate labware classes. For example, limit the tipbox location to a labware class that uses the SRT platepad for 250- µL tipboxes, and other locations to a class that uses a standard SRT platepad.	*VWorks Automation Control Setup Guide*
4	In the VWorks software, edit the device file to specify the appropriate labware class for each deck location.	"Creating or adding a Bravo device" on page 45
5	In the VWorks software, use Task Groups to ensure that tips on and tips off tasks are performed before plate movement tasks in the protocol.	*VWorks Automation Control User Guide*

Installing the 250-µL tipbox platepad on the Bravo SRT

To install the SRT platepad for 250-µL tipboxes:

1 Using the M4 hex wrench, remove the screw in the center of the platepad, and remove the standard SRT platepad.

2 Position the SRT platepad for 250- µL tipboxes so that the crosshairs are at the back left side of the deck location.

Make sure that the platepad sits level on the deck.

3 Insert the supplied star- head screw into the center of the 250- µL tipbox platepad, and use the star- head wrench to tighten the screw.

Configuring the platepad in Bravo Diagnostics

To configure the SRT platepad for 250-µL tipboxes:

1 In **Bravo Diagnostics**, click the **Profiles** tab, and open the profile for the given Bravo SRT platform.

2 In the **Profiles** tab, select the **This is a Bravo SRT** check box.

3 In the **Configuration** tab, select the **Location**.

4 In the **Location is configured as** list, select **(SRT only) platepad for 250 uL tips**.
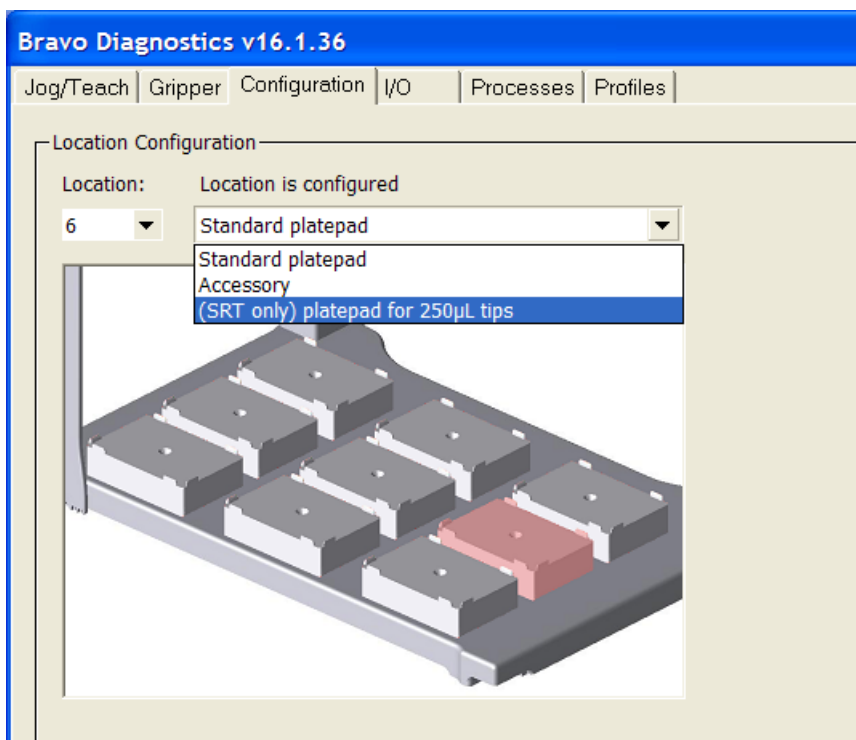
5 Click the **Jog/Teach** tab, and teach the deck location using the crosshairs on the platepad. See "Setting teachpoints" on page 61.

If you previously taught this deck location using the **Set all teachpoints based upon selected teachpoint** feature, you can:

a Select the platepad **Location**, and click **Move** to go to the preset teachpoint.

b Using small increments, jog down in the z-axis until you have paper-thin z-axis clearance between the pipette tip and the crosshairs.

c When the tip is in the correct position (directly over the crosshairs with paper-thin clearance), click **Teach.**

Note: Although the 250-µL tipbox actually sits on the Bravo SRT deck, the software makes an adjustment in the z-axis to compensate for the height difference.

6 In the **Profiles** tab, click **Update this profile.**

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 10
Starting Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing teachpoints	"Setting teachpoints" on page 61
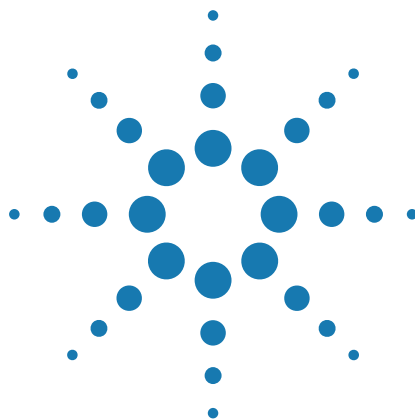
B

Autofilling accessories

This chapter describes the autofilling accessories that can be used with the Bravo Platform and provides the installation and removal procedures. This chapter contains the following topics:

Agilent Technologies

Autofilling station overview and setup workflow

About this topic

An autofilling station is a location on the Bravo Platform where a reservoir can be automatically filled with liquid. The topic describes the components and provides the workflow for setting up an autofilling station.

Autofilling accessories

Accessory	Description	See...
Pump Module	Pumps fluids to and from an autofilling reservoir or wash tray.	"Setting up a Pump Module for the Bravo Platform" on page 177
Auto Filling Reservoir	Supplies reagents to the pipette head for 96- and 384-well plates. Use this reservoir with a Pump Module to refill and empty the reservoir automatically. You can also use this reservoir with a Weigh Station.	"Reservoirs and wash stations for Bravo autofilling station" on page 174
MicroWash Reservoir	Washes the pipette tips during a run to prevent carryover and reduce cross-contamination. Use this reservoir with a Pump Module.	"Reservoirs and wash stations for Bravo autofilling station" on page 174
Open Wash Tray	Washes the pipette tips, and can be set up in either an overflow mode or a fill-and-empty mode. Use this reservoir with a Pump Module.	"Reservoirs and wash stations for Bravo autofilling station" on page 174
Weigh Station	*Optional.* Works with a Pump Module to provide precise liquid-level control for the Auto Filling Reservoir or MicroWash Reservoir.	"Setting up a Weigh Station for the Bravo Platform" on page 188

Workflow to set up an autofilling station

Step	Procedure	See...
1	If applicable, install the Weigh Station.	"Setting up a Weigh Station for the Bravo Platform" on page 188
2	Set up the Pump Module.	"Setting up a Pump Module for the Bravo Platform" on page 177
3	In Bravo Diagnostics, configure the autofilling function.	"Configuring an autofilling station for the Bravo Platform" on page 183
4	If applicable, calibrate the Weigh Station.	"Calibrating a Weigh Station" on page 189
5	If applicable, verify the teachpoint accuracy for the Weigh Station.	"Setting teachpoints" on page 61

Related information

For information about...	See...
Other Bravo accessories	"Accessories and platepads" on page 117
Bravo Barcode Reader	"Setting up the Barcode Reader" on page 193
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Reservoirs and wash stations for Bravo autofilling station

About this topic

This topic describes the following containers that can be automatically filled and emptied using the Pump Module:
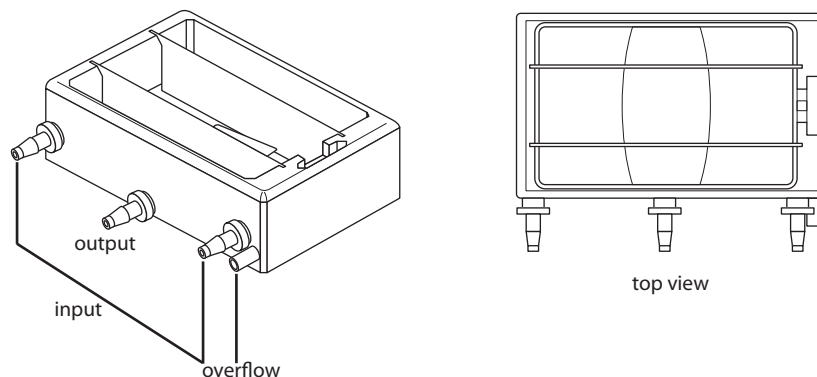
- Auto Filling Reservoir
- MicroWash Reservoir
- Open Bath Tray

Automation Solutions reservoirs are approved for use with most reagents and solvents. If you have questions on the use of a particular chemical or solvent in a Automation Solutions reservoir, contact Automation Solutions Technical Support prior to use.

Auto Filling Reservoir

The Auto Filling Reservoir is an open tray that can be installed on a Weigh Station for precision liquid-level control. The reservoir can supply reagents to 96- and 384-channel pipette heads.

Figure   Auto Filling Reservoir

output

input

overflow

top view

When properly configured in Bravo Diagnostics, the Pump Module automatically fills and drains the Auto Filling Reservoir. As the figure shows, two input ports are available to supply reagents to the pipette head. An output port is used to pump the waste and excess fluid from the reservoir. An overflow drain port can also be connected to drain the excess fluid.

MicroWash Reservoir

The MicroWash Reservoir is a wash station that is available in two types: 96-chimney or 384-chimney.

Figure   MicroWash Reservoir: 96-chinmey (left) and 384-chimney (right)
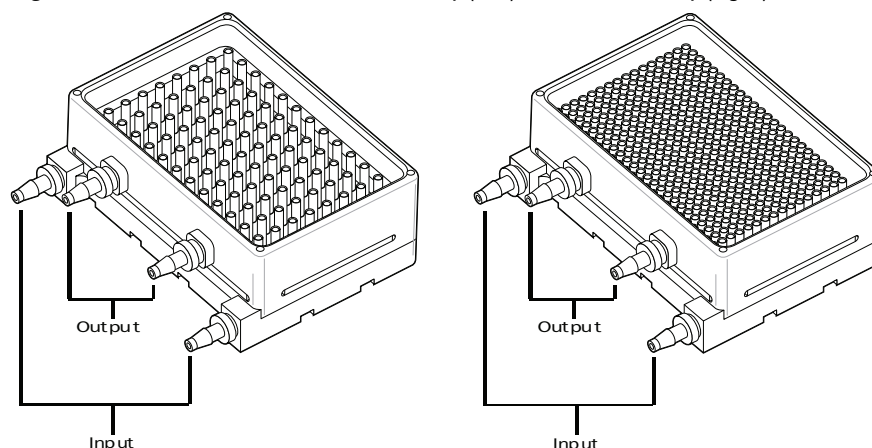
You can use the 96- and 384-chimney reservoirs with any of the Automation Solutions 96-channel pipette heads. However, the Automation Solutions 384-channel pipette head is limited to the 384-well reservoir. In all cases, make sure the pipette tips do not touch the bottom of the reservoirs. To adjust the distance from the bottom, you can use the Bravo pipetting task parameters in the VWorks4 software. For instructions, see *VWorks Automation Control User Guide*.

The chimneys in the reservoir prevent carryover and reduce contamination. The Pump Module pumps wash liquid into the MicroWash Reservoir through two input ports. The wash liquid flows up through the chimneys in the reservoir to wash the tips. The waste overflows from the chimney and is removed through two output ports.

The MicroWash Reservoir can be installed on a platepad at deck locations 1, 2, or 3. Optionally, the MicroWash Reservoir can be used on a Weigh Station for precision liquid-level control.

> **CAUTION**   The 384-channel pipette head is compatible with the 384-chimney MicroWash Reservoir only. Make sure the tips of any type of Automation Solutions pipette head do not touch the bottom of the reservoirs.

Open Bath Tray

The Open Bath Tray is an open tray that can be installed on a Weigh Station for precision liquid-level control. The tray can supply reagents to 96- and 384-channel pipette heads.

When properly configured in Bravo Diagnostics, the Pump Module automatically fills and drains the tray. The Open Bath Tray can be set up to run in either of two modes:

- *Overflow.* Fresh wash solution enters the bath from each end and overflows into the overflow trough and is pumped to waste.

- *Fill/empty.* Fresh wash solution enters the bath from both ends, but is drained via the bottom outlet. In this mode the bath is filled and emptied one or more times between each wash cycle. The bath design ensures maximal emptying to reduce the contamination load in the wash fluid between each cycle.

Figure   Open Bath Tray
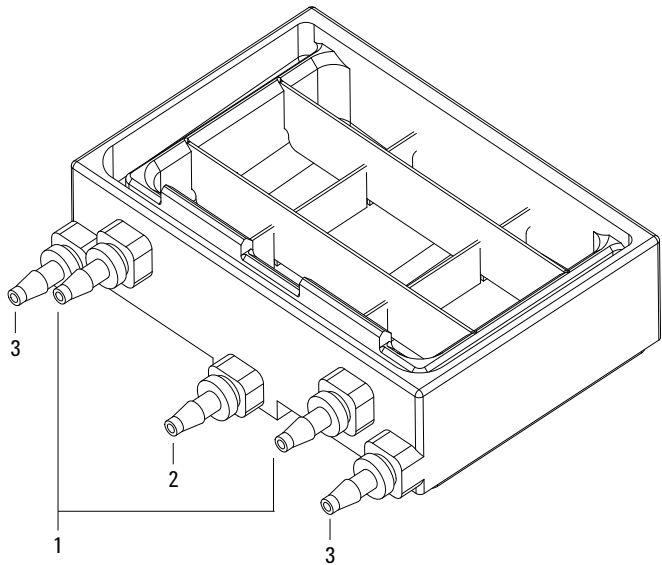
To set up the tubing for each mode:

Ports on tray		Overflow mode	Fill and empty mode
1	Top 2 ports	Connected to output (empty) tubing	Plugged
2	Bottom center port	Plugged	Connected to output (empty) tubing
3	Bottom 2 side ports	Connected to input (fill) tubing	Connected to input (fill) tubing

Related information

For information about...	See...
Weigh Station	"Setting up a Weigh Station for the Bravo Platform" on page 188
Connecting the Pump Module	"Setting up a Pump Module for the Bravo Platform" on page 177
Configuring the autofilling functions	"Configuring an autofilling station for the Bravo Platform" on page 183

Setting up a Pump Module for the Bravo Platform

About this topic

This topic provides installation instructions for the Pump Module and a reservoir.

Description

The Pump Module transfers fluids into and transfers waste away from a reservoir. You can use the Pump Module with an Auto Filling Reservoir and a Weigh Station or with a MicroWash Reservoir.

Before you start

⚠️ **WARNING**   **Before connecting an accessory, shut down the Bravo Platform to ensure that the power is turned off.**

Connecting power and communication

⚠️ **WARNING**   **Ensure that the Pump Module and the Bravo Platform are turned off before connecting the cables and routing the tubing.**

IMPORTANT   The Pump Module must be internally configured to specify use with or without a Weigh Station. If a configuration change is required, contact Automation Solutions Technical Support.

IMPORTANT   You should use one Pump Module for each pairing of reservoir and Weigh Station.

To connect the power and communication cables:

1   Turn off the Bravo Platform and the Pump Module.

2   Position the Pump Module within six feet of the Bravo Platform.

3   On the Bravo Platform back panel, plug one end of the provided serial (RJ-45) cable into the PUMP I/O port, as the following figure shows.

Figure   Pump I/O port on the Bravo Platform (back view)

Pump I/O port
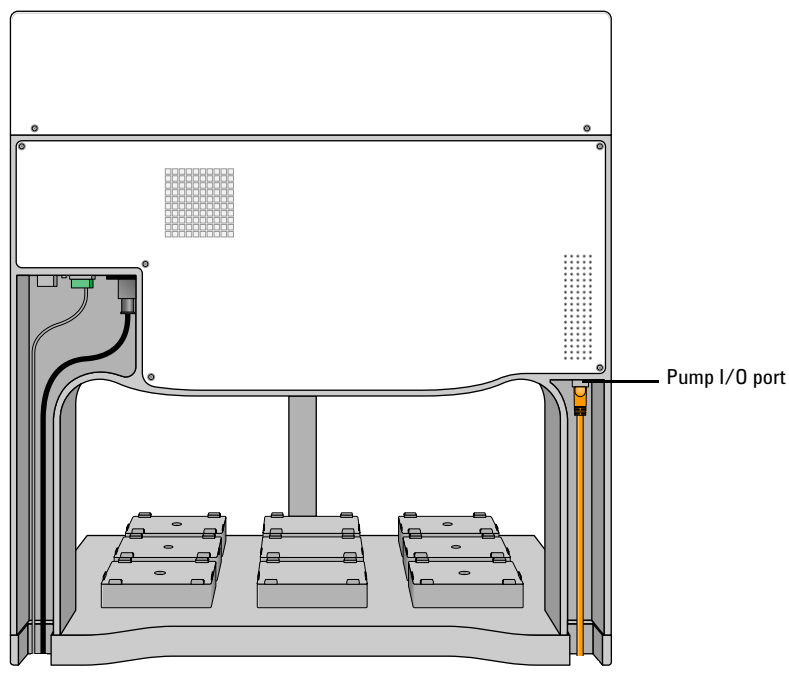
4   Plug the other end of the serial cable into the COM-IN port on the back of the first Pump Module, as the following figure shows.
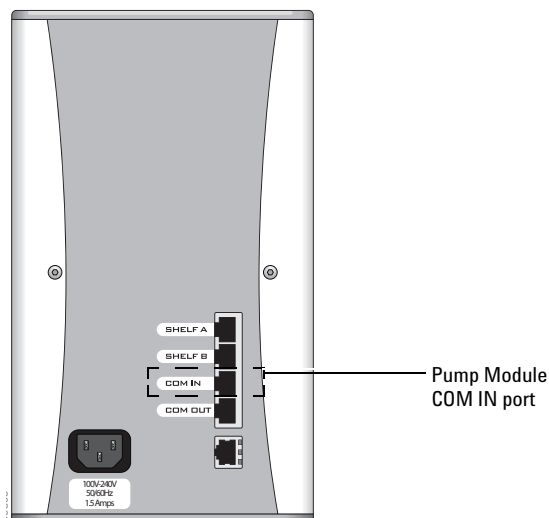
Figure   Pump Module rear view

SHELF A
SHELF B
COM IN
COM OUT

Pump Module
COM IN port

100V-240V
50/60Hz
1.5 Amps

5   To connect multiple Pump Modules:

   a   Use the second RJ-45 cable provided to connect the COM OUT port on the first Pump Module to the COM IN port on the second Pump Module.

   b   Use the third RJ-45 cable provided to connect the COM OUT port on the second Pump Module to the COM IN port on the third Pump Module.

   Repeat this step for each Pump Module in the series.

6 Using the provided power cable, plug one end of the cable into the Pump Module AC power connector on the rear panel and plug the other end into an appropriately grounded electrical receptacle.

7 To connect the Pump Module to the Weigh Station, connect the RJ-45 cable from the Weigh Station to the SHELF A port on the back of the Pump Module.

Routing the tubing

Before you begin:

* Make sure you are familiar with the input and output ports for the type of reservoir or wash tray.

* Ensure you have the necessary tubing, quick-disconnect fittings, and bottles:

Component	Description
Source bottle	Container for fill liquid
Waste bottle	Container for waste liquid
Tube A (input tubing)	3/16-in Marprene tubing with quick-disconnect plugs on both ends
Tube B (output or drain tubing)	¼-in Marprene tubing with quick-disconnect plugs on both ends

The following figure shows a tubing configuration example for a single Pump Module and an Auto Filling Reservoir.

Figure   Example tubing configuration with an Auto Filling Reservoir
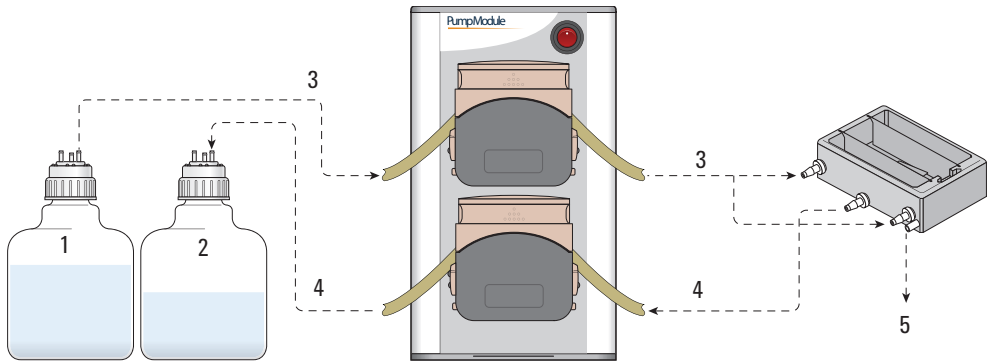
| Item	Component
1	Source bottle to fill the reservoir
2	Waste bottle to empty the reservoir
3	Input tubing (tube A) to fill the reservoir
4	Output tubing (tube B) to empty the reservoir
5	Drain tubing (tube B) for overflow to a vented waste container

> ⚠️ **WARNING**   Ensure that the Pump Module and the Bravo Platform are turned off before connecting the cables and routing the tubing.

To connect the Pump Module tubing to a reservoir:

1 Place the reservoir on the Bravo Platform deck location.

2 Route tubing from the reservoir to the 3-way connectors as follows:

   a *Fill (input)*. Cut two lengths of tube A for the measured distance between the two reservoir input ports and a 3-way connector. Connect the tubing.

   b *Empty (output)*. Cut two lengths of tube B for the measured distance between the two reservoir output ports and a 3-way connector. (If the reservoir has one output port, cut one length of tube B. Connect the tubing.

Figure   Example tubing configuration for a MicroWash Reservoir

3-way connector

Output (tube B)
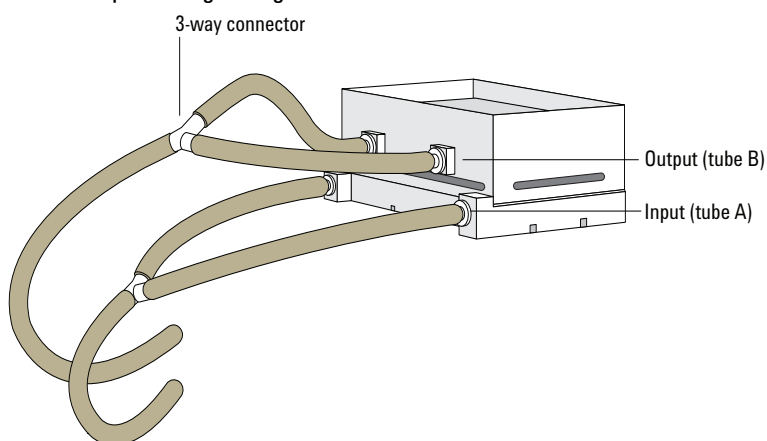
Input (tube A)

3 Route the input tubing (reservoir fill) from the source bottle through the Pump Module as follows:

> ⚠️ **WARNING**   Pinch hazard! Keep your fingers clear of the pump head interior when you close the pump head cover. Keep the pump head cover closed while the pump is running.

> **CAUTION**   Ensure that the tubing is not kinked, twisted, or stretched against the rollers. Make sure that the tube is not crushed in the clamps.

   a Cut a length of tube A for the distance from the source bottle through the Pump Module to the 3-way connector at the reservoir. Allow plenty of slack in the tubing.

   b Attach a quick-disconnect fitting to one end of the tubing, and insert the quick-disconnect fitting into the output port of the source bottle.

   c At the Pump Module, lift up the pump head cover and insert a portion of the tubing into a pump head. Use sufficient tube length so that the tubing gently arches over the rollers.

   d Ensure the tubing is located in the center of the tube clamps (V-grooves) on either side of the pump head, and then carefully lower the cover.

Figure   Inserting tubing into the pump heads

Closed pump head

Open pump head
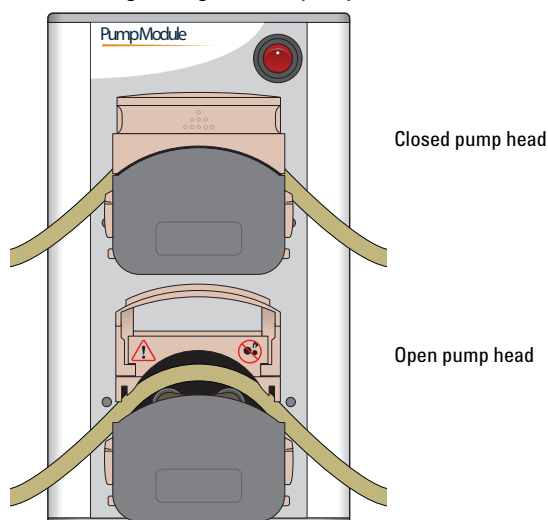
> **e**   Attach the other end of input tubing (tube A) to the 3-way connector that is connected to the reservoir input ports.

4   To route the output tubing (reservoir empty), cut tube B to a measured length from the waste bottle through the Pump Module to the 3-way connector that is connected to the reservoir output ports. Connect the output tubing following the same procedure you used for connecting the input tubing (see previous step).

(Auto Filling Reservoir only) To route the overflow gravity-drain tubing:

1   Cut tube B to the measured length from the reservoir drain port to a waste bottle.

2   Attach a quick-disconnect fitting to one end of the tubing, and insert the fitting into one of the ports on the waste bottle. Make sure the waste bottle is vented.

3   Attach the other end of the tubing to the reservoir drain port.

> **CAUTION**   Do not connect the overflow line to the empty line, or else the overflow will not drain properly. To enable the gravity drain system to work effectively, the drain tubing must always travel downward.

To complete the Pump Module setup:

1   Turn on the Pump Modules, and then turn on the Bravo Platform.

2   Start the VWorks software, and then configure the deck location in Bravo Diagnostics.

IMPORTANT   When using Marprene tubing, reset the tension after you run the Pump Module for the first 30 minutes. To reset the tension on the tubing, open the flip-top cover of the pump head, allow the tube to settle naturally across the rollers, and then reclamp the tube.

Removing a Pump Module

To remove the Pump Module:

1 In Bravo Diagnostics, use the Pump Reagent process to run the Pump Module and drain the reservoir until empty.

2 Turn off the Pump Modules, and then turn off the Bravo Platform.

3 Disconnect the Pump Module power and communication cables. Unplug the Weigh Station cable from the Pump Module.

4 Disconnect the tubing from the reservoir.

5 Remove the reservoir from the deck location.

6 Remove the tubing from the Pump Module and from the source and waste bottles.

Related information

For information about...	See...
Starting up and shutting down the Bravo Platform	"Starting up and shutting down" on page 43
Reservoir options	"Reservoirs and wash stations for Bravo autofilling station" on page 174
Installing and setting up a Weigh Station	"Setting up a Weigh Station for the Bravo Platform" on page 188
Configuring the pump and reservoir parameters	"Configuring an autofilling station for the Bravo Platform" on page 183
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Configuring an autofilling station for the Bravo Platform

About this topic

This topic describes how to configure the autofilling functions for the Pump Module.

Before you begin

Connect the Pump Module, Weigh Station, and autofilling reservoir or wash tray.

Configuring the autofilling function

To configure an autofilling station:

1   In **Bravo Diagnostics**, click the **Profiles** tab, and select the profile that you want to change.

2   On the **Configuration** page, select the location in the **Location** list, or click the location in the graphic display.

3   In the **Location is configured** list, select **Accessory**.
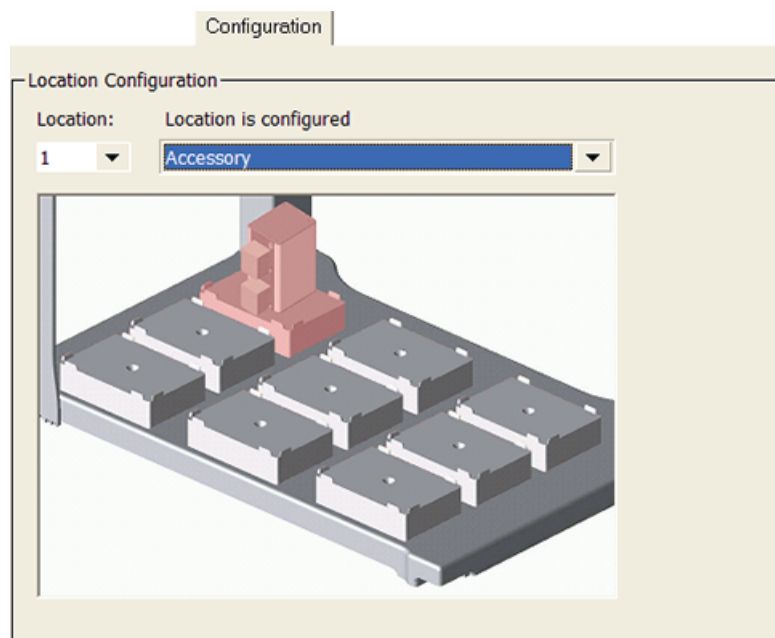
4   In the **Accessories Wizard**, do the following:

a   In the **Location for accessory** list, verify the location and then click **Next**.

b   In the **Accessory** list, select **Autofill Station**, and then click **Next**.

c   In the **Number of pump modules** box, select the total number of Pump Modules connected to this device, and then click **Next**.

For example, if only one Pump Module is connected to this Bravo Platform, select **1**. If two Pump Modules are connected to this Bravo Platform, select **2**, and so forth.

Note: To make a change, click the number to display a list of options.

d   In the **Autofill Station properties** table, set the following parameters.

Parameter	Settings
Fill module	Specify the Pump Module that this deck location uses. For example, select 1 if only one Pump Module is connected to the device. One Pump Module can function as both the Fill module and Empty module.
Pump for filling	Select which of the two pumps on the Pump Module will fill the container on the deck location, where, • Pump 1 controls the upper pump. • Pump 2 controls the lower pump.
Direction for filling	Select the pumping direction, where, • Forward moves the pumped fluid in the forward direction of the pump. • Reverse moves the fluid in the opposite direction.
Empty module	Specify the Pump Module that this deck location uses. For example, select 1 if only one Pump Module is connected to this device. One Pump Module can function as both the Fill module and Empty module.
Pump for emptying	Select which of the two pumps on the given Pump Module will empty the container on the deck location, where, • Pump 1 controls the upper pump. • Pump 2 controls the lower pump.
Direction for emptying	Select the pumping direction: Forward or Reverse.
Use Weigh Station?	If you are using a Weigh Station at this location, select Yes.
Weigh Station module number	If connecting the Weigh Station serial cable to the Pump Module SHELF A input port, select 1. If more than one Weigh Station is connected, the module number corresponds to the order in which they are connected to the controlling computer. *Note:* Agilent Technologies recommends using one Pump Module for each pairing of reservoir and Weigh Station.

e   Click **Next**, and then click **Finish** on the **Summary** page.

5   When the accessory configuration message appears and advises you to set the teachpoint to a safe value, do one of the following:

- If you are using a Weigh Station at this location, click **Yes** to move the teachpoint to a safe value.

  On the **Profiles** tab, click **Initialize this profile** , and then reset the teachpoint for the installed Weigh Station.

- If you are placing the reservoir on a standard deck location, click **No** to preserve the existing teachpoint. On the **Profiles** tab, click **Update this profile** to save the settings.

Testing the autofilling function

To test the autofilling and autoemptying functions, you can use Bravo Diagnostics to run the pumps in real time.

To test autofilling:

1   In **Bravo Diagnostics**, click the **Configuration** tab.

2   In the **Accessory Configuration** area, highlight the **Autofill Station** icon, and then click **Diagnose accessory**.

Note: The Autofill Station is represented by a Pump Module graphic in the software.
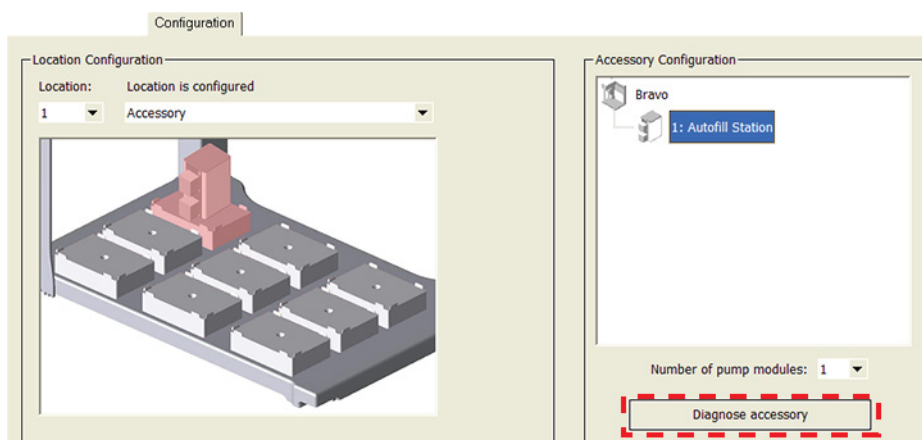
3   In the **Accessory Diagnostics** dialog box, verify the following settings.
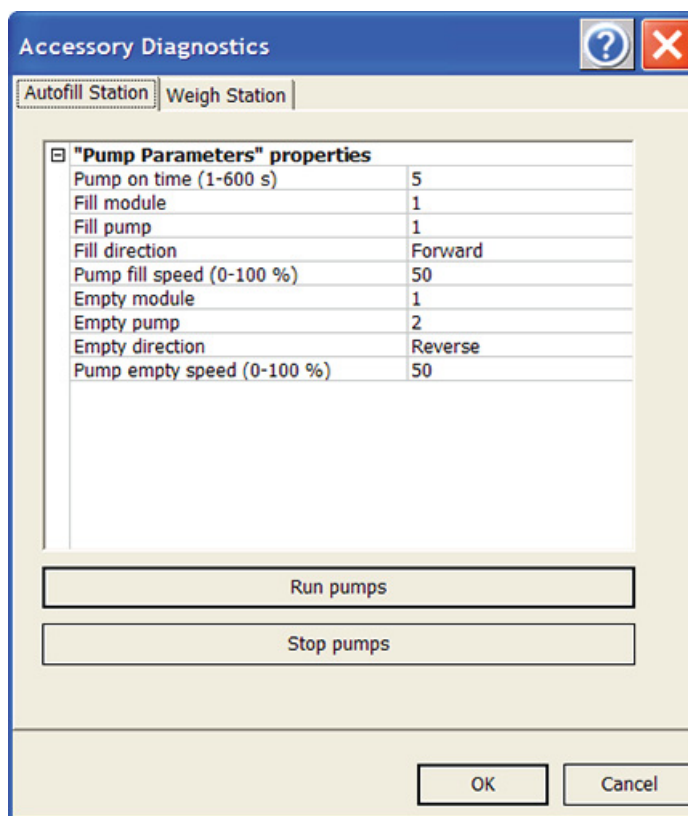
Control	Description
Pump on time (s)	Specifies the duration that the selected pump on the Pump Module runs when you click Run pumps.
Fill module	Specifies the Pump Module that this shelf uses. One Pump Module can function as both the Fill module and Empty module. For example, select 1 if only one Pump Module is connected.
Fill pump	Specifies which of the two pumps on the Pump Module to use for filling the container on the shelf, where 1 controls the upper pump. 2 controls the lower pump.
Fill direction	*Forward*. Moves the pumped fluid in the forward direction of the pump. *Reverse*. Moves the fluid in the opposite direction.
Pump fill speed (0–100%)	Specifies how quickly the pump moves the fluid, where 100% is the fastest setting.
Empty module	Specifies the Pump Module that this shelf uses. One Pump Module can function as both the Fill module and Empty module. For example, select 1 if only one Pump Module is connected.

Control	Description
Empty pump	Specifies which of the two pumps on the Pump Module to use for emptying the container on the shelf, where
	1 controls the upper pump.
	2 controls the lower pump.
Empty direction	*Forward*. Moves the pumped fluid in the forward direction of the pump.
	Reverse. Moves the fluid in the opposite direction.
Pump empty speed (0–100%)	Specifies how quickly the pump moves the fluid, where 100% is the fastest setting.
Run pumps	Starts the pumps on the selected Pump Module in real time.
Stop pumps	Stops the pumps in real time.

4 Click **Run pumps** and verify that the pump is functioning properly.

5 Click **Stop pumps**, and then click **OK**.

Related information

For information about...	See...
Starting up and shutting down the Bravo Platform	"Starting up and shutting down" on page 43
Setting up a Pump Module	"Setting up a Pump Module for the Bravo Platform" on page 177
Calibrating a Weigh Station	"Setting up a Weigh Station for the Bravo Platform" on page 188
Draining or filling a reservoir using the Pump Reagent process	"Performing a task using Bravo Diagnostics" on page 113
Setting up liquid and labware definitions	*VWorks Automation Control Setup Guide*
Using an accessory in a protocol	*VWorks Automation Control User Guide*

# Setting up a Weigh Station for the Bravo Platform

About this topic

This topic describes the Weigh Station and provides the installation, calibration, and removal instructions.

Description

A Weigh Station measures the weight of a Automation Solutions autofilling reservoir or tray that is placed on it. When appropriately configured in Bravo Diagnostics, the Weigh Station works with the Pump Module to ensure that the reservoir or tray is filled to a constant liquid level during the Pump Reagent task in a protocol. By monitoring the weight of the reservoir that sits on it, the Weigh Station controls when the Pump Module is activated.

Use one Pump Module for each pairing of reservoir and Weigh Station.

The following figure shows the Weigh Station, which looks like a platepad.

Crosshairs for setting teachpoint
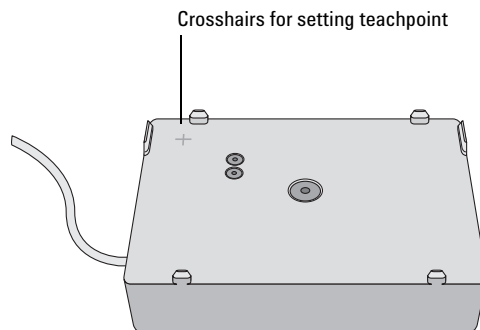
Installing or removing the Weigh Station

Before you start

The Weigh Station can be installed at deck locations 1, 2, or 3.

Make sure you have the following:

- Sockethead screw (supplied with the Weigh Station)
- M4 hex wrench
- M5 hex wrench

⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove an accessory.**

Procedures

To install a Weigh Station:

1 Using the M4 hex wrench, remove the screw in the center of the platepad at deck location 1, 2, or 3.

2 Remove the platepad.

3 Place the Weigh Station in the same deck location.

Make sure the side with the power cable faces the back of the Bravo Platform and the Weigh Station sits level on the deck.

4 Insert the supplied sockethead screw into the center of the Weigh Station and use the M5 hex wrench to tighten the screw.

To remove a Weigh Station:

1 Disconnect the Weigh Station from the Pump Module.

2 Using the M5 hex wrench, remove the screw in the center of the Weigh Station.

3 Remove the Weigh Station.

4 Place the standard platepad in the same deck location.

5 Insert the flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Calibrating a Weigh Station

Before you begin

• Make sure the Pump Module is set up and connected to the Weigh Station. See "Setting up a Pump Module for the Bravo Platform" on page 177.

• Verify that the Autofilling pad is configured in Bravo Diagnostics. See "Configuring an autofilling station for the Bravo Platform" on page 183.

Procedure

Before the Weigh Station is ready for use in a protocol, you must calibrate the empty and full settings. When you calibrate the Weigh Station, you must use the reservoir type that will be weighed.
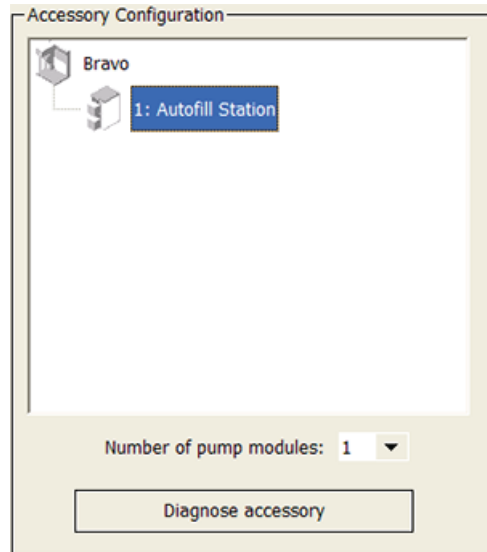
To calibrate a Weigh Station:

1 In **Bravo Diagnostics**, click the **Profiles** tab and make sure the correct profile is initialized.

2 Click the **Configuration** tab.

3 In the **Accessory Configuration** area, highlight **Autofill Station**, and then click **Diagnose accessory**.
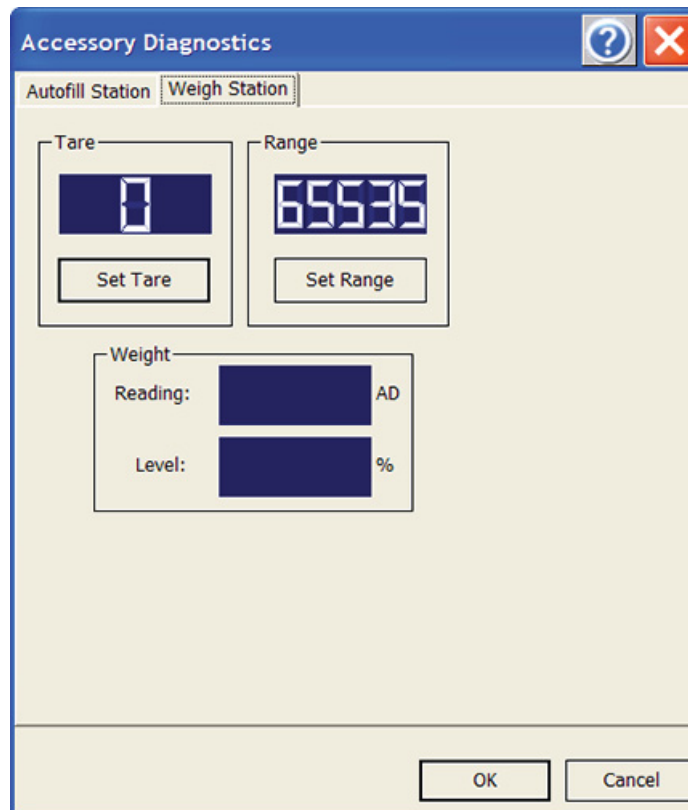
Note: The Autofill Station is represented by a Pump Module graphic in the software.

4   In the **Accessory Diagnostics** dialog box, click the second tab.

5   At the Bravo Platform, place the reservoir on the Weigh Station. Make sure the reservoir is empty.

6   In the **Accessory Diagnostics** dialog box, click **Set Tare** to configure the empty setting.

7   To configure the full setting for the reservoir:

   a   Fill the reservoir to the desired full level.

You can use the Pump Reagent command on the Processes tab to fill or drain the reservoir.

b In the **Accessory Diagnostics** dialog box, click **Set Range**.

The digital display shows a sensor reading that corresponds to the current weight of the reservoir that is on the Weigh Station.

IMPORTANT To avoid overfilling the reservoir, ensure that the full range is set while the fluid level is below the top of the reservoir.

8 Verify that the **Level** reading decreases as the liquid level decreases while you run the designated empty pump to remove any liquid from the reservoir.

9 Click **OK**.

10 On the **Profiles** tab, click **Update this profile**.

Related information

For information about...	See...
Starting up and shutting down the Bravo Platform	"Starting up and shutting down" on page 43
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Reservoir options	"Reservoirs and wash stations for Bravo autofilling station" on page 174
Connecting the Pump Module	"Setting up a Pump Module for the Bravo Platform" on page 177
Configuring the autofilling function	"Configuring an autofilling station for the Bravo Platform" on page 183
Editing teachpoints	"Setting teachpoints" on page 61
Using an accessory in a protocol	*VWorks Automation Control User Guide*
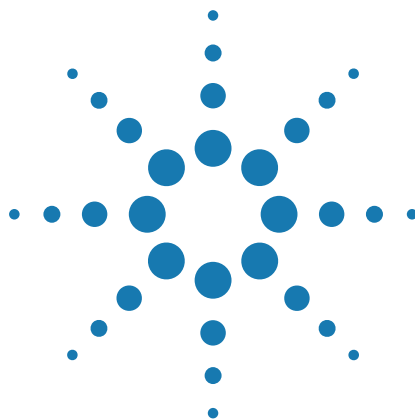
C

Setting up the Barcode Reader

This section contains the following topics:

Agilent Technologies

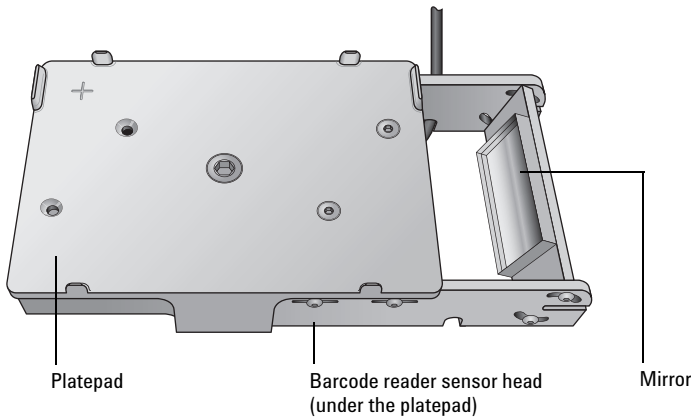# About setting up the Barcode Reader

About this topic

This topic describes the Barcode Reader and provides the workflow for setting up the Barcode Reader. To operate the Barcode Reader, see the *VWorks Automation Control User Guide*.

Barcode Reader description

The Barcode Reader consists of a platepad with a barcode reader sensor head (under the platepad) and a mirror. The Barcode Reader can be installed in place of a platepad at any deck location and is designed to scan barcodes on the east or west side of microplates.

Figure   Barcode Reader oriented to scan barcodes on the east side of microplates

Platepad   Barcode reader sensor head   Mirror
                  (under the platepad)

Setup workflow

The following table presents the workflow for installing and setting up the Barcode Reader.

Step	Procedure	See...
1	Verify the barcode requirements.	"Barcode label specifications" on page 195
2	Install the Barcode Reader.	"Installing or removing the Barcode Reader" on page 196
3	Add the Barcode Reader device and create a profile for the Barcode Reader.	"Creating a profile for the Barcode Reader" on page 197
4	Specify the Barcode Reader location in the Bravo device file.	"Specifying the Barcode Reader location" on page 199

Step	Procedure	See...
5	Adjust the Barcode Reader for optimal scanning.	"Testing and optimizing barcode scanning" on page 201

Barcode label specifications

The barcodes must meet the following requirements:

Characteristic	Requirement
Barcode formats	Code 39 Codabar Code 128 Interleaved 2 of 5 Code 93 UPC/EAN Pharmacode PDF417
Barcode height	3.34 mm (0.13 in) or taller
Print contrast	25% at 650 nm
Quiet zone	10 times the dimension of the narrowest element in the barcode or 0.25 in, whichever is greater

Related information

For information about...	See...
Setting up other accessories	• "Accessories and platepads" on page 117 • "Autofilling accessories" on page 171
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Installing or removing the Barcode Reader

Before you start

Make sure you have the following:

- Barcode Reader
- M4 hex wrench
- Accessories Hub

Procedures

> ⚠️ **WARNING**   **Turn off the Bravo Platform before you install or remove the accessory.**

To install the Barcode Reader:

1   Using the M4 hex wrench, remove the screw in the center of the platepad and remove the platepad.

2   Place the Barcode Reader at the same deck location in the correct orientation to scan barcodes on the west side or the east side of microplates. Make sure it sits level on the deck.

3   Insert the supplied flathead cap screw into the center of the Barcode Reader platepad and use the M4 hex wrench to tighten the screw.

4   Connect the cable from the Barcode Reader to the Barcode Reader module port on the Accessories Hub.

5   Edit the teachpoint for this location.

To remove the Barcode Reader:

1   Disconnect the Barcode Reader cable from the Accessories Hub.

2   Using the M4 hex wrench, remove the screw in the center of the Barcode Reader and remove the Barcode Reader.

3   Place a platepad at the same deck location.

4   Insert the supplied flathead cap screw into the center of the platepad and use the M4 hex wrench to tighten the screw.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 194
Creating a profile for the Barcode Reader	"Creating a profile for the Barcode Reader" on page 197
Specifying the Barcode Reader location in the device file	"Specifying the Barcode Reader location" on page 199
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 201

For information about...	See...
Setting up other accessories	• "Accessories and platepads" on page 117 • "Autofilling accessories" on page 171

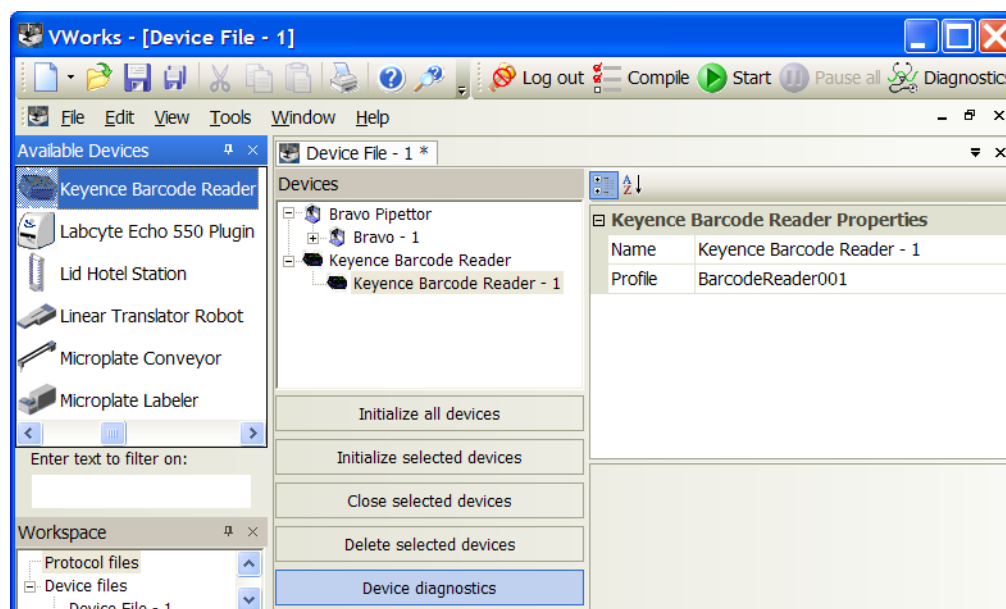# Creating a profile for the Barcode Reader

About this topic

This topic explains how to add the Barcode Reader device, and then create and initialize a profile for the Barcode Reader.

For details on creating a device file or adding devices to a device file, see "Creating or adding a Bravo device" on page 45.

Procedure

To add the Barcode Reader device and create a profile:

1 In the **VWorks** window, create a new or open an existing Bravo device file.

2 In the **Available Devices** area, double-click the **Keyence Barcode Reader** icon to add the Barcode Reader to the Devices area.

3 In the **Devices** area, select the **Keyence Barcode Reader** icon, and click **Device diagnostics**. The Keyence Barcode Reader Diagnostics dialog box opens.
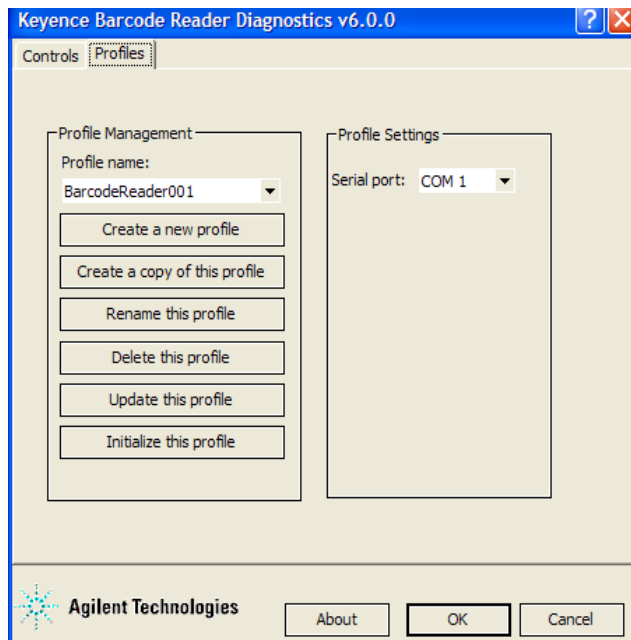
4 Click the **Profiles** tab.

5 In the **Profile Management** area, click **Create a new profile.** The Create Profile dialog box opens.

6 Type a name for the new profile and click **OK.** The new profile name appears in the Profile name list.

7 In the **Profile Settings** area, select the Accessories Hub **Serial port** that is connected to the Barcode Reader.

8 Click **Update this profile** to save the newly created profile.

9 Click **Initialize this profile** to establish communication with the Barcode Reader.

10 In the **VWorks software** window, choose **File > Save** and save the device file.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 194
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 196
Specifying the Barcode Reader location on the Bravo Platform	"Specifying the Barcode Reader location" on page 199
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 201

For information about...	See...
Setting up other accessories	• "Accessories and platepads" on page 117 • "Autofilling accessories" on page 171

# Specifying the Barcode Reader location

About this topic

Use the following procedure to specify the location of the Barcode Reader in the Bravo device file.

Procedure

***To specify the Barcode Reader location in the Bravo device file:***

1 Open the Bravo device file that contains the Keyence Barcode Reader device.

2 In the **Devices** area, expand the **Bravo** device. The list of deck locations appear.
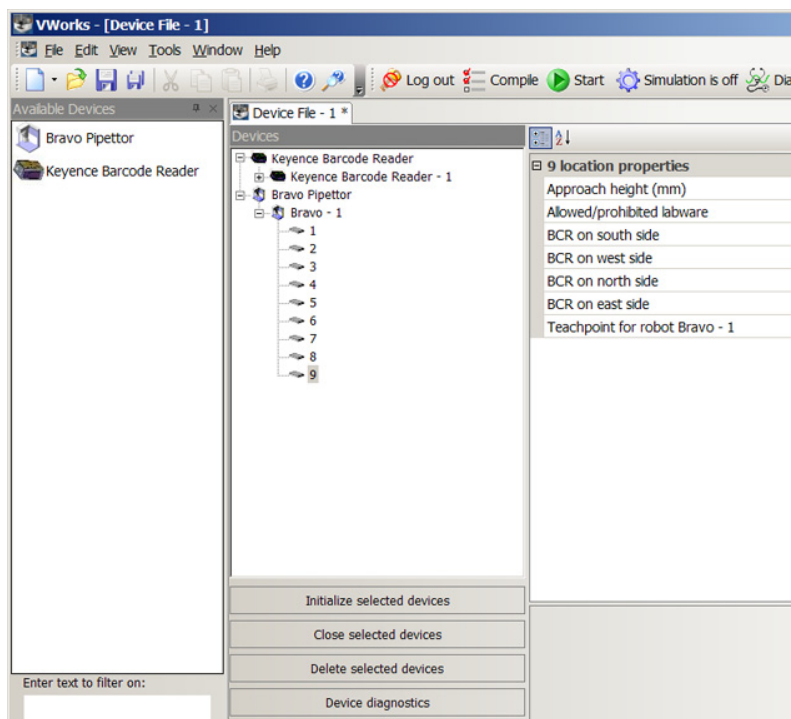
3 Select the deck location at which you installed the Barcode Reader. In the example in step 2 the Barcode Reader is installed at deck location 9, so deck location 9 is selected.

4 In the **location properties** table, select the Barcode Reader for one of the following:

- **BCR on west side**
- **BCR on east side**

Note: Do not select the north or south sides. The Bravo Barcode Reader is only able to scan barcode labels on the microplate east and west sides.

In the following example, the Barcode Reader is at deck location 9, and it will scan barcodes on the east side of microplates.

Select a Barcode Reader for west or east side.
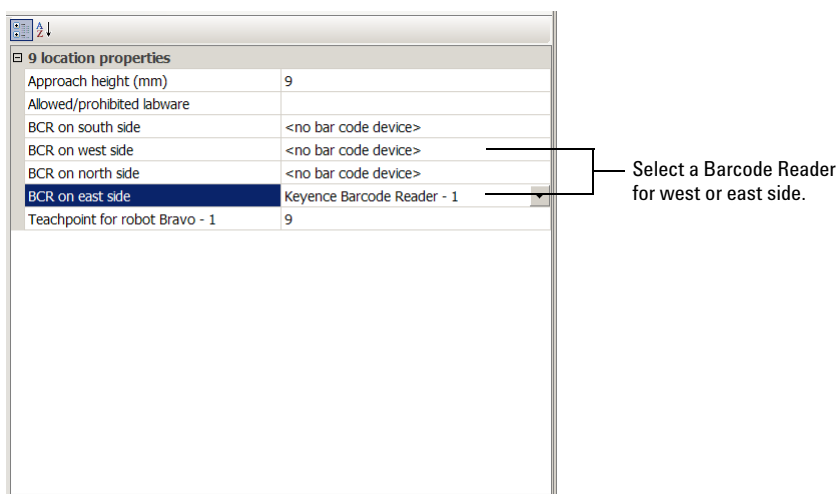
5 When you are finished, click **Initialize selected devices** to re-establish communication with the Bravo and use the updated device file.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 194
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 196
Creating a profile for the Barcode Reader	"Creating a profile for the Barcode Reader" on page 197
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 201
Setting up other accessories	• "Accessories and platepads" on page 117
	• "Autofilling accessories" on page 171

Testing and optimizing barcode scanning

About this topic

This topics explains how to:
- Use the Keyence Barcode Reader Diagnostics to test the barcode scanning
- Adjust the angle of the mirror to optimize barcode scanning
- Troubleshoot problems

Before you start

Make sure you have the following:
- M2 hex wrench
- Spare microplate that has a barcode label

## Using diagnostics to test the barcode scanning

⚠️ **WARNING**   **The barcode reader sensor head contains a class II laser that emits light at 650 nm, producing up to 1.5 mW of energy. Do not look directly into the laser beam. Looking directly into the laser beam or looking at the reflected beam can cause eye injury.**

⚠️ **WARNING**   **Do not disassemble the barcode reader sensor head. Laser emission does not automatically turn off if the sensor head is disassembled.**

To test the barcode scanning:

1   Place the spare microplate on the Barcode Reader platepad and make sure the barcode label faces the Barcode Reader mirror.

2   Open **Keyence Barcode Reader Diagnostics.**

3   In the **Profiles** tab, select the Barcode Reader profile from the **Profile** list, and click **Initialize this profile**.
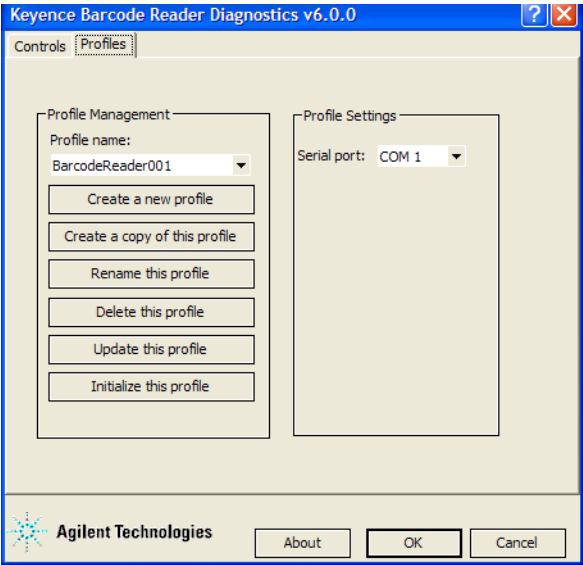
4   Click the **Controls** tab.
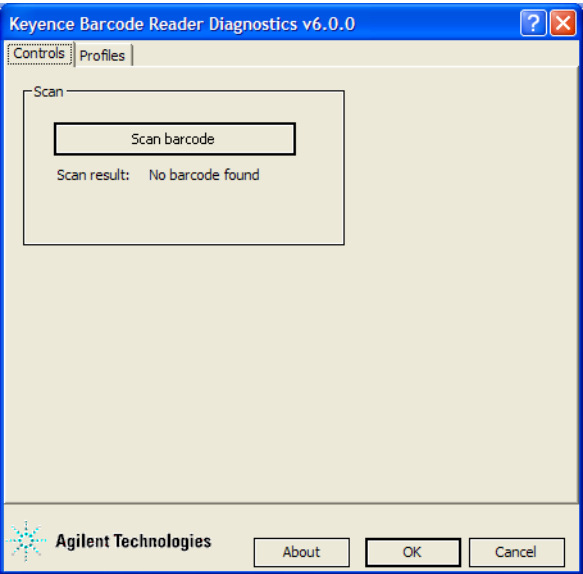
5   Click **Scan barcode.** The barcode reader laser turns on briefly to scan the barcode label. One of the following messages appears next to Scan result:

| Scan result message	Description	Next step
<barcode text>	The barcode was successfully scanned.	The setup is complete. No further adjustment is required.
No barcode found	Barcode scanning was not successful.	Proceed to step 6.

6   If the No barcode found message appears, click **Scan barcode** again and check that the barcode reader laser beam is projected onto the vertical center of the barcode label.

If the laser beam is not at the vertical center of the label, adjust the scan angle of the Barcode Reader mirror.
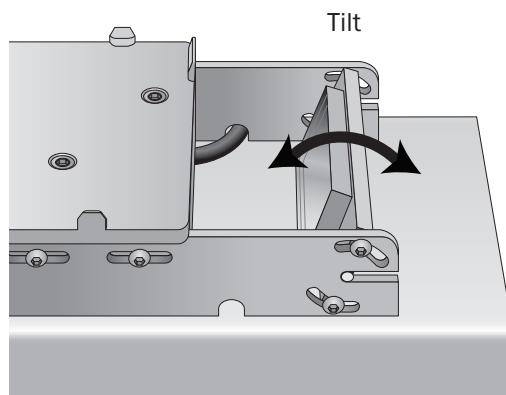
Adjusting the scan angle

To adjust the scan angle of the Barcode Reader:

1 Loosen the screws on both sides of the Barcode Reader mirror.

Loosen the screws on both
sides of the mirror.
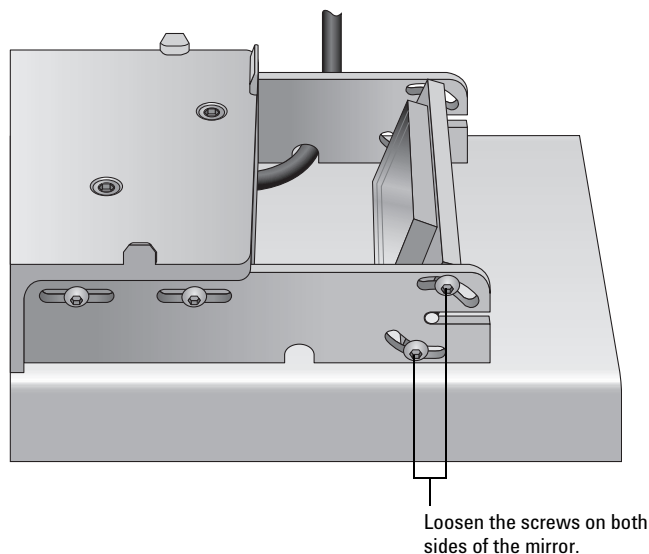
2 Tilt the Barcode Reader mirror slightly. If the angle is set up properly, you can see the laser beam at the vertical center of the barcode label each time you click Scan barcode.

Tilt

3 Tighten the screws on both sides of the barcode reader sensor head.

4 Repeat the procedures to test the barcode scanning and adjust the scan angle until the reader is able to scan the barcode successfully (the barcode text appears next to Scan result).
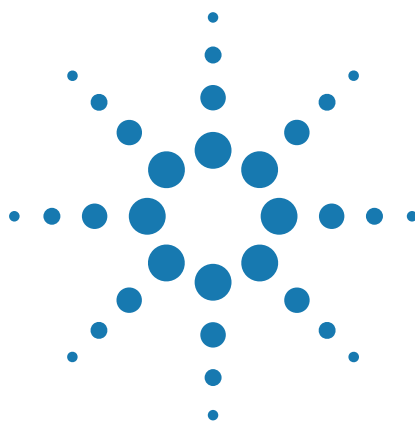
Troubleshooting

If the reader is unable to scan the barcode after many adjustments, try one or more of the following:

- Make sure the barcode label is applied properly onto the microplate.
- Make sure the microplate is sitting level on the Barcode Reader platepad.
- Make sure the barcode meets the requirements. See "Barcode label specifications" on page 195.
- Repeat the adjustment process using a new spare microplate.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 194
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 196
Creating a profile for the Barcode Reader	"Creating a profile for the Barcode Reader" on page 197
Specifying the Barcode Reader location in the device file	"Specifying the Barcode Reader location" on page 199
Setting up other accessories	"Accessories and platepads" on page 117 "Autofilling accessories" on page 171

D

Bravo Diagnostics quick reference

This appendix contains the following topics:

Agilent Technologies

Bravo Diagnostics dialog box

About this topic

This topic provides a quick reference for the Bravo Diagnostics dialog box.

Buttons

Button	Description
About	Displays Bravo Diagnostics version and copyright information.
Stop motors (keyboard SPACEBAR)	Immediately stops the pipette head movement by turning off power to all the motors.
	To re-enable the pipette head movement, click Enable all motors on the Jog/Teach tab.

Tabbed pages

Tabbed page	Description
"Configuration tab quick reference" on page 207	Provides controls for configuring accessories at specified deck locations and for testing the accessories.
"IO tab quick reference" on page 211	Provides controls and indicators for clearing motor faults and checking the head type.
"Jog/Teach tab quick reference" on page 213	Provides controls for jogging the pipette head and setting teachpoints.
"Gripper tab quick reference" on page 217	Provides controls for fine-tuning the gripper movements.
"Processes tab quick reference" on page 224	Provides controls for running diagnostic tasks in real time.
"Profiles tab quick reference" on page 219	Provides controls for managing and creating profiles and changing the pipette head.

Configuration tab quick reference

About this topic

This topic provides a reference for the Configuration tab in Bravo Diagnostics.

Procedures

The Configuration tab enables you to configure and test accessories. For the procedures, see:
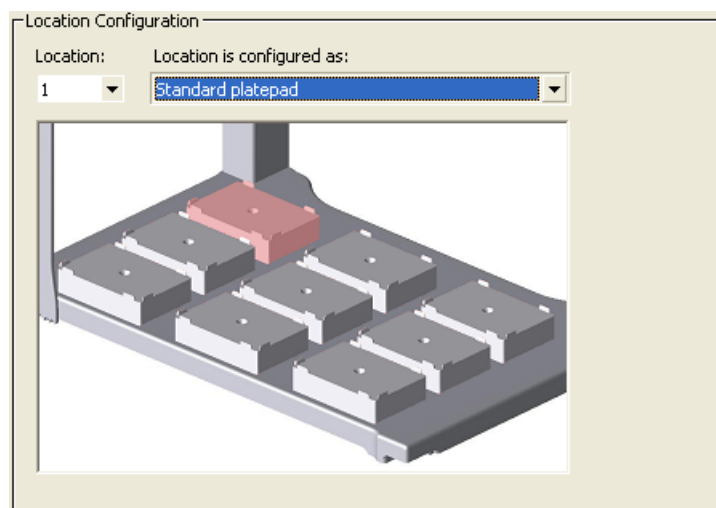
- "Accessories and platepads" on page 117
- "Autofilling accessories" on page 171

Contents

The Configuration tab in Bravo Diagnostics contains the following areas:

- "Location Configuration area" on page 207
- "Accessory Configuration area" on page 208

Location Configuration area

Control or indicator	Description
Location	A list that specifies the deck location. The deck layout graphic highlights the selected location.

Control or indicator	Description
Graphical display of Bravo deck	An interactive display that provides the following: • Alternative way to specify the location that you want to configure. • Visual display of the type of accessory configured for each location.
Location is configured as	Specifies the function of the selected location as either: • *Standard platepad.* Designates a generic pad. • *(SRT only) platepad for 250 uL tips.* Available only for the shorter model Bravo SRT for use with the 250-µL tipboxes. See "(Bravo SRT only) Setting up an LT tipbox location" on page 167. • *Accessory.* Displays the Accessory Wizard, which steps you through specifying a configured accessory at the specified position.

Accessory Configuration area
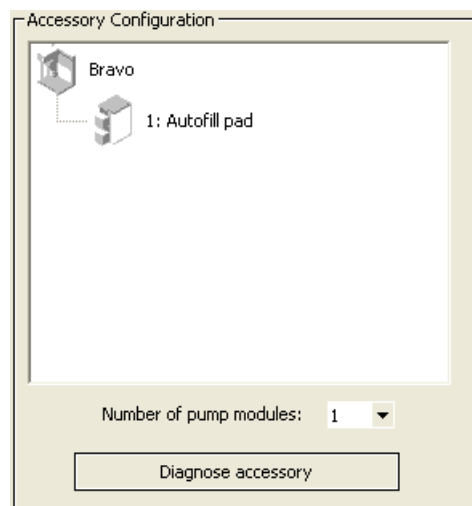
Control or indicator	Description
Graphical display of configured accessories	Displays icons of the Bravo Platform and any configured accessories associated with specific deck locations.
Diagnose accessory	Displays the Accessory Diagnostics dialog box for the selected accessory. Click the accessory icon in the graphic to display the corresponding dialog box. See "Accessory Diagnostics dialog box" on page 210.

Control or indicator	Description
Number of pump modules	Specifies the total number of Pump Modules for the given Bravo Platform. Each Pump Module contains two peristaltic pumps.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Setting up accessories	"Accessories overview for the Bravo Platform" on page 118
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
Reporting a problem	"Reporting problems" on page 92

Accessory Diagnostics dialog box

About this topic

This topic provides a quick reference for the Accessory Diagnostics dialog box.

Accessory Diagnostics dialog box procedures

The Accessory Diagnostics dialog box provides controls for testing the functioning of an accessory that is configured in Bravo Diagnostics. The tabbed pages in the dialog box change depending on which accessory you select.

The tabbed pages in the dialog box contain controls for:

- "Testing the autofilling function" on page 185
- "Calibrating a Weigh Station" on page 189
- "Testing the Microplate Vacuum Alignment Station" on page 135
- "Testing the Orbital Shaking Station" on page 142
- "Testing the Vacuum Filtration Station" on page 151

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Setting up accessories	"Accessories overview for the Bravo Platform" on page 118
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
Reporting a problem	"Reporting problems" on page 92

IO tab quick reference

About this topic

This topic provides a reference for the IO tab in Bravo Diagnostics.

Procedures

See "Clearing motor faults and checking the head type" on page 112.

Contents

The IO tab in Bravo Diagnostics contains the following controls and indicators:

Control or indicator	Description
Robot disable	Lights if the robot disable button has been activated.
Motor power fault	Lights if a fault occurs that interrupts the power to the motors.
Clear motor power fault	Restores the power and pipette head function.
Head present Head type	Lights to indicate the status of a detected pipette head: • *Green*. The software determined that the profile head type matches the mounted head. • *Red*. The software detects a mismatch between the mounted pipette head and the head type in the profile. The caption changes to, *Incorrect head is attached*.
Head type	Displays the status of the pipette head that the software detects in the head mount: • Correct head • Incorrect head
Go button is pressed	Lights when the Go button on the pendant is pressed. The Go button on the pendant should be linked to the indicator in the VWorks software.
Plate present in gripper	If the Bravo Platform includes a gripper, this indicator lights when the gripper physically grabs the plate.
Head Detection Table Output	Displays the type of head that the software detects.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Clearing a fault	"Clearing motor faults and checking the head type" on page 112
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
Reporting a problem	"Reporting problems" on page 92

Jog/Teach tab quick reference

About this topic

This topic provides a quick reference for the Jog/Teach tab in Bravo Diagnostics.

Procedures

The Jog/Teach tab enables you to:

Procedure	See...
Home the pipette head	"Homing the pipette head" on page 99
Set teachpoints	"Setting teachpoints" on page 61
Move the pipette head to a safe distance above a teachpoint, or move to a teachpoint	"Using the Move and Approach commands" on page 105
Move the pipette head incrementally in each of its axes	"Jogging the pipette head" on page 101
Change the speed of the pipette head	"Changing the pipette head speed" on page 103

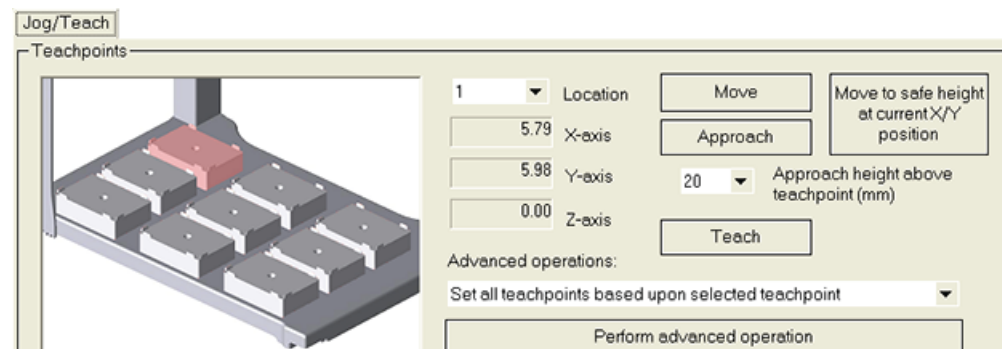### Contents

The Jog/Teach tab contains the following:

- "Teachpoints area" on page 213
- "Jog and Home Axes areas" on page 215

Teachpoints area

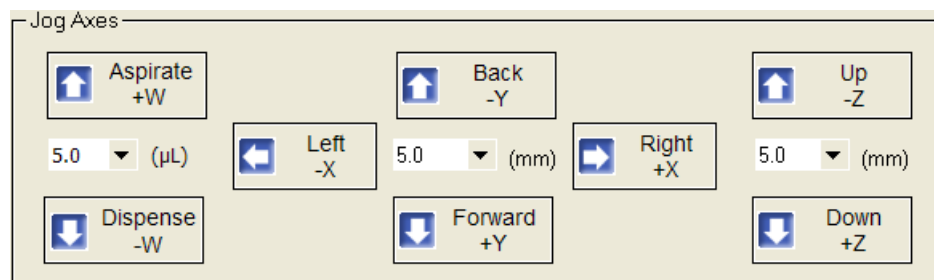The Teachpoints area contains the following controls and indicators.

Controls and indicators

Control or indicator	Description
Graphical display of Bravo deck	Provides an interactive display that enables you to specify deck locations and monitor the pipette head movement. The highlighted location indicates the location of the pipette head. You can move the head in real time by right-clicking a location and selecting a command.
Location	Specifies the deck location for the pipette head movement or to set a teachpoint. You can use either the deck graphical display or the Location list to specify the location.
X-axis, Y-axis, and Z-axis displays	Provide the current teachpoint coordinates for the selected deck location.
Move	Moves the pipette head to the teachpoint for the selected deck location.
Approach	Moves to the specified approach height above the teachpoint, or configured accessory, for the selected deck location.
Approach height above teachpoint/accessory (mm)	Specifies a vertical offset that is used when you click Approach to move the pipette head above a teachpoint. If an accessory was configured in Bravo Diagnostics at the selected location, the software adds the vertical offset to the stored height of the accessory.
Move to a safe height at current X/Y position	Moves the pipette head to the z-axis safe position that is specified in the profile.
Teach	Saves the teachpoint coordinates for the deck location.
Advanced operation	Specifies one of the following options: • *Apply Z-axis teachpoint to all locations.* Adjusts all the location teachpoints using the z-axis coordinate from the teachpoint at the selected location. • *Set all teachpoints based upon selected teachpoint.* Applies the saved teachpoint (x-, y-, and z-axis coordinates) from the selected Location to all the other deck locations. • *Reset teachpoints to defaults for current head type.* Changes all location teachpoints to the default coordinates for the selected pipette head type.
Perform advanced operation	Initiates the procedure that you selected in the Advanced operation list.

Jog and Home Axes areas

The Jog Axes, Multiple Axes, and Home Axes areas contain the following controls and indicators.

Control or indicator	Description
Jog Axes area	
Aspirate +W, Dispense –W buttons and increment (µL) list	Enables you to select the incremental distance (µL) to move the pipette head, and then move the pipette head the specified distance in the w-axis.
Left –X, Right +X, Back –Y, Forward +Y buttons and increment (mm) list	Enables you to select the incremental distance (mm) to move the pipette head, and then move the pipette head the specified distance along the x- or y-axis.
Up –Z, Down +Z buttons and increment (mm) list	Enables you to select the incremental distance (mm) to move the pipette head, and then move the pipette head the specified distance along the z-axis.
Multiple Axes area	
Speed	Sets the velocity of each pipette head movement. For example, you might want to use a slow speed when setting teachpoints.
Home XYZ	Homes the pipette head in the horizontal (xy) and vertical (z) axes.
Enable all motors/ Disable all motors	Activates the pipette head motors and turns off the pipette head motors. For example, you must disable the motors before moving the pipette head manually.
W, X, Y, and Z Axis areas	
Digital display	Displays 0.00 when the pipette head is in the axis home position.
	Displays the distance (µL) from the axis home position when the pipette head is not in the home position.

Control or indicator	Description
Home	Homes the pipette head in the selected axis. The home position is near the low-to-mid w-axis range.
Enable motor, Motor enabled	Enables or disables the motor for the selected axis. The Motor enabled indicator lights when the motor for the axis is turned on.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Stopping in an emergency	"Stopping in an emergency" on page 3
Editing teachpoints	"Setting teachpoints" on page 61
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
Reporting a problem	"Reporting problems" on page 92

Gripper tab quick reference

About this topic

The Bravo gripper can pick up labware and move it from one location to another on the Bravo deck. If the Bravo Platform includes a gripper, you use the controls on the Gripper tab to configure the gripper movements.

Procedures

You can use the Gripper tab to fine-tune the gripper movements using the following procedures:

- "Verifying the gripper setup" on page 68
- "Fine-tuning the gripper movements" on page 107

Gripper Teaching area

Control or indicator	Description
Labware	Specifies the labware to be used during a move operation as defined in the Labware Editor.
Y offset	Specifies the offset to the y-axis teachpoint at each location to center the gripper about the labware.
Teach Y offset for gripper	Calculates the offset from the selected location teachpoint to where the gripper is and applies it as the y-offset.
Approach height (mm)	Specifies a vertical offset (safe distance) above the labware.
Approach	Moves the gripper to the specified approach height.
Move	Moves the gripper to the teachpoint.

Gripper Movement area

Control or indicator	Description
Location A Pick A -> Place B	Specifies the origin and destination locations for the gripper to move the labware.
Location B Pick B -> Place A	Specifies the origin and destination locations for the gripper to move the labware.
Plate present in gripper	Lights when the gripper sensor detects labware in the gripper.

Jog Gripper Axes area

Control or indicator	Description
Up -Zg, Down +Zg and increment (mm) list	Enables you to set an incremental distance (mm) to move the gripper, and then move it the specified distance along the Zg-axis.
	The gripper holds and moves labware along the Zg-axis from one location to another.
Open -G, Close +G and increment (mm) list	Enables you to set an incremental distance (mm) to move the gripper, and then open or close it the specified amount.
	The gripper grips the labware along the G-axis.
Dock gripper below head	Moves the gripper to the docked position to ensure that there is not interference when moving the pipette head.
Open gripper/Close gripper	Opens and closes the gripper, respectively.
Speed	Sets the velocity of each gripper movement. For example, you might want to use a slow speed when setting the y offset.

Zg-Axis and G-Axis areas

Control or indicator	Description
Digital display (mm)	Displays the distance (mm) from the axis home position when the gripper is not in the home position.
Home	Homes the gripper along the selected axis.
Enable motor, Motor enabled	Enables or disables the motor for the selected axis.
	The Motor enabled indicator lights when the motor for the axis is turned on.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89
	• "Troubleshooting hardware problems" on page 89
Reporting a problem	"Reporting problems" on page 92

Profiles tab quick reference

About this topic

This topic provides a reference for the Profiles tab in Bravo Diagnostics.

Procedures

The Profiles tab enables you to:

Procedure	See...
Create a profile, or manage the available profiles	"Creating and managing profiles" on page 51
Initialize a profile	"Initializing the Bravo Platform" on page 58
Change the pipette head	"Changing the pipette head or pin tool" on page 77

Contents

The Profiles tab contains the following:
- "Profile Management area" on page 219
- "Connection area" on page 220
- "Modified Variables area" on page 223

Profile Management area

The Profile Management area contains the following controls.

> **CAUTION**   Each profile can be used by multiple protocols. Deleting, renaming, or changing the parameters for a profile based on one protocol can invalidate other protocols that use the profile.

Control	Description
Profiles name list	Specifies the active profile. Select the profile that you want to use from the list.
Create a new profile	Displays the Create Profile dialog box so that you can name the new profile. To add a profile, see "Creating and managing profiles" on page 51.
Create a copy of this profile	Creates a copy of the profile selected in the Profiles name list. The new profile name has the prefix, *Copy of*.

Control	Description
Rename this profile	Displays the Rename Profile dialog box so that you can rename the profile selected in the Profile name list.
Delete this profile	Confirms the profile to be deleted, and then deletes the selected from the Profile name list.
Update this profile	Saves changes to the selected profile. The Modified Variables area displays the unsaved variables until the Update this profile button is activated, which clears the Modified Variables area.
Initialize	Initiates communication with the Bravo Platform using the selected profile.

Connection area

The Connection area contains the following controls.

Control	Description
This Bravo is connected via ethernet	Specifies an Ethernet communication connection between the device and the computer.
Device ID	Displays the device number of the Bravo device that is communicating with the computer.
Find available devices	Opens the Discovered BioNet Devices dialog box, which lists the connected Bravo devices that the software found.
This Bravo is connected via serial	Specifies a serial communication connection between the device and the computer.
Serial port	Specifies the communication port on the computer.

Miscellaneous area

The Miscellaneous area contains the following controls.

Control	Description
Approach height	Specifies the z-axis distance or height (safety margin) above a microplate that the tips move to before moving to another quadrant of the microplate.

Control	Description
Z-axis safe position	Sets the safe z-axis distance or height of the pipette head.
	A z-axis safe position of 0 is the highest position possible for the pipette head. A z-axis safe position of 10 means the pipette head is 10 mm below the highest point.
	If you select the **Always move to safe Z before each process** option, the Bravo Platform moves to the z-axis safe height when moving between labware locations. Increasing this value may shorten run times by minimizing the z-axis movement between tasks. Making this value too large causes the pipette head to crash into labware when moving between plate locations.
Prompt user to home W-axis on first initialization	Enables a warning to display when the Bravo Platform is initialized and before the w-axis is homed.
	The warning allows time for you to make sure that liquid is not unexpectedly dispensed from tips during the homing.
Run device at medium speed during protocol	Sets the device speed to medium during a protocol run.
Always move to safe Z before each process	Moves the pipette head to the specified z-axis safe position between processes.
	If you select this option, the Bravo head moves to the specified z-axis safe height when moving between labware locations. Select this option if you have not specified the labware on the deck.
	If you do not select this option, the Bravo Platform will automatically determine the safe z-axis point based on the labware specified, thereby optimizing the processing time.
	To prevent damage to the labware or the Bravo Platform components, do not select this option if you have not specified the labware.
Ignore plate sensor during pick and place	*Bravo Platform with gripper only*. Enables the software to ignore the microplate sensor during a pick-and-place movement.
	Select this option if the microplate sensor is broken but you still want to test the pick-and-place function.

Control	Description
Prevent Bravo operation during robotic access	Enables either of the following features for a Bravo Platform that is integrated with a BenchCel Workstation, BioCel System, or third-party system: • *Concurrent operation feature.* Clear the check box. • *Safe location feature.* Select the check box, and then select the deck location in the **and move to this safe location box**. For a detailed description of these features, see "Bravo concurrent motion features for integrated systems" on page 56.
Allow "top of stack" fluid handling	Permits fluid handling tasks to be performed in the labware at the top of a specified stack.
This is a Bravo SRT	*Bravo SRT model only.* Specifies that this Bravo device is the SRT model, which is shorter than the standard model. If you are using 250-µL tips on the SRT model, select this check box, configure the tipbox location, and install the special SRT platepad for 250-µL tipboxes to ensure greater z-axis clearance and prevent potential hardware crashes. See "(Bravo SRT only) Setting up an LT tipbox location" on page 167.

Head Information area

The Head Information area contains the following controls.

Control	Description
Head type	Specifies the pipette head type for the profile.
Change head	Starts the Change head wizard, which positions the pipette head for easy access and provides prompts that step you through a procedure. **IMPORTANT** If you are changing the currently installed pipette head for the same type of pipette head and want to edit the profile, you may use the Change head wizard. Otherwise, see "Changing the pipette head or pin tool" on page 77. The Change head button is available only after you initialize a Bravo profile.

Control	Description
Teaching tip type	Specifies the type of pipette tip to use for setting the teachpoints. If you change the Teaching tip type in a profile, you must reteach the deck locations using the new tip type.
Check head type on initialize	Verifies that the pipette head specified in the profile matches the head mounted on the Bravo Platform when the profile is used by a protocol. If this check box is cleared, the Bravo Platform will run with any pipette head installed. Therefore, if the profile specifies a 96-channel head type, but a 384-channel head is installed, the head will crash.

Modified Variables area

The Modified Variables area displays any changes to the profile settings since the last time the profile was saved.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing teachpoints	"Setting teachpoints" on page 61
Troubleshooting problems	• "Troubleshooting hardware problems" on page 89 • "Troubleshooting hardware-related error messages" on page 91
Reporting a problem	"Reporting problems" on page 92

Processes tab quick reference

About this topic

This topic provides a reference for the Processes tab in Bravo Diagnostics.

Procedure

To run a process, see "Performing a task using Bravo Diagnostics" on page 113.

Contents

The Processes tab contains the following:

- "Location area" on page 224
- "Miscellaneous area" on page 225
- "Well Selection and Head Mode area" on page 225
- "Command Parameters area" on page 226

Location area

Control or indicator	Description
Location	Specifies the Bravo deck location to be used for the selected process command.
Labware at selected location	Specifies the labware to be used for the selected process command. To add a labware selection to the list, click **Open labware editor**, and use the Labware Editor.
Location 2	Specifies the Bravo deck location to be used for the selected process command.
Labware at selected location	Specifies the labware to be used at location 2 for the selected process command. To add a labware selection to the list, click **Open labware editor**, and use the Labware Editor.
Graphical display of Bravo deck	An interactive display that provides the following: - Alternative way to specify the target location. - Visual display of the type of platepad and labware configured for each location.

Miscellaneous area

Control or indicator	Description
Open labware editor	Opens the Labware Editor.
Open pipette technique editor	Opens the Pipette Technique Editor.
Open liquid library	Opens the Liquid Library Editor.

Well Selection and Head Mode area

Control or indicator	Description
Plate graphical display	Provides an interactive display that changes based on your labware selection. For example, if you use a 96-tip head and a 96-well microplate, all the wells are selected (green) by default. If you use a 96-tip head and a 384-well microplate, only one quadrant of the wells are selected by default.
	To select a quadrant:
	Click a well in that quadrant. All the wells in that quadrant turn green, indicating the selected wells.
	Alternatively, right-click the graphical display to access the following shortcut menu commands:
	• Select all wells
	• Clear all selected wells
	• Select all wells in highlighted row
	• Clear all selected wells in highlighted row
	• Select all wells in highlighted column
	• Clear all selected wells in highlighted column
Set head mode	Opens the Head Mode Selector dialog box.
	Series III pipette heads only. To pipette using one row or column of barrels instead of all barrels on the pipette head, use the controls in the dialog box to select which barrels on the pipette head to use.

Command Parameters area

The Command Parameters area contains the following controls.

Parameter	Description
Command to execute	Provides the following list of tasks that you can run in real time: • "Aspirate task parameters" on page 226 • "Dispense task parameters" on page 229 • "Mix task parameters" on page 231 • "Wash Tips task parameters" on page 234 • "Pump Reagent parameters" on page 237 • "Shake task parameters" on page 238 • "Vacuum Filtration Station task parameters" on page 240 (Filter Vacuum, Assemble Vacuum, and Disassemble Vacuum) • "Pin Tool task parameters" on page 242
Execute command	Performs the selected task command. *Note:* To stop a task immediately before it finishes running, click **Stop motors**. To resume movement of the pipette head, you can use the **Enable all motors** button on the Jog/Teach tab.

Aspirate task parameters

About this topic

The Aspirate task draws liquid from a microplate or reservoir. This topic describes the task parameters.

To run the Aspirate task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter description

The Aspirate task has the following parameters.

Parameter	Description
Volume (µL)	The volume of liquid to be drawn into each pipette tip.
Pre-aspirate volume (µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Post-aspirate volume (µL)	The volume of air to be drawn after the liquid is drawn.

Parameter	Description
Liquid class	The pipetting speed and accuracy.
	IMPORTANT To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Distance from well bottom (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the Aspirate task.
	If you specify dynamic tip extension, this is the distance at the end of the Aspirate task.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.)
Dynamic tip extension (0–20 mm/µL)	The rate at which the pipette head moves during the Aspirate task. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change.* Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change.* DTE > 1/A
	• *Slower than the volume change.* DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{aspirated} * DTE) + Distance_{well\ bottom}$
	Note: Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.
Pipette technique	The pipette location offset you want to use for the Aspirate task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.

Parameter	Description
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (–20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.
Tip touch horizontal offset (–5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Dispense task parameters

About this topic

The Dispense task dispenses liquid into a microplate or reservoir. This topic describes the task parameters.

To run the Dispense task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

The Dispense task has the following parameters.

Parameter	Description
Empty tips	The option to empty all liquid from the tips instead of using the dispense volume specification.
Volume (µL)	The volume of liquid to be dispensed from each pipette tip.
Blowout volume (µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the wells.
	Typically, the blowout volume is the same as the pre-aspirate volume.
	Note: Blowout only occurs in the last quadrant dispensed for a given Dispense task.
Liquid class	The liquid class associated with this liquid.
Distance from well bottom (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the Dispense task.
	If you specify dynamic tip retraction, this is the starting distance.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip retraction (0–20 mm/µL)	The rate at which to raise the pipette head during the Dispense task.
	Use dynamic tip retraction to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change.* Calculate dynamic tip retraction (DTR) as follows:
	DTR = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change.* DTR > 1/A
	• *Slower than the volume change.* DTR < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTR) + Distance_{well\ bottom}$
Pipette technique	The pipette location offset you want to use for the Dispense task.
	The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (–20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.
Tip touch horizontal offset (–5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	For example, if you set a value of:
	• 0, the tips move a horizontal distance equal to the well radius
	• > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch
	• < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Mix task parameters

About this topic

The Mix task aspirates and dispenses liquid multiple times to mix it. You can specify different well-bottom distances for the aspirate and dispense actions. This topic describes the task parameters.

To run either task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

The Mix task parameters include the following.

Parameter	Description
Volume (0–200 µL)	The volume of liquid to be mixed in each well.
Pre-aspirate volume (0–200 µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (0–200 µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the wells. Typically, the blowout volume is the same as the pre-aspirate volume.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Mix cycles ((0–100)	The number of times to repeat the aspirate-and-dispense cycle.

Parameter	Description
Aspirate distance (0–100 mm)	The distance between the end of the pipette tips and the well botttoms during the aspirate action. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.
Dispense at different distance	The option to dispense at a pipette tip height that is different than the aspirate distance. Select the check box to enter a value for the dispense distance.
Dispense distance (0–100 mm)	The distance between the end of the pipette tips and the well bottoms during the dispense action.
Dynamic tip extension (0–20 mm/µL)	The rate at which the pipette head moves during the Aspirate task. The software calculates the distance over which the tips will move without crashing. Use dynamic tip extension to prevent spills as the pipette tips displace the liquid. To move the tips: • *At the same rate as the volume change.* Calculate dynamic tip extension (DTE) as follows: DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls • *Faster than the volume change.* DTE > 1/A • *Slower than the volume change.* DTE < 1/A The starting and ending positions can be calculated as follows: $(V_{aspirated} * DTE) + Distance_{well\ bottom}$ *Note:* Instead of a negative aspirated volume, the software automatically moves downward toward the well bottom with each aspirate action.
Pipette technique	The pipette location offset you want to use for the Dispense task. The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.

Parameter	Description
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (–20 to 50 mm)	The vertical distance for the pipette tips to rise before touching the sides of the wells.
Tip touch horizontal offset (–5 to 5 mm)	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition. For example, if you set a value of: • 0, the tips move a horizontal distance equal to the well radius • > 0, the tips attempt to move past the well radius, which results in a more forceful tip touch • < 0, the tips move a distance less than the radius of the well, resulting in a lighter tip touch

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Wash Tips task parameters

About this topic

The Wash Tips task washes pipette tips using a number of aspirate and dispense actions. This topic describes the task parameters.

To run the Wash Tips task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

The Wash Tips task has the following parameters.

Parameter	Description
Empty tips	The option to empty the entire contents of the pipette tips, including fluid and air. The Volume parameter is ignored if this option is selected.
Volume (μL)	The volume of liquid to be dispensed from each pipette tip.
Pre-aspirate volume (μL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (μL)	Specifies the volume of air to dispense after the main volume has been dispensed.
	Typically, the blowout volume is the same as the pre-aspirate volume.
	Note: Blowout only occurs in the last quadrant dispensed for a given dispense action.
Liquid class	The liquid class associated with this liquid.
Mix cycles	The number of times you want to aspirate and dispense. Each cycle consists of one aspirate action and one dispense action.
Distance from well bottom (mm)	The distance between the end of the pipette tips and the well bottoms during the Wash Tips task.
	IMPORTANT The labware definition must be accurate and the teachpoint must be precise in order for the system to position the tips at the correct distance from the well bottom.

Parameter	Description
Dynamic tip extension (mm/(µL)	The rate at which the pipette head moves during the Wash Tips task. The software calculates the distance over which the tips will move without crashing.
	Use dynamic tip extension to prevent spills as the pipette tips displace the liquid.
	To move the tips:
	• *At the same rate as the volume change.* Calculate dynamic tip extension (DTE) as follows:
	DTE = (well depth)/(well vol) = 1/A, where A is the cross-sectional area of a well with straight walls
	• *Faster than the volume change.* DTE > 1/A
	• *Slower than the volume change.* DTE < 1/A
	The starting and ending positions can be calculated as follows:
	$(V_{dispensed} * DTE) + D_{well\ bottom}$
	$(V_{aspirated} * DTE) + D_{well\ bottom}$
Perform tip touch	The option to touch the pipette tip on one or more sides of the well.
Which side to perform tip touch	The wall or walls for tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance	The vertical distance the pipette tips rise before touching the sides of the wells.
Tip touch horizontal offset	The horizontal distance the tips move. The value is based on the well diameter specified by the labware definition.
	The value of the parameter determines the direction of movement:
	• *0.* Tips move a horizontal distance equal to the well radius.
	• *Great than 0.* Tips attempt to move past the well radius, which results in a more forceful tip touch.
	• *Less than 0.* Tips move a distance less than the radius of the well, resulting in a lighter tip touch.
Pump fill speed (%)	The speed, in percent of maximum speed, of liquid flow into the reservoir.
	For the MicroWash Reservoir, this value should be high enough for the washing liquid to just bubble over the tops of the chimneys.

Parameter	Description
Pump empty speed (%)	The speed, in percent of maximum speed, of liquid flow out of the the reservoir.
	For the MicroWash Reservoir, this value should be slightly higher than that of the inflow pump to prevent an overflow.
Dispense to waste during wash	The option to move the tips by a specified offset (defined in the Labware Editor) and dispense used fluid outside of the reservoir chimney.
	This option applies only to reservoirs that have chimneys.
Dispense to waste at height (mm)	The height at which the dispense action occurs.
	For example, during the dispense action, the tips move up to clear the chimneys, move the offset distance, and then lower to the distance you specified. If you want the lower the tips by 10 mm, specify –10 mm.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Pump Reagent parameters

About this topic

The Pump Reagent task fills or empties a reservoir or wash tray by pumping for a specified number of seconds. If the reservoir is on a Weigh Station, the pump stops fluid flow when the target weight is reached. This topic describes the task parameters.

Parameter descriptions

To run the Pump Reagent task, see .

The Pump Reagent task has the following parameters.

Parameter	Description
Reservoir mode	The action of the task: • Fill • Empty
Pump speed	The speed, in percent of maximum, at which to pump the reagent.
Pump on time	The duration of the pumping time, in seconds.
Use weigh station/shelf	The option to use the Weigh Station or Weigh Shelf.
Weigh station/shelf action threshold	The minimum fluid weight, in percent of the full weight that was calibrated on the Weigh Station or Weigh Shelf. For example, you can set the minimum threshold at 45% so that when the fluid reaches 45% of the full weight, fluid starts to pump into the reservoir.
Weigh station stop action threshold	The maximum fluid weight, in percent of the full weight that was calibrated on the Weigh Station or Weigh Shelf. For example, you can set the stop threshold at 60% so that when the fluid reaches 60% of the full weight, fluid starts to drain or pump out of the reservoir.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up an autofilling location	"Workflow to set up an autofilling station" on page 173
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Shake task parameters

About this topic

The Shake task instructs the Orbital Shaking Station to shake. This topic describes the task parameters.

To run the Shake task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

The Shake task contains the following parameters.

Parameter	Description
Mode	The action of the task: • *On*. Turns on the Orbital Shaking Station. • *Off*. Turns off the Orbital Shaking Station. • *Timed*. Turns on the shaking timer. You must specify the length of time to shake.
RPM	The shake speed, in revolutions per minute.
Direction	The direction to shake. Select one of the direction combinations: NWSE, NESW, NS, EW, NW/SE, NE/SW.
Time for operation in Timed mode (s)	The length of time, in seconds, you want to leave the shaking on. At the end of the period, the shaking will turn off.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up the Orbital Shaking Station	"Setting up the Orbital Shaking Station" on page 137
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Vacuum Filtration Station task parameters

About this topic

This topic describes the task parameters for the following:

- *Assemble Vacuum task*. Directs the robot to pick up the Vacuum Filtration Station components from designated deck locations and stack them in the order you specify.

- *Disassemble Vacuum*. Directs the robot to remove components from the Vacuum Filtration Station and place them back at the locations specified in the Assemble Vacuum task.

- *Move and Filter Plate*. Moves a plate to the Vacuum Filtration Station and turns on the vacuum.

To use the Assemble Vacuum and Disassemble Vacuum tasks, you must first set the Robot gripper offset value for the labware that will be placed on the Vacuum Filtration Station during a protocol run. You set the offset in the Labware Editor.

To run the Vacuum Filtration Station tasks, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

Assemble Vacuum task

Parameter	Description
Assembly order	The order, from bottom to top, in which you want to stack the station components. The selections are: • Base-Collection plate-Filter plate-Collar • Base-Collection plate-Collar For details, see "Setting up the Vacuum Filtration Station" on page 144.
Vacuum Filtration base	The location of the Vacuum Filtration Station base.

Disassemble Vacuum task

Parameter	Description
Vacuum Filtration Assembly	The location of the assembled Vacuum Filtration Station.

Move and Filter Plate task

The Move and Filter Plate contains the following parameters.

Parameter	Description
Mode	The action of the task: • *On*. Turns on the vacuum. • *Off*. Turns off the vacuum. • *Timed*. Turns on the vacuum timer. You must specify the vacuum length of time.
Time for operation in Timed mode	The length of time, in seconds, you want to leave the vacuum on. At the end of the period, the vacuum will turn off.
Hold down filter plate	The option to have the robot hold down the filter microplate when the vacuum is turned on to ensure a secure vacuum seal.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Setting up the Vacuum Filtration Station	"Setting up the Vacuum Filtration Station" on page 144
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
Reporting a problem	"Reporting problems" on page 92

Pin Tool task parameters

About this topic

This topic describes the task parameters for the Pin Tool task.

To run the Pin Tool task, see "Performing a task using Bravo Diagnostics" on page 113.

Parameter descriptions

The Pin Tool task contains the following parameters.

Parameter	Description
Dwell time (s)	The time duration that the pins remain at the specified height (First distance or Second distance) within the well. For example, you might start with the following values: • Adsorb, Dispense into fluid, or Mix–0.5 s or longer for more viscous fluids • Blot–2 s, or longer for more viscous fluids
Descriptive label	A text label that you can add to the task icon in the protocol. Click the arrow in the Descriptive label box to choose an option. The options include: • Enter a JavaScript variable or script. • Use a predefined label: Adsorb, Dispense, Wash, Blot, or Mix • Type your own label in the box.
Liquid class	A parameter that you can use to control the accuracy and the speed of the pin tool as it moves into and out of the wells. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Pipette technique	The pipette location offset you want to use for the Pin Tool task. The list of pipette techniques are defined in the Pipette Technique Editor.

Parameter	Description
First distance (mm)	The first height for the pin tool during the Pin Tool task. The value is the distance between the pin tips and the well bottoms. For example, during an adsorb step, you might set this value to 0 mm so that the pin tips touch the bottom of the wells. This parameter can affect the quantity adsorbed. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the pins at the correct distance from the well bottom.
Use two distances	The option to specify a second height for the pins during the Pin Tool task. For example, you could cycle the pin positions between two heights within the wells repeatedly to perform mixing or to wash the pins. Default: Not selected
Second distance (mm)	The distance between the pin tips and the well bottoms at the second height for the pins. **IMPORTANT** The labware definition must be accurate and the teachpoint must be precise in order for the system to position the pins at the correct distance from the well bottom.
Cycles	Available if you select the Use two distances option. The Cycles parameter sets the number of times to move the pins repeatedly to the two heights, for example to perform mixing or to wash the pins.
Perform tip touch	The option to touch the pins on one or more sides of the well, or to enable the pins to make lateral stirring moves inside the fluid, for example during a wash task.
Which sides to use for tip touch	The side or sides of the well to use during tip touch: North, South, East, West, North/South, West/East, West/East/South/North.
Tip touch retract distance (mm)	The vertical distance for the pins to move before moving laterally within the well, where • 0 is the vertical distance equal to the well bottom • > 0 is the vertical distance the pins rise above the bottom • < 0 is the vertical distance the pins attempt to move past the well bottom

Parameter	Description
Tip touch horizontal offset (mm)	The horizontal distance that the pins move. The value is based on the well diameter specified by the labware definition, where • 0 is a distance equal to the well radius • > 0 is the distance the pins attempt to move past the well radius, which results in a more forceful tip touch • < 0 is a distance less than the radius of the well, resulting in a lighter tip touch or no tip touch

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 49
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 113
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Glossary

clamps (BenchCel) The components inside of the stacker head that close and open the stacker grippers during the loading, unloading, downstacking, and upstacking processes.

controlling computer The lab automation system computer that controls the devices in the system.

cycle See seal cycle.

deadlock An error that occurs when the number of locations available in the system is less than the number of microplates in the system. Because the microplates cannot move to the expected locations, the protocol pauses.

device An item on your lab automation system that can have an entry in the device file. A device can be a robot, an instrument, or a location on the lab automation system that can hold a piece of labware.

device file A file that contains the configuration information for a device. The device file has the .dev file name extension and is stored in the folder that you specify when saving the file.

downstack The process in which a microplate is moved out of the stack.

error handler The set of conditions that define a specific recovery response to an error.

home position The position where all robot axes are at the 0 position (the robot head is approximately at the center of the x-axis and at 0 of the z-axis, and the robot arms are perpendicular to the x-axis).

homing The process in which the robot is sent to the factory-defined home position for each axis of motion.

hot plate (PlateLoc) A heated metal plate inside the sealing chamber that descends and presses the seal onto the plate.

insert A pad placed under the plate to support the bottom of the wells for uniform sealing.

location group A list of labware that can be moved into or out of particular slots in a storage device.

plate group A list of specific labware that can be moved into or out of a storage device without regard for the slot locations.

plate instance A single labware in a labware group that is represented by the process plate icon.

plate stage The removable metal platform on which you load a plate.

plate-stage support The structure on which you load a plate stage. The plate-stage support extends when the door opens.

profile The Microsoft Windows registry entry that contains the communication settings required for communication between a device and the VWorks software.

process A sequence of tasks that are performed on a particular labware or a group of labware.

protocol A schedule of tasks to be performed by a standalone device, or devices in the lab automation system.

regrip station A location that enables the robot to change its grip orientation (landscape or portrait), or adjust its grip at the specified gripping height. Grip height adjustment might be necessary after a robot picks up a labware higher than the specified gripping height because of physical restrictions at a teachpoint.

robot grippers The components that the robot uses to hold labware.

run A process in which one or more microplates are processed. In a standalone device, the run consists of one cycle. In a lab automation system, a run can consist of multiple cycles that are automated.

safe zone The boundary within which the robot is allowed to move without colliding with external devices.

seal cycle The process in which a single plate is sealed on the PlateLoc Sealer.

seal entry slot The narrow entry on the back of the PlateLoc Sealer where the seal is inserted into the device.

seal-loading card A rectangular card that is used to facilitate the seal loading process on the PlateLoc Sealer.

seal-roll support The triangular structures at the top of the PlateLoc Sealer where a roll of seal is mounted.

sealing chamber The area inside of the PlateLoc Sealer where the seal is applied to a plate.

shelves (BenchCel) The components inside of the stacker head that provide leveling surfaces for the microplates, thus ensuring accurate robot gripping, during the downstacking process.

stacker grippers The padding at the bottom of the stacker racks that hold microplates when a microplate is loaded, downstacked, or upstacked.

subprocess A sequence of tasks performed as a subroutine within a protocol. Typically the subprocess is performed by a single device type, such as the Bravo device.

task An operation performed on one or more labware.

task parameters The parameters associated with each task in a protocol. For example, in a labeling task, the parameters include the label value.

teachpoint A set of coordinates that define where the robot can pick up or place labware and the location of a known object.

teachpoint file The XML file that contains the settings for one or more device teachpoints.

touch screen The interface on the front of the PlateLoc Sealer where sealing parameters are set, the seal cycle can be started or stopped, and the seal cycle can be monitored.

upstack The process in which a microplate is moved back into the stack.

waypoint A set of coordinates that define a location the robot passes through on its way to a teachpoint.

workspace The boundary within which the robot can move without limitations.

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Agilent Technologies

User Guide

G5409-90006