Bravo Automated Liquid-Handling Platform

User Guide

Original Instructions

Agilent Technologies

Notices

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Contact Information

Agilent Technologies Inc.
Automation Solutions
5301 Stevens Creek Blvd.
Santa Clara, CA 95051
USA

Technical Support: 1.800.979.4811 (US only) or +1.408.345.8011 (rest of the world)
service.automation@agilent.com

Customer Service: 1.866.428.9811 or +1.408.345.8356
orders.automation@agilent.com

Customer Service by country:
http://www.chem.agilent.com/en-US/Contact-US/Pages/ContactUs.aspx

Documentation feedback:
documentation.automation@agilent.com

Web:
www.agilent.com/lifesciences/automation

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Safety Noticies

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

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

Contents

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:

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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	Configures hardware and writes software.
Lab manager, administrator, or technician	• Manages the automation system that contains the Bravo Platform • Develops the applications that are run on the system • 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, setup, and operation of the Bravo Platform.

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

What is new in this revision

Feature and description	See...
Revised the description of Vacuum Filtration Station components and the procedure for configuring the accessory in Bravo Diagnostics.	"Setting up the Vacuum Filtration Station" on page 120
Added a description of the new Filter Plate Holder configuration feature Bravo Diagnostics.	"Setting up a Trash or Filter Plate Holder accessory" on page 136
Updated the instructions for verifying the AssayMAP profile configurations and teachpoints.	"AssayMAP Bravo Platform" on page 189

Software version

This guide documents Bravo Diagnostics version 17.3.0 or later.

Related guides

Use this guide in conjunction with the following:

- *Bravo Automated Liquid Handling Platform Safety and Installation Guide*. Describes potential safety hazards and how to avoid them, how to install the device, and how to install the Light Curtain and shields.
- *Automation Solutions Products General Safety Guide*. Provides general safety information and describes potential safety hazards that you might encounter when using Automation Solutions products. A copy of this safety guide is included with your shipment.
- *VWorks Automation Control Setup Guide*. Explains how to define labware and labware classes, liquid classes, and pipetting techniques, and how to track and manage labware in storage.
- *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.

If you are using the Bravo 96AM Head, see "AssayMAP Bravo Platform" on page 189.

Related information

For more information about...	See...
How to access different formats of this user guide	"Accessing product user information" on page ix
Reporting problems	"Reporting problems" on page 78
Bravo Platform safety information	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*

Accessing product 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/chem/askb.

Accessing safety information

Safety information for the Agilent Technologies devices appears in the corresponding device safety guide or 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
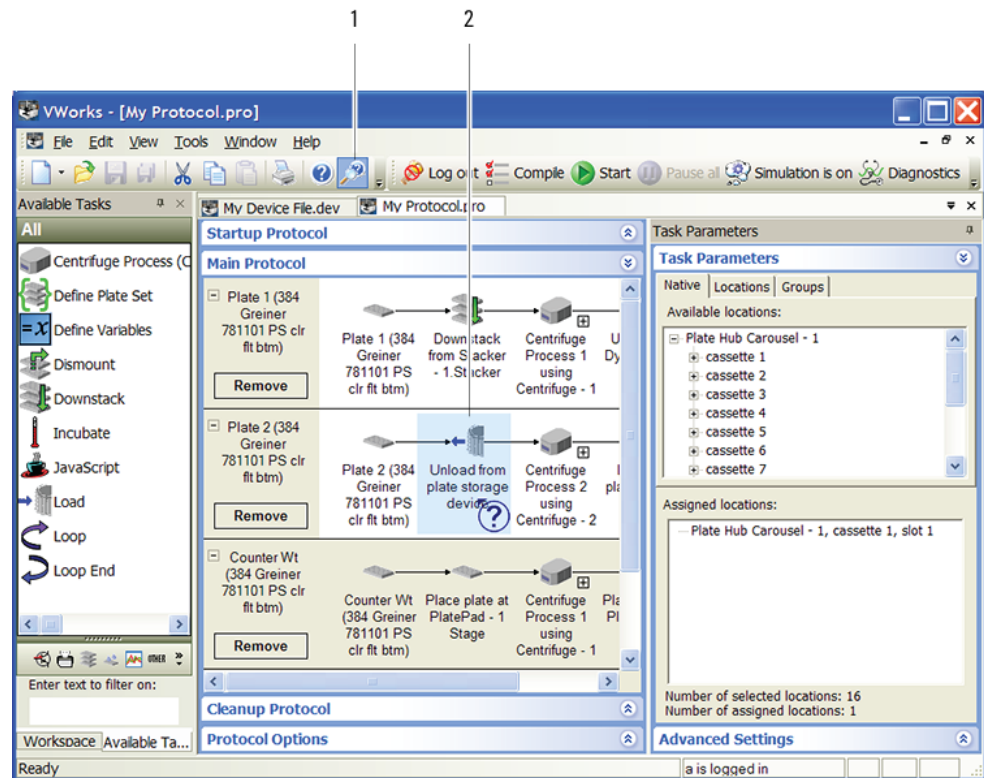
To access the context-sensitive help feature:

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

The pointer changes to [icon]. 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 to 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 78
Bravo Platform safety information	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*

Bravo Automated Liquid-Handling Platform User Guide

1
Introduction to the Bravo Platform

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

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Safety notes

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

Ensure you have read the *Bravo Automated Liquid Handling Platform Safety and Installation Guide* and are trained in the safe operation of the device.

Figure Bravo Platform (front view)
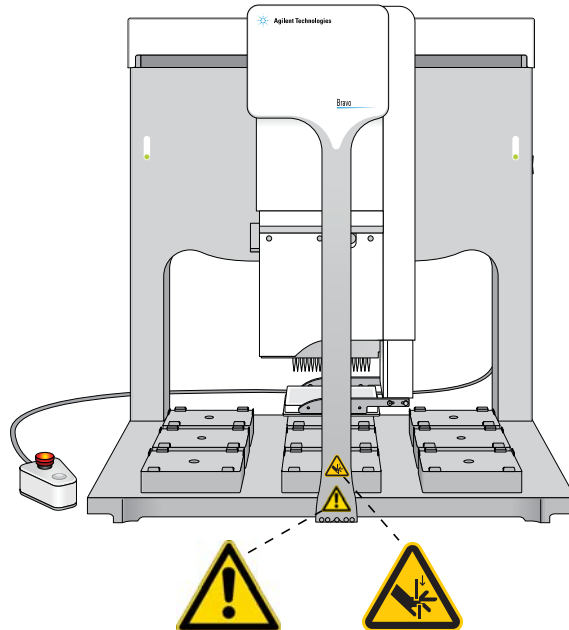
Related information

For more information about...	See...
Safety precautions, how to install the Bravo Platform	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Stopping in an emergency	"Emergency stops" on page 56

About the Bravo Platform

Product description

The Bravo Platform is a versatile liquid handler with a nine plate-location deck that is suitable for handling 96-well, 384-well, and 1536-well microplates (plates). The platform uses interchangeable pipette heads.

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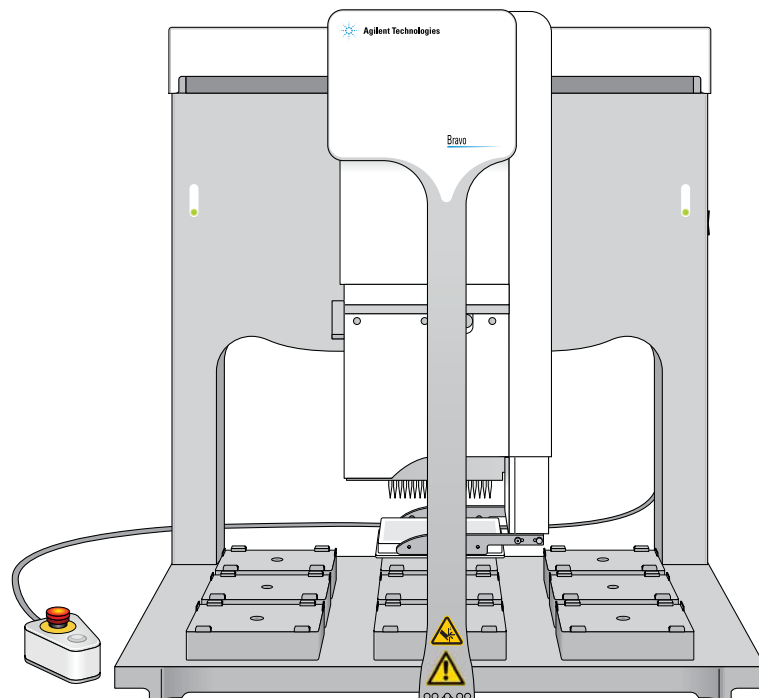
Ways to use the Bravo Platform

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 12
Components	"Hardware overview" on page 5
Accessories	"Accessories overview for the Bravo Platform" on page 102
Laboratory requirements	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Safety	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*

Hardware overview

About this topic

This topic describes the Bravo Platform primary hardware components and the axes of motion.

Primary hardware components

The following figure and table describe the primary Bravo hardware components.
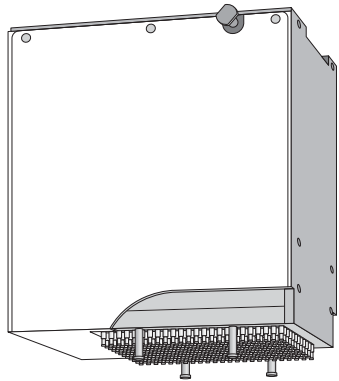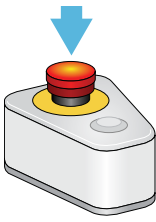
Figure Bravo Platform components (front view)

Item	Feature	Description
1	Indicator lights	The two light panels that display color-coded status of the Bravo Platform: • ⬤ *(solid blue)*. The Bravo Platform is turned on and in standby mode. • ⬤ *(flashing green)*. The software is running a protocol on the Bravo Platform. • ⬤ *(flashing orange)*. The software has initialized the Bravo Platform and Bravo Diagnostics is open. • ⬤ *(flashing red)*. The software has encountered an error while running a protocol or the interlock circuit is tripped.

Item	Feature	Description
2	Power switch	The switch on the right side of the rear wall that turns on (**I**) and off (**O**) the Bravo Platform.
3	Head mount	The fixture that provides the mechanical connections and communication inferface for the liquid-handing head. The head mount attaches to an arm that extends from the Bravo rear wall of the tie bar. The head mount travels along the arm between the front and back of the deck (*y*-axis). The arm moves the head mount from side to side across the deck (*x*-axis). For details, see Axes of motion. You can move the head mount manually while the Bravo Platform is turned off.
4	Tie bar	The vertical bar at the front of the device that adds structural support to the Bravo head mount. The tie bar moves at high speed from side to side (*x*-axis) across the front of the Bravo deck whenever the head moves to a deck location.
5	Liquid-handling head	The platform uses interchangeable Bravo-compatible heads, including disposable-tip, fixed-tip, pin tool, and the 96AM Head for AssayMAP cartridges. *Note:* The fixed-tip heads and the Series II disposable-tip heads are not designed for use with the Bravo gripper. The following figures shows an example of a disposable-tip head. ***Figure*** Series III disposable-tip head
6	Robot-disable pendant	The pendant that contains the Bravo robot-disable button, which is red, raised, and illuminated. To stop in an emergency, press the red button. The power is cut from the motors, causing all motion to stop.
7	Gripper	An optional gripper that extends from the head mount to below the pipette head tips. The gripper picks and places labware on the deck.

Item	Feature	Description
8	Deck	The area that is accessible by the liquid-handling head. The deck supports nine deck locations that are numbered 1–3 (back row), 4–6 (middle row), and 7–9 (front row).

Figure Nine deck locations (top view)
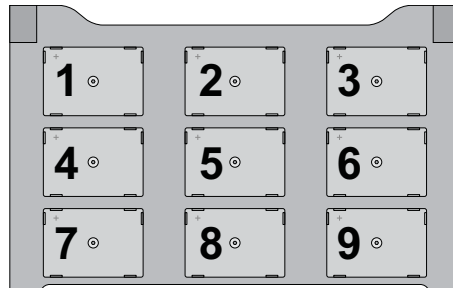
Axes of motion

The Bravo Platform has components that move in the x-, y-, and z-axes, as the following figure shows.

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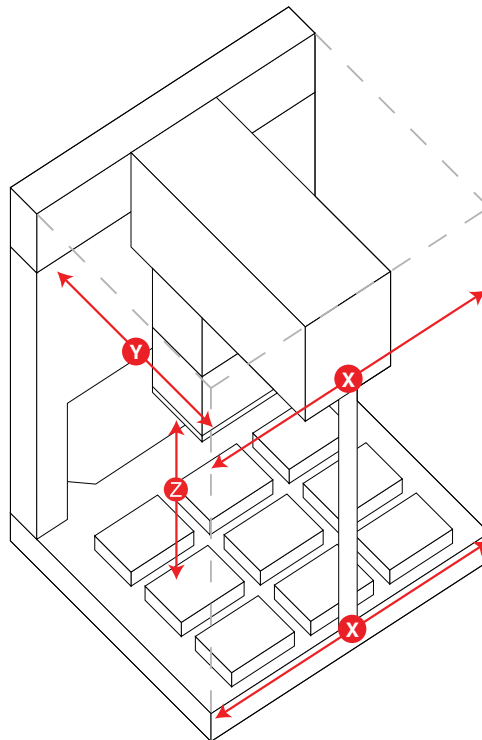
If the Bravo Platform is fitted with a gripper, the gripper moves with the Bravo head. In addition, the gripper has the following axes of motion:

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

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

Figure   Bravo gripper assembly axes of motion
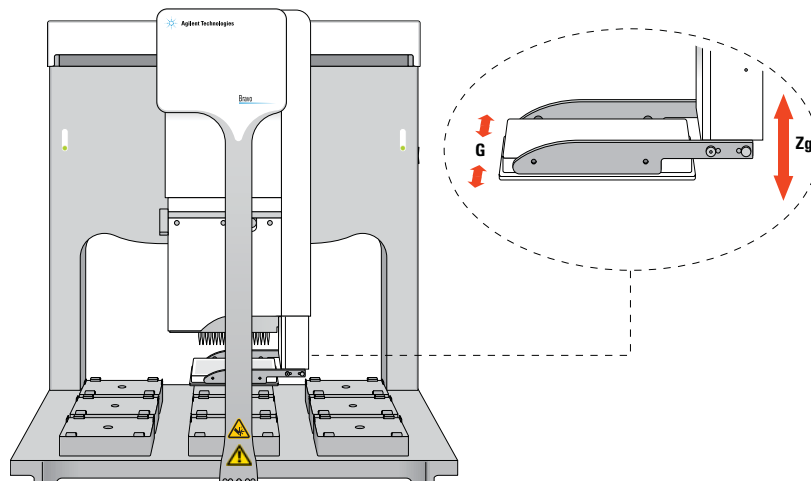
Related information

For information about...	See...
Pipette head	"Pipette heads and pin tools" on page 12
Connection panel	"Connection panel description" on page 9
Accessories	"Accessories overview for the Bravo Platform" on page 102
Laboratory requirements	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
AssayMAP Bravo Platform	"AssayMAP Bravo Platform" on page 189

Connection panel description

Bravo rear connection panel

The following figure and table describe the connection panel at the rear of the Bravo Platform.

Figure   Connection panel on back of Bravo Platform

Item	Feature	Description
1	Ethernet port	Connects the Ethernet card in the controlling computer to the Bravo Platform.
2	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.
3	Pendant port	Connects the pendant to the Bravo safety interlock circuit.
		If the Bravo Platform is integrated with the Agilent Automation Control Unit, this 6-pin pendant port connects to an E-STOP DEVICE port on the Automation Control Unit.
		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.
4	Fuse holder	Houses the AC inlet fuse and a spare fuse for the Bravo Platform. For details on the fuse type, see the *Bravo Automated Liquid Handling Platform Safety and Installation Guide*.
5	AC power entry	Connects the Bravo power cord to an AC outlet with a grounded circuit.

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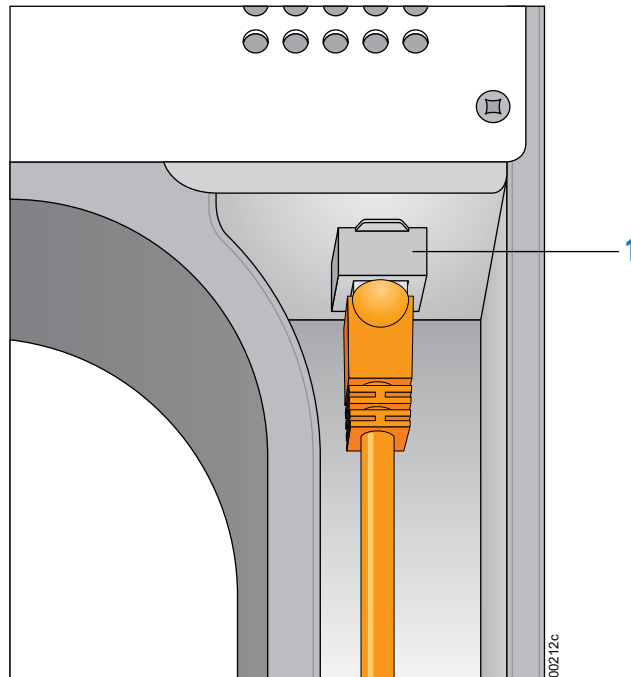
Item	Feature	Description
1	Pump I/O port	An RJ-45 I/O port that connects the Pump Module to the Bravo Platform. The connection is made with a straight-through shielded Cat-5 or Cat-6 (Ethernet) cable.
		IMPORTANT This is not an Ethernet port and should only be used to connect Automation Solutions accessories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

Related information

For more information about…	See…
Connecting the Bravo Platform	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
The pendant disable button	"Emergency stops" on page 56
How to replace the fuse	"Replacing the fuse" on page 69
Installing a Light Curtain	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*

Pipette heads and pin tools

About this topic

The Bravo Platform uses interchangeable pipette heads and pin tools. This topic describes the disposable-tip and fixed-tip pipette heads.

The Bravo 96AM Head is designed for running protocols that use the AssayMAP Bravo cartridges. For details on the Bravo 96AM Head, see "Bravo 96AM Head overview" on page 193.

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 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.

The 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 III pipette heads available for the Bravo Platform.

Head type	Max volume	Dispense into...
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
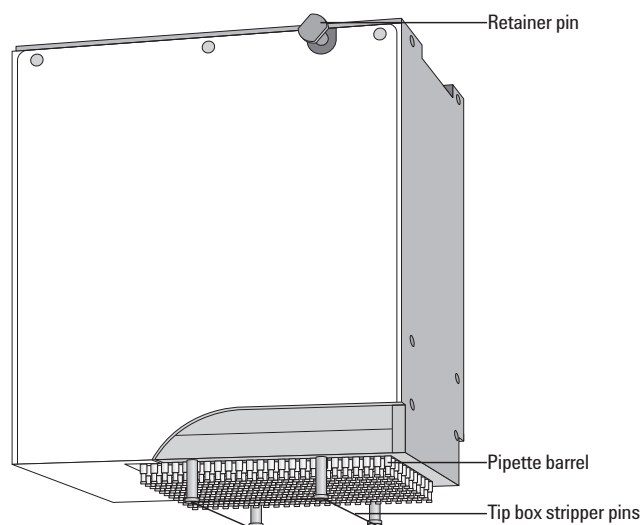
Fixed-tip pipette heads

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 accessible.

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*
Removing one pipette head and mounting a different head	"Changing the Bravo head" on page 63
Bravo 96AM Head for AssayMAP applications	"Bravo 96AM Head overview" on page 193
Controlling pipette heads	"Using Bravo Diagnostics" on page 81

Software overview

About this topic

This topic provides a generic overview of the automation software for the Bravo Platform. The software features and implementation may vary depending on the automation software that you are using to control the Bravo Platform.

For information about your Automation Solutions software, see the help available within the software or go to the online knowledge base at http://www.agilent.com/chem/askb.

About setup and control features

You use the automation software to set up and control the device. The setup features enable you to do the following:

- *Define labware*. Labware definitions describe the labware you will use during protocol runs.
- *Configure the communication method and hardware setup*. Either Ethernet or serial communication can be used. The hardware configuration includes the type of pipette head (for example, 96- or 384-channel disposable head), the accessories, and the deck layout.
- *Verify the teachpoints*. The teachpoints ensure the positional accuracy of the pipette head and gripper, if included, at each deck location.
- *Configure access by an external robot*. If the Bravo Platform is integrated in a lab automation system, you can specify whether the Bravo robot and an external robot can operate on the Bravo deck concurrently.

After you set up the Bravo Platform, you use the automation software for the following:

- *Creating and running protocols*. Protocols determine the sequence of tasks you want to automate in a run.
- *Running tasks individually, if necessary*. For example, you might want to perform an Aspirate task independently of a protocol.
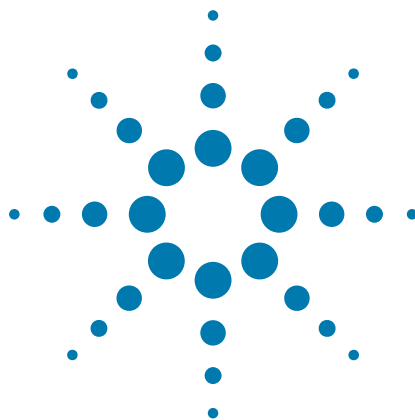
The following figure shows the Bravo Diagnostics dialog box, which enables you to set up the device and troubleshoot problems.

Figure   Bravo Diagnostics dialog box
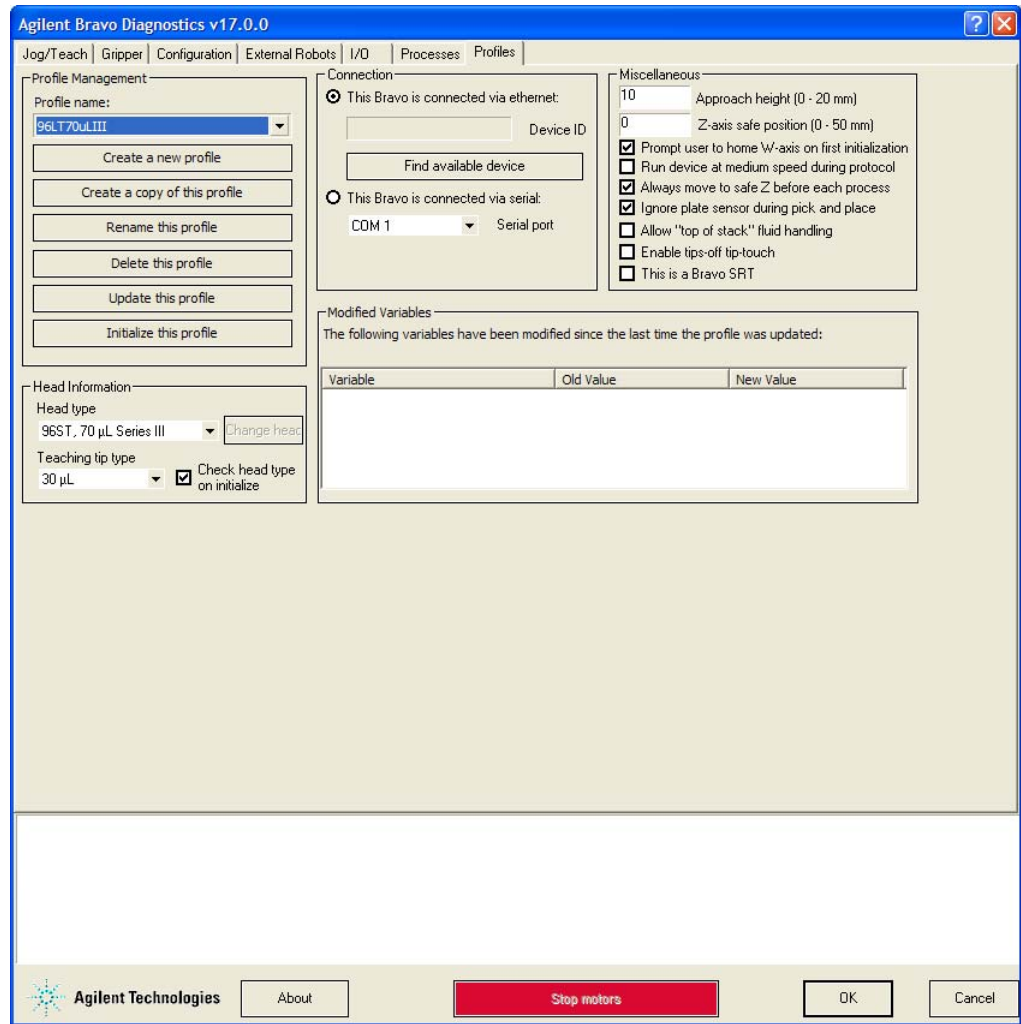
Related information

For more information about...	See...
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18
Using Bravo Diagnostics	"Using Bravo Diagnostics" on page 81
VWorks automation control software	• *VWorks Automation Control Setup Guide* • *VWorks Automation Control User Guide*

2
Setting up the Bravo Platform

This chapter contains the following topics:

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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.

If you have an AssayMAP Bravo Platform, see "AssayMAP Bravo Platform" on page 189.

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 19
2	Establish communication with the Bravo Platform.	• "Creating or adding a Bravo device" on page 21 • "Creating and managing profiles" on page 28
3	Edit or set teachpoints.	"Setting teachpoints" on page 36
4	If the Bravo Platform includes a gripper, verify the gripper setup.	"Verifying the gripper setup" on page 43
5	If the Bravo Platform is integrated with external robots, specify the deck locations that the external robots can access and whether to allow concurrent operations.	"Configuring external robot access" on page 46
6	Configure accessories, such as an autofilling reservoir.	"Accessories overview for the Bravo Platform" on page 102
7	Create protocols and set task parameters.	*VWorks Automation Control User Guide*
8	Prepare to run a protocol.	"Workflow for preparing a protocol run" on page 56

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
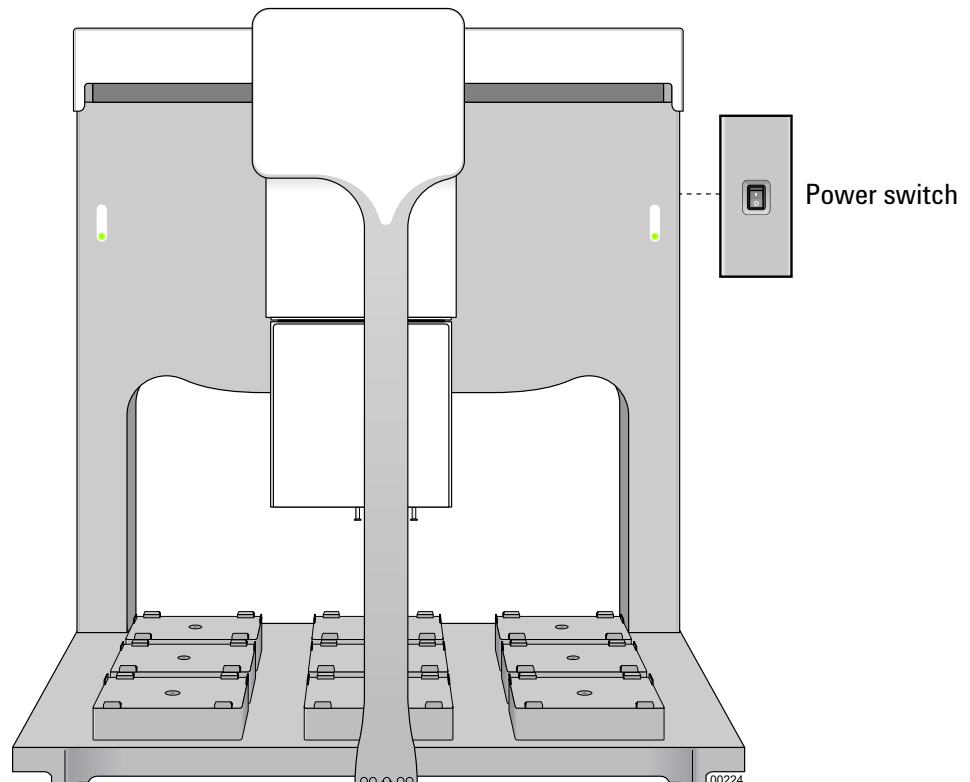
5   Start the VWorks software.

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	"Hardware overview" on page 5
The connection panel	"Connection panel description" on page 9
Cleaning up after a run	"Cleaning up after a run" on page 62
Homing the pipette head	"Homing the pipette head" on page 84
Turning on or off Bravo accessories	"Accessories overview for the Bravo Platform" on page 102
Setting up Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

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), select the following storage location, and click **Save**:

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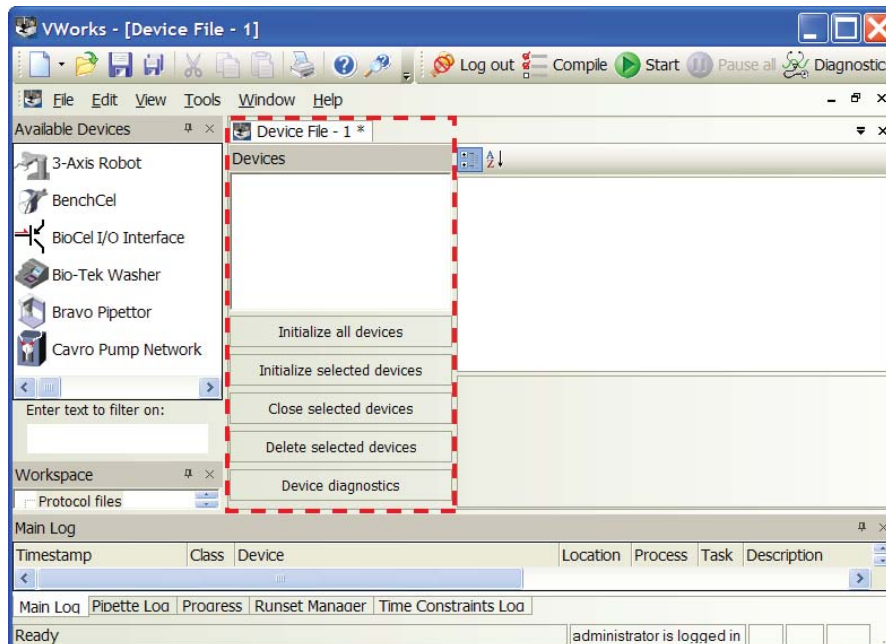
Adding the Bravo Platform to a device file

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**. The device files should be stored in the following location:

...\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**.
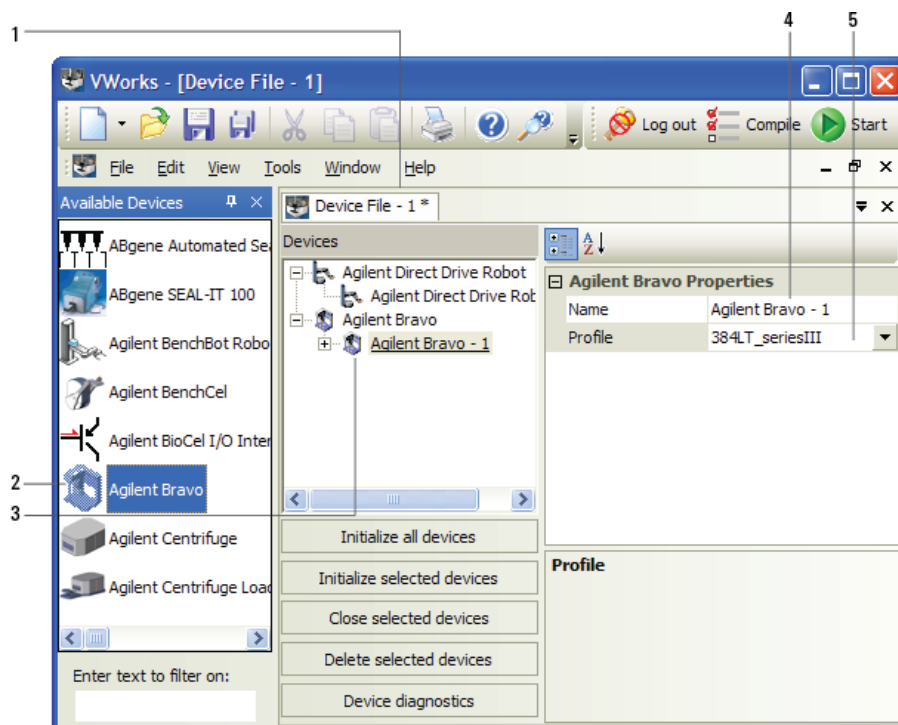
3 In the **Device File** tab, select the **Bravo-*n*** icon.

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 Diagnostics and create a profile. Then return to the **Profile** list under **Bravo Properties** and select the new profile.

IMPORTANT To use different configurations of the same device in different protocols, you can save time by creating a different device file for each configuration. For example, if you change a pipette head on a pipettor, you can simply open the device file that contains the device with the appropriate profile instead of editing the profile selection in the device file.

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.
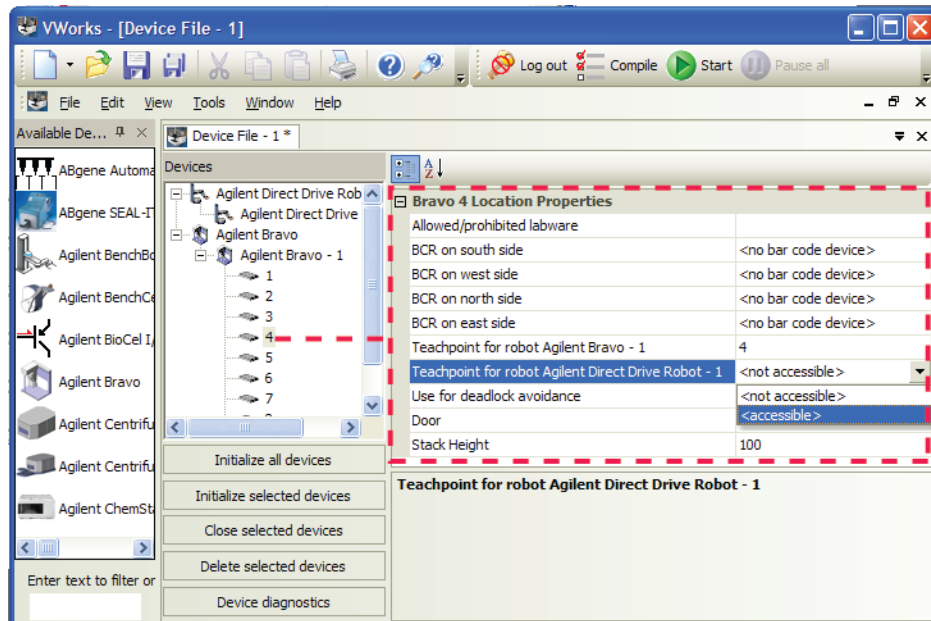
Set the desired values for the following properties. Use the default values for the remaining properties.

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.
Teachpoint for robot *<robot name>*	If the Bravo Platform is integrated with an external robot, specify whether the robot can access this location on the Bravo deck. In Bravo Diagnostics, specify whether the Bravo head should move to a safe location or can perform operations at other deck locations concurrently. **IMPORTANT** Carefully plan which locations the external robot can access.

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.

IMPORTANT If an external robot will access the Bravo deck, ensure that you carefully plan which locations can be accessed and where the Bravo head can be during the external robot's access. See "Configuring external robot access" on page 46.

Related topics

For more information about...	See...
Initializing the device	"Initializing the Bravo Platform" on page 33
Relationship of VWorks components, such as device files, profiles, teachpoints, and labware	*VWorks Automation Control User Guide*
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Profiles	"Creating and managing profiles" on page 28
Planning and configuring external robot access on the Bravo deck	"Configuring external robot access" on page 46

Opening Bravo Diagnostics

About this topic

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

Procedure

To open 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.
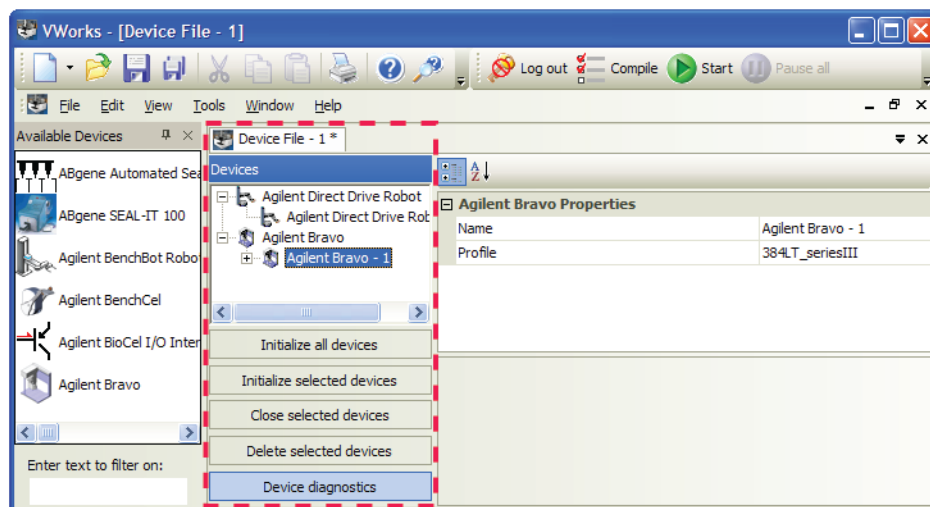
The device's diagnostics dialog box opens.

Figure Bravo Diagnostics dialog box
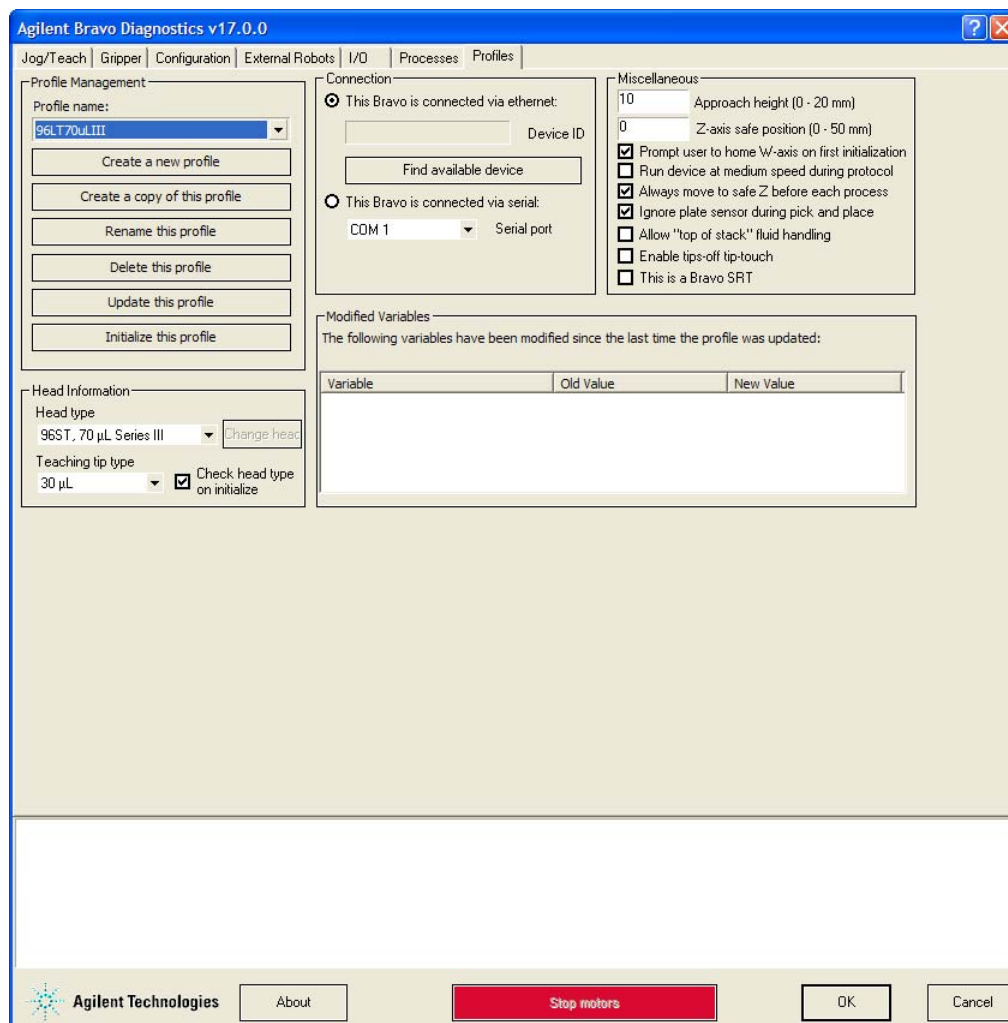
Related information

For information about…	See…
Profiles	"Creating and managing profiles" on page 28
Teachpoints	"Setting teachpoints" on page 36
Bravo Diagnostics	"Using Bravo Diagnostics" on page 81

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
- Identify deck locations for external robot access

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 profile is referenced by a device file. 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.

For information about device files, see "Creating or adding a Bravo device" on page 21. For a detailed description of the relationships between the device file, profile, and teachpoints, see the *VWorks Automation Control User Guide*.

About managing profiles

You use the Profiles tab in Bravo Diagnostics to manage the Bravo device 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**.
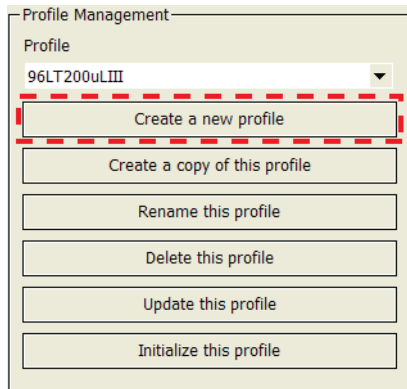
3 In the **Create Profile** dialog box, type a name for the new profile, and click **OK**.

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.
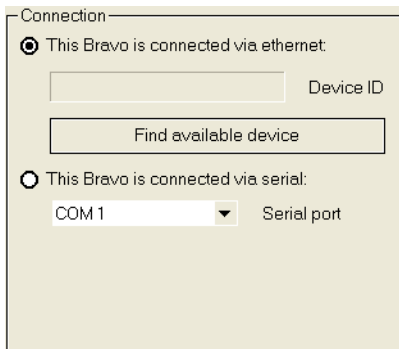
5 *Ethernet connection only*. Click **Find available device** to select the device to associate with the profile.

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**.
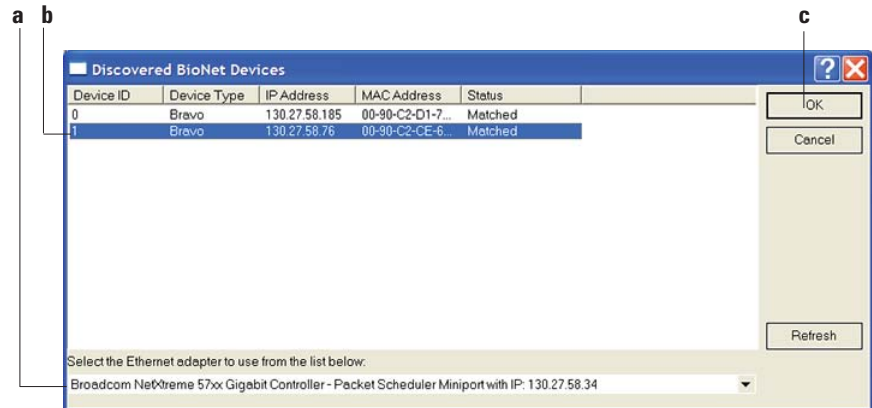
6 Under **Head Information**, configure the pipette head settings:
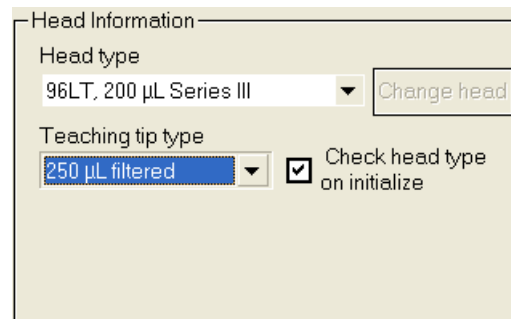
a Select the **Head type** from the list.

b *Disposable-tip heads, pin tools, and 96AM Head*. Select the **Teaching tip type** from the list.

> **CAUTION** Selecting the wrong Teaching tip type for a disposable-tip head, pin tool, or 96AM Head can result in a head crash.

> **IMPORTANT** Disposable tips must be an Agilent Technologies brand.

> **IMPORTANT** For the 96AM Head, the Teaching tip type can be a cartridge or an 250-µL tip.

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

> **CAUTION**   If this check box is cleared, the Bravo Platform will run with any head installed. Therefore, if the profile specifies a 96-channel head type, but a 384-channel head is installed, the head will crash.

Note: If the Check head type on initialize check box is cleared, the *w*-axis controls in the Jog/Teach tab will be disabled even when the device is initialized.

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 278.

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 profile must be initialized in Bravo Diagnostics before you edit the teachpoints.

Related information

For information about…	See…
Relationship of VWorks components, such as device files, profiles, teachpoints, and labware	*VWorks Automation Control User Guide*
What to do if the Bravo Platform device does not appear in step 5	"Troubleshooting hardware problems" on page 75
Concurrent motion settings for an integrated Bravo Platform	"Configuring external robot access" on page 46
Profiles tab in Bravo Diagnostics	"Profiles tab quick reference" on page 277
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26

Initializing the Bravo Platform

About this topic

To establish communication between the computer and the Bravo Platform, you initialize the Bravo device. You can initialize the Bravo Platform in the following ways:

- *Bravo Diagnostics.* To control the Bravo Platform using Bravo Diagnostics, initialize the profile in Bravo Diagnostics.

- *VWorks window.* To control the Bravo Platform from the VWorks window, for example, to run a protocol, initialize the device in the VWorks window.

Before you start

⚠ **WARNING** **When you initialize the Bravo Platform, the head and tie bar can move. To prevent potential injury, keep clear of the device while it is in motion.**

CAUTION To prevent potential equipment damage, ensure that the deck is clear of any obstacles before using the Bravo Platform.

CAUTION Using an incorrect profile can damage the Bravo Platform. Ensure that the profile is correct for the head type and deck configuration.

Initializing the Bravo Platform in Diagnostics

To initialize a profile in Bravo Diagnostics:

1 In the **VWorks** window, open the device file for the profile that you want to initialize.

To open a device file, choose **File > Open**. In the **Open** dialog box, ensure the file type is **Device Files (*.dev)**, select the file, and then click **Open**.

2 Click **No** when the **Would you like to initialize devices now?** message appears.

3 In the device file tab, select the device, and then click **Device diagnostics** to open the Bravo Diagnostics dialog box.

4 In the **Profiles** tab, ensure that the correct profile for the installed head and Bravo deck configuration is selected in the **Profile name** list.
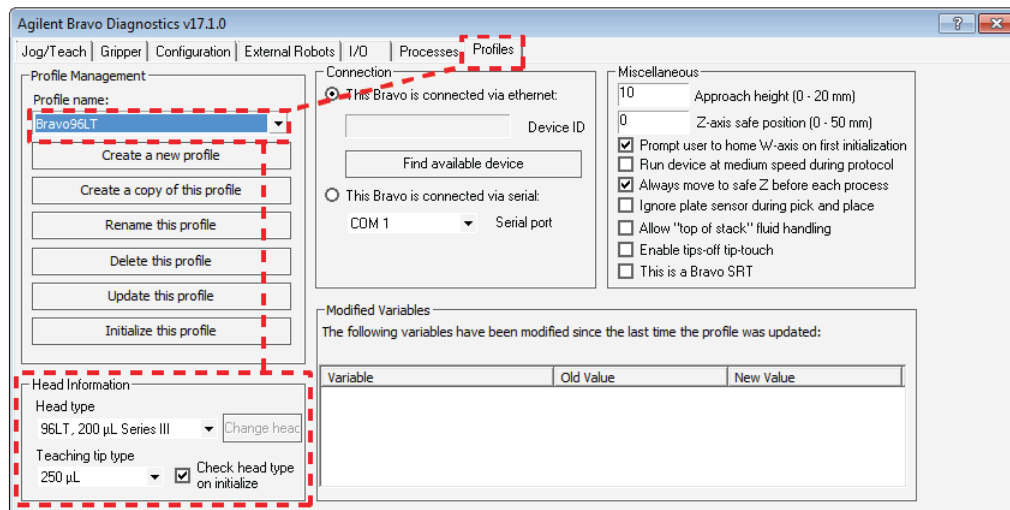
5 Verify that the selected **Head type** matches the installed head.

For example, if a Series III pipette head is installed, the Bravo Platform requires a profile for the Series III head type.

6 Click the **Configuration** tab, and see if the **Location Configuration** matches the physical layout on the Bravo deck.
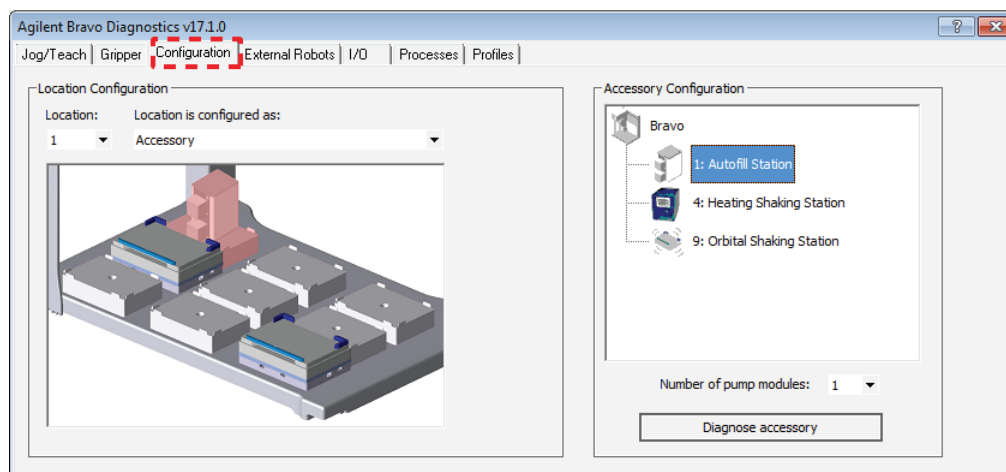
IMPORTANT If the Location Configuration differs from the physical deck layout, ensure that you select the correct profile in the Profiles tab.

7 In the **Profiles** tab, click **Initialize this profile** to start initializing the selected profile.

8 If the **A microplate-in-gripper** error message appears, do one of the following:

- *If the gripper is not holding labware.* Click **Ignore and Continue** to continue the homing process.

- *If labware is in the gripper.* Click **Abort** to cancel the initialization, and then remove the labware from the gripper. To open the gripper, you can use the tools in the Gripper tab in the Bravo Diagnostics dialog box.

9 If a **Verify that it is safe to home the W-axis (the aspirate/dispense axis)** message appears, do one of the following:

- *If the tips do not contain fluid.* Click **Retry** to continue homing the *w*-axis.

- *If the tips contain fluid.* Click **Ignore and continue**. When the **W-axis is not homed** message appears, use the tools in the Jog/Teach tab in the Bravo Diagnostics dialog box to home the *w*-axis over a waste location. Homing the *w*-axis will empty the tips.

Note: The Miscellaneous profile settings include the Prompt user to home W-axis on first initialization option and the Ignore plate sensor during pick and place option. For an explanation of the options, see "Miscellaneous area" on page 278.

Initializing the Bravo device in the VWorks software

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**.
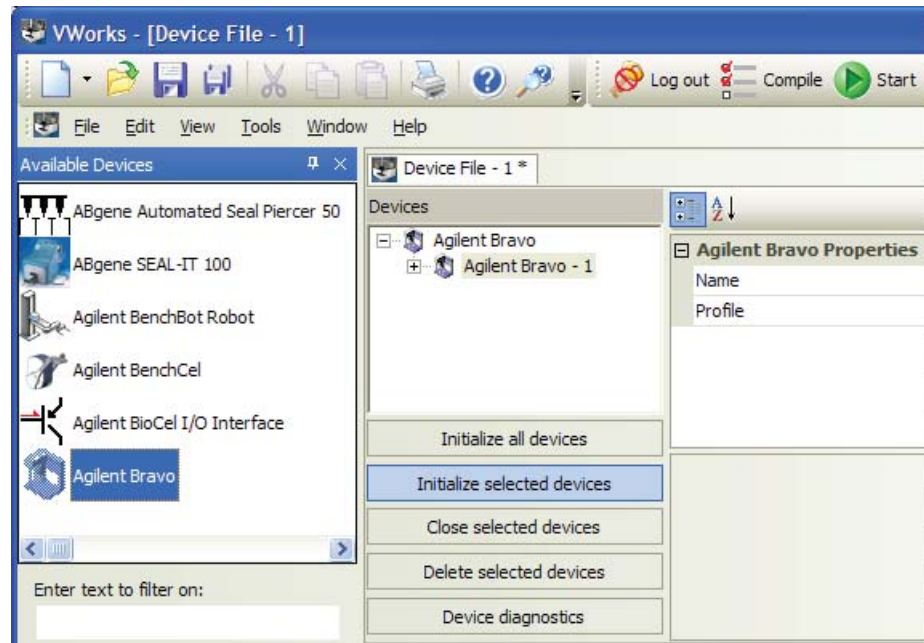
4 If the **A microplate-in-gripper** error message appears, do one of the following:

- *If the gripper is not holding labware.* Click **Ignore and Continue** to continue the homing process.

- *If labware is in the gripper.* Click **Abort** to cancel the initialization, and then remove the labware from the gripper.

5 If a **Verify that it is safe to home the W-axis (the aspirate/dispense axis)** message appears, do one of the following:

- *If the tips do not contain fluid.* Click **Retry** to continue homing the *w*-axis.

- *If the tips contain fluid.* Click **Ignore and continue**. When the **W-axis is not homed** message appears, use the tools in the Jog/Teach tab in the Bravo Diagnostics dialog box to home the *w*-axis over a waste location. Homing the *w*-axis will empty the tips. Make sure you home the *w*-axis before beginning a protocol.

Related information

For information about...	See...
Adding more devices to a device file	"Creating or adding a Bravo device" on page 21
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Profiles	"Creating and managing profiles" on page 28

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. Use the "Workflow for non-tip-box locations" on page 37.

    IMPORTANT If you are teaching the 96AM Head, see "AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231.

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

CAUTION   Using a profile that is associated with teachpoints from a different instrument can result in a hardware collision and cause equipment damage. Ensure that you verify the teachpoints associated with a profile for your specific instrument and pipette head.

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.

⚠️ **WARNING** To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should perform the procedures in this topic.

⚠️ **WARNING** The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.

Workflow for non-tip-box 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.	"Setting the first teachpoint" on page 39
2	Set teachpoints for the remaining locations by doing one of the following: • Automatically set the remaining teachpoints based on the first teachpoint.	"Setting other teachpoints based on one teachpoint" on page 40
	• For more precise teachpoints (384- or 1536-well plates), repeat step 1 for each deck location.	"Setting the first teachpoint" on page 39
3	Verify each teachpoint.	• "Verifying teachpoints for disposable-tip pipette heads" on page 41 • "Verifying teachpoints for fixed-tip pipette heads or pin tools" on page 42
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 102.

> **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 tip box location

Pressing tips on the pipette head requires a high degree of precision in the positioning of the head relative to the tip box, especially for 384-well tip boxes. Use the following workflow for deck locations where you plan to place either a tip box.

Step	For this task…	See…
1	Determine the platepad requirements for the tip box location:	
	• Standard Bravo Platform	
	– *ST tip box*. Use an Alignment Station instead of a standard platepad at the deck locations where you perform tip box operations. The Alignment Station helps provide greater tip-loading precision.	"Installing an Alignment Station" on page 142
	– *LT tip box*. If using a 250-µL tip box, you can use a standard platepad or an Alignment Station. *Note:* If using a 200-µL tip box, use a standard platepad and an LT insert for tip loading.	–
	– *Nested tip box*. Install and configure the Nested Rack Insert.	"Setting up a Nested Rack Insert" on page 143

	• SRT Bravo Platform
	  – *ST tip box*. Use an ST platepad.
	  – *250-µL tip box*. Install the 250-µL platepad and configure the deck location.
		"(Bravo SRT only) Setting up an LT tip box location" on page 158

2	Set the teachpoint for the location.	"Setting the first teachpoint" on page 39
3	*ST tip box locations*. Verify the labware definition for the tip box.	"Verifying teachpoints for disposable-tip pipette heads" on page 41
4	Verify the teachpoint. If tip box operations are not precise enough, repeat this step.	"Verifying teachpoints for disposable-tip pipette heads" on page 41

Setting the first teachpoint

If you are using a fixed-tip head or a pin tool, set the teachpoint according to the A1 needle.

If you are using a disposable-tip head or the 96AM Head, place the teaching tip type that you specified in the profile 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-tip heads.* 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.**
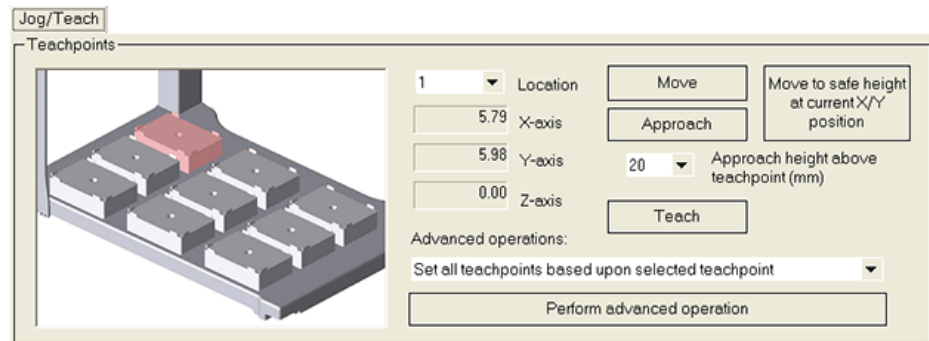
6   Use the **Jog Axes** controls to move the pipette head to the correct teachpoint as follows:
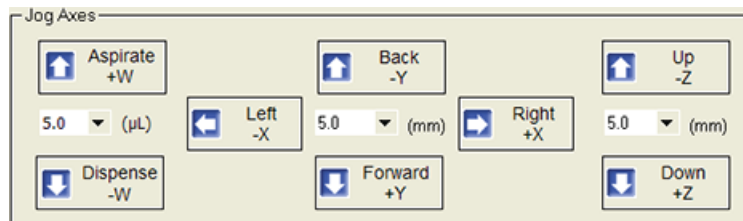
> **CAUTION**   Be careful not to jog the head down too far, especially for a fixed-tip head. Jogging the head down too far will damage the tip.

> **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
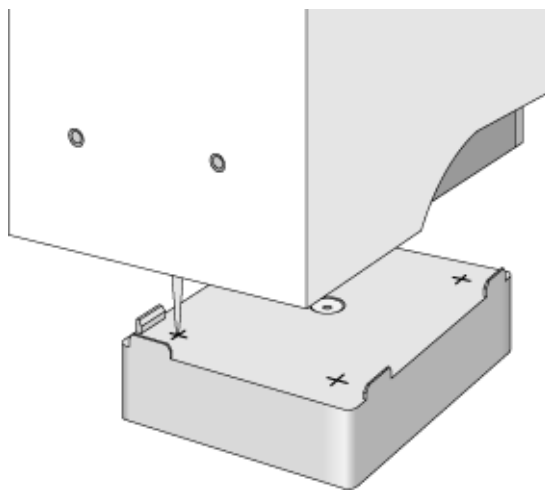
8   To save the teachpoint, click the **Profiles** tab and click **Update this profile.**

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 39.

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 39) is set in the **Location** list.
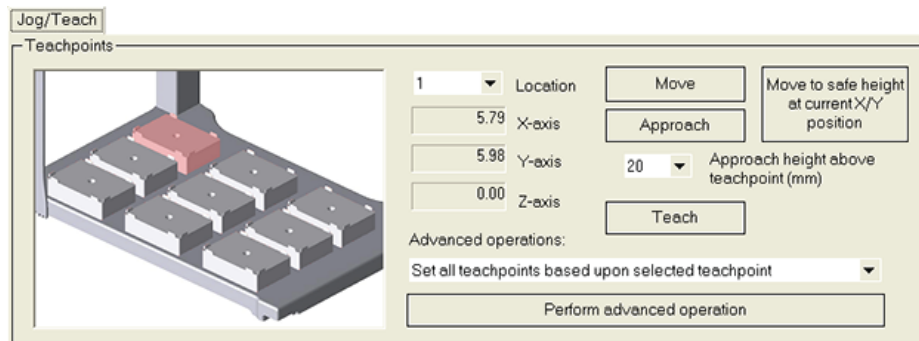
The teachpoint for the other locations will be set based on this one.

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

Verify the following:

*   The labware definition for the tip box 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 tip box labware definition:

1   Open the **Labware Editor**.

2   In the **Pipette/Well Definition** tab, verify the following values for the tip box 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 tip box full of tips on the tip box location that you are verifying. Make sure the tip box 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 tip box 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 39. 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 39.)
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 39.

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 18
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Creating and initializing a profile	"Creating and managing profiles" on page 28 (step 9)
Installing accessories	"Accessories overview for the Bravo Platform" on page 102
Changing the pipette head	"Changing the Bravo head" on page 63
The Jog/Teach diagnostics tab	"About the Jog/Teach tab" on page 82

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 start

Make sure that:

- You have labware definitions for the labware that you are using for the procedures.
- The Bravo gripper fingers are in good condition and aligned with the head. Perform a visual inspection to ensure the gripper fingers are not bent.
- The gripper pads (black rubber) are in place on the gripper fingers and in good condition. Ensure the gripper pads are not partially ripped off or pulled askew.

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
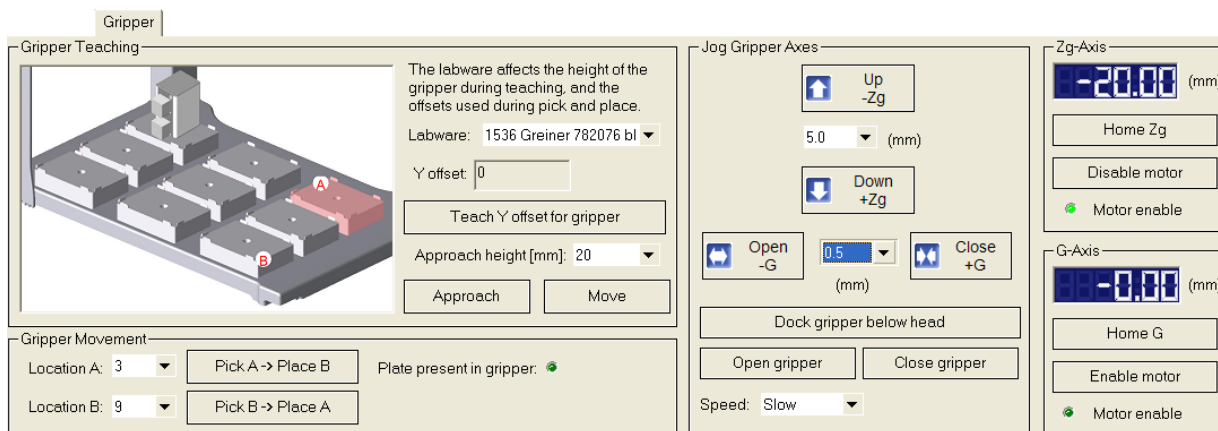
To check the gripper pick-and-place operations:

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 where a standard platepad is installed.

2   In the **Gripper** tab in **Bravo Diagnostics**, 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 18
Opening Diagnostics	"Opening Bravo Diagnostics" on page 26
Gripper tab	• "Fine-tuning the gripper movements" on page 92 • "Gripper tab quick reference" on page 274
Setting teachpoints	"Setting teachpoints" on page 36
Reporting problems	"Reporting problems" on page 78

Configuring external robot access

About external robot access options

To increase throughput, you can integrate the Bravo Platform with a microplate‑handling system or a lab automation system. The integration can enable you to transfer any number of microplates to and from the Bravo Platform for processing.

For a Bravo Platform that is integrated in a system with other plate‑handling robots, you can configure one of the following features:

*   Permit only one robot to operate on the Bravo deck at any given time. While an external robot accesses the Bravo deck, the Bravo head moves to a specified safe location and Bravo operations pause for the duration.

*   Allow the Bravo robot and one or more external robots to operate on the Bravo deck concurrently. For each external robot, you must specify the deck locations that are not available (blocked) to the Bravo robot during concurrent operations.

This topic describes:

*   "Workflow" on page 46

*   "Planning the robot access locations" on page 47

*   "Preventing concurrent operation during external robot access" on page 51

*   "Allowing concurrent operations during external robot access" on page 53

Workflow

Perform the following steps to configure an external robot's access on the Bravo deck. This workflow assumes that you have already verified the Bravo Platform teachpoints.

Step	For this task…	See…
1	Carefully plan which deck locations the external robots can access and where the Bravo head can be during the external robots' access.	"Planning the robot access locations" on page 47
2	Ensure that the device file specifies that the Bravo deck locations are accessible by the external robots.	"Creating or adding a Bravo device" on page 21
3	In Bravo Diagnostics, configure the external robot access, and then update and re‑initialize your profile.	• "Preventing concurrent operation during external robot access" on page 51 • "Allowing concurrent operations during external robot access" on page 53

Step	For this task…	See…
4	Set each external robot's teachpoints at the appropriate Bravo deck locations.	Relevant user documentation, such as the *BenchCel Microplate Handling Workstation User Guide*, the *BioCel System User Guide*, or the *Direct Drive Robot Safety Guide*.
5	Perform a dry run at slow speed to verify that there are no potential hardware collisions. Ensure that the robot-disable pendants are within easy reach in case you need to abort a robot movement.	"About performing dry runs" on page 58

Planning the robot access locations

> **CAUTION** Ensure that you plan the external robot access locations carefully to prevent potential hardware collisions. A collision between an external robot and the Bravo Platform can damage the Bravo Platform, the external robot, or both robots.

Careful planning of the deck locations that the Bravo robot and any external robots can access will optimize your throughput and prevent hardware collisions.

Physical factors to consider

Make sure you consider the following factors when you plan the deck locations that an external robot may access or when selecting a safe location for the Bravo head:

Physical factors	Description
External robot's direction of approach and Bravo x- and y-axes of motion	The Bravo tie bar moves along the x-axis across the front of the Bravo deck whenever the head moves to a deck location. If the Bravo head is at a location in the back row, the tie bar will block another robot's approach from the front to the other deck locations in that column. For example, if the Bravo head is at location 2, the tie bar blocks a front approach to locations 5 and 8. ***Figure*** Bravo head mount and tie bar motion (front view) and (side view)
External robot's physical reach	Some robots can reach any Bravo deck location, while other robots can access a subset of deck locations. For example, the BenchCel robot approaches the Bravo Platform from the left or right side only and can access only the left-most and right-most deck locations. ***Figure*** BenchCel robot's reach on Bravo deck (top view) Front
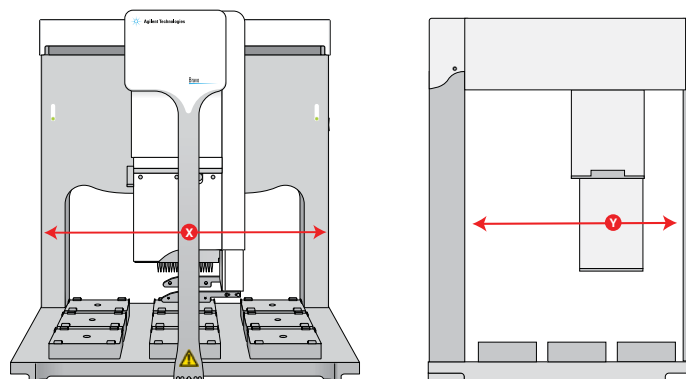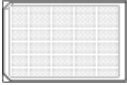
Physical factors	Description
External robot's orientation for gripping labware: landscape or portrait	Landscape and portrait gripper orientations require different space allocations on the Bravo deck. Some robots can grip using either orientation. • Landscape • Portrait
External robot's approach path	The approach path of the external robot can affect which Bravo deck locations must be blocked for the Bravo head during the external robot's access. For example, the following figure shows two variations of an external robot's approach path to deck location 7. The blue locations are where the Bravo head could potentially continue operations concurrently while the external robot is accessing the deck: • *Example A*. The external robot is accessing location 7. However, locations 1 and 4 are also blocked to prevent the tie bar from being in the path of the external robot when it accesses location 7. The Bravo head can access the remaining deck locations (blue) without risking a collision with the external robot during its approach to location 7. • *Example B*. In addition to locations 1, 4, and 7, the Bravo head is blocked from accessing location 8. The Bravo head cannot access location 8 without risking a potential collision with the external robot during its approach to location 7.

Physical factors	Description
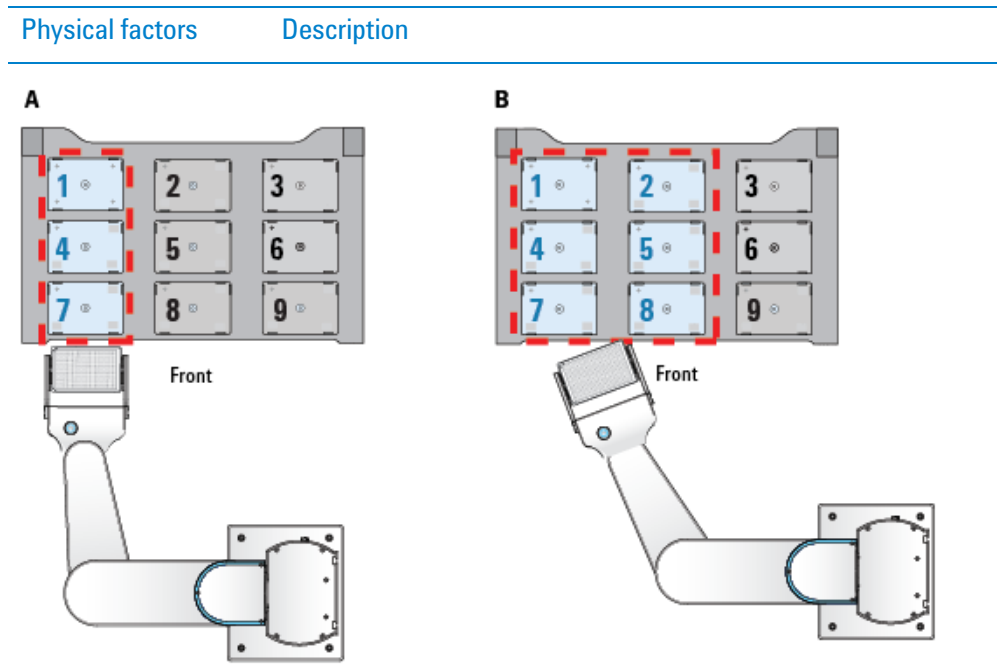
Software scheduling conflicts

The software resolves conflicts, where both the Bravo robot and external robot are scheduled to approach a blocked location, as follows:

- If the Bravo robot is at a blocked location when an external robot is scheduled to approach, the Bravo robot will complete the task in progress before moving to a different location. After the Bravo robot completes the move from the blocked location, the external robot can approach the target location.

- If the Bravo robot and the external robot are both scheduled to approach a blocked location, the software gives priority to the request that it receives first.

    For example, the Bravo robot would get priority, regardless of whether the location is configured as blocked, if the software receives the Bravo robot's request for access before receiving the request from the external robot.

Example scenario 1: Two BenchCel robots and the Bravo robot operating concurrently

In this example, three robots can move concurrently at the Bravo deck:

- *BenchCel robot 1*. Downstacks labware to deck location 1. The Bravo head is also blocked from location 4 during the external robot access to prevent a potential collision with the opened BenchCel gripper arms.

- *BenchCel robot 2*. Upstacks labware from deck location 6. The Bravo head is also blocked from locations 3 and 9 during the external robot access to prevent a potential collision with the opened BenchCel gripper arms.

- *Bravo robot*. Performs operations at locations 2, 5, 7, and 8 while the two BenchCel robots simultaneously access the other deck locations. For example, the Bravo robot could move a tip box from location 7 to 8, perform a Tips On task at location 8, and then aspirate and dispense at the labware on deck locations 2 and 5.

The following figure shows the deck location designations for the two BenchCel robots and the Bravo robot.

Figure   Deck locations for Bravo robot (blue) and BenchCel robot (gray) operations
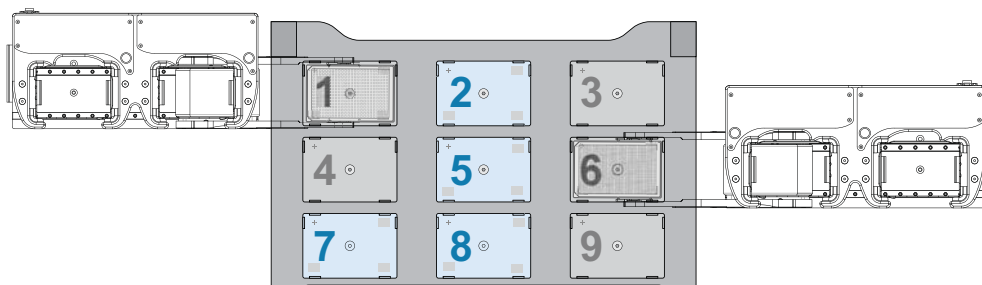
Example scenario 2: The Bravo robot, BenchBot Robot, and Direct Drive Robot operating concurrently

In this example, three robots can move concurrently at the Bravo deck:

- *BenchBot Robot with a landscape grip.* Approaches location 1 from the rear opening in the Bravo backplate. To be conservative, location 2 is also reserved for the BenchBot Robot and blocked for access by the Bravo robot.

  However, if you are certain that the external robot's approach path would not cross within the area that the Bravo head requires to access location 2, location 2 could be unblocked to optimize usage.

- *Direct Drive Robot with a portrait grip.* Approaches location 3 at the right side of the Bravo deck. To be conservative, location 6 is also reserved for this robot and blocked for access by the Bravo robot.

- *Bravo robot.* Continues operations at deck locations 4, 5, 7, 8, and 9.

The following figure shows the deck location designations for each of the three robots.

Figure   Deck locations for the Bravo robot (blue), BenchBot robot (gray), and Direct Drive Robot (gray) operations
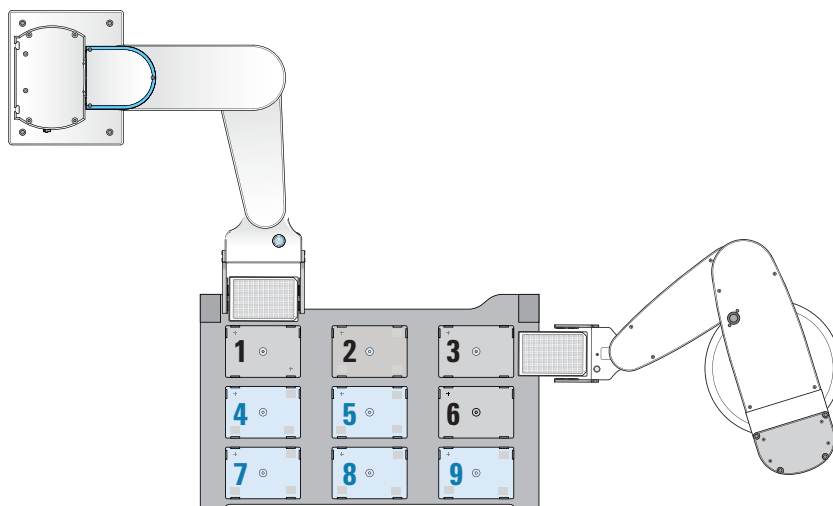
Preventing concurrent operation during external robot access

You can use the safe location feature to prevent Bravo operations while an external robot is accessing the Bravo deck. The safe location feature does the following:

- Allows one robot to access the Bravo deck at any given time. For example, if the Bravo robot is performing a liquid-handling task, the external robot will wait for the Bravo robot to finish before approaching the deck. If the external robot is placing or removing labware from a deck location, the Bravo robot will move to its safe location wait for the external robot to finish.

- Enables the Bravo robot to move to a specified deck location (safe location) whenever the external robot approaches the deck to perform a task. For example, if you specified deck location 1 as the safe location, the Bravo robot will always move to deck location 1 whenever the external robot approaches.

> **CAUTION**   You can specify any deck location as the Bravo safe location. However, to prevent potential hardware collisions, you should determine the relative position of the external robot and its approach before specifying the Bravo safe location.

For guidelines on how to select the safe location, see "Planning the robot access locations" on page 47.

To prevent concurrent operation during external robot access:

1   In **Bravo Diagnostics**, click the **Profiles** tab and select the profile that you want to update.

2   Click the **External Robots** tab.

3   Select **Prevent Bravo operation during external robot access**.

Figure   Setting the External Robots tab to prevent concurrent operation
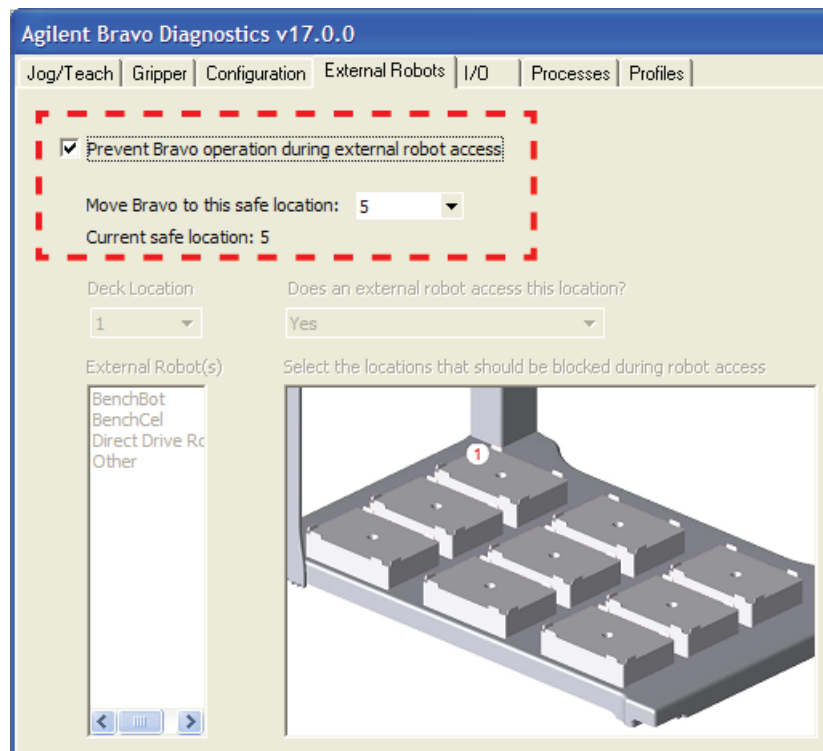
4   In the **Move Bravo to this safe location** box, select the deck location number where the Bravo head should move for the duration while the external robot is accessing the Bravo deck.

Note: Location 5 is the default safe location.

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

Allowing concurrent operations during external robot access

> **CAUTION**   To prevent potential hardware collisions, ensure that you plan the external robot access locations carefully. For guidelines, see "Planning the robot access locations" on page 47.

To allow concurrent operation during external robot access:

1 In **Bravo Diagnostics**, click the **Profiles** tab and select the profile that you want to update.

2 Click the **External Robots** tab.

3 Clear the **Prevent Bravo operation during external robot access** check box.

Figure   Setting the External Robots tab to allow concurrent operation
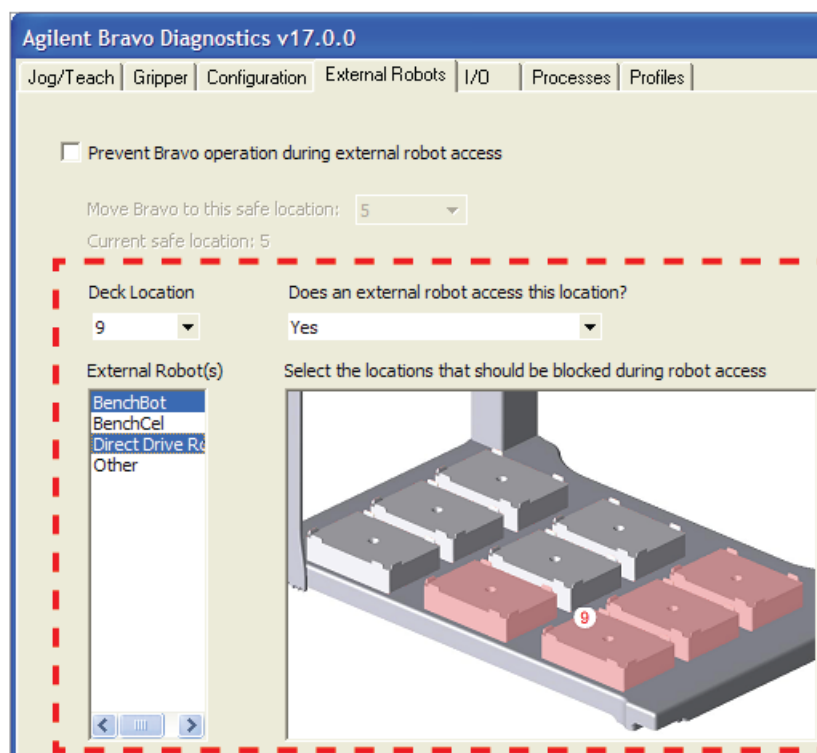
4 To configure a location for one or more robots, do the following:

a In the **Deck location** box, select the location number.

b In the **Does an external robot access this location** box, select **Yes**.

c In the **External robot** list, select the robot or robots that may access this location.

In the deck image, highlights appear at additional deck locations to be blocked. The Bravo robot cannot access blocked locations while the external robot is accessing the target location. The software proposes the most conservative layout for avoiding potential collisions.

Note: The software makes assumptions about the approach direction and robot gripper orientation when proposing blocked locations. For example, the software assumes a portrait orientation and an approach from the side of the deck for external robot access at deck locations 1, 3, 4, and 6. For locations 7 and 9, the software proposes blocked locations for either a side approach and portrait orientation or a front approach and landscape orientation.

d Verify that the proposed blocked locations in the deck image are appropriate. To block or to clear a blocked location, click the location in the deck image.

If you are certain that the external robot's approach path will not intersect with the Bravo head at the given deck location, you can unblock proposed locations to optimize the layout.

5 Repeat step 4 for other deck locations that may be accessed by external robots.

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

Related information

For information about…	See…
Profiles	"Creating and managing profiles" on page 28
Editing teachpoints	"Setting teachpoints" on page 36
Opening diagnostics	"Opening Bravo Diagnostics" on page 26

3
Preparing for a protocol run

Before you start a protocol run, you should check the Bravo Platform teachpoints and the protocol to ensure optimum operation.

This chapter contains the following topics:

Agilent Technologies

Workflow for preparing a protocol run

Workflow

The workflow for preparing a protocol run is as follows:

Step	For this task…	See…
1	Review how to operate safely and how to stop in an emergency.	• *Bravo Automated Liquid Handling Platform Safety and Installation Guide* • "Emergency stops" on page 56
2	Plan for the protocol run.	"Planning for the protocol run" on page 57
3	Perform a dry run.	"About performing dry runs" on page 58

Related information

For information about…	See…
Starting up	"Starting up and shutting down" on page 19
VWorks software	*VWorks Automation Control User Guide*

Emergency stops

When to use the emergency stop procedure

Use this procedure to:
• Abort a 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 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 the VWorks software.

Procedures

To stop the head motion in an emergency:

1 Press the red button on the robot-disable pendant. The power is cut from the motors, causing all motion to stop.
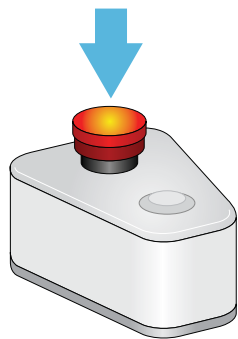
To recover from an emergency stop:

1 To release the red button on the robot-disable pendant, turn it clockwise.

2 In the VWorks 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 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	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Reporting problems	"Reporting problems" on page 78

Planning for the protocol run

Reviewing the protocol

Before you start a run, make sure you review the protocol and determine the following:

• The correct pipette head is installed.

 To avoid variability problems, use only Agilent Technologies brand tips.

- The accessories and labware required for the protocol are where they should be positioned.
- The reservoirs that must be filled.
- The waste bins or bottles that should be emptied.

Related information

For information about...	See...
Creating or revising protocols	*VWorks Automation Control User Guide*
Performing dry runs	"About performing dry runs" on page 58

About performing dry runs

What is a dry run?

A dry run is when you run a protocol using empty labware. A dry run allows you to troubleshoot a protocol or a component of the system without wasting valuable reagents and samples. You should always perform a dry run to check a new protocol.

Correcting teachpoint errors
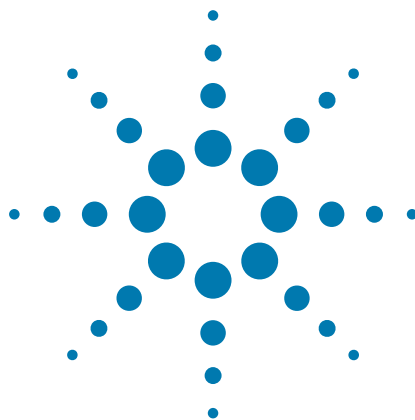
After setting the teachpoints, be sure to perform a dry run as a final check for any teachpoint errors.

Preparing for a dry run

You prepare for a dry run the same way you would prepare for a real protocol run. To review the protocol before a dry run, see "Planning for the protocol run" on page 57.

Related information

For information about...	See...
Stopping the device in an emergency	"Emergency stops" on page 56
Writing protocols	*VWorks Automation Control User Guide*
Preparing for a run	"Workflow for preparing a protocol run" on page 56

4
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	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Cleaning between protocol runs	"Cleaning up after a run" on page 62
Cleaning the Bravo Platform	"Cleaning the Bravo Platform" on page 61
Setting teachpoints	"Setting teachpoints" on page 36

For information about...	See...
Reporting a problem	"Reporting problems" on page 78

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**   **To prevent potential injury, always shut down the device before performing any maintenance procedure.**

CAUTION   Use only the recommended cleaning materials. Using other cleaning solutions and materials can cause damage to the device. Do not use abrasive, corrosive cleaning agents. Do not use metal brushes.

To clean the Bravo Platform:

1 Shut down the Bravo Platform.

2 Disconnect the power cable and communication cable.

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

Related information

For more information about...	See...
Routine maintenance	"Routine maintenance" on page 60
Cleaning up after a run	"Cleaning up after a run" on page 62
Safety guidelines	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Reporting a problem	"Reporting problems" on page 78

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 Remove used sample plates from the locations.

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

5 Wash the liquid reservoirs and wash trays.

6 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.

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

8 (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*

For information about...	See...
Running a task	"Performing a task using Bravo Diagnostics" on page 98
Shutting down	"Starting up and shutting down" on page 19

Changing the Bravo head

About this topic

The procedure for changing the head that is mounted on the Bravo Platform is basically the same for the different types of heads, including disposable-tip heads, fixed-tip heads, and pin tools. Use the procedures in this topic to remove a mounted head, install a different head, and adjust the corresponding settings in the VWorks software.

Before you begin

⚠️ **WARNING   AssayMAP Bravo Platform only. To prevent potential injury from exposure to chemical spills, ensure that you empty the syringes before uninstalling the Bravo 96AM Head. For instructions, see "Uninstalling the Bravo 96AM Head" on page 202.**

IMPORTANT   If a head is being used for the first time, make sure you have a profile specifically for that head. If necessary, create a new profile before starting the following procedure. For details, see "Creating and managing profiles" on page 28.

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

- 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.

Removing the head and mounting a different head

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

To change the mounted Bravo head:

1   On the side of the Bravo Platform, press the power switch to the **off** (**o**) position.
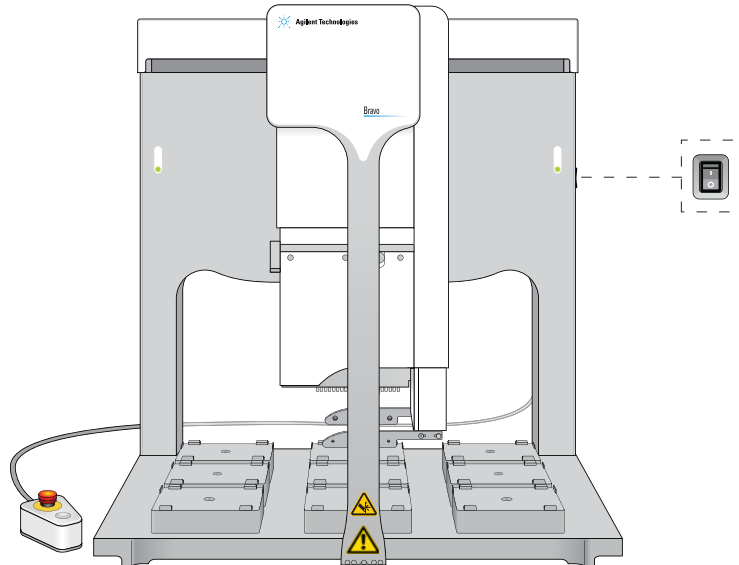
2 Make sure that the head mount is at its home position above deck location 5, as shown in the preceding figure.

If necessary, manually move the head to the center of the deck.

3 To unlock the mounted head, refer to the following figure:

a Pull out and twist the two head-retainer pins (**1**) one-quarter turn so that they remain retracted.

b Turn the head lock (**2**) counterclockwise until it clicks into position.
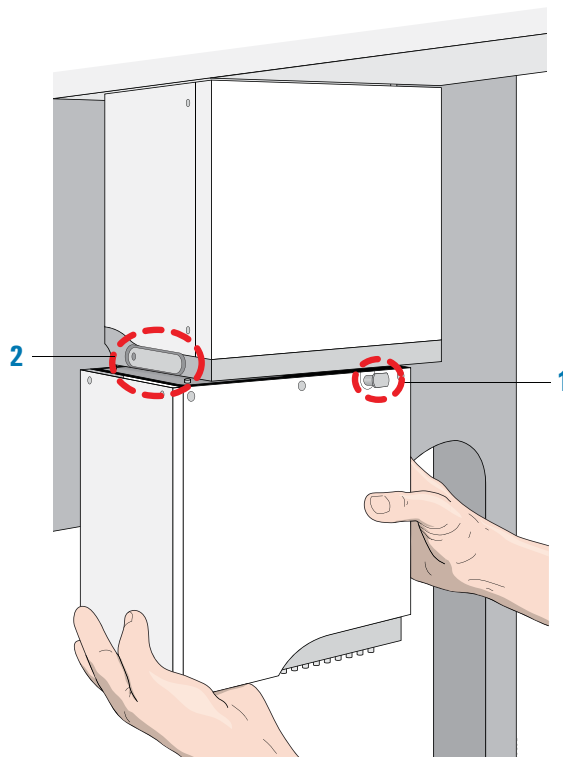
4   Grasp the head firmly using care not to touch the barrels, probes, tips, or pins. While supporting the head with your hands, use your thumbs to push the head from side to side and slide it out of the Bravo head mount.

> **CAUTION**   Carefully support the head without touching the barrels, tips, or pins. Dropping the head or bumping the barrels, tips, or pins will damage the head.

5   Carefully place the head into the head stand to protect the barrels, tips, or probes for storage as follows:

- *Disposable-tip pipette heads.* Rest the bottom of the stand on a clean, dry surface. Slide the head into the stand, with the barrels facing down, as the following figure shows.

  Figure   Series III disposable-tip head and storage stand
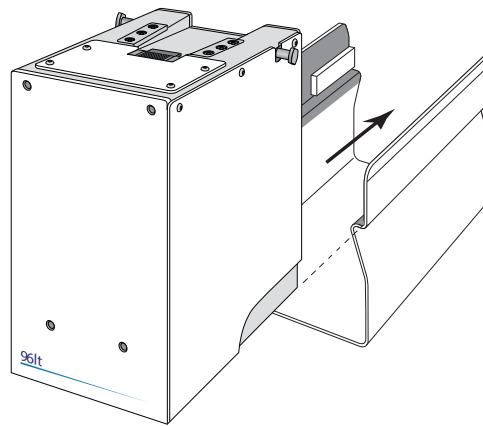
- *Fixed-tip pipette heads and pin tools.* Rest the top of the head on a clean, dry surface with the tips or pins facing up. Slide the stand onto the head as the following figure shows.

  Figure   Fixed-tip head and storage stand
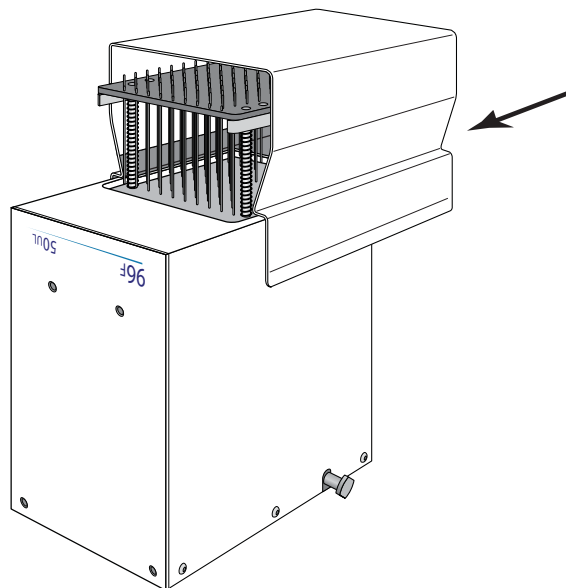
- *Bravo 96AM Head.* Ensure that the top of the head is resting on a clean, stable surface so that the probes are facing up.

  Carefully place the stand (**1**) onto the head, guiding the side cutouts onto the two side tabs (**2**) on the head. Use care to avoid touching the probes.

  Figure   Bravo 96AM Head and storage stand
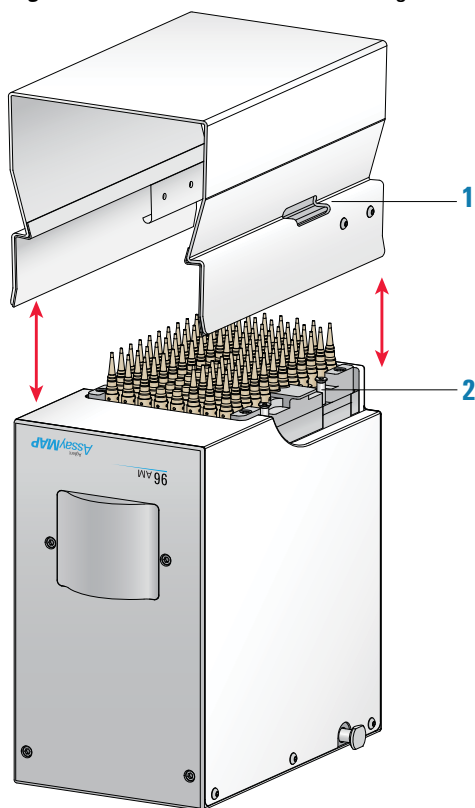
  Store the head top-side up and resting in the head stand.

6 On the head to be mounted, pull out and twist the two head-retainer pins one-quarter turn so that they remain retracted.

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

8 To lock the 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 head on the mount.
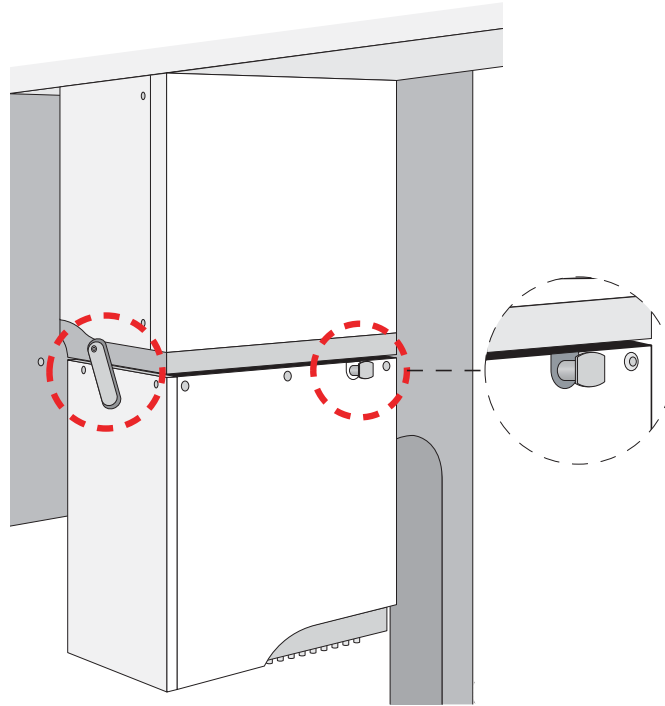
> **CAUTION**   To prevent potential contamination, avoid touching the pipette head barrels, tips, pins, or probes with your hands.

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

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

Adjusting VWorks software settings

After mounting a different Bravo head, 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 Bravo head:

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 Bravo head with this device, you must create a profile for the new Bravo head.
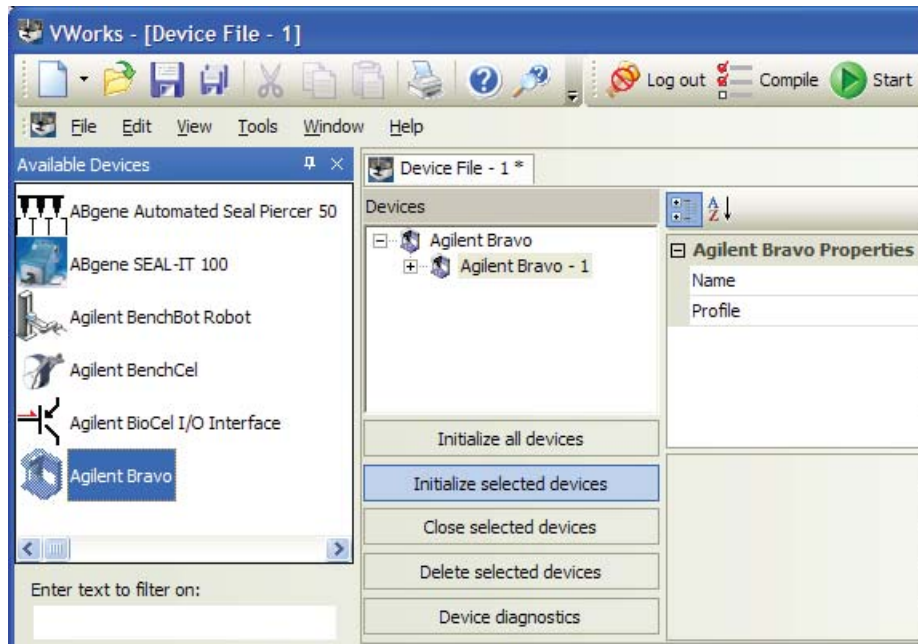
2 To initialize the Bravo Platform, click **Initialize selected devices** in the device file.

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 98
Initializing the Bravo Platform	"Initializing the Bravo Platform" on page 33
Homing the Bravo head	"Homing the pipette head" on page 84
Available Bravo heads	"Pipette heads and pin tools" on page 12
Changing the profile	"Creating and managing profiles" on page 28

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

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 5
Safety	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
How to report a problem	"Reporting problems" on page 78

Retracting tip box stripper pins

About this topic

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

Tip box stripper pins described

The disposable-tip pipette heads have four stripper pins that prevent the tip box 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-tip box, retracting the stripper pins can help prevent tips from touching other tips during a tips-on task.

Figure Pipette head components
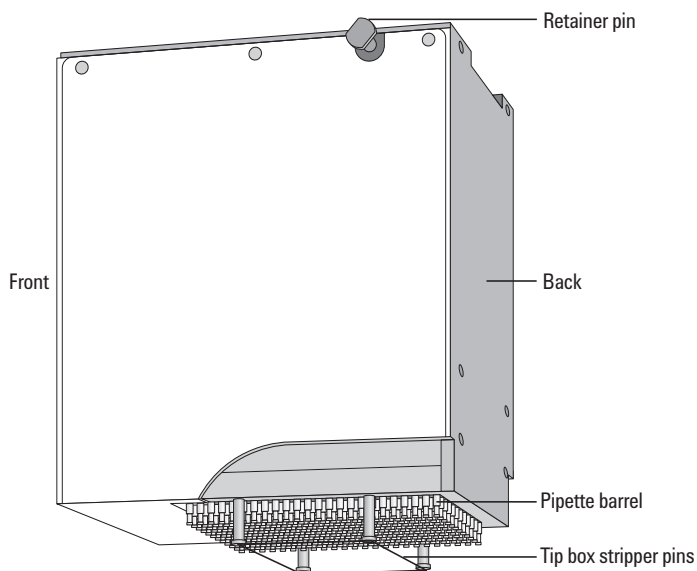
The pins are spring-loaded and should retract until the pin head is nearly flush with the surface of the pipette head. The tip of each pin, which is hidden within the pipette head housing, has a semi-circle-shaped locking mechanism that aligns with a dowel inside the pipette head to lock the pin in the retracted position.

Retracting tip box stripper pins

CAUTION If you apply too much force when pressing down or rotating the pin to retract it, the locking mechanism at the tip of the pin can bend or break. A damaged pin cannot lock in the retracted position. Use only gentle pressure to push down and rotate the pin to lock it into place.

To retract the tip box stripper pins:

1   Place the pipette head upside down on a stable surface, so that the barrels are facing up and the front of the pipette head is facing you as the following figure shows.

If directional arrows appear on the pins, gently rotate the pins so that the arrows are facing you.
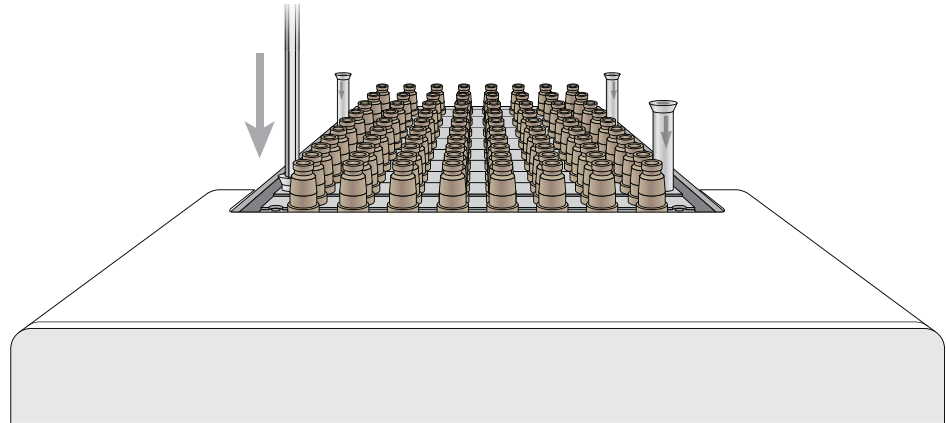
2   Insert the end of a 2-mm hex wrench into the head of one of the pins, and very gently push the pin down into the pipette head until you feel the pin stop.

Verify that the pin is properly seated, as the preceding figure shows. If the pin has an arrow, the square end of the arrow should disappear or be barely visible.

IMPORTANT   If the pin hits a stop before it retracts completely, the pin locking mechanism is above instead of below the locking dowel. While removing any downward pressure on the pin head, gently rotate the pin in quarter-turn increments until you feel the pin drop into the seated position.

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

4   Repeat this procedure for the other pins.

Releasing tip box stripper pins

To release the retracted tip box stripper pins:

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

2   Turn the wrench clockwise to release the pin.

3   Repeat this procedure 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 98
Removing and installing a pipette head	"Changing the Bravo head" on page 63

Moving the head manually

About this topic

This topic describes how to disable all servo motors, so that you can move the 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 head manually:

1   Press the red robot-disable button on the pendant.

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

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

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

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

Alternatively, in **Bravo Diagnostics**, click **Enable all motors** on the **Jog/Teach** tab.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26

For information about...	See...
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18
Moving the pipette head using Bravo Diagnostics	• "Homing the pipette head" on page 84
	• "Jogging the pipette head" on page 87
	• "Using the Move and Approach commands" on page 90

Recovering from a head collision

About this topic

Occasionally, the Bravo 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 Bravo head" on page 63
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware-related error messages" on page 77
How to report a problem	"Reporting problems" on page 78

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	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Laboratory requirements	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Changing a fuse	"Replacing the fuse" on page 69
Setting teachpoints	"Setting teachpoints" on page 36
Accessories	"Accessories overview for the Bravo Platform" on page 102
Safety guidelines	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Stopping in an emergency	"Emergency stops" on page 56
Reporting a problem	"Reporting problems" on page 78

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 28
Turning on or off the Bravo	"Starting up and shutting down" on page 19
Preparing the Bravo for a run	"Workflow for preparing a protocol run" on page 56
Hardware components	"Hardware overview" on page 5
Connecting Ethernet cables	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*

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

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

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

Reporting hardware problems

When contacting Agilent Technologies, make sure you have the serial number of the device ready. 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
- Form file (*.VWForm)

Reporting user guide problems

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

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

Related information

For information about…	See…
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75
	• "Troubleshooting hardware-related error messages" on page 77
Software error messages	*VWorks Automation Control User Guide*
Stopping in an emergency	"Emergency stops" on page 56
Shutting down	"Starting up and shutting down" on page 19

5
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.

⚠ **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

⚠ **WARNING**   **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.**

Contents of the Jog/Teach tab

The Jog/Teach tab enables you to:

- Control the Bravo Platform motion
- Edit teachpoints
- Home the head and adjust its speed
- Move the 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.
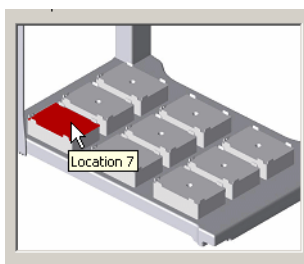
Pipette head control procedures

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

Procedure	See…
Home the pipette head	"Homing the pipette head" on page 84
Disable all pipette head motors	"Moving the head manually" on page 72
Edit teachpoints	"Setting teachpoints" on page 36
Change the speed of the pipette head	"Changing the pipette head speed" on page 89
Jog the pipette head	"Jogging the pipette head" on page 87

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 36
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 84 • "Jogging the pipette head" on page 87 • "Using the Move and Approach commands" on page 90
Moving the pipette head manually	"Moving the head manually" on page 72
The four axes of the Bravo instrument	"Hardware overview" on page 5

Homing the pipette head

About this topic

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

> **WARNING** To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.

> **WARNING** The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.

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.

Homing in this axis ...	Moves the ...
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 $z\rightarrow x\rightarrow y$.

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.
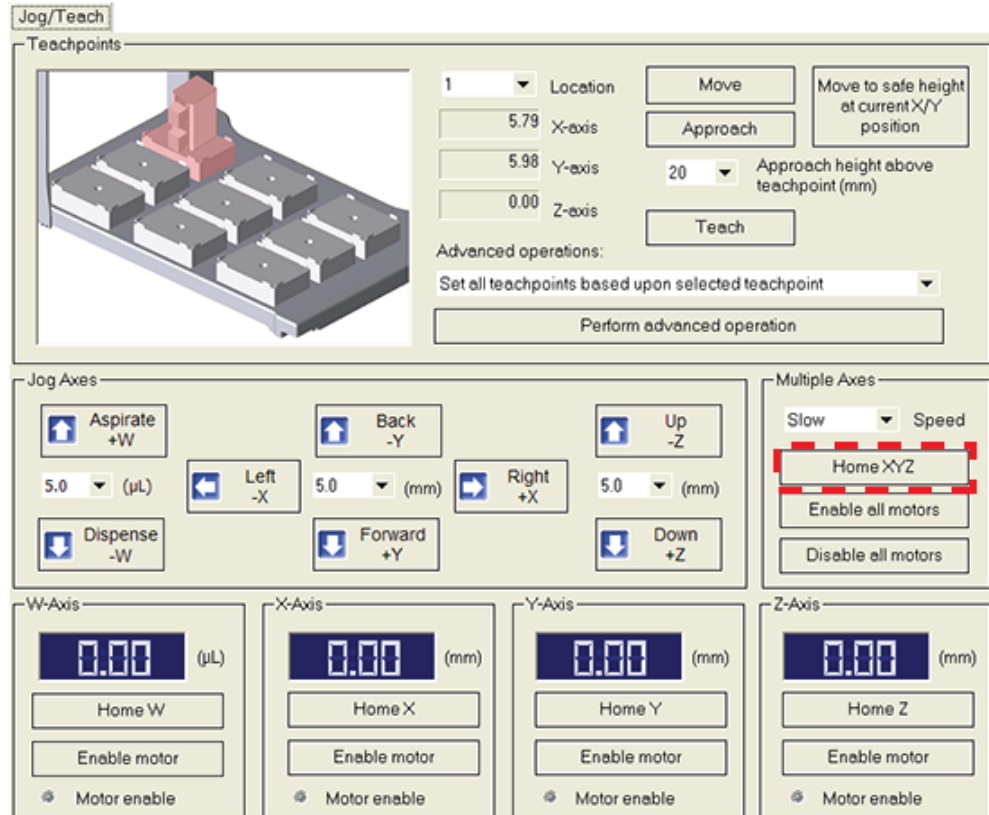
Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 84
	• "Jogging the pipette head" on page 87
	• "Using the Move and Approach commands" on page 90
Moving the pipette head manually	"Moving the head manually" on page 72
Changing the pipette head	"Changing the Bravo head" on page 63

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.

⚠️ **WARNING** **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

⚠️ **WARNING** **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.**

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.
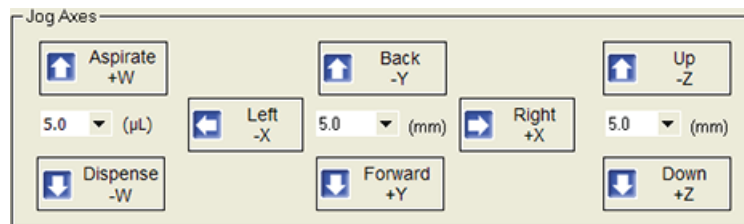
3 Click a direction button to move the pipette head.

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.
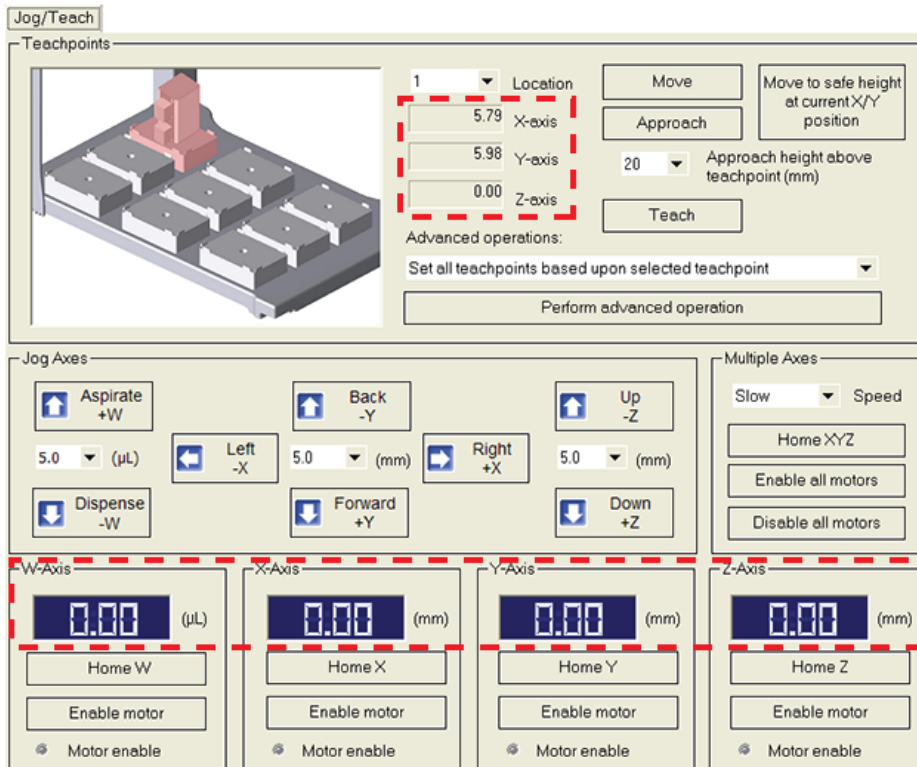
Related information

For information about...	See...
Teachpoints	"Setting teachpoints" on page 36
Opening diagnostics	"Opening Bravo Diagnostics" on page 26
Jog/Teach tab	"About the Jog/Teach tab" on page 82
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 84 • "Using the Move and Approach commands" on page 90
Moving the pipette head manually	"Moving the head manually" on page 72
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

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.

⚠️ **WARNING** **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.**

⚠️ **WARNING** **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.**

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.
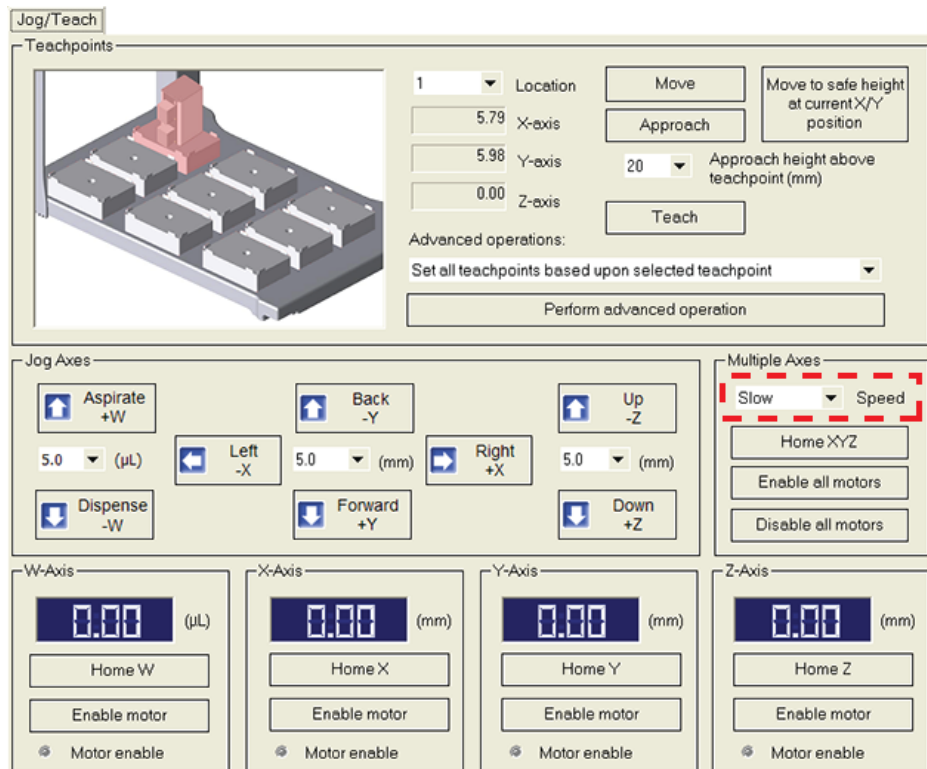
3 Click **OK** at the bottom of the **Jog/Teach** tab for the changes to take effect. The speed settings apply only when using Bravo Diagnostics.

Related information

For information about...	See...
Jog/Teach tab	"Jog/Teach tab quick reference" on page 270
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing a teachpoint	"Setting teachpoints" on page 36
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

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.

⚠️ **WARNING** To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.

⚠️ **WARNING** The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.

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 270
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 84 • "Jogging the pipette head" on page 87
Moving the pipette head manually	"Moving the head manually" on page 72
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing a teachpoint	"Setting teachpoints" on page 36
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

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.

⚠️ **WARNING** **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.**

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
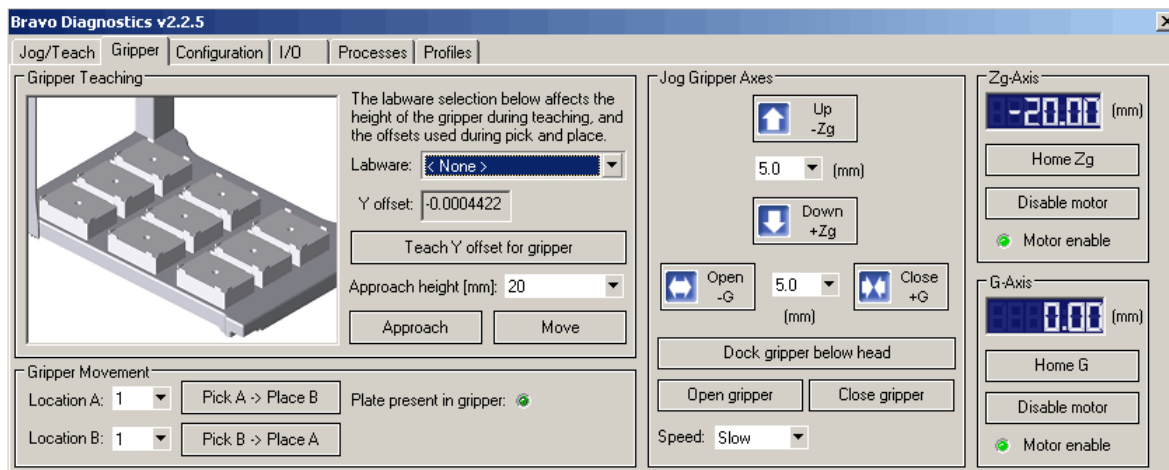
Specifying the labware

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.

The labware selection below affects the height of the gripper during teaching, and the offsets used during pick and place.

Labware: < None >
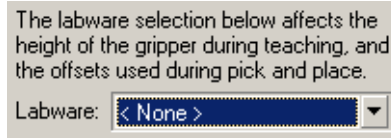
Adjusting the y-axis offset

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 .

Y offset: -0.0004422

Teach Y offset for gripper
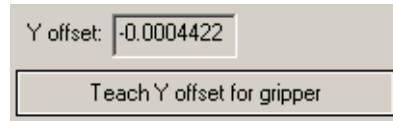
Using the Move and Approach commands

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.

Approach height [mm]: 20

Approach   Move
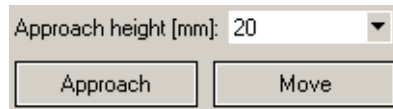
Picking up and moving labware

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.
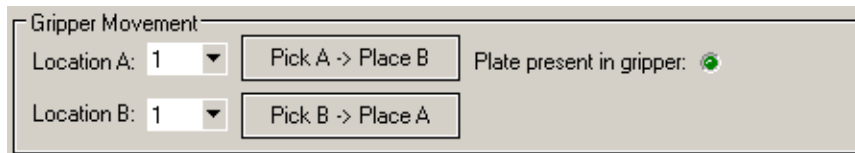
Jogging the gripper

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.
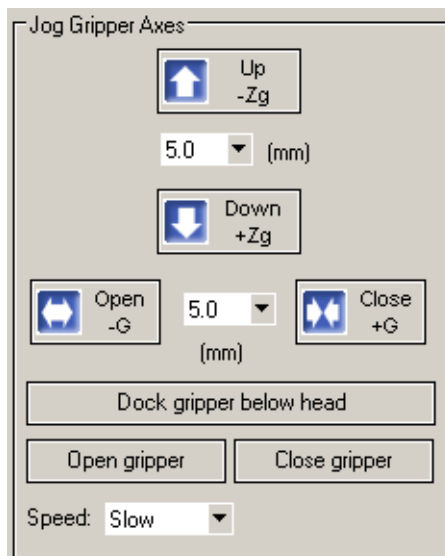
Opening and closing the gripper

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.
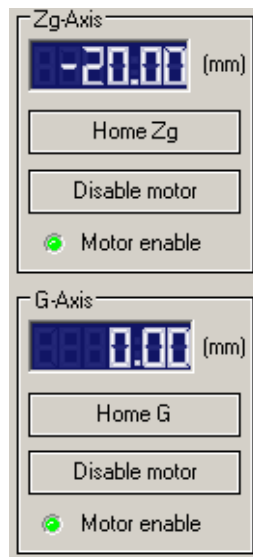
Docking the gripper

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.
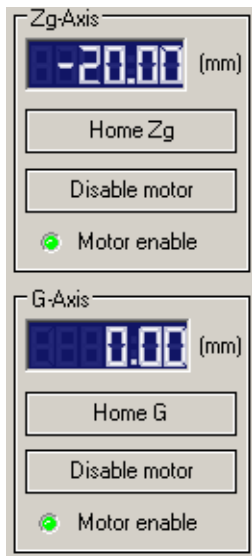
Related information

For information about…	See…
Gripper tab	• "Verifying the gripper setup" on page 43 • "Gripper tab quick reference" on page 274
Using the Jog/Teach tab controls to move the pipette head	• "Homing the pipette head" on page 84 • "Jogging the pipette head" on page 87 • "Using the Move and Approach commands" on page 90
Moving the pipette head manually	"Moving the head manually" on page 72
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing a teachpoint	"Setting teachpoints" on page 36
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18

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 268
Defining labware	*VWorks Automation Control User Guide*
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18
Troubleshooting motor fault error and power cycling	"Troubleshooting hardware problems" on page 75
Reporting problems	"Reporting problems" on page 78

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.

⚠️ **WARNING** **The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.**

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.
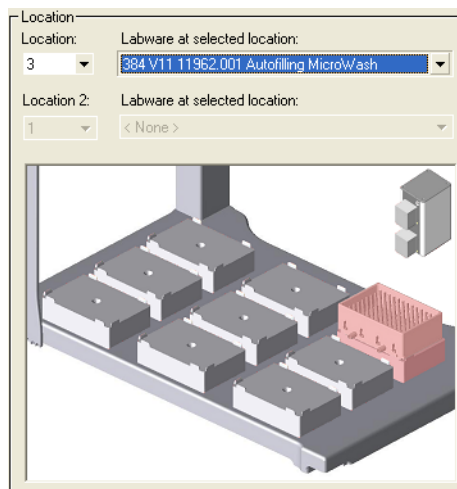
3   Select the labware from the **Labware at selected location** list.

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 disposable-tip heads and Bravo 96AM Head only.* To use one row or column of channels instead of all channels in the head:

a   Click **Set head mode**.

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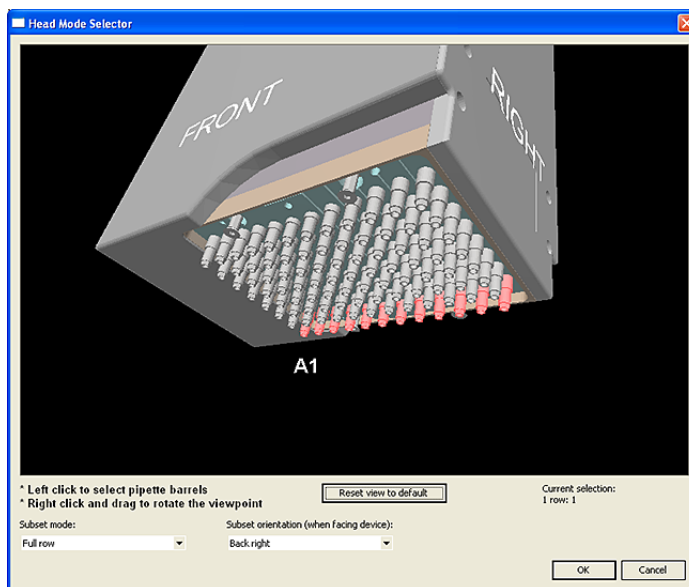
Note: If you select a single row on a disposable-tip head, make sure you retract the head stripper pins.

6   If you are using the head in serial mode or the 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.
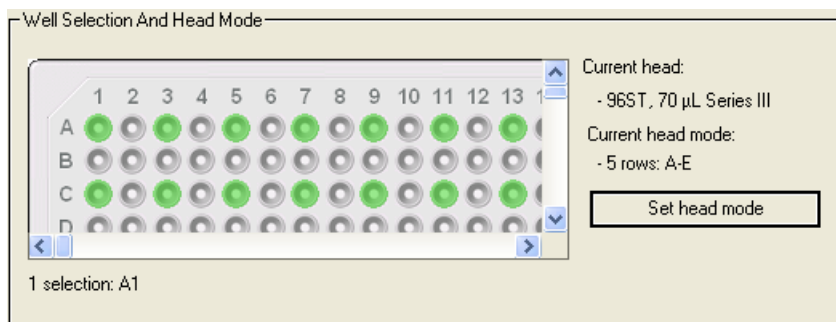
7   In the **Command Parameters** area:

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

b   Set the parameter values for the command.

Command to execute	Parameter description
Aspirate	"Aspirate task parameters" on page 284
Assemble Vacuum Disassemble Vacuum	"Vacuum Filtration Station task parameters" on page 298
Dispense	"Dispense task parameters" on page 288
Dispense to Waste	"Dispense to Waste task parameters" on page 290
Mix	"Mix task parameters" on page 293
Pump Reagent	"Pump Reagent parameters" on page 296
Shake	"Shake task parameters" on page 297
Tips On Tips Off	No parameter settings
Move and Filter Plate	"Vacuum Filtration Station task parameters" on page 298
Wash Tips	"Wash Tips task parameters" on page 302
Pin Tool	"Pin Tool task parameters" on page 304
Bravo 96AM Head only	
AM Aspirate	"AM Aspirate task parameters" on page 308
AM Cartridges On AM Cartridges Off	No parameter settings
AM Dispense	"AM Dispense task parameters" on page 313
AM Mix	"AM Mix task parameters" on page 318
AM Wash Syringes	

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

Note: To stop a process before completion, click **Stop motors** to stop the movement of the Bravo head. 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 281
Setting up the Bravo Platform	"Workflow for setting up the Bravo Platform" on page 18
Retracting the stripper pins	"Retracting tip box stripper pins" on page 70
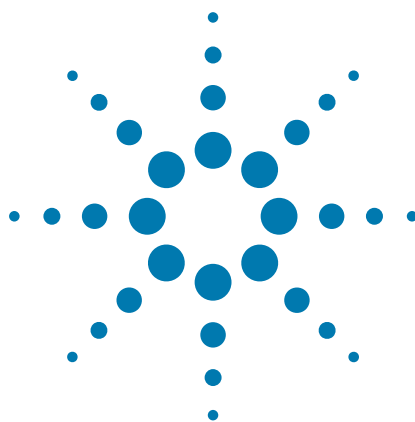
A
Accessories and platepads

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:

For details on how to set up accessories on the AssayMAP Bravo Platform, see "About installing the AssayMAP Bravo Platform" on page 200.

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 104
Alignment Station	Positions 1536-well microplates for precise pipetting and ST tip boxes for precise tips-on operations. The Alignment Station can also be used for 384-well microplates.	"Installing an Alignment Station" on page 142
Autofilling accessories	Consists of the following: • Pump Module • Auto Filling Reservoir, Tip Wash Station, or Open Wash Tray • Weigh Station (optional)	"Autofilling accessories" on page 165.
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 175
Delidding option (Bravo Diagnostics)	Enables you to configure a platepad in the software to accept a lid in a delidding process. You use Bravo Diagnostics to configure this option.	"Configuring a platepad for delidding" on page 141
Filter Plate Holder	Provides a location for a filter plate while awaiting assembly of the Vacuum Filtration Station and when disassembling the station.	"Setting up a Trash or Filter Plate Holder accessory" on page 136

Accessory	Description	See...
Heating Shaking Station (Teleshake 95)	Provides heating and fluid mixing across a microplate. The station uses the Inheco Single TEC Control (STC) or Multi TEC Control (MTC).	"Setting up thermal and shaking stations (Inheco controller)" on page 149
Light Curtain	Pauses or stops the operation if the operator reaches into the Bravo Platform during a run.	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
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.
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 146
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 107
Peltier Thermal Station (CPAC Ultraflat)	Uses Peltier technology to provide temperature control uniformly across a microplate. The station uses the Inheco Single TEC Control (STC) or Multi TEC Control (MTC).	"Setting up thermal and shaking stations (Inheco controller)" on page 149
Nested Rack Insert	Provides stability for a stack of nested tip boxes to ensure precision during a tips-on process.	"Setting up a Nested Rack Insert" on page 143
Orbital Shaking Station	Mixes labware contents using a shaking motion.	"Setting up the Orbital Shaking Station" on page 112
SRT platepad for 250-µL tip boxes	Enables tips on and tips off tasks using the 250-µL tip box on the shorter SRT Bravo Platform.	"(Bravo SRT only) Setting up an LT tip box location" on page 158
Thermal Station (chiller)	Uses a fluid-filled thermal block to provide temperature control uniformly across a microplate.	"Setting up the Thermal Station" on page 147
Trash location	Installs in a deck location 4 or 6 cutout to provide through-deck access to a trash container underneath the deck.	"Setting up a Trash or Filter Plate Holder accessory" on page 136

Accessory	Description	See...
Vacuum Filtration Station	Uses vacuum to filter the contents of a microplate.	"Setting up the Vacuum Filtration Station" on page 120

Related information

For information about...	See...
Pipette heads	"Pipette heads and pin tools" on page 12
AssayMAP Bravo Platform	"AssayMAP Bravo Platform" on page 189
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 Accessories Hub is required for operating the Microplate Vacuum Alignment Station.

Optionally, the following accessories can be connected to the hub: Barcode Reader, Light Curtain, Orbital Shaking Station, and 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
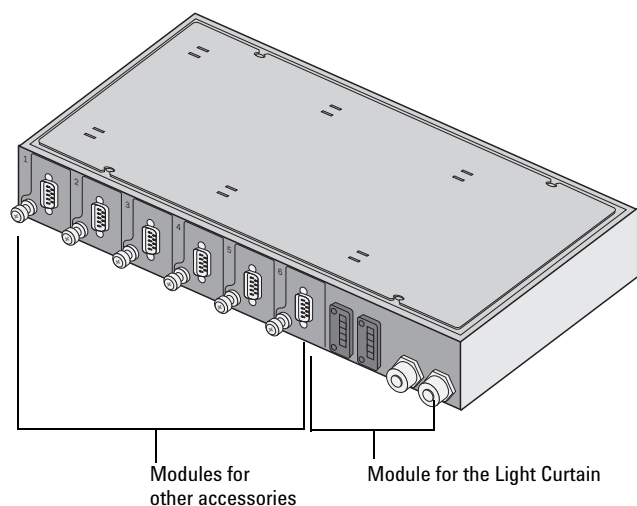
Before you start

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)

Power socket (to AC outlet with grounded circuit)

USB type B port (to another Accessories Hub)

USB type A port (to Bravo computer)
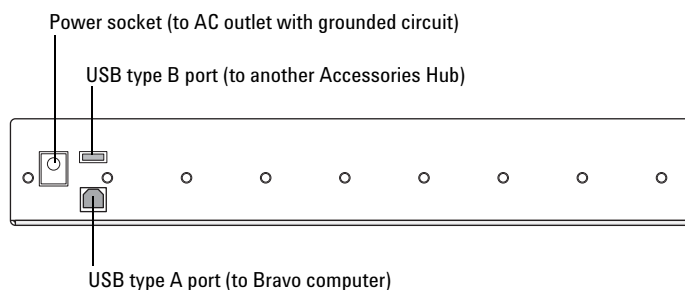
Figure   Accessories Hub connections

To accessory

Module port

Accessories Hub

Power socket

USB type B

USB type A

To AC outlet with grounded circuit

To the USB type B port on another Accessories Hub

USB port

Controlling computer
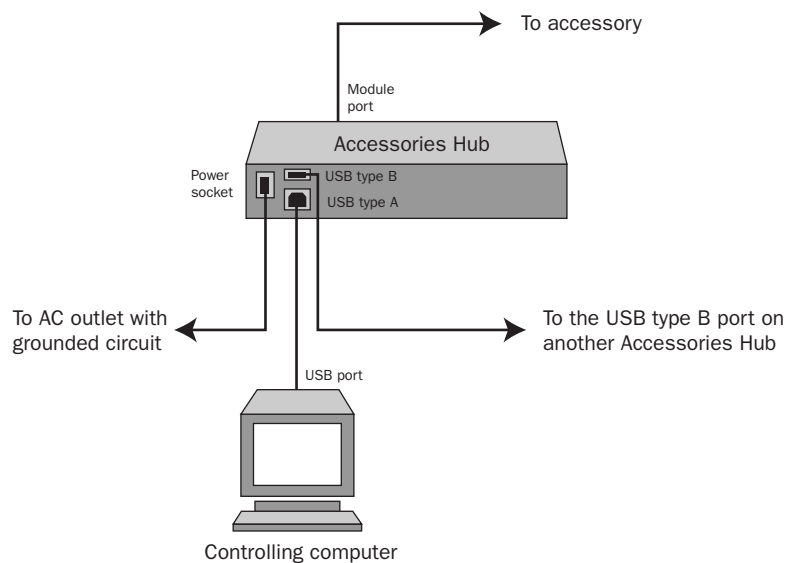
To remove the Accessories Hub:

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…
Installing the Light Curtain	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
Barcode Reader	*"Setting up the Barcode Reader" on page 175*

For information about...	See...
Microplate Vacuum Alignment Station	"Setting up a Microplate Vacuum Alignment Station" on page 107
Orbital Shaking Station	"Setting up the Orbital Shaking Station" on page 112
Vacuum Filtration Station	"Setting up the Vacuum Filtration Station" on page 120
Using an accessory in a protocol	*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
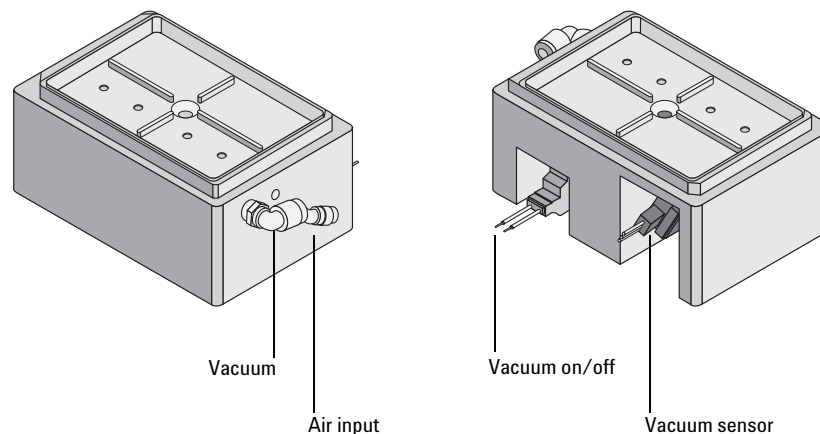
Setup workflow

Step	Procedure	See...
1	Ensure that your site can provide the compressed air and vacuum requirements.	"Requirements for compressed air and vacuum" on page 108
2	Install the Microplate Vacuum Alignment Station.	"Installing or removing the Microplate Vacuum Alignment Station" on page 108
3	Configure the station in Bravo Diagnostics.	"Configuring the Microplate Vacuum Alignment Station in Bravo Diagnostics" on page 110
4	Adjust the teachpoint if you have not already done so.	"Setting teachpoints" on page 36
5	Test the station to verify that it is properly connected and configured.	"Testing the Microplate Vacuum Alignment Station" on page 110

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
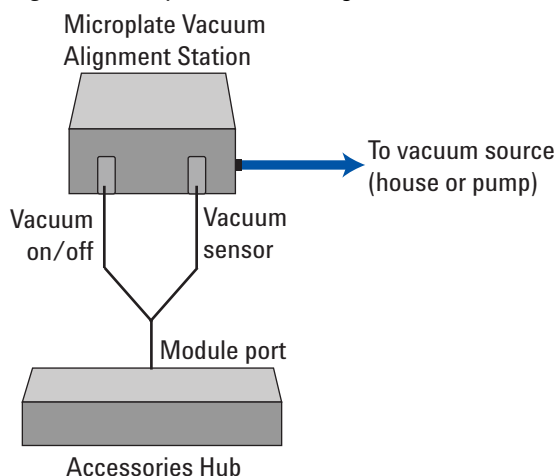
To install the Microplate Vacuum Alignment Station:

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 42*.

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**.
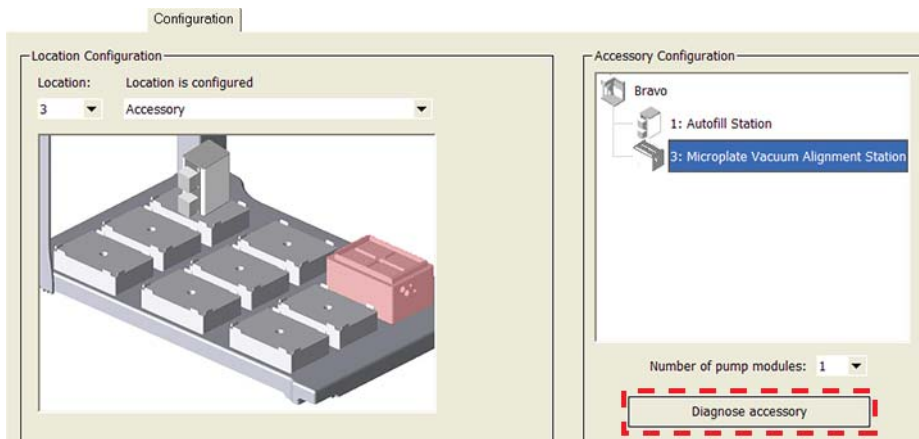
4 In the **Accessory Diagnostics** dialog box, click **Vacuum On** to open up the vacuum supply to the Microplate Vacuum Alignment Station.
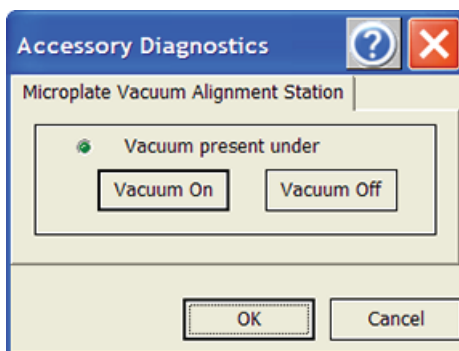
5 Verify that the **Vacuum Present** indicator is green.

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 5
Accessories Hub	"Installing the Accessories Hub" on page 104
Editing teachpoints	"Setting teachpoints" on page 36
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.

Figure   Orbital Shaking Station and adapter pad

Orbital Shaking Station

Adaptor pad
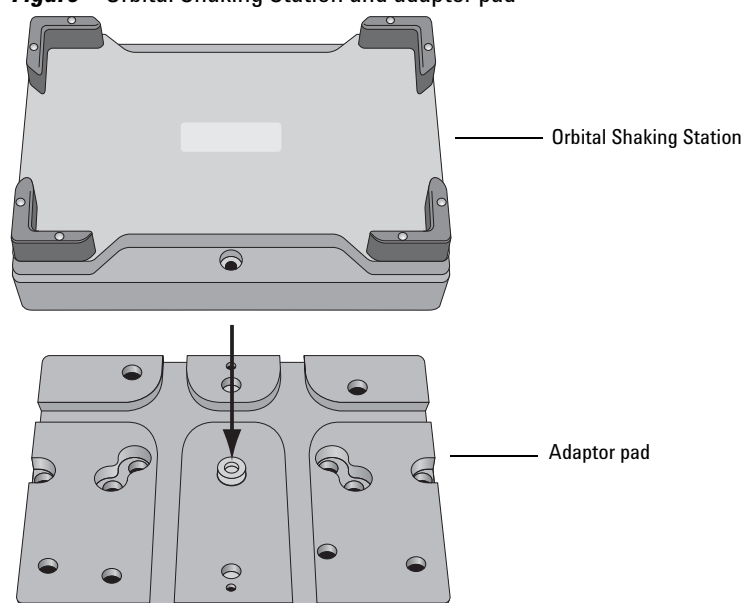
Setup workflow

Step	Procedure	See...
1	Install the Orbital Shaking Station.	"Installing the Orbital Shaking Station" on page 113
2	Configure the station in Bravo Diagnostics.	"Configuring the Orbital Shaking Station in Bravo Diagnostics" on page 115
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.	"Adjusting the teachpoint using a teach plate" on page 118
4	Test the station operation.	"Testing the Orbital Shaking Station" on page 116

Installing the Orbital Shaking Station

Before you begin

Make sure you have the following:

- Orbital Shaking Station
- Adapter pad (supplied with the Orbital Shaking Station)
- Sockethead screw that holds the adapter 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 adapter pad in the same deck location.

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

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

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

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

5 Insert the two smaller sockethead screws into the holes at the front and back end of the adapter 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)
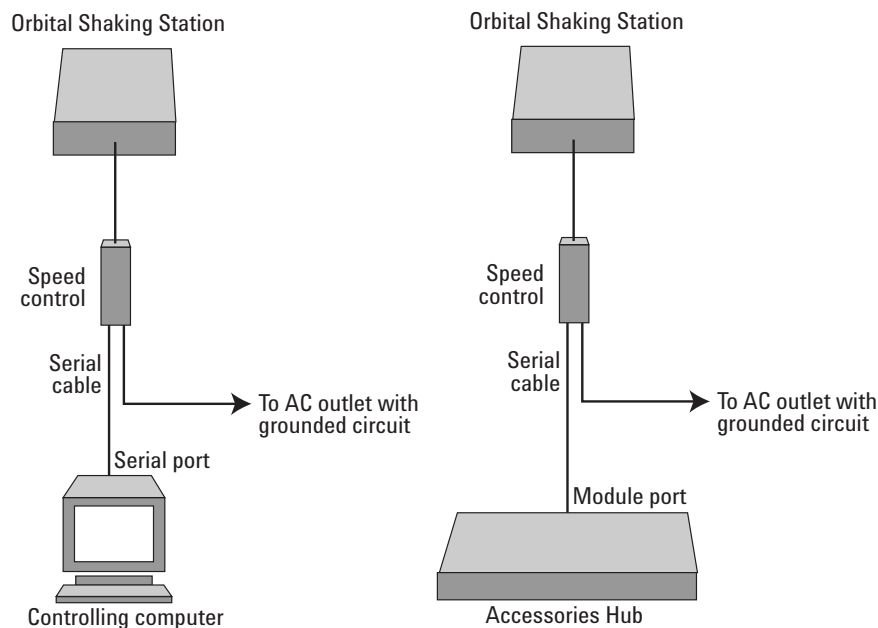
Figure   Connecting multiple Orbital Shaking Stations
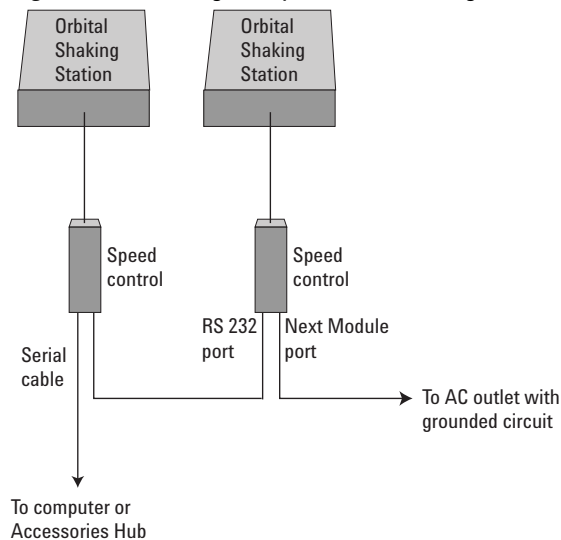
To remove the Orbital Shaking Station:

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 adapter pad.

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

6 Remove the adapter 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.

Module 1   Module 2   Module 3

To AC outlet with
grounded circuit

To computer or
Accessories Hub
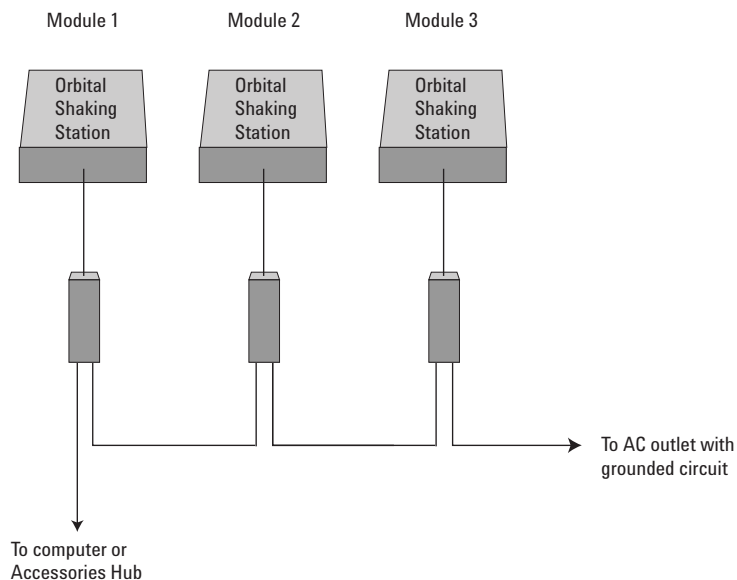
5   Click **Finish**.

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**.

8   Verify and adjust the teachpoint for the accessory location. See "Adjusting the teachpoint using a teach plate" on page 118.

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**.
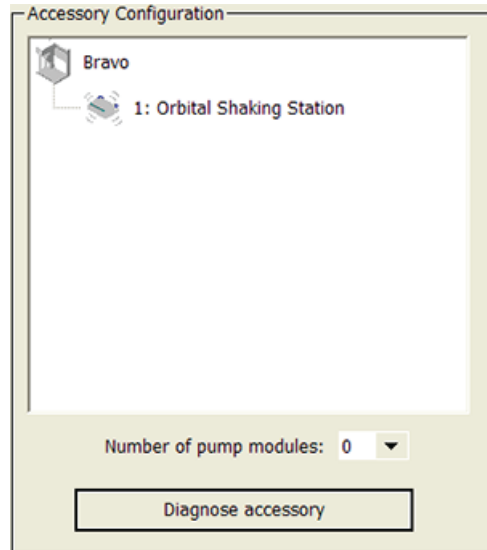
4 In the **Accessory Diagnostics** dialog box, set the following parameters.

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

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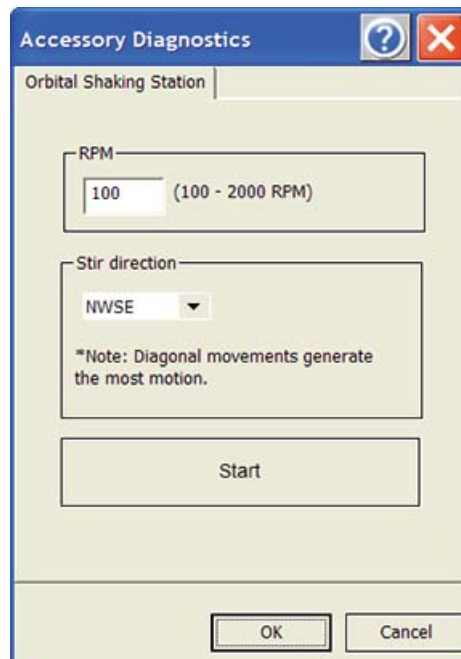
5 Click **Start**.

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 5
Accessories Hub	"Installing the Accessories Hub" on page 104
Adjusting the teachpoint	"Using the teach plate to set the teachpoint for an accessory" on page 118
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Using the teach plate to set the teachpoint for an accessory

About this topic

If the deck location teachpoint requires verification and possible adjustment after certain Bravo accessories are installed, such as the Orbital Shaking Station, use the procedure in this topic to verify and adjust the teachpoint using a teach plate.

Adjusting the teachpoint using a teach plate

Before you begin, ensure that you have the teach plate. The teach plate is a 10 mm thick metal plate that fits on a deck platepad. The teach plate has a crosshairs in one corner.

Figure   Teach plate
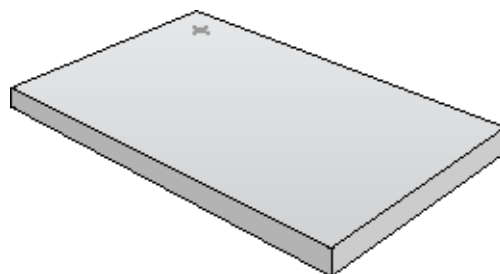
IMPORTANT   When editing the teachpoint for the accessory, you must account for the teach plate height before setting the teachpoint.

To set a teachpoint using the teach plate:

1   Place the teach plate on the accessory installed at the given deck location.

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

3 In the **Location** list, select the deck location of the accessory.

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 39.

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

6 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 station's top surface.

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

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

Related information

For information about...	See...
Bravo Platform hardware components	"Hardware overview" on page 5
Editing teachpoints	"Setting teachpoints" on page 36
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.

This topic contains the following information:

- "Before you start" on page 120
- "Component descriptions and options" on page 121
- "Supported stacking configurations" on page 123
- "Installing the station" on page 123
- "Connecting to house vacuum with the pinch-valve module" on page 125
- "Connecting and configuring the Agilent VARIO Vacuum Pump" on page 126
- "Uninstalling the Vacuum Filtration Station" on page 130
- "Configuring the Vacuum Filtration Station for the VWorks software" on page 130
- "Testing the Vacuum Filtration Station" on page 132

Before you start

The Vacuum Filtration Station may be installed on a standard Bravo Platform and is compatible with the Series III disposable-tip pipette heads only. Agilent Technologies recommends installing the station on a short platepad (SRT platepad). The Vacuum Filtration Station is not supported on the SRT Bravo Platform.

The following table presents the workflow for setting up and automating the assembly and disassembly processes for the Vacuum Filtration Station.

Step	For this task...	See...
1	Determine which components of the Vacuum Filtration Station are required for your labware.	"Component descriptions and options" on page 121 "Supported stacking configurations" on page 123 - Vacuum Filtration Station Labware Compatibility Matrix
2	Install the Vacuum Filtration Station.	"Installing the station" on page 123
3	In Bravo Diagnostics, configure the Vacuum Filtration Station in the device profile.	"Configuring the Vacuum Filtration Station for the VWorks software" on page 130

Step	For this task…	See…
4	In the VWorks Labware Editor, ensure that the labware definitions are correct for the filter and collection plates that will be placed on the Vacuum Filtration Station during a protocol run. Set the microplate parameters and the Bravo gripper offset for the labware.	*VWorks Automation Control Setup Guide*
5	In the VWorks software, add one or more pairs of the vacuum assembly and disassembly tasks in the protocol.	*VWorks Automation Control User Guide*

Component descriptions and options

The Vacuum Filtration Station applies vacuum to filter the contents of microplates placed on the station. The station consists of a collar and a manifold base that can be assembled and disassembled automatically. The following figure shows the primary components.

Figure   Vacuum Filtration Station components: **A** collar options, **B** base and optional inserts

Item	Name.	Description
1	Collar with blue gasket and clear gasket frame support	The top of the vacuum manifold, which can be placed in different stacking configurations, as described in the following section.
		The collar is available in standard and deep-well models. The deep-well collar is required to accommodate plate-on-plate stacking for deep-well microplates. The Bravo device profile configuration specifies the collar size.
		IMPORTANT If the assembled vacuum configuration includes a filter plate on top of the collar, ensure that the clear plastic frame is seated in the blue gasket to reinforce it.
		Note: Different types of gasket frame inserts are available. See the manufacturer's user documentation for a detailed description.
2	Black gaskets for collar	The same collar as item **1**, except the flexible blue gasket is replaced with two black gaskets that are held in place by an adhesive. One black gasket adheres to the top of the collar, and the second black gasket adheres to the underside surface of the collar top to maintain the correct spacing underneath the collar.
		Use the black gaskets instead of the blue gasket in the following configurations:
		• If the type of filter plate cannot be seated on the blue gasket fitted with the clear gasket frame, you may replace the blue gasket with the two black gaskets to accommodate the filter plate. In this case, adhere one black gasket on top and one black gasket on the underside of the collar.
		• If the filter plate nozzles are too short to reach the wells in the collection plate underneath the collar, you may omit the black gasket on the underside of the collar. If you do this, ensure that you specify the collar option in the Bravo device profile as **Black gasket on top side only**.
3	Inserts	The white plastic spacers that can be placed in the base manually before starting the protocol, if required, to raise the height of a collection plate that sits underneath the collar. Two sizes are available. You may use multiple inserts in combination for a combined height of 15 mm, maximum.
4	Base	The bottom of the vacuum manifold that connects to the vacuum source. The base should be installed on a short platepad to compensate for the height of the assembled station including labware.

For more details about the Vacuum Filtration Station collar and base, see the Millipore user documentation.

IMPORTANT   Ensure that the base of the station is installed on a short platepad (SRT platepad). If the Vacuum Filtration Station configuration is too tall for the Bravo gripper to assemble without the risk of a collision, an error will occur during the run.

Supported stacking configurations

In addition to the basic configuration of the collar stacked on the station base, other configurations can be automatically assembled and disassembled during a protocol run. The common configuration options are as follows:

- *Configuration A.* The filter and collection plates are part of the station assembly.

  Note: Double-filtration is possible in configuration A by including one filter plate as part of the station assembly and a second filter plate on top of the vacuum collar.

- *Configuration B.* The filter plate is not part of the station assembly. The robot will move the filter plate to the station during the protocol run after the assembly process is finished.

- *Configuration C.* The filter plate is not part of the station assembly. The robot will move the filter plate to the station during the protocol run after the assembly process is finished.
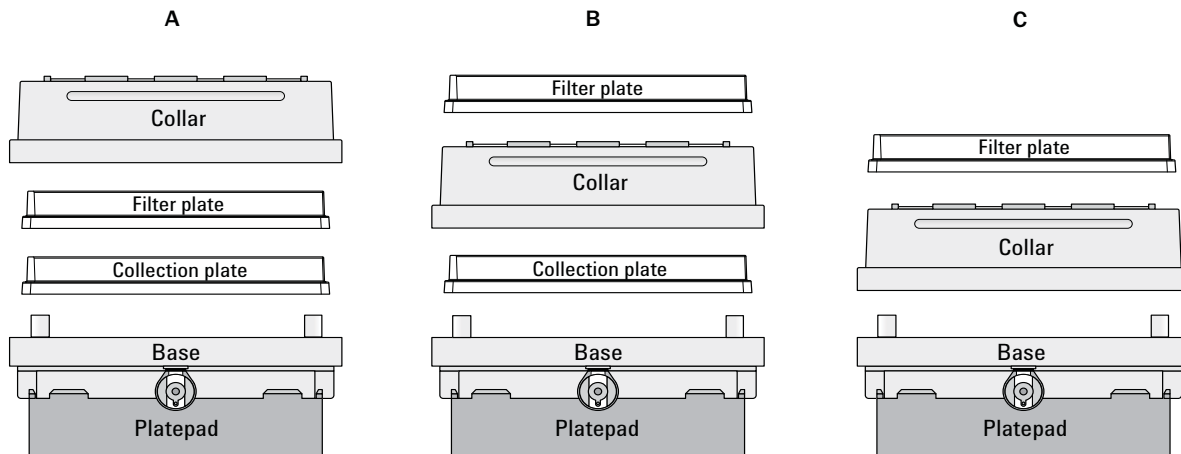
Installing the station

Before you begin

⚠️ **WARNING**   **To avoid potential injury and damage to the device, turn off the device before installing or removing an accessory.**

Make sure you have the following:

- Vacuum Filtration Station kit (contains the vacuum manifold base and collar, tubing for robotic setup, waste bottle, and filter)

  IMPORTANT   An SRT platepad is typically required to provide clearance for the height of the assembled vacuum stack.

- M1.5 hex wrench
- Vacuum source: House (requires pinch-valve module) or Agilent ME4C VARIO Pump
- Available serial port on the controlling computer

IMPORTANT   Inspect the Vacuum Filtration Station base to ensure that it is ready for robotic use: (**1**) Remove the plug, if present, that blocks the vacuum port from within the base. (**2**) Unscrew the four rubber feet if installed on the base.

Figure   Removal of (**1**) plastic plug from vacuum port and (**2**) rubber feet from base
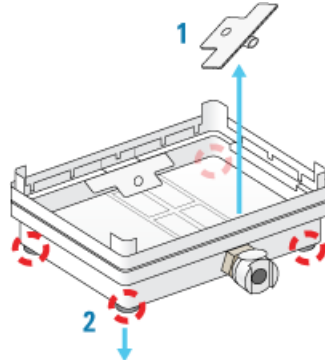
Determining the installation location

Make sure that the installation location for the Vacuum Filtration Station base enables routing of the tubing.

For example, on the Bravo deck, you can install the Vacuum Filtration Station on a platepad at deck location 1, 2, or 3 if you want to route the tubing out the rear opening.

Figure   Bravo deck (top view) locations 1, 2, and 3 on the back row
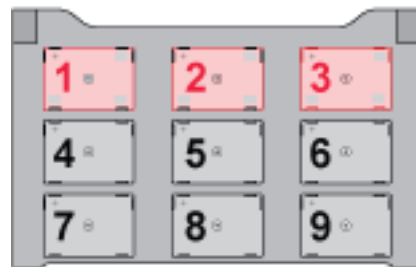
To install a Vacuum Filtration Station:

1   Place the base of the Vacuum Filtration Station on the platepad.

Ensure that the base sits level and that the vacuum port faces in the correct orientation for the tubing exit.

2   To secure the base, use a M1.5 hex wrench to tighten the setscrew in the platepad tab.

3   Connect the Vacuum Filtration Station as required for the type of vacuum source:

- House vacuum with pinch-valve module.
- Agilent VARIO Pump.

Connecting to house vacuum with the pinch-valve module

IMPORTANT   The pinch-valve tubing can collapse with regular use over time, resulting in inadequate vacuum flow for the Vacuum Filtration Station. Ensure that you replace the tubing periodically to keep the Vacuum Filtration Station functioning as intended.

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
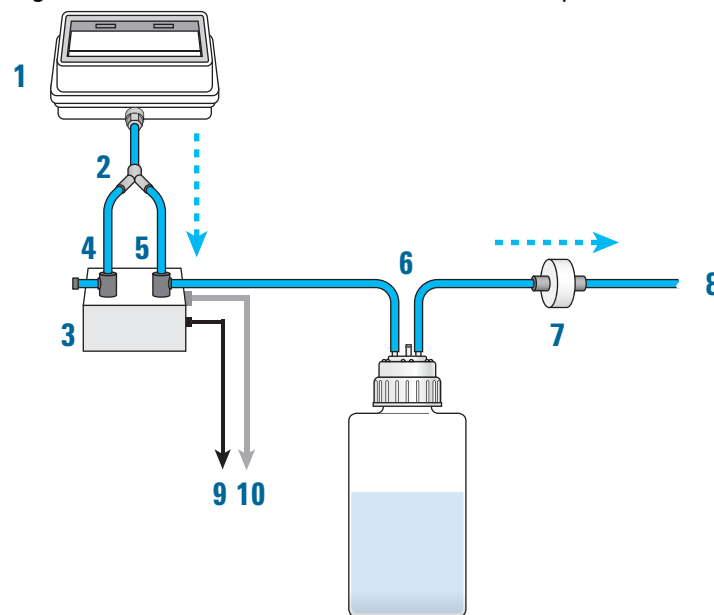
Item	Description	
1	Vacuum Filtration Station	Contains a vacuum port on the base that connects to the tubing.
2	Three-way connector	Branches the tubing from the base to the vent and valve ports on the pinch-valve module.
3	Pinch-valve module	Regulates the vacuum pressure and routes the fluid from the station to the waste bottle.
4	Vent port	Routes the vent tubing on the pinch-valve module.
5	Valve port	Routes the tubing from the waste bottle and vacuum supply to the Vacuum Filtration Station.
6	Waste bottle	Collects the waste solution from the filtration process.
7	Filter	Prevents particulates from the entering the vacuum supply.

Item	Description	
8	House vacuum	Provides the vacuum supply for the filtration process.
9	Communication cable, serial	Connects the pinch-valve module to the com port on the controlling computer.
10	Power cord	Connects the pinch-valve module to an AC outlet.

To connect the Vacuum Filtration Station to a vacuum source via the pinch-valve module:

1 Make sure the Vacuum Filtration Station base (**1**) is installed on the platepad.

2 Connect the tubing as follows:

    a Connect the tube with the quick-disconnect fitting to the port on the Vacuum Filtration Station base.

    b Connect the other end of the tubing to the pinch-valve module (**3**) using the three-way connector (**2**). One tube connects to the vent port (**4**), and the second tube connects through the valve port (**5**) to the waste bottle.

    c Connect the output tubing from the waste bottle to the vacuum source.

3 Connect the communications cable (**10**) from the pinch-valve module to a serial com port on the controlling computer.

4 Connect the power cable (**9**) from the pinch-valve module to an AC outlet.

5 Configure the Vacuum Filtration Station in the automation software.

Connecting and configuring the Agilent VARIO Vacuum Pump

The following figure shows the Agilent ME4C NT VARIO Vacuum Pump.

Figure   Agilent ME4C NT VARIO Vacuum Pump
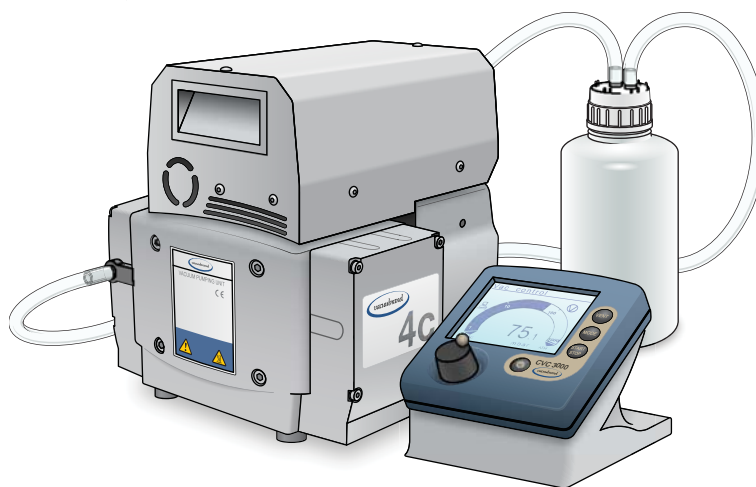
For detailed instructions about the VARIO pump, see the manufacturer's Instructions for use, provided with the pump.

The following figure shows the connections for a Vacuum Filtration Station that uses the ME4C NT VARIO Vacuum Pump.

Figure   Vacuum Filtration Station connections for ME4C NT VARIO Vacuum Pump
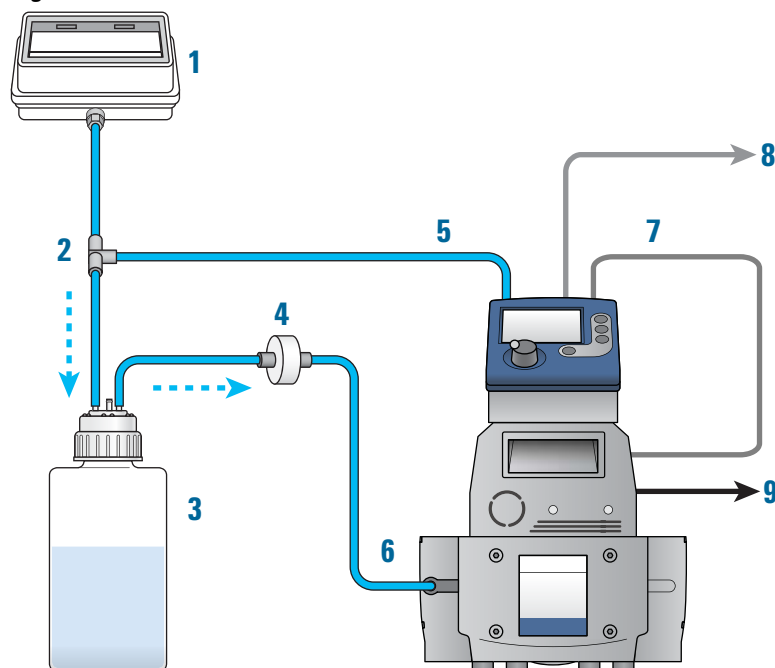
Item	Description	
1	Vacuum Filtration Station	Contains a vacuum port on that base that connects to the tubing.
2	Three-way connector	Branches the tubing from the station's base to the pump and the waste bottle.
3	Waste bottle	Collects the waste solution from the filtration process.
4	Filter	Prevents particulates from the entering the vacuum supply.
5	Controller	Controls the pump unit. **IMPORTANT** To prevent potential siphoning, ensure that the controller is located at a higher level than the waste bottle and the Vacuum Filtration Station.
6	Pump unit	Provides the vacuum supply to the station.
7	Power supply cable	Routes power between the pump and the controller.
8	Communication cable, serial	Connects pump controller to a com port on the controlling computer.
9	Power cord	Connects the pump to an AC outlet.

To connect the Vacuum Filtration Station to the ME4C NT VARIO Vacuum Pump:

1 Make sure the Vacuum Filtration Station base is installed on the platepad.

2 Using the three-way tubing connector:

    a Connect the tubing with the quick-disconnect fitting to the port on the station base (**1**), and connect the other end to the three-way connector (**2**).

    b Connect the input tubing from the waste bottle (**3**) to the three-way connector.

    c Connect tubing from the three-way connector to the port on the back of the controller (**5**).

3 Connect the output tubing from the waste bottle (**3**) to the filter (**4**), and connect the output tubing from the filter to the inlet on the front of the pump (**6**).

4 Carefully, connect the pump's power supply cable (**7**) to the 4-pin connector on the back of the controller (**5**).

> **CAUTION** Do not try to force the cable connector into the port on the controller. Doing so can damage the connector.

5 Connect the communications cable (**8**) from the pump controller to a com port on the controlling computer.

6 Connect the power cord (**9**) from the pump to an AC outlet.

7 Configure the controller communication settings as described in the following procedure.

8 Turn on the controlling computer.

9 At the back of the pump, press the power switch to the **on** (**|**) position.

10 Configure the Comm port for the Vacuum Filtration Station in your automation software. For instructions, see the configuration topics in the help for the Encore Multispan software or the VWorks software, as applicable.

To configure the controller communication settings for the pump:

1 At the controller panel, locate the power button (**1**) and the selection knob (**2**), as the following figure shows.
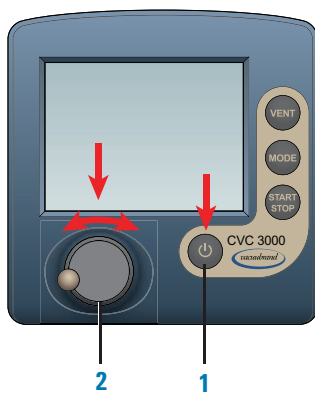
> **IMPORTANT** In the following steps, the display will reset after 20 seconds of inactivity. If this happens, repeat the steps to access the configuration display and make the selections.

2 If the controller power is off, press the power button to turn on the display.

   Note: The controller display will turn on automatically if the controller power button was already set to on.

3 Access the controller configuration display as follows:

   a Press the selection knob to display the settings menu. Turn the knob to move the selector to **Configuration**, and then press the knob to make the selection.

   b In the Configuration display, turn the knob to move the selector to **RS-232**, and then press the knob to make the selection.

   c In the **RS-232** configuration display, ensure that the parameters are set as follows:

RS-232 parameters	Values
Baud	9600
Parity	8-N-1
Handshake	None
Remote	Off
	Note: Later, after you initialize the Vacuum Filtration Station in your automation software, the Remote setting will change to On automatically.

   To change a value, turn the selection knob to the desired parameter, press the knob to access the value, and then turn the knob to change the value. Press the knob again to confirm the new setting.

   d Use the selection knob to move the selection to **Back**, and press the knob to exit each display until you exit the Configuration display.

4 Ensure that the controller displays **Vac control**.

The PC icon ⌨ will appear after you initialize the Vacuum Filtration Station in your automation software, indicating that the pump is under remote control.

> ⚠️ **WARNING** **Before using the VARIO pump, refer to the safety information in the manufacturer's user documentation.**

Note: While the PC icon appears on the controller display, the Vacuum Filtration Station is under the control of the computer, and you can no longer control the pump locally using the controller display.

If you want to reset the controller, press the power button to turn it off, set the power switch on the back of the pump to off. Wait a minute, and then turn on the pump and turn on the controller again.

For additional information on the VARIO pump, see the manufacturer's user documentation.

Uninstalling the Vacuum Filtration Station

⚠️ **WARNING**   **To avoid potential injury and damage to the device, turn off the device before installing or removing an accessory.**

To uninstall the Vacuum Filtration Station:

1   Turn off the vacuum.

2   Disconnect the pump controller or pinch-valve communications cable from the com port on the computer.

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 station base to the platepad.

6   Remove the Vacuum Filtration Station from the platepad.

Configuring the Vacuum Filtration Station for the VWorks software

IMPORTANT   The ME4C NT VARIO Vacuum Pump requires VWorks software version 11.2 or later.

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 opens.

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.** The com port on the controlling computer or on the Accessories Hub to which the communications cable from the pinch-valve module or the pump connects.

   b   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**. The options are **Standard (38 mm)** or **Deep (67.5 mm)**.

- **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.

c Pump connected. Choose one of the following:

Pump	Description
Standard	Select this option if the station is connected to the pinch-valve module.
ME4CVario	Select this option if the station is connected to the ME4C NT VARIO Vacuum Pump. If you select **ME4CVario**, set the **Pump Pressure Units** to match the unit setting on the VARIO pump controller. The options are mbar, Torr, and hPa.
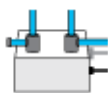
Click **Next**.

8 *Starts disassembled configuration only.* Select the following:

a In the **Location for Vacuum Filtration Collar** list, select the deck location at which the collar is located, and then click **Next.**

b In the **Vacuum Filtration Collar properties** table, specify the following, and then click **Next.**

Pump	Description
Collar type	Specify the size of the collar: Standard (38 mm) or Deep (67.5 mm).
Black gasket on top side only	If the collar has the blue gasket or two black gaskets, select No (default). If you have omitted the black gasket on the underside of the collar, select Yes.

9 Click **Finish**.

Note: 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.

10 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**.
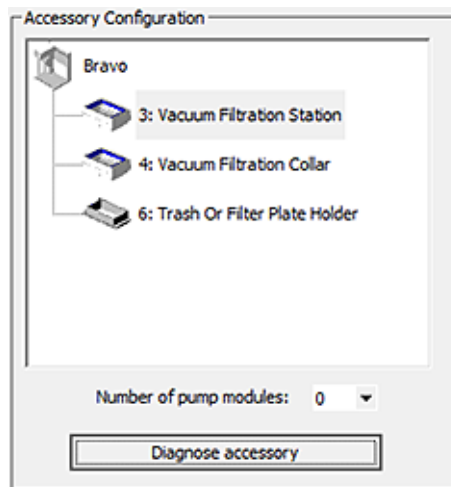
4 In the **Accessory Diagnostics** dialog box, start the vacuum as follows:

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
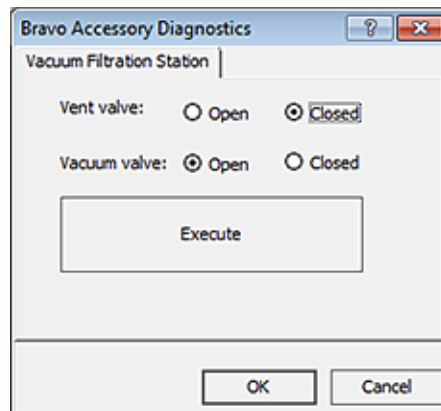
5 To stop the vacuum:

a Set the **Vent valve** to **Open**.

       b   Set the **Vacuum valve** to **Closed**.

       c   Click **Execute**.

6   Click **OK**.

Configuring the ME4C NT VARIO Vacuum Pump and testing the vacuum

If you selected the ME4C Vario 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 NT VARIO Vacuum Pump, see the manufacturer's user guide.

To configure the ME4C NT VARIO Vacuum 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 Vacuum Pump.

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

3   In the **Accessory Configuration** area, highlight **Vacuum Filtration Station**, and then click **Diagnose accessory**.
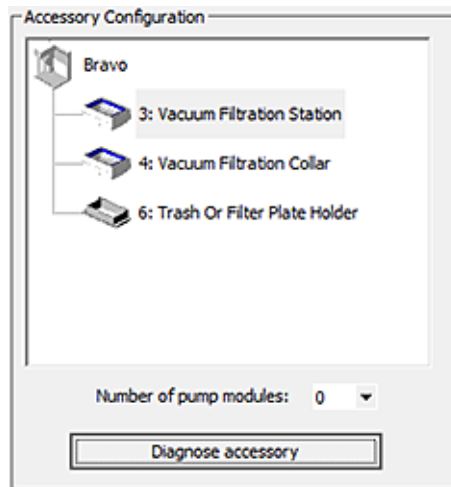
The Accessory Diagnostics dialog box opens.

Figure Accessory Diagnostics dialog box for the ME4C NT VARIO Vacuum Pump
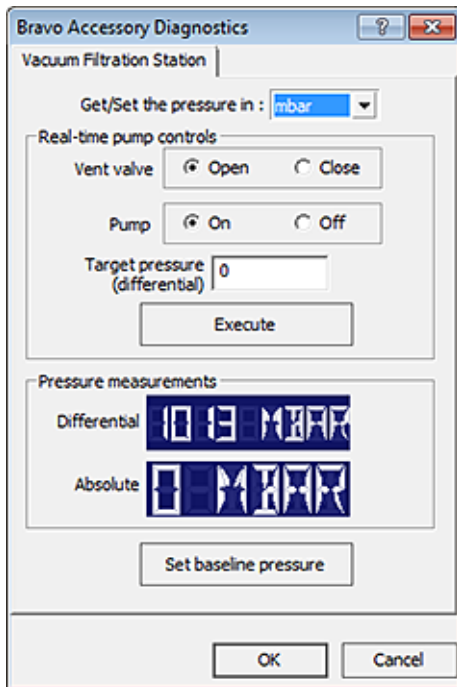
4 To configure the pump:

a In the **Get/Set the pressure in** list, select the desired unit of measure (mbar, Torr, hPa, mmHg, cmHg, and inHg). If the selected units differ from the configuration, the software will convert the values.

b Set the **Vent valve** to **Open**.

c Set the **Pump** to **Off**.

d Type the **Target pressure (differential)**.

e Click **Set baseline pressure**.

5 To start the vacuum:

a Set the **Vent valve** to **Close**.

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...
Creating labware definitions for the types of filter and collection plates used with the Vacuum Filtration Station	*VWorks Automation Control Setup Guide*
Specifying the gripper offset for the labware that will be stacked in the Vacuum Filtration Station assembly	*VWorks Automation Control Setup Guide*
The protocol liquid-handling tasks for the Vacuum Filtration Station	*VWorks Automation Control User Guide*
Videos that show the Bravo Platform, Vacuum Filtration Station, and VWorks software	http://www.agilent.com/en-us/ products/automation-solutions/ automated-liquid-handling/bravo-automated-liquid-handling-platform#videos http://www.agilent.com/en-us/ products/software-informatics/ automation-solutions/vworks-automation-control-software#videos

Setting up a Trash or Filter Plate Holder accessory

About this topic

This topic describes how to set up a deck location as one of the following:

- Trash position for disposal of pipette tips
- Filter Plate Holder for use with the Vacuum Filtration Station

  You can use this accessory as the filter plate location during the Vacuum Assemble, Move and Filter Plate, and Vacuum Disassemble tasks in the VWorks protocol.

The following figure shows the Tip Trash Position accessory, which can also be used as a Filter Plate Holder.

Figure   Agilent Tip Trash Position or Filter Plate Holder accessory
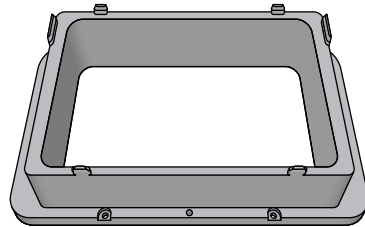
Before you start

The accessory can be installed at Bravo deck locations 4 and 6, which have cutouts for through-deck access.

Figure   Bravo Platform on deck risers and top view of deck location cutouts
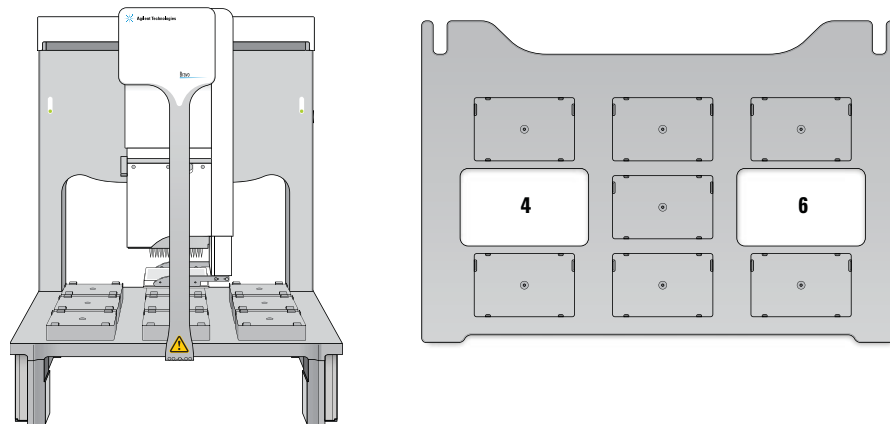
The hardware setup requirements vary depending on how the accessory is to be used.

- *Tip Trash Position.* In this case, deck risers (146 mm) are required to provide the extra height for trash collection below the deck in a trash receptacle (customer-supplied). In addition, a cutout may be required in the table below this deck location. For installation details, contact Automation Solutions Technical Support.

- *Filter Plate Holder*. If the accessory is used as a location for placing labware, the Bravo Platform does not require deck risers. The cutout in the center of the accessory is sufficient to provide the extra space for the filter plate wells to protrude beyond the bottom edges of the filter plate skirt.

  Use the following procedure to install the accessory.

Installing the Filter Plate Holder accessory

Ensure that you have the following:

- Wrenches

  Depending on the instrument, M2 and M4 hex wrenches or T10 and T30 wrenches are required.

- Filter Plate Holder accessory

To install the Filter Plate Holder accessory:

1 Uninstall the platepad, if applicable, from Bravo deck location 4 or 6.

To uninstall a platepad, remove the M6 flathead screw from the center of the platepad. Remove the platepad.

2 Remove the four M3 screws that attach the cutout cover to the deck. Lift the cutout cover out of the deck.

Figure   Side view of cutout cover on the Bravo deck
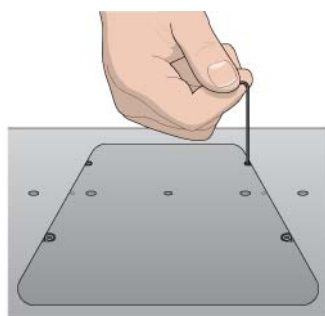
3 Position the Filter Plate Holder in the cutout, aligning the two dowel pins in the holes.

4 Install the four M3 screws that secure the Filter Plate Holder to the deck.

Figure   Filter Plate Holder front view
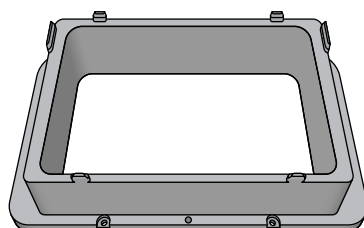
Configuring the Filter Plate Holder in the software

To configure the Filter Plate Holder 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 installed accessory.

   IMPORTANT Only deck location 4 or 6 are options for this accessory.

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 accessory, and then click **Next.**

6 In the **Accessory** list, select **Filter Plate Holder**, and then click **Next**.

7 Click **Finish.**

8 When a message appears and asks whether to move the teachpoint to a safe Z height, do one of the following:

   • Click **No** if you verified the accuracy of the platepad teachpoint before installing and configuring the accessory, no further adjustment to the teachpoint should be required.

   • Click **Yes** if you plan to reteach this location.
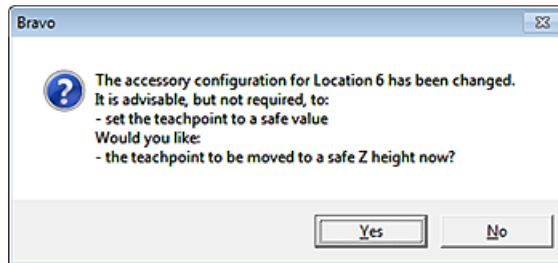
The image of the accessory appears at the specified deck location in the Configuration tab, as the following figure shows.

Figure   Filter Plate Holder in the Configuration tab
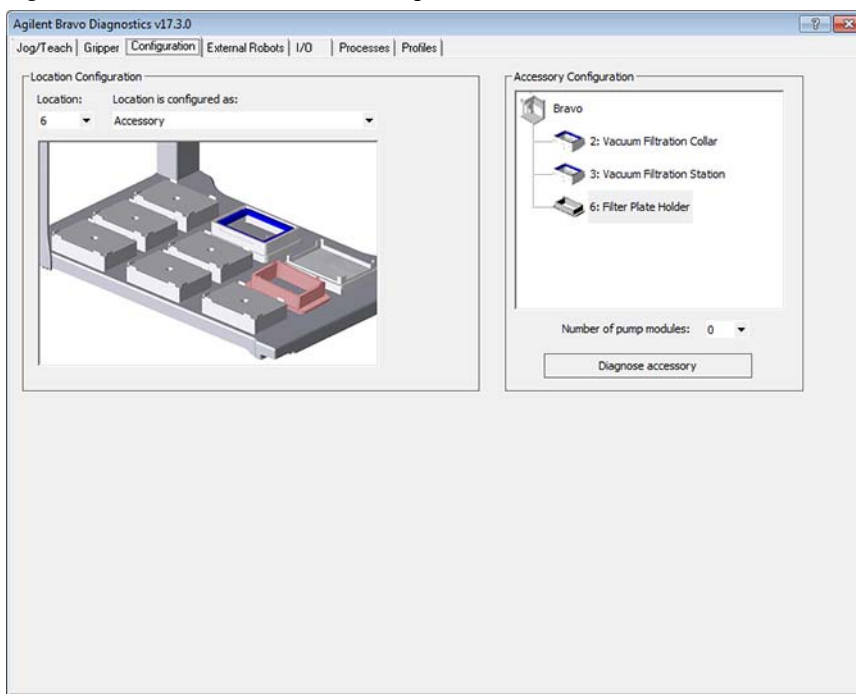
9 In the **Profiles** tab, click **Update this profile**.

When authoring protocols in the VWorks software, use the Place Plate task in the Bravo Subprocess to move filter plates or other microplates to this Bravo accessory location. You may specify which Labware Class is allowed at this location. For example, you might want to allow only filter plates at this location. For more details on Labware Classes, see the *VWorks Automation Control Setup Guide*. For more details on how to create a protocol, see the *VWorks Automation Control User Guide*.

Configuring the Trash location in the software

If you plan to use the accessory for a trash location only, no trash configuration is required in Bravo Diagnostics. Instead, you configure the accessory location as static labware in the protocol Bravo Subprocess. In the Configure Labware dialog box, ensure that you select a tip trash "labware" at the corresponding deck location. In the Bravo Subprocess, use the Tips Off task to eject the pipette tips at the Tip Trash Position accessory. The following figure shows an example protocol. For more details, see the *VWorks Automation Control User Guide*.

Figure   Example of VWorks protocol with static labware configuration for tip trash at deck location 6
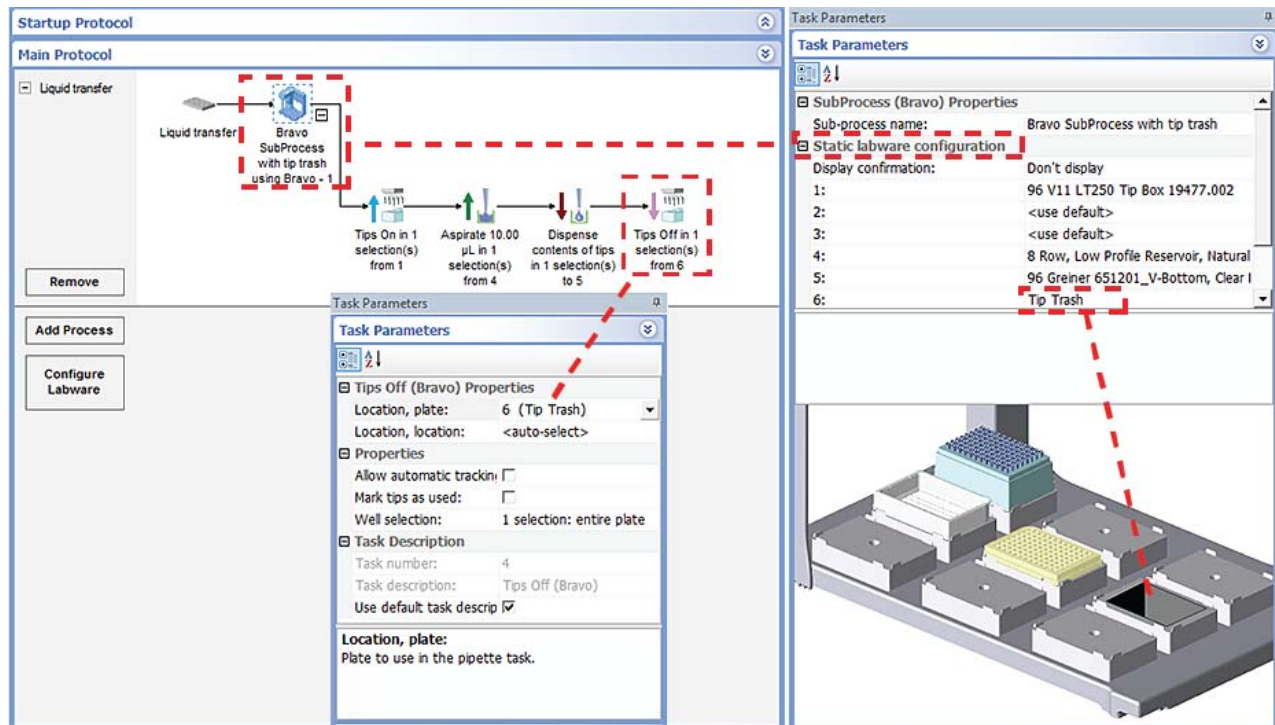
Related information

For information about...	See...
Editing teachpoints	"Setting teachpoints" on page 36
Using an accessory in a protocol	*VWorks Automation Control User Guide*

Configuring a platepad for delidding

About this topic

This topic explains how to use Bravo Diagnostics 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 26
Editing teachpoints	"Setting teachpoints" on page 36
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 tip boxes, 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
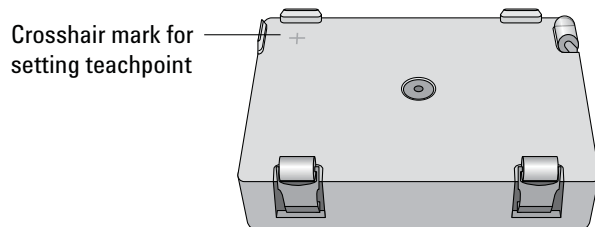
Before you start

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 5
Editing teachpoints	"Setting teachpoints" on page 36

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
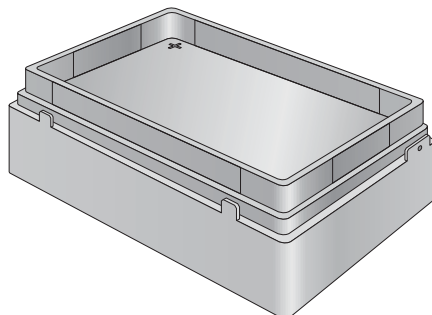
Before you begin

Make sure you do the following before installing the Nested Rack Insert:

- Ensure that the labware definition specifies a nested tip box 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 43. In Bravo Diagnostics, perform a place plate task to move a nested tip box 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 crosshairs on the insert (**1**) directly above the platepad crosshairs.

2 To secure the Nested Rack Insert, use a 1.5 mm hex wrench to tighten the platepad screw (**2**).
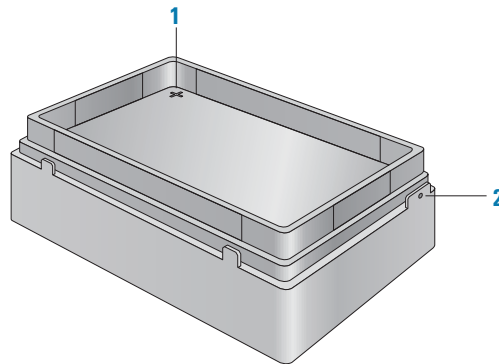
To configure the Nested Tip Rack Insert:

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

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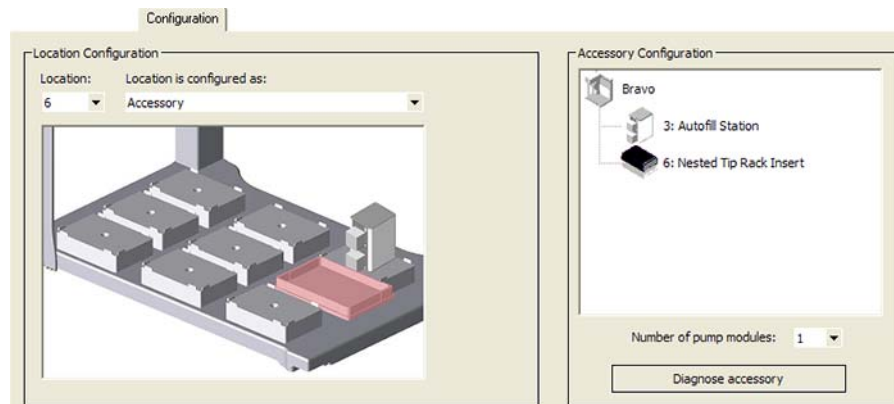
3 In the **Location is configured as** list, select **Accessory.** The Accessories Wizard appears.

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 5
Gripper y-axis offset	"Verifying the gripper setup" on page 43
Editing teachpoints	"Setting teachpoints" on page 36
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
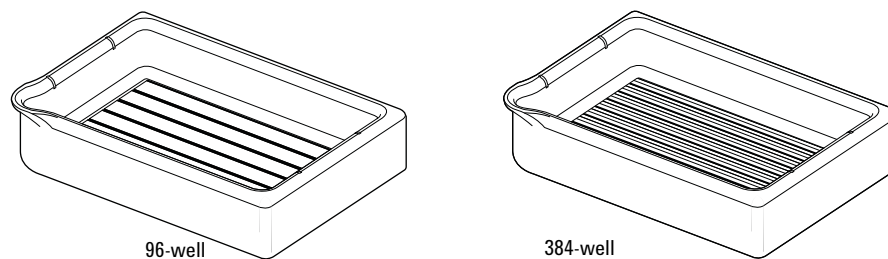
Using the reservoir

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	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
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 Thermal Station

About this topic

The Bravo Thermal Station uses a fluid-filled thermal block to provide temperature control of ±0.1°C uniformly across a microplate. This topic describes how to install the Thermal Station on a Bravo deck location.
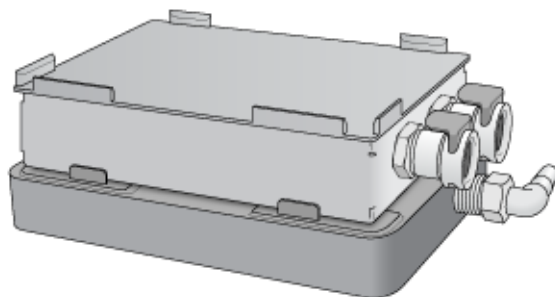
A liquid chilling unit supplies the chilled fluid to the Bravo Thermal Station. See the manufacturer's user documentation for details on how to set up the liquid chilling unit, connect the tubing to the Thermal Station, and set the temperature.

Setup workflow

Step	Procedure	See...
1	Install the Thermal Station at the Bravo deck location.	"Installing the Thermal Station" on page 148
2	Edit the teachpoint using the teach plate. Be sure to consider the 10-mm thickness of the teach plate when you edit the teachpoint.	"Using the teach plate to set the teachpoint for an accessory" on page 118

Step	Procedure	See...
3	Connect the tubing from the liquid chilling unit to the Thermal Station.	Liquid chilling unit manufacturer's user documentation
4	Control the temperature of the Thermal Station.	Liquid chilling unit manufacturer's user documentation

Installing the Thermal Station

Before you begin

Make sure you have the following:

- Thermal Station
- Adapter pad and sockethead screw that fastens the adapter pad to the deck
- Hex wrenches: M1.5 and M4
- Liquid chilling unit, tubing, and user documentation

Procedure

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

To install the Thermal Station:

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

2 Place the adapter pad in the same deck location.

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

3 Insert the larger flathead screw into the center of the adapter pad and tighten.

4 Place the Thermal Station on top of the adapter pad.

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

5 Using an M1.5 hex wrench, tighten the three set screws on the adapter pad tabs to secure the Thermal Station in place.

6 Set the teachpoint for the accessory. See "Using the teach plate to set the teachpoint for an accessory" on page 118.

Related information

For information about...	See...
Verifying and setting the teachpoint for the accessory	• "Using the teach plate to set the teachpoint for an accessory" on page 118 • "Setting teachpoints" on page 36

For information about...	See...
Using the accessory in a protocol	*VWorks Automation Control User Guide*

Setting up thermal and shaking stations (Inheco controller)

About this topic

This topic describes how to configure the Bravo thermal and thermal shaking accessories that are controlled by the Inheco Single TEC Controller (STC) or Multi TEC Controller (MTC). The Inheco STC and MTC controlled accessories include the following:

Bravo accessory name	Corresponding Inheco name
Peltier Thermal Station	CPAC Ultraflat
Heating Shaking Station	Teleshake 95

The STC can control a single Inheco device, and the MTC can control multiple Inheco devices. For a detailed description of the Inheco STC or MTC, see the Inheco STC or MTC user documentation.

Peltier Thermal Station

The Peltier Thermal Station uses Peltier technology to provide temperature control uniformly across a microplate. The station can be fitted with a variety of plate nests and adapters to provide efficient heating and cooling control for different types of microplates.

This accessory requires the Bravo risers to raise the Bravo deck surface and accommodate the height of the accessory below the deck. To install Bravo risers, contact Automation Solutions Technical Support.

The following figure shows the Peltier Thermal Station fitted with the custom plate nest.

Figure   Peltier Thermal Station with custom plate nest
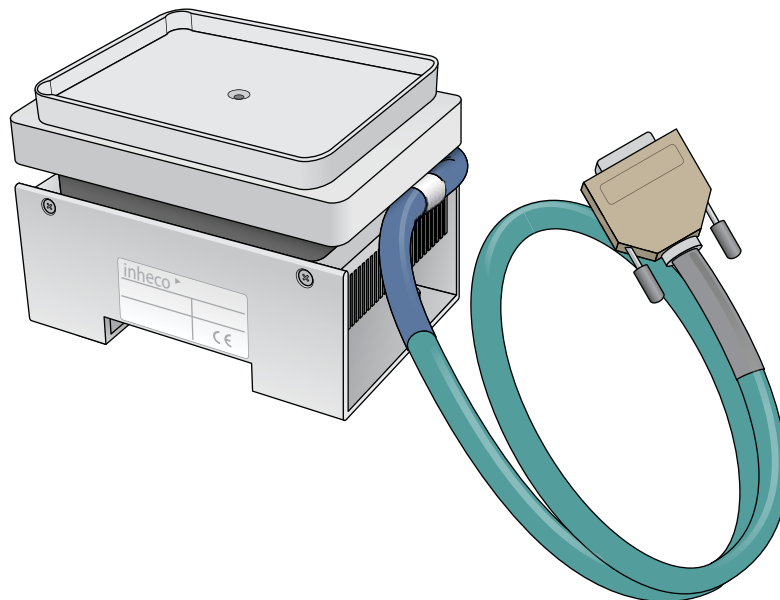
IMPORTANT   Ensure that you have the correct plate nest and adapter for the requirements of your assay. Your microplate must nest in the station correctly to ensure efficient heat transfer. For more information, contact Automation Solutions Customer Service.

Heating Shaking Station

The following figure shows the Heating Shaking Station, which provides fluid mixing and heating for microplates.

Figure   Heating Shaking Station and adapter pad
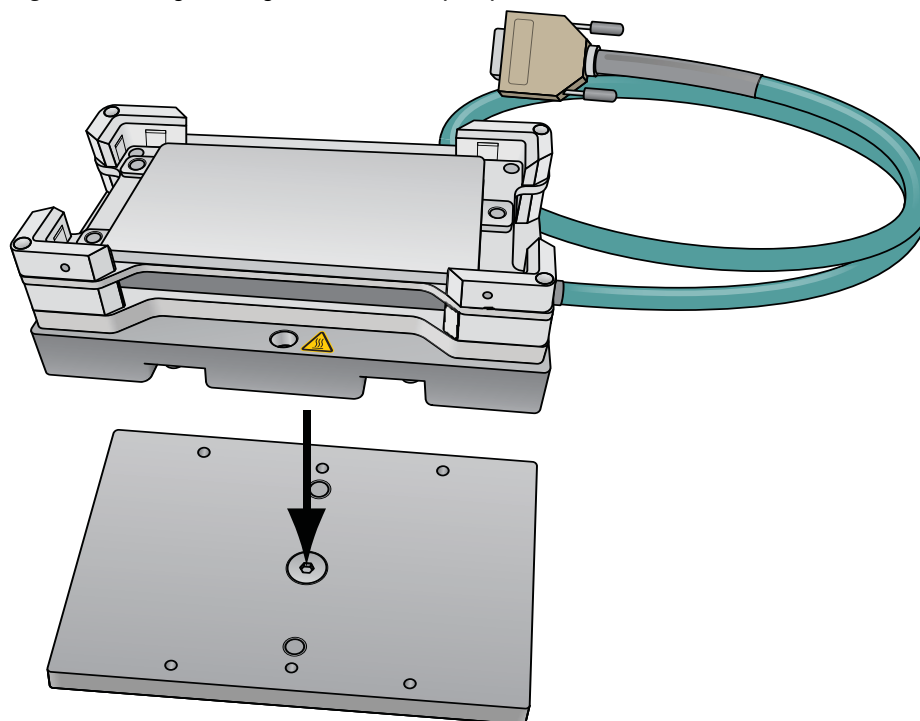
Installing the accessories

⚠️ **WARNING**   **To prevent potential injury and damage to the device, turn off the Bravo Platform before you install or remove an accessory.**

About installing the Peltier Thermal Station

Agilent Technologies installs the Peltier Thermal Station on a Bravo Platform that is slightly elevated on risers to allow room for the accessory's height below the deck.

Installing the Heating Shaking Station

The Heating Shaking Station may be installed on top of the deck at any deck location using a short adapter pad instead of a platepad.

Before you start, make sure that you have:

- Heating Shaking Station
- Adapter pad (supplied with the Heating Shaking Station)
- 2.5-mm and 4-mm hex wrench
- M6 x 12 flathead screw (to attach the adapter pad to the deck, supplied with the Heating Shaking Station)
- Two M3 x 18 socket-head cap-screws (to attach the Heating Shaking Station to the adapter pad, supplied with the Heating Shaking Station)

To install the Heating Shaking Station:

1   Using a T30 hexalobular wrench, remove the M6 screw in the center of the platepad. Remove the platepad.

2 Position the adapter pad in the predetermined deck location aligning the dowel pins in the corresponding holes on the deck.

Make sure the adapter pad sits level on the deck.

3 Insert the M6-x-12-mm flathead screw into the center of the adapter pad and use the 4-mm hex wrench to tighten the screw.
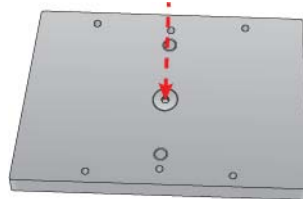
4 Place the Heating Shaking Station on top of the adapter pad.

Ensure that the station sits level on the adapter pad and the safety label faces the front of the workspace.

5 Insert the two M3-x-18-mm socket-head cap screws into the holes at the front and back end of the adapter pad and use the 2.5-mm hex wrench to tighten the screws.
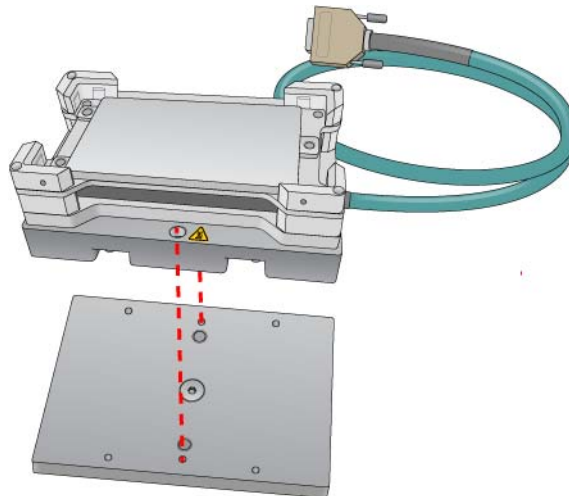
Setup workflow

To connect the Peltier Thermal Station or Heating Shaking Station, make sure you have the following:

- Inheco STC or MTC controller and power and communication cables
- Inheco user documentation for the STC or MTC, as applicable

See the Inheco user documentation for details on how to connect the STC or MTC and the accessory.

WARNING **To prevent potential injury and damage to the device, turn off the Bravo Platform and the accessory controller before you connect or disconnect an accessory.**

Step	Procedure	See...
1	Connect the STC or MTC power and communication cables to the thermal station. Set the STC or MTC power switch to the On position.	Inheco user documentation for the STC or MTC, as applicable
2	Configure the accessory in Bravo Diagnostics.	"Configuring an Inheco station in Bravo Diagnostics" on page 153
3	Edit the teachpoint for the location.	"Teaching a thermal or thermal shaking station" on page 153
4	Test the accessory operation.	"Testing a thermal or thermal shaking station" on page 156

Configuring an Inheco station in Bravo Diagnostics

To configure an Inheco 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 **Location is configured as** list, select **Accessory.** The Accessories Wizard opens.

4 In the **Accessories Wizard**, select the **Location** of the installed accessory. In the **Choose Accessory** page, select **Heating Shaking Station**.

5 Enter the following values in the accessory parameters page.

    a In the **MTCSTC Id** box, select the ID number of this device. The ID number identifies the specific device for the VWorks software.

    Note: The ID number is set using a DIP switch control on the rear panel of the Inheco STC or MTC Control. See the Inheco user documentation for a description of how to set the ID for each slot on the STC or MTC device.

    b Select the **MTCSTC Type**, either STC or MTC.

    c In the **Slot Id** box, select the slot number on the Inheco STC or MTC rear panel where the accessory's cable is connected.

    Note: The STC has only one slot.

6 Click **Finish**.

7 When the configuration message appears, click **Yes** to initialize the accessory and move the teachpoint to a safe height.

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

9 Edit the location's teachpoint for the accessory. See "Teaching a thermal or thermal shaking station" on page 153.

Teaching a thermal or thermal shaking station

The teaching procedure can vary depending on the combination of microplate, plate nest, and adapter. The procedures in this section are for the following configurations on a Bravo Platform with a disposable-tip head:

- Peltier Thermal Station with generic plate nest and adapter
- Heating Shaking Station

IMPORTANT   If you have a Peltier Thermal Station with a custom plate nest and adapter, Contact Automation Solutions Technical Support for guidance on how to teach your combination of microplate, plate nest, and adapter.

The microplate's bottom surface configuration affects how it sits in the station's plate nest. The following figure shows a skirted microplate in a Peltier Thermal Station that has a generic plate nest and adapter. In the figure, the well bottoms rest on the top of the adapter (**1**), and the skirt rests on the top of the plate nest's lower surface (**2**).

Figure   Skirted microplate sitting in Peltier Thermal Station with generic plate nest and adapter (cut-away side view)
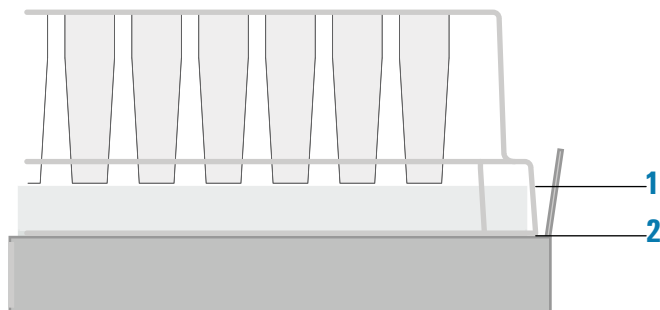
As the figure shows, the height difference between the adapter top (**1**) and the plate nest top (**2**) enables a skirted microplate to nest in the station. The well bottoms must sit directly on the adapter top to enable an efficient temperature transfer. However, the teachpoint must account for this height difference to ensure that the Bravo robot grips the microplate at the correct position and performs pipetting tasks at the correct height.

CAUTION   If your microplate does not sit in the plate nest as the figure shows, contact Automation Solutions Technical Support for guidance on whether your microplate requires a custom plate nest and adapter.

To set the teachpoint for a generic Peltier Thermal Station or Heating Shaking Station:

CAUTION   Use the following procedure only on a Bravo Platform with a disposable-tip head.

1   Place the microplate securely in the plate nest of the thermal station. Verify that the microplate sits in the plate nest so that the well bottoms are resting on the adapter and the skirt rests in the plate nest bottom surface. Remove the microplate.

2   Using calipers, measure the height difference between the adapter top (**1**) and the plate nest top (**2**) on all four sides of the plate nest interior. Make a note of the smallest number. Later in the procedure, you will add this value to the z-axis value for the teachpoint.

3   Place the teach plate in the plate nest.

Note: Alternatively, you can use a 384-well microplate instead of the teach plate to set the teachpoint xy coordinates. In this case, you set the xy coordinates based on the center of the A1 well quadrant, as the following figure shows.
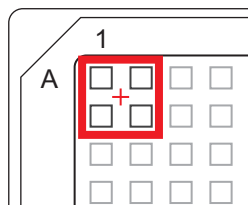
4 In **Bravo Diagnostics**, click the **Profiles** tab, and initialize the desired profile.

5 In **Bravo Diagnostics**, click the **Processes** tab, select a tip box, and perform a **Tips On** command. For details, see "Performing a task using Bravo Diagnostics" on page 98.

> **CAUTION**   Using the wrong tip for teaching can result in a head crash. Make sure the disposable tip is an Automation Solutions tip and is the same as the Teaching tip type specified in the profile.

6 In **Bravo Diagnostics**, click the **Jog/Teach** tab, and set the initial teachpoint as follows:

a Select the deck location of the station from the **Location** list.

b Use the controls to jog the pipette head so that the A1 pipette tip is directly over the crosshairs with paper-thin clearance. For details, see "Setting the first teachpoint" on page 39.

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

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

7 Adjust the teachpoint z-axis value for the teach plate height as follows:

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

b 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 surface of the adapter.

Note: When the z-axis error message appears, you may click Ignore.

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

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

8 In **Bravo Diagnostics**, click the **Processes** tab, select the empty tip box, and perform a **Tips Off** command. For details, see "Performing a task using Bravo Diagnostics" on page 98.

9 Adjust the teachpoint z-axis value for the height difference between the adapter and the plate nest as follows:

> **CAUTION**   Before you perform this step, ensure that the tips are off. Otherwise, a crash can occur between the tips and the station.

a In the **Jog/Teach** tab, select the deck location of the station, and click **Move.**

b Jog the pipette head down in the z-axis by the measured value from step 2.

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

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

> **CAUTION**   After adjusting the teachpoint to account for the height difference between the adapter and the plate nest, do not use tips to verify the teachpoint. Otherwise, a crash can occur between the tips and the station.

To verify the teachpoint by performing a pick and place:

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 the thermal station location.

5   Place a test microplate on deck location A, and then click 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. Ensure that the gripper places, but does not drop the microplate at the destination location.

Testing a thermal or thermal shaking station

> ⚠️ **WARNING**   Burn hazard. During the heating process, the thermal stations can have hot surfaces that can cause a burn injury. Allow the thermal stations to cool before attempting to touch them.

The following warning symbol appears on the thermal stations, warning you of the potential burn hazard.

To test the station:

1   Verify that the accessory (for example, Peltier Thermal Station or Heated Shaking Station) is installed on the target deck location.

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

3   In the **Accessory Configuration** area, select the **Heating Shaking Station**, and then click **Diagnose accessory**.
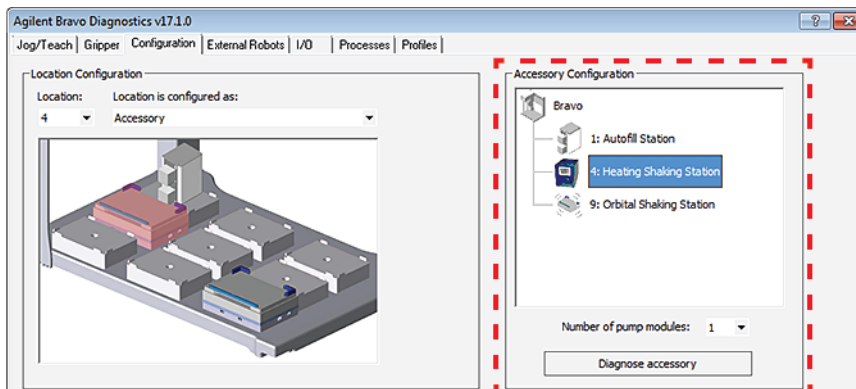
4 In the **Accessory Diagnostics** dialog box, verify that the correct device appears in the display at the top.

Note: The software obtains the device name from the STC or MTC, and then the Inheco name of the device appears in the display of the dialog box, for example, CPAC Ultraflat or Teleshake 95.
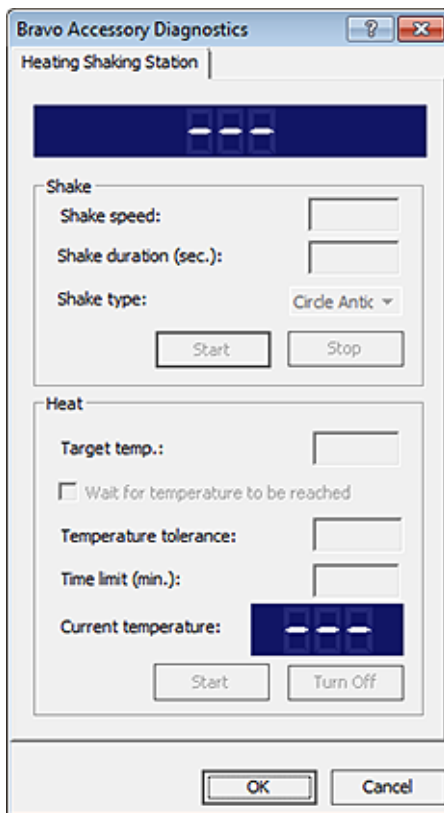
5 *Shaking accessories only.* Set the parameters in the **Shake** area:

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

b In the **Shake duration** box, type the time duration (seconds).

c In the **Shake type** box, select the type of stirring motion.

d Click **Start** to test the shake parameter settings. At the device, verify that the accessory operates correctly.

Click **Stop** to turn off the shaking feature.

6 *Thermal accessories only.* In the **Heat** area, set the parameters to test the temperature function:

a In the **Target temp** box, type the temperature (°C).

b To specify a time limit within which to reach the target temperature, select the **Wait for temperature to be reached** check box, and then set the following:

- In the **Temperature tolerance** box, type the ±°C.
- In the **Time limit** box, type a time limit (minutes).

c Click **Start** to test the Heat parameter settings. At the device, verify that the accessory operates correctly.

Click **Turn Off** to stop the heating or cooling.

7 Click **OK** to close the dialog box.

Related information

For information about...	See...
Verifying and setting the teachpoint for the accessory	• "Using the teach plate to set the teachpoint for an accessory" on page 118 • "Setting teachpoints" on page 36
Using the accessory in a protocol	*VWorks Automation Control User Guide*

(Bravo SRT only) Setting up an LT tip box 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 tip box 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 tip box platepad is physically installed and configured in the Bravo Diagnostics software. This special platepad provides additional *z*-axis clearance, and is designed for a tip box that holds 96 250-µL tips.
- Use labware classes for each deck location so that the 250-µL tip box 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 tip box
- Star-head screw and wrench for installing the SRT 250-µL tip box platepad

Workflow

Step	For this task…	See…
1	Install an SRT platepad for 250-µL tip boxes at any deck location where you plan to do tips on and tips off tasks.	"Installing the 250-µL tip box platepad on the Bravo SRT" on page 159
2	In Bravo Diagnostics, configure the location and set the teachpoint.	"Configuring the platepad in Bravo Diagnostics" on page 159
3	In the Labware Editor, set up appropriate labware classes. For example, limit the tip box location to a labware class that uses the SRT platepad for 250-µL tip boxes, 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 21
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 tip box platepad on the Bravo SRT

To install the SRT platepad for 250-µL tip boxes:

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 tip boxes 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 tip box 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 tip boxes:

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**.
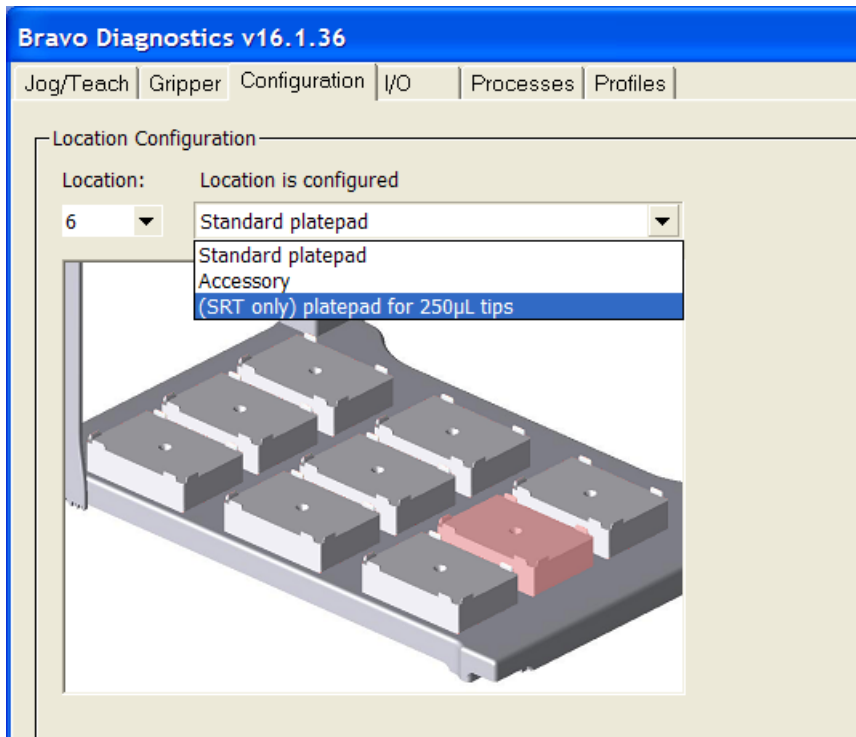
5   Click the **Jog/Teach** tab, and teach the deck location using the crosshairs
on the platepad. See "Setting teachpoints" on page 36.

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 tip box 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 5
Starting Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Editing teachpoints	"Setting teachpoints" on page 36

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:

- "Autofilling station overview and setup workflow" on page 166
- "Configuring an autofilling station for the Bravo Platform" on page 167
- "Setting up a Weigh Station for the Bravo Platform" on page 172

For details on how to set up accessories on the AssayMAP Bravo Platform, see "About installing the AssayMAP Bravo Platform" on page 200.

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. This topic describes the components and provides the workflow for setting up an autofilling station.

Autofilling accessories

Accessory	Description
Pump Module	Pumps fluids to and from one of the Agilent autofilling type reservoirs.
Agilent autofilling type reservoirs	Includes the Tip Wash Station (formerly, MicroWash Reservoir), the Auto Filling Reservoir, and the Open Wash Reservoir.
Weigh Station	*Optional.* Works with a Pump Module to provide precise liquid-level control for the Auto Filling Reservoir or Tip Wash Station.

For more details on the autofilling accessories, see the *Pump Module User Guide*.

Workflow to set up an autofilling station

Step	Procedure	See...
1	If applicable, install the Weigh Station.	*Pump Module User Guide*
2	Install the Pump Module and reservoir.	*Pump Module User Guide*
3	In Bravo Diagnostics, configure the autofilling function.	"Configuring an autofilling station for the Bravo Platform" on page 167
4	If applicable, calibrate the Weigh Station.	"Calibrating a Weigh Station" on page 172
5	If applicable, verify the teachpoint accuracy for the Weigh Station.	"Setting teachpoints" on page 36

Related information

For information about...	See...
Other Bravo accessories	"Accessories and platepads" on page 101
Bravo Barcode Reader	"Setting up the Barcode Reader" on page 175
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 an autofilling location.

Before you start

Connect the Pump Module, Weigh Station, and an Agilent autofilling type reservoir.

For details, see the *Pump Module User Guide*.

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 In the **Configuration** tab, select the location in the **Location** list, or click the location in the graphic display.

3 In the **Location is configured** list, select **Accessory**.
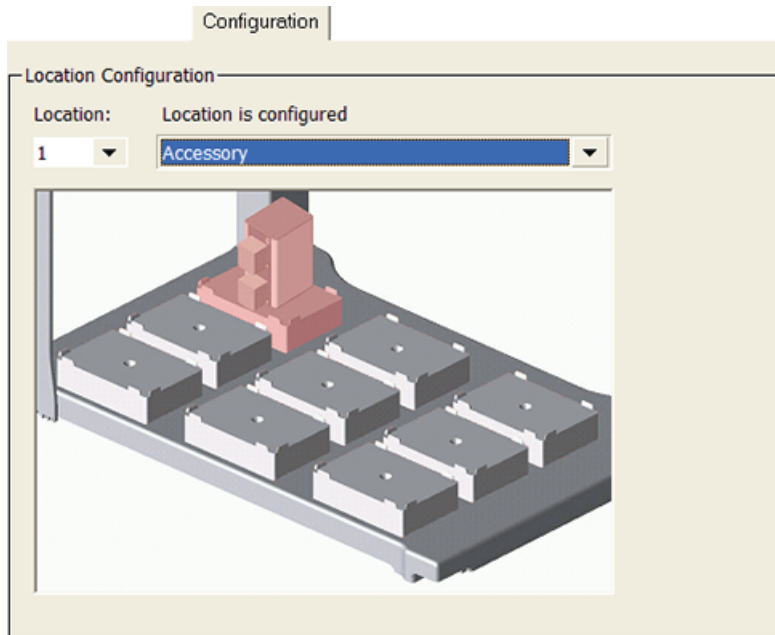
4 In the **Accessories Wizard**, do the following:

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.

Parameter	Settings
Pump for filling	Select which of the two pumps on the Pump Module will fill the container, 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.
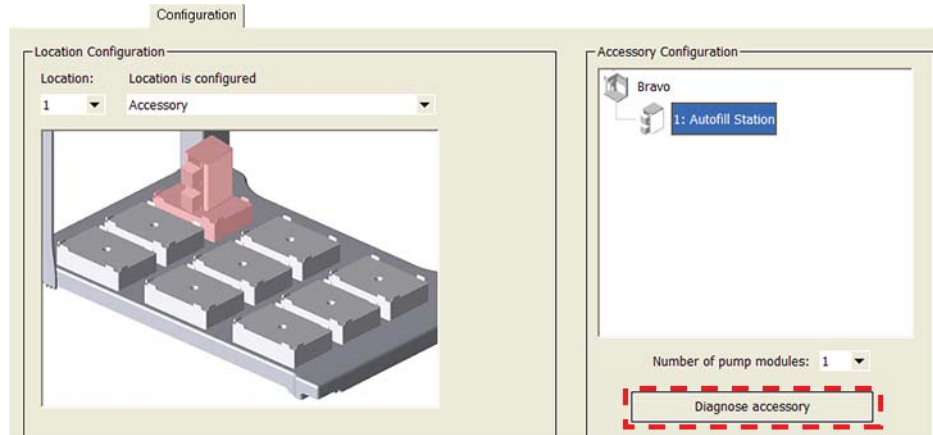
3   In the **Accessory Diagnostics** dialog box, verify the following settings.
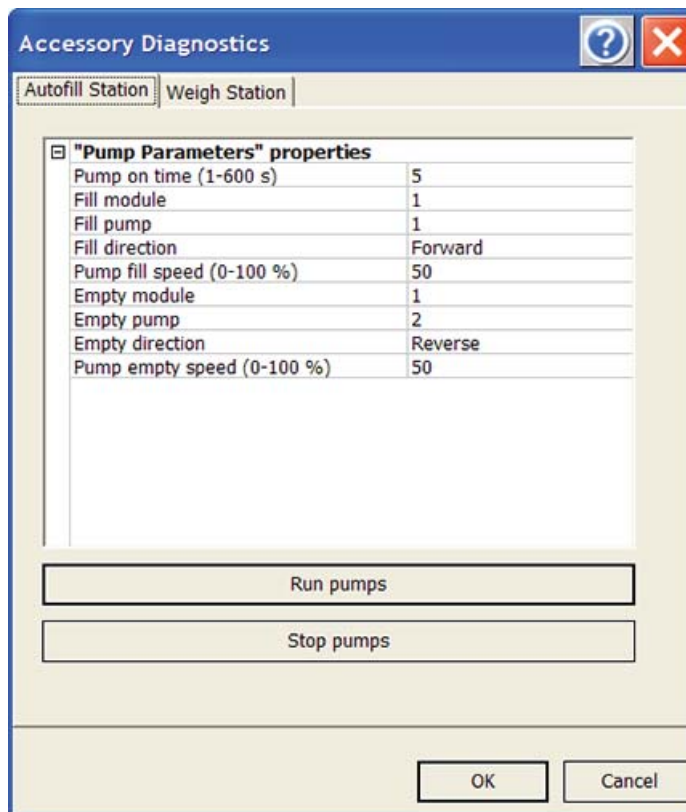
Control	Description
Pump on time (s)	Specifies the duration that the selected pump on the Pump Module runs when you click Run pumps.
Fill module	Specifies the Pump Module that this deck location uses. One Pump Module can function as both the Fill module and Empty module. For example, select 1 if only one Pump Module is connected.
Fill pump	Specifies which of the two pumps on the Pump Module to use for filling the container, 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 deck location 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.
Empty pump	Specifies which of the two pumps on the Pump Module to use for emptying the container, 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 19
Installing a Pump Module	*Pump Module User Guide*
Calibrating a Weigh Station	"Setting up a Weigh Station for the Bravo Platform" on page 172

For information about...	See...
Draining or filling a reservoir using the Pump Reagent process	"Performing a task using Bravo Diagnostics" on page 98
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 provides calibration instructions for the Weigh Station.

For a description of the Weigh Station and installation instructions, see the *Pump Module User Guide*.

Crosshairs for setting teachpoint
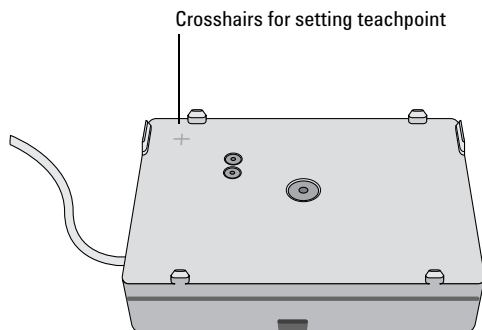
Calibrating a Weigh Station

Before you begin

- Make sure the Pump Module is set up and connected to the Weigh Station. See the *Pump Module User Guide*.
- Verify that the Autofilling pad is configured in Bravo Diagnostics. See "Configuring an autofilling station for the Bravo Platform" on page 167.

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.
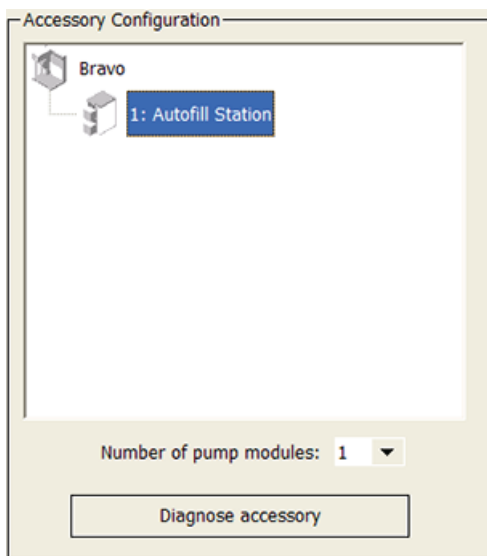
4 In the **Accessory Diagnostics** dialog box, click the second tab.
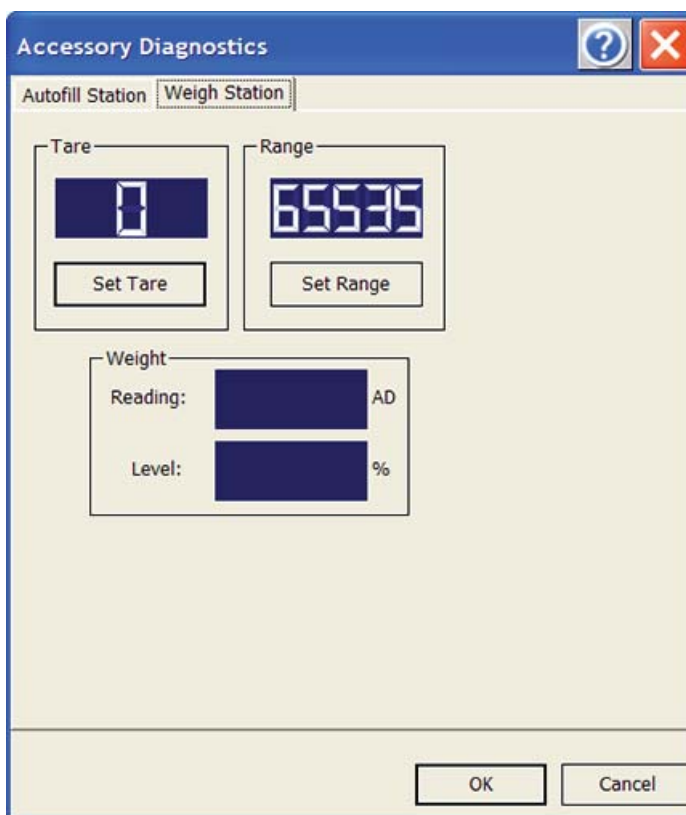
5 At the Bravo Platform, place the reservoir on the Weigh Station. Make sure the reservoir is empty.

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 19
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Installing the Pump Module	*Pump Module User Guide*
Configuring the autofilling function	"Configuring an autofilling station for the Bravo Platform" on page 167
Editing teachpoints	"Setting teachpoints" on page 36
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

Mirror

Platepad

Barcode reader sensor head
(under the platepad)
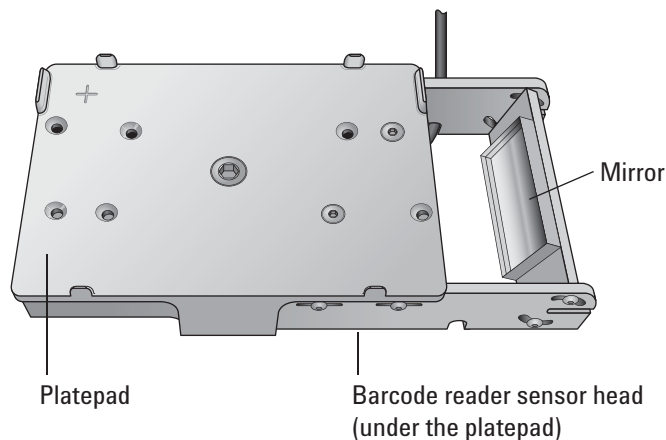
Setup workflow

The following table presents the workflow for installing and setting up the Barcode Reader. The procedures can vary depending on the brand of barcode reader sensor head (for example, Keyence or Microscan).

Step	Procedure	See…
1	Verify the barcode requirements.	"Barcode label specifications" on page 177
2	Install the Barcode Reader.	"Installing or removing the Barcode Reader" on page 177
3	Add the Barcode Reader device and create a profile for the Barcode Reader.	"Creating a profile for the Barcode Reader" on page 179
4	Specify the Barcode Reader location in the Bravo device file.	"Specifying the Barcode Reader location" on page 181

Step	Procedure	See…
5	Adjust the Barcode Reader for optimal scanning.	"Testing and optimizing barcode scanning" on page 183

Barcode label specifications

The barcode reader can read barcodes that meet the following requirements:

Characteristic	Keyence requirements	Microscan requirements
Barcode symbology	Code 39 Code 128 Interleaved 2 of 5 Code 93	Code 39 Codabar Code 128 Interleaved 2 of 5 Code 93 Code 2 of 5
Barcode height	3.34 mm (0.13 in) or taller	3.34 mm (0.13 in) or taller
Print contrast	25% at 650 nm	25% at 650 nm
Quiet zone	10 times the dimension of the narrowest element in the barcode or 0.25 in, whichever is greater	10 times the dimension of the narrowest element in the barcode or 0.25 in, whichever is greater

Note: The symbology must be stored in the barcode reader in order for the barcode reader to decode the barcode symbol.

Related information

For information about…	See…
Setting up other accessories	• "Accessories and platepads" on page 101 • "Autofilling accessories" on page 165
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 176
Creating a profile for the Barcode Reader	"Creating a profile for the Barcode Reader" on page 179
Specifying the Barcode Reader location in the device file	"Specifying the Barcode Reader location" on page 181
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 183
Setting up other accessories	• "Accessories and platepads" on page 101 • "Autofilling accessories" on page 165

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 21.

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 icon for your barcode reader sensor head (Keyence or Microscan). The Barcode Reader icon appears in the Devices area.
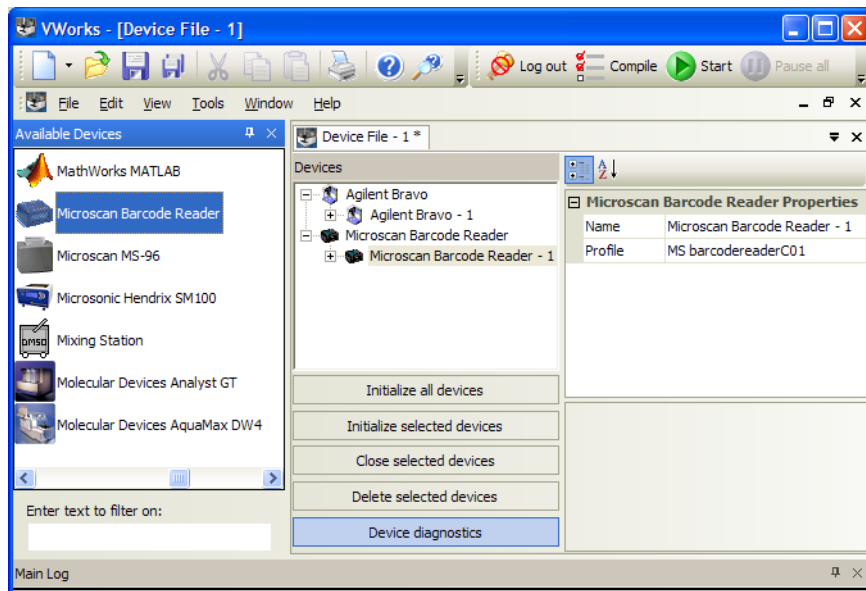
3 In the **Devices** area, select the **Barcode Reader** icon, and click **Device diagnostics**. The Barcode Reader Diagnostics dialog box opens.

Figure Keyence Barcode Reader Diagnostics dialog box
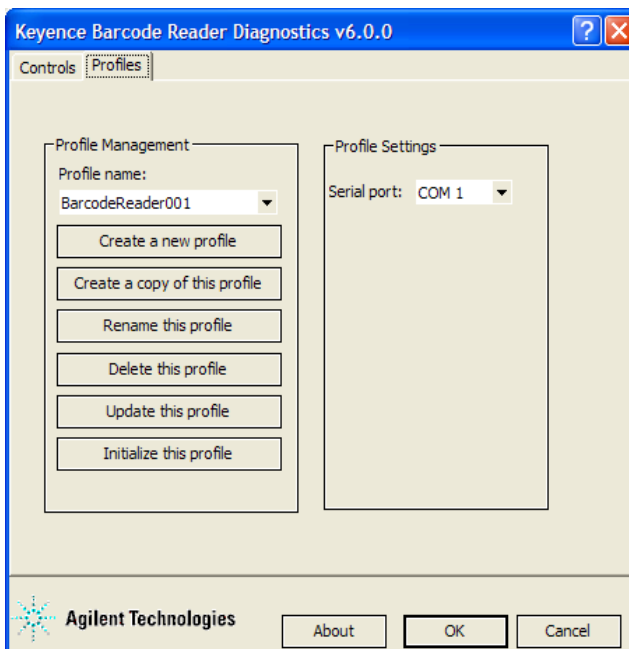
Figure Microscan Barcode Reader Diagnostics dialog box
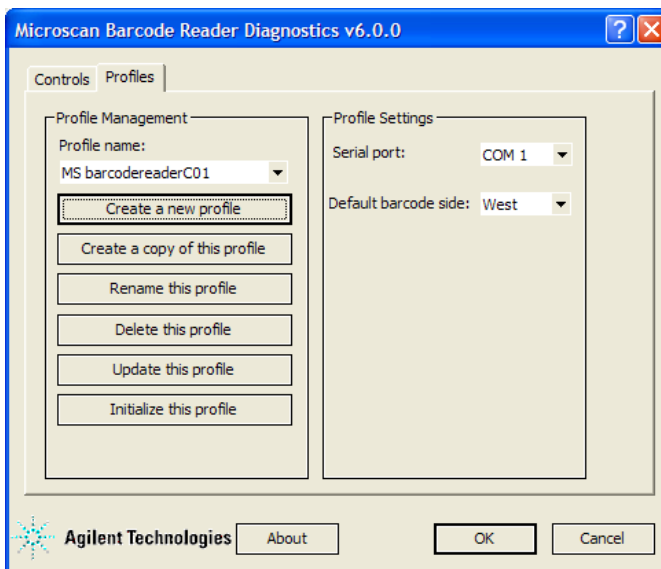
4 In the **Profiles** tab under **Profile Management**, click **Create a new profile.** The Create Profile dialog box opens.

5 Type a name for the new profile and click **OK.** The new profile name appears in the Profile name list.

6 In the **Profile Settings** area, select the Accessories Hub **Serial port** that is connected to the Barcode Reader.

7 *Microscan only.* In the **Default barcode side** list, select **East** or **West** to indicate the side of the labware that has the barcode label.

Note: The Bravo Barcode Reader can scan barcode labels on the labware east and west sides only.

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 176
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 177
Specifying the Barcode Reader location on the Bravo Platform	"Specifying the Barcode Reader location" on page 181
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 183
Setting up other accessories	• "Accessories and platepads" on page 101 • "Autofilling accessories" on page 165

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 Barcode Reader device.

2   In the **Devices** area, expand the **Bravo** device. The list of deck locations appear.
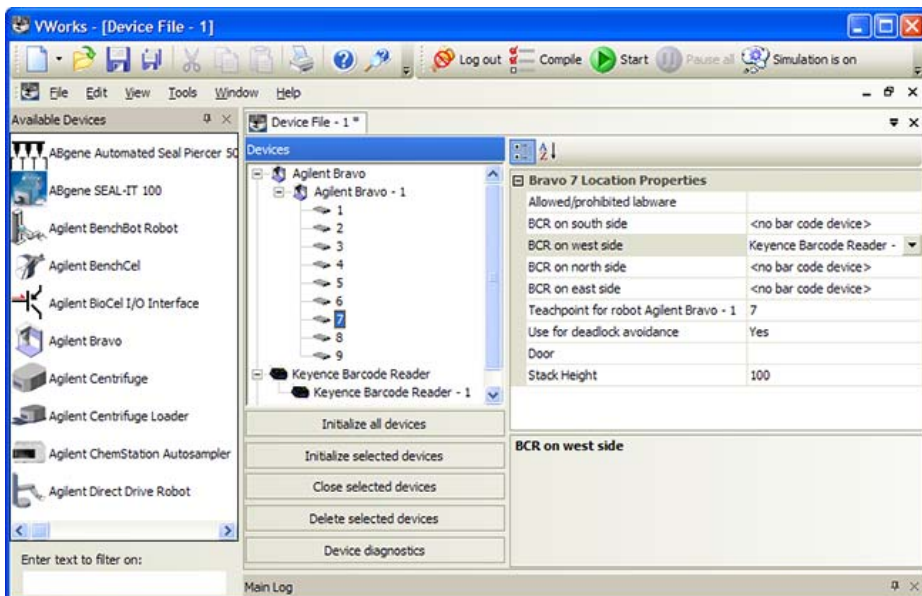
3 Select the deck location at which you installed the Barcode Reader. In the example in step 2 the Barcode Reader is installed at deck location 7, so deck location 7 is selected.

4 In the **location properties** table, select the Barcode Reader for one of the following:

- **BCR on west side**
- **BCR on east side**

Note: The Bravo Barcode Reader can scan barcode labels on the labware east and west sides only.

In the following example, the Barcode Reader is at deck location 7, and it will scan barcodes on the west side of microplates.
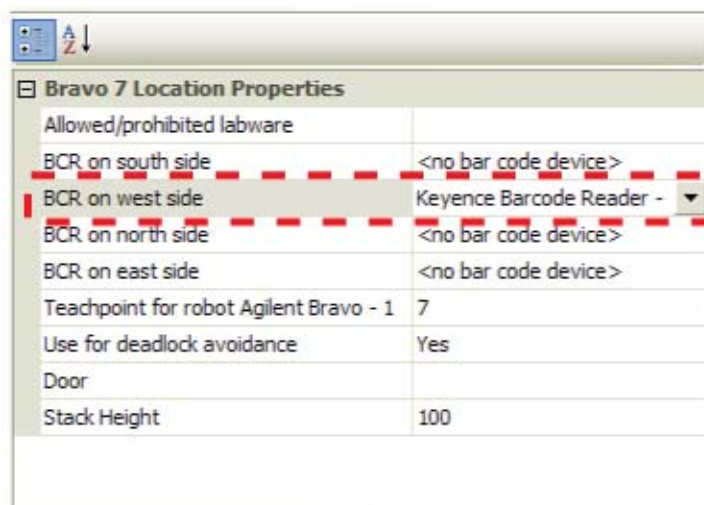
5 When you are finished, click **Initialize selected devices** to re-establish communication with the Bravo and use the updated device file.

Related information

For information about...	See...
Barcode specifications	"About setting up the Barcode Reader" on page 176
Installing the Barcode Reader	"Installing or removing the Barcode Reader" on page 177
Creating a profile for the Barcode Reader	"Creating a profile for the Barcode Reader" on page 179
Making adjustments and troubleshooting the Barcode Reader	"Testing and optimizing barcode scanning" on page 183
Setting up other accessories	• "Accessories and platepads" on page 101 • "Autofilling accessories" on page 165

Testing and optimizing barcode scanning

About this topic

This topics describes:
- "Using diagnostics to test the barcode scanning (Keyence sensor)" on page 183
- "Using diagnostics to test the barcode scanning (Microscan sensor)" on page 185
- "Adjusting the scan angle" on page 187
- "Troubleshooting" on page 187

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 (Keyence sensor)

If the barcode reader has a Keyence sensor head, use the procedure in this section to test the barcode scanning.

⚠️ **WARNING**   Class II laser hazard. Looking directly at the laser beam can result in serious eye injury. Do not look directly at the laser beam.

⚠️ **WARNING**   **Laser emission does not automatically turn off if the sensor head is disassembled. Do not disassemble the barcode reader sensor head.**

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 **Barcode Reader Diagnostics.**

3   In the **Profiles** tab, select the Barcode Reader profile from the **Profile** list, and click **Initialize this profile**.

Figure   Keyence Barcode Reader Diagnostics Profiles tab
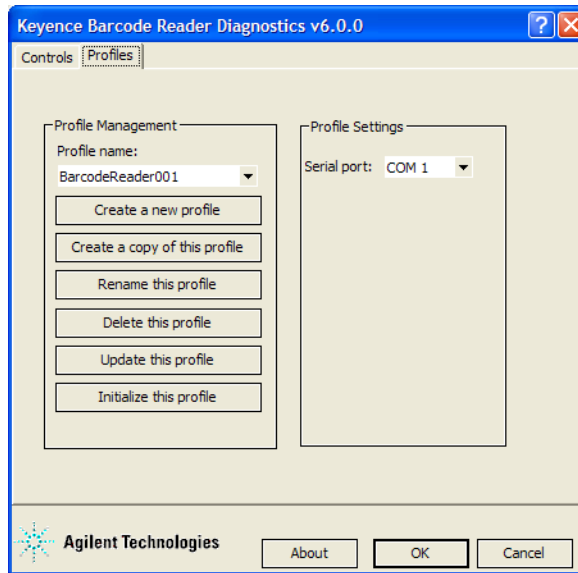
4   Click the **Controls** tab.

Figure   Keyence Barcode Reader Diagnostics 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.

Using diagnostics to test the barcode scanning (Microscan sensor)

If the barcode reader has a Microscan sensor head, use the procedure in this section to test the barcode scanning.

⚠ **WARNING**   **Class II laser hazard. Looking directly at the laser beam can result in serious eye injury. Do not look directly at the laser beam.**

⚠ **WARNING**   **Laser emission from the reader does not automatically turn off if the sensor head is disassembled. Do not disassemble the barcode reader sensor head.**

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 **Barcode Reader Diagnostics.**

3   In the **Profiles** tab, select the Barcode Reader profile from the **Profile** list, and click **Initialize this profile**.

Figure   Microscan Barcode Reader Diagnostics Profiles tab
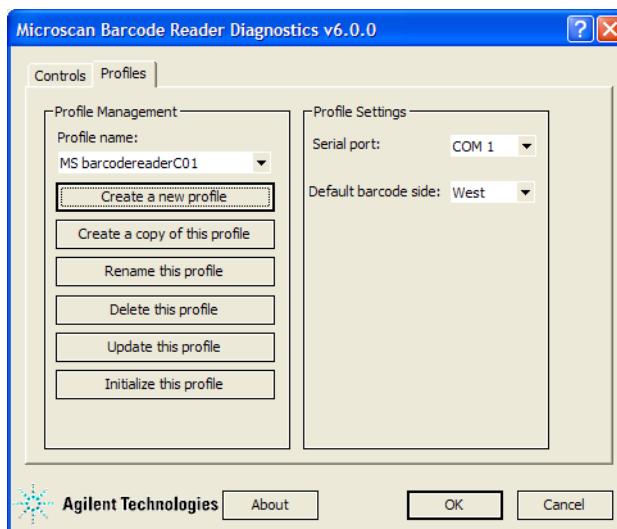
4   Click the **Controls** tab.

Figure   Microscan Barcode Reader Diagnostics Controls tab
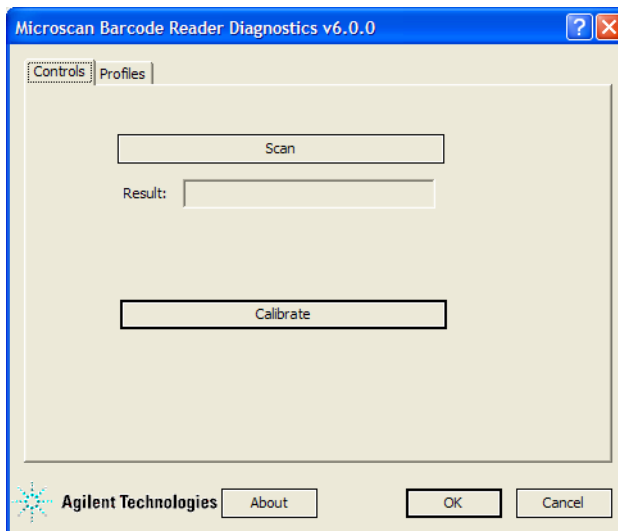
5   Click **Scan**. The barcode reader laser turns on briefly to scan the barcode label. One of the following messages appears next to Result:

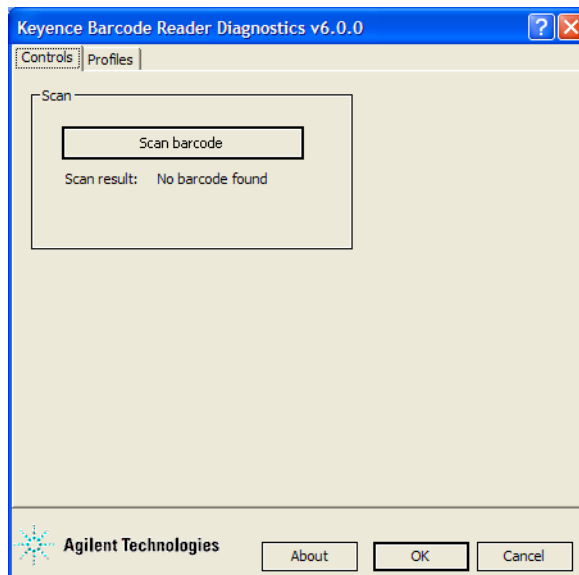| Scan result message	Description	Next step
<barcode text>	The barcode was successfully scanned.	The setup is complete. No further adjustment is required.
No barcode found	Barcode scanning was not successful.	Proceed to step 6.

6   If the No barcode found message appears, click **Scan** 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.

7   To optimize the scanner settings, click **Calibrate**.

Note: During the calibration process, the scanner attempts various settings to determine the optimum decode rate for the given conditions.

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.
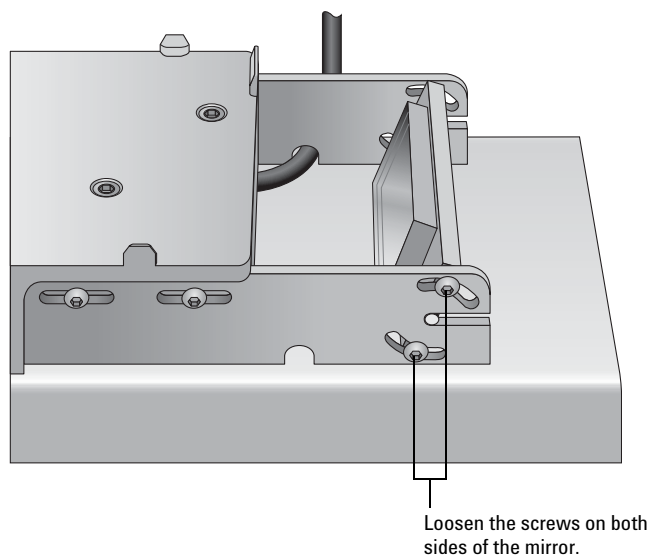
2 Tilt the Barcode Reader mirror slightly. If the angle is set up properly, you can see the laser beam at the vertical center of the barcode label each time you click Scan barcode.
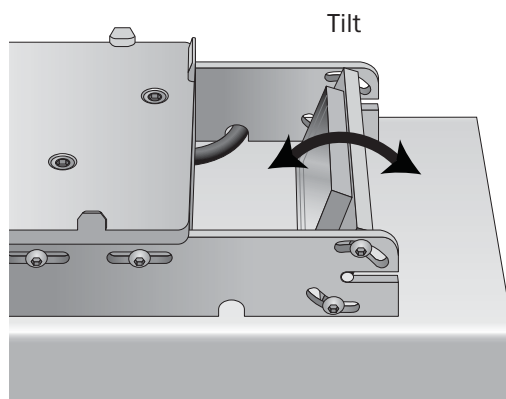
Tilt

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 177.
- 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 176
Installing the Barcode Reader	“Installing or removing the Barcode Reader” on page 177
Creating a profile for the Barcode Reader	“Creating a profile for the Barcode Reader” on page 179
Specifying the Barcode Reader location in the device file	“Specifying the Barcode Reader location” on page 181
Setting up other accessories	• “Accessories and platepads” on page 101 • “Autofilling accessories” on page 165

D
AssayMAP Bravo Platform

This section describes the AssayMAP Bravo Platform and includes the following topics:

Agilent Technologies

AssayMAP Bravo Platform overview

This topic provides an overview of the platform components and standard hardware configurations.

Hardware components overview

The AssayMAP Bravo Platform can enable high-throughput microchromatography for small-scale sample preparation. The following figure shows the components required for the AssayMAP Bravo Platform. The Bravo Platform must include the gripper assembly, which is required for removing the mounted AssayMAP cartridges and disposable tips from the Bravo 96AM Head. For a detailed description of the Bravo Platform and gripper assembly, see "Hardware overview" on page 5.

Figure   AssayMAP Bravo Platform required components
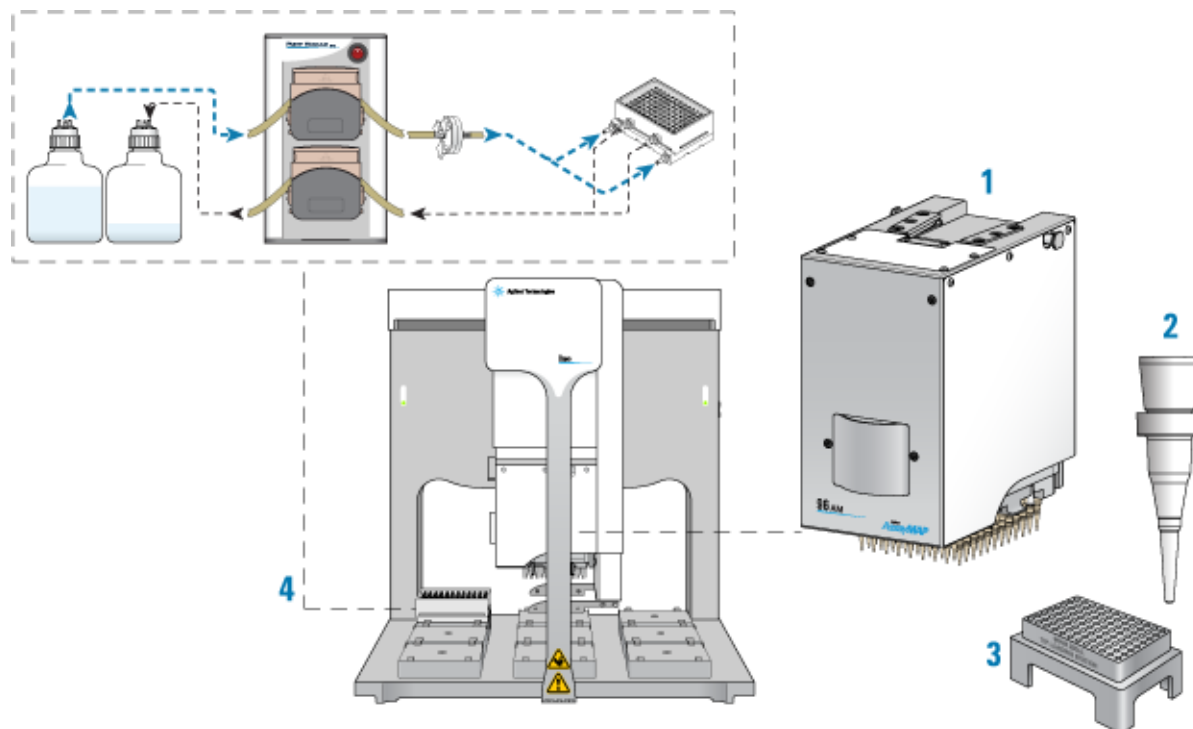
Item	Name	Description
1	Bravo 96AM Head	The 96-channel head that can transfer liquids with the bare probes of the syringes, through AssayMAP cartridges mounted on the probes, and using 250-µL disposable tips mounted on the probes. For a detailed description, see Bravo 96AM Head overview.

Item	Name	Description
2	AssayMAP cartridge	The microchromatography cartridge for small-scale sample preparation. Each cartridge features a 5-µL bed that is packed with chromatographic resin to support a variety of applications. Liquid can be aspirated or dispensed through the packed resin in the cartridges. The AssayMAP Bravo Platform provides the precision flow-rate control required for aspirating or dispensing the fluid through the packed resin in the cartridges.
		For a detailed description, see AssayMAP cartridge overview.
3	96AM Cartridge & Tip Seating Station	The metal rack that holds the AssayMAP cartridges during runs and supports the cartridges when they are mounted on the probes. The seating station is also required for mounting fewer than 96 tips on the head.
		Note: The Cartridge Transfer Utility protocol transfers the cartridges automatically from the conventional cartridge rack into the seating station.
4	AssayMAP autofilling station	The autofilling station that consists of the Pump Module 2.0, tubing kit, and 96AM Wash Station.
	Pump Module 2.0	The Pump Module supplies liquid to the 96AM Wash Station for washing operations, and it removes the waste liquid during washing operations.
	Tubing kit with inline filter	Ensure that the inline filter is connected in the input tubing line between Pump Module and the 96AM Wash Station to help prevent any tubing particulates from potentially clogging the chimneys of the 96AM Wash Station.
	96AM Wash Station	The 96-chimney reservoir for washing the probes, mounted cartridges, and mounted tips of the Bravo 96AM Head. The chimneys in the wash station prevent carryover and reduce contamination. The liquid enters the 96AM Wash Station through two input ports and then flows up through the chimneys to wash the cartridges, tips, or probes. The waste overflows from the chimneys and is removed through two outlet ports.

CAUTION   Using a model of the Tip Wash Station other than the 96AM Wash Station can result in a potential crash with the Bravo 96AM Head. Ensure that you use only the 96AM Wash Station.

Configuration options to support AssayMAP applications

Different AssayMAP applications require slightly different hardware configurations. The following figure and table describe the two standard hardware configurations.

Figure Standard configurations: (**A**) basic and (**B**) enhanced
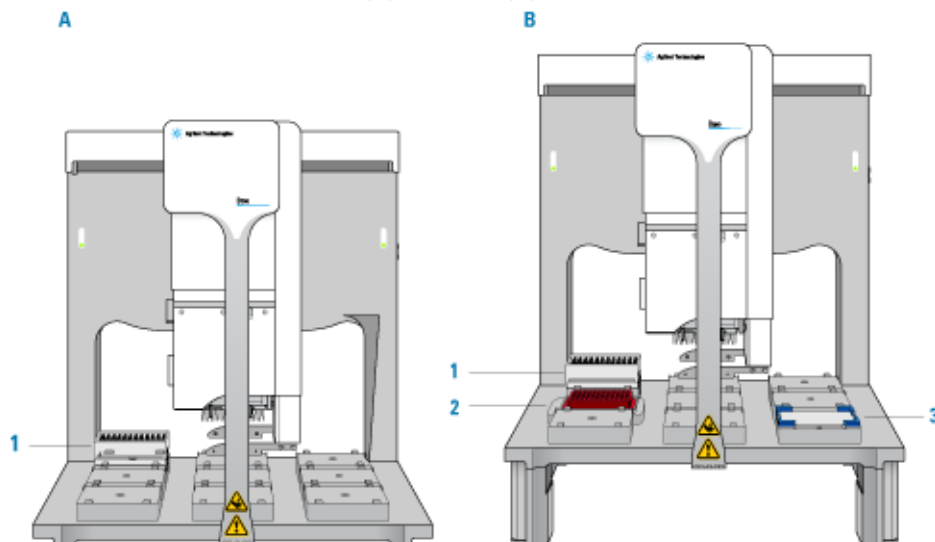
Configuration	AssayMAP Bravo Platform with…	AssayMAP applications
A Basic	96AM Wash Station (**1**) (autofilling station) at deck location 1 *Note:* The autofilling station includes a Pump Module, tubing and fittings, and two 10 L carboys.	Standard applications that do not require temperature control, such as Antibody Purification
B Enhanced	• 96AM Wash Station (autofilling station) (**1**) at deck location 1 • Peltier Thermal Station (**2**) with a custom plate nest and PCR plate insert at deck location 4 Bravo risers are required to accommodate the height • Orbital Shaking Station (**3**) at deck location 9	Applications that require temperature control, such as N-glycan Sample Prep or In-Solution Digestion

Software overview

The Protein Sample Prep Workbench is an interface that provides a collection of AssayMAP workflows, protocols, and forms for running protein sample prep applications on the AssayMAP Bravo Platform. The Protein Sample Prep Workbench includes the following:

• Workflow Library

• Application Library

• Utility Library

- Literature Library

The VWorks software is required for the Protein Sample Prep Workbench. You set up the AssayMAP Bravo Platform using the VWorks software.

Related information

For more information about...	See...
Bravo Platform	"Hardware overview" on page 5
Bravo 96AM Head	• "Bravo 96AM Head overview" on page 193 • "Installing and using the Bravo 96AM Head" on page 201 • "Requirements for partial-head liquid handling" on page 257
AssayMAP cartridges	"AssayMAP cartridge overview" on page 198

Bravo 96AM Head overview

This topic describes:
- "Bravo 96AM Head components" on page 193
- "Liquid-handling modes" on page 195

Bravo 96AM Head components

The Bravo 96AM Head components include:

- *96 channels for liquid handling.* Each channel consists of a syringe with a probe on the end. A syringe consists of a glass barrel with a plunger and a seal. The syringes can employ a combination of direct-liquid-flow and air-displacement techniques for liquid-handling tasks.

  The following figure shows a syringe and a cross-sectional close-up view of the plunger in the probe.

Figure   Bravo 96AM Head, syringe, and detail of probe tip (cross-section)
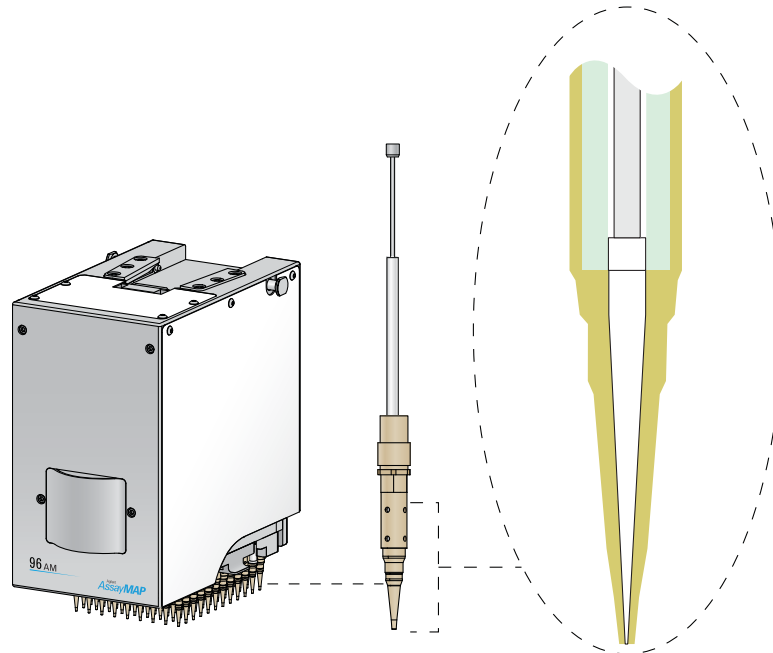
- *Mechanism for removing mounted cartridges and tips.* The head has a stripper plate, which is a spring-loaded mechanism that is actuated by the Bravo gripper assembly. The stripper plate enables the Bravo 96AM Head to remove the cartridges while still holding liquid in the syringes.

  Note: The w-axis is the motion of the displacement of the pipettor inside the head. The w-axis is not engaged during cartridge mounting or removal from the head so that fluid can be held in the syringes and probes. For the Tips On and Tips Off tasks, the Bravo w-axis goes to the zero position to empty any fluid contained in the syringes.

Figure   Stripper plate on Bravo 96AM Head (front-side view and side view)
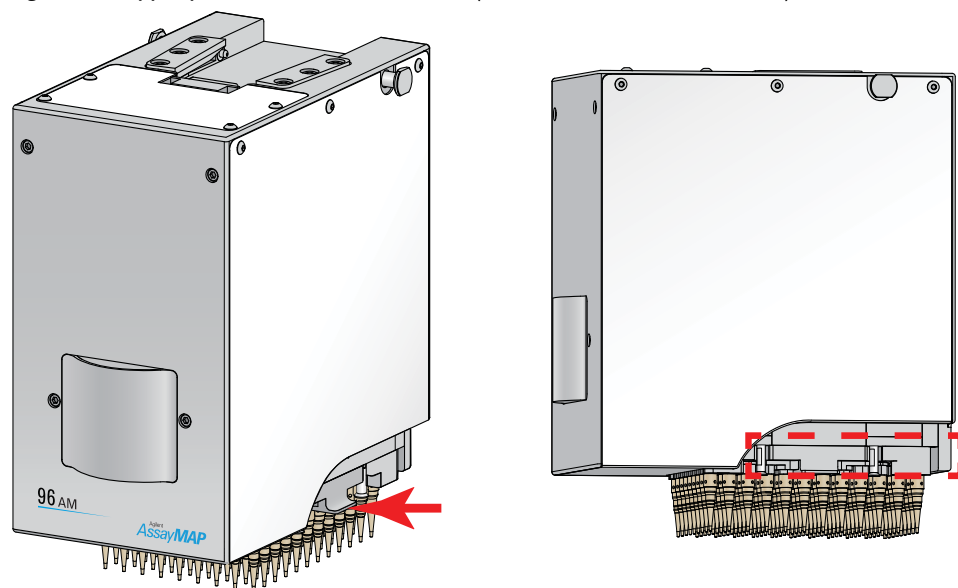
Liquid-handling modes

The Bravo 96AM Head features include the ability to:

- Transfer liquids directly with the bare probes, through AssayMAP cartridges mounted on the probes, and using mounted 250-µL large-transfer (LT) tips
- Mount or remove the cartridges while holding liquid in the syringes
- Provide precise control of flow rates and volume required for moving fluid through the packed resin in the cartridges
- Access 96-well and 384-well microplates
- Perform 96-channel liquid handling or partial-head liquid handling using a subset of the 96 channels

Protocols for the Bravo 96AM Head can employ a combination of the following liquid-handling modes:

- Bare probes
- AssayMAP cartridges mounted on the probes
- 250-µL LT tips mounted on the probes

Capabilities of each liquid-handling mode

The following figure shows a side-by-side comparison of a bare probe, a probe with a mounted cartridge, and a probe with a mounted 250-µL LT tip. The following table provides the details for each.

Figure   Comparison of probe, probe with cartridge, and probe with 250-µL LT tip

Item	Mode	Description
1	Bare probe	- Maximum volume: 250 µL can be aspirated into the syringe before the syringe is full. - Only 96-channel (full head) liquid handling is supported. - As the tips of the syringes, the probes can be in direct contact with the samples for liquid-handling tasks.

Item	Mode	Description
2	AssayMAP cartridge	• Maximum volume: 250 µL can be pulled through the cartridge into the syringe before the syringe is full. • Either all 96 or a subset of the liquid-handling channels are supported. • When cartridges are mounted on the probes, the syringes can push or pull liquids through the resin bed of the cartridges.
3	Disposable 250 µL LT tip	• Maximum volume: 150 µL can be pulled into a mounted tip before the excess fluid overflows into the syringe. The probe protrudes into the tip volume capacity. • Either all 96 or a subset of the liquid-handling channels are supported. • With tips seated on the probes, the syringes can transfer samples without coming into direct contact with them. **IMPORTANT** If the aspiration volume exceeds the capacity of the disposable tips, the excess fluid will overflow into the syringes. You can clean the probes and syringes by washing at the 96AM Wash Station. **IMPORTANT** The 96AM Cartridge & Tip Seating Station is required to mount a partial head of tips. *Note:* Disposable tips mount approximately 9.68 mm (0.15-inch) lower relative to the housing of a Bravo 96AM Head than they would relative to the housing of a standard 96LT Head.

CAUTION Extended use of the Bravo 96AM Head with dry syringes for disposable-tip liquid handling can shorten the life of the syringe seals.

Examples of each liquid-handling mode

The following figure shows how liquid moves through a mounted cartridge, through a bare probe, and into a mounted disposable tip.

Figure Syringe-and-probe liquid-handling modes (cutaway views)

Probe
Syringe plunger
Cartridge
Inlet seal
5 µL bed

Cartridge aspirate   Cartridge dispense   Direct probe   Disposable tip
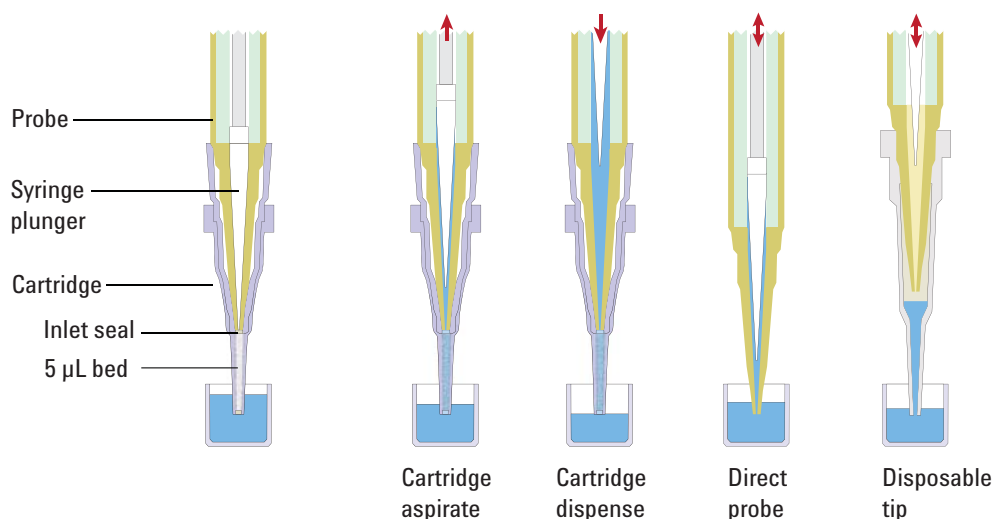
- *Cartridge aspirate*. A series of different liquids can be pulled up through the cartridge bed in sequence without removing the mounted cartridges and washing out the syringes in between the different aspirate steps.

- *Cartridge dispense*. Cartridges can be mounted while the syringes contain liquids. The liquid in the syringes can be dispensed down through the mounted cartridges at precisely controlled flow rates for different types of tasks.

  For example, you can dispense equilibration buffer down through the mounted cartridges for priming and equilibration tasks, and you can dispense elution buffer through the mounted cartridges to recover eluate in a microplate.

- *Direct probe*. Liquid can be aspirated directly into the syringes and transferred using the bare probes.

  The cartridges can be removed to dispense the liquid collected in the syringes, wash the syringes, and then aspirate other fluids into the syringes before mounting the cartridges again for additional dispensing steps.

- *Disposable tip*. As the preceding figure shows, the probe protrudes into the tip volume that is normally used to hold liquid. Therefore, the tip volume capacity is reduced when mounted on a probe.

Related information

For more information about...	See...
AssayMAP cartridges	"AssayMAP cartridge overview" on page 198
Bravo 96AM Head	- "Bravo 96AM Head overview" on page 193 - "Installing and using the Bravo 96AM Head" on page 201 - "Requirements for partial-head liquid handling" on page 257

AssayMAP cartridge overview

This topic describes the AssayMAP cartridge, cartridge rack, and receiver plate.

Cartridge anatomy

The following figure shows the parts of the cartridge.

Figure Cross-sectional side view of cartridge (left) and cartridge mounted on probe (right)

Item	Part	Description
1	Sample cup	The top part of the cartridge that mounts on the probe. *Note:* When the cartridge is not mounted on a probe, the sample cup can hold up to 200-µL of liquid.
2	Inlet seal	The tapered seal at the top of the packed resin bed. When the probe is inserted into the cartridge, the tip of the probe engages the inlet seal. This configuration enables the Bravo 96AM Head probe to make or break a fluid-tight connection between the packed-resin bed and the liquid inside the syringe.
3	Resin bed	The part of the cartridge that is packed with 5-µL beaded resin. The bead size can vary depending on the assay (20 µm to 100 µm).
4	Bed supports, upper and lower	Frits at the top and bottom of the resin bed provide a membrane that retains the resin beads within the bed while allowing a bidirectional flow of fluid to pass through the cartridge.

Cartridge rack, lid, and receiver plate

The cartridges are shipped in a stack that consists of a lid, cartridge rack, and receiver plate, as the following figure shows.

Figure   AssayMAP cartridge rack lid (**1**), rack with cartridges (**2**), and receiver plate (**3**)
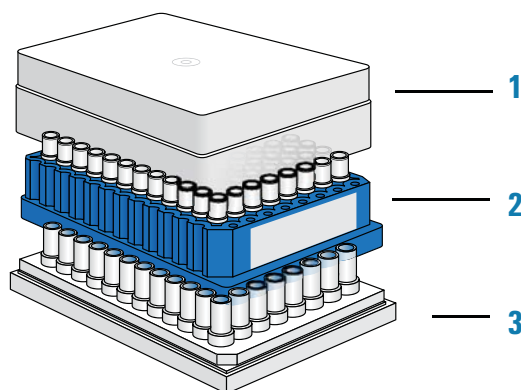
The lid rests directly on top of the cartridges and provides protection during shipping and storage. The lid can also prevent cartridges from being pushed out when the cartridge rack is inserted into a receiver plate.

In the VWorks software, the 96AM Cartridge Rack and Receiver Plate is defined as labware. This labware definition is installed when you install the provided AssayMAP protocols and forms.

About seating the cartridges on the probes

You use the 96AM Cartridge & Tip Seating Station, shown in the following figure, to ensure proper seating of the cartridges or tips on the syringe probes. A cartridge transfer utility enables you to use the AssayMAP Bravo Platform to automatically transfer the cartridges from the cartridge rack to the seating station.

In the VWorks software, the 96AM Cartridge & Tip Seating Station is defined as labware. This labware definition is installed when you install the provided AssayMAP protocols and forms.

Note: In a VWorks protocol, the 96AM Cartridge & Tip Seating Station is configured as static labware in the startup protocol.

Figure   96AM Cartridge & Tip Seating Station

Related information

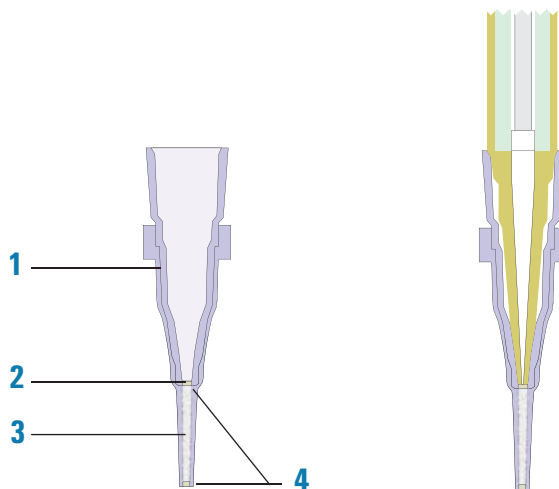| For more information about...	See...
AssayMAP Bravo Platform	"AssayMAP Bravo Platform overview" on page 190
Bravo 96AM Head	• "Bravo 96AM Head overview" on page 193 • "Installing and using the Bravo 96AM Head" on page 201 • "Requirements for partial-head liquid handling" on page 257

About installing the AssayMAP Bravo Platform

Typically, an Agilent representative installs the AssayMAP Bravo Platform and sets up the software configuration. This topic provides the installation workflow for your reference.

The software setup workflow is described in "Setting up the AssayMAP Bravo Platform" on page 215.

If you have questions about installing and setting up the AssayMAP Bravo Platform, contact Automation Solutions Technical Support.

Step	For this task...	See...
1	Install the Bravo Platform and safety equipment. *Note:* To have Bravo risers installed, contact Automation Solutions Technical Support.	*Bravo Automated Liquid Handling Platform Safety and Installation Guide*
2	Ensure that the Bravo 96AM Head is installed.	"Installing and using the Bravo 96AM Head" on page 201

Step	For this task...	See...
3	Ensure that the accessories for your AssayMAP hardware configuration are installed.	"Configuration options to support AssayMAP applications" on page 192
	• 96AM Wash Station (all configurations)	"Installing the 96AM Wash Station" on page 209
	• Peltier Thermal Station (enhanced configuration) This accessory requires the Bravo Platform to be elevated on risers to allow room for the accessory's height below the deck.	Automation Solutions Technical Support
	• Orbital Shaking Station (enhanced configuration)	"Installing the Orbital Shaking Station" on page 113 **IMPORTANT** You will use the AssayMAP-specific instructions to configure the accessories in the software.
4	Set up the AssayMAP Bravo Platform.	"Setting up the AssayMAP Bravo Platform" on page 215
5	Open the Protein Sample Prep Workbench.	"Opening the Workbench and accessing the utilities" on page 254
6	Verify the performance of the syringes in the Bravo 96AM Head.	*AssayMAP Syringe Test Kit User Guide*

Installing and using the Bravo 96AM Head

This topic addresses the following:

- Guidelines for using and storing the Bravo 96AM Head
- About the tip box stripper pins
- Uninstalling the Bravo 96AM Head
- Installing the Bravo 96AM Head

Guidelines for using and storing the Bravo 96AM Head

Ensure that you understand the following warnings and cautions about the proper way to handle and use the Bravo 96AM Head.

⚠️ **WARNING** **The probes of the Bravo 96AM Head are sharp and can scratch you if they brush across your hand. A probe scratch can expose you to any contaminants remaining on the probes. Be careful to avoid touching the probes.**

> **CAUTION**   Extended use of the Bravo 96AM Head with dry syringes for disposable-tip liquid handling can shorten the life of the syringe seals.

> **CAUTION**   To prevent potential damage, ensure the Bravo 96AM Head probes, tips, or cartridges do not touch the bottom of the 96AM Wash Station. To adjust the distance from the bottom, you can use the Bravo liquid-handling task parameters in the VWorks software.

> **CAUTION**   Before leaving the Bravo 96AM Head idle overnight, wash the syringes thoroughly with deionized water to prevent salt buildup that could damage the syringe seals.

IMPORTANT   To transfer greater than 150 µL liquid, use the bare probes instead of disposable tips. The syringes can hold up to 250 µL. If you aspirate more than 150 µL using 250-µL tips, the excess aspirated liquid will enter the syringes. Ensure that you wash the syringes as appropriate for your protocol to prevent contamination.

For information about using a subset of the 96 channels, see "Requirements for partial-head liquid handling" on page 257.

About the tip box stripper pins

> **CAUTION**   If the Bravo 96AM Head tip box stripper pins are extended, the pins will crash into the wash station during syringe washing. To prevent potential equipment damage, ensure that the pins are always retracted during use.

Figure   Bravo 96AM Head (side view) with tip box stripper pins retracted and extended
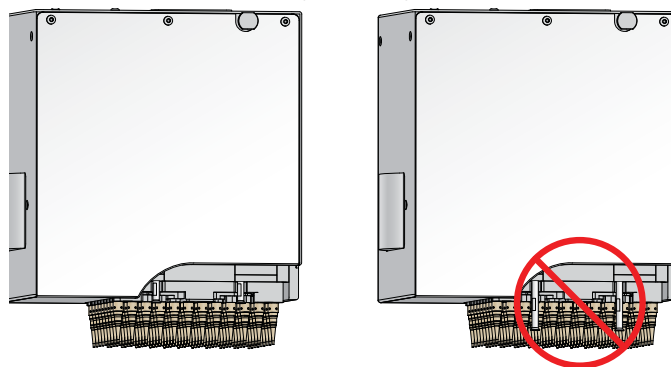
Uninstalling the Bravo 96AM Head

> **CAUTION**   Placing the probes of the Bravo 96AM Head (bottom of head) on any surface can damage the probes. To protect the probes when the head is not mounted on the Bravo Platform, place the top of the head on a clean, stable surface so that the probes are facing upward. For storage, use the storage stand.

To remove the Bravo 96AM Head from the Bravo Platform:

1   Put on gloves to protect your hands from potential exposure to sharp edges and any residual contaminants.

2   Ensure that the syringes are empty as follows:

   a   In the **Protein Sample Prep Workbench**, open the **Utility Library**.

   b   In the **System Startup/Shutdown** utility, run the **Startup** protocol. The Startup protocol purges any liquid left in the head, which is required for long-term storage or conducting syringe repairs.
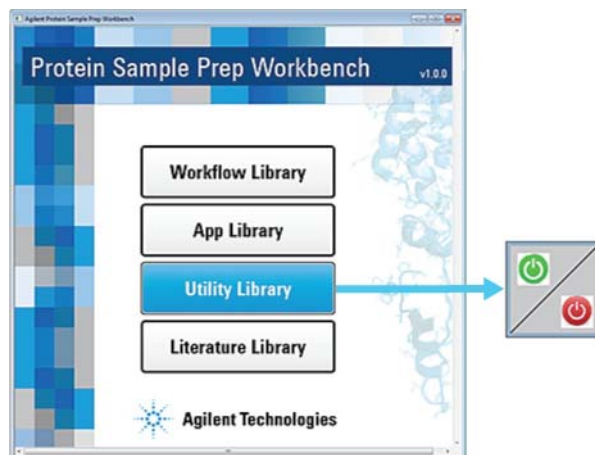
3   On the side of the Bravo Platform, press the power switch to the **off** (**o**) position.

4   Gently, move the Bravo head manually to position it over deck location 6, which will provide easier access for removing the head.
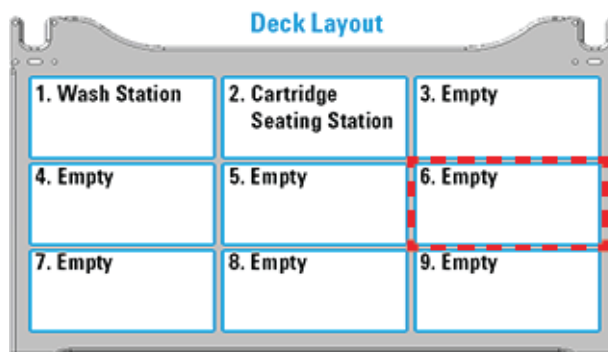
5   To unlock the mounted head, refer to the following figure:

   a   Pull out and twist the (**1**) two head-retainer pins one-quarter turn (90°) so that they remain retracted.

   Note: The straight edge of the retainer pins should be horizontal.

   b   Turn the (**2**) head lock counterclockwise until it clicks into position.

Figure   Installed Bravo 96AM Head: (**1**) retainer pin and (**2**) head lock
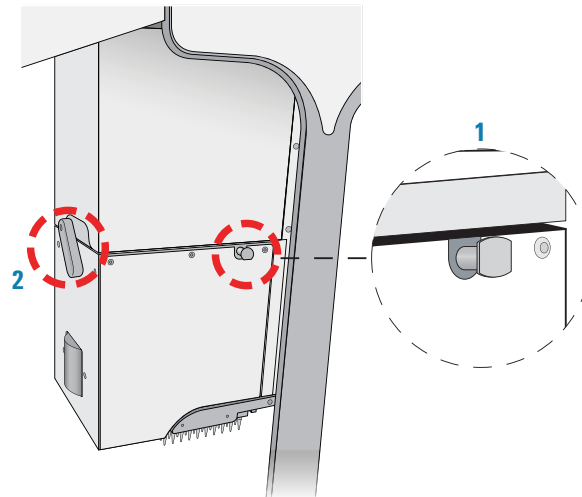
6   Reaching from the left side of the Bravo tie bar, grasp the head firmly as follows:

   a   With your left hand firmly grip the left side of the head.

   b   Place your right hand under the flat area just to the left of the syringe array to support the weight of the head.

7   While supporting the head with your hands, slide the head to the left and out of the Bravo head mount.

> **CAUTION**   Support the head securely without touching the probes. Dropping the head or bumping the probes will damage the syringes.

Figure   Uninstalling the Bravo 96AM Head
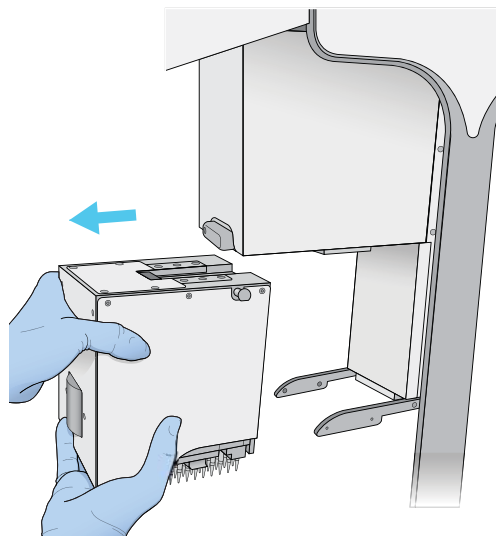
8   Carefully place the head upside down on a clean, stable surface so that the probes are facing up.

Figure   Bravo 96AM Head upside down
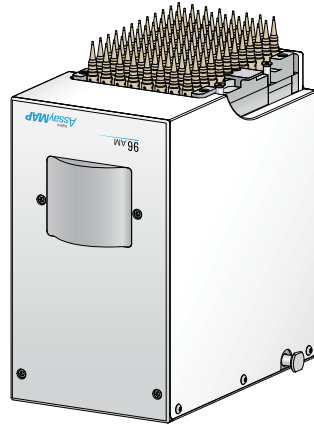
9   Carefully lift the stand onto the head, guiding the stand's side cutouts (**1**) onto the head side tabs (**2**). Use care to avoid touching the probes.

Figure   Removing or inserting the stand on the head
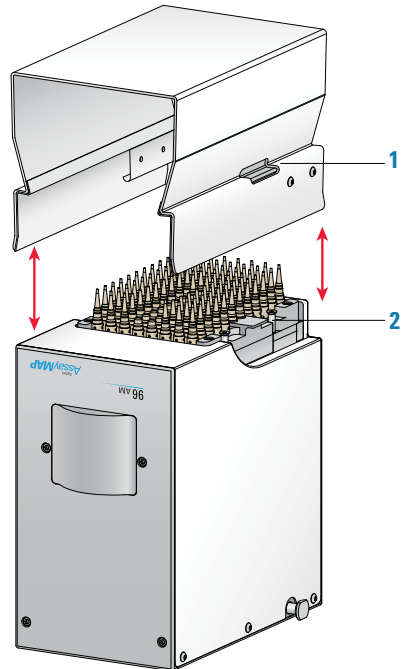
Figure   Bravo 96AM Head in storage stand
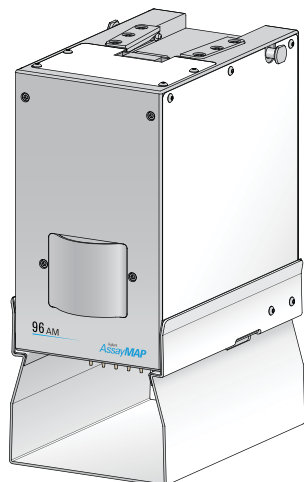
Installing the Bravo 96AM Head

To remove the Bravo 96AM Head from the storage stand:

1   Ensure that the top of the head is resting on a clean, stable surface. The probes should be facing upward, as the following figure shows.

2   Using both hands, carefully lift the stand off of the head while guiding the stand's side cutouts (**1**) off the head side tabs (**2**). Use care to avoid touching the probes.

Figure   Removing or inserting the stand on the head
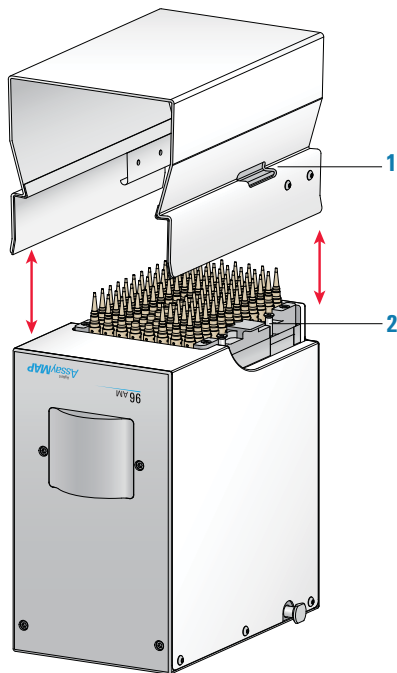
> **CAUTION**   Placing the probes of the Bravo 96AM Head (bottom of head) on any surface can damage the probes. To protect the probes when the head is not mounted on the Bravo Platform, place the top of the head on a clean, stable surface so that the probes are facing upward. For storage, use the storage stand.

To install the Bravo 96AM Head:

1   On the head, twist the two head-retainer pins one-quarter turn so that they are in a vertical orientation. (The pins will snap back into place when you install the head.)
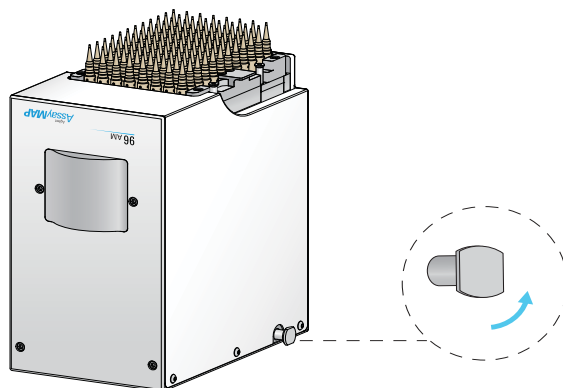
2   With your left hand, firmly grip the left side of the head. Place your right hand under the flat area just to the left of the syringe array to support the weight of the head.

3   While supporting the head with your hands, slide the head onto the Bravo head mount. Press the head firmly into place to ensure the head is plugged into the connector receptacle on the head mount. You should hear the click when the retaining pins snap into place.

Figure   Installing the Bravo 96AM Head in the Bravo head mount
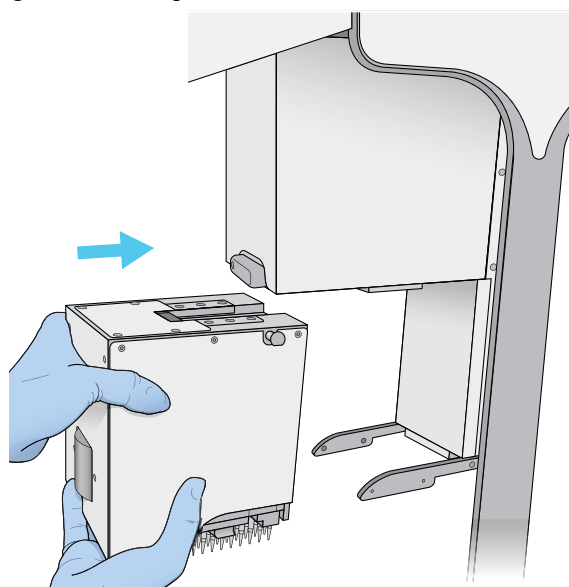
Note: If you do not hear the pins snap into place, check that the straight edges of the retainer pins are in the vertical position, as the following figure shows. Attempt to rotate the pins to ensure that they are in the locked position. The pins should not rotate freely.

Figure   Installed Bravo 96AM Head: (**1**) retainer pin and (**2**) head lock
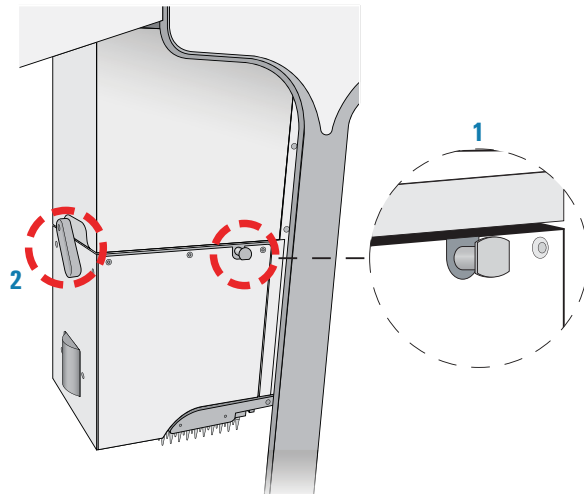
4   To lock the head, rotate the head lock clockwise until it reaches its hard stop. This ensures that the head is fully seated and does not shift position during operation.
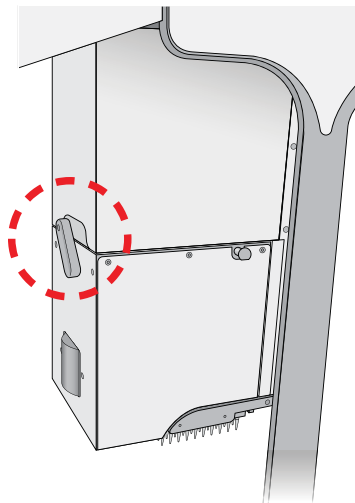
CAUTION   Dropping the head or bumping the probes will damage the syringes. If the Bravo head is not properly secured in place, it could drop unexpectedly. Ensure that the head is securely locked into the head mount.

Related information

For more information about...	See...
Installation workflow for AssayMAP Bravo Platform	"About installing the AssayMAP Bravo Platform" on page 200
Partial-head liquid handling	"Requirements for partial-head liquid handling" on page 257
Bravo 96AM Head	"Bravo 96AM Head overview" on page 193

Installing the 96AM Wash Station

About this topic

Typically, an Agilent representative will set up the AssayMAP Bravo Platform. This topic presents the sequence of setup procedures for reference. This topic describes how to install a 96AM Wash Station on the AssayMAP Bravo Platform.

Figure   96AM Wash Station installed on platepad with brackets
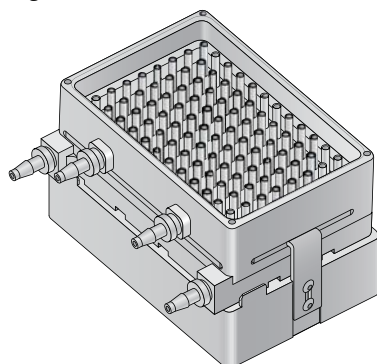
Workflow

Step	For this task...	See...
1	Install the 96AM Wash Station on the deck.	"Installing the 96AM Wash Station" on page 209
2	Connect the tubing from the wash station to the Pump Module.	"Tubing connections for 96AM Wash Station" on page 212
3	Configure the wash station location in the software and set the teachpoints.	"Setting up the AssayMAP Bravo Platform" on page 215

CAUTION The AssayMAP Bravo Platform requires precise positioning of the 96AM Wash Station relative to the pipette tips, cartridges, and probes. Ensure that the teachpoint is correct and that the 96AM Wash Station is secured to the platepad to prevent potential collisions.

Installing the 96AM Wash Station

Before you start

WARNING **To prevent potential injury, turn off the Bravo Platform before you install or remove any accessory.**

Ensure that you have the following:

* 96AM Wash Station and the platepad with brackets
* Pump Module 2.0
* Tubing kit with inline filter

Ensure that you install the 96AM Wash Station at deck location 1.

Figure 96AM Wash Station installed at deck location 1
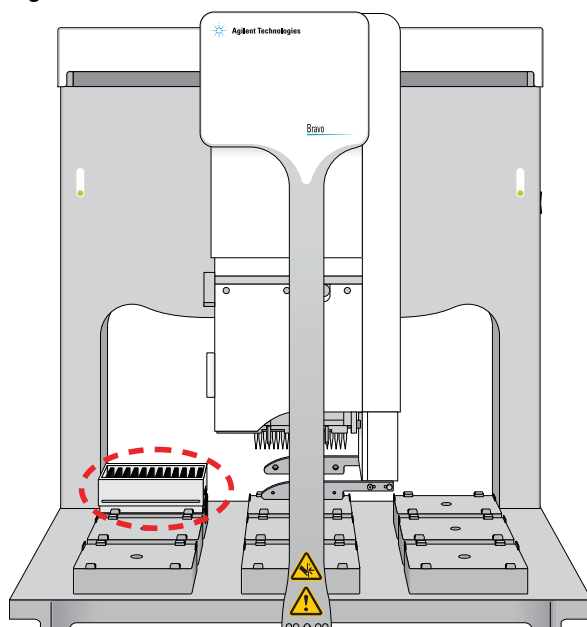
To install the wash station:

1 At deck location 1, remove the standard platepad and install the bracketed platepad. Use the supplied screw to secure the platepad to the deck.

Ensure the platepad crosshairs are oriented towards the northwest corner of the deck, as the following figure shows.

Figure   Deck location 1 (top view) showing crosshairs orientation
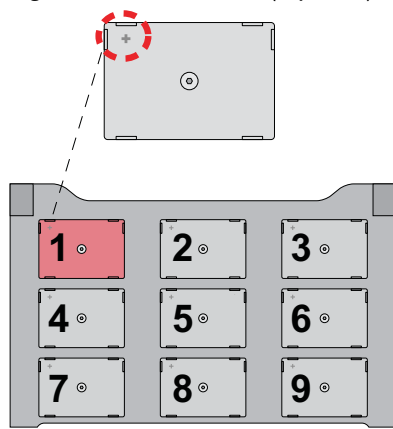
2   On the platepad side that is next to the crosshairs, uninstall the bracket using a hex driver to remove the two 2-mm screws.

Note: The wash station is easier to install if you remove the outer bracket, and then replace the bracket after the wash station is in position.

Figure   Bracket next to platepad crosshairs
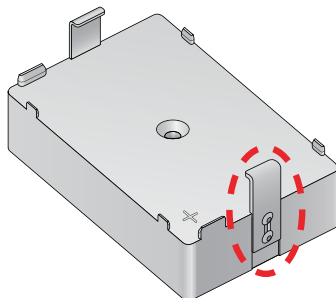
3   Install the wash station on the platepad as follows:

a   Ensuring that the inlet and outlet ports are towards the rear of the deck, place the wash station on the platepad.

b   Guide the platepad's inner bracket into the wash station's horizontal side slot.

c   Re-install the bracket that you removed in step 2 on the outer side of the platepad. Ensure that you guide the bracket into the corresponding horizontal slot on the wash station. Ensure that both brackets remain engaged as you tighten the bracket screws.

d   Ensure that the wash station sits level on the platepad and that both brackets are holding the wash station securely in place.

Figure   96AM Wash Station secured with platepad brackets.
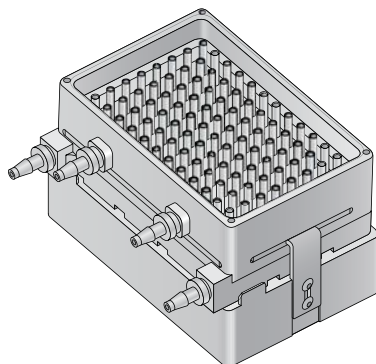
Tubing connections for 96AM Wash Station

The following figure shows the AssayMAP Bravo tubing connections for the 96AM Wash Station. As the figure shows, the upper pump (**A**) is for the fill line and the lower pump (**B**) is for the empty line.

Figure   96AM Wash Station fill line (**A**) and empty line (**B**)
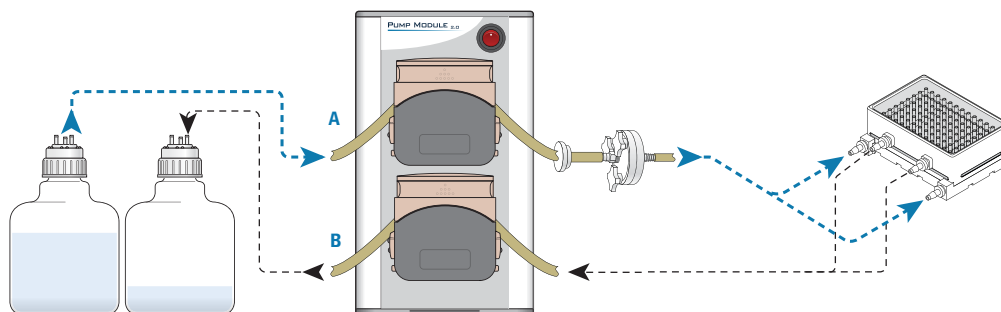
To ensure proper chimney filling and waste emptying characteristics for the 96AM Wash Station, ensure that you use the proper tubing combination for the Pump Module. The following table gives two recommendations: one for conservative buffer usage, and one for inducing higher volume flow through the chimneys.

Fill-and-empty characteristics	Tubing recommendation
High volume flow in chimneys (recommended)	• Fill line (**A**) Marprene tubing, 6.4 mm (1/4-in) ID, 1.6 wt • Emptying line (**B**) Marprene tubing, 8 mm (5/16-in) ID, 1.6 wt The 5/16-in diameter tubing is too large for the quick-disconnect fittings and the wash station ports. You use this larger tubing only in the pump head and splice it to the 1/4-in tubing to enable connections with the other fittings and wash station ports. See the following figure and table for a tubing example and a description of the tubing components.

Fill-and-empty characteristics	Tubing recommendation
Conservative buffer usage	• Fill line (**A**) Marprene tubing, 4.8 mm (3/16-in) ID, 1.6 wt • Emptying line (**B**) Marprene tubing, 6.4 mm (1/4-in) ID, 1.6 wt

Figure   Tubing example and components for high volume flow in the chimneys

Item	Component	Description
1	Source bottle	Supplies the fill liquid for the wash station.
2	Waste bottle	Collects the waste liquid that is pumped from the reservoir.
3	Tubing, 8-mm (5/16-in)	For high volume flow in the chimneys, use the 5/16-in diameter Marprene tubing for the length of tubing in the pump head.
4	Tubing, 6.4-mm (1/4-in)	The 1.4-in Marprene tubing is for the input and output tubing connections to the wash station and the source and waste bottles. The 5/16-in diameter tubing is too large for the quick-disconnect fittings and the wash station ports. So, you use a union connector (**5**) to splice the 5/16-in tubing to the 1/4-in tubing.
5	Connector, union	Joins two sizes of tubing, such as the 5/16-in tubing to the 1/4-in tubing.
6	Quick-disconnect fitting	Enables easy removal of the wash station. The quick-disconnect fittings include an automatic-close valve. Fluid can flow only if a positive connection is made.
7	Inline pump filter	Removes the particulates that can clog the chimneys in the wash station.
8	3-way connector	Enables one tube to branch into two tubes at the input and output ports on the wash station.

For detailed Pump Module connection instructions, see the *Pump Module User Guide*.

Related information

For more information about...	See...
Configuring the wash station in the software and setting the teachpoint	"Setting up the AssayMAP Bravo Platform" on page 215
Pump Module	*Pump Module User Guide*
Bravo 96AM Head	• "Bravo 96AM Head overview" on page 193
	• "Installing and using the Bravo 96AM Head" on page 201
	• "Requirements for partial-head liquid handling" on page 257

Turning on the AssayMAP Bravo Platform

Procedure

To turn on the platform:

1   If you have not already done so, turn on any accessories, such as the Pump Module. If applicable, ensure that the Inheco STC Controller and the control module for the Orbital Shaking Station are turned on.

2   Start the Microsoft Windows operating system.

3   On the side of the AssayMAP Bravo Platform, press the power switch to the **on (|)** position.
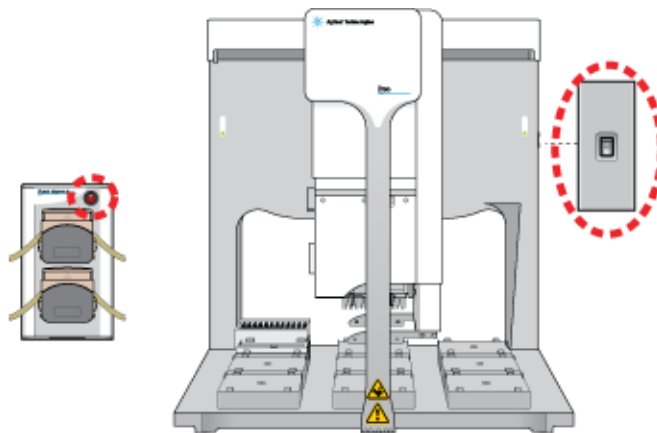
The green light on the switch is illuminated when the Bravo Platform is on.

IMPORTANT   If the VWorks software has not yet been configured for your instrument, you must configure the software before operating the AssayMAP Bravo Platform.

Related information

For more information about...	See...
Setting up the AssayMAP Bravo Platform	"Setting up the AssayMAP Bravo Platform" on page 215
Starting up the AssayMAP Bravo Platform	"About the System Startup/Shutdown utility" on page 254

Setting up the AssayMAP Bravo Platform

About this topic

Typically, an Agilent representative will set up the AssayMAP Bravo Platform. This topic presents the procedures for reference.

Before you start

⚠️ **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the AssayMAP Bravo Platform should perform the setup procedures.**

Software requirements

For the computer requirements, see the software release notes or the VWorks Knowledge Base at www.agilent.com/chem/askb.

The AssayMAP Bravo Platform requires compatible versions of the VWorks software and the Protein Sample Prep Workbench. See the software release notes for compatibility requirements and software installation instructions.

Setup workflow

You must set up the AssayMAP Bravo Platform in the VWorks software before you run the protocols in the Protein Sample Prep Workbench. Make sure that you perform the following steps in the order given.

Step	For this task...	See...
1	Turn on the AssayMAP Bravo Platform.	"Turning on the AssayMAP Bravo Platform" on page 214
2	Understand the device profile requirements	"Device profile requirements" on page 216

Step	For this task...	See...
3	Start the VWorks software, establish communication, and verify the device profile settings for your installation.	"Verifying the settings in your device profiles" on page 218

Device profile requirements

> **CAUTION**   Using a profile that is associated with teachpoints from a different AssayMAP Bravo Platform or different Bravo 96AM Head can result in a hardware collision and cause equipment damage. Ensure that you verify the profiles and teachpoints for your specific instrument and Bravo 96AM Head.

> **CAUTION**   Using the wrong device profile or an improperly created profile can result in equipment damage. If you are uncertain about which device file or profile to use, see your lab administrator.

Each AssayMAP application requires a specific Bravo device file and profile. The device profile specifies the head type (Bravo 96AM Head), Ethernet communication settings for the device, the configuration of the platepads and accessories on the deck, and the associated teachpoints for the specific combination of instrument and Bravo 96AM Head.

Each device profile is associated with a device file. The following table lists the device files and associated profiles installed with the Protein Sample Prep Workbench v2.0.

Table   AssayMAP device files and associated profiles

Device file name	Profile name	AssayMAP applications
AssayMAP Bravo.dev	AssayMAP 1 profile	Affinity Purification Antibody Purification Immobilization
GlykoPrep-Plus_AM Bravo.dev	GlykoPrep-Plus profile	N-Glycan Sample Prep applications
AM Peptide Sample Prep.dev	AssayMAP Peptide Sample Prep profile	Fractionation IMAC Cartridge Customization In-Solution Digestion: Multi-Plate Peptide Cleanup Phosphopeptide Enrichment Protein Cleanup
InSolution Digestion-AM Bravo.dev	Single Plate InSolution Digestion	In-Solution Digestion: Single Plate
Normalization-AM Bravo.dev	AssayMAP Normalization	Normalization

The device profile must specify the correct deck configuration and the associated teachpoints for the Bravo deck layout. For example, the GlykoPrep-Plus profile can be used with hardware configuration B but not with hardware configuration A.

Related information

For more information about...	See...
AssayMAP Bravo Platform hardware configurations	"Configuration options to support AssayMAP applications" on page 192
Setting teachpoints for the AssayMAP Bravo Platform	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231

Verifying the profile settings for the AssayMAP Bravo Platform

About this topic

Typically, an Agilent representative will set up the AssayMAP Bravo Platform when it is first installed. This topic presents the verification procedures for reference.

⚠️   **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the AssayMAP Bravo Platform should perform the setup procedures.**

Before you start

You must verify the profile settings and configuration anytime the following occurs:

• The AssayMAP Bravo Platform is being set up for the first time

• The device files were overwritten or otherwise corrupted

Ensure that you complete the following workflow for all the device profiles included with the Protein Sample Prep Workbench.

Step	For this task...	See...
1	In the profile, ensure that the deck is configured for each of the installed accessories.	"Verifying the settings in your device profiles" on page 218
2	Ensure the deck configuration in the profile matches the physical AssayMAP Bravo deck.	"Verifying the deck configuration in the profile" on page 221

Verifying the settings in your device profiles

IMPORTANT   Ensure that the Protein Sample Prep Workbench is closed.

To verify the profile settings:

1   Start the VWorks software.

You can click the VWorks desktop icon or use the Start menu on the Windows desktop to start the VWorks software.

2   Ensure that Simulation is off.

Figure   Simulation button in the VWorks window
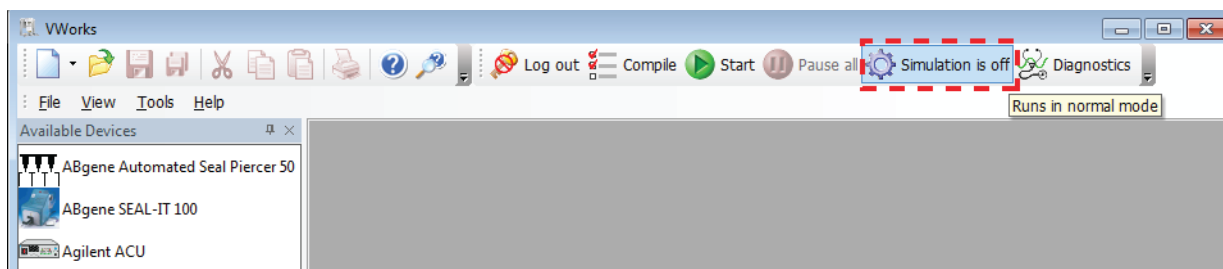
3   In the **VWorks** window, open the corresponding AssayMAP device file for the profile that you are verifying.

To open a device file, choose **File > Open**. In the **Open** dialog box, ensure the file type is **Device Files (*.dev)**, select the file, and then click **Open**.

The device files are installed in the following default location:

C:\VWorks Workspace\Workbench\Device Files

4   Click **No** when the **Would you like to initialize devices now?** message appears.
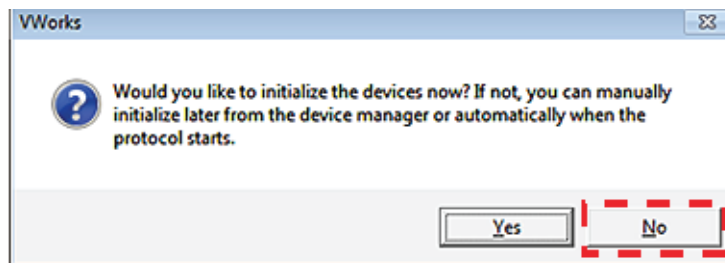
5   In the *<name>*.dev tab, ensure that the **Profile** selection is correct.

Figure   Device file and associated profile

Device file name	Profile name
AssayMAP Bravo.dev	AssayMAP 1
GlykoPrep-Plus_AM Bravo.dev	GlykoPrep-Plus
AM Peptide Sample Prep.dev	AssayMAP Peptide Sample Prep
InSolution Digestion-AM Bravo.dev	Single Plate InSolution Digestion
Normalization-AM Bravo.dev	AssayMAP Normalization

If necessary, select the correct name from the **Profile** list, and then click the **Save** icon.

Figure   AssayMAP Bravo.dev tab and Profile setting for AssayMAP 1
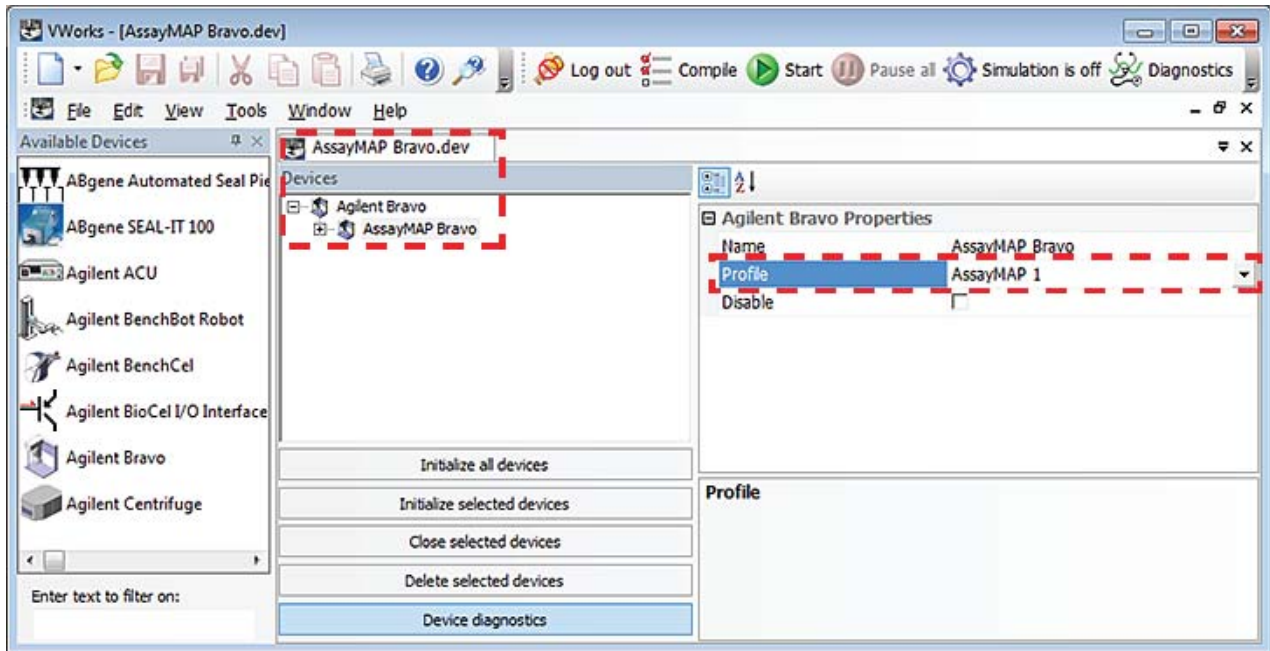
6   In the *<name>*.dev tab, click **Device diagnostics**. The **Bravo Diagnostics** dialog opens.

7   In the **Profiles** tab, verify the **Profile name**.

8   Verify the following **Head Information** properties.

Figure   Head Information area on the Profiles tab
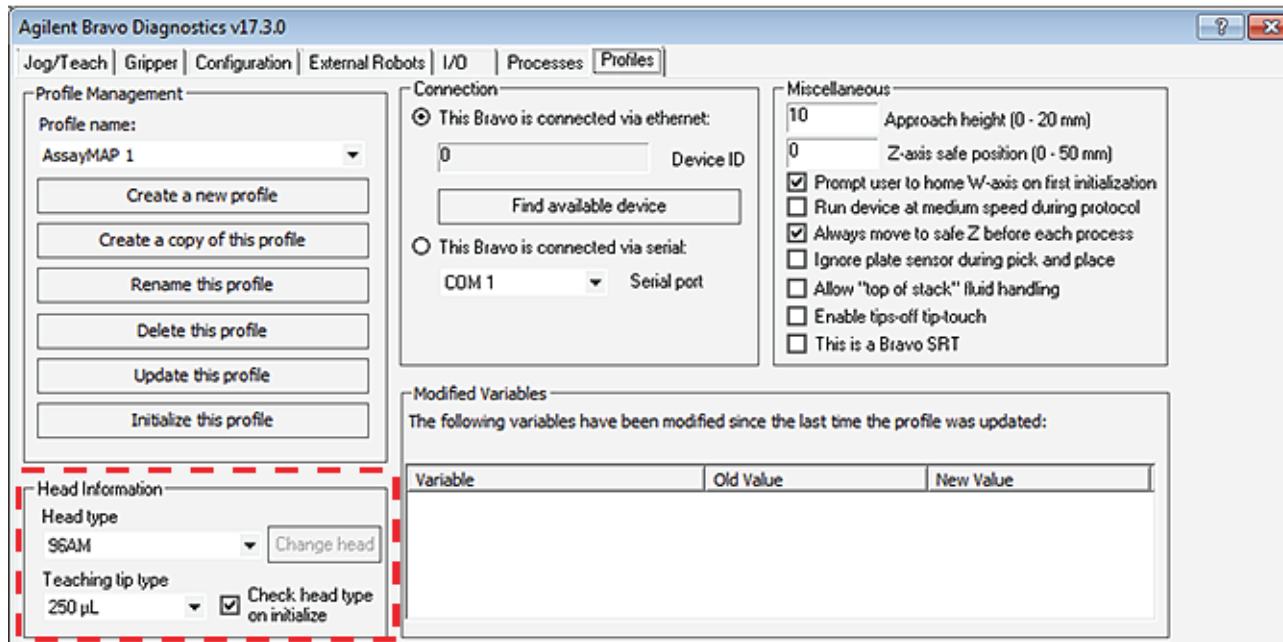
Property	Setting
Head type	96AM
Teaching tip type	250 µL
Check head type on initialize	☑ checked

9 In the **Connection** area, select **This Bravo is connected via ethernet**, and then click **Find available device** to select the device to associate with the profile.

In the **Discovered BioNet Devices** dialog box that appears, perform the following tasks:
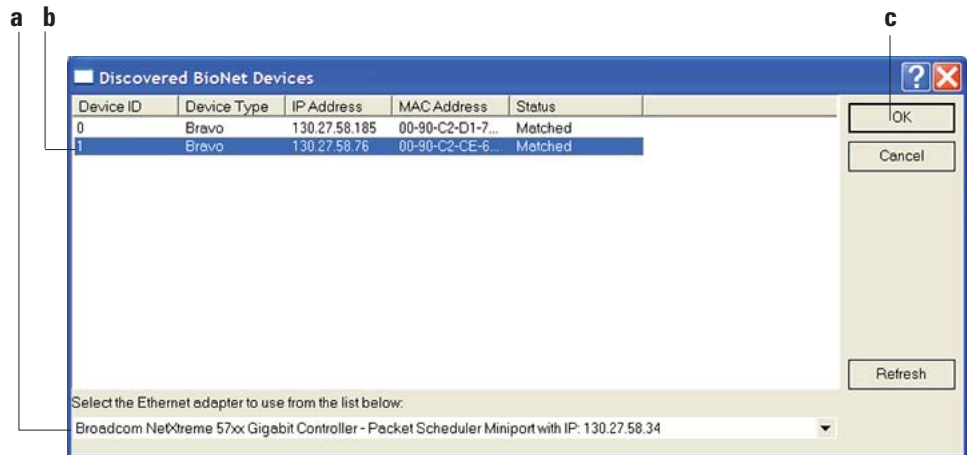
a Click the **Select the Ethernet adapter to use from the list below**, and select the correct adapter for the device connection.

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**.

10 In the **Miscellaneous** area, verify the property settings. The following figure list the settings for each profile.

11 If you have made any changes, click **Update this profile**.

Figure   Miscellaneous area of the Profiles tab showing variations in property settings for different AssayMAP profiles

Verifying the deck configuration in the profile

Verify the configuration in each of the profiles separately. Ensure that the profile deck configurations match the accessories installed on the Bravo deck. By default, the AssayMAP device profiles can include configurations for the following:

- **Autofill Station at deck location 1**. Controls pumping the liquid to and from the 96AM Wash Station. This configuration is required for all AssayMAP applications and included in all AssayMAP profiles by default.

- **Heating Shaking Station at deck location 4**. Controls the Peltier Thermal Station (also known as the CPAC Ultraflat).

  Note: The Heating Shaking Station configuration is required for any heating or shaking accessory that is controlled by an STC or MTC controller.

- **Orbital Shaking Station at deck location 9**. Controls the Orbital Shaking Station.

The following table describes the requirements for each profile.

Profile	Verification tasks	See…
AssayMAP 1 profile	By default, the AssayMAP 1 profile includes only the Autofill Station (96AM Wash Station) as an accessory configuration. All other deck locations are configured as standard platepads. If the Peltier Thermal Station and Orbital Shaking Station are installed on the AssayMAP Bravo deck, reconfigure the corresponding deck locations for these accessories in the AssayMAP 1 profile.	"Verifying the Autofill Station configuration (96AM Wash Station)" on page 224
GlykoPrep-Plus profile	By default, the GlykoPrep-Plus profile includes the following configurations: • Autofill Station (96AM Wash Station) • Heating Shaking Station for the Peltier Thermal Station (location 4) • Orbital Shaking Station (location 9) If these accessories are not installed on the AssayMAP Bravo deck, reconfigure the corresponding deck locations for a standard platepad.	• "Verifying the Autofill Station configuration (96AM Wash Station)" on page 224 • "Verifying the Peltier Thermal Station configuration" on page 226 • "Verifying the Orbital Shaking Station configuration" on page 228
AssayMAP Peptide Sample Prep profile	By default, the AssayMAP Peptide Sample Prep profile includes the following configurations: • Autofill Station (96AM Wash Station) • Heating Shaking Station for the Peltier Thermal Station (location 4) • Orbital Shaking Station (location 9) If these accessories are not installed on the AssayMAP Bravo deck, reconfigure the corresponding deck locations for a standard platepad.	• "Verifying the Autofill Station configuration (96AM Wash Station)" on page 224 • "Verifying the Peltier Thermal Station configuration" on page 226 • "Verifying the Orbital Shaking Station configuration" on page 228

Profile	Verification tasks	See...
Single Plate InSolution Digestion profile	By default, the Single Plate InSolution Digestion profile includes the following configurations: • Autofill Station (96AM Wash Station) • Heating Shaking Station for the Peltier Thermal Station (location 4) • Orbital Shaking Station (location 9) If these accessories are not installed on the AssayMAP Bravo deck, reconfigure the corresponding deck locations for a standard platepad. In addition to the physical accessories, this profile includes a Lid Hotel configuration at deck locations 3 and 7. Even though standard platepads are installed at these deck locations, the Lid Hotel configuration enables the locations for Delidding and Relidding tasks.	• "Verifying the Autofill Station configuration (96AM Wash Station)" on page 224 • "Verifying the Peltier Thermal Station configuration" on page 226 • "Verifying the Orbital Shaking Station configuration" on page 228
AssayMAP Normalization profile	By default, the AssayMAP Normalization profile includes the following configurations: • Autofill Station (96AM Wash Station) • Heating Shaking Station for the Peltier Thermal Station (location 4) If Peltier Thermal Station is not installed on the AssayMAP Bravo deck, reconfigure the corresponding deck location for a standard platepad. The AssayMAP Normalization profile also includes accessory teachpoints at deck locations 2 and 6 for the Bravo Plate Riser accessory, which must be verified and adjusted if necessary. This accessory has no configuration settings.	• "Verifying the Autofill Station configuration (96AM Wash Station)" on page 224 • "Verifying the Peltier Thermal Station configuration" on page 226

Verifying the Autofill Station configuration (96AM Wash Station)

About this topic

Use the following procedure to verify the configuration settings for the Autofill Station installed on an AssayMAP Bravo Platform.

⚠️   **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the AssayMAP Bravo Platform should perform the setup procedures.**

Configuration requirements

All AssayMAP device profiles should already include the configuration for an Autofill Station at deck location 1. If you want to verify the accessory configuration in the profile, use the following procedure.

Procedure

To verify the Autofill Station configuration:

1   In **Bravo Diagnostics**, ensure the correct profile is selected in the **Profiles** tab.

2   In the **Configuration** tab, verify that the deck image shows a Pump Module at deck location 1.
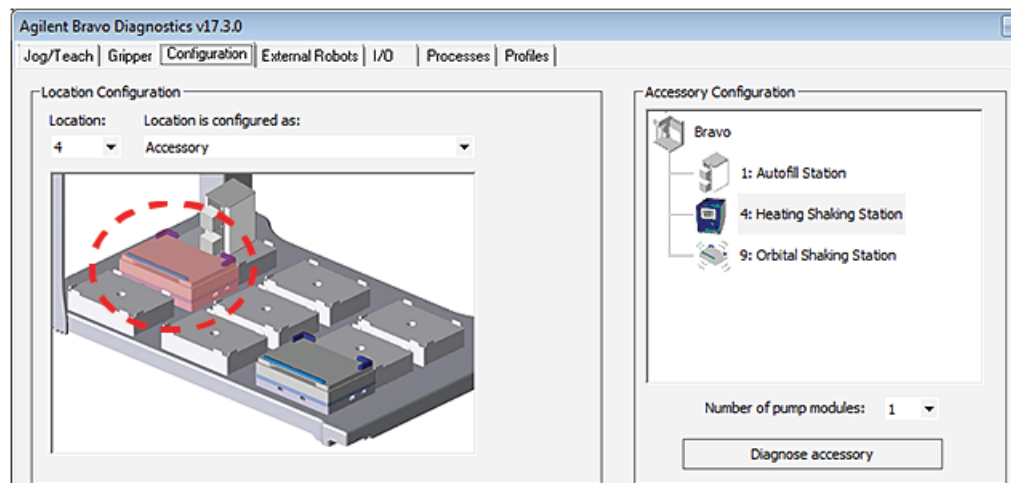
Note: The AssayMAP 1 profile has no other accessories configured by default.

3   To verify the settings, right-click deck location 1 in the image. In the shortcut menu that appears, click **Configure location > Accessory**. The Bravo Accessories Wizard opens.

4   In the **Location for accessory** list, verify the location and then click **Next**.

5   In the **Accessory already configured** page, click **Yes, reconfigure existing accessory**, and then click **Next**.

6   Verify the following property settings in the **Autofill Station properties** table, and then click **Next**.

Autofill station properties	Setting
Fill module	1
Pump for filling	Pump 1
Direction for filling	Forward
Empty module	1
Pump for emptying	Pump 2
Direction for emptying	Reverse
Use Weigh Station?	No
Weigh Station module number	1

7   Click **Finish**. The Bravo Accessories Wizard closes.

8   If you made any changes to the configuration settings, click the **Profiles** tab, and then click **Update this profile** to save the changes.

Related information

For more information about...	See...
Verifying the AssayMAP profile settings	"Verifying the profile settings for the AssayMAP Bravo Platform" on page 217
Verifying the AssayMAP profile settings for accessories	"Verifying the Peltier Thermal Station configuration" on page 226
	"Verifying the Orbital Shaking Station configuration" on page 228
Setting teachpoints for the AssayMAP Bravo Platform	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231

Verifying the Peltier Thermal Station configuration

About this topic

Use the following procedure to verify the configuration settings for the Peltier Thermal Station installed on an AssayMAP Bravo Platform.

> ⚠️ **WARNING**   To avoid potential injury and damage to the device, only personnel trained in how to teach the AssayMAP Bravo Platform should perform the setup procedures.

Configuration requirements

The configuration requirements vary for each profile as follows:

Profile	Heating Shaking Station at deck location 4 (default)	Requirements
AssayMAP 1	No	If the Peltier Thermal Station is installed, configure the accessory using the following procedure.
GlykoPrep-Plus	Yes	The Peltier Thermal Station is required for the device profile. Configure the accessory using the following procedure.
AssayMAP Peptide Sample Prep	Yes	Although the Peltier Thermal Station is optional for the device profile, the deck location 4 configuration must match the installation. If the Peltier Thermal Station is installed, use the following procedure.
Single Plate InSolution Digestion	Yes	If the Peltier Thermal Station is installed, use the following procedure.
AssayMAP Normalization	Yes	If the Peltier Thermal Station is installed, use the following procedure.

Configuring and verifying the Peltier Thermal Station

To verify the configuration for the Peltier Thermal Station:

1   In **Bravo Diagnostics**, ensure the correct profile is selected in the **Profiles** tab.

2   In the **Configuration** tab, verify that the deck image shows a Heating Shaking Station icon at deck location 4.
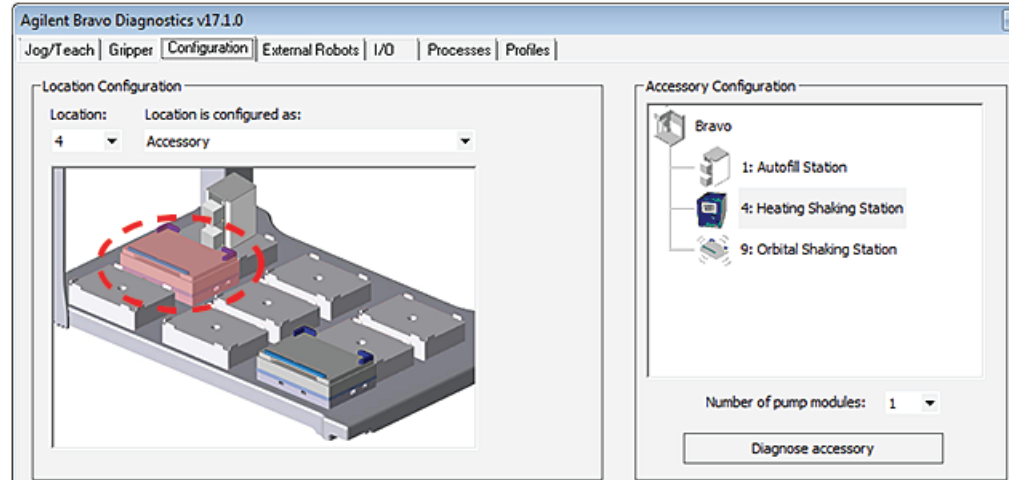
3 To verify the settings, right-click deck location 4 in the image. In the shortcut menu that appears, click **Configure location > Accessory**. The Bravo Accessories Wizard opens.

4 In the **Location for accessory** list, verify the location and then click **Next**.

5 In the **Accessory already configured** page, click **Yes, reconfigure existing accessory**, and then click **Next**.
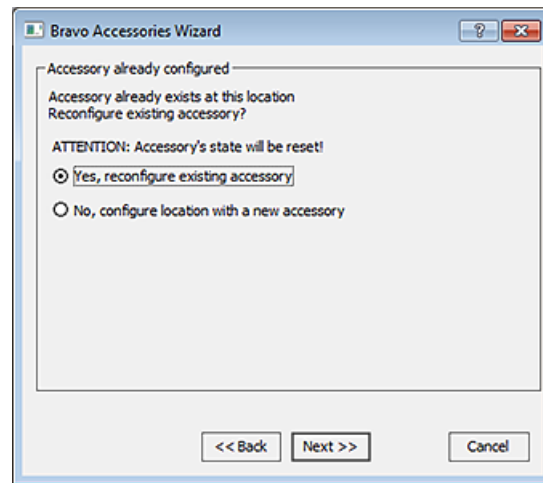
If the accessory is not yet configured at this location, in the **Choose Accessory** page, choose the **Heating Shaking Station**.

Note: Earlier versions of Bravo Diagnostics use the name Inheco STC/MTC Controller for this accessory.

6 Verify the following settings in the **Properties** table, and then click **Next**.

Properties	Setting
MTCSTC Id	0
Type	STC
Slot Id	1

Note: The Inheco STC Controller ships with an MTCSTC Id setting of 0. However, this setting may have been changed on demo units for use with multiple devices. Use the DIP switches on the back of the STC Controller to determine what the actual Id setting is and make changes if necessary. See the manufacturer's user documentation for more information.

7   Click **Finish**. The Bravo Accessories Wizard closes.

8   When the accessory configuration message appears, click **Yes** to move the teachpoint to a safe height.

9   If you made any changes to the configuration settings, click the **Profiles** tab, and then click **Update this profile** to save the changes.

Related information

For more information about...	See...
Verifying the AssayMAP profile settings	"Verifying the profile settings for the AssayMAP Bravo Platform" on page 217
Verifying the AssayMAP profile settings for accessories	"Verifying the Autofill Station configuration (96AM Wash Station)" on page 224
	"Verifying the Orbital Shaking Station configuration" on page 228
Setting teachpoints for the AssayMAP Bravo Platform	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231

Verifying the Orbital Shaking Station configuration

About this topic

Use the following procedure to verify the configuration settings for the Orbital Shaking Station installed on an AssayMAP Bravo Platform.

⚠️   **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the AssayMAP Bravo Platform should perform the setup procedures.**

Configuration requirements

The configuration requirements vary for each profile as follows:

Profile	Deck location 9 default configuration	Requirements
AssayMAP 1	Standard platepad	If the Orbital Shaking Station is installed, configure the accessory using the following procedure.
GlykoPrep-Plus	Orbital Shaking Station	The Orbital Shaking Station is required for the device profile. Configure the accessory using the following procedure.
AssayMAP Peptide Sample Prep	Orbital Shaking Station	Although the Orbital Shaking Station is optional for the device profile, the deck location 9 configuration must match the installation. If the Orbital Shaking Station is installed, use the following procedure.
Single Plate InSolution Digestion	Orbital Shaking Station	If the Orbital Shaking Station is installed, configure the accessory using the following procedure.
AssayMAP Normalization	Standard platepad	If the Orbital Shaking Station is installed, configure the accessory using the following procedure.

Configuring and verifying the Orbital Shaking Station

To configure the Orbital Shaking Station:

1 In **Bravo Diagnostics**, ensure the correct profile is selected in the **Profiles** tab.

2 In the **Configuration** tab, verify that the deck image shows a Orbital Shaking Station icon at deck location 9.
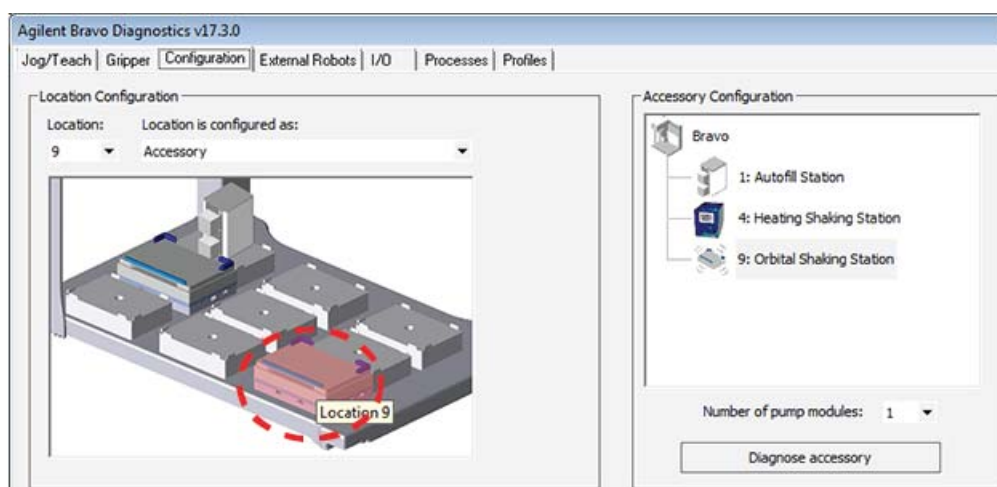
3 To verify the settings, right-click deck location 9 in the image. In the shortcut menu that appears, click **Configure location > Accessory**. The Bravo Accessories Wizard opens.

4 In the **Location for accessory** list, verify the location and then click **Next**.

5 In the **Accessory already configured** page, click **Yes, reconfigure existing accessory**, and then click **Next**.

If the accessory is not yet configured at this location, in the **Choose Accessory** page, choose the **Orbital Shaking Station**.

6   Verify the following settings in the **Properties** table, and then click **Next**.

Orbital Shaking Station properties	Setting
Serial Port	1
Module Number	1

Note: The Serial Port parameter will be automatically defined when the USB-to-serial adapter is connected to the computer. You might need to lookup the port assigned to this device in the computer Device Manager.

7   Click **Finish**. The Bravo Accessories Wizard closes.

8   If the accessory configuration message appears, click **Yes** to move the teachpoint to a safe height.

9   If you made any changes to the configuration settings, click the **Profiles** tab, and then click **Update this profile** to save the changes.

Related information

For more information about...	See...
Verifying the AssayMAP profile settings	"Verifying the profile settings for the AssayMAP Bravo Platform" on page 217
Verifying the AssayMAP profile settings for accessories	"Verifying the Autofill Station configuration (96AM Wash Station)" on page 224
	"Verifying the Peltier Thermal Station configuration" on page 226
Setting teachpoints for the AssayMAP Bravo Platform	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231

AssayMAP teaching part 1: Using the Teachpoint Update protocol

About this topic

This topic provides part 1 of 4 procedures that you follow to set the teachpoints in the AssayMAP 1 profile, and then run a teachpoint-update protocol to automate the teachpoint adjustments for all the other profiles in the Protein Sample Prep Workbench.

Teachpoint requirements

A teachpoint is a set of axial coordinates that define a location to which the Bravo head moves. Each of the nine deck locations has a teachpoint.

> **CAUTION** Using a profile that is associated with teachpoints from a different instrument can result in a hardware collision and cause equipment damage. Ensure that you verify the teachpoints associated with each profile for your specific instrument and Bravo 96AM Head.

Every device profile in the Protein Sample Prep Workbench must be adjusted to the correct teachpoints of the specific AssayMAP Bravo Platform.

About the AssayMAP Teachpoint Update protocol

The AssayMAP Teachpoint Update protocol will guide you through the following sequence of events:

1 Setting teachpoints in the AssayMAP 1 profile.

2 Setting teachpoints for all other profiles in the Protein Sample Prep Workbench based on the AssayMAP 1 profile.

Several of the profiles included in the Protein Sample Prep Workbench require special teachpoint adjustments for accessories that will be placed on specific Bravo deck locations. These teachpoint adjustments for accessories are automatically included when using the AssayMAP Teachpoint Update protocol. The following table lists the special teachpoint adjustments that are included.
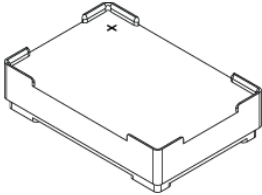
Profile	Deck location	Teachpoint adjustments for accessories
GlykoPrep-Plus	4	Raises the teachpoint z-axis coordinate by 4.4 mm to accommodate the height of the Red PCR Insert on the Peltier Thermal Station.

Profile	Deck location	Teachpoint adjustments for accessories
AssayMAP Normalization	2, 6	Raises the teachpoint z-axis coordinate by 28.5 mm at these deck locations to accommodate the height of the Bravo Plate Riser.

Before you start

⚠️ **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should perform the procedures in this topic.**

⚠️ **WARNING**   **When you initialize the Bravo Platform, the head and tie bar can move. To prevent potential injury, keep clear of the device while it is in motion.**

CAUTION   To prevent potential equipment damage, ensure that the deck is clear of any obstacles before initializing the AssayMAP Bravo Platform.

- Ensure that all Protein Sample Prep Workbench profiles have been installed, and that they are configured correctly. See "Verifying the profile settings for the AssayMAP Bravo Platform" on page 217.
- Ensure that the following protocol is installed with the Protein Sample Prep Workbench:

  C:\VWorks Workspace\Workbench\Protocols\AssayMAP Teachpoint Update v1p0.pro

- Ensure that the Protein Sample Prep Workbench software is not open. If you have not already done so, start the VWorks software and ensure that Simulation is off.
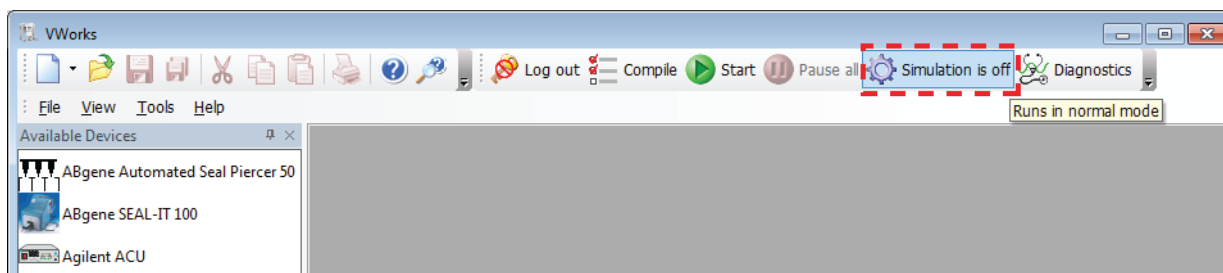
Note: The AssayMAP Teachpoint Update protocol is not designed to work in simulation mode.

- Review "AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238 to ensure that you are familiar with the special teaching requirements for the AssayMAP Bravo Platform.

- Use the following workflow:

Step	For this task…	See…
1	Start the AssayMAP Teachpoint Update protocol.	"Starting the AssayMAP Teachpoint Update protocol" on page 233
2	In the AssayMAP 1 profile, set the teachpoint for deck location 2 and derive the teachpoints for the other eight deck locations automatically.	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238
3	Fine tune the derived teachpoints for the remaining deck locations.	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238
4	*Orbital Shaking Station only.* If the accessory is installed at deck location 9, fine tune the teachpoint.	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241
5	Adjust the teachpoint for the 96AM Wash Station.	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241
6	Update the teachpoints in the other profiles in the Protein Sample Prep Workbench to match the AssayMAP 1 profile.	"AssayMAP teaching part 4: Updating the other profiles" on page 245

Starting the AssayMAP Teachpoint Update protocol

To start the AssayMAP Teachpoint Update protocol:

1 In the VWorks window, click **File > Open**. The Open dialog box appears.

2 In the **Open** dialog box, ensure the file type is **Protocol Files (*.pro)**. Locate the C:\VWorks Workspace\Workbench\Protocols folder, select the **AssayMAP Teachpoint Update v1p0.pro** file, and then click **Open**.
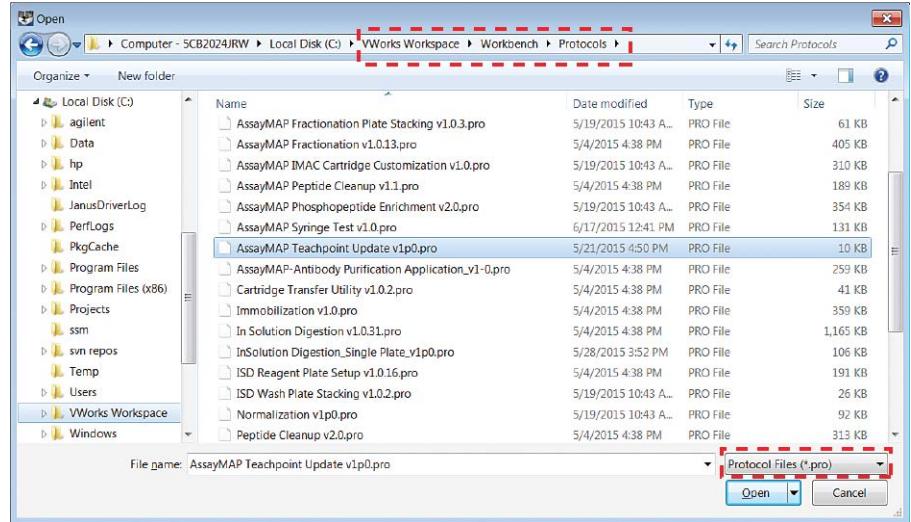
3   When the following VWorks initialization message appears, click **Yes**.
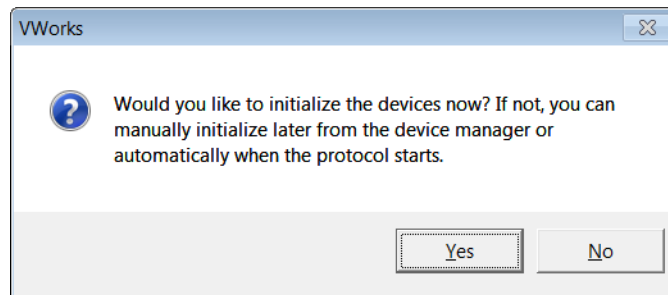
The AssayMAP Bravo.dev file opens, and the AssayMAP 1 profile initializes.

4   Ensure that the AssayMAP Teachpoint Update protocol is open in the VWorks window, and then click **Start**.
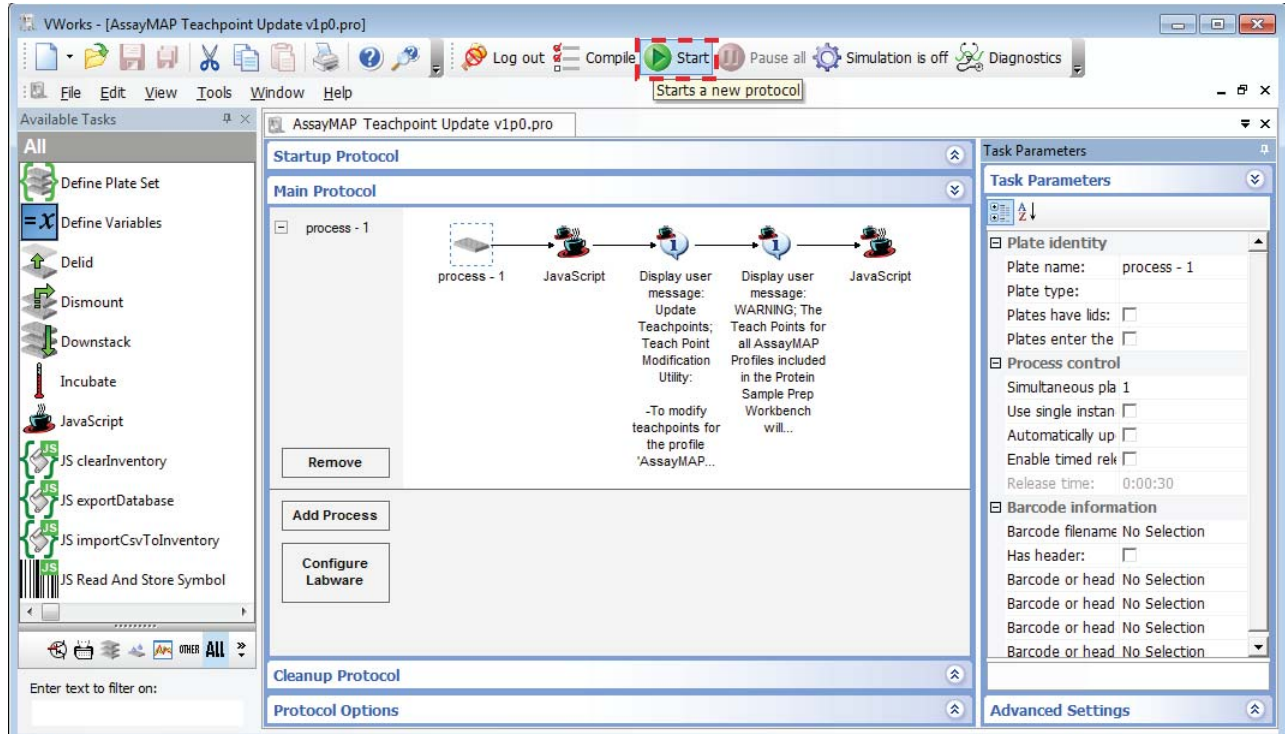
5 In the **Run Configuration** dialog box, click **Finish** to start the protocol.
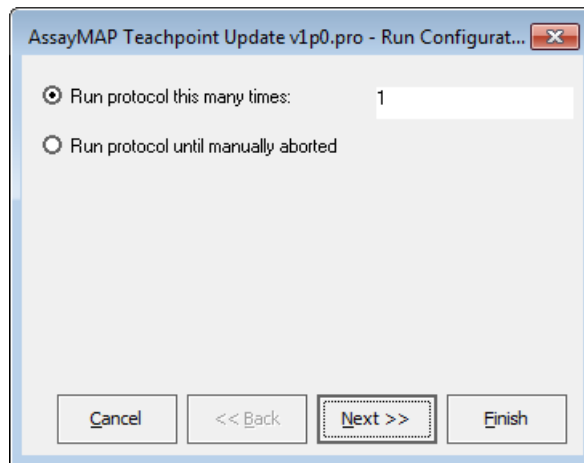
6 When the **Update Teachpoints** dialog box appears, do one of the following:

- If the teachpoints for this instrument have not yet been set in the AssayMAP 1 profile, click **Pause and Diagnose**. Proceed to step 7.

- If the teachpoints for this instrument have already been adjusted in the AssayMAP 1 profile, click **Continue**, and then skip ahead to the procedure: "AssayMAP teaching part 4: Updating the other profiles".
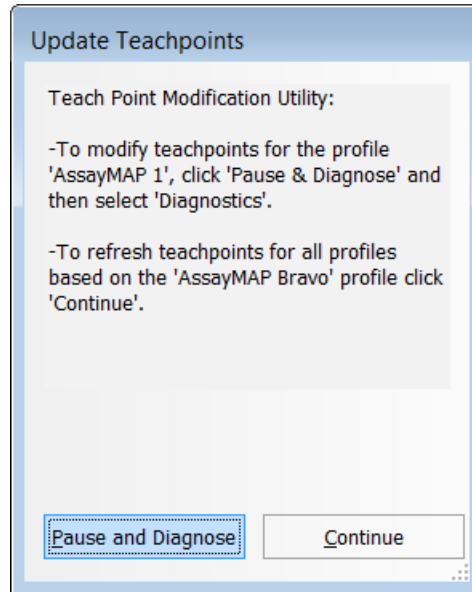
7 In the **Scheduler Paused** dialog box, click **Diagnostics**.
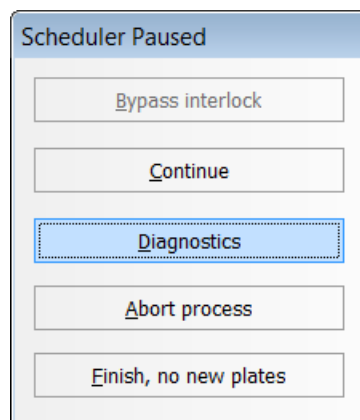
8 Select the **AssayMAP Bravo device** from the list, and click **Device Diagnostics.**
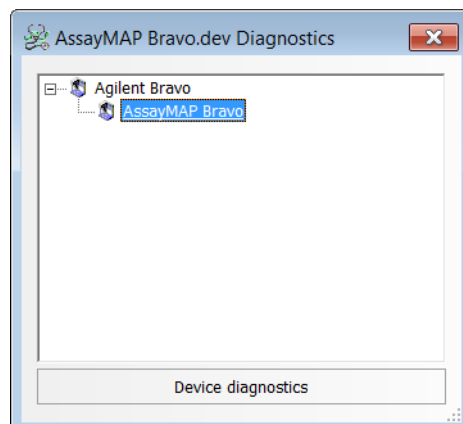
9 In the **Bravo Diagnostics** dialog box, click the **Profiles** tab and ensure that the AssayMAP 1 profile is selected.
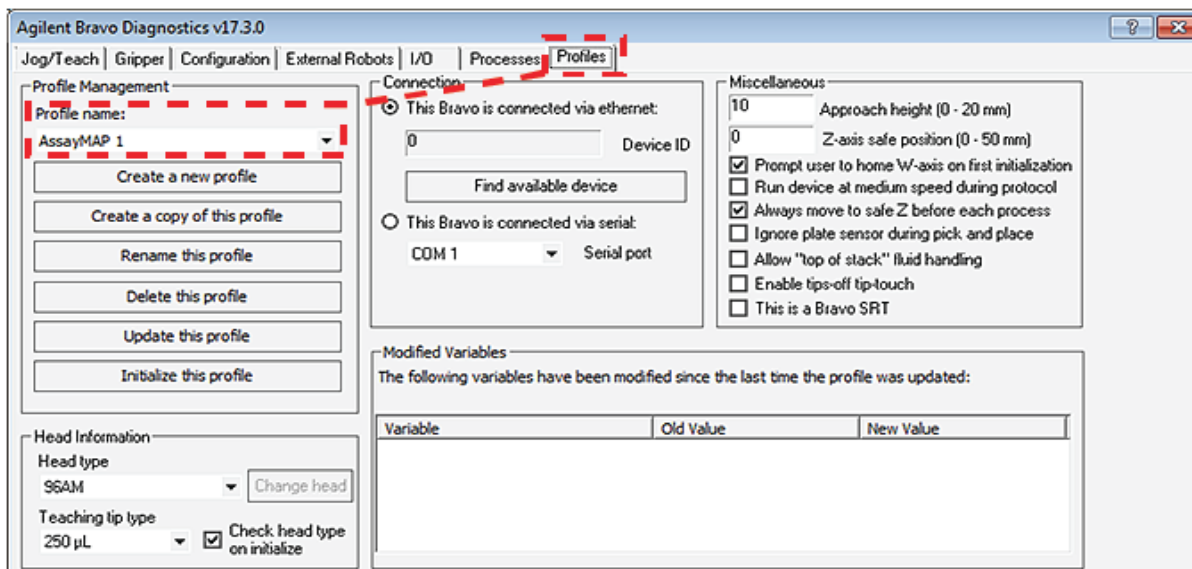
10 Click the **Jog/Teach** tab and set the teachpoints for the AssayMAP 1 profile.

Related information

For more information about...	See...
Next steps	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238
	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241
	"AssayMAP teaching part 4: Updating the other profiles" on page 245

AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile

About this topic

This topic assumes that you are using one of the following workflows:

- "AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231
- "Manually updating teachpoints in each AssayMAP profile" on page 247

Before you start

⚠️ **WARNING**   To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should perform the procedures in this topic.

⚠️ **WARNING**   The red Stop motors button in Bravo Diagnostics does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed after you click the button. To perform an emergency stop, press the red button on the robot-disable pendant.

CAUTION   To prevent the 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.

IMPORTANT   Make sure that you remove all labware from the deck except for the 96AM Wash Station at deck location 1. The wash station remains installed at deck location 1 in the following procedure while you set the teachpoint for deck location 2. In a subsequent procedure, you will adjust the wash station teachpoint at deck location 1.

Ensure that the profile is initialized in Bravo Diagnostics. If you are running the AssayMAP Teachpoint Update protocol, the profile should already be initialized.

The following procedures assume that you have basic knowledge of the Bravo teaching process and have been trained to teach the Bravo Platform.

Setting the teachpoint for deck location 2 and deriving the remaining teachpoints

To set the teachpoints:

1   Manually seat a 250-µL pipette tip on probe A1 (back left corner of the Bravo 96AM Head). Ensure that the pipette tip locks into place with the probe.

Ensure a standard platepad is installed at deck location 2.

2   In the **Bravo Diagnostics** dialog box, click the **Jog/Teach** tab.
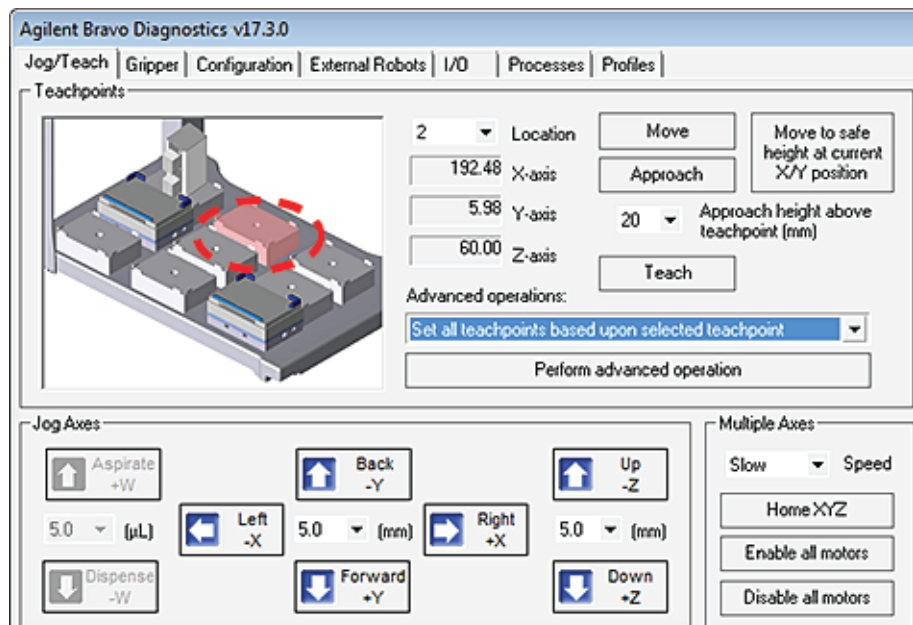
3 In the image of the Bravo deck in the upper left corner, click **Location 2**.

4 Carefully, use the **Jog Axes** controls to adjust the position of the tip above the crosshairs on platepad 2. Use incrementally smaller jog increments as you jog the tip down closer to the crosshairs.

As the tip moves down along the z-axis towards the crosshairs, the following error message appears. Visually inspect the clearance remaining between the tip and the crosshairs. If the tip is not yet at the crosshairs, adjust the jog increment as required, and click **Ignore** to continue jogging the head down.

> **CAUTION**   Before you click Ignore in the error message, verify that enough space remains to continue jogging the head down. Jogging the head down too far will result in a collision and cause equipment damage.
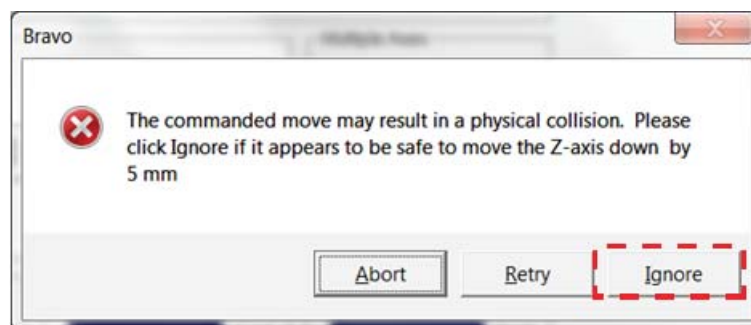
Note: This error message appears every time you jog in the z-axis to a point that is lower than the default z-axis teachpoint (60.00 mm).

5 When the pipette tip is perfectly centered above the platepad crosshairs in the x- and y-axes, and the tip is as close as possible to the crosshairs in the z-axis without making contact, click **Teach**.

6 To derive the teachpoints for the remaining locations from deck location 2:

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

b   Ensure that deck location 2 is still selected, and then click **Perform advanced operations**.

c   Click **OK** in the confirmation message.

Fine tuning the teachpoints

To fine tune the automatically derived teachpoints:

1   In the **Jog/Teach** tab image of the Bravo deck, click **Location 3**.

2   In the **Approach height above teachpoint** list, select **10**, and then click **Approach**.

The Bravo head moves to deck location 3 and moves down so that the pipette tip is approximately 10 mm above the platepad crosshairs.

3   Carefully, use the **Jog Axes** controls to adjust the position of the A1 pipette tip above the crosshairs. Use incrementally smaller jog increments as you jog the tip down closer to the crosshairs.

4   When the pipette tip is perfectly centered above the platepad crosshairs in the x- and y-axes, and the pipette tip is as close as possible to the crosshairs in the z-axis without making contact, click **Teach**.

5   Repeat steps 1 to 4 for deck locations 4, 5, 6, 7, and 8.

IMPORTANT   If the Peltier Thermal Station is installed at deck location 4, ensure that the plate nest is empty and the PCR plate insert is not installed.

6   Set the teachpoints for the accessory locations:

Note: The AssayMAP Teachpoint Update protocol automatically makes the teachpoint adjustments for the Bravo Plate Riser (deck locations 2 and 6) in the Normalization profile and the Red PCR plate insert on the Peltier Thermal Station (deck location 4) in the GlykoPrep-Plus profile.

a   Perform one of the following steps to set the teachpoint for deck location 9 for your setup:

- If a standard platepad is installed at deck location 9, repeat steps 1 to 4 to fine tune the teachpoint.

- If an Orbital Shaking Station is installed at deck location 9, see "Teaching the Orbital Shaking Station at deck location 9" on page 241.

b   Set the teachpoint for the 96AM Wash Station at deck location 1 according to "Teaching the 96AM Wash Station at deck location 1" on page 242.

Related information

For more information about...	See...
Next step	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241

For more information about...	See...
Previous steps in the AssayMAP teaching workflow	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231
	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238

AssayMAP teaching part 3: Adjusting teachpoints for accessories

About this topic

This topic includes the following procedures:

- "Teaching the Orbital Shaking Station at deck location 9" on page 241

  Skip this procedure if the deck configuration does not contain the Orbital Shaking Station.

- "Teaching the 96AM Wash Station at deck location 1" on page 242

⚠ **WARNING**   **To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should perform the procedures in this topic.**

Teaching the Orbital Shaking Station at deck location 9

The Orbital Shaking Station is required at deck location 9 for the AssayMAP GlykoPrep-Plus profile configuration. Although the Orbital Shaking Station might not be required for applications other than the GlykoPrep-Plus workflows, if the Orbital Shaking Station is installed at deck location 9, a teachpoint adjustment is required. Use the following procedure to set the teachpoint for the Orbital Shaking Station at deck location 9.

Before you start

Ensure that you have the pipettor teaching plate (G5550-17692). The teaching plate is a 10-mm thick metal plate that fits in the plate nest of an accessory. The teaching plate has a crosshairs in one corner, as the following figure shows.

Figure   Pipettor teaching plate
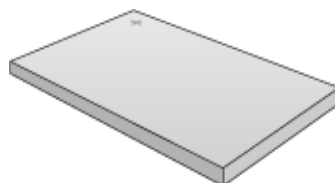
IMPORTANT   Ensure that a 250-µL pipette tip is seated on probe A1 (back left corner) of the Bravo 96AM Head.

To teach the Orbital Shaking Station at deck location 9:

1   Place the teaching plate in the plate nest of the Orbital Shaking Station. Ensure that the crosshairs is at the back left corner and facing upward.

Press down on the teaching plate so that the bottom touches the top surface of the plate nest.

2   In the **Jog/Teach** tab, and click **Location 9**.

3   In the **Approach height above teachpoint** box, type **20**, and then click **Approach**.

The Bravo head moves to deck location 9 and moves down so that the tip is approximately 10 mm above the teaching plate crosshairs.

4   Carefully, use the **Jog Axes** controls to center the A1 tip above the crosshairs on the teaching plate. When the X and Y positions are properly centered, click **Teach**.

5   Click the **Move to safe height at current X/Y position**. Remove the teaching plate from the Orbital Shaking Station.

6   Ensure that deck location 9 is still selected, and then click **Move**. The head moves down so that the tip is approximately 10 mm above the top surface of the plate nest in the Orbital Shaking Station.

7   Carefully, use the **Jog Axes** controls to move the head down in the z-axis until the pipette tip is as close as possible to the top surface of the plate nest, without making contact.

8   Click **Teach** to set the new teachpoint values for deck location 9.

9   To save the new teachpoint for this location, click the **Profiles** tab, and then click **Update this profile.**

Teaching the 96AM Wash Station at deck location 1

CAUTION   Failure to remove the pipette tip from the A1 probe will cause the pipette tip to collide with the wash station chimney, damaging the Bravo 96AM Head and 96AM Wash Station. Ensure that you remove the pipette tip before starting the procedure.

To teach the 96AM Wash Station:

1   If you have not already done so, remove the pipette tip from probe A1.

IMPORTANT   Ensure that the 250-µL tip remains selected as the Teaching tip type in the Profiles tab. Ensure that no pipette tips or cartridges are seated on the Bravo 96AM Head.

2   In the **Bravo Diagnostics Jog/Teach** tab, click **Location 1**.
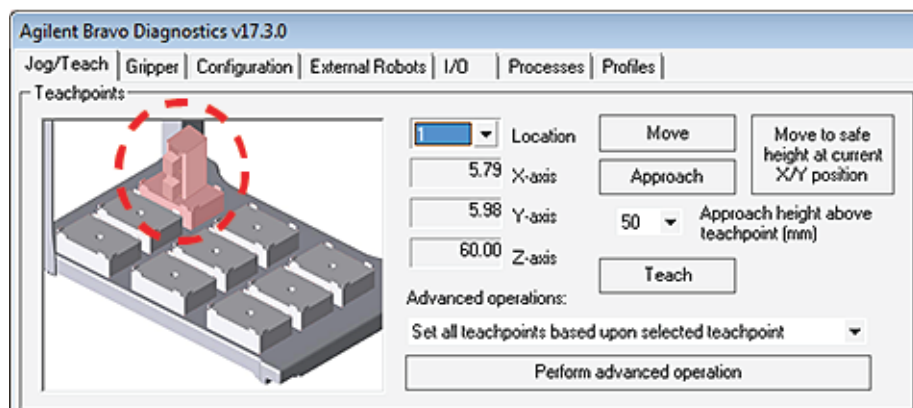
Note: Additional accessories will appear in the image if you have configured them in this profile.

3 Under the **Location** list, locate the **Z-axis** box. Write down the Z-axis value on a piece of paper. You will use this value in a subsequent step.

Note: The Z-axis teachpoint value for Deck Location 1 is typically between 105.2–105.8 mm for a standard height AssayMAP Bravo Platform and standard platepad.
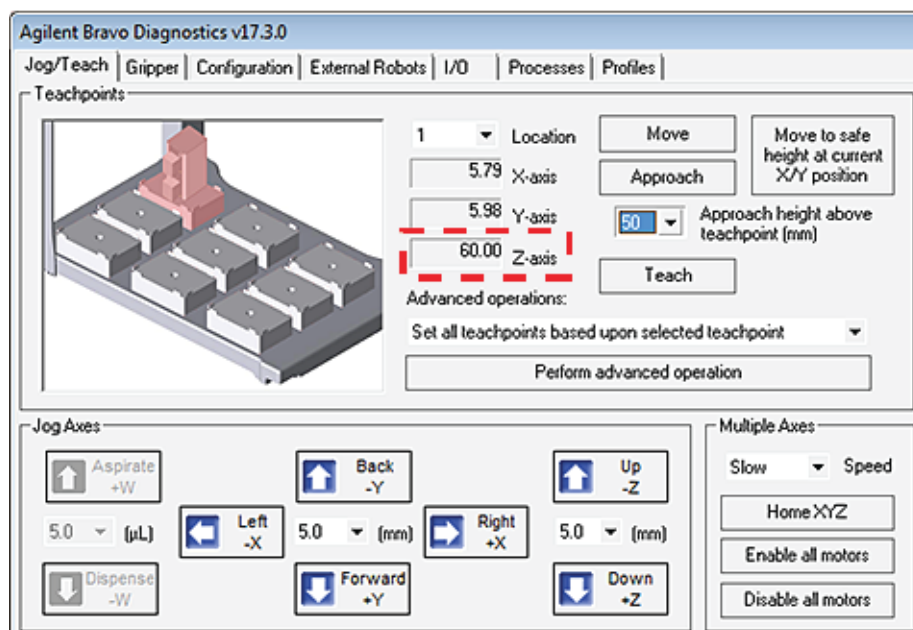
4 In the **Approach height above teachpoint** box, type **50**, and then click **Approach**.
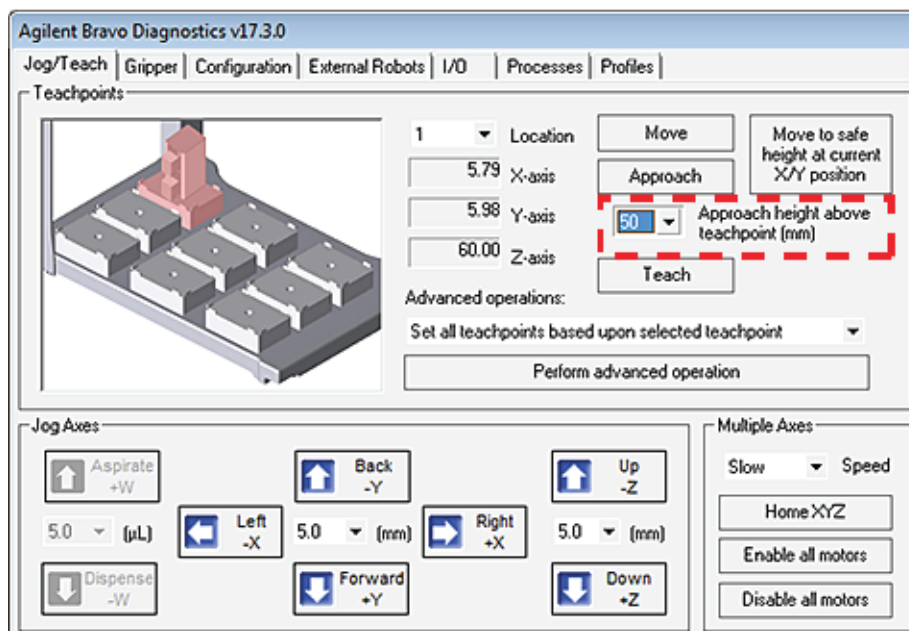
5   Carefully, use the **Jog Axes** controls to position the syringe probes so that they are perfectly centered over the corresponding chimneys in the wash station.

The tips of the probes should be approximately 1 mm above the tops of the chimneys.

6   When the probes and chimneys are perfectly aligned, use the **Jog Axes** controls to move the head down along the *z*-axis to the original **Z-axis** teachpoint value that you recorded in step 3.

Note: This step will insert the probes into the wash station chimneys, which is a normal part of the teaching process.

7   When the position of the *z*-axis (as indicated by the Z-axis readout in the bottom right of the screen) matches the value that was written down from above, click **Teach** to set the new teachpoint for deck location 1.

8   Click the **Move to safe height at current X/Y** position to remove the probes from the wash station chimneys, and return the head to the safe Z-height.

9   In the **Profiles** tab, click the **Update this profile** to save the new teachpoints.

Related information

For more information about...	See...
Next step	"AssayMAP teaching part 4: Updating the other profiles" on page 245
Previous steps	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231
	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238

AssayMAP teaching part 4: Updating the other profiles

Before you start

Ensure that you have completed the following procedures:

- "AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231.
- "AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238.
- "AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241.

Finishing the Update Teachpoints protocol run

To finish the Update Teachpoints run:

1 If you have finished setting teachpoints for the AssayMAP 1 profile, close the **Bravo Diagnostics** dialog box and the **AssayMAP Bravo.dev Diagnostics** dialog box.

2 In the **Scheduler Paused** dialog box, click **Continue**.
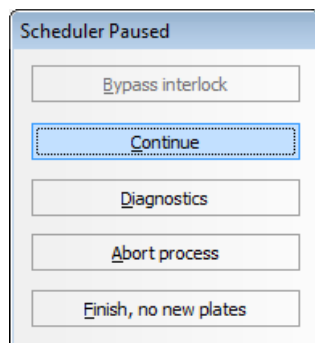
3 When the WARNING dialog box appears, do one of the following:

- Click **Continue** to update the teachpoints in all the Workbench profiles based on the AssayMAP 1 profile teachpoints.

  After the protocol completes the update process, make sure that you verify the setup.

- To keep the other profiles in their current state (teachpoints not updated to match the AssayMAP 1 profile), click **Pause and Diagnose**, and then click **Abort**.

WARNING

The Teach Points for all AssayMAP Profiles included in the Protein Sample Prep Workbench will now be updated to reflect changes made in the AssayMAP 1 profile:

Are you sure that you want to Update the Teachpoints for All Profiles?

-To update all teachpoints, click 'Continue'

-To cancel the teachpoint update, click 'Pause & Diagnose' and then select 'Abort'.

Pause and Diagnose   Continue

Related information

For more information about...	See...
Next step	"Verifying the setup in the Protein Sample Prep Workbench" on page 253
Previous steps	"AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231
	"AssayMAP teaching part 2: Adjusting the AssayMAP 1 profile" on page 238
	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241

Manually updating teachpoints in each AssayMAP profile

About this topic

In general, you should use the four-part semi-automated workflow that starts with "AssayMAP teaching part 1: Using the Teachpoint Update protocol" on page 231.

Alternatively, you can use the following workflow to set the teachpoints for all nine deck locations in every device profile manually.

Before you start

Ensure that all device profiles in the Protein Sample Prep Workbench have been installed, and that they are configured correctly. See "Verifying the profile settings for the AssayMAP Bravo Platform" on page 217.

> **CAUTION**   Using a profile that is associated with teachpoints from a different instrument can result in a hardware collision and cause equipment damage. Ensure that you verify the teachpoints associated with each profile for your specific instrument and Bravo 96AM Head.

Workflow for manually setting teachpoints

Step	For this task...	See...
1	Initialize the AssayMAP 1 profile.	"Initializing the Bravo Platform in Diagnostics" on page 33
2	In the AssayMAP 1 profile, set the teachpoint for deck location 2 and derive the teachpoints for the other eight deck locations automatically.	"Setting the teachpoint for deck location 2 and deriving the remaining teachpoints" on page 238
3	Fine tune the derived teachpoints.	"Fine tuning the teachpoints" on page 240
4	*Normalization profile only*. If the Bravo Plate Riser is installed at deck locations 2 and 6, adjust the teachpoint at these locations to accommodate the extra height.	"Adjusting the teachpoint for the Bravo Plate Riser" on page 248
5	*GlykoPrep-Plus profile only*. If the Peltier Thermal Station is installed at deck location 4, adjust the teachpoint to accommodate the red PCR plate insert.	"Adjusting the Peltier Thermal Station for the red PCR plate insert" on page 251
6	*Orbital Shaking Station only*. If the accessory is installed at deck location 9, fine tune the teachpoint.	"Teaching the Orbital Shaking Station at deck location 9" on page 241
7	Adjust the teachpoint for the 96AM Wash Station.	"Teaching the 96AM Wash Station at deck location 1" on page 242
8	Repeat steps 1 to 7 for every device profile in the Protein Sample Prep Workbench.	—

Adjusting the teachpoint for the Bravo Plate Riser

Use the following procedures only if the deck configuration contains the Bravo Plate Risers, for example, the AssayMAP Normalization profile.

IMPORTANT   If you are running the AssayMAP Teachpoint Update protocol, the teachpoint is adjusted automatically for the Bravo Plate Riser. For details, see "About the AssayMAP Teachpoint Update protocol" on page 231.

Bravo Plate Riser description

The Bravo Plate Riser is a 2.84-cm tall deck accessory that you can place atop a standard platepad on the Bravo deck. The Bravo Plate Riser requires a teachpoint adjustment in the Bravo profile to ensure that the Bravo head moves to the correct height at the location where the Bravo Plate Riser is installed.

The following figure shows the Bravo Plate Riser, which has a crosshairs in one corner to facilitate adjusting the teachpoint.

Figure   Bravo Plate Riser
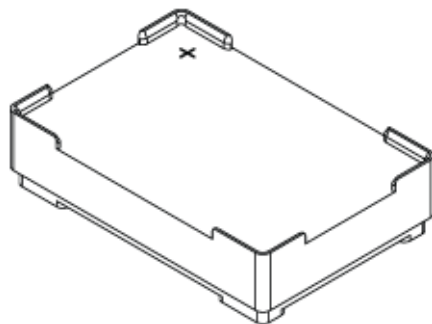
CAUTION   Placing the Bravo Plate Riser at a deck location that does not have the corresponding teachpoint in the device profile will result in a collision, causing equipment damage. Ensure that the device profile includes the corresponding teachpoint for any deck location where the Bravo Plate Riser is installed.

About the AssayMAP Normalization profile

The AssayMAP Normalization profile (Normalization-AM Bravo.dev) includes teachpoints for the Bravo Plate Riser at deck locations 2 and 6. However, you should adjust the teachpoints on your instrument and verify the teachpoints before running the Normalization application for the first time.

Figure   Normalization profile Bravo Plate Riser deck locations
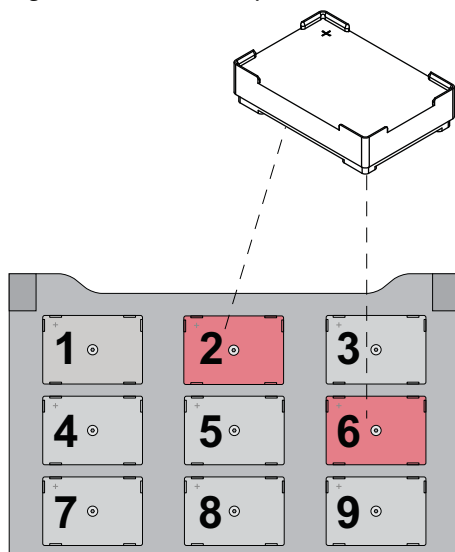
IMPORTANT   When setting the teachpoint, ensure that a 250-µL pipette tip is seated on probe A1 (back left corner) of the Bravo 96AM Head.

Adjusting the teachpoint for the Bravo Plate Riser

Use the following procedure to adjust a standard platepad teachpoint to accommodate the Bravo Plate Riser.

To adjust the teachpoint for the Bravo Plate Riser:

1   Place the Bravo Plate Riser on the platepad at the corresponding deck location. Ensure that the Bravo Plate Riser is oriented so that the crosshairs is at the back left corner.

Press down on the Bravo Plate Riser so that it is seated on the platepad.

2   In the **Jog/Teach** tab, click the **Location** list, and then select the deck location that you are teaching.

3   In the **Approach height above teachpoint** box, type **50**, and then click **Approach**.

The Bravo head moves to the selected deck location, and then moves down so that the tip is approximately 22 mm above the crosshairs on the Bravo Plate Riser.

4   Carefully, use the **Jog Axes** controls to move the head down in smaller and smaller increments until the pipette tip is about 1 mm above the crosshairs on the Bravo Plate Riser.

Visually inspect the alignment to determine if the left-to-right (X) and front-to-back (Y) positions of the tip are centered above the crosshairs on the Bravo Plate Riser. If necessary, use the **Jog Axes** controls (Left, Right and Forward, Back) to center the A1 tip above the crosshairs.

5   Carefully, use the **Jog Axes** controls to move the head down in tiny increments until the pipette tip is as close as possible to the crosshairs on the Bravo Plate Riser without touching the surface.

6   Click **Teach** to set the new teachpoint values for the deck location.

7   To save the new teachpoint for this location, click the **Profiles** tab, and then click **Update this profile.**

8   Repeat this procedure for the other deck location where the Bravo Plate Riser will be installed.

Verifying the teachpoint for the Bravo Plate Riser

Use the following procedure to verify the adjusted teachpoint for the Bravo Plate Riser.

1   Ensure that the Bravo Plate Riser is securely seated on the platepad at the corresponding deck location. Ensure that the Bravo Plate Riser is oriented so that the crosshairs is at the back left corner.

2   In the **Jog/Teach** tab, click the **Location** list, and then select the deck location you are teaching.

3   Click **Move**, The Bravo head moves to the selected deck location so that the tip is at the crosshairs on the Bravo Plate Riser.

4   Visually inspect the alignment to ensure that the tip is centered from left to right and front to back.

> **CAUTION**   A hardware collision can occur if you initialize a device profile that does not include the teachpoints for the Bravo Plate Riser while the Bravo Plate Riser remains on the deck. Ensure that you remove the Bravo Plate Riser from the deck when initializing a different device profile.

Related information

For more information about...	See...
Verifying the setup	"Verifying the setup in the Protein Sample Prep Workbench" on page 253
Setting teachpoints manually	"Manually updating teachpoints in each AssayMAP profile" on page 247
Adjusting the teachpoint for the red PCR plate insert	"Adjusting the Peltier Thermal Station for the red PCR plate insert" on page 251

Adjusting the Peltier Thermal Station for the red PCR plate insert

About this topic

IMPORTANT   If you are running the AssayMAP Teachpoint Update protocol, the teachpoint is adjusted automatically. For details,

Use the following procedure only if the deck configuration includes the Peltier Thermal Station and you plan to use the red PCR plate insert.

The AssayMAP GlykoPrep-plus applications require the red PCR plate insert to be present in the plate nest of the Peltier Thermal Station for the entire workflow.Use the following teaching procedure to accommodate this requirement for deck location 4 in the GlykoPrep-plus profile.

Figure   PCR plate insert

IMPORTANT   Ensure that the PCR plate insert is not installed in the Peltier Thermal Station at deck location 4 for the following teaching procedure.

Adjusting the teachpoint for the PCR plate insert

To adjust the teachpoint for the PCR plate insert:

1   In the **Jog/Teach** tab, click **Location 4**.
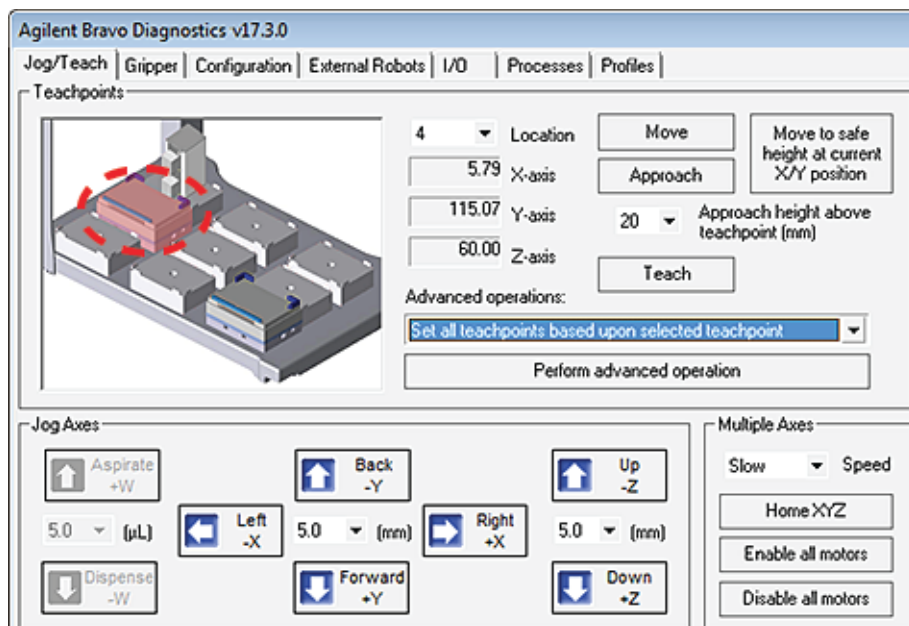
2   Click **Move** to move the head to the previously defined teachpoint for location 4.

3   Using the Jog Axes controls, jog the head up (-Z) by exactly 4.3 mm.

For example, if the value for the teachpoint's Z-axis coordinate from the fine tuning was 104.00 mm, the new value after adjusting by 4.3 mm will be 99.70 mm.

4   Click **Teach** to set the new teachpoint.

5   To save the new teachpoint for this location, click the **Profiles** tab, and then click **Update this profile.**

Related information

For more information about...	See...
Setting up the platform	"Setting up the AssayMAP Bravo Platform" on page 215
Updating teachpoints for other accessories	"AssayMAP teaching part 3: Adjusting teachpoints for accessories" on page 241
	"Adjusting the teachpoint for the Bravo Plate Riser" on page 248
Verifying the setup	"Verifying the setup in the Protein Sample Prep Workbench" on page 253

Verifying the setup in the Protein Sample Prep Workbench

About this topic

Typically, an Agilent representative will set up and verify a new installation of the AssayMAP Bravo Platform. This topic presents the workflow for reference.

Workflow

Perform the procedures in the following workflow to verify the setup after you have verified the teachpoints for a new installation of the AssayMAP Bravo Platform.

Step	For this task…	See…
1	Open the Protein Sample Prep Workbench and access the utility library.	"Opening the Workbench and accessing the utilities" on page 254
2	Open the System Startup/ Shutdown utility and run the Startup protocol.	Instructions for the Startup protocol in the Protein Sample Prep Workbench
3	Run the Syringe Wash utility for 50 cycles.	Instructions for the utility in the Protein Sample Prep Workbench
4	Perform a mock run of the Affinity Purification protocol.	Affinity Purification user guide in the Protein Sample Prep Workbench
5	Run the Syringe Test utility.	Instructions for the utility in the Protein Sample Prep Workbench
6	Open the System Startup/ Shutdown utility and run the Shutdown protocol.	Instructions for the Startup protocol in the Protein Sample Prep Workbench

Opening the Workbench and accessing the utilities

Before using the Workbench applications and utilities

You must set up the AssayMAP Bravo Platform in the VWorks software before you run the protocols in the Protein Sample Prep Workbench. For details, see "Setting up the AssayMAP Bravo Platform" on page 215.

Opening the Protein Sample Prep Workbench

To open the Protein Sample Prep Workbench:

On the Windows desktop, double-click the **Protein Sample Prep Workbench** icon.

Alternatively, on the Windows desktop, click **Start > All Programs > Agilent Technologies > Protein Sample Prep Workbench> Protein Sample Prep Workbench**.
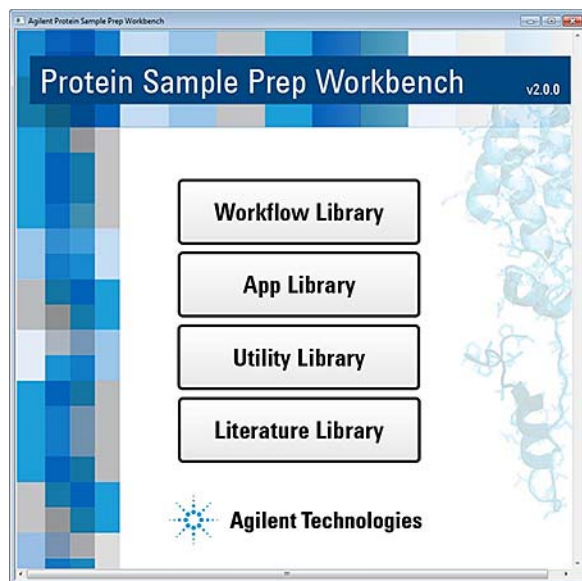
About the System Startup/Shutdown utility

The System Startup/Shutdown utility consists of two protocols:

- **Startup**. You should run the Startup protocol when you first start up the AssayMAP Bravo Platform or before running any application protocol.
- **Shutdown**. You should run the Shutdown protocol after every application protocol run, if the AssayMAP Bravo Platform will not be in use for 1 hour or longer, and before shutting down the device overnight.

To access the utilities and their corresponding instructions, see the following
section.

Accessing a workbench utility

To access a utility:

1   In the **Protein Sample Prep Workbench**, do one of the following:

- If you have not yet logged in, click **Utility Library**. The VWorks software
  starts, and then the User Authentication dialog box opens.
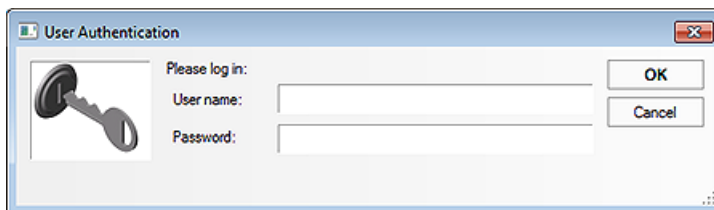
Type your VWorks user name and password, and then click **OK**.

Note: The default login user name is `administrator`.
The default password is `administrator`.

- If you have already logged in to the software, click the **Utility Library**
  button in any of the other libraries of the Protein Sample Prep
  Workbench.

2   In the **Utility Library**, locate the name of the utility you want to use, and
then click **Utility** to open the utility.

Figure   Utility Library in the Protein Sample Prep Workbench
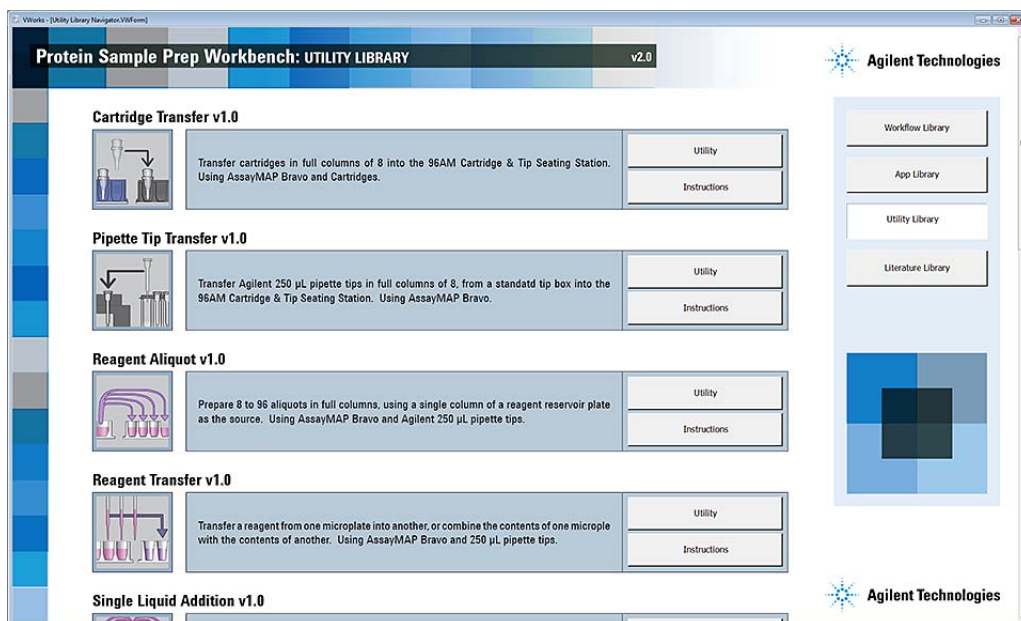
3   Click **Instructions** to display the user guide for the corresponding utility.

About running the AssayMAP protocols

For instructions on how to run an AssayMAP protocol, click the button for the corresponding application in the Protein Sample Prep Workbench Literature Library.

Figure   Protein Sample Prep Workbench Literature Library main page
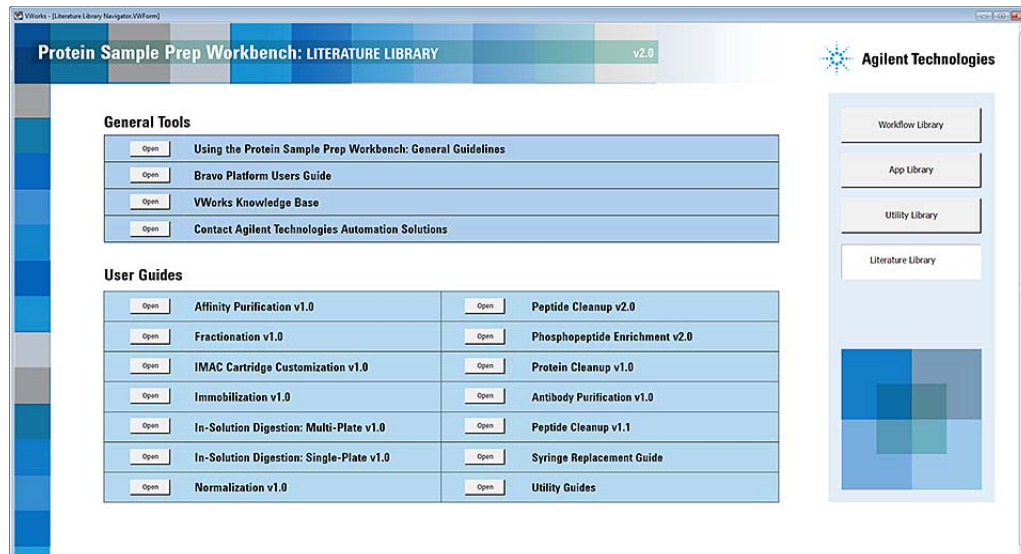
Alternatively, go to the Protein Sample Prep Workbench section of the VWorks Knowledge Base.

Related information

For more information about...	See...
How to access the VWorks Knowledge Base	"Accessing product user information" on page ix
Entering labware definitions in the VWorks software	*VWorks Automation Control Setup Guide*
Creating protocols in the VWorks software	*VWorks Automation Control User Guide*

Requirements for partial-head liquid handling

The Bravo 96AM Head can perform liquid-handling tasks with a subset of the 96 channels (partial head) only if you are using AssayMAP cartridges or 250-µL tips. This topic provides guidelines to help ensure that any partial-head liquid handling is done correctly.

> **CAUTION**   Attempting to use the bare probes for liquid-handling tasks that employ fewer than 96 channels can cause a crash, resulting in damage to the Bravo 96AM Head.

Tasks performed at the 96AM Wash Station

To prevent potential crashes with the tall chimneys and walls of the 96AM Wash Station, ensure that the well selection parameter is set to the entire plate for any task at the 96AM Wash Station.

> **CAUTION**   Attempting to perform a task at the 96AM Wash Station while a portion of the Bravo 96AM Head is offset above an adjacent location may result in a crash, causing potential damage to the head. Ensure that you use the entire plate well selection for any task at the 96AM Wash Station.

Clearance issues when using a partial head of cartridges

> **CAUTION**   Using a single cartridge or an irregular array of cartridges can cause a potential head crash. Ensure that the selection of cartridges originates at probe A1 and that the selection of probes is contiguous. Carefully plan the deck layout and robot moves to prevent potential collisions between the remaining bare probes and the items on the Bravo deck.

Figure   Probe for channel A1 in the Bravo 96AM Head
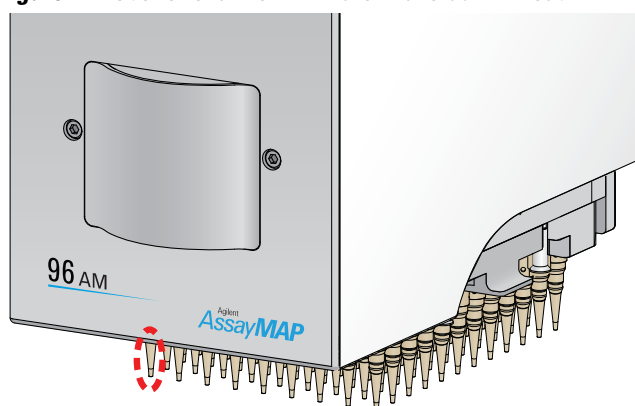
When fewer than 96 cartridges are mounted on the head, careful planning of the deck layout and the robot moves is required to prevent potential collisions between the remaining bare probes and the items on the Bravo deck. A mounted cartridge extends only 9 mm beyond the tip of a bare probe, as the following figure shows.

Figure   Vertical distance between the tips of a bare probe and a mounted cartridge

9 mm
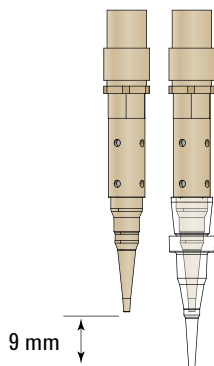
Because the distance between the tip of the bare probe and a mounted cartridge is relatively small, you must ensure the following:

• The depth at which the cartridges enter the wells is no more than 9 mm.

• When doing partial-plate operations where the head is offset horizontally from the target deck location (not centered over the platepad), ensure sufficient vertical clearance for the unused probes:

    – *Target deck location.* If the labware has deep wells and the head goes down too far, a collision between the unused probes and the perimeter of the labware can occur.

    – *Adjacent deck location.* If a labware or other object at the adjacent location is taller than the labware at the target location, a collision between the unused probes and the tall object or labware can occur.

Note: No horizontal offset of the head is required for partial-plate operations where the selection of channels in the head aligns with the labware well selection. For example, probe A1 enters well A1.

The following figures show examples of partial-plate operations where the head is offset horizontally from the target deck location. In this example, cartridges are mounted on the probes in columns 1 and 2. To access the wells in columns 11 and 12 of the labware at deck location 7, the head is offset over deck location 8.

Figure   Example of a partial-head horizontal offset from deck location 7
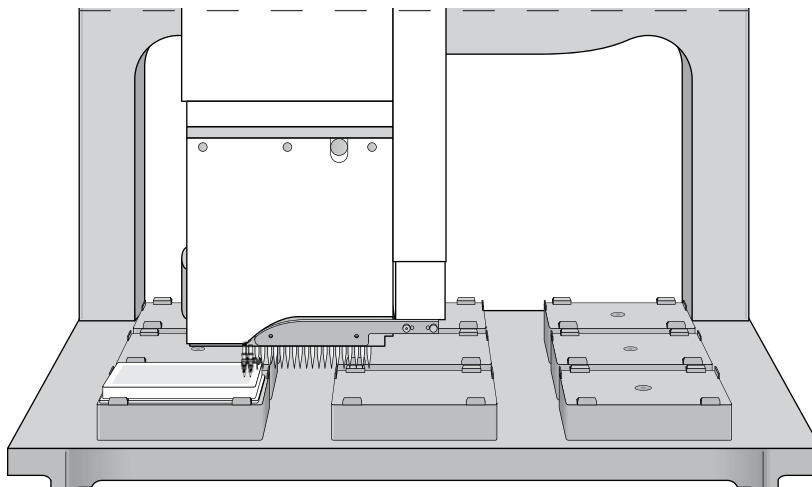
> **CAUTION**   If the head is offset from deep-well labware at the target deck location, the unused probes can collide with the labware's perimeter if the head goes down too far.

If the labware at location 7 was a deep-well microplate and you tried to aspirate from the bottom of the wells in columns 11 and 12, the bare probes in column 3 of the head would crash into the right side wall of the deep-well microplate.

> **CAUTION**   If the head has fewer than 96 cartridges and is offset from the target deck location, the unused probes can have undesired contact with surrounding objects or samples. To prevent equipment damage and contamination, verify that sufficient clearance exists at the adjacent deck location.

If deck location 8 contained labware taller than the microplate at deck location 7, the head's bare probes would crash into the labware at location 8, as the following figure shows.

Figure   Example of partial-head horizontal offset with taller labware at the adjacent location
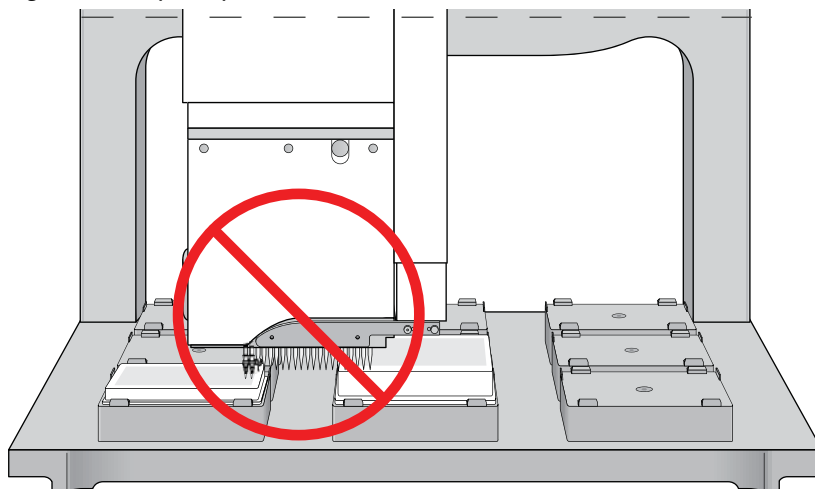
Although the VWorks software considers the geometry of the labware at the target deck location during the task, the software is unaware of the labware height on the adjacent deck location where the head will be offset.

Requirements for mounting a partial head of 250-µL tips

> **CAUTION**   A collision will result if the Bravo 96AM Head is offset from the tip box location when pressing on tips. When picking up tips from a tip box, ensure that the Bravo 96AM Head is centered over the tip box.

> **CAUTION**   To ensure consistent seating of tips on the probes, use the 96AM Cartridge & Tip Seating Station to seat the tips on the probes.

The Bravo 96AM Head must be centered over the tip box when picking up tips to be transferred to the 96AM Cartridge & Tip Seating Station.

Figure 96AM Cartridge & Tip Seating Station
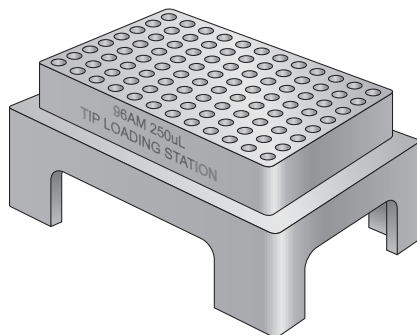
Related information

For more information about...	See...
Bravo 96AM Head	"Bravo 96AM Head overview" on page 193
Using and storing the Bravo 96AM Head	"Installing and using the Bravo 96AM Head" on page 201

E
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

⚠️ **WARNING** **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the robot-disable pendant.**

Button	Description
About	Displays Bravo Diagnostics version and copyright information.
Stop motors (keyboard SPACEBAR)	Stops the motors that drive the Bravo head. However, the head can continue to move in the same direction and at the same speed due to inertia.
	To re-enable the head movement, click Enable all motors on the Jog/Teach tab.

Tabbed pages

Tabbed page	Description
"Configuration tab quick reference" on page 263	Provides controls for configuring accessories at specified deck locations and for testing the accessories.
"External Robots tab quick reference" on page 267	Provides controls for configuring where the Bravo head can be when an external robot accesses the deck and whether operations can occur concurrently.
"IO tab quick reference" on page 268	Provides controls and indicators for clearing motor faults and checking the head type.
"Jog/Teach tab quick reference" on page 270	Provides controls for jogging the pipette head and setting teachpoints.
"Gripper tab quick reference" on page 274	Provides controls for fine-tuning the gripper movements.
"Processes tab quick reference" on page 281	Provides controls for running diagnostic tasks in real time.
"Profiles tab quick reference" on page 277	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 101
- "Autofilling accessories" on page 165

Contents

The Configuration tab in Bravo Diagnostics contains the following areas:

- "Location Configuration area" on page 263
- "Accessory Configuration area" on page 264

Location Configuration area
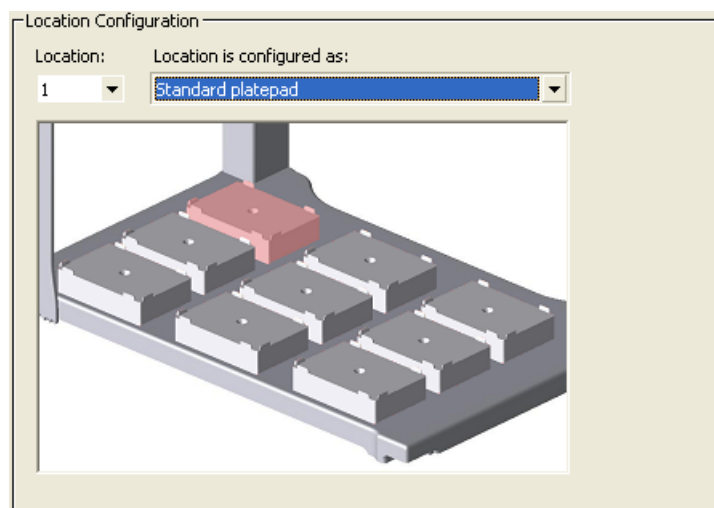
Control or indicator	Description
Location	A list that specifies the deck location. The deck layout graphic highlights the selected location.

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 tip boxes. See "(Bravo SRT only) Setting up an LT tip box location" on page 160. • *Accessory.* Displays the Accessory Wizard, which steps you through specifying a configured accessory at the specified position.

Accessory Configuration area
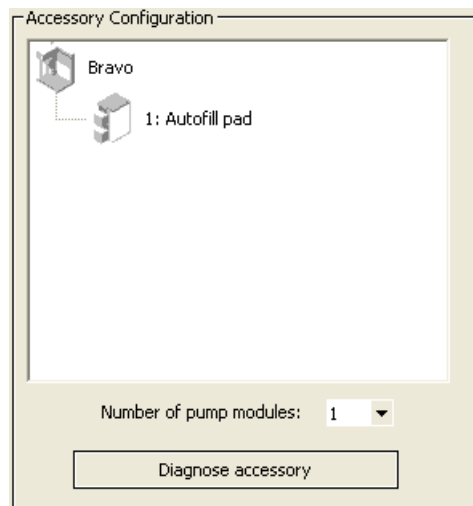
Control or indicator	Description
Graphical display of configured accessories	Displays icons of the Bravo Platform and any configured accessories associated with specific deck locations.
Diagnose accessory	Displays the Accessory Diagnostics dialog box for the selected accessory. Click the accessory icon in the graphic to display the corresponding dialog box. See "Accessory Diagnostics dialog box" on page 266.

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 26
Setting up accessories	"Accessories overview for the Bravo Platform" on page 102
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

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 169
- "Calibrating a Weigh Station" on page 172
- "Testing the Microplate Vacuum Alignment Station" on page 110
- "Testing the Orbital Shaking Station" on page 116
- "Testing the Vacuum Filtration Station" on page 134
- "Testing a thermal or thermal shaking station" on page 158

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
Setting up accessories	"Accessories overview for the Bravo Platform" on page 102
Troubleshooting problems	"Troubleshooting hardware problems" on page 75 "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

External Robots tab quick reference

About this topic

This topic provides a reference for the External Robot tab in Bravo Diagnostics. Read this topic if you have a Bravo Platform that is integrated in a system with other plate-handling robots.

Procedures

The External Robot tab provides the controls for configuring how an external robot can access the Bravo deck. You can configure whether to permit only one robot to operate on the Bravo deck at any given time or to allow concurrent operation.

For configuration procedures, see "Configuring external robot access" on page 46.

Contents

The External Robot tab contains the following controls and indicators:

Control or indicator	Description
Prevent Bravo operation during external robot access	Enables and disables the concurrent operation of the Bravo robot while an external robot accesses the Bravo deck. • Select the check box to disable concurrent operation and to move the Bravo head to a specified safe location on the deck during the external robot access. • Clear the check box to enable concurrent operation.
Move Bravo to this safe location	Allows you to specify the deck location where the Bravo head will move if an external robot is accessing the Bravo deck.
Current safe location	Displays the selected safe location.
Deck location	Selects a location on the Bravo deck.
Does an external robot access this location?	Specifies whether the selected deck location may be accessed by an external robot.
External robots	Specifies which external robots may access the selected deck location.
Select the locations that should be blocked during robot access	Allows you to specify locations on the Bravo deck where the Bravo robot is prohibited from moving during the external robot access.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
How to configure locations for external robot access	"Configuring external robot access" on page 46
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

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 97.

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*.

Control or indicator	Description
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 26
Clearing a fault	"Clearing motor faults and checking the head type" on page 97
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

Jog/Teach tab quick reference

About this topic

This topic provides a quick reference for the Jog/Teach tab in Bravo Diagnostics.

> ⚠️ **WARNING**   To avoid potential injury and damage to the device, only personnel trained in how to teach the Bravo Platform should use the Jog/Teach tab controls.

> ⚠️ **WARNING**   The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the robot-disable pendant.

Procedures

The Jog/Teach tab enables you to:

Procedure	See...
Home the pipette head	"Homing the pipette head" on page 84
Set teachpoints	"Setting teachpoints" on page 36
Move the pipette head to a safe distance above a teachpoint, or move to a teachpoint	"Using the Move and Approach commands" on page 90
Move the pipette head incrementally in each of its axes	"Jogging the pipette head" on page 87
Change the speed of the pipette head	"Changing the pipette head speed" on page 89

Contents

The Jog/Teach tab contains the following:

- "Teachpoints area" on page 270
- "Jog and Home Axes areas" on page 272

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.

Control or indicator	Description
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.
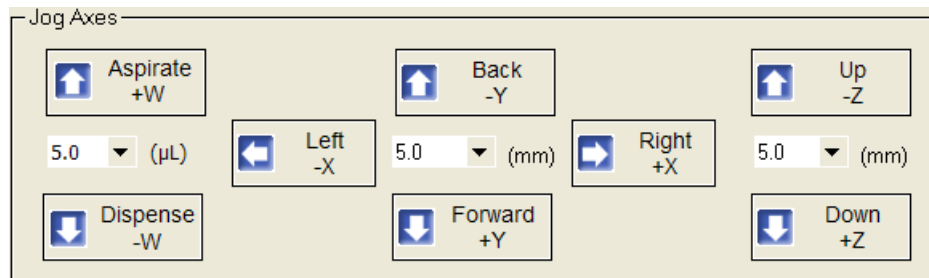
Control or indicator	Description
Jog Axes area	
Aspirate +W, Dispense –W buttons and increment (µL) list	Enables you to select the incremental distance (µL) to move the pipette head, and then move the pipette head the specified distance in the *w*-axis.
Left –X, Right +X, Back –Y, Forward +Y buttons 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	

Control or indicator	Description
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.
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 26
Stopping in an emergency	"Emergency stops" on page 56
Editing teachpoints	"Setting teachpoints" on page 36
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

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.

⚠️ **WARNING** **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the robot-disable pendant.**

Procedures

You can use the Gripper tab to fine-tune the gripper movements using the following procedures:

- "Verifying the gripper setup" on page 43
- "Fine-tuning the gripper movements" on page 92

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.

Control or indicator	Description
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 26
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75 • "Troubleshooting hardware problems" on page 75
Reporting a problem	"Reporting problems" on page 78

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 28
Initialize a profile	"Initializing the Bravo Platform" on page 33
Change the pipette head	"Changing the Bravo head" on page 63

Contents

The Profiles tab contains the following:
- "Profile Management area" on page 277
- "Connection area" on page 278
- "Modified Variables area" on page 281

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 28.
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 this profile	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 device	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.
Allow "top of stack" fluid handling	Permits fluid handling tasks to be performed in the labware at the top of a specified stack.
Enable tips-off tip-touch	Performs a tip touch in the tip box after a Tips Off task to ensure that the tips fall from the head into the tip box.

Control	Description
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 tip box location, and install the special SRT platepad for 250-µL tip boxes to ensure greater z-axis clearance and prevent potential hardware crashes. See "(Bravo SRT only) Setting up an LT tip box location" on page 160.

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 Bravo head" on page 63.
	The Change head button is available only after you initialize a Bravo profile.
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.
	CAUTION 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.
	Note: If this check box is cleared, the w-axis controls in the Jog/Teach tab will be disabled even when the device is initialized.

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 26
Editing teachpoints	"Setting teachpoints" on page 36
Troubleshooting problems	• "Troubleshooting hardware problems" on page 75
	• "Troubleshooting hardware-related error messages" on page 77
Reporting a problem	"Reporting problems" on page 78

Processes tab quick reference

About this topic

This topic provides a reference for the Processes tab in Bravo Diagnostics.

⚠️ **WARNING** **The red Stop motors button does not perform an immediate stop. The Bravo head can continue to move in the same direction at the same speed. To perform an emergency stop, press the red button on the robot-disable pendant.**

Procedure

To run a process, see "Performing a task using Bravo Diagnostics" on page 98.

Contents

The Processes tab contains the following:
- "Location area" on page 282
- "Miscellaneous area" on page 282
- "Well Selection and Head Mode area" on page 283
- "Command Parameters area" on page 284

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 and Bravo 96AM Head only. To use one row or column of channels instead of all channels in the head, use the controls in the dialog box to select which channels on the 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 284
	• "Dispense task parameters" on page 288
	• "Dispense to Waste task parameters" on page 290
	• "Mix task parameters" on page 293
	• "Pump Reagent parameters" on page 296
	• "Shake task parameters" on page 297
	• Tips On and Tips Off
	• "Vacuum Filtration Station task parameters" on page 298 (Assemble Vacuum, Disassemble Vacuum, and Move and Filter Plate)
	• "Wash Tips task parameters" on page 302
	• "Pin Tool task parameters" on page 304
	• *Bravo 96AM Head only*
	   – AM Cartridges On and AM Cartridges Off
	   – "AM Aspirate task parameters" on page 308
	   – "AM Dispense task parameters" on page 313
	   – "AM Mix task parameters" on page 318

Execute command	Performs the selected task command. *Note:* To stop a task before it finishes running, click **Stop motors**. To resume movement of the 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 98.

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.
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.)

Parameter	Description
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.
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.

Parameter	Description
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 26
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 98
Reporting a problem	"Reporting problems" on page 78

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 98.

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 26
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 98
Reporting a problem	"Reporting problems" on page 78

Dispense to Waste task parameters

About this topic

This topic describes the task parameters for the Dispense to Waste task, which is available only for a location with a Tip Wash Station (also known as a MicroWash Reservoir).

The Dispense to Waste task moves the pipettes by a horizontal offset and then dispenses used fluid in between the chimneys in the Tip Wash Station. The software calculates the horizontal offset automatically based on the labware definition for the Tip Wash Station.

To run the Dispense to Waste task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 98. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter descriptions

The Dispense to Waste task has the following parameters.

Parameter	Description
Empty tips	The option to empty all the liquid from the head into the Tip Wash Station outside the chimneys.
Volume (µL)	The volume of liquid to be dispensed from each pipette.
Blowout volume (µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the tips are still in the Tip Wash Station.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.

Parameter	Description
Override dispense flow rate from liquid class	The option to override the dispense velocity specified in the liquid class. Selecting this option enables you to specify a value for the dispense flow rate without changing the liquid class.
Dispense flow rate (0–500 µL/s)	The numerical value or the JavaScript variable that will override the dispense velocity setting in the liquid class.
	A JavaScript variable enables the value to be assigned later, for example through a VWorks form. Using a VWorks form, an operator could easily change the flow rate for a dispense step in increments from as low as 1 µL/min up to 1001 µL/min using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (µL/s) at run time. If you want an operator to enter the value in microliters per minute (µL/min), you can use scripting to convert the values for the software to use.
Distance from well bottom (mm)	The absolute distance between the end of the pipette tips and the bottom of the Tip Wash Station during the Dispense to Waste 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 (mm/µL)	The rate at which to raise the pipette head during the Dispense to Waste task.
	Use dynamic tip retraction to prevent spills as the pipette tips displace the liquid.
	To move the pipettes:
	• *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:
	$(V_{dispensed} * DTR) + Distance_{well\ bottom}$
Perform tip touch on North/ East side	The option to touch the tip on an outer side of the adjacent northeast chimney or wall in the Tip Wash Station after performing the dispense.
Tip touch retract distance (–20 to 50 mm)	The vertical distance for the pipette tips to rise before performing the tip touch.
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 26
Editing the labware classes, liquid library, or pipetting techniques	*VWorks Automation Control Setup Guide*

For information about...	See...
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 98
Reporting a problem	"Reporting problems" on page 78

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 98.

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 26
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 98
Reporting a problem	"Reporting problems" on page 78

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 "Performing a task using Bravo Diagnostics" on page 98.

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 26
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 167
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 98
Reporting a problem	"Reporting problems" on page 78

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 98.

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 26
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 112
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 98
Reporting a problem	"Reporting problems" on page 78

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 98.

Parameter description: 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 (configuration A) • Base-Collection plate-Collar (configuration B) • Base-Collar (configuration C) For details, see "Setting up the Vacuum Filtration Station" on page 120.
Vacuum Filtration base	The location of the Vacuum Filtration Station base.
Insert height (0-15 mm)	The height of the white plastic spacer, if present, that can be placed in the base manually before starting the protocol. The insert is used to raise the height of the collection plate and reduce the spacing between the filter plate nozzles and the collection plate underneath. Measure the height (mm) from the bottom edge to the top edge of the insert. If you are using multiple inserts, measure the combined height of the stack of inserts. If no insert is in the base, use a value of 0.0 mm (default). **CAUTION** If the assembled stack of plates and inserts is too tall, the collar of the Vacuum Filtration Station may not seal properly during the vacuum tasks, and the software will display an error message.

Parameter description: Disassemble Vacuum task

Parameter	Description
Vacuum Filtration Assembly	The location of the assembled Vacuum Filtration Station.

Parameter description: Move and Filter Plate task

Parameter	Description
Mode	The action of the task. The options are On, Off, and Timed. • On and Off. If you are not timing the filtering process, add two Move and Filter Plate tasks in the protocol for each filtering operation. One task turns on the vacuum (Mode = On), and the other task turns off the vacuum (Mode = Off). • Timed. If you plan to time the filtering process, add only one Move and Filter Plate task. The task turns on the vacuum, and then turns off the vacuum automatically at the end of the time period.
When filtration timing begin *ME4C VARIO Vacuum Pump only*	The different options for when to start timing the filtration process: • When pressure is achieved • When the vacuum pump starts
Time for operation in Timed mode (s)	The duration, in seconds, that you want to leave the vacuum on. At the end of the period, the vacuum will turn off.
Hold or tap down filter plate *Bravo Platform only*	The different options for whether to have the Bravo gripper hold down the filter plate when the vacuum is turned on to ensure a secure vacuum seal: • None • Tap down. The Bravo gripper will hold down the filter plate from the top only for the time period specified in the Duration for tap down parameter. • Hold down. The Bravo gripper will hold down the filter plate from the top for the duration of the task. *Note:* If you select None or Tap down, the protocol can perform other tasks in parallel. Concurrent operation is not an option if you select Hold down.
Duration for tap down (1-30 s) *Bravo Platform only*	The length of time, in seconds, that the Bravo gripper will hold down the filter plate if the Tap down option is selected.
Time allowed to reach pressure(s) *ME4C VARIO Vacuum Pump only*	The length of time, in seconds, to allow the vacuum to reach the specified target pressure. An error message displays if the target pressure is not reached within the time specified.

Parameter	Description
Pressure units *ME4C VARIO Vacuum Pump only*	The desired unit of measure: mbar, Torr, hPa, mmHg, cmHg, or inHg. **IMPORTANT** The Pump Pressure Units setting in the profile configuration must match the units set at the VARIO pump controller in order for the software to convert the values to different pressure units.
Target pressure *ME4C VARIO Vacuum Pump only*	The difference between the pressure of the outside atmosphere above the filter and the pressure in the Vacuum Filtration Station manifold, including the enclosure beneath the filter. For example, if you set the Target pressure to 600 mbar and the ambient pressure displayed on the Vario pump is 1000 mbar, the vacuum will remain on until the reading on the Vario pump reaches 400 mbar.
Vent delay *ME4C VARIO Vacuum Pump only*	The length of time, in seconds, to wait for the air pressure under the filter to equalize with the ambient air pressure.

Related information

For information about...	See...
Opening Bravo Diagnostics	"Opening Bravo Diagnostics" on page 26
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 120
Performing a diagnostic task	"Performing a task using Bravo Diagnostics" on page 98
Reporting a problem	"Reporting problems" on page 78

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 98.

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.
	IMPORTANT To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
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.
	If you also select the Dispense to waste during wash option, the tip touch is performed on the northeast side only.
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.

Parameter	Description
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.
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 26
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 98
Reporting a problem	"Reporting problems" on page 78

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 98.

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.
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.

Parameter	Description
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
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 26
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 98
Reporting a problem	"Reporting problems" on page 78

AM Aspirate task parameters

About this topic

This topic describes the task parameters for the AM Aspirate task, which is available only for the Bravo 96AM Head.

The AM Aspirate task is designed for aspirating fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head. In addition to the parameters for the Aspirate task, the AM Aspirate task allows you to override the flow rate from liquid class.

To run the AM Aspirate task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 98. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Aspirate task has the following parameters.

Parameter	Description
Volume (µL)	The volume of liquid to be drawn into each probe, cartridge, or tip.
Pre-aspirate volume (µL)	The volume of air to be drawn before the probes, cartridges, or tips enter the liquid.
Post-aspirate volume (µL)	The volume of air to be drawn after the liquid is drawn.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override aspirate flow rate from liquid class	The option to override the aspirate velocity in the specified liquid class. Selecting this option enables you to specify a value for the aspirate flow rate without changing the liquid class.

Parameter	Description
Aspirate flow rate (0–500 µL/s)	The numerical value or the JavaScript variable that will override the aspirate velocity setting in the liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for an aspirate step in increments from as low as 1 µL/min up to 2000 µL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (µL/s) at run time. If you want an operator to enter the value in microliters per minute (µL/min), you can use scripting to convert the values for the software to use.

Parameter	Description
Distance from well bottom (-20–100 mm)	The distance between the tips of the probes, cartridges, or disposable tips and the *well bottoms* during the AM Aspirate task.
	If you specify dynamic tip extension, this is the distance at the end of the AM Aspirate task.
	Use a positive number for tasks that are performed with mounted cartridges, mounted tips, or bare probes at labware other than a cartridge rack.
	If the task is performed in the upper cup of unmounted cartridges, you can use a negative number for the parameter value. In this case, the *well bottom* is the top of the cartridge cup, as shown in the following figure.
	For example, a negative number enables a cup wash step while the cartridges are in the cartridge rack before they are mounted on the Bravo 96AM Head.
	IMPORTANT You can use a negative number for this parameter only if the AM Aspirate task is performed in cartridges that are located in a cartridge rack.
	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 (0–20 mm/µL)	The rate at which the Bravo 96AM Head moves during the AM 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 AM 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.
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.

Parameter	Description
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 26
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 98
Reporting a problem	"Reporting problems" on page 78

AM Dispense task parameters

About this topic

This topic describes the task parameters for the AM Dispense task, which is available only for the Bravo 96AM Head.

The AM Dispense task is designed for dispensing fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head. In addition to the parameters for the Dispense task, the AM Dispense task allows you to override the flow rate from liquid class.

To run the AM Dispense task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 98. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Dispense task has the following parameters.

Parameter	Description
Empty tips	The option to empty all liquid from the probes, cartridges, or tips instead of using the dispense volume specification.
Volume (µL)	The volume of liquid to be dispensed from each probe, cartridge, or tip.
Blowout volume (µL)	Specifies the volume of air to dispense after the main volume has been dispensed while the probes, cartridges, or tips are still in the wells. Typically, the blowout volume is the same as the pre-aspirate volume. Note: Blowout occurs only in the last quadrant dispensed for a given AM Dispense task.
Liquid class	The pipetting speed and accuracy. **IMPORTANT** To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override dispense flow rate from liquid class	The option to override the dispense velocity in the selected liquid class. Selecting this option enables you to specify a value for the dispense flow rate without changing the liquid class.

Parameter	Description
Dispense flow rate (0– 500 μL/s)	The numerical value or the JavaScript variable that will override the dispense velocity setting in the liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for an aspirate step in increments from as low as 1 μL/min up to 2000 μL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (μL/s) at run time. If you want an operator to enter the value in microliters per minute (μL/min), you can use scripting to convert the values for the software to use.

Parameter	Description
Distance from well bottom (-20–100 mm)	The distance between the tips of the probes, cartridges, or disposable tips and the *well bottoms* during the AM Dispense task.
	If you specify dynamic tip extension, this is the distance at the end of the AM Dispense task.
	Use a positive number for tasks that are performed with mounted cartridges, mounted tips, or bare probes at labware other than a cartridge rack.
	If the task is performed in the upper cup of unmounted cartridges, you can use a negative number for the parameter value. In this case, the *well bottom* is the top of the cartridge cup, as shown in the following figure.
	For example, a negative number enables a prewetting step before mounting and priming the cartridges.
	IMPORTANT You can use a negative number for this parameter only if the AM Dispense task is performed in cartridges that are located in a cartridge rack.
	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 AM Dispense task. The list of pipette techniques are defined in the Pipette Technique Editor.
Perform tip touch	The option to touch the probes, cartridges, or tips 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 probes, cartridges, or 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 26
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 98
Reporting a problem	"Reporting problems" on page 78

AM Mix task parameters

About this topic

This topic describes the task parameters for the AM Mix task, which is available only for the Bravo 96AM Head.

The AM Mix task is designed for aspirating and dispensing fluids through AssayMAP Bravo cartridges that are mounted on the Bravo 96AM Head.

To run the AM Mix task from Diagnostics, see "Performing a task using Bravo Diagnostics" on page 98. To use the task in a protocol, see the *VWorks Automation Control User Guide*.

Parameter description

The AM Mix task has the following parameters.

Parameter	Description
Volume (µL)	The volume of liquid to be mixed in each well.
Pre-aspirate volume (µL)	The volume of air to be drawn before the pipette tips enter the liquid.
Blowout volume (µL)	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 velocity and accuracy.
	IMPORTANT To ensure consistent pipetting, always select a liquid class for liquid-handling tasks.
Override flow rates from liquid class	The option to override the aspirate and dispense velocity in the selected liquid class. Selecting this option enables you to specify a value for the flow rate without changing the liquid class.

Parameter	Description
Aspirate/dispense flow rate (0–500 µL/s)	The numerical value or the JavaScript variable that will override both the aspirate and dispense velocity in the selected liquid class.
	A JavaScript variable enables the value to be assigned later. For example, using a VWorks form, an operator could easily change the flow rate for a mix step in increments from as low as 1 µL/min up to 2000 µL/min or more using the same liquid class.
	If the task is included in a VWorks macro, a JavaScript variable enables you to change the value for the task at the macro level.
	IMPORTANT The software requires that the flow rate value be in microliters per second (µL/s) at run time. If you want an operator to enter the value in microliters per minute (µL/min), you can use scripting to convert the values for the software to use.
Mix cycles (0–100)	The number of times to repeat the aspirate-and-dispense cycle.
Dynamic tip extension (0–20 mm/µL)	The rate at which the Bravo 96AM Head moves during the aspirate action. 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.

Parameter	Description
Pipette technique	The pipette location offset you want to use for the Mix task. The list of pipette techniques are defined in the Pipette Technique Editor.
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 tips of the probes, cartridges, or disposable tips and the well bottoms during the dispense action.
Perform tip touch	The option to touch the tips 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 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 26

For information about...	See...
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 98
Reporting a problem	"Reporting problems" on page 78

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