

Absorbance



Plate Washing



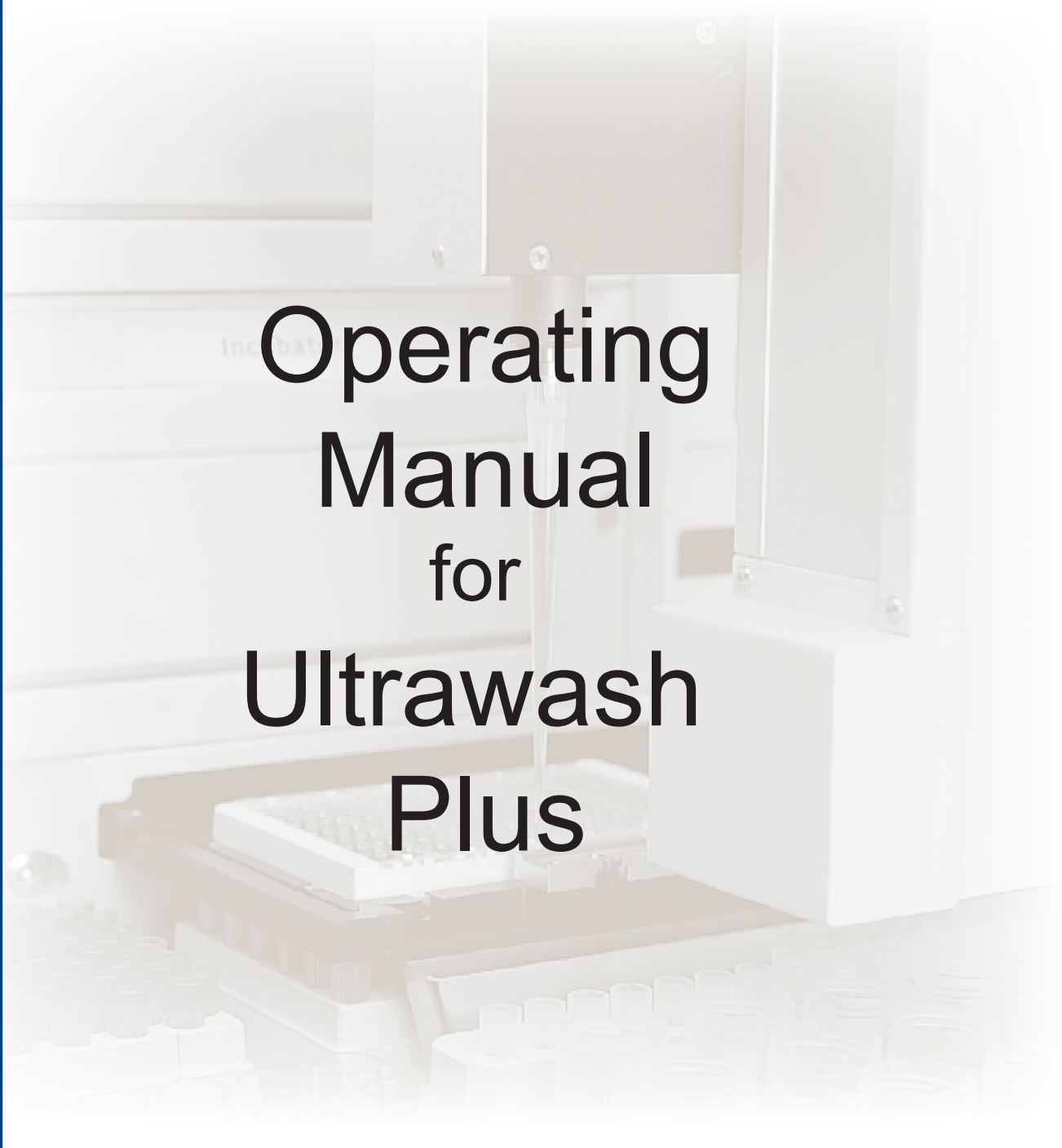
Luminescence



Automated
Processing



Software

A background image of a laboratory instrument, likely a plate washer, with a white pipette tip positioned over a multi-well plate. The image is faded and serves as a backdrop for the title text.

Operating Manual for Ultrawash Plus

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ULTRAWASH PLUS
Automatic
Washer/Aspirator

Operating Manual

IMPORTANT

Read Carefully Before Operation or Adjustment

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SAFETY INFORMATION

WARNING: IF THIS EQUIPMENT IS USED IN A MANNER NOT SPECIFIED BY THE MANUFACTURER, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED.

WARNING SYMBOLS:



Adjacent to the power outlet for pump connection.

Ensure that the pump being connected is correct for the Ultrawash voltage settings and is of the type recommended.



Adjacent to the line voltage options.

CAUTION: Remove the power cord prior to replacing fuses to avoid the risk of electric shock.

The Ultrawash PLUS is an installation Category II product.

WARNING: ELECTRIC SHOCK HAZARD

Although this instrument is fully insulated and grounded, it is important for all users to be aware of the potential hazard of using liquids in close proximity to an electrical supply. In the event of any spillage, the instrument must be immediately isolated from the electrical supply and the liquid cleaned up. The electrical supply **MUST NOT** be reconnected until the instrument has been fully inspected by a competent electrician or an Approved Service Engineer.

DO NOT operate this equipment with covers removed (potentially lethal voltages are contained within).

DO NOT operate the equipment with the safety earth (ground) disconnected.

ENSURE that the voltage and fuse ratings on the rear panel of the Ultrawash PLUS primary unit and the vacuum/pressure unit correspond to the local mains supply.

ENSURE that the mains power cable is correctly wired. Colour codes are as follows:

United States

Black
White
Green

Live
Neutral
Ground

Europe

Brown
Blue
Green/Yellow

Live
Neutral
Earth (Ground)

continued overleaf

SAFETY INFORMATION

CAUTION:

DO NOT remove the head section or any tubing unless both Ultrawash PLUS units are switched off and system pressure is released.

DO NOT attempt to remove the plate carrier while it is being raised or lowered.

ENSURE that all connectors are tight before switching on the vacuum/pressure unit.

If there is any doubt or concern about the safety of the instrument contact the nearest Approved Service Centre.

SPECIFICATIONS

Primary Unit

Wash cycles	1-9
Aspirate/Dispense operation	96 well
Microplate types	U, V, C, or Flat bottom wells
Dispense precision	± 10% (water, 200ul dispense volume)
Dispense pressure (set at factory)	8 -9 psi adjustable
Dispense volume	50-500 µl per well
Plate carrier speed	Adjustable from keypad (1-9)
Soak time	0-90 seconds
Fuse requirements	115V, 60Hz, 6A T 230V, 50Hz, 3A TT

Dimensions

Primary Unit	9.8"H x 16.1"L x 7.9"W	17.6 lbs
Vacuum/Pressure Unit	9.5"H x 12.0"L x 7.0"W	18.0 lbs
Bottle Holder	5.1"H x 21.3"L x 6.3"W	3.4 lbs

Vacuum/pressure Unit

Maximum continuous pressure	15 psi/1.0 bar
Maximum vacuum	660 mm Hg/0.9 bar
Mains input (set at factory)	230V, 50Hz or 115V, 60Hz
Current at rated load	6A@115V; 3A@230V
Power at rated load	580VA
Insulation class	B
Thermal protection	Auto reset

Bottle Holder

Tubing material	Food grade
Bottles	2 fluid, 2 aspirate
Bottle capacity	4 litres each

1. INTRODUCTION

The Ultrawash PLUS is an automatic microplate washer/aspirator designed for use with 96-well microplates.

Operator-programmable features include pre-selection of dispense volumes, soak times, number of wash/aspirate cycles and aspirate times. In addition the operator has manual override controls for aspirating and dispensing.

The Ultrawash PLUS is available with a 96-channel aspirate/dispense head for washing a whole plate.

The plate carrier drive speed is variable and can be increased or decreased to suit operating requirements.

Automatic clean control allows the system to be completely flushed with distilled or de-ionised water and air dried after use.

The Ultrawash PLUS can also be programmed to access different aspirate and dispense heights, allowing for a "customised" set up by the operator to optimise the washing of the user's regular plate types.

2. INSTALLATION

2.1 Unpacking

The Ultrawash PLUS is packed to provide maximum protection during shipment. Take care when unpacking it and examine it carefully for damage. **Report any shipping damage to the carrier immediately.** Check the contents against the shipping checklist enclosed and report any omissions to your supplier.

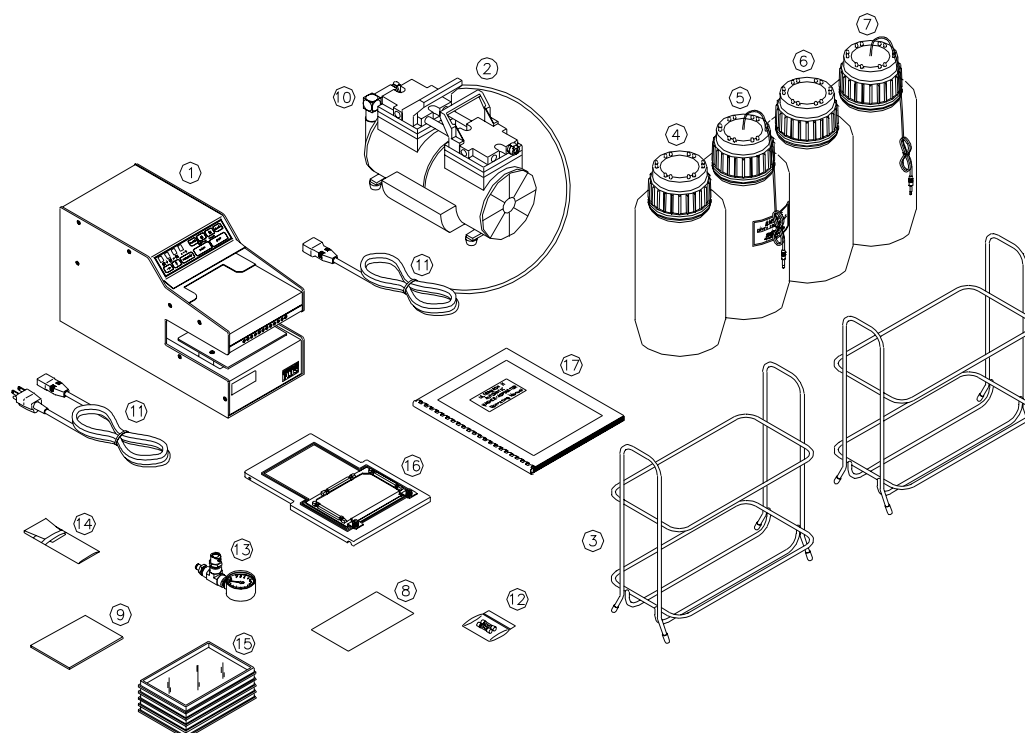


Figure 1: Example Packing contents

- | | | | |
|---|--------------------------------------|----|-------------------------------------------|
| 1 | Ultrawash PLUS primary unit | 9 | Absorbant pad |
| 2 | Vacuum/pressure unit with power cord | 10 | Flow control valve (attached to the pump) |
| 3 | Bottle holder | 11 | Power cord |
| 4 | Vacuum bottle | 12 | Fuse |
| 5 | Vacuum bottle | 13 | Gauge |
| 6 | Clean bottle | 14 | Cleaning wires |
| 7 | Wash bottle | 15 | Pack of 5 purge trays |
| 8 | QC certificate | 16 | Microplate carrier |
| | | 17 | Instruction manual |

ULTRAWASH *Plus*

Training Checklist

The Ultrawash Plus Training Checklist is provided as a guide to ensure that the critical functions of Installation, Operation and Maintenance have been covered during the training session.

- **Installation**

- Bottle and tubing assembly*

- Bottle functions*

- Numbering system*

- Dispense and waste connections*

- Head insertion and release*

- Electrical connections*

- Power outlets*

- Washer

- Pump

- ON / OFF switch*

- Washer

- Pump

- Warning lights – connections*

- Dispense bottle empty

- Waste bottle full

- Review safety information*

- **Instrument panel controls**

- Programming keys*

- 4 window digital display*

- Dispense volume

- Soak time

- Aspirate time

- Number of cycles (ASPIRATE/DISPENSE/SOAK)

- Function select arrow*

- Increment arrow*

- Program keys – displays*

- Protocol number (maximum of 20)

- Plate type

- Up to 5 types (1 – 5)

Continued on next page

Operational keys

Purge (4 cycles of wash solution)

Manual dispense

Manual aspirate

Clean (4 cycles of water)

Start – initiate program

Stop – emergency stop control

Indicator lights

Dispense bottle empty

Waste bottle full

- **Washer set-up**

Plate carrier – horizontal adjustment

Plate carrier – vertical adjustment

Press PROGRAM to display the program number and plate type

Press START & STOP together to enter the Calibrate mode

ASPIRATE moves the plate carrier up

DISPENSE moves the plate carrier down

START stores the current setting and moves to the next option

STOP returns to the Operating mode

Adjust the dispense position to 2mm above top of plate

Adjust the aspirate position to just above the well bottom

Adjust the volume dispensed

ASPIRATE to increase volume

DISPENSE to decrease volume

Set volume, soak time and number of cycles

- **Maintenance**

Flushing with water

After testing

End of day

Daily cleaning

Weekly cleaning

- **Verification procedure**

- **Review Operating Manual table of contents**

2.2 Muffler Installation

Remove the muffler taped to the side of the pump and fit as shown in Figure 2.

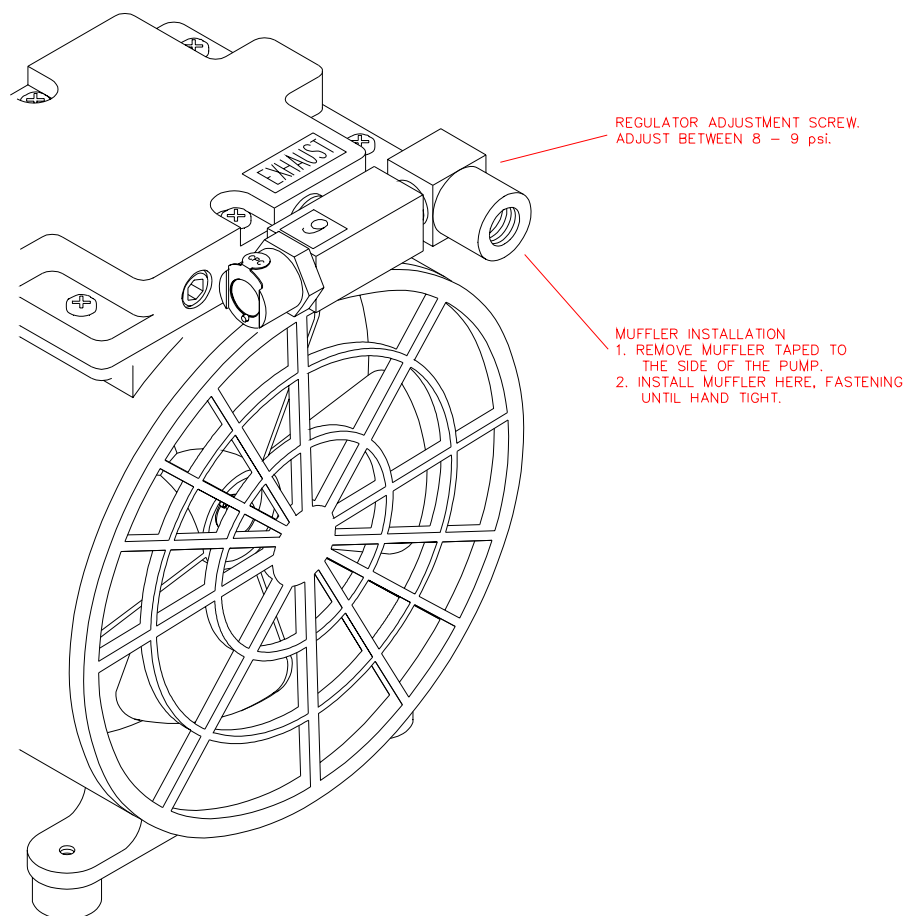


Figure 2: Muffler installation and regulator adjustment

2.3 Bottle and Tubing Connections

1. Place the vacuum, clean and wash bottles in the bottle rack in the order shown in Figure 3.

Note: All bottle caps must be tightly screwed on. Loose fitting caps will adversely affect the overall operation of the washer.

2. Place the Ultrawash PLUS primary unit on a firm level surface with the bottle rack assembly to the rear of the unit, ensuring that the bottles are correctly located in the bottle rack (Figure 3).
3. Stand the vacuum/pressure unit on a firm level surface underneath the bench or next to the main unit.
4. Connect all tubing as shown in Figure 4.

Ultrawash PLUS

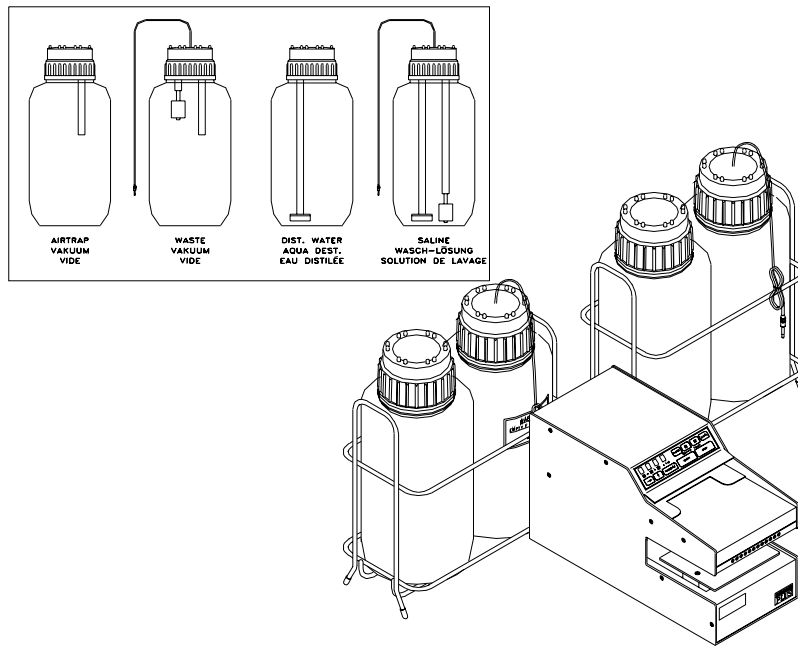


Figure 3: Bottle positions in rack

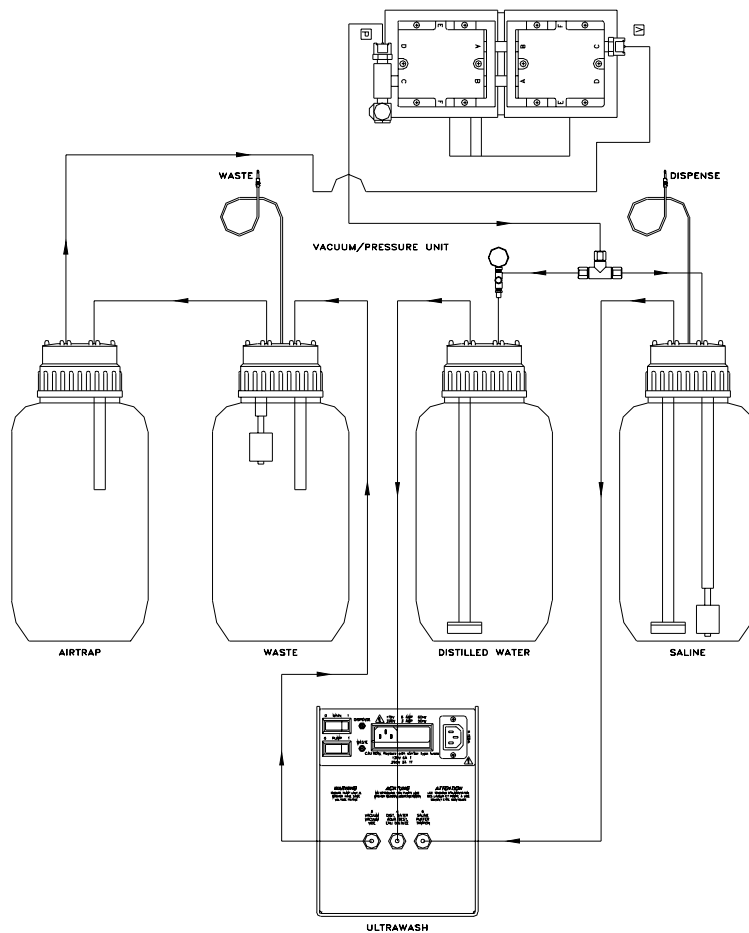


Figure 4: Tubing connections

5. Start with the Ultrawash PLUS primary unit. Turn the unit so that the quick connections are facing you.
 - a) Take the tube labelled **3** and connect to the main unit labelled **3 Vacuum**.
 - b) Take the tube labelled **4** and connect to the main unit labelled **4 Distilled Water**.
 - c) Take the tube labelled **6** and connect to the main unit labelled **6 Saline**.
6. Place the vacuum/pressure unit in the location that you would like it to remain.
 - a) Take the tubing labelled **V** and connect to the connector marked **V** on the pump unit as shown in Figure 3.
 - b) Take the tubing labelled **P** and connect to the connector marked **P** on the pump unit as shown in Figure 3.
 - c) Take the pressure gauge and connect it to the distilled water bottle fitting. Connect the 90° fitting to the pressure gauge.

2.4 Head Release Plate

Depress the head release lever to disconnect the Aspirate/Dispense head assembly from the Ultrawash PLUS primary unit, enabling it to be removed for cleaning or maintenance.

Before releasing the head, run a clean cycle then make certain that the electrical supply has been switched off and the reservoir pressure is released.

Note: *Small amounts of liquid may be left in the head fitting. Care should be taken to have the plate carrier in place to stop this liquid from entering the unit.*

The head is refitted by sliding on the guide rails until the quick disconnect fittings click and the release lever pops up.

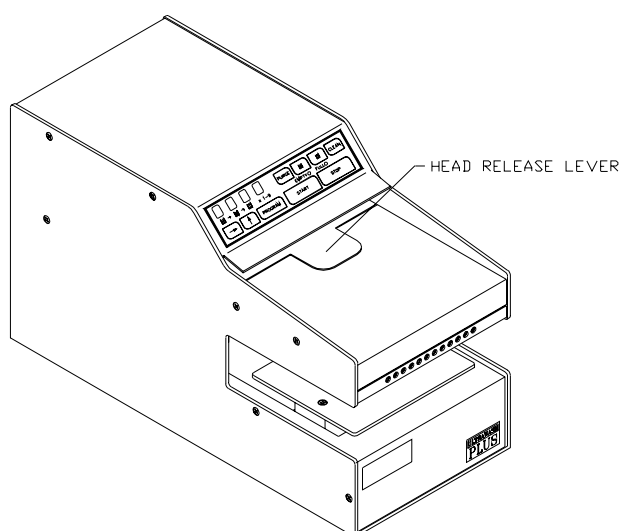


Figure 5: Head release plate lever

2.5 Electrical Connections

Before proceeding check that the mains supply is of the correct electrical rating by inspecting the mains power receptacle on the back of the Ultrawash PLUS primary unit (#3 Figure 6).

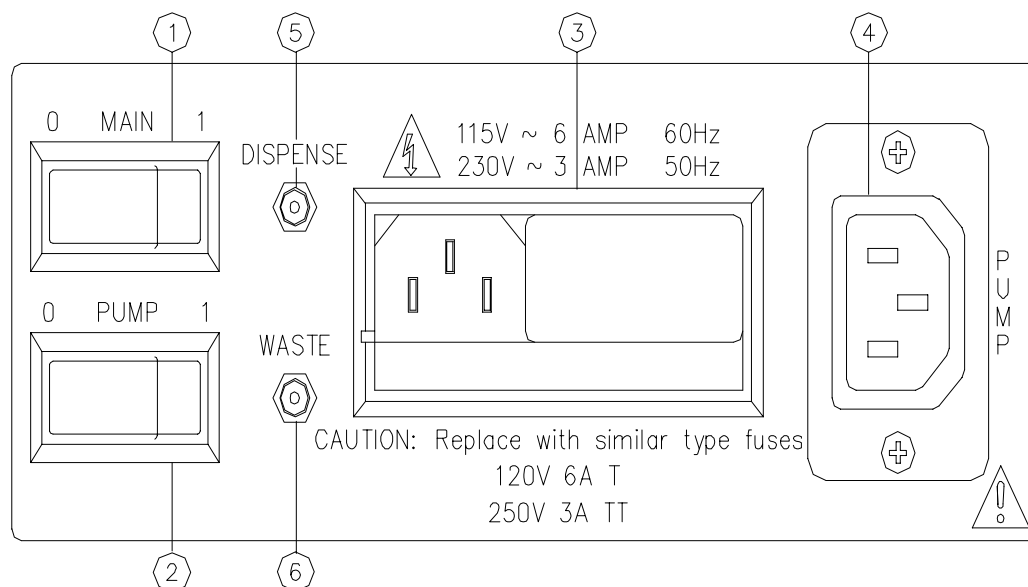


Figure 6: Ultrawash PLUS primary unit rear panel

1. **Mains power switch**
Instrument power **on** or **off**.
2. **Pump power switch**
Pump only power **on** or **off**.
3. **Mains power socket**
230 V, 50Hz; 115V, 60 Hz pre-set at factory
4. **Power supply socket for vacuum/pressure unit**
Connect the power cord to the socket (#3 Figure 6) in the rear panel of the Ultrawash PLUS primary unit and then into the mains outlet. Connect the vacuum/pressure unit to the outlet on the Ultrawash PLUS Main unit marked **PUMP** (#4 Figure 6).
5. **Dispense empty receptacle**
Connect the male connector from the dispense bottle to the **dispense** receptacle on the rear panel of the Ultrawash PLUS primary unit (Figure 6).
6. **Waste full receptacle**
Connect the male connector from the vacuum bottle to the **waste** receptacle on the rear panel of the Ultrawash PLUS primary unit (Figure 6).

3. OPERATING CONTROLS

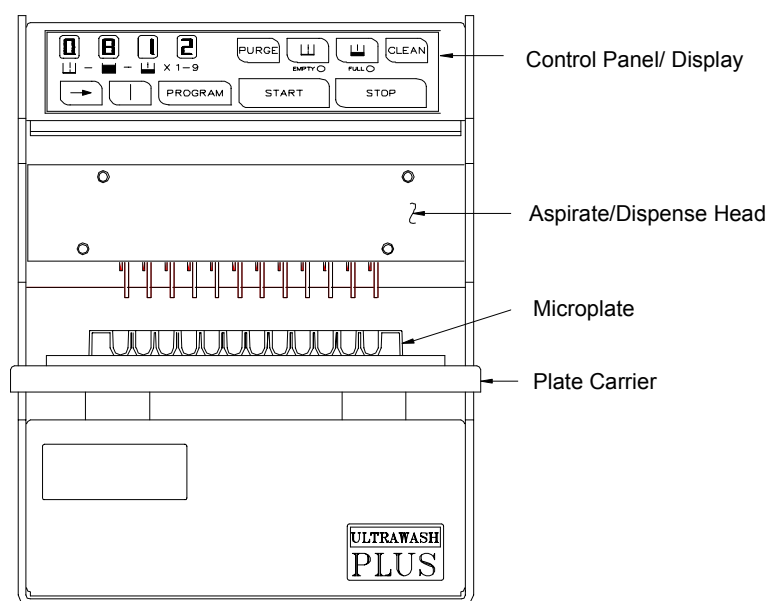


Figure 7: Ultrawash PLUS front view

3.1 Instrument Panel

The instrument panel is comprised of two sections, the left-hand side being the pre-selection and programming section, and the right-hand side the operational section. The switches on both panels are touch-sensitive.

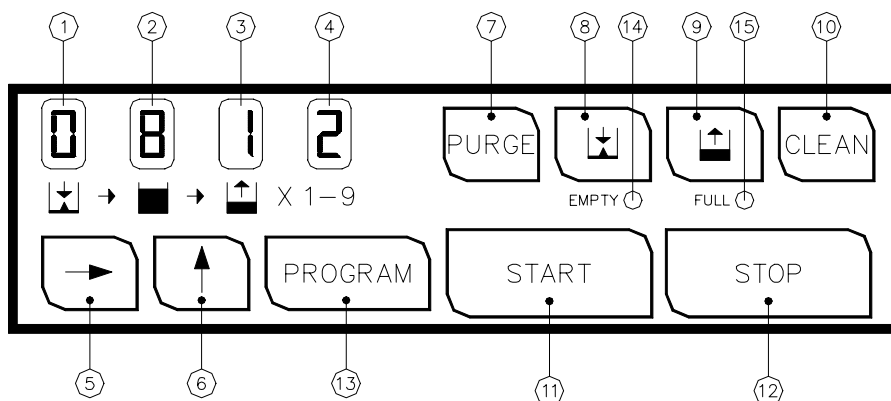


Figure 8: Instrument Panel

- | | | | |
|---|-------------------------------|----|--------------------------|
| 1 | Dispense volume control | 9 | Aspirate control |
| 2 | Soak time display | 10 | Clean control |
| 3 | Aspirate time display | 11 | Start key |
| 4 | Number of wash cycles display | 12 | Stop key |
| 5 | Function select control | 13 | Program key |
| 6 | Program increment control | 14 | Dispense empty indicator |
| 7 | Purge control | 15 | Waste full indicator |
| 8 | Dispense control | | |

The left-hand panel has four window "digital" displays and three touch-sensitive controls. Each of the digital displays (1 to 4) can be independently adjusted within the range of 1-9 or 0-9 by using controls 5 and 6.

1. Dispense Volume Display

Shows the volume of liquid to be dispensed into each well indicated by an arbitrary scale of 1 to 9. The greater the number, the greater the volume.

The maximum volume 9, can be pre-set between 300 μ l and 500 μ l using the calibrate mode, see section 3.2.

The minimum volume (setting 1) is factory set to 50 μ l.

2. Soak Time Display

Shows the time the wash liquid stays in the wells after dispensing, and before aspiration, on a scale of 0 to 9, in 10 second increments.

Setting 0 has no soak time in the cycle.

Setting 7 includes a 70 second delay between dispensing and aspirating.

3. Aspirate Time Display

Shows the aspiration period on a scale of 1 to 9, in 1 second increments.

This is normally pre-set during manufacture to match the requirements of the vacuum/pressure unit.

If an alternative vacuum unit or different viscosity wash solution is used, this value may need adjustment.

4. Number of Wash Cycles Display

Shows the number of complete wash/aspirate cycles which the system will automatically perform.

One complete cycle consists of dispense, soak and aspirate. The number of cycles can be selected in the range 1 to 9. During operation, this display shows which cycle is in progress.

5. Function Select Control

Selects the function to be programmed.

An illuminated dot on the appropriate display indicates which function is selected.

The dot may be moved by pressing the function select, each depression moves the dot to the next window.

Adjustment may only be made to the function with the illuminated dot.

The command is automatically cancelled after five seconds if the program increment control (#6) is not pressed.

- 6. Program Increment Control** Used in conjunction with control #5 (i.e., it depends on the position of the illuminated dot), permits the user to increase or decrease the setting of one of the displays 1 to 4.
- 7. Purge Control** (priming function) Fills the entire system with wash fluid when the key is pressed to remove air from the lines and to prime liquid in the Aspirate/Dispense head for dispensing. The sequence consists of four cycles. The last program settings, including the plate calibration settings, will determine the depth of the pins in the Purge Tray.
- 8. Dispense Control** Manually delivers a pre-set volume of wash fluid into each well. The amount dispensed is pre-set using display #1 in conjunction with controls #5 and #6.

Note: The Ultrawash PLUS will always carry out an aspirate cycle before any wash solution is dispensed in either manual or automatic mode.

- 9. Aspirate Control** Manually aspirates the contents of each well.
- 10. Clean Control** Flushes the entire system with distilled or de-ionised water. The sequence, which is not adjustable, consists of four cycles and includes air drying to ensure that the aspirate/dispense head is left clean and dry.
- 11. Start Key** Initiates a complete automatic wash/ aspirate cycle.
- 12. Stop Key** Emergency stop control which will stop operation during any function and return the plate carrier to the home position.
- 13. Program Key** Pressing this key displays the protocol storage location number from 01 to 20 in the display window 1 and 2. The Ultrawash Plus can store 5 different plate types (U, V, C, or Flat Bottom). The plate storage location number from 1 to 5 will be displayed in Window 4. There will be a dot in Window 3 separating the wash protocol location number from the plate location number.
- 14. Dispense Empty Indicator** When LED is **on**, the dispense bottle is empty. Refilling it shuts off the LED.
- 15. Waste Full Indicator** When LED is **on**, the aspirate bottle is full. Emptying it shuts off the LED.

Note: The dispense empty cable and the waste full cable must be plugged into the rear panel of the washer unit or the LED will remain on.

3.2 Mode Selection

There are two dual key combinations which permit entry into two operating modes: **STOP** plus another key pressed simultaneously will cause the instrument to abort its current operation and return the plate carrier to the home position before entering the selected operating mode. The key combinations for each mode are given below.

- 1. Calibrate Mode** **STOP + START** are pressed simultaneously to enter calibrate mode. This enables the dispense and aspirate positions to be reset (see section 4). The plate carrier can be moved up by pressing the **ASPIRATE CONTROL** key and down by pressing the **DISPENSE CONTROL** key. The correct position can be accepted by pressing **START**. The maximum dispense volume can also be set in this mode.

- 2. Plate Carrier Speed** **STOP + PURGE** pressed simultaneously will allow the plate carrier speed to be varied. A value in the range 1 to 9 can be entered and accepted by pressing **START**. The slowest setting is 1 and the fastest is 9.

There is one more operational mode that is entered by pressing the **PROGRAM** key.

- 3. Program** Press **PROGRAM**, the current protocol number with the associated plate type will be displayed. The Ultrawash PLUS has 20 protocol storage locations numbered from 01 to 20. The Ultrawash also has 5 plate type storage locations numbered from 1 to 5. Press **PROGRAM** to toggle between the protocol number display and the protocol display. To move to another plate type location, press **PROGRAM INCREMENT**. To review what is in the displayed protocol location, press **PROGRAM**. The user can start the wash protocol from either the protocol display or the protocol number with the plate type display by pressing **START**.

4. CALIBRATION PROCEDURE & PLATE TYPE STORAGE LOCATION

The Ultrawash PLUS has on board storage for five microplate type settings. The first microplate location is pre-set for a DYNEX Technologies Flat bottom (plate number 1). These settings govern the aspirate, dispense and wash positions. As microplates vary from manufacturer to manufacturer, it is advisable to check that the dispense/aspirate tips locate accurately into the wells of the microplate. The limits of plate carrier movement both vertically and horizontally can be adjusted. This procedure will enable the user to fully calibrate the Ultrawash PLUS for optimum performance.

***Note:** Before altering the plate carrier alignment, make certain the Ultrawash PLUS is on a level surface, and the tubing and cables are connected. The trap and waste bottles should be empty. The clean and wash bottles should be full with de-ionised water. Make certain all bottle caps are securely tightened. Turn on the main power switch.*

4.1 Plate Carrier Horizontal Adjustment

The plate carrier has an adjustable template.

This adjustable plate holder allows the user to adjust the microplate positioning from left to right. The left position is the offset position. This position should be utilized to obtain maximum wash efficiency with Flat and "C" bottom wells. The right position should be utilized when washing with "U" and "V" bottom wells (pins are centered). To adjust the plate holder from side to side, loosen the two thumbscrews and move the plate holder all the way to the left or all the way to the right. Re-tighten the thumbscrew after moving the plate holder.

4.2 Plate Carrier Vertical Adjustment

1. Press **PROGRAM** to display the protocol location number and the associated microplate type. The plate number will be displayed in window four.
2. Move to the desired plate location by pressing the **PROGRAM INCREMENT** control. Pin height / depth is determined by the plate type selected.

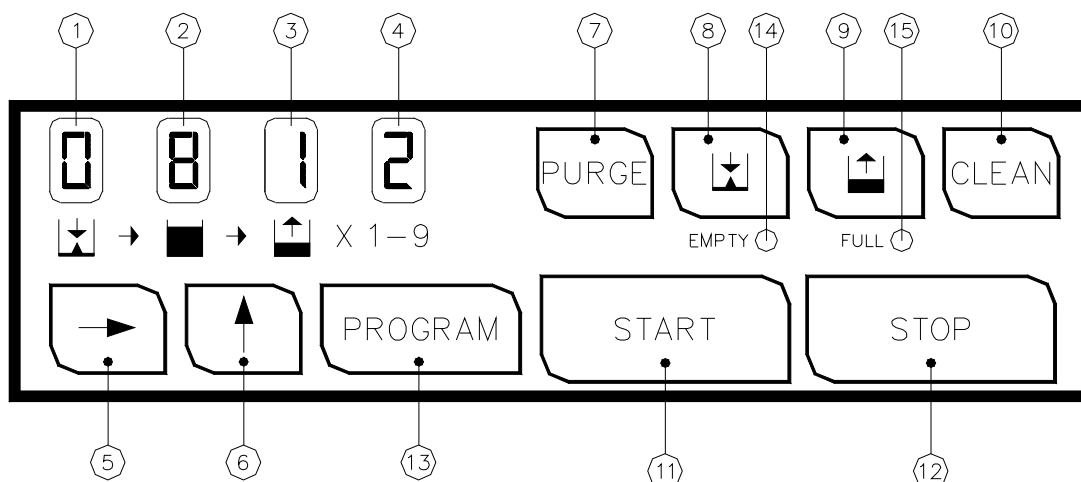


Figure 9: Display

- | | | | |
|---|-------------------------------|----|--------------------------|
| 1 | Dispense volume control | 9 | Aspirate control |
| 2 | Soak time display | 10 | Clean control |
| 3 | Aspirate time display | 11 | Start key |
| 4 | Number of wash cycles display | 12 | Stop key |
| 5 | Function select control | 13 | Program key |
| 6 | Program increment control | 14 | Dispense empty indicator |
| 7 | Purge control | 15 | Waste full indicator |
| 8 | Dispense control | | |

2. Select the **CALIBRATE MODE**. Press **STOP** and **START** simultaneously. In calibrate mode:

- ASPIRATE CONTROL** moves the plate carrier upwards until the key is released.
DISPENSE CONTROL moves the plate carrier downwards until the key is released.
START stores the current setting and moves to the next option.
STOP returns to normal operating mode.

3. Insert the desired type of microplate into the plate carrier.

Note: The following procedures are for initially setting up the Ultrawash PLUS. However they should be repeated at regular intervals to maintain efficient functioning of the Ultrawash PLUS as microplates vary and laboratory operations change.

4.3 Setting the Dispense Position

Select the **CALIBRATE MODE**. Press **STOP** and **START** simultaneously. In the calibrate mode, the display initially shows the current dispense position and then changes to "0000". (The number displayed is the number of motor steps from the "home" position which is when the plate carrier is in the down position.) The dispense height should be approximately 2mm above the top of the microplate.

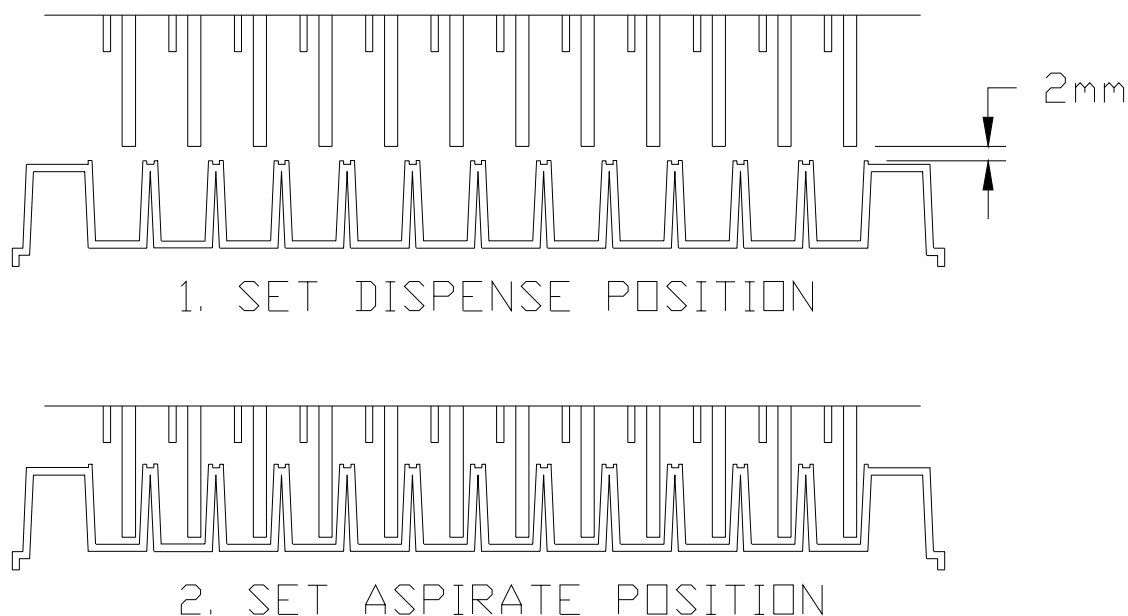


Figure 10: Dispense/Aspirate tip vertical alignment

If the dispense height does not require changing, press **START** to skip to "setting the aspirate position".

If the dispense height needs to be reset, press the **ASPIRATE CONTROL** key. The plate carrier will slowly, and then more quickly, start to rise. As the plate carrier is moved up and down, the display increases or decreases to indicate the position. Continue to press the **ASPIRATE CONTROL** key until the desired dispense position is reached. If the plate carrier advances too far upward, press the **DISPENSE CONTROL** key to move the plate back down to achieve the 2mm spacing above the microplate.

Once the desired dispense position is reached, or if the position is not required to be changed, press the **START** key to store the current position and proceed to "setting of the aspirate height".

4.4 Setting the Aspirate Position

The display shows the current aspirate position, before changing to read "0000".

The aspirate height should be as close to the bottom of the well as possible without touching the bottom of the well. (If the pin touches the bottom of the well, the vacuum will be obstructed and the pin will not aspirate properly.)

In the same way as for changing the dispense position, change the aspirate height by moving the plate carrier upwards or downwards using the **ASPIRATE CONTROL** and **DISPENSE CONTROL** keys. (When the aspirate position appears to be as close as possible to the bottom of the well, move the plate carrier out slightly. Pay close attention to any restriction of movement or scratching noises. A restriction or a scratching noise would indicate that the vacuum pins are hitting the bottom of the wells. The plate carrier would need to be set down further.) When the current aspirate position is correct, press the **START** key to store the setting and continue to the next stage of the calibration routine.

4.5 Adjusting the Maximum Volume Dispensed

The maximum volume dispensed can be adjusted by pressing the **ASPIRATE CONTROL** key or the **DISPENSE CONTROL** key to increase or decrease the volume displayed.

The dispense volume is adjustable in 10 μ l increments from 300 μ l to 500 μ l. Whatever value is entered into the software here is the value used to determine the increment size used during the automatic operation of the washer. Setting 9, for example, will dispense the maximum volume.

The scale is linear. If the maximum volume (which corresponds to 9 on the scale) is 450 μ l, each increment represents 50 μ l (maximum volume divided by maximum scale reading). Therefore setting the dispense volume to 4 will dispense 200 μ l.

When the desired volume is displayed, press the **START** key to store the setting and return the software to the normal operational mode.

Note: *The procedures outlined for adjusting the maximum volume dispensed should be repeated for each plate type required and stored in the appropriate plate protocol storage location.*

4.5 Calibration Check

Turn on the Pump power switch. Press **PURGE** to prime the washer. Observe the action of the plate carrier. The washer will first aspirate, then fill the wells four times, leaving liquid in the wells after the last dispense. The plate carrier will return to the home position, and the washer will beep to alert the user the Purge cycle is complete.

Pull out the plate carrier and observe all the wells for even distribution of liquid. Empty or low wells indicate that a particular dispense pin is clogged. The head should be removed and the blockage removed by using one of the cleaning wires sent in the accessory package.

Run the Purge cycle again to make sure the dispense pin is now dispensing correctly.

Press **START**. Observe the plate carrier for proper performance. The plate carrier should move upwards. The aspirate pins should start aspirating the liquid from the microplate. The plate carrier should continue to move up until reaching, but not hitting the bottom of the wells. The plate carrier should now move downward until the aspirate pins are approximately 2mm above the top of the microplate. The plate carrier should pause, the dispense pins should start dispensing.

If a soak time was set, the plate carrier will remain paused for the specified time. The plate carrier will again move upward to aspirate the liquid. This procedure will be repeated for the specified number of washes set.

After the final wash, the plate carrier will move down to the home position and beep to indicate that the wash cycle is complete. Pull the plate carrier out and remove the microplate.

Vigorously blot the plate out on dry absorbent towels one time. Observe the towel for the amount of liquid blotted from the wells. The amount of liquid should appear as individual dots for each well. If there is excess liquid on the towel, the user should go back into the calibration procedure and redo the aspirate settings.

If the results are acceptable, the washer is calibrated and ready to start a normal wash cycle once wash solution is added to the #6 - 7 wash bottle.

5. OPERATING INSTRUCTIONS

5.1 Preparation for Use

1. Fill the WASH bottle with buffered saline or other suitable wash liquid. Refit the cap securely onto the bottle.

Note: *If the bottle caps are not tightened, a pressure drop occurs, resulting in a decrease of operating efficiency. Check the pressure gauge. A pressure reading of less than 8 psi may indicate a pressure leak.*

2. Fill the CLEAN bottle with distilled or de-ionised water and refit the cap securely onto the bottle.
3. Ensure that the VACUUM bottles are empty.

IT IS IMPORTANT THAT THE VACUUM BOTTLE NEVER BECOMES FILLED WITH LIQUID DURING OPERATION. THIS BOTTLE IS INTENDED TO BE A "SAFETY" TRAP, PROTECTING THE VACUUM/PRESSURE UNIT FROM LIQUID BEING PULLED INTO THE VACUUM PUMP. BE SURE THAT LIQUID DOES NOT ENTER THIS BOTTLE. IF LIQUID IS PULLED INTO THIS BOTTLE, TURN THE SYSTEM OFF AND EMPTY AT ONCE.

4. Turn the Ultrawash main power switch and the pump power switch on.
5. The visual display on the left-hand section of the front panel will indicate the status of the machine, until the plate carrier reaches its home position. Then the numeric displays will indicate the previous automatic operation mode.
6. Pull the plate carrier forward, place a microplate in position, and push the plate carrier back into position.
7. Press the **PURGE** control. Actuation of this control purges the system with washing solution. The plate carrier will automatically return to its home position. At this stage the machine will have dispensed the pre-set volume of liquid, according to window #1 (see Figure 11), in all wells of the microplate.
8. Remove the microplate and visually check that even dispense distribution has taken place.

5.2 Automatic Program Adjustment

The visual display on the left-hand section of the front panel indicates the current status of the instrument.

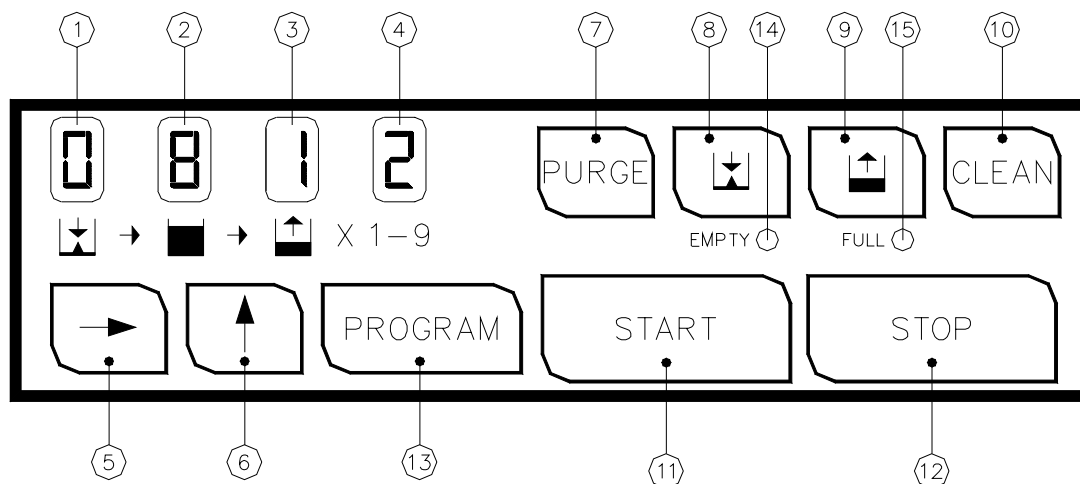


Figure 11: Display showing automatic wash cycle example

- | | | | |
|---|-------------------------------|----|--------------------------|
| 1 | Dispense volume control | 9 | Aspirate control |
| 2 | Soak time display | 10 | Clean control |
| 3 | Aspirate time display | 11 | Start key |
| 4 | Number of wash cycles display | 12 | Stop key |
| 5 | Function select control | 13 | Program key |
| 6 | Program increment control | 14 | Dispense empty indicator |
| 7 | Purge control | 15 | Waste full indicator |
| 8 | Dispense control | | |

Press **PROGRAM**, the current protocol number with the associated plate type will be displayed. The Ultrawash has 20 protocol storage locations numbered from 01 to 20. The Ultrawash also has 5 plate type storage locations numbered 1 to 5. Press **PROGRAM** to toggle between the protocol number display and the protocol display. To move to another protocol location, press **FUNCTION SELECT**. To move to another plate location, press **PROGRAM INCREMENT**. To view what is in the displayed protocol location, press **PROGRAM**.

Press **FUNCTION SELECT** which causes an illuminated dot to be displayed in window 1. The dot may be moved by pressing the **FUNCTION SELECT**, each depression moves the dot to the next window. Adjustment may only be made to the function with the illuminated dot. To adjust a function, press **PROGRAM INCREMENT** and proceed as follows:

- 1. Volume Control** Position the illuminated dot in the dispense volume display and adjust accordingly. The higher the number display, the larger the volume dispensed. The adjustment range of 1-9 equals approximately 50µl to 500µl, depending on the maximum volume set. (see section 4)

- 2. Soak Time** This is the second display window and can be adjusted in 10-second increments, e.g., if set at position 0, zero soak time is included. A setting of 3 provides a 30-second soak time, etc. The maximum setting is 9 (90-second soak time).

- 3. Aspirate Control** The third window is the aspirate control which is a pre-set function. Do not adjust this unless a vacuum other than that supplied with the Ultrawash PLUS system is being used.

- 4. Washing Cycles** The right-hand window displays the number of washing cycles. This may be adjusted within the range 1 to 9.

Once these parameters are set, the protocol will be saved with the corresponding protocol number from 01 to 20. Follow the above procedure to store additional protocols.

5.3 Operation

***Note:** The Ultrawash PLUS will beep if keys other than PURGE are pressed after first switching on. This ensures that the system is purged before initial operation.*

1. Slide out the plate carrier, fit a purge tray securely into the carrier and replace.
2. Press **PURGE** to flush the system with washing solution.
3. When the four cycles are complete, press the **ASPIRATE CONTROL** key to empty the purge tray.

Once the **PURGE** cycle is complete, proceed with operation as described below.

1. Place a microplate into the plate carrier.
2. Press **PROGRAM**. Select the appropriate wash protocol by pressing **FUNCTION SELECT** (see section 5.2). Select the appropriate plate type by pressing **PROGRAM INCREMENT** (to set plate type, see section 4).
3. Press the **START** key. The Ultrawash will proceed with all the pre-programmed requirements. A beep will sound to alert the operator that the wash cycle is complete.

4. Remove the microplate from the unit, insert the next microplate and repeat the cycle.

Pressing **STOP** at any time will halt operation and return the plate to the home position.

Pressure can be released from the bottles, for example to refill bottles with wash or flush solutions, by switching the pump power switch to off. However, when the vacuum/pressure unit is powered up again, a purge cycle must be carried out before commencing operation.

If the Ultrawash PLUS is to be unused for one hour or more, a clean cycle should be initiated to prevent build up of salt. The instrument should always be switched off overnight.

Automatic Wash Cycle Example

The following sequence occurs after depressing the **PURGE** button then the **START** button.

Operation

The Microplate located on the plate carrier moves upwards and the contents are aspirated.

The plate moves into the dispense position. The volume of liquid dispensed will be in accordance with the setting shown in display #1 i.e., 5.

The soak time will automatically start following the dispense function. This will be in accordance with the setting shown in window #2 (i.e. 3 = 30 seconds)

Upon completion of the soak time, the plate will move to the aspirate position and will be aspirated according to the setting shown in window #3.

The plate will move into the dispense position

Display (see Figure 11)

Window #4 shows 0 and the dot on the right-hand side of this digit is illuminated.

The dot on the right-hand side of window #1 will be illuminated, and window #4 will index from 0 to 1 to indicate the first wash cycle has started.

The dot on the right-hand side of window #2 will be illuminated.

The dot will be illuminated on the right-hand side of window #3.

Window #4 will show 2, indicating that the second wash cycle has now commenced.

This cycle will be repeated in exactly the same way as the first wash cycle. Once the desired number of wash cycles has been completed, the unit will stop automatically and will beep twice to alert the user that the program has been completed.

5.4 Replenishing Solutions

The wash and clean reservoirs are replenished as follows:

1. Run a clean cycle to evacuate as much liquid from the washer as possible.
2. Turn the vacuum/pressure main power switch off and wait 30 seconds to release pressure in the reservoirs.
3. Fill the wash bottle with buffered saline or another appropriate wash solution and refit the cap securely.
4. Fill the clean bottle with distilled or de-ionised water and refit the cap securely.
5. Ensure that the vacuum bottles are empty. Tighten the tops firmly by hand pressure.
6. Turn the vacuum/pressure main power switch on and wait 30 seconds for the wash and flush bottles to pressurise.
7. Slide out the plate carrier, fit a purge tray securely into the carrier and replace.
8. Press **PURGE** to flush the system with washing solution.
9. When the four cycles are complete, press the **ASPIRATE CONTROL** key to empty the purge tray.

6. MAINTENANCE/TROUBLESHOOTING

The first vacuum bottle should be emptied regularly. Fluid should not be allowed to accumulate in the second vacuum trap bottle. Any accumulation of fluid in this bottle will shorten the life of the vacuum/pressure unit.

6.1 Flushing the Washer

Once testing has been completed, or at least at the end of each day, the Ultrawash PLUS should be flushed to prevent saline solution drying in the wash/aspirate system. This will prevent blockages.

1. Pull the plate carrier out. Place a purge tray or microplate into the plate carrier. Slide the plate carrier all the way in until it stops under the aspirate/dispense head.
2. Remove the wash solution from the wash bottle and replace with distilled or de-ionised water.
3. Cycle the system through a wash cycle 3 times. This will ensure flushing of the internal solenoid valves, removing any residual wash solution. Press **CLEAN**. The unit will run the factory pre-set number of cycles and then the entire system is automatically air-dried.
4. Press **CLEAN** again.
5. When this procedure is complete, turn the vacuum/pressure switch off and wait for one minute. This allows any residual liquid to run to the end of the aspirate/dispense tubes. Then shut off the main power switch.
6. Pull the plate carrier out, remove the purge tray, and discard any fluid in the tray. Place the absorbent sponge, soaked in de-ionised water and fully wrung out, into the purge tray. Slide the plate carrier back into the wash position.
7. Lift the purge tray with your fingers and gently blot any excess moisture on the pins.
8. Remove the purge tray and absorbent sponge and replace with an empty microplate or another purge tray.
9. Wipe surfaces of the washer with a sponge soaked in a mild detergent and water or with a 70% alcohol solution.

6.2 Periodic Cleaning Procedure

Although the Ultrawash PLUS is constructed from high quality materials, spilled saline solutions, solvents, acids or bases should be removed immediately. Exterior surfaces should be cleaned with a mixture of water and mild detergent.

The plate holder and the positioning templates can be cleaned by sliding it completely out of the instrument and washing it with water. The bottles and tubing should be cleaned periodically with a general purpose laboratory cleaner.

Daily cleaning

1. Pull the plate carrier out. Place a purge tray or microplate into the plate carrier. Slide the plate carrier all the way in until it stops under the aspirate/dispense head.
2. Disconnect tubes 4 and 6 from the back of the instrument then plug tube 4 into fitting 6.
3. Run the purge cycle twice.
4. Return tubes to the original position.
5. Run the clean cycle twice.
6. When this procedure is complete, turn the vacuum/pressure switch off and wait for one minute. This allows any residual liquid to run to the end of the aspirate/dispense tubes. Then shut off the main power switch.
7. Pull the plate carrier out, remove the purge tray, and discard any fluid in the tray. Place the absorbent sponge, soaked in de-ionised water and fully wrung out, into the purge tray. Slide the plate carrier back into the wash position.
8. Lift the purge tray with your fingers and gently blot any excess moisture on the pins.
9. Remove the purge tray and absorbent sponge and replace with an empty microplate or another purge tray.
10. Wipe surfaces of the washer with a sponge soaked in a mild detergent and water or with a 70% alcohol solution.

Weekly Cleaning

1. Pull the plate carrier out. Place a purge tray or microplate into the plate carrier. Slide the plate carrier all the way in until it stops under the aspirate/dispense head.
2. Empty the wash buffer bottle. Fill with 600ml of 70% alcohol solution (Isopropyl, Methyl, or Ethyl).
3. Re-tighten the cap and shake the bottle vigorously.
4. Turn the main power and pump power switches on.
5. Run a Purge cycle four times.
6. Turn the pump power switch off.
7. Empty buffer bottle.
8. Add 300ml's of de-ionised water to the wash buffer bottle.
9. Re-tighten the cap and shake the bottle vigorously.
10. Discard the 300ml's of liquid and refill the bottle half full with fresh de-ionised water.
11. Turn the pump power switch on.
12. Run the Purge cycle four times.
13. Run the clean cycle twice.
14. Shut off the pump power switch.
15. Blot the pins.
16. Shut off the main power switch.
17. Discard all remaining fluids.
18. Remove the purge tray and absorbent sponge and replace with an empty microplate or another purge tray.
19. Wipe down all surfaces of the washer with a sponge soaked in a mild detergent and water or with a 70% alcohol solution.

6.3 Decontamination Procedure

1. Discard any remaining wash buffer and fill each bottle with approximately 600ml of 70% alcohol solution (Reagent Grade Alcohol, Methanol, Ethanol, or Isopropyl can be used). Replace each cap and shake vigorously to "coat" the entire inside of each bottle with alcohol solution.
2. Ensure that the waste and the waste trap bottles are empty. Ensure that a blank wash plate is correctly seated in the plate carrier.
3. Turn both the main power and pump power switch on.
4. Wait for about 30 seconds, then press **PURGE**, to flush the lines and solenoid with alcohol and allow for completion.
5. Repeat the purge four more times.
6. Check the liquid level in the waste bottle, empty if needed.
7. Shut off the pump power switch.
8. Empty any remaining alcohol solution from all bottles.
9. Add about 200ml of de-ionised water into each bottle, replace each and shake vigorously, decant all of the de-ionised water from each bottle.
10. Fill the wash and distilled water bottle half full with de-ionised water, replace the caps and connect each wash bottle to a washer unit
11. Turn on washer.
12. Press **PURGE**, to flush the lines and solenoid with de-ionised water and allow for completion.
13. Repeat step #12 a minimum of four more times.
14. Press **CLEAN** and allow for completion.
15. Repeat step #14 one more time.
16. Remove and empty all bottles.
17. Re-seal the bottles. Press **PURGE**, to flush the system.
18. Press **CLEAN** to remove any liquid from the tubing.
19. Empty the waste bottle.
20. Turn both power switches off.

21. Carefully slide out the plate carrier and remove the blank wash plate, replace with the purge tray that has a damp absorbent sponge on it, which has been soaked in 70% alcohol. Slide in the plate carrier and using your fingers from each side, carefully lift the purge tray to gently blot the probes.
22. Remove the purge tray and absorbent sponge and replace with an empty microplate or another purge tray.
23. Carefully wipe the outside surfaces of each washer unit with a cloth soaked in a mild detergent.

CAUTION

**The head must NOT be
autoclaved**

6.4 Ultrawash PLUS Verification Procedure

Equipment needed: Ultrawash PLUS, flat bottom microplates, scale, PBS Tween 20 solution, de-ionised water, and distilled water.

1. Connect the pressure gauge to the bottle fitting, and adjust the pressure to 8 psi. Refer to Figure 2 on page 13 for location of pressure adjustment screw.
2. Go into the calibrate mode (press the **START** and **STOP** keys simultaneously) set the aspirate and dispense heights for a flat bottom microplate. Next, set the maximum dispense volume to 450 ul.

6.4.1 Dispense Test:

1. Prepare 0.05% Tween 20 solution in distilled water for the wash solution.
2. Set the display to 4014.
3. Insert a microplate into the plate carrier.
4. Press the **PURGE** key.
5. Press the manual **ASPIRATE CONTROL** key.
6. Press the manual **DISPENSE CONTROL** key.
7. The dispense volume should be approximately 200ul.
8. Remove the microplate, and visually examine it for uniform well dispensing.
9. Replace the microplate, and press the manual **ASPIRATE CONTROL** key.
10. Set the display to 7014.
11. Press the manual **DISPENSE CONTROL** key.
12. The dispense volume should be approximately 350ul.
13. Remove the microplate, and visually examine it for uniform well dispensing.
14. Replace the microplate, and press the manual **ASPIRATE CONTROL** key.
15. Set the display to 9014.
16. Press the manual **DISPENSE CONTROL** key.
17. The dispense volume should be approximately 450ul.
18. Remove the microplate, and visually examine it for uniform well dispensing.
19. Replace the microplate into the plate carrier. Press the manual **ASPIRATE CONTROL** key.

Make sure all wells are dispensing evenly and at the highest dispense setting (9) that the entire well is being filled.

Not all flat bottom plates can hold 450ul. Some of the dispensed liquid may be aspirated off the top of the wells depending on the dispense height setting. A positive meniscus is achieved by setting the dispense height higher and therefore a less positive meniscus would require a lower setting. Please refer to the calibration procedure (section 4), to set the dispense position and aspirate position.

6.4.2 Aspirate Test:

1. Prepare 0.05% Tween 20 solution in distilled water for the wash solution.
2. Set the display to 7014.
3. Insert a microplate into the plate carrier.
4. Press **PURGE**.
5. Remove the microplate from the plate carrier.
6. Weigh an empty clean flat bottom microplate.
7. Insert the new microplate into the plate carrier.
8. Press **START** to initiate the wash protocol.
9. Reweigh the plate after the wash cycle is complete. The difference should be less than 0.28 grams.
10. Run 2 clean cycles with de-ionised water.

6.5 General Maintenance

The Ultrawash PLUS is constructed to be as maintenance-free as possible and does not require servicing beyond the flushing and cleaning as detailed above. The main cabinet consists of four different elements.

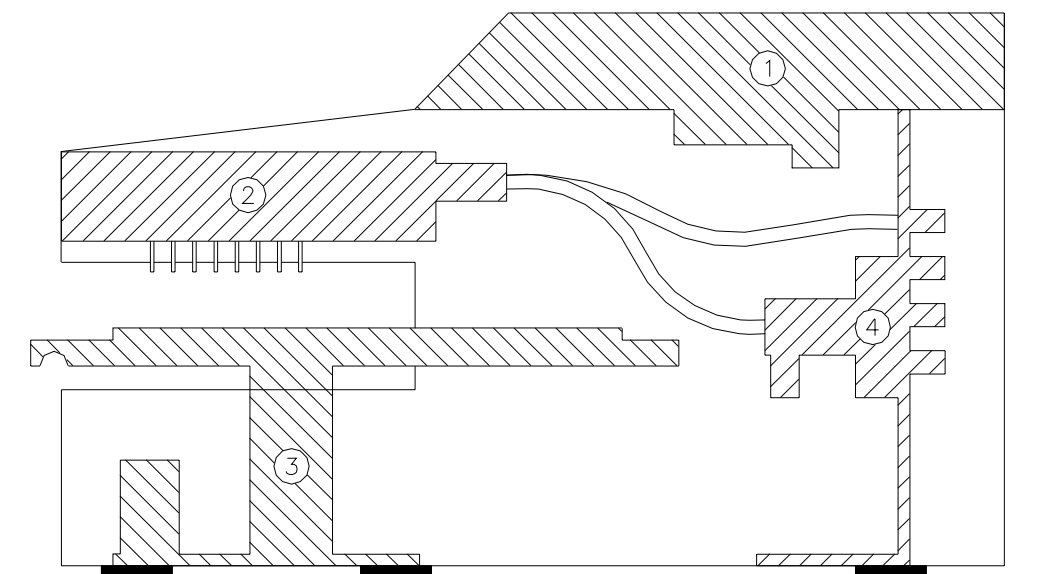


Figure 12: Identification of elements in main cabinet

1. Electronic section
2. Aspirate/dispense head section
3. Plate movement section
4. Fluid handling section

1. The **Electronic Section** incorporates the touch-sensitive controls and related electronic components. This electronic section is fully shielded against any possible liquid spillage and can be removed for repair in one piece by removing the head cover of the unit. **Note:** Only this section carries mains voltage.
2. The **Aspirate/Dispense Head Section** is fitted on sliding rails and can be removed from the machine for cleaning purposes. Connection between the head and other functional parts is made via two tubing connections coupled via quick-connection fittings.
3. The **Plate Movement Section** is comprised of the plate lift mechanism and the plate carrier.
4. The **Fluid Handling Section** consists of valves for saline, distilled water and air pressure, mounted on one bracket which can be readily removed for servicing.

Under normal conditions it is not necessary to be concerned about any of the above sections, except for the aspirate/dispense head assembly (#2). If it appears that certain wells are not aspirating or dispensing liquid comparably with all other wells on a plate, the aspirate or dispense tips may be clogged. Remove the head assembly and insert the manifold cleaning wires into the dispense/aspirate tips. Take care not to bend or damage the tips. Replace the head assembly into the unit and run a clean cycle to flush out any materials loosened by the wire

6.6 Troubleshooting

The Ultrawash PLUS can be expected to operate for extended periods without the need for repair. In the unlikely event that the operation of the washer seems abnormal, the following possible causes and solutions should be investigated. If the fault cannot be cured using the information given here, contact an Approved Service Centre.

Problem	Possible cause	Solution
Display & pump do not operate	No power	Check that the power cord is connected
	Blown fuse	Replace with properly rated fuse
	ON/OFF switch defective	Contact an Approved Service Centre
Pump not operating	No power cord to pump unit	Connect with special power cord, supplied
	Power switch on main unit not in proper position	Push power switch to the ON position
	Liquid pulled into pump unit	Contact an Approved Service Centre
Aspirate/dispense head not dispensing evenly in all wells	Clogged dispense pins	Remove aspirate/dispense head assembly and clean using manifold cleaning wire, then run a clean cycle; Disassembly of the aspirate/dispense head may be required if clog persists
	Air leak	Check pressure reading on pressure gauge, Check caps, fittings and tubing for leaks - make sure they are tightened securely
Aspirate/dispense head leaking	Air leak in system	Check pressure reading on pressure gauge, Check caps, fittings and tubing for leaks - make sure they are tightened securely
Other problems		Contact an Approved Service Centre

6.7 Fuse Replacement

If no display lights appear when the Ultrawash PLUS primary unit is switched on, first check the power cable. Ensure that the cord is firmly connected. If this was connected properly, switch off the mains power and disconnect the power cord. Slide away the clear protective cover and pull the black release tag to remove the fuse (see Figure 13). Check the continuity of the fuse. To avoid risk of fire, always replace a fuse with one of the same type and rating. Ensure that fuse rating is adequate for the mains voltage set and displayed by the voltage selection card.

CAUTION! Ensure that the voltages and fuse ratings on the rear panel of the Ultrawash primary unit and the vacuum/pressure unit correspond to the local mains supply.

The Ultrawash PLUS primary unit can be configured to suit various local mains voltages. There is a voltage selection card at the back of the unit, beneath the fuse holder. To change the mains voltage, first disconnect the power cord from the instrument and remove the circuit card. Re-insert the circuit card such that the correct voltage setting is uppermost and is oriented so that it can be read easily from the rear of the instrument - refer to Figure 13. (This reflects a washer set for 230 volt operation.)

The vacuum/pressure unit supply voltage cannot be adjusted. If the voltage is incorrect, contact DYNEX Technologies Customer Service.

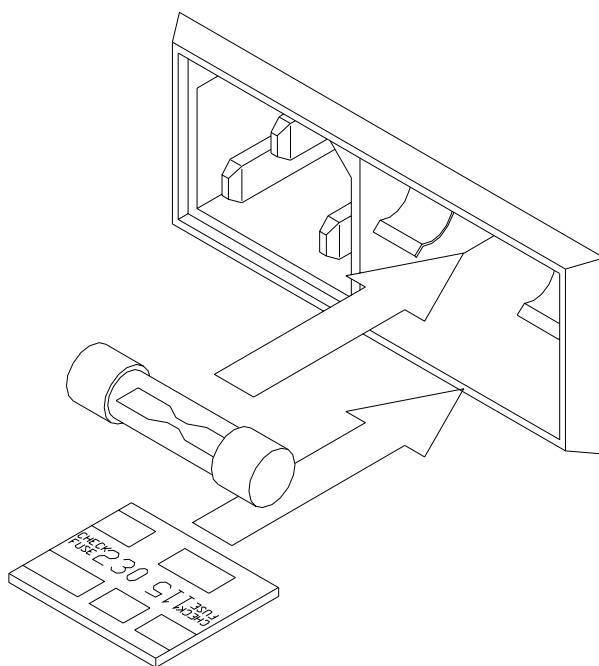


Figure 13: Setting mains supply voltage

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Please Contact your local sales office for accessories, technical assistance or information on product servicing.

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