



AquaMax 2000 AquaMax 4000

Microplate Washers

User Guide

AquaMax 2000/4000 Microplate Washer User Guide

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Safety Information

Information about the safe use of the instrument from Molecular Devices includes an understanding of the user-attention statements in this guide, the safety labels on the instrument, precautions to follow before you operate the instrument, and precautions to follow while you operate the instrument.

Make sure that everyone involved with the operation of the instrument has:

- Received instruction in general safety practices for laboratories.
- Received instruction in specific safety practices for the instrument.
- Read and understood all Safety Data Sheets (SDS) for all materials being used.

Read and observe all warnings, cautions, and instructions. The most important key to safety is to operate the instrument with care.



WARNING! If the instrument is used in a manner not specified by Molecular Devices, the protection provided by the equipment might be impaired.

Warnings, Cautions, Notes, and Tips

All warning symbols are framed within a yellow triangle. An exclamation mark is used for most warnings. Other symbols can warn of other types of hazards such as biohazard, electrical, or laser safety warnings as are described in the text of the warning. Follow the related safety information.

The following user attention statements might be displayed in the text of Molecular Devices user documentation. Each statement implies the amount of observation or recommended procedure.



WARNING! A warning indicates a situation or operation that could cause personal injury if precautions are not followed.



CAUTION! A caution indicates a situation or operation that could cause damage to the instrument or loss of data if correct procedures are not followed.








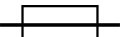




Note: A note calls attention to significant information.



Tip: A tip provides useful information or a shortcut but is not essential to the completion of a procedure.

Symbols on the Instrument

Each safety label found on the instrument contains an alert symbol that indicates the type of potential safety hazard.

Symbol	Indication
	Consult the product documentation.
	Potential biohazard.
	Potential electrical-shock hazard from a high-voltage source. Read and understand all safety instructions before you proceed with the installation, maintenance, and service of all modules. Power off the instrument and disconnect the power cord before you do maintenance procedures that require removal of a panel or cover or disassembly of an interior instrument component.
	Power switch indicates power on.
	Power switch indicates power off.
	Fuse location.
	European technology conformity.
	United Kingdom technology conformity.
	Certification by TUV Rheinland for compliance with US and Canadian product safety standards.
	California proposition 65 requires businesses to provide warnings to Californians about significant exposures to chemicals that cause cancer, birth defects, or other reproductive harm.

Electrical Safety

To prevent electrical injuries and property damage, inspect all electrical equipment before use and report all electrical deficiencies. Contact Molecular Devices technical support for equipment service that requires the removal of covers or panels.



WARNING! The instrument is an Equipment Class 1 product that relies on protective earth grounding for safe operation. Any interruption of the protective earth ground conductor, inside or outside the instrument, or disconnection of the protective earth ground terminal can result in personal injury. Use only the power cord provided with the equipment.



WARNING! The power cord is considered the means of disconnecting power from the unit, do not position the equipment so that it is difficult to reach the power cord or power switch on the rear enclosure.

Chemical and Biological Safety

Normal operation of the instrument can involve the use of materials that are toxic, flammable, or otherwise biologically harmful. When you use such materials, observe the following precautions:

- Handle infectious samples based on good laboratory procedures and methods to prevent the spread of disease.
- Observe all cautionary information printed on the original containers of solutions before their use.
- Dispose of all waste solutions based on the waste disposal procedures of your facility.
- Operate the instrument in accordance with the instructions outlined in this guide, and take all the required precautions when using pathological, toxic, or radioactive materials.
- Splashing of liquids can occur. Take applicable safety precautions, such as wearing safety glasses and protective clothing when working with potentially hazardous liquids.
- Observe the applicable cautionary procedures as defined by your safety officer when using hazardous materials, flammable solvents, toxic, pathological, or radioactive materials in or near a powered-up instrument.



WARNING! Never use the instrument in an environment where potentially damaging liquids or gases are present.

Moving Parts Safety

The instrument contains moving parts that can cause injury. Under normal conditions, the instrument is designed to protect you from these moving parts.

To prevent injury:

- Never try to exchange labware, reagents, or tools while the instrument is operating.
- Never try to physically restrict the moving components of the instrument.



WARNING! Do not attempt to access the interior of the instrument unless specifically instructed to do so. The moving parts inside the instrument can cause injury. Do not operate the instrument with any covers or panels removed.



Note: Observe all warnings and cautions listed for all external devices attached to or in use during the operation of the instrument. See the applicable user guide for the operating and safety procedures of that device.

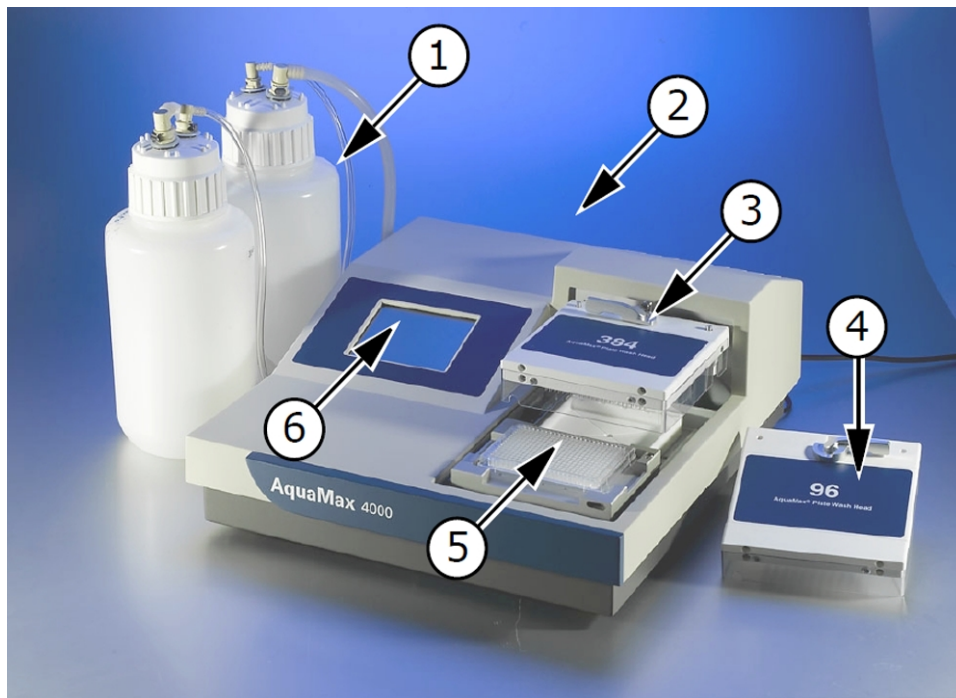
You can configure the AquaMax® 2000 Microplate Washer and the AquaMax® 4000 Microplate Washer to process 96-well and 384-well plates you use in both biochemical and cell-based assays that meet your current application requirements. The modular design provides upgrade options when your lab requirements change.

- Wash heads are available in 96-well and 384-well configurations for both plate wash and cell wash.
- All wash heads are interchangeable. The software detects which wash head you install.
- The AquaMax Microplate Washers prime, clean, and rinse the wash heads with the touch of a single button.
- The AquaMax Microplate Washers process all plate wells simultaneously during dispense, aspirate, and wash operations.
- Whole-well dispensing and aspiration in 384-well plates result in 2 to 4 times faster plate processing than other commercially available plate washers.
- The AquaMax Microplate Washers support most plate formats through the user-definable plate library. You can store up to 32 plate types in the plate library.
- The AquaMax 2000 Microplate Washer is equipped with two reagent ports to connect two different dispense bottles and the AquaMax 4000 Microplate Washer has four reagent ports to connect four different dispense bottles. You can drain waste into a waste bottle or for non-toxic waste, directly into a sink. The AquaMax Microplate Washers support 4 L or 10 L bottles.
- You control all washer operations through the instrument touch screen interface.
- The program library stores three factory defined programs and 100 user defined programs. Each program can contain up to 50 steps.

AquaMax Microplate Washers are compatible with Molecular Devices the StakMax® Microplate Handling System and other robots.

You can bypass the instrument touch screen and use a host computer to control the AquaMax Microplate Washers through a USB command interface. See [Using a Host Computer for Instrument Control on page 57](#).

Components



AquaMax 4000 Microplate Washer Components

Item	Description
1	4 L reagent reservoirs
2	Back panel with USB and StakMax Microplate Handler connectors
3	384-well wash head
4	96-well wash head
5	Plate carriage with plate
6	Touch screen

Touch Screen

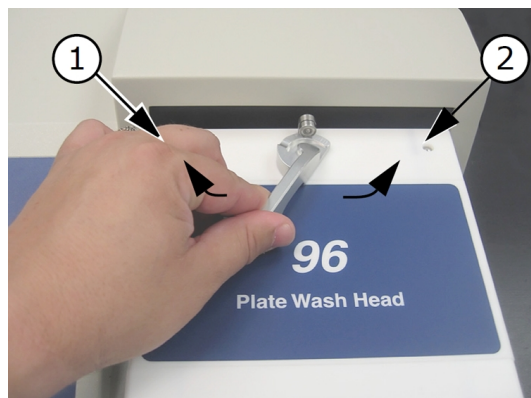


You use the touch screen to control the instrument operation. The touch screen displays the instrument status and provides access to instrument settings and programs. The touch screen also controls the StakMax Microplate Handler, when attached.

Wash Heads

Plate wash heads have either 96 or 384 paired probes. The instrument uses the long probe for aspiration and the short probe to dispense. The plate wash heads have straight dispense probes for thorough cleaning and aspiration. The cell wash heads have angled dispense probes to minimize cell loss during washing.

The wash heads are interchangeable and a lever mechanism allows you to remove and re-attach the wash heads.



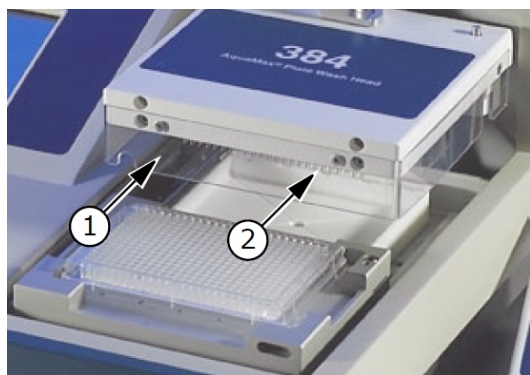
96-Well Plate Wash Head Lock

Item	Description
1	Close
2	Open



Note: If you use a 96-well wash head for a 384-well plate or vice versa, a motor pinch error occurs when the wash head tries to descend toward the wells. A mismatch should not damage the wash head.

Each wash head has a clear plastic guard to protect the probes from damage, and to prevent spills, sprays, and injury to users.



384-Well Plate Wash Head and Guard

Item	Description
1	Plastic guard
2	Aspiration and dispense probes on underside of wash head

Plate Carriage

The plate carriage is located on the right side of the washer. The plate carriage slides in and out of the wash chamber to load and unload.

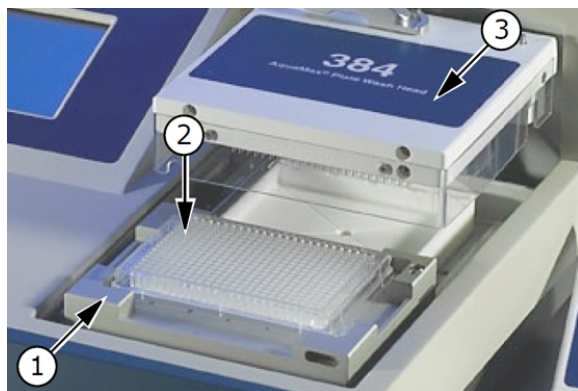


Plate Carriage

Item	Description
1	Plate carriage in eject position
2	384-well plate
3	384 wash head



CAUTION! Do not obstruct the movement of the plate carriage during operation. Obstruction can damage the instrument.

Supported Plate Types

You can define plate types and store up to 32 plate types in the plate library. AquaMax Microplate Washers accommodate rigid SBS-standard polystyrene and polypropylene plates with dimensions 128.2 mm (L) × 86.0 mm (W), and heights ranging from 13.5 mm to 15.5 mm, including:

- 96-well and 384-well standard formats (U-bottom, V-bottom, or Flat)
- 96-well half area
- 96-well and 384-well small volume



Note: Some plates with conical or tapered wells and some small volume plates are not compatible with bottom wash and aspirate operations.

96-well strip plates fall outside SBS guidelines, and compatibility of these plates with the instrument varies across brands. Plates with strips that are held firmly in a more rigid frame and have smaller tabs are generally more washer compatible. You should avoid plates with strips that have large tabs and are held loosely in a flexible frame, such as Nunc strip plates with C8 configuration. If you are unsure whether a plate is compatible, consult Technical Support or your sales representative before proceeding.

The instrument supports magnetic bead washing using the Dexter Magnetic Technologies LifeSep magnetic bead separator adapter plates.

Plate Library

The following plate types are in the plate library when you turn the instrument on for the first time. See [Plates Tab on page 49](#).

Plate Library Plate Type Specifications

Name	# Wells	Bottom	Manufacturers' #	Height (mm)	Depth (mm)
Costar	96	Flat	3650, 3916, 3915, 3361, 3590, 9018, 3591, 9017, 3641, 3628, 3370, 2507, 2509, 2503, 3665, 3600, 3362, 3917, 3912	14.20	10.67
Falcon	96	Flat	353915, 353228, 353937, 353279, 353941, 353296	14.25	10.59
Greiner	96	Flat	655101	14.40	10.90
Nunc	96	Flat	165305	14.80	12.50
Costar	384	Flat	3640, 3652, 3654, 3662, 3680, 3700, 3701, 3702, 3703, 3704, 3705, 3708, 3709, 3710; 3723	14.20	11.43
Falcon	384	Flat	353234, 353239, 353962	14.32	11.50
Greiner	384	Flat	781091	14.40	11.50
Nunc	384	Flat	142761	14.40	11.70

Reagent and Waste Bottle Ports

The source channels and waste connections are located on the left side of the instrument. The AquaMax 2000 Microplate Washer has two source channels and the AquaMax 4000 Microplate Washer has four. Each source channel is composed of a fluid input, a pressure output, and an optional level sensor connector and you can connect each source channel to a reagent bottle. You can drain waste into a waste bottle and you can install a waste sensor to detect a full waste bottle. You can drain non-toxic waste directly into a sink.

The AquaMax Microplate Washers support 4 L or 10 L bottles.



AquaMax 4000 Microplate Washer

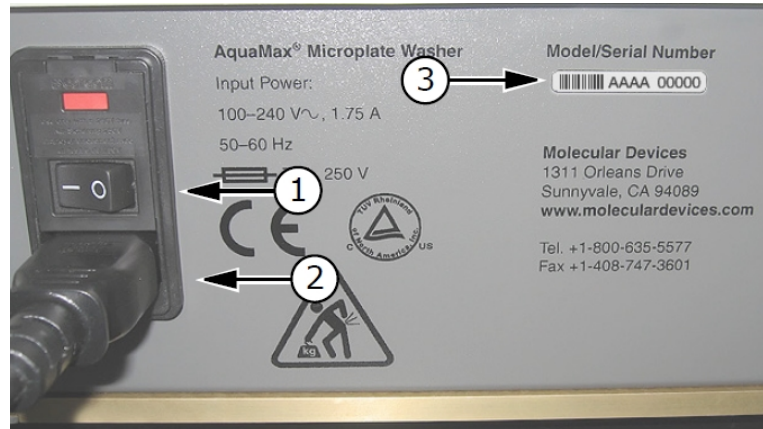
Item	Description
1	Waste full sensor input
2	Waste fluid output
3	Source channels (green, red, blue, and yellow)*
4	Source bottle pressure outputs
5	Source bottle fluid inputs
6	Source bottle empty sensor inputs

*The AquaMax 2000 Microplate Washer has only green and red inlets.

Back Panel

The power switch, power cord receptacle, communication ports, and instrument information, are located on the back panel of the instrument.

Labels and text next to the power switch provide important information about the instrument, such as line voltage rating and serial number. Use the model/serial number on this label when you contact Molecular Devices for technical support.

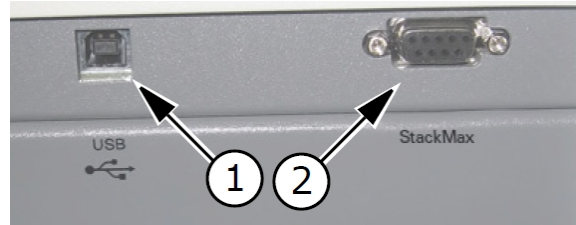


Back Panel Right Side

Item	Description
1	Power switch
2	Power cord receptacle
3	Serial number

There are two communication ports on the left side of the back panel.

Use the USB Type B port to control a robotic plate handler. Use the StakMax communication port to control StakMax Microplate Handler operations. The StakMax control cable is available with the StakMax Microplate Handler integration kit (Part Number: 0310-5454).



USB and StakMax Connectors

Item	Description
1	USB port
2	StakMax



Set up the instrument on a level surface, away from direct sunlight, dust, drafts, and vibrations.



WARNING! Shock Hazard. To avoid electrical shock, turn the power switch to the OFF position and remove the power cord before you install or move the instrument.



WARNING! Risk of fire, explosion, or shock. Do not operate the instrument in an environment where potentially damaging liquids or gases are present.



CAUTION! Do not operate the instrument in an environment with a temperature below 15°C.



CAUTION! Do not touch or loosen any screws or parts unless specifically instructed by Molecular Devices. Doing so can cause misalignment and voids the instrument warranty.

Unpacking the Instrument



WARNING! The AquaMax Microplate Washers weigh approximately 18.5 kg (41 lbs). Lift with care.

The AquaMax Microplate Washer ships in two specially designed containers.

- The base unit box contains the washer unit and accessories (manual, power cord, waste tube, and tubing label kit):
 - AquaMax 2000 Microplate Washer (Part Number: 0310-5363)
 - AquaMax 4000 Microplate Washer (Part Number: 0310-5227)
 - The tubing label kit contains 4×3 pieces of colored slip-on plastic spiral wraps, one group of each color, to label bottle connections (liquid, pressure, level sensor).
- The wash head box contains up to four wash heads, each in a clamshell container:
 - 96-Well Microplate Wash Head (Part Number: 0310-5216T)
 - 96-Well Cell Wash Head (Part Number: 0310-5217T)
 - 384-Well Microplate Wash Head (Part Number: 0310-5219T)
 - 384-Well Cell Wash Head (Part Number: 0310-5218T)

The standard AquaMax Microplate Washer does not include bottles. If you purchase bottles separately, check to make sure that all bottles and tubing are present. Each reservoir bottle should contain a cap, fluid tubing, and air tubing. The waste bottle should contain its own waste tubing.

- Reagent and waste bottles:
 - 4-Liter Reservoir without Level Sensor (Part Number: 5000801)
 - 4-Liter Reservoir with Level Sensor (Part Number: 5000802)
 - 10-Liter Reservoir (Part Number: 5012304)
 - 10-Liter Waste Reservoir (Part Number: 9000-0296)

The AquaMax Microplate Washers support 4 L or 10 L bottles.

Keep all boxes and packing materials including the clamshell containers for the wash heads. Use the original packing materials for long-term storage of the instrument. You must use the original packing material if you ship the instrument for repair.

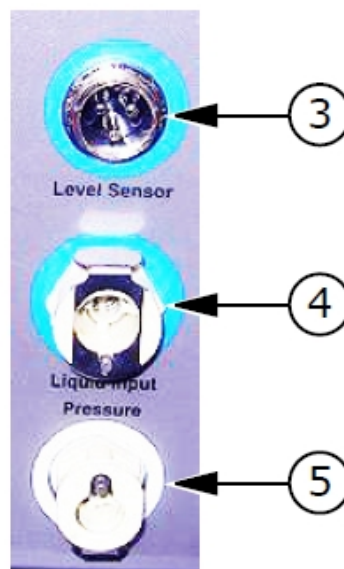
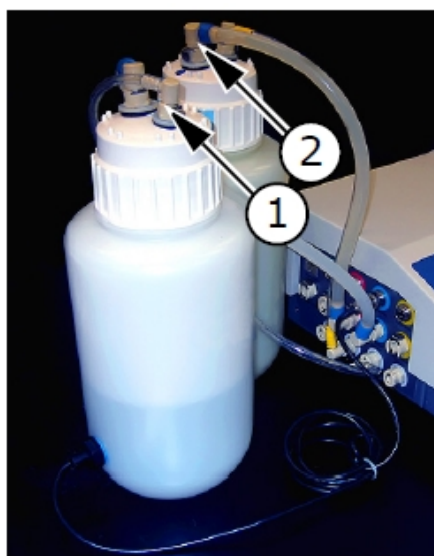


Note: If a box is damaged in transit, it is important that you retain the box for inspection by the carrier in case there is damage to the instrument.

Connecting Reagent Bottles

Each reagent bottle comes with two quick-connect fittings and tubing in two sizes. The larger tube is for fluid. The smaller tube is for bottle pressure.

The AquaMax Microplate Washers support 4 L or 10 L bottles only.



Reagent Bottles and Connections Fittings

Item	Description
1	Small fitting for pressure connection
2	Large fitting for liquid input
3	Level sensor fitting on the instrument
4	Liquid input fitting on the instrument
5	Pressure connector on the instrument



CAUTION! The source bottle and waste fluid fittings are the same size. Do not connect source bottles to the waste output, or damage to the instrument can occur.



CAUTION! Pressurized bottles for the AquaMax Microplate Washers provide up to 5 years of service. Eventually, the bottles will show signs of aging such as yellowing, plastic degradation, or thread wear. You should replace bottles at the earliest signs of aging. Use only bottles supplied for use with the AquaMax 2000 Microplate Washer and the AquaMax 4000 Microplate Washer.

To connect a reagent bottle:

1. Fill the bottle with a reagent and tighten the cap firmly.

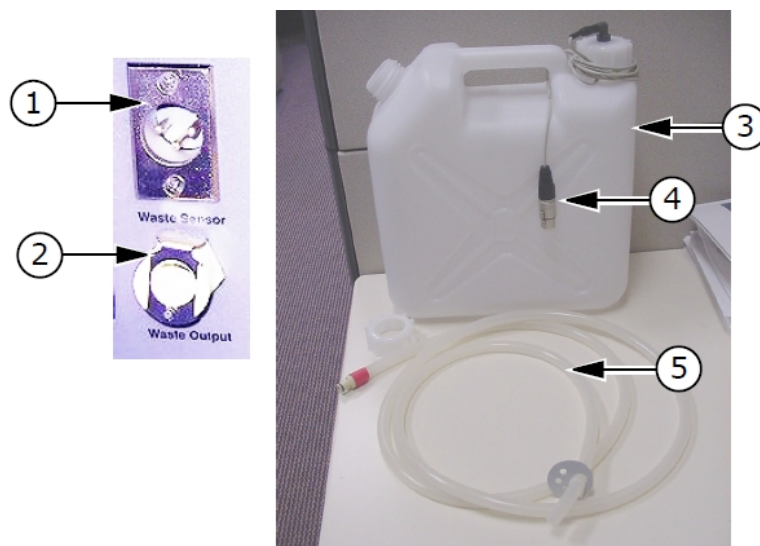
*** Tip:** For quick and accurate assembly of reagent bottles, use slip-on rings to color-code all tube and sensor connections.

2. Connect one end of the fluid tube to the large fitting on the bottle cap.
3. Connect the other end to a Liquid Input on the left side of the instrument (green, red, blue, or yellow).

*** Tip:** Push down on the metal fitting of the quick connector to ease the fitting into place.

4. Connect one end of the pressure tube to the small fitting on the bottle cap.
5. Connect the other end to the Pressure fitting below the Liquid Input.
6. If the bottle has an Empty sensor, connect the sensor to the Level Sensor connector above the Liquid Input fitting.

Connecting Waste Bottles



Waste Bottle and Connection Fittings

Item	Description
1	Waste sensor connector
2	Waste output fitting
3	Waste bottle
4	Waste full sensor
5	Waste tube

To connect a waste bottle:

1. Connect the quick connect fitting of the waste tube to the Waste Output fitting on the left side of the instrument.
2. Connect the free end of the tube to a vented waste container.
For non-toxic waste you can place the free end of the tube directly into a sink. The open end of the waste tube must be below the level of the microplate washer and must remain free of obstruction.



CAUTION! An obstructed waste tube can damage the instrument.

3. If the bottle has a waste full sensor, connect the waste full sensor to the Waste Sensor input fitting.



WARNING! Biohazard. Waste tubing must be connected during operation. Waste fluid is ejected out of the waste port. If no waste tube is connected, waste will spray and spill from the waste output port.



CAUTION! Waste containers must be vented. Connecting the waste tube to a pressurized or closed vessel will cause damage to the waste pump.

Installing Wash Heads



CAUTION! The probes on the underside of the wash head are delicate. Take care when you handle the wash heads.

To install a wash head:

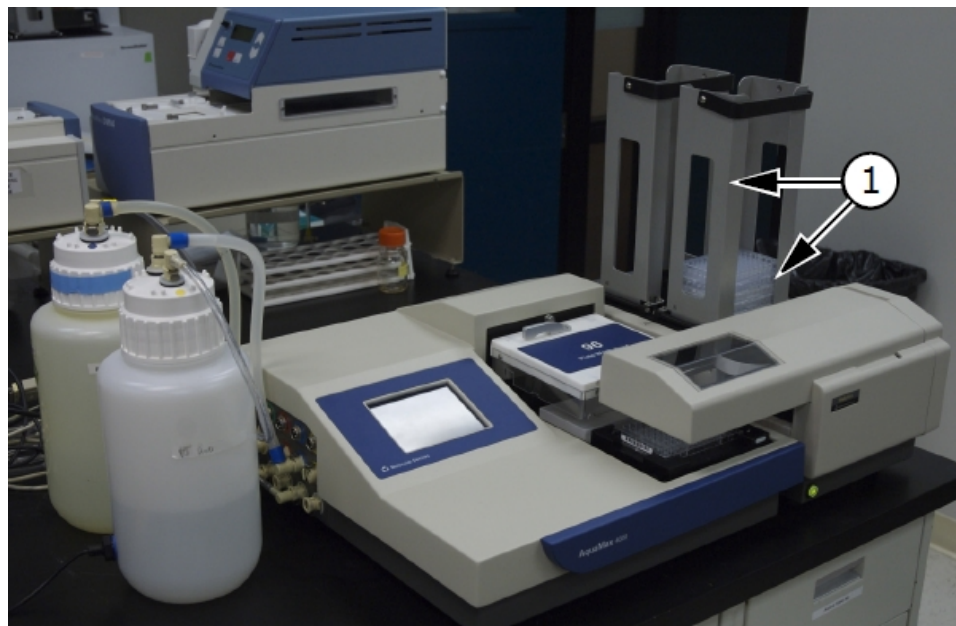
1. Install the wash head either 96 or 384. Wash heads ship pre-qualified and will work with any base unit.
2. Move the lever to the left to lock the wash head in place.



3. Power on the instrument power switch located on the back panel.
The following operations occur as the instrument initializes when powered on:
 - The wash head rises to prepare for a plate to load.
 - The touch screen turns on and displays the instrument status.
 - The plate carriage and wash head motor find home and return to the eject position.

Connecting an AquaMax Microplate Washer to a StakMax Microplate Handler

The microplate washer uses on board programs to control the microplate stacker. See [Stacker Options on page 35](#).



AquaMax Microplate Washer With StakMax Microplate Handler

Item	Description
1	StakMax Microplate Handler

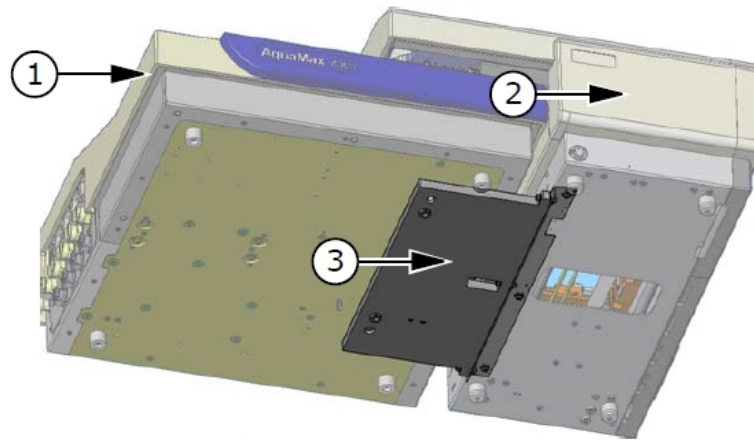
To connect an AquaMax Microplate Washer to a StakMax Microplate Handler you need a StakMax integration kit (Part Number: 0310-5454). The integration kit consists of a StakMax/AquaMax base plate, bolts for the base plate, a tool for the bolts, a StakMax communication cable, and an integration manual.

For additional instructions, see the StakMax integration kit user guide.

To set up an AquaMax Microplate Washer with a StakMax Microplate Handler:

1. Power off both the AquaMax Microplate Washer and the StakMax Microplate Handler and disconnect the power cords from the power supply.

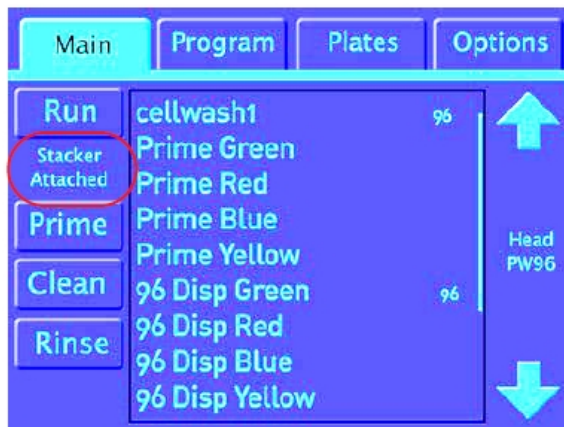
- Use the StakMax/AquaMax base plate to connect the StakMax Microplate Handler to the AquaMax Microplate Washer.



StakMax to AquaMax Adapter Plate

Item	Description
1	Small fitting for pressure connection
2	Large fitting for liquid input
3	Level sensor fitting on the instrument

- Connect the StakMax communication cable to the serial port on the back of the StakMax Microplate Handler.
- Connect the StakMax communication cable to the StakMax port on the back panel of the AquaMax Microplate Washer. See [Back Panel on page 15](#).
- Power on the AquaMax Microplate Washer and the StakMax Microplate Handler. The StakMax Microplate Handler detects the connection to the AquaMax Microplate Washer and when the AquaMax Microplate Washer detects the connection to the StakMax Microplate Handler the Main tab displays *Stacker Attached*.



Use the touch screen to operate the AquaMax Microplate Washer.

To power on the instrument, do one of the following:

- If the instrument is powered off, turn the instrument power switch located on the back panel to the On position.
The instrument performs diagnostic checks and the touch screen displays the Main tab. See [Main Tab on page 25](#).
- If the instrument is in shutdown mode, tap anywhere on the touch screen to wake the instrument up. See [Defining Shutdown Options on page 56](#).

Administrative Mode

When you power on the instrument for the first time, the touch screen allows all users to access all program functions, plate functions, and options.

You can put the instrument into Administrative mode to restrict access to editing functions and system options from the Options tab. See [Options Tab on page 53](#).

When the instrument is in Administrative mode, you must tap Admin and enter the administrator passcode. There is one passcode and you must enter the passcode on each tab.

You do not need the passcode to run programs, view program details and plate details, or access the Depressurize, Purge, and Shutdown functions on the Options tab.

Administrative mode requires the entry of a passcode to access the following functions and options:

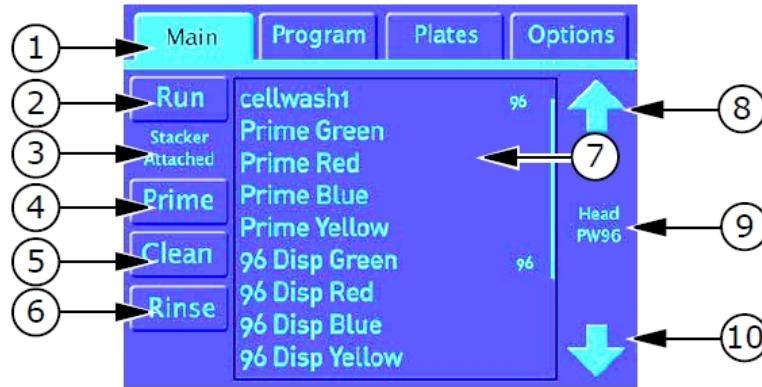
- New (Program, Plates)
- Rename (Program)
- Delete (Program, Plates)
- Calibrate Screen (Options)
- Edit (Program, Plates)
- Copy (Program)
- Restack (Options)
- Change Passcode (Options)
- Shutdown Options (Options)



Chapter 4: Main Tab

4

Use the Main tab to run programs. There are shortcuts to run the Prime, Clean, and Rinse one-touch programs and the list of programs. You can edit and copy the one-touch programs but you cannot rename or delete them.

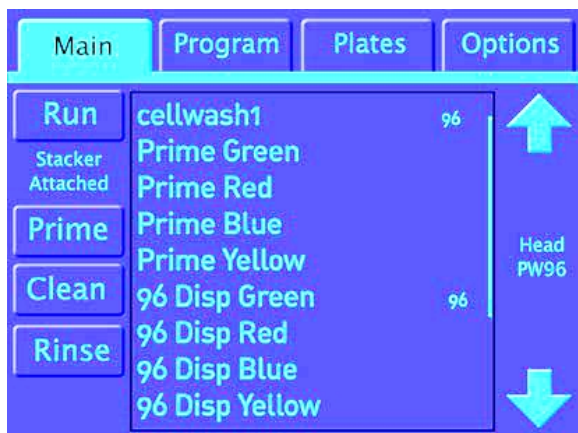


Main Tab

Item	Description
1	Function tabs with the Main tab selected.
2	Run: Select a program and tap to run the program.
3	Stacker Attached: Indicates the AquaMax Microplate Washer is attached to a StakMax Microplate Handler.
4	Prime: Tap to run the Prime program. The one-touch Prime program performs a full prime on the wash head and internal fluidics from the default fluid inlet.
5	Clean: Tap to run the Clean program. The one-touch Clean program cleans and decontaminates internal fluid paths. The system primes with the cleaning solution, pauses for 5 minutes to allow the cleaning solution to soak in the system, and follows with 3 rinse cycles using the rinse solution. The default program uses the red inlet to clean and the green inlet to rinse. The system is purged at the end of this program. See Cleaning Solutions on page 80 .
6	Rinse: Tap to run the Rinse program. The one-touch Rinse program runs the standard rinse cycle three times to flush the internal fluidics with rinse solution from the default green inlet. At the end of the rinse program, the system drains the rinse solution from the fluid paths.
7	Program List: Displays the list of the programs in the program library. The number to the right of the program name (96 or 384) refers to the plate type.
8,10	Up Arrow/Down Arrow: Tap to scroll through the list of programs.
9	Head: Displays the wash head or cell head you install: <ul style="list-style-type: none"> • PW96: 96-well plate wash head • PW384: 384-well plate wash head • CW96: 96-well cell wash head • CW384: 384-well cell wash head

Running Programs

The Main tab lists the programs you can run.



Programs that display with gray font are not compatible with the wash head you install. You cannot run a gray program.

Programs that display with red font indicate that the plate type has changed. When you run a red program, a *Plate parameters changed* message displays. Click **OK** to acknowledge the changes and return to the program list where you can run the program or click **Cancel** to exit the program without running it.

To run a program:

1. Connect the reagent bottles to the Liquid Input and Pressure fittings on the left side of the instrument.
2. Connect the waste tube to the Waste Output fitting and the Waste bottle.
3. Load the plate in the plate carriage.
4. On the touch screen, select the **Main** tab.
5. In the program list, select a program and tap **Run**. The touch screen displays the Program tab with the program status. See [Program Tab on page 29](#).



Running One-Touch Programs

There are several one-touch programs.

To run a one-touch program:

1. Connect the reagent bottles to Liquid Input and Pressure fittings on the left side of the instrument.
2. Connect the waste tube to the Waste Output fitting and the waste bottle.
3. Select the **Main** tab and tap a one-touch program in the list. The touch screen displays the Program tab with the program status. See [Program Tab on page 29](#).

Canceling Programs

When you run a program, the touch screen displays the status on the Program tab.

To cancel a running program under normal circumstances, tap **Cancel**.

This stops the program, turns off the pumps, resets the wash head, moves the plate carriage to the plate load position, and performs program clean up before you can use the touch screen for further operations.

Emergency Stop Programs

In the event where you need to stop a program immediately, the Program tab includes a Stop button.

To stop a program in emergency conditions:

1. On the Program tab, tap **Stop** to display a confirmation message.
2. Tap **OK** to recover and remove the plate.
3. If fluid remains in the trough, select the **Options** tab and tap **Purge**.



Note: You must re-prime the wash head to continue.



Chapter 5: Program Tab

Use the Program tab to manage the program library.

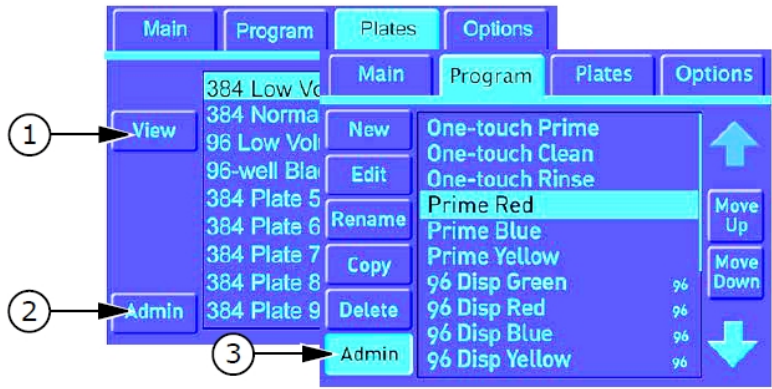


Program Tab

Item	Description
1	Function tabs with the Program tab selected.
2	New: Tap to display the Program Settings dialog where you define the non-step settings for a new program. See Program Settings on page 33 .
3	Edit: Select a program and tap to display the Program Settings dialog where you edit the non-step settings for a program. See Program Settings on page 33 .
4	Rename: Select a program and tap to enter the new name for the program.
5	Copy: Select a program and tap to copy the program you select.
6	Delete: Select a program and tap to delete the program. You cannot delete one-touch programs.
7	Program List displays the list of programs in the program library. The number to the right (96 or 384) refers to the plate type. Red indicates that the plate type in the program changed since the program was last run.
8,11	Up Arrow/Down Arrow: Tap to scroll through the program list.
9,10	Move Up/Move Down: Select a program and tap to move the program up or down in the program list. You cannot move the one-touch programs from the top of the program list.

Program Tab in Administrative Mode

In Administrative mode, you have access to the View button and the Admin button. Tap Admin and enter the administrator passcode to access the program management settings.



Program Tab in Administrative Mode

Item	Description
1	View: Select a program and tap to view the program settings and steps.
2	Admin: Tap to enter the administrator passcode. After you enter the passcode, you have access to the restricted functions on the Program tab.
3	Admin: Indicates that the instrument is in administrative mode.

Managing the Program Library

You can modify one-touch programs but you cannot rename or delete one-touch programs.



Note: Program settings and menus are optimized for the wash head you install. Before you create or edit a program, make sure to install the applicable wash head. Do not remove the wash head before you save the program changes. If you remove the wash head, the touch screen resets and any unsaved program changes are lost.

Creating Programs

You can create a new program from scratch or you can copy a program to create a new program. See [Copying Programs on page 32](#).



To create a new program:

1. On the Program tab, tap **New**.
2. Enter the program name and tap **OK** to display the Program Settings dialog.
3. In the Plate list, select a plate type. See [Changing the Plate Type for Programs on page 33](#).



Note: You cannot select plate types that are not compatible with the wash head.

4. Tap **Program Options** to:
 - Add messages to the program. See [Message Options on page 34](#).
 - Enable stacker options for the program. See [Stacker Options on page 35](#).
 - Adjust the dispense rate accuracy. See [Adjusting Dispense on page 36](#).



Note: Test dispense rate accuracy separately and use the results to adjust the settings in the program.

5. Tap **OK** to save the changes.
6. Add steps to the program. See [Adding Steps to Programs on page 38](#).
7. Select a step and tap **Move Up** and **Move Down** to rearrange the steps within the list.
8. Tap **Test** to execute a test run or tap **Done** to exit programming mode.
9. Tap **Yes** to confirm the changes.

Copying Programs

To copy a program:

1. On the Program tab, select a program and tap **Copy** to display the Copy Program dialog.
2. Enter the program name and tap **OK** to display the Program Settings dialog.
3. Select a plate type and tap **OK**. See [Changing the Plate Type for Programs on page 33](#).
4. Edit the steps in the program. See [Managing Program Steps on page 37](#).
5. Select a step and tap **Move Up** and **Move Down** to rearrange the steps within the list.
6. Tap **Test** to execute a test run or tap **Done** to exit programming mode.
7. Tap **Yes** to confirm the changes.

Editing Programs

To edit a program:

1. On the Program tab, select a program and tap **Edit**.
2. Edit the steps in the program. See [Managing Program Steps on page 37](#).
3. Select a step and tap **Move Up** and **Move Down** to rearrange the steps within the list.
4. Tap **Test** to execute a test run or tap **Done** to exit programming mode.
5. Tap **Yes** to confirm the changes.

Renaming Programs



Note: You cannot rename one-touch programs.

To rename a program:

1. On the Program tab, select a program and tap **Rename**.
2. Enter the program name.
3. Tap **OK** to save the change.

Deleting Programs

You cannot delete one-touch programs and you cannot recover a program after you delete it.

To delete a program:

1. On the Program tab, select a program and touch **Delete**.
2. Tap **OK** to confirm the deletion.

Program Settings

Use the Program Settings dialog to define non-step program settings such as the plate type, messages, stacker integration, and dispense volume. The Program Settings dialog displays when you create a new program.

To access the Program Settings dialog:

1. On the Program tab, select a program and tap **Edit**.
2. At the top of the steps list, select **Program Settings** and tap **Edit**.



Program Settings

Item	Description
1	Plate: Displays the list of plate types in the plate library. The highlighted plate type is used by the current program. You do not need to specify a plate type for programs that involve only maintenance steps such as Prime, Soak, Clean, Rinse, and Standby. Select No Plate for maintenance programs. Gray indicates that the plate type is not compatible with the wash head you install and you cannot select this plate type.
2	Program Options: Tap to display the Program Options dialog with additional program options. See Program Options on page 34 .
3	Up/Down Arrows: Tap to scroll through the plate type list.



Note: Program settings and menus are specific to the wash head you install. Plate types that are not compatible with the wash head you install display as disabled.

Changing the Plate Type for Programs

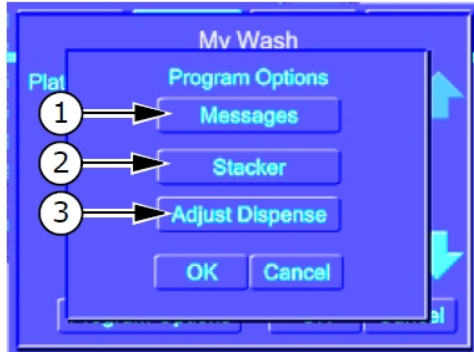
To change the plate type for a program:

1. On the Program tab, select a program and tap **Edit**.
2. In the list of steps, select **Program Settings** and tap **Edit**.
3. Select the plate type from the list.
4. Tap **OK** to exit the Program Settings dialog.
5. Tap **Done** to exit programming mode.
6. Tap **OK** to confirm the changes.

Program Options

Use the Program Options dialog to access the Messages dialog, the Stacker Settings dialog, and the Adjust Dispense dialog.

From the Program Settings dialog, tap **Program Options** to display the Program Options dialog. See [Program Settings on page 33](#).

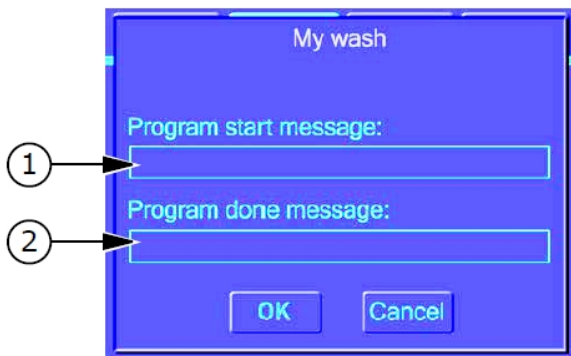


Program Options

Item	Description
1	Messages: Tap to display the Messages dialog. See below.
2	Stacker: Tap to display the Stacker Settings dialog. See Stacker Options on page 35 .
3	Adjust Dispense: Tap to display the Adjust Dispense dialog. See Adjusting Dispense on page 36 .

Message Options

Use the Messages dialog to have the program display a message before and after the program runs.



Message Options

Item	Description
1	Program Start Message: Tap to enter the message that displays on the touch screen before the program runs. The user must acknowledge the message before the program runs.
2	Program Done Message: Tap to enter the message that displays on the touch screen after the program runs.

To access the Messages dialog:

1. In the list of steps, select **Program Settings** and tap **Edit**.
2. Tap **Program Options**.
3. Tap **Messages**.

Stacker Options

Use the stacker options dialog to enable the use of the StakMax Microplate Handler for a step in a program. With the stacker enabled, plates are supplied from the stacker input. Each plate is washed and then placed in the stacker output. The program ends when the input stack is empty.



Note: The stacker options are available when a stacker is not attached to the washer. If you run a program with the stacker functions enabled and there is no stacker attached to the washer, the washer displays a message with instructions to add the plate manually.



Stacker Options

Item	Description
1	Enable Stacker: Tap to enable and disable the plate stacker. The stacker is enabled when the button is highlighted.
2	Restack at End: Tap to transfer the plates back to the input stack at the end of the program.

To access stacker options:

1. In the list of steps, select **Program Settings** and tap **Edit**.
2. Tap **Program Options**.
3. Tap **Stacker**.

Adjusting Dispense

Use the Adjust Dispense dialog to optimize the accuracy of the dispense volumes based on the requirements of the program. The instrument dispense accuracy is set during manufacturing. Various installation configurations can affect accuracy, such as location and size of reagent bottles, types of reagent, and so on. These adjustments are specific and individual to each program. After you determine the adjustment for these parameters, you can use the same setting whenever you use that combination (Liquid type, Head type, and so on).

For best results test dispense accuracy in a test program and then use the results to adjust the working program.

To adjust dispense accuracy for a program:

1. Set the instrument up to match the parameters of the program.
2. On the Program tab, tap **New** to display the Program Settings dialog.
3. Tap **Program Options** to display the Program Options dialog.
4. Tap **Adjust Dispense** to display the Adjust Dispense dialog.



5. Tap the color of the inlet to which you connect the liquid to use and set the adjustment to 0%.
6. Weigh an empty plate.
7. Add a Dispense step to the program from that fluid inlet: 300 μ L/well/96-well plate or 100 μ L/well/384-well plate.
8. Run the program.
9. Weigh the plate after the dispense to measure the amount of liquid dispensed.
10. Divide the fluid mass by the fluid density and number of wells to get the measured volume per well:

$$\text{Measured volume per well} = \frac{\text{Fluid mass} \& \text{Fluid density}}{\text{Number of wells (96 or 384)}}$$

11. Use the following equation to determine the fractional dispense accuracy:

$$\text{Dispense accuracy} = 100 \times \left(\frac{\text{Measured Volume}}{\text{Expected Volume}} \right) - 100$$

12. Round up this value to the nearest integer and enter this value in the Adjust Dispense dialog for the applicable fluid inlet. Use whole numbers in the range of 50% to 200%.
13. Repeat for each fluid intake until the test program results in the proper dispense volume.
14. Select the working program and tap **Edit**.
15. Enter the results from the test program into the Adjust Dispense dialog of the working program.

Managing Program Steps

Use the Program tab to manage the steps in programs.

To manage program steps:

1. On the **Program** tab, select a program.
2. Tap **Edit**.



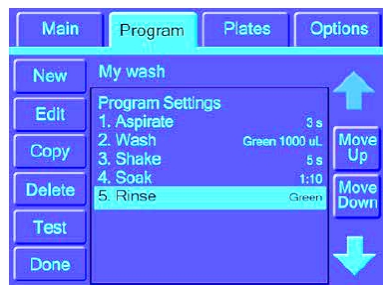
Program Details

Item	Description
1	New: Tap to display the New Step dialog where you select the step. See Selecting New Steps on page 39 .
2	Edit: Select a step and tap to edit the step. See Editing Steps in Programs on page 38 .
3	Copy: Select a step and tap to copy the step.
4	Delete: Select a step and tap to delete the step.
5	Test: Tap to test run the program steps.
6	Done: Tap to close the program and return to the program list.
7	Displays the name of current program.
8	Program Settings: Tap to display the Program Settings dialog where you define non-step program settings. See Program Settings on page 33 . To manage the Program Settings, select Program Settings and tap Edit.
9	Program Details: Displays the steps in the program with details on the right.

Adding Steps to Programs

To add a step to a program:

1. On the Program tab, select a program and tap **Edit**.



2. Tap **New** to display the list of step types you can add.
3. Select a step type to display the parameters dialog for the step type. See [Selecting New Steps on page 39](#).
4. Define the step parameters and tap **OK** to display the step in the list.
5. Repeat to add additional steps, up to 50 steps per program.
6. Select a step and tap **Move Up** and **Move Down** to rearrange program steps within the list.
7. Tap **Test** to execute a test run or tap **Done** to exit programming mode.
8. Tap **OK** to confirm the changes.

Editing Steps in Programs

To edit a step in a program:

1. On the Program tab, select a program and tap **Edit**.
2. Select a step:
 - Tap **Edit** to edit the step parameters. See [Managing Program Steps on page 37](#).
 - Tap **Copy** to add the same step to the end of the program.
 - Tap **Delete** to delete the step.
3. Select a step and tap **Move Up** and **Move Down** to rearrange program steps within the list.
4. Tap **Test** to execute a test run or tap **Done** to exit programming mode.
5. Tap **Yes** to confirm the changes.

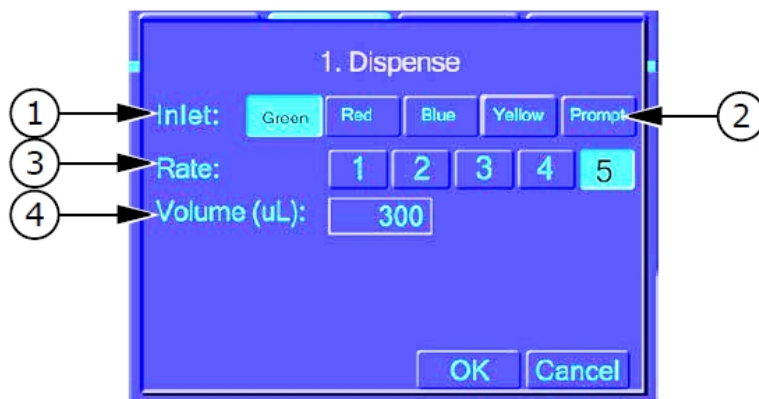
Selecting New Steps

Use the New Step dialog to select the step types to include in the program. Each program can have up to 50 steps. Before you create or edit a program, configure the instrument for the operations of program. The instrument detects the options you install (such as the wash heads etc.) and enables the functions that are applicable to the installed options. Steps that are not compatible with the equipment you install in the instrument appear gray.



Dispense Step Settings

Use the Dispense dialog to define the parameters to dispense fluid into a plate. Fluid dispense occurs at the top of the wells to prevent contamination to the probes.



Dispense Settings


Item	Description
1	Inlet: Tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to have the instrument pause before dispensing and wait for the user to specify the inlet.
3	Rate: Tap to set the dispense rate. See Plate Wash Dispense Rates .
4	Volume: Tap to enter the volume to dispense. Enter 5 to 150 μL for 384-well plates and 20 to 400 μL for 96-well plates. If the volume is outside the range of the plate type, you cannot save or run the program. Note: Do not dispense a greater volume than the plate manufacturer lists.

Plate Wash Dispense Rates

Plate Wash Dispense Rate	96 Plate Wash		384 Plate Wash	
	(mmHg)	(μ L/plate/sec)	(mmHg)	(μ L/plate/sec)
1	150	18300	150	21600
2	200	22100	200	25600
3	250	25400	250	26200
4	350	31300	350	35600
5	450	36600	450	41400

Cell Wash Dispense Rates

Plate Wash Dispense Rate	96 Plate Wash		384 Plate Wash	
	(mmHg)	(μ L/plate/sec)	(mmHg)	(μ L/plate/sec)
1	75	7200	150	19400
2	100	9100	200	23000
3	150	12400	250	26300
4	250	17800	350	32100
5	350	22500	450	37400

 **Tip:** To achieve the best dispense volume accuracy and precision set at the highest rate (Rate 5) and volume.

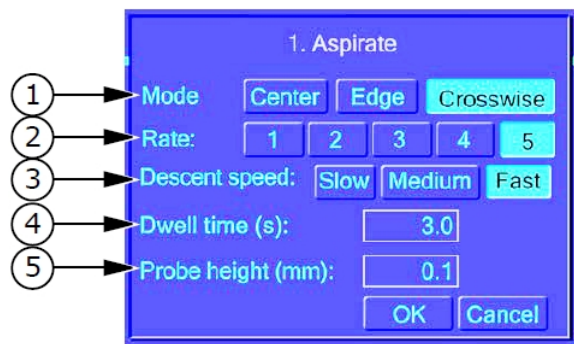
Dispense accuracy is set to specification during manufacturing. To adjust dispense factors, see [Adjusting Dispense on page 36](#).

The following factors can affect dispense accuracy:


- Type of reagent.
- Locations and size of reagent bottles.
The AquaMax Microplate Washers support 4 L or 10 L bottles only.
- Level of reagent in bottles (too full or too low).

Aspirate Step Settings

Use the Aspirate dialog to define the parameters to remove fluid from a plate.



Aspirate Settings

Item	Description
1	Mode: <ul style="list-style-type: none"> • Tap Center to aspirate from the center of the wells. • Tap Edge to aspirate from the edged of the wells, flat bottom wells only. • Tap Crosswise to aspirate from front to back of wells, flat bottom wells only.
2	Rate: Tap to set the aspiration rate. See the Aspiration Rates table below.
3	Descent Speed: Tap to set the speed at which the probes enter the wells.
4	Dwell Time: Tap to enter the amount of time for the probe to dwell at the final probe position. (Default = 1 second. Range is 0-30 seconds.)
5	Probe Height: Tap to enter the final probe height above the bottom of the well. The range is 0 to the top of well. The maximum probe height is the well depth specified in the plate library. To avoid damage to probes and plate bottom, the instrument has a “no touch” feature. For uniformly flat plate bottoms, if the height is set to 0 mm, the aspiration pins are offset from the well bottom by a minimum clearance. <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p>CAUTION! Not all plate-well bottoms are uniformly flat, so scratching can occur for the Crosswise mode. To avoid scratching, position tips at least 0.2 mm above the highest point for all of the well bottoms. If scratching continues, change plate lot or brand, or select a different aspiration mode.</p> </div>

Aspiration Rates

AQ 4000	AQ 2000	96 (µL/well/sec)	384 (µL/well/sec)
5	Fast	270	70
4		240	60
3		200	50
2	Gentle	80	20
1		50	10

*** Tip:** For plate washing, minimal residual volume is best achieved when you use the Crosswise mode with a Rate of 5, the Fast descent speed, a 1 second Dwell Time, and 0 mm to 0.2 mm Probe Height.

Wash Step Settings

Use the Wash dialog to define the parameters for steps that wash a plate.

Note: To prevent overflow when you use the Wash function with a plate wash head, add a surfactant such as Tween to the wash solutions.



Wash Settings

Item	Description
1	Inlet: Tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to have the instrument pause before dispensing and wait for the user to specify the inlet.
3	Rate: Tap to set the wash rate. See the Wash Rates table below. (AquaMax 4000 Microplate Washer only)
4	Volume: Tap to enter the volume of wash fluid to use per well. (50 μ L to 3000 μ L)
5	Wash Position: <ul style="list-style-type: none"> • Bottom: Tap to have the probes aspirate to the bottom of the well, then wash at that position. Bottom washing results in partially empty wells at the end of the wash. • Top: Tap to have the probes remain just below the top of the well, then wash at that position. Top washing results in full wells at the end of the wash.

Wash Rates

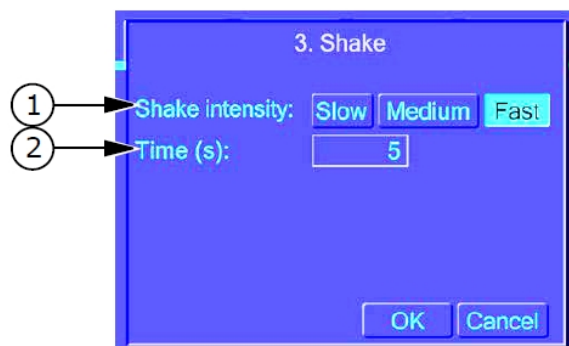
Model	Options	96 (μ L/well/sec)	384 (μ L/well/sec)
AquaMax 4000	Fast	270	70
	Gentle	200	60
AquaMax 2000	(no option)	270	70

*** Tip:** Wash volume should not exceed 10x the well volume.

*** Tip:** The wash step leaves the wells partially empty (bottom wash) or full (top wash). To empty the wells, add an aspiration step.

Shake Step Settings

Use the Shake dialog to define the parameters for steps that shake the plate in the carriage.

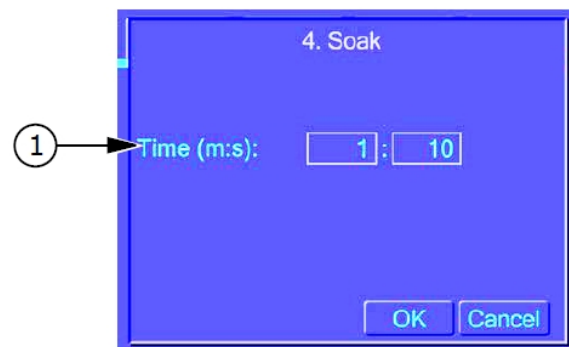


Shake Settings

Item	Description
1	Shake Speed: Tap the speed to shake the plate (Slow, Medium, or Fast). A fast shake is vigorous and generally mixes the wells in 10 to 30 seconds.
2	Time: Tap to enter the shake duration. (1 to 600 seconds)

Soak Step Settings

Use the Soak dialog to define the parameters for steps that pause the program and allow the plate to soak. During a soak step, the instrument removes the probes from the plate wells and no other operations occur.



Soak Settings

Item	Description
1	Time: Tap to enter the duration of soak, in minutes and seconds. (1 second to 120 minutes)

Fast Wash Step Settings

Use the Fast Wash dialog to define the parameters for rapid plate washing that uses multiple aspirate-dispense cycles. Fast Wash performs a final aspiration after the last cycle. All aspirations use a rate of 5 and a fast descent speed. See [Aspirate Step Settings on page 41](#).



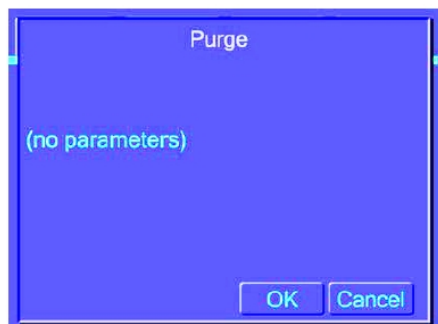
Fast Wash Settings

Item	Description
1	Inlet: Tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to have the instrument pause before dispensing and wait for the user to specify the inlet.
3	Rate: Tap to set the dispense rate. See Plate Wash Dispense Rates on page 40 .
4	Volume: Tap to enter the volume of wash fluid to dispense per well in each cycle. Use 20 to 400 μ L for 96-well plates and 5 to 150 μ L for 384-well plates.
5	Cycles: Tap to enter the number of times to dispense the volume.
6	Dwell Time: Tap to enter the duration for the probe to rest at the final probe position. (Default = 1 second. 0 to 30 seconds)
7	Probe Height: Tap to enter the final probe height above the bottom of the well during aspiration. The range for plate wash heads is 0 mm to the top of the well.

Purge Step Settings

Use the Purge dialog to add a purge step that evacuates liquids from the wash head. Run a purge step when you do not plan to use the washer again immediately. Purging prevents needle clogging or mold growth when the instrument is idle. The purge step has no programmable parameters.

*** Tip:** Run a Purge step before you remove the wash head.



Rinse Step Settings

Use the Rinse dialog to define the parameters for steps that flush the reagent through the internal fluidics and the wash head you install.

After you rinse with a harsh reagent, such as a cleaning solution, rinse with water several times to fully remove any harmful residues. Rinsing does not empty the wash head completely. Follow the rinse with a purge step before you remove the wash head or shutdown the system.



Rinse Settings

Item	Description
1	Inlet: Tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to have the instrument pause before dispensing and wait for the user to specify the inlet.

Repeat Step Settings

Use the Repeat dialog to define program steps to repeat. One Repeat step counts as just one step in the 50-step program limit, regardless of the number of steps or cycles you repeat. The system does not allow you to add a Repeat step within another Repeat step.



Repeat Settings

Item	Description
1	Repeat From Step: Tap the drop-down and select the number of the step at which to start the repetition. The list contains the previous steps in the program.
2	Repetitions: Tap and enter the number of extra cycles to perform. For example, set repetitions to 5 to have the step you select execute once from the original place in the program and then repeat 5 more times in the Repeat step, for a total of 6 cycles.

Prime Step Settings

Use the Prime dialog to define the parameters for the steps to prime the internal fluidics and the wash head with a reagent. During the Prime step, the needles are immersed in the priming liquid to wash the outsides of the needles. This step type does not require a plate type.



Prime Settings

Item	Description
1	Inlet: tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to pause the instrument before dispensing and wait for the user to specify the inlet.
3	Mode: <ul style="list-style-type: none"> Maintenance: Tap to use 150 mL of the reagent to prepare the instrument after long periods of system inactivity. Full: Tap to use 400 mL of the reagent to prepare the instrument after you install a wash head, exchange the reagent, or purge the system.

Standby Step Settings

Use the Standby dialog to define the parameters for standby steps that keep wash fluid in the head without the need to prime the head if there is a delay between uses.

The Standby step fills the prime/soak trough with a wash fluid and leaves the dispense/aspirate probes in the wash fluid.

You can use the touch screen to select the source bottle for the wash fluid and to program the wash fluid to automatically change at specific time intervals.

To discontinue the Standby step and continue using the instrument, tap Cancel. This drains the trough and dispenses a small amount of the wash fluid through the dispense needles.



Standby Settings

Item	Description
1	Inlet: Tap the color of the inlet to which you connect the liquid to use for this step.
2	Prompt: Tap to have the instrument pause before dispensing and wait for the user to specify the inlet.
3	Change Solution Every: Tap to select the duration before the system drains and refills the solution in the soaking trough.



Chapter 6: Plates Tab

6

Use the Plates tab to manage the plate types in the plate library. See [Plate Library](#) on page 13.

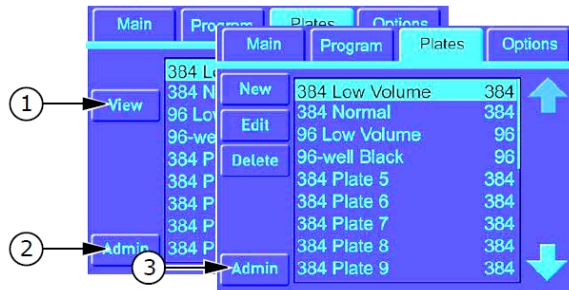


Plates Tab

Item	Description
1	New: Tap to create a new plate type.
2	Edit: Select a plate type and tap to edit the details of the plate type.
3	Delete: Select a plate type and tap to delete the plate type.
4	Plate List: Displays the lists of plate types in the plate library.
5	Up Arrow and Down Arrow: Tap to scroll through the plate type list.

Plates Tab in Administrative Mode

In administrative mode, you have access to the View button and the Admin button. Tap Admin and enter the administrator passcode to access the plate type management options.



Plates Tab in Administrative Mode

Item	Description
1	View: Select a plate type and tap to view the plate details.
2	Admin: Tap to enter the administrator passcode. After you enter the passcode, you have access to the restricted functions on the Plates tab.
3	Admin: Indicates the instrument is in administrative mode.

Managing Plate Type Definitions

Use the Plate Definition dialog to define the plate type parameters. The plate type definition controls the position of the plate and the probes. Inaccurate settings can cause some operations to run incorrectly.

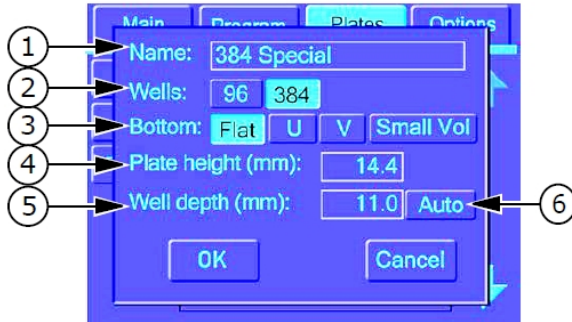


Plate Type Definition

Item	Description
1	Name: Tap to enter or edit the plate type name. (Max 20 characters)
2	Wells: Tap 96 for a 96-well plate or tap 384 for a 384-well plate.
3	Bottom: <ul style="list-style-type: none"> Flat: Tap for plate types with full-size flat-bottom wells. Crosswise and Edge aspiration modes are for Flat plates only. U: Tap for plate types with round-bottom wells. V: Tap for plate types with tapered wells. Small Vol: Tap for small volume or half-area plate types.
4	Plate Height (mm): Tap to enter the distance in millimeters from the plate base to the top of the wells. When you use a magnetic bead-washing insert (LifeSep 96F or 384F biomagnetic separators), the plate height is the total height of the carriage insert and plate stack. Note: You cannot use carriage inserts with robotics.
5	Well Depth (mm): Tap to enter the distance in millimeters from the bottom of the well to the top of the well. Well depth is critical for reliable instrument operation. An incorrect well depth can result in inefficient plate aspiration, plate and wash head damage, or a <i>Vertical Error 225</i> .
6	Auto: Tap to have the instrument calibrate the well depth.

Creating Plate Types

When you create a new plate type, select a similar plate type in the list before you tap New. The values that display in the Plate Type dialog default to the parameters of the plate type you select.

To create a plate type:

1. On the Plates tab, tap **New** to display the Plate Definition dialog.
2. Tap **Name**, enter the name of the plate type, and then tap **OK**.
3. Tap a **Wells** option:
 - Tap **96** for a 96-well plate.
 - Tap **384** for a 384-well plate.
4. Tap a **Bottom** option:
 - Tap **Flat** for plates with full-size flat-bottom wells. The Crosswise and Edge aspiration modes are for Flat plates only.
 - Tap **U** for plates with round-bottom wells.
 - Tap **V** for plates with tapered wells.
 - Tap **Small Vol** for small volume or half-area plates.
5. Tap **Plate Height** and enter the distance in millimeters from the plate base to the top of the wells. When you use a magnetic bead-washing insert (LifeSep 96F or 384F biomagnetic separators), this is the total height of the carriage insert and plate stack.



Note: You cannot use carriage inserts with robotics.

6. Well Depth:
 - Tap **Well Depth** and enter the well depth.
 - Tap **Auto**, insert a plate in the carriage, and tap **OK**. The instrument measures the well depth and displays the depth in the Well Depth field.
7. Tap **OK** to save and exit.

Editing Plate Types

All programs that refer to the plate type you edit display red in the program list to indicate the plate type definition has changed since the last time the program ran.

To edit a plate type:

1. On the Plates tab, select a plate type and tap **Edit** to display the Plate Definition dialog.
2. Tap **Name**, change the name of the plate type, and then tap **OK**.
3. Tap a **Wells** option:
 - Tap **96** for a 96-well plate.
 - Tap **384** for a 384-well plate.
4. Tap a **Bottom** option:
 - Tap **Flat** for plates with full-size flat-bottom wells. The Crosswise and Edge aspiration modes are for Flat plates only.
 - Tap **U** for plates with round-bottom wells.
 - Tap **V** for plates with tapered wells.
 - Tap **Small Vol** for small volume or half-area plates.
5. Tap **Plate Height** and change the distance in millimeters from the plate base to the top of the wells. When you use a magnetic bead-washing insert (LifeSep 96F or 384F biomagnetic separators), this is the total height of the carriage insert and plate stack.
6. Well Depth:
 - Tap **Well Depth** and change the well depth.
 - Tap **Auto**, insert a plate in the carriage, and tap **OK**. The instrument measures the well depth and displays the depth in the Well Depth field.
7. Tap **OK** to save and exit.

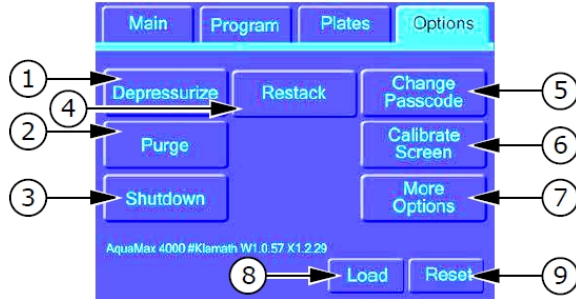
Deleting Plate Types

You cannot recover a plate type after you delete it.

To delete a plate:

1. On the Plate tab, select a plate type and tap **Delete**.
2. Tap **OK** to confirm the deletion.

Use the Options tab to do instrument functions and manage Administrative mode.



Instrument Options

Item	Description
1	Depressurize: Tap to release the system and bottle pressure. During operation, the source bottles can be under mild pressure, up to 500 mmHg (10 psi or 70 kPa). Before you change the fluid in the source bottles, depressurize to avoid releasing pressure when you open the cap.
2	Purge: Tap to purge the system fluidics. Purge empties the wash head, prime trough, and common fluid paths. Do a purge before you change the wash heads to remove excess fluids. After a system failure, do a purge to drain the liquid left in the Prime/Soak trough.
3	Shutdown: Tap to start the shutdown process you define from the Advanced Options dialog. See Defining Advanced Options on page 55 .
4	Restack: Tap to command the StakMax Microplate Handler to move all plates in the output stack to the input stack, leaving them in their original input order. Restack is available when you connect a StakMax Microplate Handler to the instrument.
5	Change Passcode: Tap to enter an administrator passcode to turn on Administrative mode, to change the administrator passcode, or to remove the administrator passcode to turn off Administrative mode. See Administrative Mode on page 23 .
6	Calibrate Screen: Tap to display the Calibrate Screen dialog where you calibrate the touch positions on the touch screen. See Screen Calibration on page 55 .
7	More Options: Tap to display the Advanced Options dialog where you define shutdown parameters and turn on/off Auto Drain. See Defining Advanced Options on page 55 .
8	Load/Eject: Tap to load a plate and then to eject a plate on the plate carriage. Use this to retrieve a plate after a system failure.
9	Reset: Tap to perform a software reset without power cycling the instrument and to position the plate carriage in the eject position.

Turning Administrative Mode On

To turn on Administrative mode:

1. On the Options tab, tap **Change Passcode** and enter the administrator passcode. The Change Passcode option does not display when the instrument is in Administrative mode.
2. Tap **OK** to save and exit.

Options Tab in Administrative Mode

In administrative mode, you have access to several options without having to enter the administrator passcode.



Options Tab in Administrative Mode

Item	Description
1	Depressurize: Tap to release the system and bottle pressure. During operation, the source bottles can be under mild pressure, up to 500 mmHg (10 psi or 70 kPa). Before you change the fluid in the source bottles, depressurize to avoid releasing pressure when you open the cap.
2	Purge: Tap to purge the system fluidics. Purge empties the wash head, prime trough, and common fluid paths. Do a purge before you change the wash heads to remove excess fluids. After a system failure, do a Purge to drain the liquid left in the Prime/Soak trough.
3	Shutdown: Tap to start the shutdown process you define from the Advanced Options dialog. See Defining Advanced Options on page 55 .
4	Admin: Tap to enter the administrator passcode. After you enter the passcode, you have access to the restricted functions on the Options tab.
5	Load/Eject: Tap to load a plate and then to eject a plate on the plate carriage.
6	Reset: Tap to reset the software without power cycling the instrument.

Changing Administrator Passcode/Turning Administrative Mode Off

To turn off administrative mode, remove the administrator passcode.

To remove or change the administrator passcode:

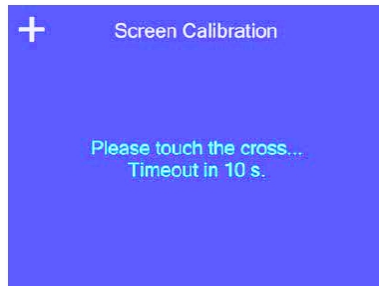
1. On the Options tab, tap **Admin** and enter the current passcode to enter Administrative mode.
2. Tap **Change Passcode**:
 - Enter a new administrator passcode to edit the passcode.
 - Use the back arrow key to delete the existing passcode and turn off Administrative mode.
3. Tap **OK** to save and exit.

Screen Calibration

Use the screen calibration dialog to calibrate the position of the touch screen overlay in the display area.

To calibrate the touch screen:

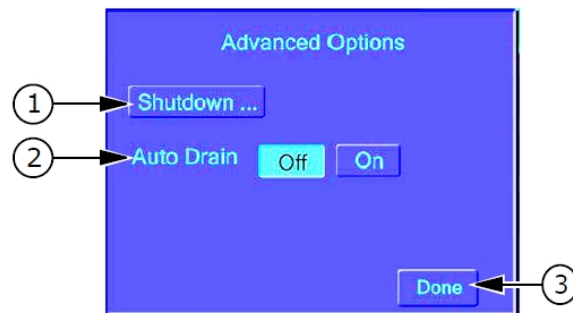
1. On the Options tab, tap **Calibrate Screen**.



2. Tap the crosses as they appear on the screen.
The Screen Calibration dialog closes when the calibration completes or after 10 seconds.

Defining Advanced Options

Use the Advanced Options dialog to define shutdown parameters and to turn Auto Drain on or off.



Advanced Options

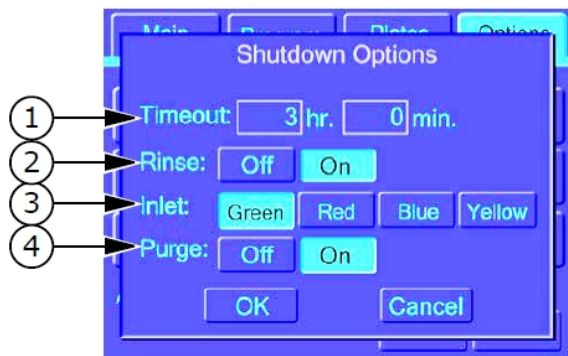
Item	Description
1	Shutdown Options: Tap to display the Shutdown Options dialog where you define the instrument shutdown parameters. See Defining Shutdown Options on page 56 .
2	Auto Drain: <ul style="list-style-type: none"> • Tap On to automatically drain the trough every time a plate ejects. • Tap Off to turn off the Auto Drain feature.
3	Done: Tap to return to the Options tab. See Options Tab on page 53 .

Defining Shutdown Options

Use the Shutdown Options dialog to define the automatic shutdown parameters. Use automatic shutdown for general use with short periods of inactivity. Automatic shutdown turns off the touch screen, releases system pressure, shuts off all motors and valves, and puts the instrument in a low power mode. You can define the shutdown process to include a rinse and purge cycle.

For longer periods of inactivity, for example if you do not use the instrument every day, power off the instrument. See [Powering Off the Instrument on page 84](#).

For storage or shipping, rinse and purge the instrument and remove the wash head before you power off the instrument. See [Removing the Wash Head on page 81](#).



Shutdown Options

Item	Description
1	Timeout: Tap Hr. and enter the number of hours of inactivity to wait. Tap the Min. and enter the number of minutes of inactivity to wait before the instrument automatically shuts down.
2	Rinse: <ul style="list-style-type: none"> • Tap On to have the instrument do a rinse before shutting down. • Tap Off to not do a rinse before shutting down.
3	Inlet: Tap the color of the inlet to which you connect the liquid to use for the rinse.
4	Purge: <ul style="list-style-type: none"> • Tap On to purge the system after rinsing and before shutting down. • Tap Off to not purge the system before shutting down.

Chapter 8: Using a Host Computer for Instrument Control



You can use a host computer to control the AquaMax Microplate Washers. Use the commands in this section to bypass the instrument touch screen.

You connect a StakMax Microplate Handler directly to an AquaMax Microplate Washer via a StakMax interface cable. You send the commands described in this section to the washer only. Washer commands provide limited control of the StakMax Microplate Handler but there is no direct control of the stacker.

To control of both the AquaMax Microplate Washer and the StakMax Microplate Handler, or another robot, connect each device separately to the host computer (via USB for the AquaMax Microplate Washer). The host computer must coordinate timing of actions of the washer and robot.

Host Computer Interface

The host computer controls the instrument via the USB port with the following settings:

- USB Specification: USB 1.1
- USB Baud Rate: 12 Mbit/s (full speed mode)
- USB Vendor ID: 2496 (0x09C0)
- USB Product ID: 347 (0x015B)
- USB Device Class: Communication Device Class (CDC)

The host computer communicates with an embedded master controller firmware via the USB connection using asynchronous ASCII transmissions to a virtual serial port.

Command Format

Document Conventions

CAPS ITALICIZED	Command names
	Indicates the possible choices for that argument
,	A comma separates the arguments. In the instrument, arguments are space delimited; therefore, the comma is shown here only for clarity
italicized	Command arguments
ON	An argument in all capital letters, such as ON, implies that a literal string is required.
CRLF	Carriage Return and Line feed characters (“\r\n”)

All commands must follow the format:

```
/CMD_NAME [command_args] CR
```

- ‘/’ (Forward slash) indicates start of a new command and clears firmware command buffer. It is optional and can be omitted.
- *CMD_NAME* is a command name separated from *command_args* by a white space.
- *Command_args* is a list of zero or more arguments, each separated by white space.
- *CR* is the end-of-command character.

Commands and arguments are not case sensitive.

It is acceptable, but not required, to allow commands to be abbreviated with a minimum 4 characters to uniquely identify the command. The commands are searched in alphabetical order. The first match is the selected command.

String arguments cannot include prohibited characters: CR LF TAB /<>\?*:|“ .

String arguments can be enclosed in double quotes.

No Error (OK) Responses

Valid commands with no response data and empty lines are acknowledged by the “no data OK” response:

```
OKTABCRLF>
```

Where `OKTAB` identifies the no error response terminated by the character (`>`) and `CRLF` added for better readability in terminal applications.

For example: a successful `READ VERSION` command returns:

```
OKTAB W1.0.4 CRLF>
```

Error Responses

Unknown commands, commands with invalid numbers or types of arguments, and commands that are unable to perform their function are acknowledged by the response:

```
FAILTABxxx {"text"}CRLF>
```

Where character `FAIL` identifies the error response and `xxx` represents the decimal error code followed by the text message string separated by double-quote characters and terminated by the `CRLF>`.

In case of an error response, status of the instrument should be acquired by the status command. If the instrument is unable to continue to operate properly, for example, because of a motor stall or a sensor fault, you must reset the instrument.

General Commands

Initialization

Reset

Command: `/RESET [no arg]`

Action:	Resets the washer. Stops pumps, closes all valves, homes all axes, and moves the plate carrier to the loaded position. It requires polling of the instrument status for completion with <code>/status</code> command.
Response:	“No data OK” response if the command succeeds.

Software Reset

Command: `/SOFTRES [no arg]`

Action:	Restores the instrument to turned on state without disrupting the current communications connection, it does not home axes.
Response:	“No data OK” response if the command succeeds.

Device Information

Version

Command: /VERSION [no arg]

Action:	Sends and returns current master controller, GUI and motor controller firmware versions. It also sends the StakMax firmware version if present.
Response:	Returns current master controller and GUI firmware versions – ASCII string representing firmware versions in <id><major>.<minor>.<build>format.
Example:	OKTABW1.2.3 X1.2.3 W1.2.3 STK:1.2.3CRLF>, where 'W1.2.3' represents the current master controller, 'X1.2.3' current GUI, 'W1.2.3' current motor controller, and 'STK:1.2.3' current StakMax firmware versions.

Name

Command: /NAME [no arg]

Action:	Returns the name and model of the instrument.
Response:	Name and model ASCII string, "AquaMax 2000" or "AquaMax 4000".
Example:	OKTABAquaMax 4000CRLF>

Serial Number

Command: /SERIAL [no arg]

Action:	Returns the serial number of the instrument.
Response:	Serial number as an ASCII string.
Example:	OKTABAQ4K01001CRLF>

Status

Command: /STATUS [no arg | y | z]

Action:	Returns the serial number of the instrument.
Response:	<p>IDLE the instrument or AXTS is idle, no errors, ready to run.</p> <p>BUSY a protocol or a single command is being executed (for example, axis is moving).</p> <p>nm</p> <p>FAULT the instrument or AXTS cannot operate properly, possible motion fault (axis stalled). It requires RESET command to continue.</p> <p>nm</p> <p>PAUSE an instrument or AXTS is paused waiting for a user input - "Pause 0" to continue or "Stop" to cancel or stop the action.</p> <p>nm</p>
Response:	<p>Where</p> <p><n> is a report flag: "1" = a new report message is available, "0" = no news.</p> <p><m> is an index of the running protocol. A single-action command in progress returns the step number as "-1".</p>
Example:	OKTABIDLECRLF>; OKTABBUSY 0 3CRLF>; OKTABBUSY 1 3CRLF>

State Report

Command: /REPORT [no arg]

Action:	Returns a text message describing the current action in progress or status.
Response:	<p>“text message” n m</p> <p>Where n is an action flag:</p> <p>(-127) = display post-program user message (in Pause state).</p> <p>(-2) = display pre-program user message (in Pause state).</p> <p>(-1) = load a plate to wash position.</p> <p>0 = single action command or first step of program in progress.</p> <p>1-(N-1) = program step in progress.</p> <p>(N) = unload a plate to eject position, where N = number of program steps. and where m is a step repeat count:</p> <p>“0” indicates first time the step is executed.</p> <p>“1” indicates second time the step is executed, and so on.</p>
Example:	<p>OKTAB “Ejecting a plate...”-2 0CRLF></p> <p>OKTAB “Aspirating ...”0 0CRLF></p> <p>OKTAB “Resetting the instrument”0 0CRLF></p>

Motion Control

Eject Plates

Command: /EJECT [no arg | (0 | 1)]

Action:	Ejects or loads the plate, reports current “eject” position.
	[no arg]: Returns current “eject” position (= 0 if plate is loaded, = 1 if plate is ejected).
	[0]: Load plate. Moves the plate carrier to wash position (lifts the head to unload position first).
	[1]: Eject plate. Moves the plate carrier to loading position (lifts the head to unload position first).
Response:	<p>“No data OK” response if the command succeeds if (0 1) argument is present.</p> <p>Reports an eject state “0” or “1” when no arguments specified.</p>

Response: Emergency Stop = STOP BUTTON

Command: /HALT [no arg] = Stop button

Action:	In an emergency case, it immediately halts any running protocol or command, releases pressure, closes all valves, turns off pumps, and removes power from all axes.
Response:	“No data OK” response if the command succeeds.

Stop (Abort) = Cancel Button


Command: /STOP [no arg]

Action:	Stops the currently running protocol, stops the running step, and moves the plate carriage to the eject position.
Response:	“No data OK” response if the command succeeds.

Program Control



Pause / Resume

Command: /PAUSE [no arg | 0 | 1]

Action:	Temporarily pauses (or resumes) execution of a running program.
	[no arg]: Reports current state.
	[0]: Resumes execution of a paused program.
	[1]: Requests a pause. The program is paused and the status reports PAUSE only after the current step is done. In PAUSE state, a program waits for the "/pause 0" command from the host to proceed to the next step.
	 Note: Firmware switches to PAUSE state to display start/stop program user messages and report situations requiring user intervention. For example, when a waste bottle is full. It expects to receive "/pause 0" to resume or "/stop" to stop a program.
Response:	

Shutdown

Command: /SHUTDOWN [no arg | Proc {Inlet}]

Action:	Temporarily pauses (or resumes) execution of a running program.
	 Note: The command returns an error if the instrument status is busy running a program or motion command.
	 Note: When the shutdown starts, the firmware resets the LCD screen so that the backlight turns off when the shutdown completes.
	[no arg]: Returns "1" if shutdown is in progress, "0" if otherwise.
	[Proc, {Inlet}]:
	[0]: Depressurizes bottles.
	[1]: Rinses Inlet and then depressurizes bottles.
	[2]: Purges and then depressurizes bottles.
	[3]: Rinses Inlet and then purges and depressurizes bottles.
Response:	"No data OK" response if the command succeeds.

User Adjustment

Liquid Factor

Command: /LIQF [no arg | P0 {P1 P2 P3}]

Action:	For currently open protocols, specifies a liquid factor value to adjust effective dispense time for a specified inlet for any dispense (wash) step in 50-200[%] of the calculated nominal. This command returns an error if no protocol is open.
	Adjustment value 100% sets nominal calculated dispense time (no correction). A value of 100-200% increases (x1.0-2.0) and value 50-99% decreases (x0.5-0.99) dispense time for an inlet. [no arg]: Reads the liquid factor adjustment values for all inlets.
	[P0]: Value [%] of nominal dispense time for inlet 0 (green).
	[P1]: Value [%] of nominal dispense time for inlet 1 (red). [P2]: Value [%] of nominal dispense time for inlet 2 (blue). [P3]: Value [%] of nominal dispense time for inlet 3 (yellow).
Response:	“No data OK” response if the command succeeds.
Example:	/LIQF 100 50 100 200CRLF to decrease dispense time for red to 50% and increase yellow inlet to 200% of the nominal (calculated) time. /LIQFCRLF returns OKTAB 100 50 100 200CRLF>

Program Management Commands

You create programs to wash plates and perform maintenance. These programs are composed of basic primitives for wash functions (dispense, aspirate, wash, shake), program control (soak/pause, repeat), or maintenance functions (prime, purge, rinse). Firmware maintains these programs in non-volatile storage, with a total of 103 slots available.

All step primitives in any program share the same plate type from the plate library.

You edit the programs by adding, deleting, and replacing step primitives using the following commands.

Factory Defined Programs

Factory defined one-touch programs are dedicated to instrument maintenance: rinsing, cleaning, priming. These programs are composed of the same primitives as regular user programs.

The one-touch programs provide access to common maintenance operations and can be customized like any other program. The default programs offer a functional method to perform the named method. You can edit these programs in the same way as other programs but you cannot change the names One-touch Prime, One-touch Clean, and One-touch Rinse. The one-touch protocols are stored in slots 0-2.

Program Control



Note: When you author the code to control the instrument, the commands use the word "protocol". "Protocol" is synonymous with the word "program" for this section.

Command: /PROTOCOL [<Index> | Run <index>| Open | Close <save>| New <name>| Delete <index>| Copy <index> <name>| Rename <index> <name>| Get <m>| Set <m> <Args>]

Action:	Edits and views the stored protocol list. Used in conjunction with the /step command to edit protocol steps.
Index Action:	Read protocol name, where Index is a decimal number [0-102].
Index Response:	"No data OK" response if protocol does not exist, "protocol name" <k> <m> <n> if the protocol exists, where: <k> is the total number of steps. <m> is the "dirty" flag: 0 = valid plate attached, 1 = attached plate settings have changed since protocol was saved (protocol is not executable until it has been saved again). <n> is the attached plate geometry: 0 = 96 wells, 1 = 384 wells.
Index Example:	/prot 0 returns OKTAB"My protocol #1" 5 0 1CRLF>
Run Action:	Executes <index> protocol.
Run Response:	"No data OK" response if the command succeeds.
Open Action:	Opens <index> the protocol for viewing or editing.

Open Response:	“No data OK” response if the command succeeds.
Close Action:	Closes access to the opened protocol. <Save> is a Boolean to save protocol (1) or to discard changes (0).
Close Response:	“No data OK” response if the command succeeds.
New Action:	Creates a new blank protocol with the name set to <name>. <Name> is limited to 19 characters. Default program settings are: no start or end messages, “no-plate” attached, manual stacker mode, no restacking.
New Response:	Returns index of the new protocol if command succeeds.
New Example:	/prot new “My New Protocol”CRLF returns OKTAB4CRLF>
Delete Action:	Deletes Index protocol. One-touch protocols 0-2 cannot be deleted. All other protocol indexes can change after a successful delete.
Delete Response:	“No data OK” response if the command succeeds.
Copy Action:	Creates a copy of <index> protocol with the name set to <name>. <Name> is limited to 19 characters. Default program settings are: no start or end messages, “no-plate” attached, manual stacker mode, no restacking.
Copy Response:	Returns index of the copied protocol if command succeeds.
Copy Example:	/prot copy 3 “Copied Protocol”CRLF returns OKTAB5CRLF>
Rename Action:	Renames Index protocol to <name>. One-touch protocols 0-2 cannot be renamed.
Rename Response:	“No data OK” response if the command succeeds.
Get Action:	Reads a field, <m>, from the open protocol settings, where <m> is 0 = start message, 1 = end message, 2 = protocol parameters. A protocol must be opened (/protocol open) before /protocol get can succeed.

Get Response:	Returns the start or end messages (<m>=0 or 1) or the parameter list. The parameter list consists of single character tokens followed by the token value, where the tokens are: P: Plate ID, 0-31 or -1 for “no plate”. F: Dirty flag (128 = dirty, 0 = OK), indicating the attached plate has changed since the protocol was last stored. M: Stacker mode (0 = manual, 1 = automatic, use stacker if attached). R: Restack mode (0 = no restacking, 1 = restack plates after protocol completes with a stack of plates).
Get Example:	<code>/prot get 0CR</code> returns OKTAB”Hello world” CRLF> <code>/prot get 2CR</code> returns OKTABP2 F0 M0 R0CRLF>
Set Action:	Sets a field, <m>, of the open protocol settings, where <m> is 0 = start message, 1 = end message, 2 = protocol parameters. A protocol must be opened (<code>/protocol open</code>) before <code>/protocol set</code> can succeed. The <Args> parameter for set 0 and set 1 is the start or end message enclosed in double quotes. The <Args> parameter for set 2 is a list of single character tokens followed by the token value, where the tokens are: P: Plate ID, 0-31 or -1 for “no plate”. M: Stacker mode (0 = manual, 1 = automatic, use stacker if attached). R: Restack mode (0 = no restacking, 1 = restack plates after protocol completes with a stack of plates).
Set Response:	“No data OK” response if the command succeeds.
Set Example:	<code>/prot set 0 “Hello world”CR</code> sets the start message. <code>/prot set 2 P2 M1 R1CR</code> sets the plate to type 2, automatic stacking and restacking on. <code>/prot set 2 P-1 M0CR</code> sets the plate to type to “no plate” (only maintenance steps available) and manual plate delivery.

Edit/View Protocol Steps

Command: /STEP[New <index>| Delete <index>| Default <code>| Get <index>| Set <index> <code> <tokens>]

Action:	Edits and views steps of the currently open protocol (/protocol open). The first parameter defines the specific action. Step indices range from 0–49.
New Response:	“No data OK” response if the command succeeds.
Delete Action:	Deletes <index> step. Existing subsequent steps are decremented.
Delete Response:	“No data OK” response if the command succeeds.
Default Action:	Reads the default settings of <code> step type, where <code> is as described in section {Function-specific Step Arguments and Return Data}.
Default Response:	Returns the step parameter list in the format of <tokens> as described in section {Function-specific Step Arguments and Return Data}.
Get Action:	Reads the settings of the <index> step.
Get Response:	“No data OK” response if step does not exist, <code> <tokens> if the protocol exists, where <code> and <tokens> are as described in section {Function-specific Step Arguments and Return Data}.
Set Action:	Sets the settings of the <index> step, using the <code> and <tokens>, where <code> and <tokens> are as described in section {Function-specific Step Arguments and Return Data}.
Set Response:	“No data OK” response if the command succeeds.

Function Specific Step Arguments and Return Data

The <code> and <tokens> parameters of the /STEP command and response are mnemonics for protocol steps primitives and required parameters.

<Code> Step Types

disp	Dispense
aspi	Aspirate
wash	Wash
shak	Shake
soak	Soak (wait)
repe	Repeat
prim	Prime
purg	Purge
stan	Standby
rflu	Rinse-flush
nop	Blank (no operation)
whsq	FastWash

<Tokens> is the step parameter list in the format of single letter tokens followed by corresponding (integer) values.

Parameter Tokens

I	Inlet Number (0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt)
R	Rate (generally 0-4)
T	Time (seconds)
U	Time (tenths of seconds)
V	Volume (microliters/well)
M	Mode
S	Speed
A	Address (index) of another step
N	Number

Dispense (DISP)

Dispense step delivers the fluid into the plate. The dispense needles move to just above the top of the plate and the horizontal position. The dispense valve opens for a calculated time to deliver the volume at the specified flow rate. See [Dispense Step Settings on page 39](#).

Parameter Tokens

I	Inlet Number: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
R	Rate: Dispense Rate (5 head specific pressure levels, 0 = Lowest, 4 = Highest, corresponds to the user interface settings 1 to 5)
V	Volume: Dispense Volume Per Well 20- 400 (96-well), 5-150 (384-well) [μ L]
Example:	/STEP set 5 DISP i0 r2 v350CR, response is OKTABCRLF> /STEP get 5CR, response: OKTABDISP I0 R2 V350CRLF>

Aspirate (ASPI)

Aspiration removes fluid from the plate. Vacuum begins prior to the needles coming into contact with the liquid surface. Vacuum continues as the needles descend at the specified rate to the specified position. The needles are left at the specified height for the specified time. The needles withdraw from the wells at a predefined rate and vacuum stops after the needles are above the wells. For crosswise aspiration the head descends to the specified height and then moves the plate horizontally from edge to edge of the wells relative to needle horizontal position for the specified time. See [Aspirate Step Settings on page 41](#).

Parameter Tokens

M	Mode: 0 = Center, 1 = Edge, 2 = Crosswise motion from edge to edge
R	Rate: Aspiration (vacuum): 0 = Lowest, 4 = Highest Vacuum, corresponds to rates 1 to 5 in the user interface
S	Speed: Probe Descent Speed: 0 = Slow, 1 = Medium, 2 = Fast
H	Aspiration Height From Plate Bottom [μ m]
U	Time: Aspiration Time 0-300 [0.1 sec]
Example:	/STEP set 4 ASPI M0 R1 S2 T60CR, response OKTABCRLF> /STEP get 4 CR, response: OKTAB ASPI M0 R1 S2 T60 CRLF>

Wash (WASH)

Washing is simultaneous aspiration and dispense. Aspiration begins as with whole plate aspiration. However, when the aspiration needles reach the specified height, dispensing begins. No crosswise aspiration is allowed in this mode. The aspiration rate should be greater than the dispense rate. The simultaneous aspiration and dispensing continue for the specified dispense volume. Aspiration then continues as the needles withdraw from the wells as with whole plate aspiration. See [Wash Step Settings on page 42](#).

Parameter Tokens

I	Inlet: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
R	Rate: Aspirate/Dispense Wash Rate: 0 = Gentle, 1 = Fast
V	Volume: Dispense Volume 50-3000 [μ L per well]
H	Wash Height: 0 = Plate Bottom, 1 = Plate Top
Example:	/STEP set 3 WASH I2 R0 V3500CR returns OKTABCRLF> /STEP get 3 returns OKTABWASH I2 R0 V3500 CRLF>

FastWash (WHSQ)

Washing is sequential aspiration and dispense. Aspiration at the highest rate begins as with whole plate aspiration. After the aspiration needles reach the specified height and the dwell period expires, the head starts moving up and dispense begins. The dispense continues until the specified volume per cycle dispenses. Aspiration continues as the needles move down to the specified height. Then the cycle repeats. See [Fast Wash Step Settings on page 44](#)

This mode does not support non-flat bottom plates or crosswise aspiration.

Parameter Tokens

I	Inlet: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
R	Dispense Rate [1 to 5]: 1 = Gentle, 5 = Fast
V	Dispense Volume: 20-400 [μ L per well per cycle]
H	Aspiration Height From Plate Bottom: [0 μ m to well depth]
U	Dwell Time: Aspiration Time 0 to 25.5 [x 0.1 sec]
N	Number of Cycles: [1 to 255]
Example:	/step set 3 SQWH 12 R0 V300 H1000 U0 N3CR returns OKTABCRLF> /step get 3 returns OKTABSQWH 12 R0 V300 H1000 U0 N3CRLF>

Shake (SHAK)

The plate shakes for the specified time at the given intensity level. Shake is linear along the horizontal axis. See [Shake Step Settings on page 43](#).

Parameter Tokens

S	Speed: 0 = Slow, 1 = Medium, 2 = Fast
T	Time: 1-600 [sec]
Example:	/step set 2 SHAK T120CR returns OKTABCRLF> /step get 2 CR returns OKTABSHAK T120 CRLF>

Soak/Wait (SOAK)

Soak removes the needles from the wells and no other operations are performed for the specified time. See [Soak Step Settings on page 43](#).

Parameter Tokens

T	Time: 1-7200 [sec]
Example:	/step set 2 SOAK T60 CR returns OKTABCRLF> /step get 2 CR returns OKTAB SOAK T60CRLF>

Repeat (REPE)

The protocol repeats steps from the specified first step to the repeat command in order, the specified number of times. Firmware supports up to 8 repeat loops per protocol. See [Repeat Step Settings on page 46](#).

Parameter Tokens

A	Address (index) to Repeat From [0-49]
N	Number of Repetitions [1-99]
Example:	/STEP set 1 REPE A0 N2CR returns OKTABCRLF> /STEP get 1 CR returns OKTABREPEAT A0 N2CRLF>

Prime (PRIM)

Prime fills the internal fluid path with the specified fluid and removes bubbles. This is similar to whole plate dispense except that the fluid is sent to waste and the wash vacuum valve is used to back fill the manifold. Full prime is used when the system has been purged prior to prime. Maintenance prime is used when you change inlets or other fluid is already in the system. See [Prime Step Settings on page 46](#).

Parameter Tokens

I	Inlet: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
R	Rate: Prime Type [0-1]: 0 = Maintenance (~150 mL), 1 = Full (~350 mL)
Example:	/STEP set 0 PRIM I2 R0CR returns OKTABCRLF> /STEP get 0 CR returns OKTABPRIM I2 R0CRLF>

Purge (PURG)

Purge removes all fluid from the internal fluidics path. The vacuum valves open in the wash manifold and waste trough to remove all liquid. Parameter tokens are: none. See [Purge Step Settings on page 45](#).

Parameter Tokens

Example:	/STEP set 1 PURGCR returns OKTAB CRLF> /STEP get 1CR returns OKTABPURGCRLF>
----------	--------------------------------------------------------------------------------

Standby (STAN)

Standby step fills the prime/soak trough with a rinse fluid and leaves the dispense tips in the rinse fluid. At the specified refresh interval, the trough drains and refills with the rinse fluid. When you stop the operation through a user interface selection, the trough drains and a small amount of fluid rinses (dispenses) through the dispense needles. See [Standby Step Settings on page 47](#).

Parameter Tokens

I	Inlet: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
T	Time: Refresh Interval, 1-86400 [sec], (-1) = Never
Example:	/STEP set 2 STAN I2 T60CR returns OKTAB CRLF> /STEP get 2CR returns OKTAB STAN I2 T7200CRLF>



Note: This step primitive runs until the Stop command is received. Upon completion firmware drains the trough.



Note: Firmware stores the standby interval as 16-bit word in minutes (1-1440).

Rinse-flush (RFLU)

Rinse-flush step rinses all common fluidics (prime/soak trough, head, valves) with fluid. Upon completion the head is left empty. See [Rinse Step Settings on page 45](#).

Parameter Tokens

I	Inlet: 0 = Green, 1 = Red, 2 = Blue, 3 = Yellow, -1 = Prompt
Example:	/step set 2 RFLU i0 CR returns OKTAB CRLF> /step get 2CR returns OKTAB RFLU i0 CRLF>

No Operation (NOP)

Skips the step.

Parameter Tokens

Example:	/set 5 NOPCR, /get 5 CR returns OKTABNOPCRLF>
----------	-----------------------------------------------

Execute Step

Command: /EXEC [PURGE | STAN {tokens}]

Action:	Executes a single step primitive without creating a protocol. This command supports only purge and standby steps. The PURGE and STAN options act identical to the corresponding steps.
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Plate Library Access

The plate library stores up to 32 plate descriptions (indexed 0-31). Plate descriptions include a unique configuration ID, the plate name, number of wells, well geometry (flat, V-bottom, U-bottom, small volume), plate height, and well depth.

The first 8 plates, though editable, are set to factory default values.

Factory Defaults

Index	Name	# Wells	Bottom	Height (µm)	Depth (µm)
0	Costar96	96	Flat	14200	10670
1	Falcon96	96	Flat	14250	10590
2	Greiner96	96	Flat	14400	10900
3	Nunc96	96	Flat	14800	12500
4	Costar384	384	Flat	14200	11430
5	Falcon384	384	Flat	14320	11500
6	Greiner384	384	Flat	14400	11500
7	Nunc384	384	Flat	14400	11700

Command: /PLATE [{} | <plate> | Index <id> | Select <index> | New <name> | Ren <index><name> | Del <index> | Get <index> | Set <index> <Args> | Used <index> | Auto <type>]

Action:	Edits and views the stored plate library.
{ } Action:	If no argument is used, reads selected plate's description.
{ } Response:	Returns the configuration ID, name, and formatted parameters of the selected plate.
{ } Example:	/plate returns OKTAB 9 "384-well flat plate" CRLF wells: 384 height: 10000[um] depth: 5000[um] CRLF>
<plate> Action:	Reads the specified plate's configuration ID and its name.
<plate> Response:	Returns the configuration ID and name of the plate at index <plate>. If the index does not contain a plate, the "no data OK" response is returned.
<plate> Example:	/plate 8 returns OKTAB 14 "My plate" CRLF>
Index Action:	Provides runtime conversion from a configuration ID to the corresponding plate Index.
Index Response:	Returns the plate index or -1 if the plate is not found.
Index Example:	/plate index 14 returns OKTAB 8 CRLF>

<i>Select Action:</i>	If <plate> is given, selects <plate> index and sets plate specific hardware offsets (requires compatible wash head installed).
<i>Select Response:</i>	Returns “No data OK” response if <plate> is given, otherwise returns the configuration ID of the selected plate or -1 if no plate is selected.
<i>Select Example:</i>	/plate select 8 returns OKTAB CRLF< /plate select returns OKTAB 14 CRLF>
<i>New Action:</i>	Adds a new plate description at the end of the plate list, with new name <name>, given in double quotes and limited to 19 characters.
<i>New Response:</i>	Returns the index of the new plate description.
<i>New Example:</i>	/plate new “another plate” returns OKTAB 10 CRLF>
<i>Ren Action:</i>	Renames <index> plate to <name>, given in double quotes and limited to 19 characters.
<i>Ren Response:</i>	“No data OK” response if the command succeeds.
<i>Del Action:</i>	Deletes <index> plate.
<i>Del Response:</i>	“No data OK” response if the command succeeds.
<i>Get Action:</i>	Reads the <index> plate description parameters.
<i>Get Response:</i>	Returns the parameters as a list of single character tokens followed by the integer token value, where the tokens are: W: Plate well type: 0 = 96 wells, 1 = 384 wells. B: Bottom shape: 0 = flat, 1 = U-bottom, 2 = V-bottom, 3 = small volume. D: Well depth, microns (0-plate height). H: Plate height, microns (7500-25500).
<i>Get Example:</i>	/plate get 2CR returns OKTAB W0 B0 D14400 H10900CRLF>
<i>Set Action:</i>	Sets the <index> plate description parameters to the values given in <Args>. <Args> is a list of single character tokens followed by the integer token value, where the tokens are: W: Plate well type: 0 = 96 wells, 1 = 384 wells. B: Bottom shape: 0 = flat, 1 = U-bottom, 2 = V-bottom, 3 = small volume. D: Well depth, microns. H: Plate height, microns.
<i>Set Response:</i>	“No data OK” response if the command succeeds.

<i>Set Example:</i>	/plate set 8 W0 B1 D5000 H10000CR returns OKTAB CRLF>
<i>Used Action:</i>	Determines the total number of programs (protocols) currently using the <index> plate.
<i>Used Response:</i>	Returns the number of programs.
<i>Used Example:</i>	/plate used 8 returns OKTAB 1 CRLF>
<i>Auto Action:</i>	Starts automatic well-bottom detection routine, if <type> is given, or provides last determined well depth. The <type> parameter describes the plate type, 0 for 96-well or 1 for 384-well.
<i>Auto Response:</i>	“No data OK” response if command succeeds. If <type> is omitted, the last determined well depth is returned or 0 if the procedure failed. The well depth value determined by ‘/plate auto’ is not stored in any plate index. Use ‘/plate set’ to store the well depth.
<i>Auto Example:</i>	/plate auto 0 CR starts automatic detection and returns OK TAB CRLF> /plate auto CR returns OK TAB 8512 CRLF>

StakMax Microplate Handler Control

The StakMax Microplate Handler is automatically detected by the washer during power-on initialization. The AquaMax Microplate Washer controls the StakMax Microplate Handler via the StakMax communication port connection.

Stacker Control

Command: /STACKER [{} | Init, Restack, Load 0|1 | Plates | Barcode]

Action:	Controls the StakMax Microplate Handler.
{ } Action:	Detects whether the StakMax Microplate Handler is connected to the StakMax port.
{ } Response:	Returns "1"= StakMax Microplate Handler detected, "0"= not detected. Firmware polls for a StakMax Microplate Handler presence every 1 second when the instrument is in IDLE state sending /STATUS command to StakMax port.
{ } Example:	/STATUS returns OKTAB FAULT 1 OCRLF>; stacker is not connected
<i>Init</i> Action:	Initializes the StakMax Microplate Handler.
<i>Init</i> Response:	"No data OK" response if the command succeeds.
<i>Init</i> Example:	/STACK INITCRLF returns OKTABCRLF>; command is accepted by the AquaMax Microplate Washer
<i>Restack</i> Action:	Restacks plates from stack B to A after running a program.
<i>Restack</i> Response:	"No data OK" response if the command succeeds.
<i>Load</i> Action:	"1" = Load a plate from stack A, "0" = unload a plate from the AquaMax Microplate Washer to stack B.
<i>Load</i> Response:	"No data OK" response if the command succeeds.
<i>Plates</i> Action:	Returns the number of plates successfully loaded from the StakMax Microplate Handler by running the protocol. The number changes when a plate is loaded from the StakMax Microplate Handler and its barcode (if present) is read. Host software can use this command to poll progress of automatic plate loading to retrieve the loaded plate barcode.
<i>Plates</i> Example:	/STACK PLATESCRLF returns OKTAB 1 CRLF>; 1 plate was loaded from StakMax Microplate Handler /STACK PLATESCRLF returns OKTAB 2 CRLF>; 2nd plate is loaded from StakMax Microplate Handler

<i>Barcode Action:</i>	Returns the barcode string read by the StakMax Microplate Handler enclosed by double quotes (if available). The string is cleared at the start of the plate load (return "") and updated from the StakMax Microplate Handler barcode reader when the plate is successfully loaded to the AquaMax Microplate Washer (loaded plate number is incremented). If the StakMax Microplate Handler is unable to read the barcode command returns "NO BARCODE AVAIL" string. The command with an argument requires polling the washer status for move completion until it is not BUSY. Status IDLE indicates success, FAULT – if stacker move has failed.
<i>Barcode Example:</i>	/STACK BARCODECRLF returns OKTAB "NO BARCODE AVAIL" CRLF>; the barcode is not available /STACK BARCODECRLF returns OKTAB "" CRLF> plate loading from the StakMax Microplate Handler is in progress, the barcode is not read yet /STACK BARCODECRLF returns OKTAB "21-60371-01" CRLF>; return the barcode from the last loaded plate
<i>Example:</i>	/REPORT returns OKTAB "StakMax command timeout [190]" -2 0 CRLF>

Errors

Errors that arise during runtime are stored in an error buffer. The error buffer is maintained in non-volatile memory, so all error messages will survive an instrument power cycle or reset.

The error buffer is a circular first-in, first-out list with 128 elements. When full, additional errors overwrite the earliest error and an “error buffer is full” warning is logged.

To minimize the likelihood of overflowing the error buffer, an error count mechanism reports consecutively repeated errors. The count is displayed at the end of the error string. For example: “<error code><message><boot count> (nnn times)”

Error Reporting

/ERROR [Last, List | Number | n | Count | Clear]

<i>no argument</i>	Displays all of the errors in chronological order. The format is as follows: current boot count {#bootcount} firmware {version} CRLF. #error code {message} ({#bootcount}) ({# of occurrences} times) CRLF.
<i>Last</i>	Displays the code of the last error in the buffer. If no argument is given, the last error code is displayed. If there is an argument, the last n errors are given.
<i>List</i>	Displays a list of all error numbers and descriptive text.
<i>Number</i>	Displays the contents of the error log in numeric form. Only error numbers and occurrence count are returned.
<i>n</i>	Displays the nth error in the log with its ASCII string. An index value of COUNT is the most recent error and index value of zero displays the oldest error.
<i>Count</i>	Displays the number of errors in the log.
<i>Clear</i>	Clears the error log.

Error Recovery

Errors 600 are caused by improper input. No recovery is required. The error prevented instrument operation. Instrument operation continues with the next valid command.

Errors between 100 and 199 permit continued operations. Continued operation is possible following acknowledgment and/or correction of the error. For example: empty waste container to correct waste full error.

Errors between 200 and 299 or less than 100 are Fatal Errors: only status commands are available. A reset is required for continued operation.

Instrument Response

The host computer should receive a response from a directly connected instrument within 1 second. If no response is received within the allowed time, the host computer should generate a timing error and can assume that the microplate washer is not connected or not functioning properly.



Experienced lab personnel can safely perform all maintenance procedures described in this manual. Review the manual prior to beginning the maintenance procedures. Maintenance not covered in this manual should be performed only by a Molecular Devices representative.

You should perform routine maintenance at the end of each day or before extended instrument inactivity.

Purging the Instrument



CAUTION! You must install a wash head to run all maintenance programs.



CAUTION! If you use decontaminant solutions other than AquaMax Sterilant, consult the chemical compatibility. Verify that the decontaminant solution will not cause damage to the instrument. See [Cleaning Solutions on page 80](#).

You can use one-touch programs or a similar program to purge the instrument.

To purge the instrument:

1. Prime each inlet with sterile water to remove the last wash buffers used.
2. Use the one-touch Clean program to clean each inlet with a cleaning solution.
3. Purge all fluid from the system.
4. For long-term storage, prime each inlet with an empty bottle to remove all fluids from the system.



Note: You can autoclave reservoir bottles without the caps but you cannot autoclave the caps.

Decontaminating the Instrument



WARNING! Biohazardous Material. Wear protective equipment and dispose of waste materials in accordance with laboratory site regulations and procedures. Solutions used in the instrument and waste materials might be biohazardous.



WARNING! Chemical Waste Disposal Hazard. Wear protective equipment and dispose of waste materials in accordance with applicable regulations and procedures. Waste material might contain toxic, corrosive, and biohazardous material.

Decontaminate the instrument after you use infectious or toxic materials in the instrument. You can safely use isopropanol in the fluid channels and on the external surface of the instrument. You can also use AquaMax Sterilant or other commercially available laboratory decontaminants. These products remove buildup of blood serum, fatty and amino acids, protein complexes, and polymer films to prevent clogging of the washer channels and wash heads. You should mix these solutions according to the manufacturers' instructions. See [Cleaning Solutions on page 80](#).



Note: You should carefully consider the interaction between disinfectants and the materials in the AquaMax Microplate Washer before you introduce disinfectants.

Cleaning the Exterior



WARNING! Risk of electrical shock. There are no user-serviceable parts inside the instrument. Refer service requests to Molecular Devices service representatives.



CAUTION! Risk of equipment damage. Do not open the panels and covers to clean inside the instrument. The exposed circuitry and power supply inside the instrument can be damaged by water-based or conductive cleaning agents.

You should use a cloth or sponge that you dampen with water to clean the outside surfaces of the instrument and the plate drawer.

- Do not use abrasive cleaners.
- If necessary, use a mild soap solution diluted with water or a glass cleaner, and wipe clean with a damp cloth or sponge to remove any residues.
- Do not spray cleaner directly onto the instrument.

Fluids that spill in the instrument during operation drain through the prime/soak trough.



CAUTION! If the trough fluid overfills or spills elsewhere, it leaks through the bottom of the instrument to the counter beneath. You must wipe up spills immediately to prevent damage.

Cleaning Solutions

The following are compatible and incompatible cleaning solutions for the AquaMax Microplate Washers.

Compatible Solutions	Incompatible Solutions
AquaMax® Sterilant (Part Number: R8156) * See AquaMax Sterilant on page 97	Strong Acids
5% to 20% household bleach, or 0.02% to 0.1% sodium hypochlorite **	Xylene, Toluene
CoulterClenz *	NaOH, KOH, or other strong alkalines
Tergezyme *	THF (Tetrahydrofuran)
Ethanol	Aldehydes
Pierce RBS 35 *	Esters
	Aromatic Hydrocarbons
	Halogenated Hydrocarbons
	Ketones
* Follow manufacturer's directions for proper use.	
** Do not leave bleach in the system for more than 15 minutes. Rinse thoroughly with water afterward to remove all bleach residue.	

Removing the Wash Head

You must always wash and purge heads before you remove them. Any fluid that remains can spill onto the instrument and cause damage. Fluid that remains in the head can lead to the growth of mold and salt crystals that cause blockage in the dispense and aspiration probes.

To remove the wash head:

1. Use AquaMax Sterilant, DI water, or your usual rinsing agent. On the Main tab, tap **Rinse** to run the One-touch Rinse program. See [Main Tab on page 25](#).



Note: Repeat several times if you use a harsh reagent.

2. On the Options tab, tap **Purge** to run the One-touch Purge program. The wash head can retain approximately 3 cc of liquid after a purge. See [Options Tab on page 53](#).
3. Disengage the locking lever on the wash head and lift the wash head away from the instrument.
4. Turn the wash head so that the inlets for the wash head are pointing down over a folded paper towel. Do not touch the probes.
5. Hold the wash head over a paper towel and gently tap the inlet end to drain any remaining fluid.
6. Store the wash head with the clear plastic guard installed, with the probes facing down, and on a flat surface or inside a protective container.



Note: For long-term storage, use the clamshell container from the original shipment.



Tip: If the carriage does not eject automatically after an error condition or power outage, recover the carriage manually. See [Recovering the Plate and Wash Head Manually on page 81](#).

Recovering the Plate and Wash Head Manually

The Options tab has a Reset button on the bottom right corner to perform a software reset without power cycling the instrument. If the washer fails during an operation, perform a reset to manually retrieve a plate that is stuck in the system.

To recover the plate and wash head manually:

1. On the Options tab, tap **Reset** to return the wash head and plate to their unloaded positions.
2. Retrieve the plate.



CAUTION! Do not touch or put pressure on the dispense or aspiration probes, as they can be damaged.

3. Lift the wash head gently by the finger guard until it clears the plate.
4. Disengage the wash head lever mechanism and remove the wash head.
5. Carefully slide the plate carriage out. On the Options tab, tap **Load/Eject** if the plate carriage is stuck.
6. Remove the plate from the plate carriage.

Cleaning Wash Heads

One or more of the aspiration/dispense probes can clog if you do not purge the wash heads properly after use. Clogged probes can cause uneven dispense/aspirate rates or liquid can drip out of the probes.



Note: To clean a wash head for storage, follow the procedure in [Removing the Wash Head on page 81](#).

To clean wash heads:

1. Connect the AquaMax Sterilant to the red inlet and connect the rinse water to the green inlet for the standard setup.
2. On the Main tab, tap **Clean** to run the One-touch Clean program using the AquaMax Sterilant. The one-touch Clean program cleans and decontaminates internal fluid paths. The system primes with the cleaning solution, pauses for 5 minutes to allow the cleaning solution to soak in the system, and follows with 3 rinse cycles that use the rinse solution. The system is purged at the end of this program.



Note: If the problem persists, clean the wash head in an ultrasonic wash bath with either sterile water or a mild detergent. If necessary, clean individual clogged dispense or aspiration probes with cleaning wires.

Changing the Fuses

Fuses can burn out. If the instrument does not seem to get power after you switch it on, check to see whether the power cord is securely plugged into a functioning power outlet and to the AC input connector at the rear of the instrument.



WARNING! High Voltage. Always turn the power switch off and disconnect the power cord from the main power source before you perform any maintenance procedure that requires removal of any panel or cover or disassembly of any interior instrument component.

If the power failed while the instrument was on, check that the power cord is not loose or disconnected and that power to the power outlet is functioning properly.

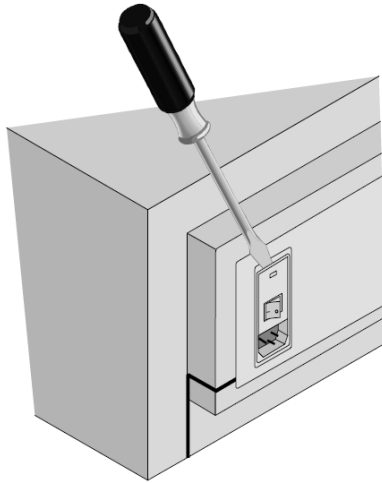
If these checks fail to remedy the loss of power, replace the fuses. If you do not have spare fuses, you can obtain them from Molecular Devices.

The fuses are located in the fuse carrier on the rear of the instrument.

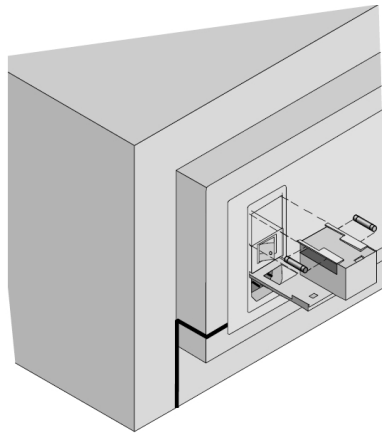
To replace the fuses:

1. Turn the instrument around for easy access to the rear panel.
2. Switch the power switch to the off position.
3. Unplug the power cable from the wall outlet and the power cable port on the instrument.

4. Insert a small, flat-blade screwdriver into the slot above the power switch at the top of the black plastic cover. Gently pry the cover open. The cover hinges down to allow you to see the fuse box inside.



5. Insert the blade of the screwdriver into the small slot on the top front of the fuse carrier. Pull the fuse carrier toward you, out of the instrument.
6. The fuses are located on the top sides of the holder. While it is possible that only one fuse needs to be replaced, you should replace both fuses to ensure continued proper operation. Gently pull the old fuses from the carrier by hand and discard them.



7. Gently place new fuses into the carrier by hand.
8. Return the fuse carrier to the slot above the power switch making sure that the fuses are closest to the top of the carrier and the removal slot is toward you. Slide the fuse holder all the way into the slot.
9. Lift the cover and press it into place, making sure the cover snaps closed.
10. Reconnect the power cable to the instrument and to the wall outlet.
11. Power on the instrument.



Note: If the instrument still does not power on after you change the fuses, contact Molecular Devices Technical Support. See [Obtaining Support on page 85](#).

Before You Move the Instrument

Make sure that the new location meets the specifications described in [Setting Up the Instrument on page 17](#).



Note: Depending on the distance that you move the instrument, you can repackage it in its original shipping packaging to secure the Z and Y axis motion stages. If you do not have the shipping container, contact Molecular Devices Technical Support. See [Obtaining Support on page 85](#).

To move the instrument:

1. Remove any plate from the instrument.
2. For extended storage, purge the instrument to remove all reagents from the system. If you plan to use the instrument immediately after the move, a purge cycle is sufficient. See [Purging the Instrument on page 79](#).
3. Remove the wash head. See [Removing the Wash Head on page 81](#).
4. Disconnect all source and waste bottles and tubes.
5. Turn off the power switch and unplug the power cord.
6. Tilt the instrument to drain any liquid that might have spilled.
7. Empty the waste reservoir.

Powering Off the Instrument

The instrument shuts down automatically when the instrument is inactive for the amount of time you define in the Shutdown Options dialog. See [Defining Shutdown Options on page 56](#).

To manually power off the instrument:

1. Leave the wash head installed throughout the procedure.
2. Confirm that the waste tube is correctly installed with either a waste bottle or drain. See [Connecting Waste Bottles on page 19](#).
3. On the Main tab, tap **Rinse** to run the One-touch Rinse program using AquaMax Sterilant, DI water, or other rinse agent. See [Main Tab on page 25](#).
4. On the Options tab, tap **Purge** to run the One-touch Purge program. See [Options Tab on page 53](#).
5. On the Program tab, select a prime program and set the Inlet option to **Prompt**. See [Prime Step Settings on page 46](#).
6. Replace each reagent bottle with an empty bottle. See [Connecting Reagent Bottles on page 18](#).
7. On the Main tab, tap **Prime** and specify the inlet with the empty bottle. Repeat this step two more times.



Note: If you do not have enough empty bottles, perform Step 6 and Step 7 separately for each inlet in turn.

8. When the fluid channels are clean and empty, remove the wash head before you turn the power off. See [Removing the Wash Head on page 81](#).
9. On the back of the instrument, turn the power switch to the Off position.

Obtaining Support

Molecular Devices is a leading worldwide manufacturer and distributor of analytical instrumentation, software, and reagents. We are committed to the quality of our products and to fully supporting our customers with the highest level of technical service.

Our Support website, support.moleculardevices.com, has a link to the Knowledge Base, which contains technical notes, software upgrades, safety data sheets, and other resources. If you still need assistance after consulting the Knowledge Base, you can submit a request to Molecular Devices Technical Support.

You can contact your local representative or Molecular Devices Technical Support at 800-635-5577 x 1815 (North America only) or +1 408-747-1700.

In Europe call +44 (0) 118 944 8000.

To find regional support contact information, visit www.moleculardevices.com/contact.




The following sections describe how to troubleshoot potential problems during operation of the AquaMax Microplate Washer. For problems not listed, or if the suggested resolution does not fix the problem, contact Technical Support. See [Obtaining Support on page 85](#).



Note: It is your responsibility to decontaminate the instrument, as well as any accessories, before you request service by and before you return the instrument or any components to Molecular Devices.


System Fluidics Issues

Problem	Possible Causes & Remedies
Air in the bottle lines.	On the Main tab, tap Prime to run the One-touch Prime program.
Leaks from the liquid inlet quick connects on the left side of the washer.	When the bottle tube is disconnected from the quick-connect, it is normal for a small amount of liquid to leak from the inlets.
The prime trough does not drain and is filled with liquid.	On the Options tab, tap Purge to drain the prime trough and empty the wash head.
Liquid under instrument.	<p>If the overflow drain is full or wet, and liquid is overflowing from the prime/soak trough:</p> <ul style="list-style-type: none"> • Verify that the total dispense volume in the program does not exceed the maximum well volume for the plate in use. See Managing Plate Type Definitions on page 50. • Adjust the dispense accuracy. See Adjusting Dispense on page 36. • Remove any blockage in the prime/soak trough. <p>If the overflow drain is completely dry:</p> <ul style="list-style-type: none"> • Check around the instrument for other sources of leaks, such as the tubing connectors from the bottles. • If the leakage is coming from within the instrument, contact Technical Support. <p> Note: A small amount of liquid will not cause damage to the instrument. If the trough is full, manually purge the trough by touching Purge in the Options tab. Carefully wipe up any spills under the instrument.</p>

General Instrument Issues

Problem	Possible Causes & Remedies
No power to the instrument or touch screen.	The instrument may be in Shutdown mode: <ul style="list-style-type: none"> • Touch anywhere on the touch screen to activate it. No power to the instrument: <ul style="list-style-type: none"> • Check that the power cord is plugged in. • Check that the power outlet has power. • Verify the power switch is turned to the On position.
The plate carriage or wash head does not move freely.	Obstruction to the motion of the wash head or plate carriage: <ul style="list-style-type: none"> • Remove obstructions from the path of the wash head and plate carriage.

System Pressure Issues

Problem	Possible Causes & Remedies
Pressure timeout error 154.	If the system cannot achieve target bottle pressure: <ul style="list-style-type: none"> • Check that all pressure fittings are properly connected. • Tighten caps on all reservoir bottles. • Remove all pressure tubes from the bottles and reconnect them to one reservoir bottle at a time, to determine which bottle is having pressure problems. • Inspect the air tubes for leaks. • Disconnect the air and liquid connectors from washer, but leave the waste connected, and then run the program. If the problem is bottle-specific or hose-specific, you should not get an error. If the error persists, contact Technical Support. <hr/>  Note: If the total air volume in all the bottles is large (>10 L), it can take up to 5 minutes to pressurize the bottles.
Loud pump noise during operation.	Waste tube might have been connected incorrectly: <ul style="list-style-type: none"> • Verify that the waste tube has no shut-off valve on either end. • Verify that the waste tube is connected to the Waste Output on the left side of the instrument. • Verify that the free end of the waste tube is in a sink drain or a vented bottle below the height of the instrument.


External Communication Issues

Problem	Possible Causes & Remedies
The StakMax Microplate Handler is not communicating.	<ul style="list-style-type: none"> • Verify that the StakMax cable is connected to both the StakMax Microplate Handler and the AquaMax Microplate Washer. • Power-cycle both instruments to re-establish the connections.
The robot is not communicating.	<ul style="list-style-type: none"> • Verify that the USB cable is connected to both the robot and the AquaMax Microplate Washer. • Verify that the communication port setting corresponds to the virtual COM port assigned to the USB driver. • Power-cycle both the robot and the AquaMax Microplate Washer to re-establish connections.
Data cannot be downloaded from instrument to computer using the AquaMax Utility.	<ul style="list-style-type: none"> • Verify that the USB cable is plugged into both the AquaMax Microplate Washer and the computer. • Verify that the communication port setting corresponds to the virtual COM port assigned to the USB driver. • Restart the computer and power-cycle the AquaMax Microplate Washer to re-establish connections.

Wash Issues

Problem	Possible Causes & Remedies
Some wells overflow during wash.	<p>Aspiration probe tips might be touching the well bottoms during bottom wash:</p> <ul style="list-style-type: none"> • Verify that all plate parameters in the plate library match the plate in use. If necessary, re-calibrate the well depth using the Auto feature according to Managing Plate Type Definitions on page 50. <p>Wash solution surface tension causing uneven aspiration:</p> <ul style="list-style-type: none"> • Add surfactant (such as Tween) to the wash solution. <p>Wash volume is too high:</p> <ul style="list-style-type: none"> • Decrease the wash volume. The wash volume should not exceed 10x well volume. <p>One or more aspiration/dispense probes might be clogged:</p> <ul style="list-style-type: none"> • To clean the wash heads, follow the procedures in Cleaning Wash Heads on page 82.
Liquid left in wells after Wash program step.	By design, the Wash step leaves some residual liquids in the wells. Follow the Wash step with an Aspirate step to remove the liquids if needed.



Cell Wash Issues

Problem	Possible Causes & Remedies
Coating or cells in wells are damaged after wash or aspirate.	<ul style="list-style-type: none"> • Decrease the aspiration rate (96-cell wash head only). • Decrease the aspiration dwell time. • Increase the aspiration probe height.
Coating or cells in wells are damaged after dispense.	<p>Decrease the dispense rate.</p>  <p>Note: For the 384-cell wash head, you should use the highest dispense rate possible that does not damage the cell layer.</p>

Dispense Issues

Problem	Possible Causes & Remedies
No liquid in the plate after dispense.	<ul style="list-style-type: none"> • Verify that the dispense parameters (inlet, volume) are set correctly. • Verify that all appropriate bottles and tubes are connected to the instrument, and that the bottles are not empty. • Verify that the system has been primed properly.
Dispense precision is out of spec (high CV, left-right bias, empty wells, or outliers).	<p>Air bubbles in the wash head or system fluidics:</p> <ul style="list-style-type: none"> • Run a full Prime, such as the One-touch Prime program. <p>One or more dispense probes might be clogged:</p> <ul style="list-style-type: none"> • Follow the clean wash heads procedures to unclog the probes. See Cleaning Wash Heads on page 82.
Dispense accuracy is out of spec (high/low dispense volume).	<p>Dispense adjustment values might be incorrect:</p> <ul style="list-style-type: none"> • Adjust the dispense accuracy. See Adjusting Dispense on page 36.
Dripping from the dispense probes.	<p>Air bubbles in the wash head or system fluidics:</p> <ul style="list-style-type: none"> • Run a thorough prime program (such as the one-touch Prime program). <p>One or more dispense probes might be clogged:</p> <ul style="list-style-type: none"> • Follow the clean wash heads procedures to unclog the probes. See Cleaning Wash Heads on page 82.
Dispense overfills the plate.	<p>Dispense volume might be set too high:</p> <ul style="list-style-type: none"> • Verify that the total dispense volume in the program does not exceed the maximum well volume for the plate in use. <p>Dispense adjustment values might be incorrect:</p> <ul style="list-style-type: none"> • Adjust the dispense accuracy. See Adjusting Dispense on page 36.

Aspiration Issues



Problem	Possible Causes & Remedies
The plate is stuck on the wash head after aspiration or wash.	Plates with conical or tapered bottoms (such as certain V-bottom or small volume/ half-area plates) might be incompatible with aspiration and wash operations.
Incomplete aspiration across the entire plate.	<p>Incorrect plate definition:</p> <ul style="list-style-type: none"> • Verify that the plate parameters in the plate library match the plate in use. If necessary, re-calibrate the well depth using the Auto feature. See Managing Plate Type Definitions on page 50. <p>Incorrect aspiration parameters:</p> <ul style="list-style-type: none"> • 96-well plates require crosswise aspiration to achieve minimal residual volumes. If necessary, change the aspirate mode to Crosswise. • Aspirate dwell time and rate might have to be increased. See Aspirate Step Settings on page 41. • Aspirate probe height should be set at 0.0 mm to 0.2 mm for minimal residual volumes. See Aspirate Step Settings on page 41. <hr/> <p> Note: If aspiration problems persist, follow the Aspirate Testing Procedure that is part of the instrument's Performance Qualification. If you do not have this procedure, contact Technical Support.</p>
Significant residual liquids in a few wells.	<p>One or more aspiration probes might be clogged:</p> <ul style="list-style-type: none"> • Follow the procedures to clean the wash heads to unclog the probes. See Cleaning Wash Heads on page 82. <p>Aspiration probe tips might be touching the well bottoms:</p> <ul style="list-style-type: none"> • Verify that all plate parameters in the plate library match the plate in use. If necessary, re-calibrate the well depth using the Auto feature. See Managing Plate Type Definitions on page 50. • Increase the aspiration probe height. <hr/> <p> Note: All wells should have approximately an equal volume of liquid prior to the aspiration step. Uneven initial well volumes can cause incomplete aspiration.</p>
Dripping from the aspiration probes.	<p>Residual fluids in the aspiration probes:</p> <ul style="list-style-type: none"> • Increase the aspiration Dwell time. • Select Fast descent speed and increase aspiration rate. <p>One or more aspiration probes might be clogged:</p> <ul style="list-style-type: none"> • To unclog the probes, follow the procedures in Cleaning Wash Heads on page 82.

Instrument Error Messages

After you perform the recommended tasks, touch Stop or Cancel to continue.



WARNING! Before you manually check for obstructions, turn off the power to the AquaMax Microplate Washer.

Problem	Possible Causes & Remedies
“Z-Motor Pinched” or “Z-Motor Stalled” Error.	<p>Obstruction to the motion of the wash head:</p> <ul style="list-style-type: none"> Turn off the power to the instrument and then remove any obstructions from the path of the wash head. <p>Incorrect plate definition:</p> <ul style="list-style-type: none"> Verify that plate height and well depth in the plate library match the plate in use. If necessary, recalibrate the well depth using the Auto feature. See Managing Plate Type Definitions on page 50. <p>Improper alignment between the wash head and plate carriage:</p> <ul style="list-style-type: none"> The dispense/aspiration probes should be aligned to the center of the wells. If they are not, contact Technical Support.
“Y-Motor Pinch” Error.	<p>Obstruction to the motion of the plate carriage:</p> <ul style="list-style-type: none"> Turn off the power to the instrument and then remove any obstructions from the path of the plate carriage.
“Y: Failed find home” Error	<p>Obstruction to the motion of the plate carriage:</p> <ul style="list-style-type: none"> Turn off the power to the instrument and then remove any obstructions from the path of the plate carriage. <p>The plate carriage home sensor might be malfunctioning:</p> <ul style="list-style-type: none"> Turn off the instrument and remove the wash head. Slide the plate stage forward to reveal the plate carriage home sensor on the left side of the prime trough (see image next page). Use a lint-free paper towel to dry the interior and the region around the sensor. When the sensor is completely dry, turn on the instrument again. <p> Note: The sensor might need to be replaced. Contact Technical Support.</p>
“Z: Failed find home” Error 220	<p>Obstruction to the motion of the wash head:</p> <ul style="list-style-type: none"> Turn off the power to the washer and then remove any obstructions from the path of the wash head. <p>The wash head home sensor might be malfunctioning:</p> <ul style="list-style-type: none"> In the Options tab, touch Reset. <p> Note: The sensor might need to be replaced. Contact Technical Support.</p>
“No Plate Detected” Error 178	<p>No plate in the plate carriage:</p> <ul style="list-style-type: none"> Verify there are no obstructions in the plate carriage. Place a plate in the plate carriage. Turn off the power to the instrument and then move the carriage in and out and clean around the white carriage clip using an isopropanol-dampened swab. <p>Plate sensor is malfunctioning:</p> <ul style="list-style-type: none"> The sensor might be misaligned. Contact Technical Support.


Problem	Possible Causes & Remedies
Pressure timeout error 154.	<p>If the system cannot achieve target bottle pressure:</p> <ul style="list-style-type: none"> • Check that all pressure fittings are properly connected. • Tighten caps on all reservoir bottles. • Remove all pressure tubes from the bottles and reconnect them to one reservoir bottle at a time, to determine which bottle is having pressure problems. • Inspect the air tube for leaks. • Disconnect the air and liquid connectors from washer, but leave the waste connected, and then run the program. If the problem is bottle-specific or hose-specific, you should not get the error. If the error persists, contact Technical Support. <p> Note: If the total air volume in all the bottles is large (>10 L), it can take up to 5 minutes to pressurize the bottles.</p>



Plate Stage Home Sensor



Plate Sensor



Appendix A: Instrument Specifications



The following table lists the technical specifications for the AquaMax 2000 Microplate Washer and the AquaMax 4000 Microplate Washer.



Note: Technical specifications are subject to change without notice.

Technical Specifications

Item	Description
Environmental Conditions	
Environment	For Indoor use only
Altitude	2,000 m (6,561.68 ft)
Temperature	10°C (50°F) to 30°C (86°F)
Humidity	10% to 90% RH non-condensing
Installation Category	II
Pollution Degree	2
General Specifications	
Size (H × W × D)	21 cm (8.3 in.) × 46.6 cm (18.5 in.) × 51.7 cm (20.3 in.)
Weight	18.5 kg (40.8 lbs)
Power Supply	Auto-switching
Wash Head	PET (polyethylene terephthalate), 304 stainless steel
Liquid Contact Materials	Nylon, Polypropylene, Teflon, Polyethylene, Stainless Steel, and Silicone
Compatible Plates	SBS-conforming 96-well and 384-well; flat-bottom, U-bottom, and V-bottom plates See Supported Plate Types on page 12
Liquid Inlets	2 or 4
Outlets	Waste to drain or vented container
Shake Options	3 speeds Up to 600 sec. max.
Interface Connections	USB and proprietary StakMax connect
Regulatory Certifications	cTUVus mark
Performance Specifications	
Precision (96-well)	< 4% CV @ 300 µL
Precision (384-well)	≤ 3% CV @ 100 µL

Technical Specifications (continued)

Item	Description
Washing Times 96 Wash Head, 300 μ L/well	Single cycle: 11 sec. Three cycles: 26 sec.
Washing Times 384 Wash Head, 100 μ L/well	Single cycle: 12 sec. Three cycles: 28 sec.
FastWash Times (optimized for speed)	96 Wash Head, 300 μ L/well, three cycles: 14 sec. 384 Wash Head, 100 μ L/well, three cycles 16 sec.
Process Time With StakMax Microplate Handler (Fast Wash, 96 Wash Head, 300 μ L/well, three cycles)	< 13 min. for 20 plates
Wash Volume	100-3,000 μ L
Residual Volume, 96	\leq 5 μ L
Residual Volume, 384	\leq 2 μ L
Dispense Volume	10-400 μ L per well

Appendix B: AquaMax Sterilant



You can use the AquaMax Sterilant (Part Number: R8156) to clean and sterilize the fluid paths in the AquaMax Microplate Washers.

Accumulated residues and contaminating microorganisms can impair the operation of liquid handling equipment. Proteins in cell culture media, salts and minerals in buffers, and other reagent components can build up on fluid path surfaces. This can clog channels and probes and can result in incomplete or inaccurate dispensing and aspiration. Microorganisms such as bacteria, fungi, and molds can accumulate in the fluid path creating similar fouling problems. Simply flushing the fluid path with water or alcohol/water solutions is often ineffective to remove residue.

AquaMax Sterilant was developed to remove organic and inorganic material and kill microorganisms, including endospores, in fluid paths in liquid handling instruments.

The AquaMax Sterilant simultaneously removes endotoxin from the fluid paths. Endotoxin is a substance produced by Gram negative bacteria that can cause a variety of significant cellular reactions in vitro, including cell activation and death. Minimizing the amount of endotoxin in fluid paths is necessary to avoid detachment and adverse effects on mammalian cells during the course of subsequent experiments. A two-hour treatment with the AquaMax Sterilant substantially removes endotoxin adherence to interior fluid path surfaces.

Contents

The following required materials are included in the AquaMax Sterilant kit:

- Sterilant Solution A Concentrate (4X): detergent in buffered aqueous solution (two 1 L bottles)
- Sterilant Solution B: sodium hypochlorite in aqueous solution (two 14 ml bottles)

Materials Required But Not Provided

The following materials are required for the preparation of the AquaMax Sterilant but are not included in the kit:

- Deionized water
- Graduated cylinder (minimum 500 ml capacity)
- Pipettor (minimum 1 ml capacity)

Storage

Store the unopened kit package at a temperature between 10°C (50°F) and 40°C (104°F).

After you open the kit:

- Store the Sterilant Solution A Concentrate (4X) and any 1X Solution A (prepared by mixing 1 volume of Sterilant Solution A Concentrate with 3 volumes of deionized water) at a temperature between 10°C (50°F) and 40°C (104°F).
- Store the tightly capped bottle of Sterilant Solution B at a temperature between 2°C (35.6°F) and 8°C (46.4°F).

Avoid freezing any of the solutions.

You must use the prepared sterilant within one hour. You cannot store the prepared sterilant for later use.

Preparing the Sterilant

The automated clean cycle on the AquaMax Microplate Washer uses approximately 420 ml of sterilant. You should prepare 500 ml of sterilant to make sure that you have enough.

To prepare 500 ml of the sterilant:

1. Combine 125 ml of Sterilant Solution A Concentrate (4X) and 375 ml of deionized water to prepare 1X Solution A.
2. Mix thoroughly.
3. Within 1 hour of use, add 1 ml of Sterilant Solution B to the 500 ml of 1X Solution A.
4. Mix thoroughly.



Note: You must use the prepared sterilant within one hour of preparation. You cannot store the prepared sterilant for later use. You can prepare 1X Solution A up to 30 days in advance.

Using the Sterilant

For stubborn cleaning situations, you should do the following procedure with the prepared sterilant. You can modify the existing One-touch Clean program or create a new program.

To use the prepared sterilant:

1. Prime with prepared sterilant (from the red inlet).
2. Soak for 5 minutes, or up to 2 hours for endotoxin removal.
3. Purge.
4. Prime with deionized water (from the green inlet).
5. Rinse with deionized water.
6. Repeat rinse twice, for a total of three rinses.
7. Purge.

Warnings, Precautions, and Limitations

For research use only.

When handling Solutions A and B, wear gloves and eye protection. Avoid ingestion. Use the solutions in a well-ventilated environment. For more safety information, consult the Material Safety Data Sheet for Solutions A and B.

As supplied, Solution A might not be sterile.

The following information is provided in compliance with Worker and Community Right-To-Know Regulations:

Sterilant Solution A Concentrate (4X)

Chemical Composition

The chemical composition of this solution is a trade secret and the proprietary property of Molecular Devices.

Sterilant Solution B

Chemical Composition: Sodium Hypochlorite, Solution CAS #: 7681-52-9



Using the Washer for ELISA Based Applications

Objective: wash effectively to get a dry plate to achieve low background and improved signal.

All ELISA assays differ in their binding properties. Biochemical antigen-antibody interactions can be strong or weak.

In general, use:

- Medium to high dispense rate
- Medium to high aspiration rate
- Fast aspiration descent speed
- Long aspiration time
- Probe height set to 0 mm to 0.2 mm or bottom of the well
- Aspiration offset to the center of the well, or crosswise aspiration for a completely dry well
- Slow to fast plate shaking
- Bottom or top washing

Using the Washer for Cell Based Applications

Objective: wash effectively without lifting cells off the well bottom to achieve a low background and improved signal.

All cells differ in their adherent properties. For example, CHO cells adhere strongly, while HEK293 cells tend to adhere weakly. Do not wash the cells any more than is necessary to achieve low background and sufficient signal.

Different cell lines will tolerate different wash conditions. The following are general recommendations, but each cell line and wash solution will require optimization by the user.

For best results with the 96 Cell Wash Head, use:

- Low dispense rate
- Medium to high aspiration rate
- Fast aspiration descent rate
- Short aspiration dwell time
- Probe height of 3 mm or more above the bottom of the well
- Gentle or no plate shake

For best results with the 384 Cell Wash Head, use:

- High dispense rate
- High aspiration rate
- Fast aspiration descent rate
- Short aspiration dwell time
- Probe height of 2 mm or more above the bottom of the well
- Gentle or no plate shake



Note: If you use a wash solution that contains Tween or another reagent with low surface tension and the primed head is allowed to sit between plate washes, some fluid loss through the dispense pins can occur. If this occurs, you should do a maintenance prime before you wash the next plate.

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