Thermo Scientific Wellwash® AC

User Manual

Rev. 1.4

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Thermo SCIENTIFIC

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1 SAFETY SYMBOLS AND MARKINGS

These symbols are intended to draw your attention to essential information and alert you to the presence of hazards as indicated. Some of these symbols may not appear in the manual or on the product:

SAFETY SYMBOLS USED IN THE WELLWASH AC

Power ON

Power OFF

WARNING MARKINGS USED IN THE DOCUMENTATION

Caution: risk of electric shock.

Caution: biohazard risk.

Caution: risk of personal injury to the operator or a safety hazard to the surrounding area.

Caution: risk of damage to the instrument, other equipment or loss of performance or function in a specific application.

WEEE symbol This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC.

2 ABOUT THE USER MANUAL

This user manual has been written for the end user (for example, laboratory technician) and provides information on the Thermo Scientific Wellwash AC microplate washer. This manual contains the installation and operating instructions for the Wellwash AC microplate washer.

Read the manual in its entirety prior to operating the instrument.

This user manual has been designed to give you the information you need to:

- Review safety precautions.
- Install the Wellwash AC.
- Understand the Wellwash AC menus.
- Create or modify wash protocols.
- Run wash protocols using the Wellwash AC in routine jobs and research.
- Perform basic maintenance procedures.
- Troubleshoot the instrument performance.

This user manual also describes features and specifications of the Wellwash AC hardware and on-board software.

Chapter 6 ROUTINE OPERATION explains the washing, aspirating, dispensing and orbital shaking principles and procedures.

In Chapter 9 TROUBLESHOOTING GUIDE you will find explanations of error messages and a problem-solving guide. The user should be familiar with the contents of Chapter 7 on maintenance.

For warranty and ordering information refer to Chapters 10 WARRANTY CERTIFICATE and 11 ORDERING INFORMATION.

In an effort to produce useful and appropriate documentation, we appreciate your comments on this user manual to your local Thermo Fisher Scientific representative.

3 INTRODUCTION TO THE WELLWASH AC

There are two models of the Wellwash AC:

- 5161020 Wellwash AC, 100 – 240 V with 1 x 1 l Rinse, 2 x 2 l Wash and 1 x 4 l Waste bottles;
- 5161030 Wellwash AC Big Bottles, 100 – 240 V with 1 x 2 l Rinse and 2 x 4 l Wash bottles

The Wellwash AC Big Bottles model comes with a separate box containing a big waste bottle:

- 1093620 1 x 10 l Waste bottle

Both of these models can be configured to use stackers. Robotic integration is simple and effective with the Wellwash AC.

3.1 Intended use

The Wellwash AC microplate washer (*Fig. 3.1*) is intended for professional research use by trained personnel. The instrument is intended for automated washing, aspirating, dispensing and orbital shaking of microplates and strips in 96-well plate format. Use for self-testing is excluded.

3.2 Principle of operation

The Wellwash AC microplate washer is designed for both routine and research applications. For reliable performance, the highly effective twin-strip wash head traverses rapidly the stationary plate during washing. The LCD menu-driven program allows easy programming and display of wash parameters. The Wellwash AC has an integrated orbital shaker for efficient washing and reduced soaking times. The bottle module unit (BMU) includes two 2-liter primary wash bottles, a 4-liter waste bottle and a 1-liter rinse bottle that can also function as a wash buffer source. As an option big bottle sizes are available, refer to Chapters 3 INTRODUCTION TO THE WELLWASH AC and 11 ORDERING INFORMATION. The RS-232C serial port allows computer control and access to print instrument parameters. Refer to Section 4.2 Wellwash AC microplate washer.

Fig. 3.1 Wellwash AC microplate washer

3.3 Advantages of using the Wellwash AC

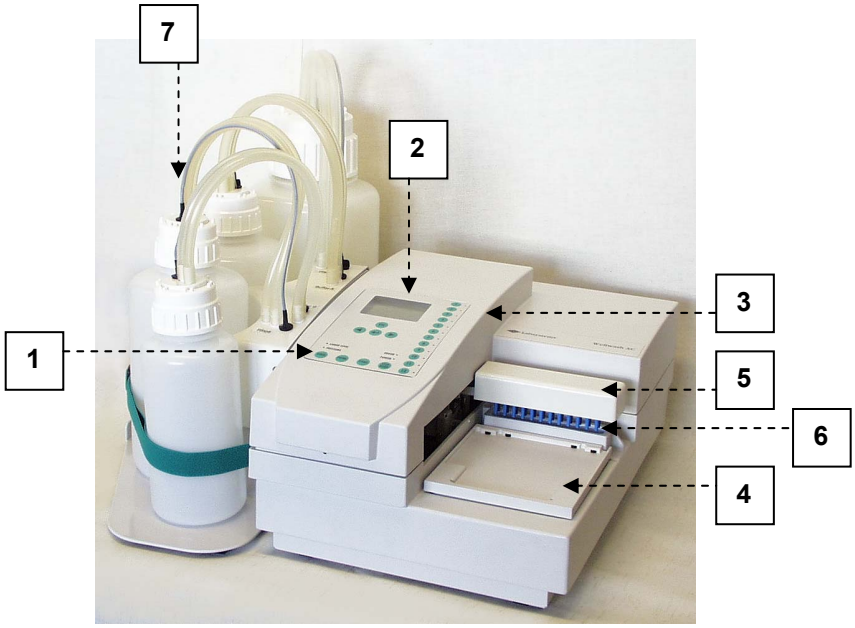
The Wellwash AC microplate washer provides several advantages relating mainly to the principle of operation in that it has/is:

- Robotic compatibility for additional capacity
- Superb washing performance and very low residual volumes for reliable results
- Easy to use with flexible programming
- Fully integrated orbital shaking for thorough washing and reduced soaking times
- A unique multibuffer module with fully automatic switching and purging of washing liquids
- A fast and reliable twin-strip wash head system

4 FUNCTIONAL DESCRIPTION

4.1 Instrument layout

4.1.1 Front view

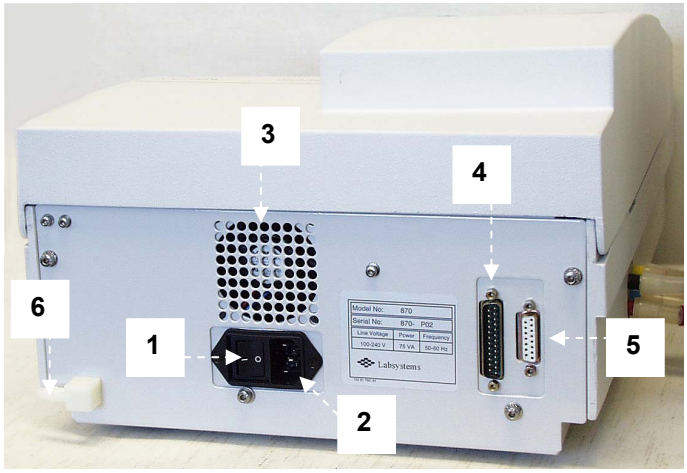


1. Keypad
2. Display
3. Cover
4. Plate carrier
5. Wash head holder with cover on
6. Prime trough
7. Bottle module unit (BMU)

Fig. 4.1 Wellwash AC front view with the cover closed

Fig. 4.2 Wellwash AC front view with the cover open

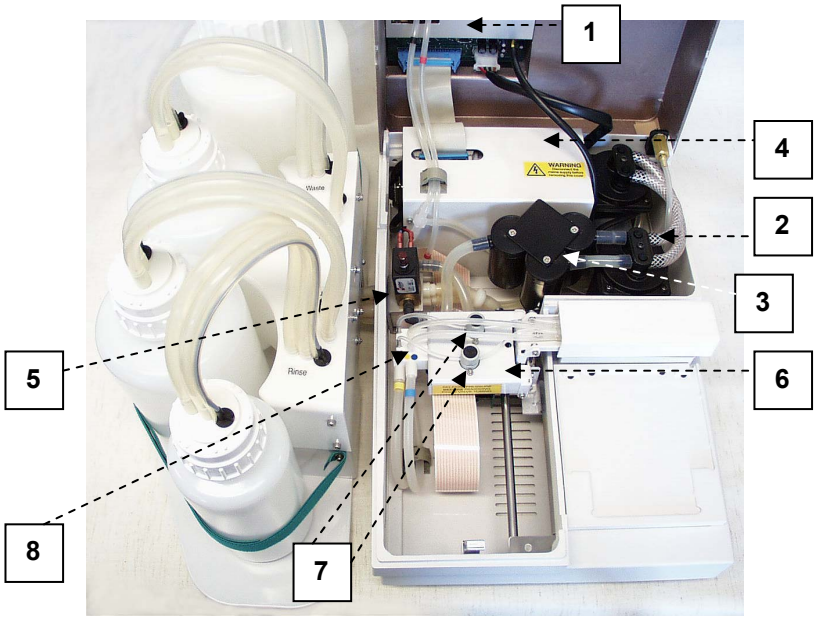
4.1.2 Back view



1. ON/OFF switch
2. Mains power supply socket
3. Cooling-air outlet
4. Serial port RS-232C
5. Connection cable to bottle module unit (BMU)
6. Exhaust vent

Fig. 4.3 Wellwash AC rear view

4.1.3 Internal view



1. Control PCB and tubing
2. Pump assembly
3. Silencer
4. Power package
5. Pressure transducer
6. Carriage
7. Pinch valves
8. Manifold

Fig. 4.4 Wellwash AC internal view

4.2 Wellwash AC microplate washer

The Wellwash AC microplate washer (*Fig. 4.5*) is designed to wash 96-well microplates or strips in 8 x 12 or 12 x 8 format. It is easy to program the twin-strip microplate washer that is provided with liquid level sensors for wash, rinse and waste bottles. The integrated orbital shaker and automatic rinsing and priming functions guarantee excellent washing performance. The Wellwash AC comes with two 2-liter primary wash bottles, a 1-liter rinse bottle and a 4-liter waste bottle. For robotic operation, the Wellwash AC Big Bottles, including two 4-liter primary wash bottles, a 2-liter rinse bottle and a 10-liter waste bottle, is available. Refer to Chapters 3 INTRODUCTION TO THE WELLWASH AC and 11 ORDERING INFORMATION.

The Wellwash AC is easy to program with a memory of up to 99 washing programs. A washing program can include up to four (4) protocols. These protocols can be complete washing protocols with all parameters needed for washing, including soaking and shaking or a separate aspirating, dispensing and orbital shaking protocol.

Interchangeable wash heads allow for 1 x 8, 2 x 8, 1 x 12 and 2 x 12-way processing of a microplate (*Fig. 4.6*).

The washer consists of two main components: the washer unit (washer), and the bottle module unit (BMU). The two units are connected by a single multi-way cable and several push-on pipe connections.

Operation and programming is controlled through a membrane keypad and graphic display on the top cover of the washer.

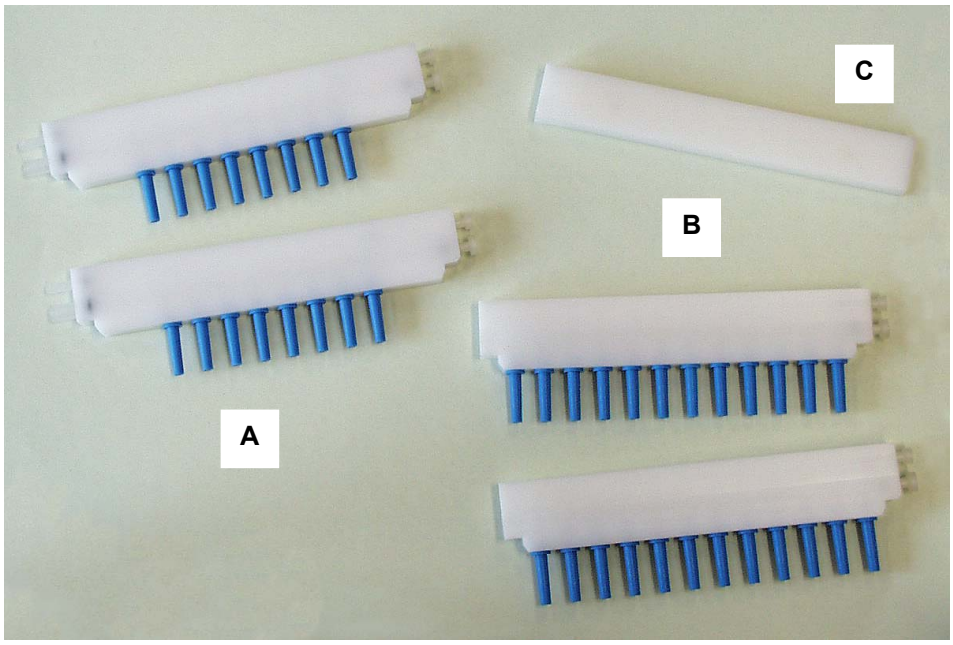
The main principle of washing is that in any particular washing program the wells of a microplate will first be emptied and then filled with wash liquid. Washing will be performed to include as many cycles as programmed. During a programmed soaking time between different washing cycles, the microplate shakes automatically if shaking has been programmed.

The washer functions as follows. The microplate to be washed is placed onto the plate carrier of the Wellwash AC (*Fig. 6.3 – Fig. 6.4*), which is held still during wash operations. The wash heads held in the cradle of the Wellwash AC travel across the top of the well of the first selected strips of a microplate. Aspiration is performed during the time when the wash heads are being lowered into the wells. After the wells are empty, the wash heads dispense washing liquid into the wells. The wash heads move on to the next selected strips to perform the same operation. When the whole plate has been washed, the plate will shake if shaking has been programmed during soaking time. After the soaking time, the wash heads move to the first selected strip again and the previous steps will be performed with as many cycles as programmed.

The dispense method is a pressurized system with flow control through two pinch valves. Aspiration is through vacuum. Orbital shaking is achieved by mounting the plate carrier on eccentric pins, which then spin. Refer to *Fig. 7.3*.

Fig. 4.5 Wellwash AC microplate washer

The wash head alternatives used and supplied are shown below (*Fig. 4.6*). For more information on wash heads and ordering information, refer to Section 5.2.4 How to install or change wash heads and 6.3.6.4 How to clean wash heads and Chapter 11 ORDERING INFORMATION.



A 2 x 8-Way wash heads
B 2 x 12-Way wash heads
C 1 x Blank head

Fig. 4.6 Interchangeable wash heads

The keypad and display are essential parts of the washer. The keypad allows the user to communicate with the washer by entering commands and alphanumeric characters. For more information on the keypad and display, refer to Sections 6.2 How to use the keypad and display, 6.2.1 Control panel keys and 6.2.2 Control panel indicators.

Fig. 4.7 Wellwash AC keypad and display

5 INSTALLATION

5.1 What to do upon delivery

5.1.1 How to unpack

Move the unpacked instrument to its site of operation. Unpack the Wellwash AC instrument and accessories carefully with the arrows on the transport package pointing upwards. The following notes and instructions are sent with the instrument and are immediately available when you open the package:

- the Warranty Certificate card
- the packing instructions/packing list, and the
- *Wellwash AC User Manual*.

CAUTION DO NOT touch or loosen any screws or parts other than those specially designated in the instructions. Doing so might cause misalignment and will invalidate the instrument warranty.

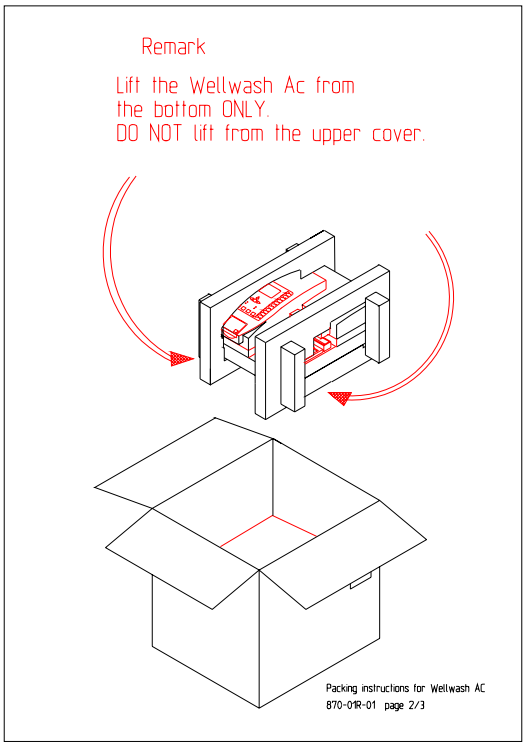


Fig. 5.1 Unpacking the Wellwash AC

1. The Wellwash AC is packed in a single box. However, the 10 l waste bottle for the Wellwash AC Big Bottles model comes in a separate box.
2. Place the box on the floor and open the top.
3. Remove the washer that is in styrox transportation supports. The washer is lifted out of the box by holding the transportation supports.

4. Remove the transportation supports and polythene wrapping and place the washer onto a laboratory bench with the rear facing front. Lift the washer from the bottom of the Wellwash AC. **DO NOT lift the washer by the cover** (*Fig. 5.1*). To lift or relocate the instrument, put your fingers under the bottom on either sides and lift it with your back straight.
5. Remove the inner box and the bottle module unit (BMU) from the inner box.
6. Then place the BMU along the *left* hand side of the washer.
7. Open the accessory pack and remove the wash heads (two pieces each of 1 x 8-way and 1 x 12-way wash heads). The accessory pack is located in the inner box with the BMU.

Retain the original packaging and packing material for future transportation. The packaging is designed to assure safe transport and minimize transit damage. Use of alternative packaging materials may invalidate the warranty. Also retain all instrument-related documentation provided by the manufacturer for future use.

5.1.2 Checking delivery for completeness

Check the enclosed packing list against order. If any parts are missing, contact your local Thermo Fisher Scientific representative or Thermo Fisher Scientific Oy.

5.1.3 Checking for damage during transport

Visually inspect the transport package, the instrument and the accessories for any possible transport damage.

If the carton has been damaged in transit, it is particularly important that you retain it for inspection by the carrier in case there has also been damage to the instrument.

Neither the manufacturer nor its agents can be held responsible for any damage incurred in transit, but the manufacturer will make every effort to help obtain restitution from the carrier. Upon receipt of the carrier's inspection report, arrangements will be made for repair or replacement.

Visually check all interconnections in the basic instrument. Check that there are no loose parts inside the instrument.

If any parts are damaged, contact your local Thermo Fisher Scientific representative or Thermo Fisher Scientific Oy.

5.1.4 Environmental requirements

When you set up your Wellwash AC, avoid sites of operation with excess dust, vibrations, strong magnetic fields, direct sunlight, draft, excessive moisture or large temperature fluctuations.

- Make sure the working area is flat, dry, clean and vibration-proof and leave additional room for cables, lids, wash, rinse and buffer bottles, etc.
- Make sure the ambient air is clean and free of corrosive vapors, smoke and dust.
- Make sure the ambient temperature range is between +10°C (50°F) and +40°C (104°F).
- Make sure relative humidity is between 10% and 90% (non-condensing).

Leave sufficient space (at least 10 cm) on both sides and at the back of the unit to allow adequate air circulation.

The Wellwash AC does not produce operating noise at a level that would be harmful. No sound level measurements are required after installation.

WARNING DO NOT operate the instrument in an environment where potentially damaging liquids or gases are present

5.1.5 Things to avoid

DO NOT smoke, eat or drink while using the Wellwash AC. Wash your hands thoroughly after handling test fluids. Observe normal laboratory procedures for handling potentially dangerous samples. Use proper protective clothing. Use disposable gloves. Be sure the working area is well-ventilated.

Never spill fluids in or on the equipment.

5.1.6 Technical prerequisites

Place the instrument on a normal laboratory bench. The net weight of the entire equipment is approx. 13 kg (28.8 lbs.) – washer unit 9.5 kg (21.1 lbs.) and bottle module unit 3.5 kg (7.7 lbs.).

The instrument operates at voltages of 100 – 240 Vac and a frequency range of 50/60 Hz.

5.2 Setups before you put the instrument into operation

5.2.1 How to release the transport locks

1. Open the cover with the 2.5 mm hexagonal screwdriver supplied. To facilitate opening the cover, lift the cover up gently while you insert the cover opening/closing tool into the small aperture (*Fig. 5.2*). **Warning** The cover cannot be opened or closed without a tool.

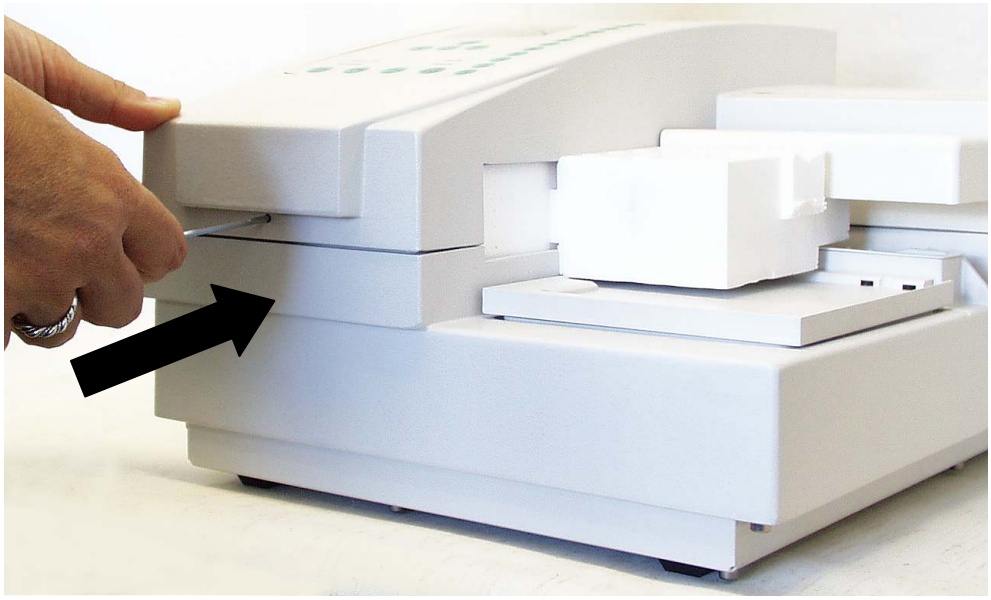


Fig. 5.2 Opening/Closing the cover

2. Ensure the transport locks (*Fig. 5.3*), i.e., styrox piece and pinch valve holders, have been released before you put the instrument into operation (*Fig. 5.4 – Fig. 5.7*).

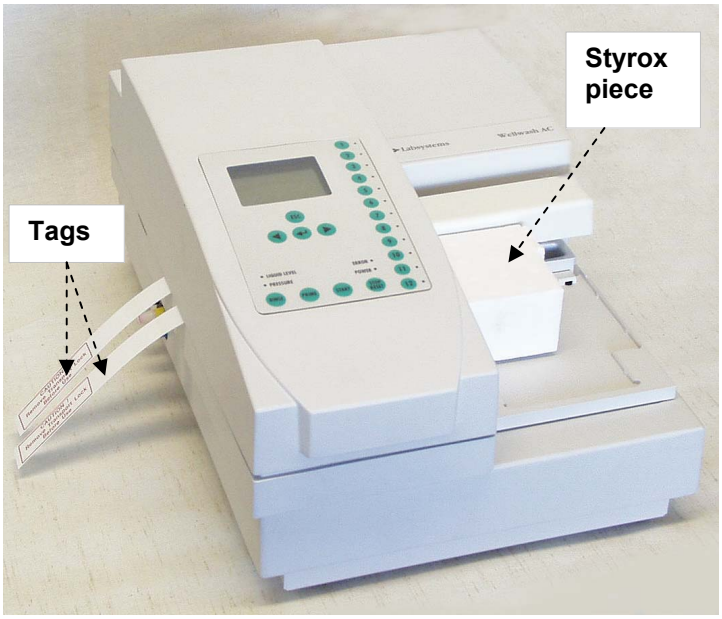


Fig. 5.3 Location of the Wellwash AC transport locks

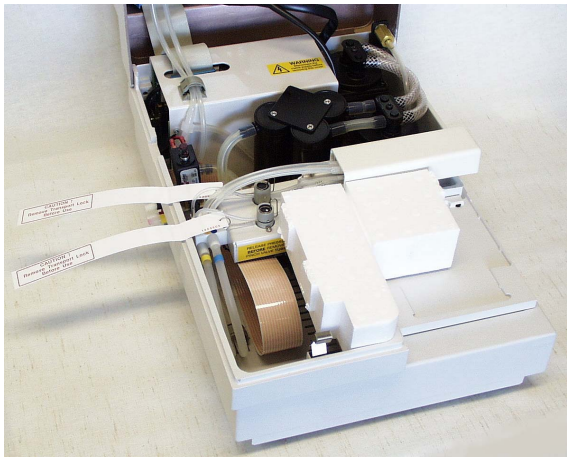


Fig. 5.4 Both transport locks unreleased

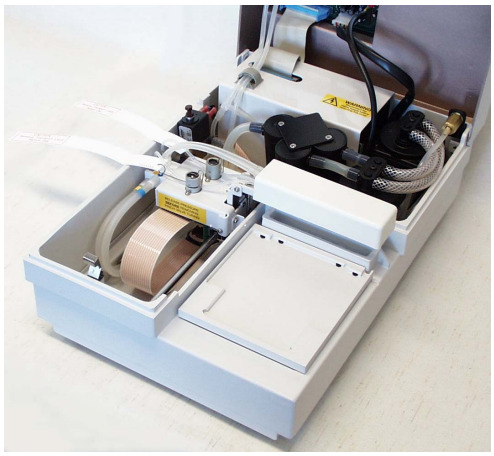


Fig. 5.5 Styrox piece removed

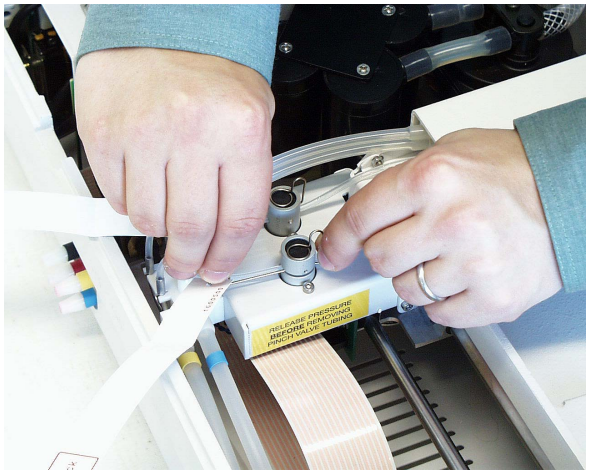


Fig. 5.6 Release of the pinch valves

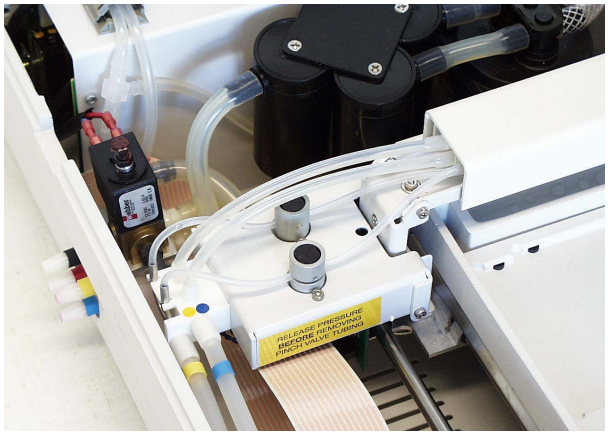


Fig. 5.7 With the transport locks released

3. Save both of them and the pinch valve holders until needed for future transportation of the instrument.

   Note The pinch valve holders can also be used on a more regular basis to keep wet tubing from being flattened/squashed when shutdowns of longer than several days occur.

4. Close the cover of the washer with the 2.5 mm hexagonal screwdriver supplied. To facilitate closing the cover press the cover down gently, while you insert and press the tool into the aperture (*Fig. 5.2*).

5.2.2 How to ensure startup

1. **WARNING** Ensure the mains switch (see *Fig. 4.3*) on the bottom of the back panel is in the OFF position.

2. Connect the mains supply cable to the mains power socket (*Fig. 5.8*) at the bottom of the back panel. If you need to use any other type of mains supply cable than supplied, use only cables certified by the local authorities.

3. Connect the instrument to a correctly installed line power outlet that has a protective conductor that is grounded.

WARNING Never operate your instrument from a power outlet that has no ground connection. Never use a power cable other than the power cable provided by Thermo Fisher Scientific and designed for your region.

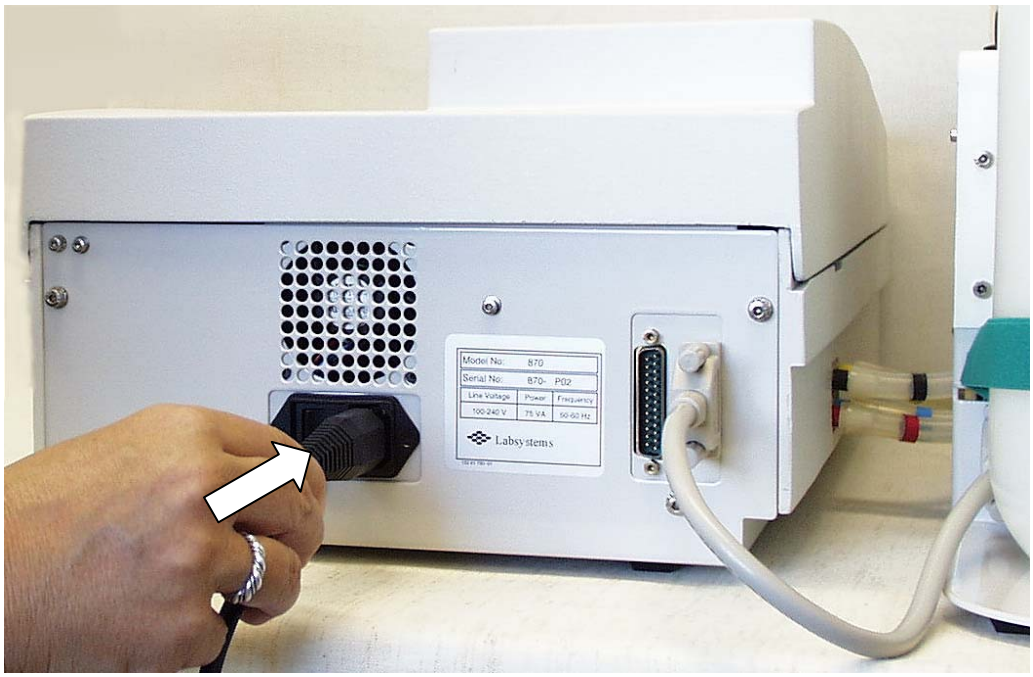


Fig. 5.8 Connecting the mains supply cable

5.2.3 Installation procedure

The following procedure may be carried out by any suitably skilled person using standard tools.

1. Check the location and OFF position of the mains switch and the location of the bottle module unit (BMU) connection cable. Note the exhaust vent must not be obstructed. Refer to *Fig. 4.3*.

WARNING DO NOT connect or disconnect the BMU connection cable while the Wellwash AC is switched on.

2. Turn the washer to face with the front forward and place the bottle module unit (BMU) approx. 5 cm to the left of the washer so that the front edges are aligned.

3. Connect the pressure/aspirate and vacuum tubing from the BMU to the washer unit (see *Fig. 5.9*). All tubes and connections are color coded to ensure correct connection. The color code is as follows:

■	**Black**	Air pressure feed from the washer to the BMU
■	**Yellow**	Wash liquid feed or reagent feed from the BMU to the washer
■	**Red**	Vacuum feed from the pump unit to the waste bottle
■	**Blue**	Waste feed from the wash head to the waste bottle

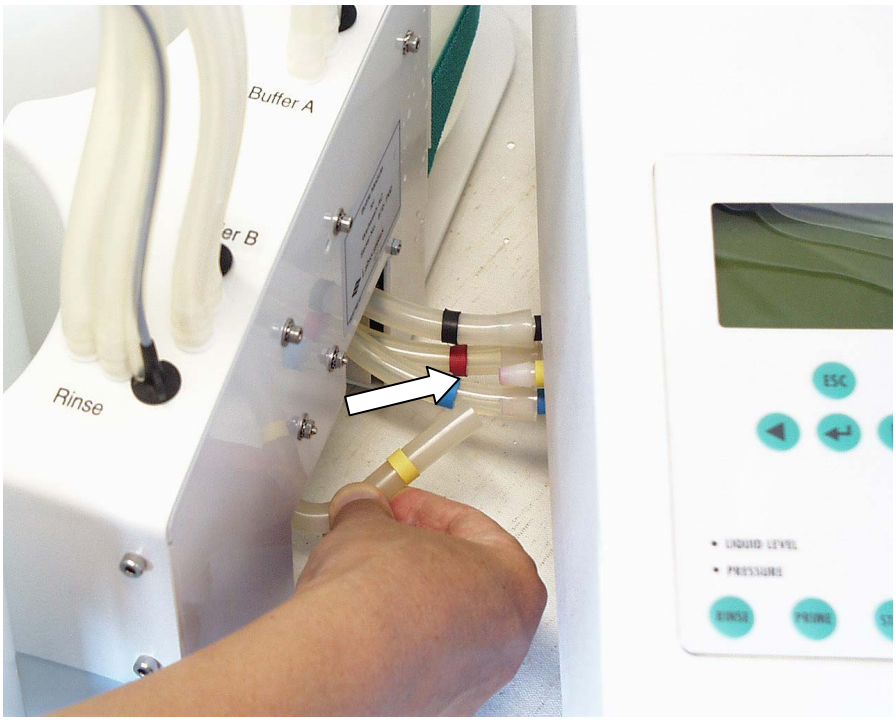


Fig. 5.9 Connecting the tubing from the BMU to the washer unit

5. Check that the transport locks, i.e., styrox piece and pinch valve holders, have been removed. Connect the cable from the BMU to the matching connector on the back panel on the right hand corner (*Fig. 5.10*). Place the BMU along the side of the washer. Ensure that the tubing between the units is not twisted.

6. The instrument is supplied with two 8-way heads fitted, which should be used during this installation phase. The instrument is also supplied with two 12-way heads and one blanking head. Refer to Section 5.2.4 How to install or change wash heads.

7. Close the cover of the washer with the 2.5 mm hexagonal screwdriver supplied. To facilitate closing the cover press the cover down gently, while you insert and press the tool into the aperture (*Fig. 5.2*).

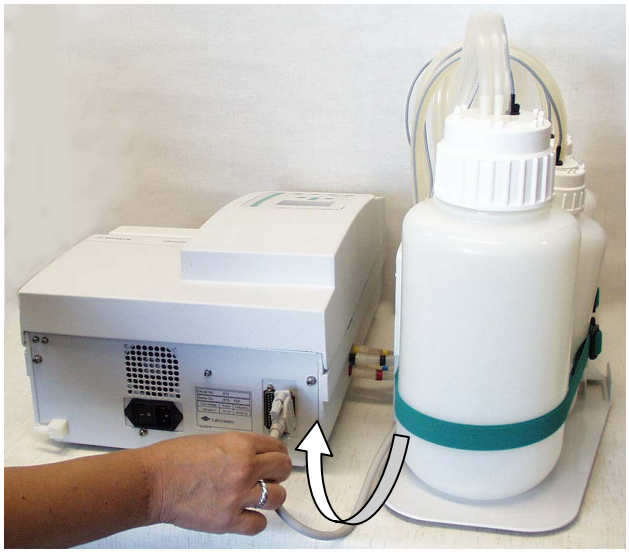


Fig. 5.10 Connecting the bottle module unit (BMU) cable to the washer unit

8. Ensure that the plug mates correctly with the bottle insert (*Fig. 5.11 – Fig. 5.13*).

Fig. 5.11 Mating the plug with the bottle insert

Fig. 5.12 Reconnecting the bottle cap

Fig. 5.13 Tightening the bottle cap

9. Familiarize yourself with the quick-release cap. **Push** the black liquid level **sensor and** the **tubing all the way down** (*Fig. 5.14 – Fig. 5.16*).

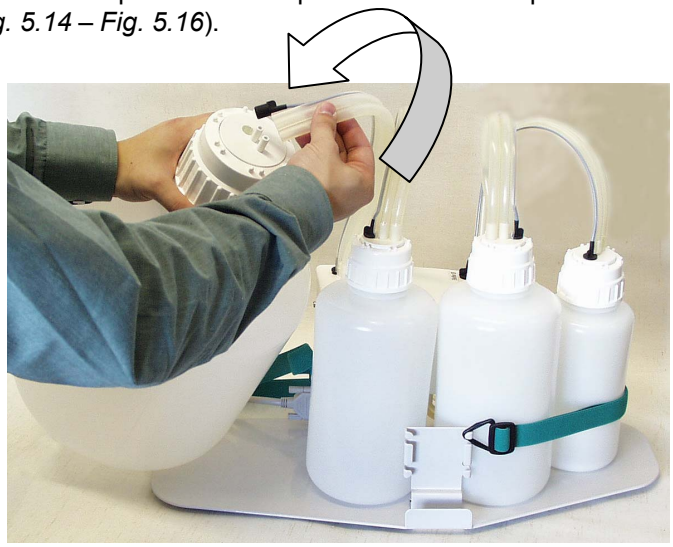


Fig. 5.14 Connecting the liquid level sensor and the tubing to the cap

Fig. 5.15 Inserting the liquid level sensor and the tubing

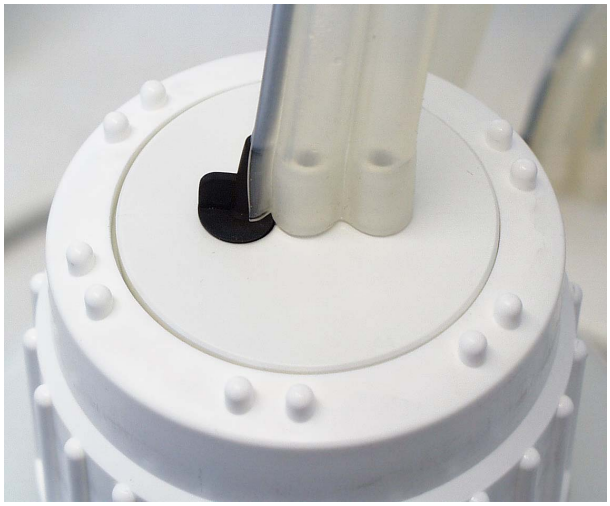


Fig. 5.16 Liquid level sensor and tubing connected to the quick-release cap
NB the correct positions.

10. Ensure that the bottles are secured with the straps. Adjust the straps if necessary (*Fig. 5.17 – Fig. 5.19*).

Fig. 5.17 Adjusting the strap

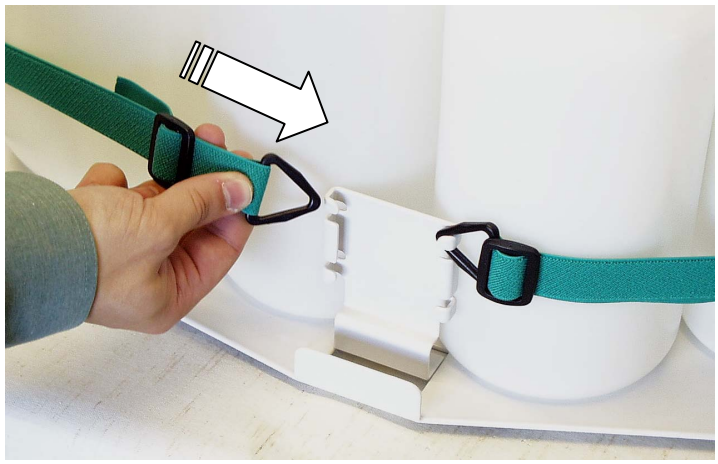


Fig. 5.18 Attaching the strap to the adjustment piece

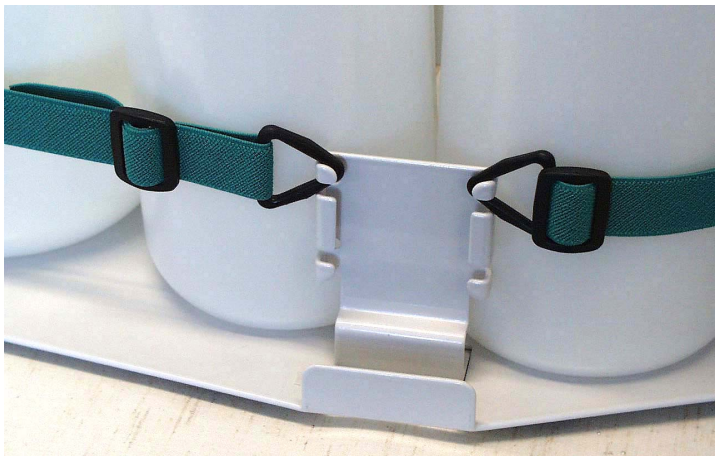


Fig. 5.19 Bottles secured with the straps

11. Note that the adjustment piece of the bottle module unit (BMU) has to be readjusted if you use, for example, a 10 l waste bottle instead of the 4 l one (*Fig. 5.20* – *Fig. 5.21*). Use a hexagonal screwdriver for readjusting the BMU adjustment piece. Move the adjustment piece down.

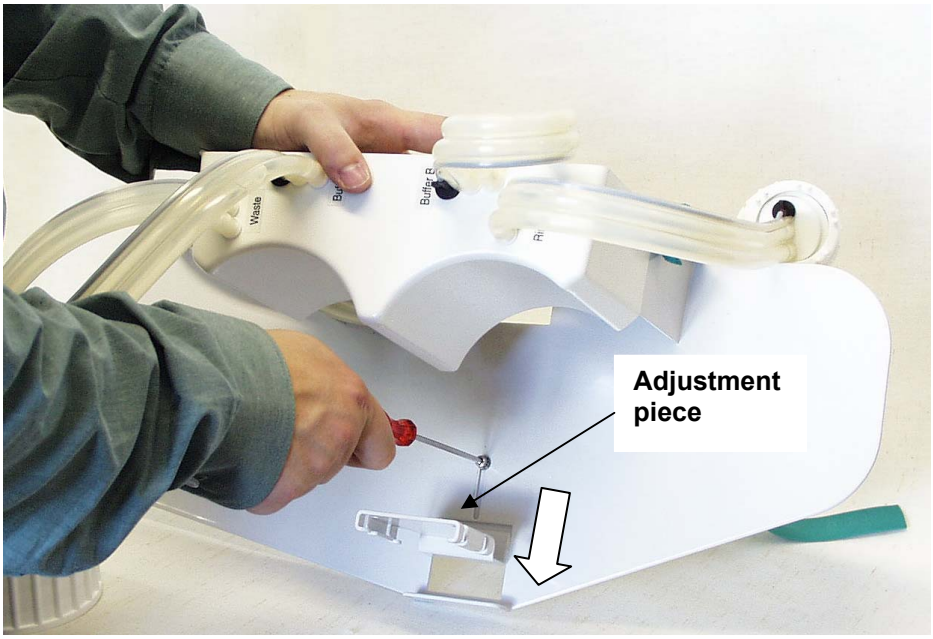


Fig. 5.20 Readjusting the BMU adjustment piece for a big bottle or big bottles

Fig. 5.21 BMU adjustment piece readjusted for a big bottle

12. Ensure that the washer mains switch is in the OFF position. Connect the mains plug to the mains power socket (*Fig. 5.8*). If a suitable mains supply cable is not provided, use only cables or adapters certified by the local authorities. Connect the instrument to a correctly installed line power outlet, which has a protective conductor that is grounded.

5.2.4 How to install or change wash heads

- The 'Change head' routine found in the menu **SETUP↵MAINTAIN↵HEADS↵** should be run and followed closely. The routine will clear the lines of liquid first by rinsing them and then by purging them with air.
- The program will prompt the user to change the wash head. The user must then enter the new wash head configuration before the routine can finish. This provides the instrument with a record of the head configuration installed. This is then used to check for program mismatches.
- Once the head configuration has been changed, check the wash programs and modify accordingly.

Install a new wash head as follows:

1. First open the cover of the instrument with the 2.5 mm hexagonal screwdriver supplied (*Fig. 5.2*).

2. Remove both the pinch valve holders before use. Refer to *Fig. 5.6*.

3. Store the pinch valve holders for future use.

4. Fit the wash heads to the tubing according to *Fig. 5.22*. Note the difference in sizes. Pay attention to corresponding tubes and holes. The larger thicker tube is the aspiration (waste) tube, while the smaller tube is the dispensing tube. Check that the smaller thinner tube goes through the pinch valve before you connect it to the wash head. Apply silicone grease to the O rings of the tubes if necessary. Also note that the wash heads are packed separately and must be installed before use.

Fig. 5.22 Fitting the 1 x 12-way wash head to the tubing

5. Fit the wash heads next to each other onto the wash arm (*Fig. 5.23*). See the next page.

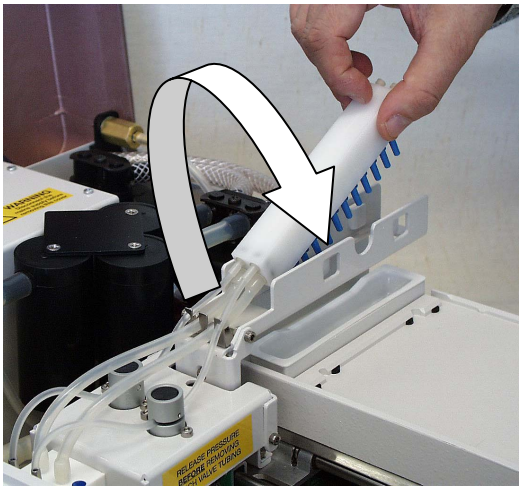


Fig. 5.23 Fitting the 2 x 12 wash heads next to each other onto the wash arm

6. Check that the wash heads are evenly inserted (*Fig. 5.24*).

Fig. 5.24 2 x 12 wash heads evenly inserted

7. Put the cover of the wash heads back on again by fitting it onto the wash arm and pushing it forward to the end position (*Fig. 5.25*). If you intend using the instrument with robots, remove the wash head cover.

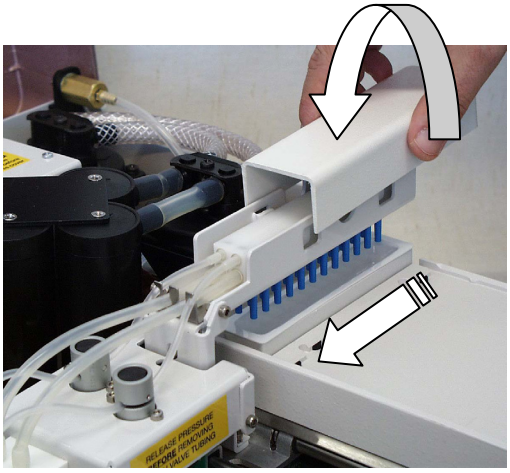


Fig. 5.25 Fitting the wash head cover back on again

8. Ensure that the wash heads are in the correct order.

9. Close the cover of the washer with the 2.5 mm hexagonal screwdriver supplied. To facilitate closing the cover press the cover down gently, while you insert and press the tool into the aperture (*Fig. 5.2*).

Note **If only one head (1 x 8 or 1 x 12) is to be used, the user has to remember to place the Blank head in the rear position (*Fig. 5.26*).**

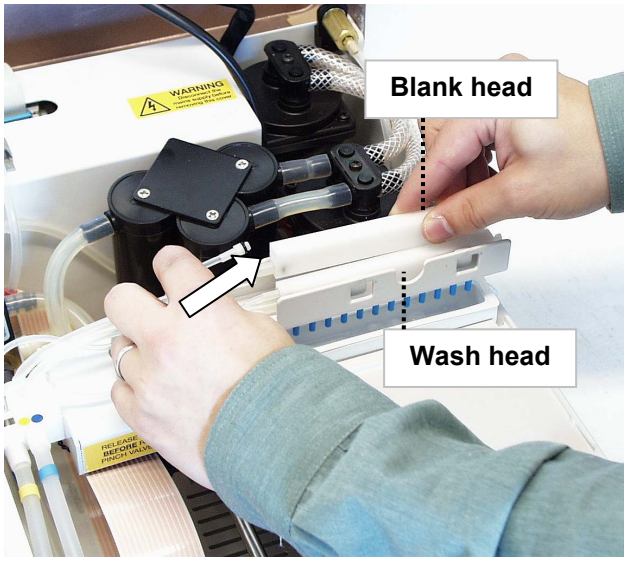


Fig. 5.26 Fitting the blank head to the rear position

10. Always ensure that the thinner dispensing tubes are correctly positioned in the pinch valves. Refer to *Fig. 5.27 – Fig. 5.28*.

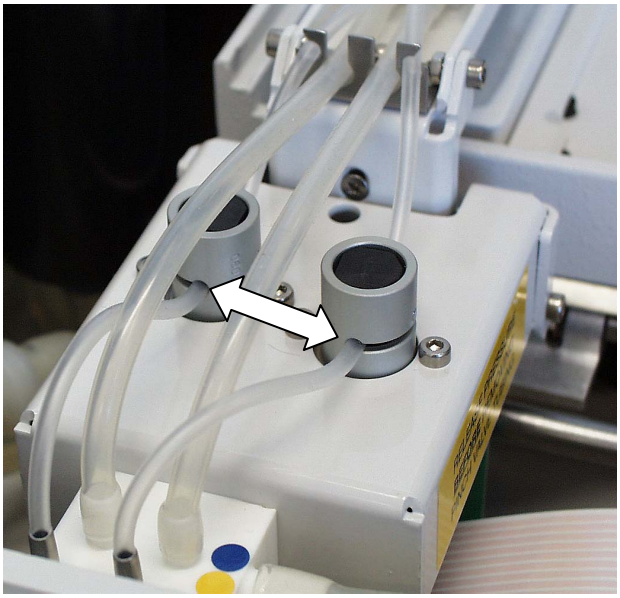


Fig. 5.27 Correct position of the dispensing tubes in the pinch valves (from the left)

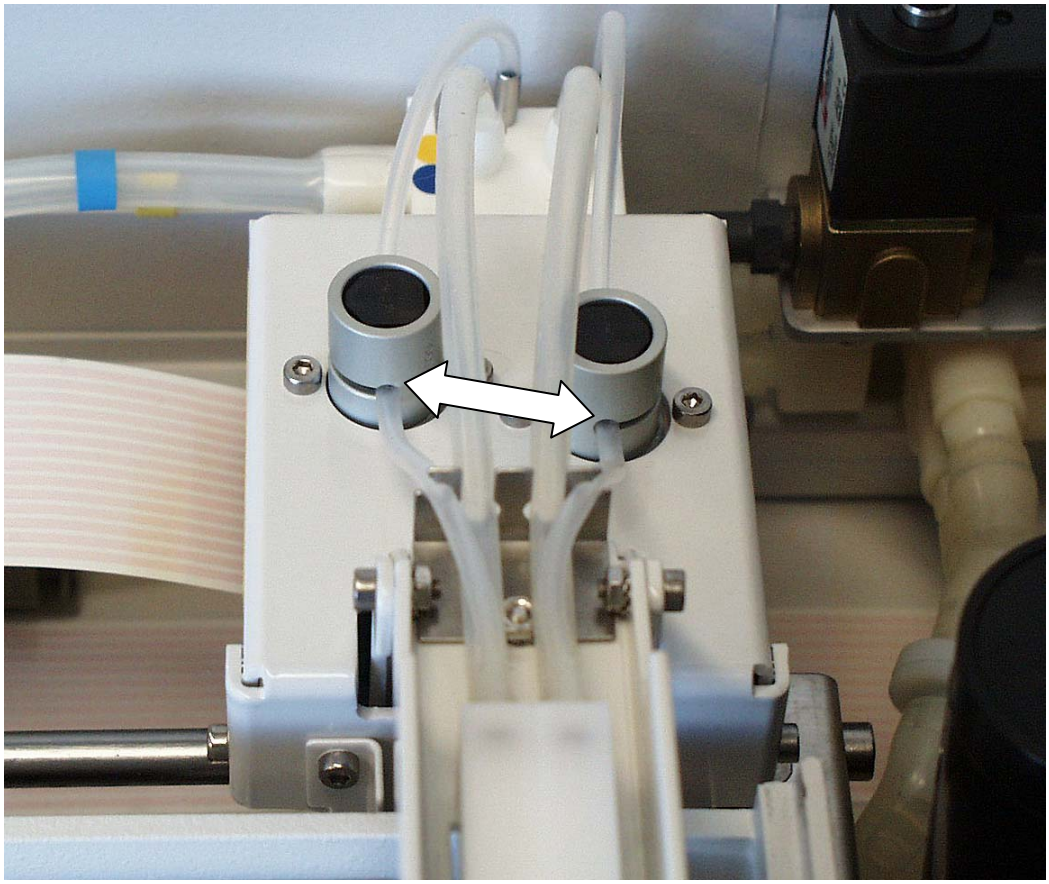


Fig. 5.28 Correct position of the dispensing tubes in the pinch valves (from the right)

5.3 Operational check

The following procedure should be completed to confirm the correct functioning of the washer prior to normal use. **DO NOT fill the bottles yet.**

Note Switch the washer unit off before opening any bottle caps! DO NOT unscrew the cap of a bottle with the pump running as this might release residual pressure.

For more information on the keypad and display, refer to Sections 6.2 How to use the keypad and display, 6.2.1 Control panel keys and 6.2.2 Control panel indicators.

5.3.1 Power on

- Close the cover with the 2.5 mm hexagonal screwdriver supplied. To facilitate closing the cover press the cover down gently, while you insert and press the tool into the aperture (*Fig. 5.2*).

- Ensure the backlight of the LCD is turned on. Immediately after that the software version of the program momentarily flashes on the display. Then the wash head, carriage and plate carrier will move into their home positions, respectively, i.e., the motions appear in the order stated. Note that the wash head will move only very slightly in the vertical or horizontal direction if it is not far away from its home position. After this the work menu is displayed.

5.3.2 Rinse (Dry) check

1. Turn the empty RINSE bottle upside down. This action will prompt the instrument to believe that there is liquid in the RINSE bottle.

2. Press the RINSE key. The pump will start working. Then turn the RINSE bottle back to its normal upright position.

3. The washer will first bring the air purge online and perform a rinse cycle whereby rinse liquid is flushed into the prime trough. The wash head is automatically lowered and the pinch valve is opened for a short time before returning to the rest position. The valve will then select RINSE and repeat the cycle. Air will be blown through the tips when the pinch valve(s) opens/open, which can be heard quite clearly.

4. If all functions well, then proceed. Otherwise see Chapter 9 TROUBLESHOOTING GUIDE.

5.3.3 Row selection check

1. First select a ready-made program, for example, No. 9. Refer to Section 6.3.3 SELECT menu.

2. Then select the rows to be washed by pressing the appropriate key, for example, '12'. Refer to Section 6.2.1 Control panel keys. When the key is pressed for the first time, only the corresponding indicator will light up, which means that only row 12 is to be processed.

3. After that press the key again to illuminate all the rows including the one pressed, which indicates that all the rows will be processed.

4. Press STOP/RESET twice to motion home and clear the row selection.

5. Reselect 12 rows.

6. If all functions well, then proceed. Otherwise see Chapter 9 TROUBLESHOOTING GUIDE.

5.3.4 Run check

- First select a ready-made program, for example, No. 9.

- Then press the START key. The instrument will check the operation of the system, for example, motions and power failure.

- Since there is no liquid in the BUFFER A bottle, the error message 'BUFFER A LOW, START TO CONTINUE, ESC TO QUIT' will appear. When you press START, the washer will select buffer A, prime the system and start washing the plate three times row by row. In Plate mode, the wash head will travel three times over the plate and then return to home position.

- If all functions well, then proceed. Otherwise see Chapter 9 TROUBLESHOOTING GUIDE.

5.4 Operating precautions and limitations before operation

1. Read this manual in its entirety, as it contains information necessary to ensure safe operation.

2. Always ensure that the electrical supply in the laboratory conforms to that specified on the rating label on the rear of the instrument.

3. Particular attention should be paid to the correct fitting of the tubing – follow the color code carefully.

4. Fill the wash and rinse bottles only after installation and operational check of the system. **Switch the washer unit off before opening any bottle caps.** The cap of a bottle should not be unscrewed with the pump running as this might release residual pressure.

5. Check that the correct program has been selected for the washer to follow.

6. Check that the wash liquids are put in the correct containers called for by the program.

7. Check that there is sufficient liquid in the wash bottle and room in the waste container to run the program or series of programs. Empty the waste bottle *before* a run or a series of runs. The liquid level sensor will warn you if safe levels have been passed. Some warnings can be overridden – *at the user's risk*.

8. Check that the wash head configuration matches the configuration called for by the program. For example, if 2 x 12-way heads have been fitted and the program calls for a 1 x 8-way head, this may result in the plate carrier getting wet.

9. Fit the microplate in the correct orientation appropriate for the wash head configuration. Note that *if you do not load a microplate correctly* onto the instrument (for example, a 12-way wash head has been fitted when a plate is loaded for an 8-way head), *this will result in the plate carrier getting wet*.

10. Select the number of rows to be processed correctly, or where strips are missing from the row to be washed.

5.5 Initialization check list

Tick	*Item*
❑	Unpack the Wellwash AC instrument, and the 10 l waste bottle if ordered. Refer to *5.1.1*. Retain the original packaging and packing material for future transportation.
❑	Check the delivery for completeness. Refer to *5.1.2*.
❑	Check for damage during transport. Refer to *5.1.3*.
❑	Place the washer and the bottle module unit (BMU) on a normal laboratory bench taking into account both the environmental and technical prerequisites. Refer to *5.1.4* and *5.1.6*. Leave sufficient clearance on both sides and at the rear of the unit.
❑	Release the transport locks, i.e., the styrox piece and pinch valve holders. Refer to *5.2.1*. The pinch valve holders can be used regularly for keeping wet tubing from being flattened.
❑	Connect the pressure/aspirate and vacuum tubing from the BMU to the washer unit according to the color code used. See *Fig. 5.9*. Refer to 5.2.3.
❑	Connect the BMU cable to the washer unit. See *Fig. 5.10*. Refer to *5.2.3.*

Tick	*Item*	*Continued*

❑ Connect the mains supply cable to the mains power socket. See *Fig. 5.10*. Refer to *5.2.3* and *5.2.2*.

❑ Familiarize yourself with the quick-release bottle caps. Refer to *5.2.3*. Reconnect the bottle caps if necessary. Ensure that the plug mates correctly with the bottle insert. See *Fig. 5.11*. Push the liquid level sensor and tubing connected to the quick-release cap all the way down according to *Fig. 5.16*.

❑ Adjust the straps if necessary. See *Fig. 5.17* to *Fig. 5.20*. Refer to *5.2.3*.

❑ Open the accessory pack and remove the wash heads supplied with the instrument (two pieces each of 1 x 8-way and 1 x 12-way wash heads). The accessory kit, *Fig. 7.4*, contains the blank head. Install the wash heads according to Section *5.2.4*. **If only one head is to be used, the user has to remember to place the Blank head in the rear position (***Fig. 5.26***).** Insert the wash heads evenly, see *Fig. 5.24*.

❑ Carry out the operational check according to Section *5.3*. **DO NOT fill the bottles yet.**
Note Switch the washer unit off before opening any bottle caps. The cap of a bottle should not be unscrewed with the pump running as this might release residual pressure. Fill the bottles only after installation and operational check of the system, refer to Section *6.5.1*.

❑ Familiarize yourself prior to operation with Section *5.4*.

❑ Empty the waste bottle just in case before a run or a series of runs.

❑ Check that the wash head configuration matches the configuration called for by the program. Refer to Sections *5.2.4*, *6.3.4.3.1* and *6.3.6.3*.

❑ Place the microplate correctly onto the plate carrier. Refer to Section *6.5.6*. Fit the microplate in the correct orientation appropriate for the wash head configuration.

❑ Read the user manual prior to routine operation to familiarize yourself with the use of the keypad and display (6.2), entering a password (*6.2.3*), programming (*6.3*), how to select programs (*6.3.3*) or demosessions (*6.3.3.1*), how to create a program (*6.3.4.1*) or a linked program (*6.3.4.2*), how to create a wash protocol (*6.3.4.3.1*), etc. A program may contain max. four protocols.

❑ For startup, refer to Sections *5.2.2*, *6.1*, *6.4* and *6.5*.

6 ROUTINE OPERATION

6.1 Switching on

Power ON/OFF switch
This two-position switch at the rear of the washer controls the electrical power to both the washer and the bottle module unit (BMU). The BMU is powered by the low voltage supply from the washer.

6.2 How to use the keypad and display

The keypad has an embossed, tactile membrane with 20 keys. The display is a 8 x 21 character graphic dot-matrix LCD module. There are 16 control panel indicators (LEDs) in all. Refer to Sections 6.2.1 Control panel keys and 6.2.2 Control panel indicators. Press the corresponding control panel key or indicator.

The keypad and display are shown in *Fig. 6.1*.

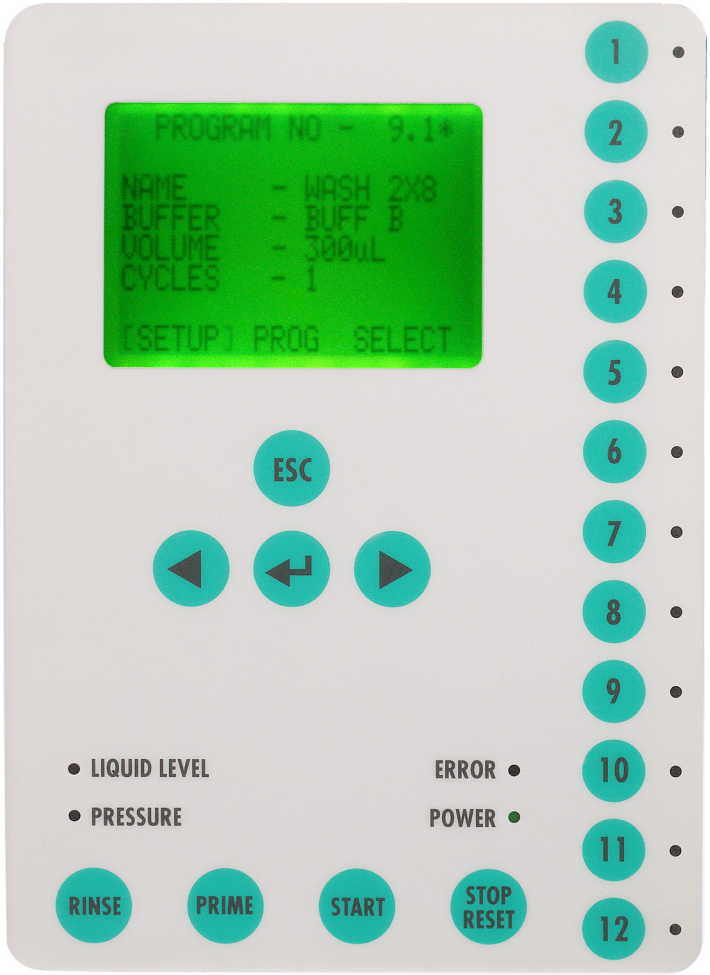


Fig. 6.1 Wellwash AC keypad and display

The display shows the current program and its main parameters.

6.2.1 Control panel keys

1 – 12 The line of keys numbered 1 to 12 are the **row entry keys** and serve various purposes depending on the instrument's mode. The adjacent indicator LED illuminates to confirm entry once the row selection has been made. See Section 5.3.3 Row selection check for detailed operation. In certain modes the keys are used to select from the menu options shown on the display or to select a wash program number from the internal memory.

RINSE Initiates a rinse routine, which will firstly purge the line from the bottle module unit (BMU) to the wash head with air and then put liquid from the rinse bottle online. The rinse liquid will remain online if another rinse is required.
Used to empty the prime trough when it has been filled for some reason or another, for example, when the user has contrary to instructions stopped liquid handling operations by pressing the STOP/RESET key.

PRIME To prime the system with the liquid specified by the first protocol of the currently displayed wash program.

START Runs the program shown on the display.

STOP/RESET **This key has a different effect depending on the washer status**.
If a program is running, the effect will be to halt the run and reset the washer to its rest state (idle).
When the instrument is in the rest state, the first press moves the wash head to home position and the second press clears the row selections.

< > The **arrow keys** move the pointers (flashing square brackets) to scan through the options on that level of the menu tree.
An arrow on the bottom line of the display indicates that there are more options in that direction.
When you program wash protocols, the arrows will show the alternatives you may select.

ESC Brings back the previous level of the menu tree or steps back to the previous parameter option. See the menu tree showing the various levels and parameters below. Brings up more of the parameters for the first protocol of the current program.

↵ The **ENTER** (↵) **key** selects the appointed option and may display another set of options or parameters. This selection sequence may be repeated several times to get to the desired parameter.

The above-mentioned arrow keys, ESC key and the ENTER key are called **program keys** and are used for navigating through the menu options shown on the bottom line of the display.

6.2.2 Control panel indicators

1 – 12

The **yellow** LEDs show, which rows have been selected.
See the row entry key functions in Sections 5.3.3 Row selection check and 6.2.1 Control panel keys.

LIQUID LEVEL

The **red** LED shows an error when either the wash liquid or the waste level or the bottle module unit (BMU) cable has triggered the sensor in the respective bottle(s).

PRESSURE

The **red** LED shows an error in either the pressure or vacuum levels of the bottles. This is active when the pump is running.

ERROR

The **red** LED shows when the washer has some other kind of error.
The display will indicate the type of error and the course of action to take.

POWER

The **green** LED indicates that the washer is powered.

6.2.3 How to take security measures (Password)

The first eight programs (#1,.., #8) of all 99 possible user programs are password protected. The purpose of this protected memory area is to ensure that programs placed here cannot later be accidentally tampered with or deleted.

The password has to always be entered separately at power OFF and ON if you want to change a program in the protected memory area, i.e., programs marked # 1 – 8. However, the password protected programs 1 – 8 can be selected by default to be the current program to be displayed for reading or used for a run.

Scroll to **SETUP/SECURITY** and press ↵ (ENTER). Key in the password by using only the control panel keys 1 – 10.

< MAINTAIN [SECURITY] >

Note that you have to key in the password correctly and immediately in its complete 4-number set. Each press of a key is immediately saved. So if you have previously keyed in the password incorrectly, you will have to start from the beginning to key in the four numbers. The program informs you of a rejected keying in after the last number by producing an audible warning sound. If all four numbers have been keyed in correctly, the program returns to the upper menu level without producing a warning sound.

When the password [‘1234’] has been correctly keyed in, the password becomes valid and you have logged in. The user can then change programs in the password protected area through the PROG menu in the same way as for the unprotected program area #9, .., #99. The password is valid until the power is switched off.

When the password is not valid, the Wellwash AC does not allow you to make any changes to the protected memory area. The program produces the error message ‘**Private area (Password needed) Programming denied**’ when you try to make any changes. The password is not valid, i.e., you log off, when you switch the power OFF. In other words, if you want to protect a program area that has been accessed with a password, you have to switch the power off in the washer when you leave the instrument.

Note If the password is changed, you cannot run the programs # 1 – 8.
Note Only the password [‘1234’] is valid for users.

6.3 Programming

The programs and instrument functions are programmed through the user interface by following the instructions given on the display. Refer to Section 6.3.2 Menu layout. The bottom line of the display shows the main menu offering the options **SETUP**, **PROG** or **SELECT**, which are explained below.

The current menu selections are shown by so-called pointers or flashing square brackets, for example, [SETUP]. An arrow indicates whether more options are available off-screen.

6.3.1 Menu example

For example, to reach the row selection clearing, the parameters would be (see Section 6.3):

SETUP↵ USER↵ CLEAR↵ {*parameter*}

1. First press the **< >** keys to point to SETUP.
2. Press ↵ (ENTER).
3. Then press the **< >** (arrow) keys to point to USER.
4. Press ↵.
5. After that press the **< >** keys to point to CLEAR.
6. Press ↵.
7. Press the **< >** keys to scroll the parameter selection. The user then has access to the CLEAR parameters for reviewing or editing their values.
8. Finally press ESC, which does not change the former parameter selection. However, pressing ↵ saves the parameter selection.
   The ESC key will take the user back to USER and then back to SETUP.

6.3.2 Menu layout

Below you can see the menu layout.

SETUP
- USER
  - RINSE
  - PRIME
  - PURGE
  - CLEAR
- MAINTAIN
  - BMU
  - SLEEP
  - HEADS
  - CLEAN
  - TRANSIT
  - PRESSURE
- SECURITY

PROG
- NEW
- EDIT
- COPY
- DEL
- PRINT
- VIEW

SELECT
- Select the current program

There are three submenus under **SETUP** as listed above:

- **USER** that contains nonprogram defined settings;
- **MAINTAIN** that contains functions to assist in cleaning or replacing parts, and
- **SECURITY** for entering the password. Programs # 1 – 8 are password protected. Refer to Section 6.2.3 How to take security measures.

6.3.3 SELECT menu

Scroll to **SELECT** and press ↵. Refer to Sections 6.2.3 How to take security measures, 6.3 Programming and 6.5.4 Program selection for more information on the use of the SELECT menu.

```
SETUP PROG [SELECT]
```

On-board programs are accessed with the ROW entry keys when SELECT is selected from the display. The LEDs of the ROW entry keys flash yellow when a selection can be made. Refer to Sections 6.2.1 Control panel keys and 6.2.2 Control panel indicators for more information on how to use the keypad. The ROW entry keys 1 to 10 are used to designate the program number, tens first then units.

Examples

- To select program 23 => Press ROW 2 firmly and quickly then ROW 3.
- ROW 10 enters 0. To select program 50 => Press ROW 5 then ROW 10.

The arrow keys (**< >**) can also be used to scan through the programs, for example, to look for the name of a program. ENTER (↵) will retrieve and display the program ready for running. The ESC key will abandon the selection.

```
>No. 1-      NO PROTOCOL
 No. 2-      NO PROTOCOL
 No. 3-      NO PROTOCOL
 No. 4-      NO PROTOCOL
 No. 5-      NO PROTOCOL
 No. 6-      NO PROTOCOL
 No. 7-      NO PROTOCOL
 No. 8-      NO PROTOCOL
```

```
 No. 93-     NO PROTOCOL
 No. 94-     NO PROTOCOL
 No. 95-     NO PROTOCOL
 No. 96-     NO PROTOCOL
 No. 97-     NO PROTOCOL
 No. 98-     NO PROTOCOL
 No. 99-     NO PROTOCOL
> No. 1-     NO PROTOCOL
```

6.3.3.1 Demosessions

The Wellwash AC on-board software contains six ready-made programs marked # 9 to 14. The programs are described below in greater detail.

In several routine washes, three washing cycles are used. Furthermore, it is generally recommended that the wash volume is as large as possible, for example, 300 – 1000 µl.

Protocol No. 9 is named ‘2X8WASH’. The program carries out:
three times washing with 300 µl using 2 x 8 wash heads with normal aspiration

Protocol No. 9	**‘2X8WASH’**
WASH HEAD	2x8
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	0s
ASPIRATE HIGH	NO
ASPIRATE MODE	NORMAL
LEAVE PLATE WET	NO

Protocol No. 10 is named '2X8SHAKE'. The program carries out:
three times washing with 300 µl, 5 s shake between each washing cycle using 2 x 8 wash heads with sweep aspiration

Protocol No. 10	'2X8SHAKE'
WASH HEAD	2x8
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	5s
SHAKING	ON
ASPIRATE HIGH	NO
ASPIRATE MODE	SWEEP
LEAVE PLATE WET	NO

Protocol No. 11 is named '2X8LINK'. The program carries out:
three times washing with 300 µl with Buffer A, 5 s shaking between each washing cycle, automatic addition of 200 µl Buffer B using 2 x 8 wash heads with sweep aspiration

Protocol No. 11	'2X8LINK'
Link No. 1:	
WASH HEAD	2x8
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	5s
SHAKING	ON
ASPIRATE HIGH	NO
ASPIRATE MODE	SWEEP
LEAVE PLATE WET	NO
Link No. 2	
BUFFER SOURCE	BUFF B
DISPENSE VOLUME	200µl
SOAK TIME	0s

Protocol No. 12 is named '2X12WASH'. The program carries out:
three times washing with 300 µl using 2 x 12 wash heads with normal aspiration

Protocol No. 12	'2X12WASH'
WASH HEAD	2x12
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	0s
ASPIRATE HIGH	NO
ASPIRATE MODE	NORMAL
LEAVE PLATE WET	NO

Protocol No. 13 is named '2X12SHAK'. The program carries out:
three times washing with 300 µl, 5 s shake between each washing cycle using 2 x 12 wash heads with sweep aspiration

Protocol No. 13	'2X12SHAK'
WASH HEAD	2x12
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	5s
SHAKING	ON
ASPIRATE HIGH	NO
ASPIRATE MODE	SWEEP
LEAVE PLATE WET	NO

Protocol No. 14 is named '2X12LINK'. The program carries out:
three times washing with 300 µl with Buffer A, 5 s shaking between each washing cycle, automatic addition of 200 µl Buffer B using 2 x 12 wash heads with sweep aspiration

Protocol No. 14	'2X12LINK'
Link No. 1:	
WASH HEAD	2x12
BUFFER SOURCE	BUFF A
WASH VOLUME	300µl
No. OF CYCLES	3
MODE	PLATE
STEPOVER	NO
WASH HIGH	NO
SOAK TIME	5s
SHAKING	ON
ASPIRATE HIGH	NO
ASPIRATE MODE	SWEEP
LEAVE PLATE WET	NO
Link No. 2	
BUFFER SOURCE	BUFF B
DISPENSE VOLUME	200µl
SOAK TIME	0s

6.3.4 PROG menu

The options associated with program creation and function are covered in this section. Users are advised to thoroughly read and understand this section in order to become familiar with programming the Wellwash AC. **Note you cannot modify programs # 1 to 8 if you have not entered a password.**

Note An asterisk * after the program number indicates that there is more than one sequentially linked protocol within the program.

6.3.4.1 How to create a program (PROG↵NEW)

The user can create a new program, enter the name, main mode and the parameters through the **PROG↵NEW** menu.

PROGRAM No. 90.1
NO PROTOCOL
[NEW]

Scroll to **PROG↵NEW** and press ↵.

Note A program may contain **max. four protocols**. The protocols of a program are sequentially linked. Note that the programs can contain the same or different combinations of linked protocols.

The protocol types are as follows:

WASH If you want to specify the washing requirements, the WASH protocol includes the following parameters:
HEAD TYPE; BUFFER SOURCE; WASH VOLUME; No. OF CYCLES; MODE; STEPOVER; WASH HIGH; SOAK TIME; SHAKING; ASPIRATE HIGH; ASPIRATE HEIGHT/ASPIRATE MODE; LEAVE PLATE WET; LINK PROTOCOL, and SLEEP IN FIVE MINUTES *****.

ASPIRATE If you want an aspiration run only, the ASPIRATE protocol includes the following parameters:
HEAD TYPE; No. OF CYCLES; MODE; ASPIRATE HIGH; ASPIRATE HEIGHT/ASPIRATE MODE; LINK PROTOCOL, and SLEEP IN FIVE MINUTES *****.
Aspirate means removing liquids through negative pressure or suction.

DISPENSE If you want to add liquids without aspiration, the DISPENSE protocol includes the following parameters:
HEAD TYPE; BUFFER SOURCE; DISPENSE VOLUME; SOAK TIME; SHAKING; LINK PROTOCOL, and SLEEP IN FIVE MINUTES *****.

SHAKE If you want to only shake/soak the plate, the SHAKE protocol includes the following parameters:
SOAK TIME; SHAKING; SHAKE SPEED; LINK PROTOCOL, and SLEEP IN FIVE MINUTES *****.

***** Refer to Section 6.3.4.2.

LINK PROTOCOL and SLEEP IN FIVE MINUTES constitute the so-called trailer of the program.

6.3.4.2 How to create a linked program

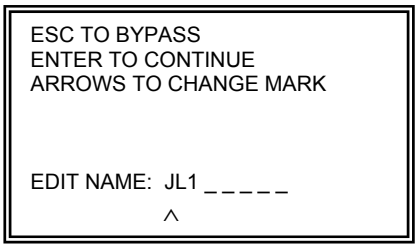
The HEAD TYPE option will only be displayed once during each programming and it will be in the first protocol (WASH, ASPIRATE or DISPENSE but **not** SHAKE).

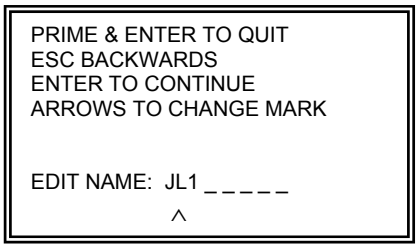
Note If SHAKE is the main protocol, then the HEAD TYPE option will be displayed in the next linked protocol selected (WASH, ASPIRATE or DISPENSE).

The SLEEP IN FIVE MINUTES option will only be displayed in the last sequentially linked protocol of the program.

6.3.4.3 Program header

Before a new program or protocol can be created, the user is prompted to give the program a name.





- Up to eight characters are allowed using A to Z, space and 0 to 9.
- The characters are changed using the arrow keys (**< >**).
- When you press the arrow keys (**< >**) continuously, the letters will scroll quicker.
- ENTER (↵) moves the cursor to the right and ESC moves it to the left.
- You can skip to the next entry by pressing PRIME and ENTER simultaneously when you edit a name.

6.3.4.3.1 How to create a wash protocol

This is the normal way of starting a washing program. It includes all necessary parameters required for a routine wash.

Scroll to **WASH** and press ↵. See the wash protocol on the next two pages. Refer also to Section 6.3.4.1.

Question	Answer
ENTER TO ACCEPT ARROWS TO SELECT HEAD TYPE	**2 x 8** **1 x 12** **2 x 12** **1 x 8** Select the menu option with < or > and press ↵ to accept. Refer to Section 6.3.6.3 How to maintain wash heads for more information on wash heads.
ENTER TO ACCEPT ARROWS TO SELECT BUFFER SOURCE	**BUFFER A** (rear bottle) **BUFFER B** (front bottle) **RINSE** (forefront bottle) Select the menu option with < or > and press ↵ to accept. Automatic flushing is carried out if two separate buffer solutions are used.
ENTER TO ACCEPT ARROWS TO SELECT WASH VOLUME	**50 µl to 1000 µl** in 50 µl steps Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT No. OF CYCLES	**1 to 10** Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT MODE	**PLATE** Washes each row once before returning to the first row to perform the remaining washes. **STRIP** Washes each row the designated number of washes before moving to the next row. Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT STEPOVER	**YES** Maintains an even soak period for each row by pausing over rows not selected and stepping over the row without processing. **NO** Performs the whole sequence directly. Select the menu option with < or > and press ↵ to accept. **Note** Select NO for STEPOVER with an uneven number of row selections.
ENTER TO ACCEPT ARROWS TO SELECT WASH HIGH	**YES** Dispensing begins when the head is at the dispense height. **NO** Dispensing begins as the head begins to rise from the bottom of the well. Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT SOAK TIME	**0 s, 1 s, 2 s, 5 s, 10 s, 15 s, 20 s, 30 s, 45 s, 60 s,** **2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 45 min and 60 min** Select the menu option with < or > and press ↵ to accept. A soak time between each washing cycle is then executed. Refer to Section 6.5.5 How to shake for more information on recommended minimum soak times.
ENTER TO ACCEPT ARROWS TO SELECT SHAKING	**ON** This option is only available during a soak period when a SOAK TIME greater than 0 s has been selected. **OFF** Select the menu option with < or > and press ↵ to accept. Refer to Sections 6.5.5 How to shake and 6.3.4.3.4 How to create a separate shake protocol for more information on shaking.
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE HIGH	**YES** Aspirates at a height specified by ASPIRATE HEIGHT. **NO** If a SWEEP (re: ASPIRATE MODE) is required, select NO. Select the menu option with < or > and press ↵ to accept. *Continued*

Question	Answer *Continued*
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE HEIGHT	**If ASPIRATE HIGH YES** **0 mm** (= bottom of the well) **to 11.5 mm** in 0.5 mm steps Select the menu option with < or > and press ↵ to accept. This parameter is the height that the tips descend to during the aspirate cycle. This parameter is dynamically adjustable. The wash head will move to the last row of the plate and move up and down with each adjustment.
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE MODE	**If ASPIRATE HIGH NO** **NORMAL** Aspirates from the bottom of the well but in the center position. **SWEEP** Aspirates in three different positions across the bottom of the well. Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT LEAVE PLATE WET	**YES** Does not aspirate at the end of the wash protocol, which leaves the plate filled. **NO** Performs the final aspirate, which leaves the plate empty. In **PROG↵VIEW** the display shows 'LEAVE PLATE DRY'. Select the menu option with < or > and press ↵ to accept.
	The following display will be showed **ENTER TO SAVE** Press ↵ to save the wash protocol.
ESC TO BYPASS ENTER TO CONTINUE ARROWS TO CHANGE MARK EDIT NAME: JL1_ _ _ _ _ ^	Before the program goes to the LINK PROTOCOL option, the user has the opportunity to check and edit the name given at the start of the **PROG↵NEW** session. Press ↵ eight times if you want to accept the name and continue or just ESC to bypass.
ENTER TO ACCEPT ARROWS TO SELECT LINK PROTOCOL	**YES** The LINK PROTOCOL option to add another protocol. Up to four protocols can be sequentially linked. **NO** The option to finish the program. Select the menu option with < or >. Press ↵ to accept. Then the program returns to the protocol type menu.
ENTER TO ACCEPT ARROWS TO SELECT SLEEP IN FIVE MINUTES	**YES** Runs the SLEEP routine if the washer is not used for five minutes after running a program. **NO** Skips this feature. Press ↵ to accept and **SAVING 'JL1_ _ _ _ _'** flashes on the screen. **Note** SLEEP IN FIVE MINUTES will be displayed only after the last protocol has been created.

6.3.4.3.2 How to create a separate aspirate protocol

This protocol is used when you want a separate aspiration independent from that in the wash protocol, refer Section 6.3.4.3.1 How to create a wash protocol. Refer also to Section 6.3.4.1.

Scroll to **ASPIRATE** and press ↵. See the aspirate protocol on the next page.

Question	Answer
ENTER TO ACCEPT ARROWS TO SELECT HEAD TYPE	**2 x 8** **1 x 12** **2 x 12** **1 x 8** Select the menu option with < or > and press ↵ to accept. Refer to Section 6.3.6.3 How to maintain wash heads for more information on wash heads.
ENTER TO ACCEPT ARROWS TO SELECT No. OF CYCLES	**1 to 10** Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT MODE	**PLATE** Aspirates each row once before returning to the first row to perform the remaining aspirations. **STRIP** Aspirates each row the designated number of aspirations before moving to the next row. Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE HIGH	**YES** Aspirates at a height specified by ASPIRATE HEIGHT. **NO** If a SWEEP (re: ASPIRATE MODE) is required, select NO. Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE HEIGHT	**If ASPIRATE HIGH YES** **0 mm** (= bottom of the well) **to 11.5 mm** in 0.5 mm steps Select the menu option with < or > and press ↵ to accept. This parameter is the height that the tips descend to during the aspirate cycle. This parameter is dynamically adjustable. The wash head will move to the last row of the plate and move up and down with each adjustment.
ENTER TO ACCEPT ARROWS TO SELECT ASPIRATE MODE	**If ASPIRATE HIGH NO** **NORMAL** Aspirates from the bottom of the well but in the center position. **SWEEP** Aspirates in three different positions across the bottom of the well. Select the menu option with < or > and press ↵ to accept.
	The following display will be showed **ENTER TO SAVE** Press ↵ to save the aspirate protocol.
ESC TO BYPASS ENTER TO CONTINUE ARROWS TO CHANGE MARK EDIT NAME: JL1_ _ _ _ _ ^	Before the program goes to the LINK PROTOCOL option, the user has the opportunity to check and edit the name given at the start of the **PROG↵NEW** session. Press ↵ eight times to accept the name and continue or just ESC to bypass.
ENTER TO ACCEPT ARROWS TO SELECT LINK PROTOCOL	**YES** The LINK PROTOCOL option to add another protocol. Up to four protocols can sequentially be linked. **NO** The option to finish the program. Select the menu option with < or > and press ↵ to accept. Then the program returns to the protocol type menu.
ENTER TO ACCEPT ARROWS TO SELECT SLEEP IN FIVE MINUTES	**YES** Runs the SLEEP routine if the washer is not used for five minutes after running a program. **NO** Skips this feature. Press ↵ to accept and **SAVING 'JL1_ _ _ _ _'** flashes on the screen. **Note** SLEEP IN FIVE MINUTES will be displayed only after the last protocol has been created.

6.3.4.3.3 How to create a separate dispense protocol

Scroll to **DISPENSE** and press ↵. Refer also to Section 6.3.4.1.

< ASPIRATE [DISPENSE] >

Note The wells should be empty before you fill them in a dispense protocol. The programmed volume will be dispensed into the wells.

Question	Answer
ENTER TO ACCEPT ARROWS TO SELECT HEAD TYPE	**2 x 8** **1 x 12** **2 x 12** **1 x 8** Select the menu option with < or > and press ↵ to accept. Refer to Section 6.3.6.3 How to maintain wash heads for more information on wash heads.
ENTER TO ACCEPT ARROWS TO SELECT BUFFER SOURCE	**BUFFER A** (rear bottle) **BUFFER B** (front bottle) **RINSE** (forefront bottle) Select the menu option with < or > and press ↵ to accept. Automatic flushing is carried out if two separate buffers are used.
ENTER TO ACCEPT ARROWS TO SELECT DISPENSE VOLUME	**50 µl to 400 µl** in 50 µl steps Select the menu option with < or > and press ↵ to accept.
ENTER TO ACCEPT ARROWS TO SELECT SOAK TIME	**0 s, 1 s, 2 s, 5 s, 10 s, 15 s, 20 s, 30 s, 45 s, 60 s,** **2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 45 min and 60 min** Select the menu option with < or > and press ↵ to accept. A soak time between each dispensing cycle is executed. Refer to Section 6.5.5 How to shake for more information on recommended minimum soak times.
ENTER TO ACCEPT ARROWS TO SELECT SHAKING	**ON** This option is only available during a soak period when a SOAK TIME greater than 0 s has been selected. **OFF** Select the menu option with < or > and press ↵ to accept. Refer to Sections 6.5.5 How to shake and 6.3.4.3.4 How to create a separate shake protocol for more information on shaking.
	The following display will be showed **ENTER TO SAVE** Press ↵ to save the dispense protocol.
ESC TO BYPASS ENTER TO CONTINUE ARROWS TO CHANGE MARK EDIT NAME: JL1_ _ _ _ _ ^	Before the program goes to the LINK PROTOCOL option, the user has the opportunity to check and edit the name given at the start of the **PROG↵NEW** session. Press ↵ eight times if you want to accept the name and continue or just ESC to bypass.
ENTER TO ACCEPT ARROWS TO SELECT LINK PROTOCOL	**YES** The LINK PROTOCOL option to add another protocol. Up to four protocols can sequentially be linked. **NO** The option to finish the program. Select the menu option with < or > and press ↵ to accept. Then the program returns to the protocol type menu.
ENTER TO ACCEPT ARROWS TO SELECT SLEEP IN FIVE MINUTES	**YES** Runs the SLEEP routine if the washer is not used for five minutes after running a program. **NO** Skips this feature. Press ↵ to accept and **SAVING 'JL1_ _ _ _ _'** flashes on the screen. **Note** SLEEP IN FIVE MINUTES will be displayed only after the last protocol has been created.

6.3.4.3.4 How to create a separate shake protocol

Scroll to **SHAKE** and press ↵. Refer also to Section 6.3.4.1.

< DISPENSE [SHAKE]

Question	Answer
ENTER TO ACCEPT ARROWS TO SELECT SOAK TIME	**0 s, 1 s, 2 s, 5 s, 10 s, 15 s, 20 s, 30 s, 45 s, 60 s,** **2 min, 5 min, 10 min, 15 min, 20 min, 30 min, 45 min and 60 min** Select the menu option with < or > and press ↵ to accept. Refer to Section 6.5.5 How to shake for more information on recommended minimum soak times.
ENTER TO ACCEPT ARROWS TO SELECT SHAKING	**ON** This option is only available during a soak period when a SOAK TIME greater than 0 s has been selected. **OFF** Select the menu option with < or > and press ↵ to accept. Refer to Section 6.5.5 How to shake for more information on shaking.
ENTER TO ACCEPT ARROWS TO SELECT SHAKE SPEED	**If SHAKING ON** **LOW** 650 rpm **MED** 800 rpm **HIGH** 950 rpm Select the menu option with < or > and press ↵ to accept.
	The following display will be showed **ENTER TO SAVE** Press ↵ to save the shake protocol.
ESC TO BYPASS ENTER TO CONTINUE ARROWS TO CHANGE MARK EDIT NAME: JL1_ _ _ _ _ ^	Before the program goes to the LINK PROTOCOL option, the user still has the opportunity to check and edit the name given at the start of the **PROG↵NEW** session. Press ↵ eight times if you want to accept the name and continue or just ESC to bypass.
ENTER TO ACCEPT ARROWS TO SELECT LINK PROTOCOL	**YES** The LINK PROTOCOL option to add another protocol. Up to four protocols can sequentially be linked. **NO** The option to finish the program. Select the menu option with < or > and press ↵ to accept. Then the program returns to the protocol type menu.
ENTER TO ACCEPT ARROWS TO SELECT SLEEP IN FIVE MINUTES	**YES** Runs the SLEEP routine if the washer is not used for five minutes after running a program. **NO** Skips this feature. Press ↵ to accept and **SAVING 'JL1_ _ _ _ _'** flashes on the screen. **Note** SLEEP IN FIVE MINUTES will be displayed only after the last protocol has been created.

6.3.4.4 How to edit a program

The user can alter the wash parameters of an existing program/protocol through the **PROG↵EDIT** menu.

Scroll to **PROG↵EDIT** and press ↵.

The different protocol question sessions will not be presented here in detail: refer to Section 6.3.4.1 How to create a program (PROG↵NEW) for greater detail.

In the EDIT mode, LINK No. 2 to LINK No. 4 can be deleted by answering **NO** to the request **LINK PROTOCOL YES** or **NO** at the stage when you want to delete any previously edited links.

Note However, LINK No. 1 (= main protocol) cannot be deleted in the EDIT mode. The main protocol can only be deleted through the **PROG↵DEL** menu.

In contrast to **PROG↵NEW**, the **PROG↵EDIT** mode does not immediately show the display where the program name can be edited.

If **PROG↵NEW** is pressed at this stage, the error message 'Cannot create twice' will be displayed as the program already exists.

6.3.4.5 How to copy a program

This enables the user to copy an existing program to a new location.

Scroll to **PROG↵COPY** and press ↵.

All programs can be copied, for example, No. 55 to No. 79 or No. 79 to No. 55. Programs from # 9 forward to # 99 can be copied even if the password is not known. However, if the password is entered, programs # 1 to # 8 can also be copied.

When you copy a program, the Wellwash AC offers you the first vacant location possible. You do not have to accept this location, but can choose another location to paste the program into by using the arrow keys.

Question	Answer
COPY FROM No. 15 'JL15_ _ _ _'	For example, if program 15 named 'JL15' is selected using the SELECT mode, the following display will be showed **ARROWS TO SELECT** **ENTER TO ACCEPT** **ESC TO QUIT**
SEARCHING FIRST FREE COPY TO No. 16 NO PROTOCOL	If ↵ is pressed, the displays in the left column will be showed **SEARCHING FIRST FREE** flashes on the screen
EDIT NAME: JL15_ _ _ _ ^	When ↵ is pressed, the following display will be showed **ESC TO BYPASS** **ENTER TO CONTINUE** **ARROWS TO CHANGE MARK**
EDIT NAME: JL16_ _ _ _ ^ COPYING 15 TO 16	When ↵ is pressed, the following display will be showed **PRIME & ENTER TO QUIT** **ESC BACKWARDS** **ENTER TO CONTINUE** **ARROWS TO CHANGE MARK** Press ↵ six more times to continue, if you do not want to select the other alternatives. **COPYING 15 TO 16** flashes on the screen before the program returns to the main menu

6.3.4.6 How to delete a program

This enables the user to delete the current program # 9 to # 99 even if the password is not known. However, if you have entered a password, programs # 1 to # 8 can also be deleted.

Scroll to **PROG↵DEL** and press ↵.

Question	Answer
DELETE No. 15 'JL15_ _ _ _'?	First select the program to be deleted using the SELECT menu. For example, if program 15 named 'JL15' is selected, the following display will be showed **ENTER - YES** **ESC - NO**
DELETING PROGRAM No. 15 NO PROTOCOL	If ↵ is pressed, the displays in the left column will be showed **DELETING** flashes on the screen Then the program returns to the main menu.

6.3.4.7 How to print a program

The user can print out the program via the RS-232C serial port, refer to Section 8.4 Remote control to Wellwash AC. Refer to *Fig. 4.3*.

Scroll to **PROG↵PRINT** and press ↵. The listing of the selected/loaded program is immediately sent to the serial port when you press ↵.

```
< COPY  DEL  [PRINT]      >
```

6.3.4.8 How to view a program

This menu item allows the user to obtain an overview of the multiprotocol program on the display. Use the **PROG↵VIEW** option to see the parameters for any protocols used.

Scroll to **PROG↵VIEW** and press ↵.

```
< DEL  PRINT  [VIEW]      >
```

Use:
- the arrow (**< >**) keys to scroll the sequentially linked protocols;
- the ENTER (↵) key to display the details of that protocol, and
- the ESC key to return to the PROG menu.

Example displays

```
PROGRAM No. 15.1*

NAME -      JL15_ _ _ _
BUFFER -    BUFF A
VOLUME -    300µl
CYCLES -    3
```

```
PROGRAM No. 15.2*

NAME -      JL15_ _ _ _
BUFFER -    BUFF B
VOLUME -    250µl
CYCLES -    1
```

6.3.5 USER submenu

The user can use ARROWS TO ADJUST, ENTER TO ACCEPT or ESC TO QUIT.

6.3.5.1 How to set rinse parameters

This option is available for rinsing the system automatically. The washer can be programmed to AUTORINSE by selecting rinses with set rinse times and volumes. The AUTORINSE resets its timer if interrupted by liquid handling operations.

Scroll to **SETUP↵USER↵RINSE** and press ↵.

< [RINSE] PRIME PURGE >

Question	Answer
RINSE TIME	**OFF (not in use)** **15 min** to **8 h** in 15 min steps **Note** The RINSE TIME will start only after a liquid handling operation has been run once. Select the rinse time and press ↵.
RINSE VOLUME	**5 ml** to **100 ml** in 5 ml steps Select the rinse volume and press ↵ to accept.

6.3.5.2 How to set prime parameters

Priming is the operation of filling the tubing with fluid to expel the air, which will enable dispensing to begin.

Scroll to **SETUP↵USER↵PRIME** and press ↵.

< RINSE [PRIME] PURGE >

Question	Answer
PRIME VOLUME	**5 ml** to **100 ml** in 5 ml steps Select the prime volume and press ↵ to accept.

Note The programmed prime volume will also affect the clean and transit programs. Refer to pp. 53 and 54.

6.3.5.3 How to set purge parameters

Purging is the operation of blowing air through the liquid lines to clear and flush out liquids.

Scroll to **SETUP↵USER↵PURGE** and press ↵.

Question	Answer
PURGE TIME	**1 s to 20 s** in 1 s steps Select the purge time and press ↵ to accept.

6.3.5.4 How to clear the row selection in action

This option is available to specify when the row selection is to be cleared.

Scroll to **SETUP↵USER↵CLEAR** and press ↵.

Question	Answer
CLEAR ROWS AFTER	**NEVER** = DO NOT clear the rows. **EDIT** = Clear the selection after editing a program. **SELECT** = Clear the selection when a new program has been selected. **END** = Clear the rows at the end of every program run. **ALL** = Clear the rows after all the above options (except NEVER). Select the menu option with < or > and press ↵ to accept.

6.3.6 MAINTAIN submenu

A number of routines are provided under this menu to assist in cleaning or servicing the washer. The user is prompted at each stage to do whatever is necessary.

6.3.6.1 How to check the status of the bottle module unit

This option enables the user to check the status of the bottle module unit (BMU), i.e., to check whether or not the cable(s) and/or liquid sensor(s) are in place and functioning correctly.

Scroll to **SETUP↵MAINTAIN↵BMU** and press ↵.

< [BMU] SLEEP HEADS

Question	Answer
BMU SIGNALS WASTE OK BUFFER A OK BUFFER B OK RINSE OK BMU CONNECTED ESC TO QUIT	The following display will be shown when the liquid level sensors and the BMU connection cable are properly and tightly in their place, there is sufficiently room in the waste and the input buffers are full enough.
BMU SIGNALS WASTE OK BUFFER A BAD BUFFER B BAD RINSE BAD BMU LOOSE ESC TO QUIT	The following display (CONNECTED => LOOSE; OK => BAD) will be shown when the BMU connection cable is loose or disconnected Connect the BMU cable.
BMU SIGNALS WASTE BAD BUFFER A OK BUFFER B OK RINSE BAD BMU CONNECTED ESC TO QUIT	The following example display (OK => BAD) will be shown when the Waste bottle is *full*; the Rinse bottle is either *empty*, the bottle cap is not secure or the Rinse liquid level sensor is not inserted correctly Rectify the problem.

6.3.6.2 How to go to a sleep (standby) mode

This option will shut down the washer immediately by running a rinse sequence leaving the wash head lowered so that the tips are immersed in rinse solution.

Scroll to **SETUP↵MAINTAIN↵SLEEP** and press ↵.

< BMU [SLEEP] HEADS

Refer to Sections 6.3.4.3.4 How to create a separate shake protocol and 6.6 Shutdown and Chapter 7 MAINTENANCE for more information on the SLEEP routine.

Question	Answer
SLEEPING PROCEDURE	**ENTER TO CONTINUE** **ESC TO QUIT**
WASHER STANDBY	If ↵ is pressed, the following display will follow **Rising pressure** flashes on the screen
WASHER STANDBY	When the washer is in the standby mode, the wash head will be in the prime trough **POWER DOWN** **OR** **PRESS START TO WAKE**
TO EMPTY THE TROUGH?	If **START** is pressed, the next display will follow **START TO ACCEPT** **ESC TO QUIT**
WAKING UP Preparing new runs FLUSHING	If **START** is pressed, the following displays will follow **Rising pressure** flashes on the screen

6.3.6.3 How to maintain wash heads

This option clears the liquid lines so that the user can change the wash heads. Refer to Sections 6.3.4.3.1 How to create a wash protocol and 5.2.4 How to install or change wash heads for more information on wash heads.

Scroll to **SETUP↵MAINTAIN↵HEADS** and press ↵.

< BMU SLEEP [HEADS]

Question	Answer
WASH HEAD PROCEDURE	**ENTER TO CONTINUE** **ESC TO QUIT**
PRESS ENTER TO Flush out wash heads ESC TO BYPASS	If ↵ is pressed, the display in the left column will be showed
CURRENT WASH HEADS	If ↵ is pressed, the following display will be showed **Rising pressure** flashes on the screen
ARROWS TO ADJUST ENTER TO ACCEPT ESC TO QUIT HEAD TYPE	**2 x 8** **1 x 12** **2 x 12** **1 x 8** Select the menu option with < or > and press ↵ to accept.

The wash head options are thus 1 x 8, 2 x 8 (factory set default), 1 x 12 and 2 x 12-way (*Fig. 4.6*). For a new protocol, the default will be the configuration set in the HEADS option.

Note The HEAD TYPE option will only be displayed once during each programming and it will be in the first link protocol (WASH, ASPIRATE or DISPENSE but **not** SHAKE).

6.3.6.4 How to clean wash heads

This option performs a decontamination procedure by rinsing the liquid lines thoroughly with both a cleaning agent and deionized distilled aqua and by finally blowing them clear. The wash head is not immersed at the end of the run.

Scroll to **SETUP↵MAINTAIN↵CLEAN** and press ↵.

< [CLEAN] TRANSIT >

Question	Answer
CLEANING PROCEDURE	**ENTER TO CONTINUE** **ESC TO QUIT**
CLEANING PROCEDURE EMPTY ALL BOTTLES FILL WITH CLEANING AGENT	If ↵ is pressed, the following display will be showed **ENTER TO CONTINUE** **ESC TO QUIT**
CLEANING LINE BUFFER A CLEANING LINE BUFFER B CLEANING LINE RINSE	If ↵ is pressed, the displays in the left column will be showed and the system cleans the lines at first with a cleaning agent.
CLEANING PROCEDURE EMPTY ALL BOTTLES FILL WITH WATER	If ↵ is pressed, the following display will be showed **ENTER TO CONTINUE** **ESC TO QUIT**
CLEANING LINE BUFFER A CLEANING LINE BUFFER B CLEANING LINE RINSE	If ↵ is pressed, the displays in the left column will be showed and the system cleans the lines a second time with deionized distilled aqua.

Note If the head type is 1 x 8 or 1 x 12, the Wellwash AC will only wash the one wash head and leave liquids in the other wash head during the cleaning procedure. Change head type if necessary.

Note The prime volume will affect the clean program.

6.3.6.5 How to prepare transit

This option empties liquids from the washer and prepares it for either relocation or transport. It also enables disconnecting the tubes between the washer unit and the bottle module unit (BMU).

Note Switch the washer unit off before opening any bottle caps! DO NOT unscrew the cap of a bottle with the pump running as this might release residual pressure.

Note The BMU might contain liquid.

Scroll to **SETUP↵MAINTAIN↵TRANSIT** and press ↵.

< CLEAN [TRANSIT] >

Question	Answer
TRANSIT PROCEDURE	**ENTER TO CONTINUE** **ESC TO QUIT**
TRANSIT PROCEDURE EMPTY ALL BOTTLES AND RECONNECT	If ↵ is pressed, the following display will be showed **ENTER TO CONTINUE** **ESC TO QUIT**
EMPTYING LINE BUFFER A EMPTYING LINE BUFFER B EMPTYING LINE RINSE	If ↵ is pressed, the following displays will be showed and the system empties the lines of liquid. **Rising pressure** flashes first on the screen and then **PRIMING**
TRANSIT PROCEDURE REMOVE AND DRY PRIME TROUGH	If ↵ is pressed, the following display will be showed and the wash heads move. **ENTER TO CONTINUE** Remove and dry the prime trough manually. **ESC TO QUIT** **Note** Do finish the procedure.
TRANSIT PROCEDURE Moving head home?	After removing and drying the prime trough, press ↵ to continue. The following display will be showed **ENTER TO CONTINUE** **ESC TO QUIT** Press ↵ to continue and the wash head moves back to home position.

Note If the head type is 1 x 8 or 1 x 12, the Wellwash AC will only wash the one wash head and leave liquids in the other wash head during the transit procedure. Change head type if necessary.

Note The prime volume will affect the transit program.

6.3.6.6 How to check the pressure level

This option enables the user to check the pressure level, i.e., to check whether or not the quick-release bottle caps and tubing are tightly fastened and there are no leakages in the pressure system.

Scroll to **SETUP↵MAINTAIN↵PRESSURE** and press ↵.

< [PRESSURE]

Question	Answer
ESC TO QUIT - - - - - - - PRES VAC - - - - - - - Rising pressure	The following display in the left column will be shown when ↵ is pressed. Rising pressure will appear at the bottom of the screen before the indicative values start to rise
ESC TO QUIT - - - - - - - PRES VAC - - 550 92 - - 288 38 - - -	DO NOT press the ESC key before the black pressure bars have risen completely. The top values vary, but the bottom values remain the same (factory settings). If the top pressure level values start to fall, ensure that there are no leakages in the pressure system and that the bottle caps are securely connected. Note that the Pressure LED will light up when the values fall below the lower warning level values 288/38.

6.4 How to START

Power up the washer and it will check the system functions correctly.

First place the microplate onto the plate carrier (*Fig. 6.2 – Fig. 6.4*).

Press the START key to begin the program shown on the display.

The washer reads each protocol in the program and checks that all the parameters match and the liquid levels are alright. If there are any errors, the washer informs the user by displaying the problem and tells the user which course of action to take.

6.5 How to run wash programs

Once a program has started, it checks for liquid levels at the start of each protocol.

After the run the program selection remains for the next run but the row selection may be cleared, depending on how the CLEAR option was set in the USER menu.

You can still change the row selection by making new entries or by pressing the STOP/RESET key twice.

6.5.1 How to fill bottles

1. **Switch the washer unit off before opening any bottle caps! DO NOT unscrew the cap with the pump running as this will release the pressure.** Unscrew the bottle cap. However, by unscrewing the cap, you will release the pressure. Always unscrew the cap slowly to prevent liquid on the inside of the plug from spraying out. It is best to remove the plug slowly from the bottle, since the liquid lines are normally full and some spillage may occur.

2. Remove the bottles and fill them when necessary.

3. Reassemble in reverse sequence **ensuring that the pipe on the underside of the plug mates with the receptacle in the insert and the coding slot on the bottle rim mates with the pin in the cap** (*Fig. 5.11*).

4. **Always reprime the system before running a wash or dispense program**. Refer to Section 6.5.3 Priming the system.

6.5.2 Rinse functions

- The RINSE key initiates a sequence to blow air through the line to the wash head before selecting the rinse liquid from the rinse bottle. The rinse liquid is then pumped through the system for a short period and left in the lines.
- The washer can be programmed to AUTORINSE (rinse the system automatically), the delay between rinses and the volume dispensed in the rinse being defined in the **SETUP↵USER↵RINSE↵** menu.
- Automatic purging is carried out if two separate buffer solutions are used.

6.5.3 Priming the system

- The PRIME key initiates a sequence, which selects the liquid specified by the first protocol of the wash program and ensures that the lines to the head are filled with that liquid. If another buffer is selected than the one primed, a sequence of blowing air through the line will take place before filling with the second liquid occurs.
- The volume used during priming is defined in the **SETUP↵USER↵PRIME↵** menu.
- If the first protocol is not a Wash or Dispense type, the next protocol in the link will be used. If there are no Wash or Dispense type protocols in the program, an error message will be displayed.

6.5.4 Program selection

- The programs can be chosen from the on-board memory (marked # 1 to 99).
- The programs are accessed through the SELECT menu. Of all the programs marked # 1 – 99 on the Wellwash AC, programs # 1 – 8 are password protected.

6.5.5 How to shake

The shaker function can be run in two ways. It can either be called by the program during the SOAK period or as a SHAKE only program.

For the SHAKE only program, there are three options for the *shake speed* - LOW, MED (= medium) or HIGH. Each option is a preprogrammed factory setting and they are set at 650, 800, and 950 rpm, respectively. Define also a soak time and the shaking will then be carried out during this time.

A series of experiments within a wash program have been performed with aqueous liquids to determine the optimal shake speeds and the minimal *soak times* for different well volumes. The results are shown in the table below.

Recommended minimum soak times

	LOW	**MED**	**HIGH**
< 200 µl/well	2 min	20 s	20 s
> 200 µl/well	> 2 min	30 s	20 s

When the user selects SHAKE during a soak period with a soak time greater than zero seconds, the shake speed is automatically selected for the Wash and Dispense protocols and is dependent on the soak time. Select the HIGH shake speed for a soak time of 20 s or less, whereas the MED shake speed for a longer soak time.

With 300 µl per well in a Thermo Scientific Combiplate (refer to Section 11.2 List of strips and plates for demonstration purposes), the HIGH shake speed does not spill aqueous liquid. A safety factor of the shaker's 2 mm orbit dimensions prevents the plate from spilling during a Shake mode.

When in the Wash mode, after the wells are filled, the program will look ahead in the current program to determine if there is a shake before an aspirate. If so, and with a total volume more than 350 µl, the tips will sip off the excess volume immediately after washing each strip. For example, in a program containing a 400 µl wash and a nonzero soak, the excess volume in the wells will be removed automatically before shaking.

In the Dispense mode this is not the case. It is assumed that the user knows the volume dispensed in the wells and care must be taken when shaking. For example, if a plate is washed with 300 µl and left wet, followed by a dispense of 100 µl, the washer does not perform an Auto-Sip, since the wash volume is below 350 µl. However, if the plate is shaken, it will spill liquid as the total volume in each well is actually 400 µl. The user needs to take care that it does not overfill.

6.5.6 How to load the microplates

- The plate is inserted rear first into the plate carrier (*Fig. 6.3*) and pressed against the four black bump pads (*Fig. 6.2*) before lowering the plate front (*Fig. 6.4*). The pads will apply pressure to the plate to stop free movement during processing.

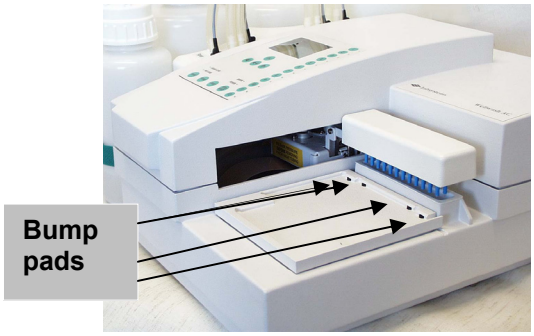


Fig. 6.2 Plate carrier with four bump pads

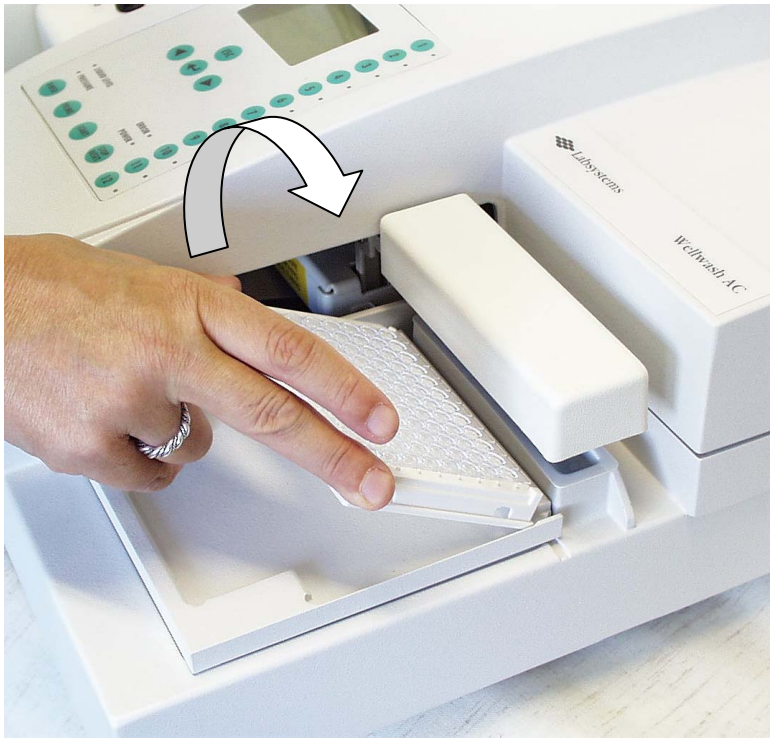


Fig. 6.3 Inserting the microplate rear first

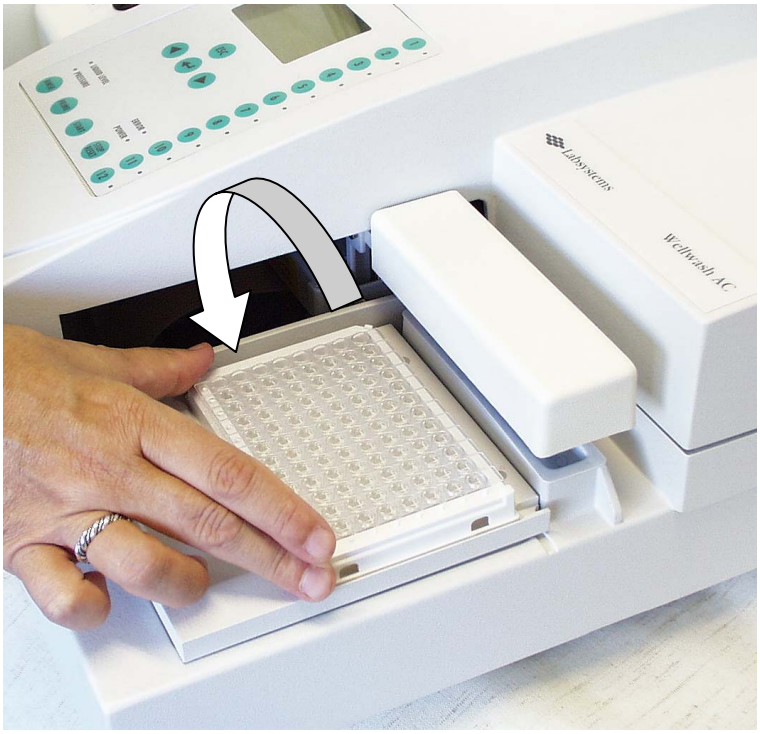


Fig. 6.4 Lowering the microplate after insertion

- The user must ensure that the plate is orientated to match the wash heads. Refer to Section 5.2.4 How to install or change wash heads.
- The plate or microstrips must be properly and steadily lowered onto the surface of the plate carrier to prevent jamming of the head movement.

6.5.7 Row selection

- The ROW keys are used to enter the number of the rows of the plate to be processed. The exact operation of this function is dependent on several parameters of the protocol selected.
- When you use a single head, press the ROW key once to select only that row. By pressing the same key twice you will select all rows up to that number.
- When you use a double head, press the ROW key once to select that row and the *previous* row. However, if you select STEPOVER, only even rows are allowed. By pressing the same key twice you will select all rows up to that number.
- An illicit entry such as entering more rows than the plate orientation allows will result in an audible warning.

6.5.8 How to cancel a run

You may cancel a started run by pressing the STOP/RESET key except when the Wellwash AC is already waiting for a user input (key) to some warning or error message being displayed as a consequence of some error detected in the run.

6.5.9 Power failure

If there is a power failure or the user disconnects the power himself during a run, an error message will be displayed as the power returns.

6.6 Shutdown

Remove any microplates still on the plate carrier. Dispose of all microplates and strips as biohazardous waste.

At the end of the day, either run RINSE a few times or run the **SETUP↵USER↵MAINTAIN↵SLEEP↵** routine.

In order to decontaminate the washer, run the **SETUP↵USER↵MAINTAIN↵CLEAN↵** routine.

For extended shutdown periods, run the CLEAN routine first. Then the bottles should be emptied and the liquid lines cleared by running **SETUP↵MAINTAIN↵TRANSIT↵**.

Switch the Wellwash AC off by pressing the power switch (see *Fig. 4.3*) at the bottom left of the back panel of the instrument into the OFF position.

Wipe the instrument surfaces with a soft cloth or tissue paper moistened with deionized distilled aqua, a mild detergent (SDS, sodium dodecyl sulfate) or soap solution.

If you have spilt infectious agents on the washer, disinfect with 70% alcohol or some other disinfectant (see Section 7.5 Decontamination procedure).

6.7 Guidelines for use

Preventative maintenance should be followed closely to keep the washer in the best condition for maximum reliability. A poorly maintained instrument will not give the best results.

6.7.1 Damage to the selector valve

The selector valve body is made of PTFE, which is a soft material. Abrasive particles present in liquids may damage the valve and cause leaks. Therefore, liquids used should be particle-free or coarsely filtered through a 100 μm mesh.

6.7.2 Salt deposit

Depending on the concentration of the wash buffers, crystallization may occur around the dispense tips and bottle necks. Therefore, **regular cleaning of these parts is essential**. Refer to Section 7.2.2.

7 MAINTENANCE

7.1 Regular and preventive maintenance

7.1.1 General

Routine and service procedures must be performed by the user to prevent unnecessary wear or hazards and are described below at the frequency with which they should be applied.

The type of lubricant recommended is commonly available engine oil, such as SAE30 or SAE15/40. Similar light oils may be used, but **thick oil or greases are not recommended.**

Abrasive cleaning agents are not recommended, because they are likely to damage the paint finish.

It is recommended that the case of the instrument is cleaned periodically to maintain its good appearance. A soft cloth dampened in a warm, mild detergent solution will be sufficient.

Painted surfaces can be cleaned with most laboratory detergents. Dilute the cleaning agent as recommended by the manufacturer. DO NOT expose painted surfaces to concentrated acids or alcohols for prolonged periods of time as damage may occur.

Clean the display areas with a mild laboratory detergent. The keypad has a wipe-clean surface.

Plastic covers and surfaces can be cleaned with a mild laboratory detergent or alcohol.

Silicone grease can be applied to both the O rings of bottles and wash heads when necessary.

Ultraviolet rays can be used to sterilize objects, for example, the surface of the Wellwash AC instrument and other areas where destruction of bacteria is necessary.

If any surfaces have been contaminated with biohazardous material, a mild sterilizing solution should be used.

DO NOT autoclave the bottles or any part of this instrument.

Check regularly that the tubes are not flattened in the pinch valve. If the tubing is flattened, roll it between your fingers or hands to make it round again.

7.2 Maintenance check list

Item	*Interval*					
	Day	*Week*	*Month*	*3 Months*	*6 Months*	*Year(s)*
Wipe away spilt saline solutions, solvents, acids or alkaline solutions immediately from outer surfaces. Refer to *7.2.1*.	*					
Empty the bottles immediately when the level sensor triggers off and rinse them with water. Refer to *7.2.1*.	*					
Clean up spillages immediately as they occur, especially around the plate carrier and the bottle module unit (BMU) bottle caps. Refer to *7.2.1*.	*					
Clean the plate carrier immediately when spillages occur on or around the carrier and lift the carrier off the eccentric pins. Refer to *7.2.1.1*.	*					
Keep the instrument free of dust and liquid spills. Refer to *7.2.2*.	*					
Clean the wash bottles regularly. Refer to 7.2.2.	*					
Run RINSE a couple of times before shutdown. Refer to *7.2.2*.	*					
At the end of the day, run **SETUP↵MAINTAIN↵SLEEP↵**. Refer to *7.2.2*.	*					
Before shutdown for the day or the weekend (refer to *7.2.3*), run **SETUP↵MAINTAIN↵CLEAN↵**.	*	*				
Give the washer a wipeover with a mild detergent solution. Refer to *7.2.3*.		*				
Clean the wash heads/wash tips. Refer to *7.2.3.1*.		*				
Check the condition of the pinch valve tubing. Refer to *7.2.4.1*.			*			
Clean any spillage that may have seeped under the carrier and remount. Refer to *7.2.5* and *7.2.1.1*.				*		
Inspect the liquid and waste bottles for signs of wear, etc. Refer to *7.2.6*.					*	
It is recommended to replace the liquid bottles after two years of use. Refer to *7.2.7*.						*

* = depending on the laboratory conditions and the use of the washer

7.2.1 Immediate

- Although the Wellwash AC is constructed from high-quality materials, you must immediately wipe away spilt saline solutions, solvents, acids or alkaline solutions from outer surfaces to prevent damage.
- Empty the waste bottle when the level sensor triggers off (= is activated).
- Clean up spillages as they occur, especially around the plate carrier and the bottle module unit (BMU) bottle caps.

7.2.1.1 How to clean the plate carrier

- When spillages have occurred onto or around the plate carrier, clean the plate carrier immediately. The plate carrier can be removed by lifting it evenly off the eccentric pins of the plate carrier (*Fig. 7.1*).

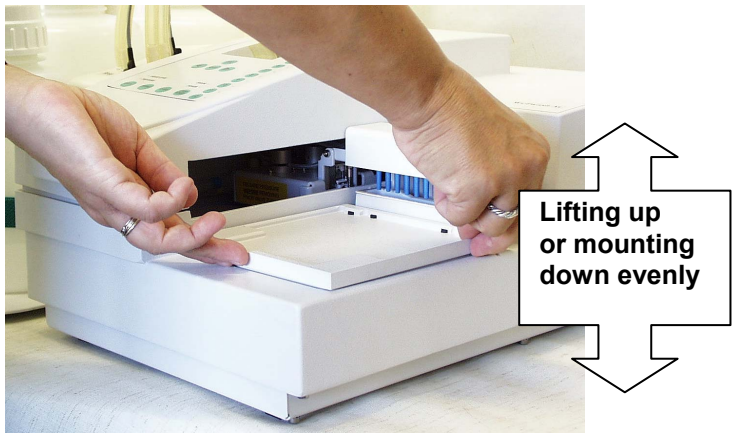


Fig. 7.1 Lifting or mounting the plate carrier

- Both the plate carrier and the area surrounding the eccentric pins can be wiped with a mild detergent (*Fig. 7.2*).

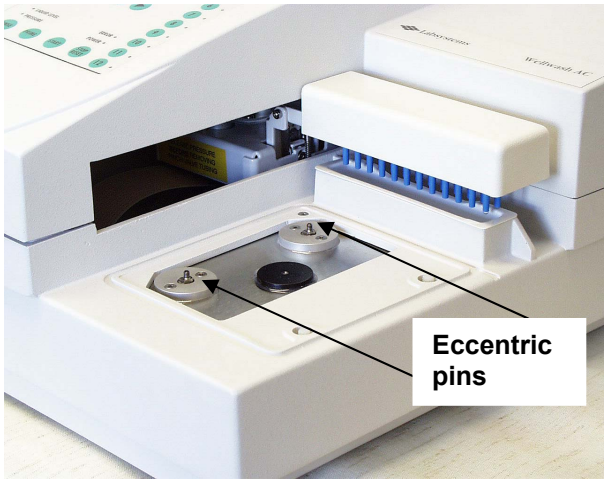


Fig. 7.2 Eccentric pins of the plate carrier

- Mount the plate carrier carefully and evenly back onto the eccentric pins of the plate carrier so that the pins are not damaged or bent in the event (*Fig. 7.3*). Ensure the plate carrier is in its rest position.

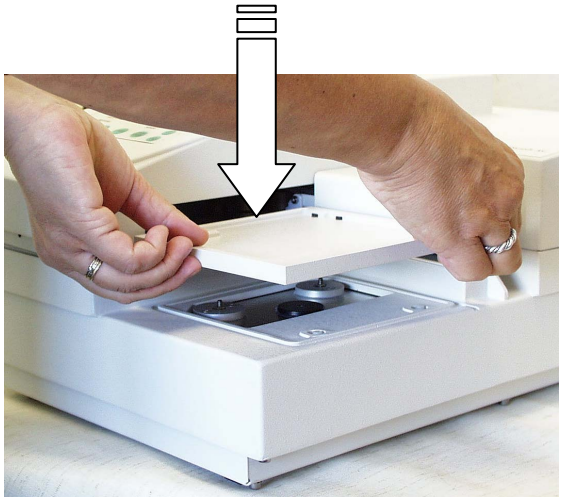


Fig. 7.3 Mounting the plate carrier back onto the eccentric pins

7.2.2 Daily

For reliable daily operation keep the instrument free of dust and liquid spills.

At the end of the day fill the wash bottles with deionized distilled aqua and prime all lines by selecting the program number 11 or 14.

At the end of the day run **SETUP↵MAINTAIN↵SLEEP↵**, which will flush the lines through with rinse solution and leave the head immersed in rinse solution in the prime trough and shut down the instrument.

Alternatively, run RINSE a couple of times before shutdown.

7.2.3 Weekly

Before shutdown for the weekend run **SETUP↵MAINTAIN↵CLEAN↵**, which rinses and clears the lines and leaves the head raised.

The washer should be given a wipeover with mild detergent solution to maintain a good appearance.

7.2.3.1 How to clean the wash heads/wash tips

- Remove the heads from the washer.
- Run the declogging tool or cleaning wire (*Fig. 7.4:12*) supplied with the accessory kit through the dispense and aspirate tube openings.
- Wash the tips through with warm water.
- Allow the water to flow from the tips into the wash head (backflush) to prevent the tips from trapping debris.
- Rinse with deionized distilled aqua.
- Remove the wash heads.
- You can insert the wash head(s) into deionized distilled aqua for longer periods.

7.2.4 Monthly

7.2.4.1 How to check the condition of the pinch valve tubing

- Remove the tubing from the valve and examine the shape.
- If the tubing is becoming flattened by the pinch action, then open the flattened part and refit the tube so that the pinch occurs in a different place.
- If the tubing remains pinched when removed, then replace it with a similar length piece cut from the piece supplied with the accessory kit.
- Some liquids may require this maintenance to be carried out more or less frequently – the user can decide the interval best.

7.2.5 Quarterly

Clean any spillage which may have seeped under the carrier and refit (see Section 7.2.1.1).

7.2.6 Half-yearly

The liquid and waste bottles should be inspected for signs of wear (especially where the liquid is in greatest contact with the bottle), such as discoloration, small cracks (crazing) or material becoming more brittle, especially if stored in direct sunlight for long periods.

7.2.7 Longer periods

Due to the nature of the material used in the manufacture of the liquid bottles (high density polyethylene or HDPE), our suppliers have recommended that the **liquid bottles be replaced after two years of use**.

7.3 Wellwash AC accessory kit

The contents of the Wellwash AC accessory kit (Cat. no. 24072660) is shown below (*Fig. 7.4*). The Wellwash AC accessories are needed for maintenance purposes.

Item no.	*Cat. no.*	*Item*
1	1012150	AC blank head
2	1030480	O ring 1.78 mm x 1.78 mm EDPM 70 SH
3	1030120	O ring 4.70 mm x 1.42 mm NITRILE
4	000759045	O ring 1.15 mm I/D x 1.0 mm CROSS SECTION NITRILE
5	1033070	O ring 2.90 mm x 1.78 mm NITRILE
6	1030490	O ring 6.07 mm x 1.78 mm NITRILE
7	000759048	O ring size BS126 34.6 mm I/D x 2.62 mm CROSS SECTION NITRILE
8	000759049	O ring size BS130 40.95 mm I/D x 2.62 mm CROSS SECTION NITRILE
9	000759050	O ring size BS148 69.52 mm I/D x 2.62 mm CROSS SECTION NITRILE
10	000759051	O ring size BS229 59.92 mm I/D x 3.53 mm CROSS SECTION NITRILE
11	000788004	Silicone tubing 1.98 x 0.6 ft
12	004/319	Declogging tool
13	95029360	Strip 1 x 8 assembled UB, RE bottom (Combiplate 8) *
14	2203130	Silicone grease

* There is one of each item with the exception of 10 Combiplates.

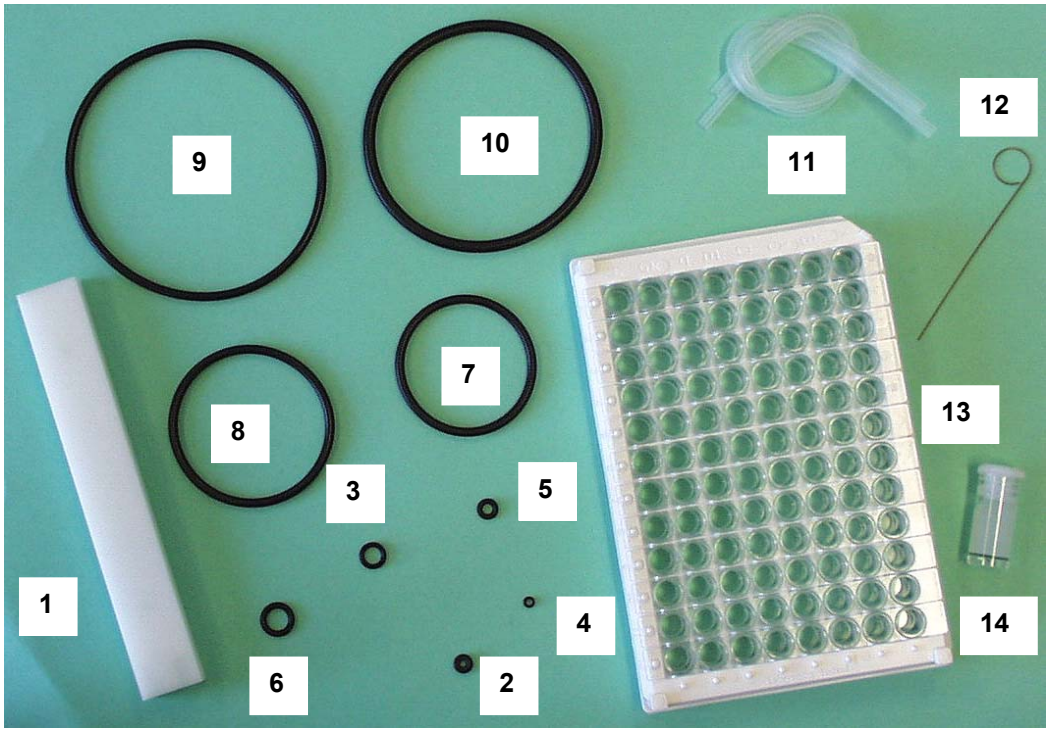


Fig. 7.4 Contents of the Wellwash AC accessory kit

7.4 Disposal of materials

Refer to local regulations for the disposal of infectious material.

The samples can be potentially infectious. Dispose of all used microplates, microstrips, disposable gloves, syringes, disposable tips, etc. as biohazardous waste.

7.5 Decontamination procedure

If there is any risk of contamination with biohazardous material, the procedure recommended below or some other corresponding decontamination procedure must be performed.

The complete decontamination procedure must be performed before shipping the instrument to Thermo Fisher Scientific Oy, for example, for repair, or relocating the instrument from one laboratory to another. Refer to Section 7.6 How to pack for service.

Decontamination is not required for the proper functioning of the instrument.

Example of decontaminants:

- Ethanol 70%
- Virkon® solution 1-3%
- Glutaraldehyde solution 4%
- Chloramine T
- Microcide SQ 1:64

IF LOCAL OR LABORATORY REGULATIONS PRESCRIBE REGULAR DISINFECTION, IT IS NOT ADVISABLE TO USE FORMALDEHYDE, SINCE EVEN SMALL TRACES OF FORMALDEHYDE AFFECT THE ENZYME BEING USED IN EIA TESTS IN A NEGATIVE WAY RESULTING IN BAD TEST RESULTS.

Always use disposable gloves and protective clothing and operate in a well-ventilated area.

DO NOT autoclave the reagent, buffer, wash, rinse or waste bottles.

1. Prepare the decontaminant: for example, 1 – 3% Virkon solution or 200 ml 4% glutaraldehyde solution (or another agent recommended by your safety officer).

2. Run the CLEAN program (**SETUP↵MAINTAIN↵CLEAN↵**).

3. Empty the fluid containers.

4. Switch the power OFF and disconnect the mains supply cable (see *Fig. 5.8*).

5. Disinfect the outside of the instrument using a wad of cotton wool/cloth soaked in 70% ethanol.

6. Place the plate carrier and wash heads, for example, in 1 – 3% Virkon solution or 200 ml 4% glutaraldehyde solution for 10 min and rinse them with deionized distilled aqua.

7. Place the entire instrument in a large plastic bag. Ensure that the reagent containers are disconnected and open.

8. Place a wad of cotton wool soaked in the prepared solution into the bag. Ensure the wad does not make contact with the instrument.

9. Close the bag firmly and leave the instrument in the bag for at least 24 h.

10. Remove the instrument from the bag.

11. Clean the instrument using a mild detergent.

12. Remove any stains using 70% ethanol.

13. Reposition the plate carrier and the wash heads on the unit.

14. Flush the fluid path of the instrument with deionized distilled aqua using the priming procedure.

15. The wash heads can be sterilized in 70% ethanol.

16. Also wash and disinfect the wash, rinse and waste bottles.

17. After performing this decontamination procedure, include a signed and dated Certificate of Decontamination both inside the transport package and attached to the outside of the package.

7.6 How to pack for service

When you ship the instrument for service remember to:

- Inform about the use of hazardous materials.
- Decontaminate the instrument beforehand.
- Install the transport locks.
- Pack the instrument according to the enclosed packing instructions.
- Use the original packaging to ensure that no damage will occur to the instrument during shipping. Any damage will incur additional labor charges.
- Include a dated and signed Certificate of Decontamination (see Section 9.4.1.1) both inside and attached to the outside of the package, in which you return your instrument (or other items).
- Enclose the return authorization number (RGA) given by the Thermo Fisher Scientific representative.
- Indicate the fault after you have been in touch with your local Thermo Fisher Scientific representative or Thermo Fisher Scientific's service department.

See Section 8.1 for details on storage and transportation temperatures.

7.7 Service contracts

It is strongly recommended that the instrument is regularly maintained and serviced every six months on a contract basis by the manufacturer's trained service engineers. This will ensure that the product is properly maintained and gives trouble-free service. Contact Thermo Fisher Scientific's service department for more details.

7.8 Disposal of the instrument

1. Decontaminate the instrument prior to disposal. See Sections 7.5, 9.4.1 and 9.4.1.1 on decontamination. Also wash and disinfect the bottles prior to disposal.

2. Dispose of the instrument according to the legislation stipulated by the local authorities concerning take-back of electronic equipment and waste. The proposals for the procedures vary by country.

   Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State (European Country), and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/WEEERoHS**.

3. Regarding the original packaging and packing materials, use the recycling operators known to you.

4. For more information, contact your local Thermo Fisher Scientific representative.

8 TECHNICAL SPECIFICATIONS

8.1 General specifications

Technical specifications

Overall dimensions

- Combined washer and bottle module unit

	Cat. no. 5161020	***5161030***
Width	540 mm (21.3 in.)	640 mm (25.2 in.)
Depth	530 mm (20.9 in.)	670 mm (26.4 in.)
Height	390 mm (15.4 in.)	500 mm (19.7 in.)

- *Washer unit* 300 mm (11.8 in.) (W) x 430 mm (16.9 in.) (D) x 200 mm (7.9 in.) (H)
- *Bottle module unit* 215 mm (8.5 in.) (W) x 530 mm (20.9 in.) (D) x 390 mm (15.4 in.) (H)

Weight (total)

Cat. no. 5161020	***5161030***
13 kg (28.8 lbs.)	14.8 kg (32.6 lbs.)

- *Washer unit* 9.5 kg (21.1 lbs.)
- *Bottle module unit* 3.5 kg (7.7 lbs.) (bottles empty)

Operating conditions (indoor use)

+10°C – +30°C, RH: 90% max.
Full specification +25°C nominal

Transportation conditions

-40°C – +70°C, packed in transport packaging

Storage conditions

-10°C – +70°C, packed in transport packaging

Line voltage

100 – 240 Vac, 50/60 Hz, nominal (operating range 90 – 264 V)

Power consumption

130 VA

Heat dissipation

444 BTU max.

Display

8 x 21 character graphic dot-matrix LCD module

Keypad

An embossed, tactile membrane keypad with 20 keys

Computer interface

- ***baud rate***
- ***character format***
- ***handshaking***

RS-232C serial interface
9600 baud (bd)
1 start bit, 8 data bits, 1 stop bit, no parity
None

Liquid containers

	Cat. no. 5161020	***5161030***
Wash bottle capacity	2 x 2 liters	2 x 4 liters
Rinse bottle capacity	1 liter	2 liters
Waste bottle capacity	4 liters	10 liters

All containers are fitted with a liquid level sensor and a quick-release cap

Wash heads

2 x 8-way head
2 x 12-way head
1 x blanking head

Pump system

Double-head pump to create pressure and vacuum

Max. pressure in reagent bottle	15 psi
Normal operating pressure	5.5 psi
Max. vacuum in waste bottle	600 mbar

Pressure and vacuum monitored by pressure transducers
Liquid dispensing: pressurized system, valve
Liquid aspiration: membrane pump, pressurized system

Performance specifications

Washing volume	50 – 1000 µl in 50 µl increments
No. of washing cycles	1 – 10
Residual aspiration volume	< 3 µl per well with standard aspiration mode (flat-bottom plate) < 1 µl per well with sweep aspiration mode (flat-bottom plate)
Aspiration height	Adjustable, 0 – 11.5 mm
Dispensing volume	50 – 400 µl
Dispensing accuracy	± 10% @ 300 µl
Dispensing precision	CV 3% @ 300 µl
Soaking/Shaking time	1 – 60 min
Rinsing time	0 – 8 h in 15 min increments
Rinsing volume	5 – 100 ml in 5 ml increments
Priming volume	5 – 100 ml in 5 ml increments
Purging time	1 – 20 s in 1 s increments
Memory	99 programs
Linking	1 – 4 linked protocols in one program
Orbital shaker	2 mm orbit, 650 – 950 rpm

8.2 Safety specifications

8.2.1 Live parts

The instrument is safe to operate with the covers fitted and these must not be removed. The covers protect the user from live parts and they should only be removed after switching the instrument off and disconnecting the mains supply cable, and only by suitably qualified maintenance and repair personnel.

Voltages dangerous for human beings are present in this instrument. Before removing any covers, disconnect the instrument from the power supply.

8.2.2 Pressurized system

The liquid containers are maintained at a working pressure of 5.5 psi. Therefore, **liquid or pressure lines must not be disconnected while pressurized** or while the pump is running. The bottle pressure is released by unscrewing any of the pressurized bottle caps. The disconnected lines **must be reconnected securely before repressurization**.

The Wellwash AC fulfills the following requirements:

IEC 61010-1:1990 + A1:1992 + A2:1995/EN 61010-1:1993 + A2:1995 including CENELEC Common Modifications, FI, US and CA National differences.

The safety specifications are also met under the following environmental conditions in addition to or in excess of those stated in the operating conditions:

Altitude	up to 2000 m
Temperature	+5°C - +40°C
Mains supply fluctuations	± 10% from nominal
Installation category (overvoltage category)	II according to IEC 60664-1 (Note 1)
Pollution degree	2 according to IEC 60664-1 (Note 2)

Notes

1. The *installation category* (overvoltage category) defines the level of transient overvoltage, which the instrument is designed to withstand safely. It depends on the nature of the electricity supply and its means of overvoltage protection. For example, in CAT II, which is the category used for instruments in installations supplied from a supply comparable to public mains, such as hospital and research laboratories and most industrial laboratories, the expected transient overvoltage is 2500 V for a 230 V supply and 1500 V for a 120 V supply.

2. The *pollution degree* describes the amount of conductive pollution present in the operating environment. Pollution degree 2 assumes that normally only nonconductive pollution, such as dust, occurs with the exception of occasional conductivity caused by condensation.

Both of these affect the dimensioning of the electrical insulation within the instrument.

8.3 In conformity with the requirements

The Wellwash AC bears the following markings:

Type 870
100 – 240 Vac, 50/60 Hz, Class I
CE mark

The Wellwash AC conforms to the following requirements:

2006/95/EC (Low Voltage Directive)
2004/108/EC (Electromagnetic Compatibility Directive, EMC)
FCC Part 15, Subpart B/Class B
2002/96/EC (Waste of Electrical and Electronic Equipment)

Safety performance:

IEC 61010-1:1990 + A1:1992 + A2:1995/EN 61010-1:1993 + A2:1995 including CENELEC Common Modifications, FI, US and CA National differences.

EMC performance:

EN 50081-1:1992	Generic emission standard. Residential, commercial and light industry.
EN 50082-1:1997	Generic immunity standard. Residential, commercial and light industry.
EN 61326-1:1997 + A1:1998 + A2:2001 + A3:2003	Product family standard.

Test standards and	**Performance limits**
EN 55022:1994	Class B, 150 kHz – 1 GHz
EN 61000-3-2:1995 + A1:1998 + A2:1998 + A13:1997 + A14:2000	Class D
EN 61000-3-3:1995	
ANSI C63.4:1992	Class B, 450 kHz – 1 GHz
EN 61000-4-2:1995	4 kV CD, 8 kV AD, Criteria B
EN 61000-4-3:1996	3 V/m, 80 MHz – 2 GHz, Criteria A
EN 61000-4-4:1995	1 kV, Criteria B
EN 61000-4-5:1995	2 kV line to ground, 1 kV line to line, Criteria B
EN 61000-4-6:1996	3 V_{rms}, 150 kHz – 80 MHz, Criteria A
EN 61000-4-8:1994	3 A/m, Criteria A
EN 61000-4-11:1994	30%/10 ms, Criteria B 60%/100 ms, Criteria B 100%/20 ms, Criteria B 100%/5 s, Criteria C

8.4 Remote control to Wellwash AC

Hardware requirements

The Wellwash AC is connected to a RS-232C serial port of a PC. Baud rate is 9600 with 1 start bit, 8 data bits, 1 stop bit and no parity. No hardware handshaking is used.

The F9/F25 serial cable (Cat. no. 2305290) is used in remote control. The serial connector on the instrument is a 25 pin male D connector. Reception is through pin 3, transmission through pin 2 and signal ground is at pin 7.

Protocol

All data is transferred in a limited set of ASCII characters. A Wellwash AC command must be terminated with a <CR> or <LF> character or any combination of them (CR, LF, CR LF, LF CR). CR is the abbreviation for carriage return and LF for line feed. Only <CR>, <LF> and printable ASCII characters are legal transmission elements.

Command format

The commands comprise a 3 character command identifier, for example, LIS (= LIStloadedprogram), SEP (= SElectProgram), SER (= SElectRows), STA (= STArtloadedprogram), STO (= STOpstartedprogram), etc. followed by command parameters applicable to the command. The <SPACE> character separates the fields of the command.

Examples SEP<SPACE>55<CR><LF> (=SElectProgram # i; selects program # 55 into use; *the command has a parameter*)
STA<CR><LF> (=STArtloadedprogram; starts the loaded program; *the command ends*)

Response format

All response lines start with the same 3 character identifier as the command being executed.

The first response line contains only the command identifier and it is sent when the execution of the command starts.

The last response line contains the command identifier, end field characters ‘END’ and the status field which is ‘0’ for a successful completion, otherwise an error or warning code appears.

Between the first and the last response line are command specific data lines if data is returned. Note that these lines may not be there if an error is reported.

For a more thorough description of the commands, contact Thermo Fisher Scientific Oy.

9 TROUBLESHOOTING GUIDE

9.1 Troubleshooting guide

Normally, if an error occurs, the display will advise the course of action to remedy the problem. The problems covered below are considered as faults that require repair or corrective work. If the installation procedure is carefully followed, no faults should arise. However, if problems do occur or reoccur, contact authorized technical service immediately.

Error	*Description*	*Action*
No power LED	The mains lead is not connected properly. The power is switched OFF. An internal fuse has blown.	Reconnect the lead. Switch ON the power. Contact authorized technical service.
Power fails immediately	The main voltage is not correct.	Contact authorized technical service.
No display	An internal fuse has blown.	Contact authorized technical service.
Liquid Level LED on	The level sensor is not located correctly in the cap. The float is not buoyant. The bottles are full or empty.	Refit the level sensor. Contact authorized technical service. Take appropriate action.
Pressure LED on	The bottle seals are damaged or missing. The head is blocked. The tube is disconnected or punctured.	Replace the O ring. Clear the tips. Replace the tube length.
Error LED on	The mechanisms cannot initialize. Nonspecific	Remove the obstruction. Follow the display advice.
Unequal dispensing or aspiration of liquid	The microplate is incorrectly positioned on the plate carrier. One or more of the wash tips are clogged/blocked.	Check and adjust the position of the plate carrier. De-clog the washer tips.
Low dispense volume	Tubes are flattened under pinch valves. The selector valve ports are misaligned to the core.	Open the pinch valves and release the flattened part of the tube. Check the lines from the bottle module unit (BMU) through to the wash head for kinks. Contact authorized technical service.
Buffer leakage under BMU	The selector valve is worn out.	Contact authorized technical service to replace the selector valve.

Check regularly that the tubes are not flattened in the pinch valve. If the tubing is flattened, roll it between your fingers or hands to make it round again.

9.2 FAQs about the Wellwash AC

Q1: Do I need to order separate accessories to be able to carry out the washing step in the microplate assay?
A1: No, all typically required accessories are enclosed with the Wellwash AC.

Q2: Can I program the instrument to wash with liquid 1 and then dispense liquid 2 automatically?
A2: Yes. For example, you may have a washing sequence including 5 washing cycles with liquid 1 and after that you can dispense liquid 2 into the plate. The Wellwash AC carries all this out automatically in either a linked program or with two separate programs.

Q3: What different steps can be linked to one assay protocol?
A3: 1. Washing: including all parameters for carrying out complete washing, like wash volume, number of washing cycles, soaking time, shaking, etc.
2. Separate dispensing.
3. Separate aspiration.
4. Separate shaking.

Note that an application program can also be created comprising 4 different kinds of washing steps using different wash liquids.

Q4: When does the instrument give a warning of too little liquid?
A4: An audible warning, the liquid level warning red light and an error message on the LCD screen are given when there is about 550 ml of liquid left in the wash bottles (or about 100 ml of liquid left in the rinse bottle). You may override this warning by continuing with START if the liquid volume is sufficient for your application.

Q5: Why is the warning of low liquid given so early even when there is enough liquid left for my application?
A5: Due to the unique feature of the Wellwash AC, the wash volume can be up to 1000 µl. One example of washing can be 5 washing cycles with 1000 µl. The required wash liquid volume in this case is about 500 ml of washing reagent (5 x 96 x 1000 µl). Therefore, the warning is given early even though there would be enough liquid for the present washing. One of the most used washing protocols is 3 times washing with 300 µl. In this case the required liquid volume is about 100 ml. You may override this warning by continuing with START.

Q6: What does it mean, when you initiate the prime or wash function and the row selection LEDs start to go off one after one?
A6: It means that the instrument is increasing the pressure sufficiently to start the requested operation.

Q7: Can customers purchase only the plain bottle caps?
A7: No. The supplier does not sell caps separately.

Q8: Can the bottles be autoclaved?
A8: No.

Q9: When the normal washing cycle is selected, the dispensing volume inside the wells is the same as the programmed. But when shaking is included in the program, the volume of the wash liquid seems to be less than the programmed. Why?
A9: After dispensing the programmed washing volume, the Wellwash AC automatically aspirates extra liquid from the well to prevent spilling wash liquid during the shaking. This is a unique feature of the Wellwash AC. The dispensed liquid volume is as great as programmed, only extra liquid is removed.

Q10: Should the bottle module unit (BMU) be installed close to the washer?
A10: Yes.

Continued

FAQs about the Wellwash AC Cont.

Q11: Can the dispense pressure be adjusted by the customer?
A11: No, the customer cannot adjust the dispensing pressure. Only the service personnel can do this by adjusting the pump pressure. When the pump pressure is adjusted, it will affect the volumes dispensed.

Q12: Why are the tube connectors red and is it alright to use the washer when this is the case?
A12: The test solution used in the factory is red and therefore some of the tube ends may be discolored. It is, however, alright to use the washer in this condition.

9.3 Hazards

This instrument is designed to provide full user protection. When correctly installed, operated and maintained, the instrument will present no hazards to the user.

The following recommendations are given to ascertain added user safety.

9.3.1 Electrical

Ensure that the mains supply cable supplied with the unit is always used. **If a correct type of mains cable is not provided, use only cables certified by the local authorities.**

The mains plug should only be inserted into a socket outlet provided with a protective ground contact. The protective action must not be negated by use of an extension cable without a protective ground wire.

When the instrument is connected to the mains supply, the opening of covers or removal of components is likely to expose live parts. The instrument should be disconnected from all voltage sources by disconnecting the mains supply cable, before it is opened for any adjustment, replacement, maintenance or repair purposes.

Any adjustment, maintenance or repair of the opened instrument under voltage should be avoided, if possible, but if unavoidable, should only be carried out by a skilled technician aware of the hazard.

Voltages dangerous for human beings are present in this instrument. Before removing any covers, disconnect the instrument from the power supply.

The same precautions applicable when using any electrical equipment should certainly be observed with this instrument. DO NOT touch switches or electrical outlets with wet hands. Switch the instrument off before disconnecting it from the mains supply.

9.3.2 Mechanical

The wash head is a free-moving mechanical device controlled by the instrument and not directly by the operator. It is designed for ‘hands-off’ operation and should be used as such. **Never reach into the work space, while the instrument is performing a wash cycle.** If it is necessary to stop the operation of the equipment, press the STOP/RESET key on the control panel.

9.3.3 Environmental

Infectious samples and corrosive fluids are commonly used with this equipment. The 'hands-off' nature of the system allows the user to wash the reaction wells without getting into direct contact with these fluids. However, the wells that have been in contact with potentially hazardous fluids must be handled before and after the wash process, and this should be done with utmost care. Hand and eye protections should always be worn as well as corrosive resistant laboratory coats.

Observe normal laboratory procedures for handling potentially hazardous samples.

9.3.4 Defects and abnormal stresses

Whenever it is likely that the protection against safety hazards has been impaired, the instrument should be made inoperative and be secured against any unintended operation.

The protection is likely to be impaired if, for example, the instrument:
1. shows visible damage;
2. fails to perform the intended functions;
3. has been subjected to prolonged storage under unfavorable conditions, or
4. has been subjected to severe transport stresses.

9.4 Service request protocol

If the Wellwash AC requires service, contact your local Thermo Fisher Scientific representative or Thermo Fisher Scientific's service department. DO NOT under any circumstances send the instrument for service without any prior contact. It is imperative to know the fault and nature of the required service.

The Thermo Fisher Scientific representative or distributor will take care of sending a complaint form (Complaint-order) to Thermo Fisher Scientific's service department. The Complaint-order contains a more detailed description of the fault, symptom or condition. Give all the necessary information to the distributor, who will fill in and forward the Complaint-order to Thermo Fisher Scientific's service department.

Check Section 7.6 How to pack for service. You will find instructions on how to proceed before shipping the instrument for service.

Check that any necessary decontamination procedure has been carried out before packing. See Sections 9.4.1 and 9.4.1.1 on decontamination. Refer also to Section 7.5 Decontamination procedure. Ensure that the Certificate of Decontamination as well as the return authorization number (RGA) are sent with the instrument.

Thermo Fisher Scientific's service department will keep you up to date with the progress of service and provide you with any further details you might need, for example, on maintenance, serviceability, troubleshooting and replacement.

9.4.1 Decontamination

Decontamination should be performed in accordance with normal laboratory procedures. Any decontamination instructions provided with the reagents used should be followed.

A decontamination procedure is only recommendable when infectious substances have been in direct contact with any part(s) of the instrument.

9.4.1.1 Certificate of Decontamination

The decontamination procedure is required prior to shipping the instrument to Thermo Fisher Scientific Oy, for example, for repair. If, for any reason, the instrument is shipped back to Thermo Fisher Scientific Oy, it must be accompanied by a dated and signed Certificate of Decontamination, which must be attached to the outside of the package containing the instrument. See Section 7.5 Decontamination procedure.

Failure to confirm decontamination will incur additional labor charges or at worst the items will be returned for proper cleaning.

Before returning any instrument(s) or item(s), ensure that they are fully decontaminated. Confirm A or B status:

Name: _____

Address: _____

Tel./Fax: _____

Name: _____ Serial no.: _____

A)
I confirm that the returned items have not been contaminated by body fluids, toxic, carcinogenic or radioactive materials or any other hazardous materials.
B)
I confirm that the returned items have been decontaminated and can be handled without exposing the personnel to health hazards.

Materials used in the unit: Chemicals + Biological • Radioactive *)

Specific information about contaminants: _____

_____

Decontamination procedure[1]: _____

_____

_____

Date and place: _____

Signature: _____

Name (block capitals): _____

*) The signature of a Radiation Safety Officer is also required when the unit has been used with radioactive materials.

This unit is certified by the undersigned to be free of radioactive contamination.

Date and place: _____

Signature: _____

Name (block capitals): _____

[1] Please include decontaminating solution used.

10 WARRANTY CERTIFICATE

Thermo Fisher Scientific Microplate Instrumentation Business products are fully guaranteed against defective parts and materials, including defects caused by poor workmanship, for a period of one year from the date of delivery.

Thermo will repair or replace defective parts or materials during the term of warranty at no extra charge for materials and labor provided that the products were used and maintained in accordance with Thermo Fisher Scientific's instructions. The warranty is invalid if products have been misused or abused.

For the warranty to be effective, the product must have been purchased either directly from Thermo Fisher Scientific or from an authorized Thermo Fisher Scientific distributor. The guarantee is not transferable to a third party without prior written approval from Thermo Fisher Scientific.

This guarantee is subject to the following exclusions:

- Any defects caused by normal wear and tear.
- Defects caused by fire, lightning, flood, earthquake, explosion, sabotage, war, riot, or any other occurrence of the type listed above.
- Refurbished products that are subject to different warranty conditions.

THIS WARRANTY IS IN LIEU OF ALL OTHER EXPRESSED OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The seller is not liable for any loss or damage arising out of or in connection with the use of the product or other indirect damages.

These warranty terms and conditions can be obtained from your local Thermo Fisher Scientific dealer.

Note Consumables are not included in the warranty.

11 ORDERING INFORMATION

Code	Instrument/System
5161020	Wellwash AC, 100-240 V with 1 x 1 l Rinse, 2 x 2 l Wash and 1 x 4 l Waste bottles
5161030	Wellwash AC Big Bottles, 100-240 V with 1 x 2 l Rinse and 2 x 4 l Wash bottles
1093620	1 x 10 l Waste bottle (*Fig. 11.1*)

Fig. 11.1 10 l waste bottle

11.1 List of accessories

Code	Item	Quantity
1508310	*Wellwash AC User Manual*	1
15018940	*Wellwash AC IQ/OQ/PQ*	1
24073570	Wellwash AC IQ/OQ/PQ Package	1
3629300	Packing material for Wellwash AC	

11.2 List of strips and plates for demonstration purposes

Code	Item	Qty
9502227	96 Well Plate UB, RE bottom (Cliniplate)	50 pcs/box
95029350	Strip 1 x 8 assembled UB, RE bottom (Combiplate 8)	50/box
95029370	Strip 1 x 12 assembled UB, RE bottom (Combiplate 12)	50/box
9205	Styrene 96-well Plate, flat bottom	50/box

11.3 List of spare parts

Code	Item
WW007/11	1 x 8 Wash head (*Fig. 4.6*)
WW007/1	1 x 12 Wash head (*Fig. 4.6*)
WW007/6	1 l Wash bottle with level sensor (LS) assembly and LS cap
WW007/7	2 l Wash bottle with level sensor assembly and LS cap
WW007/8	4 l Waste bottle with level sensor assembly and LS cap
WW007/17	Small level sensor cap (1- and 2-liter bottle)
WW007/18	Large level sensor cap (4-liter bottle)
WW007/22	2 l Wash bottle with level sensor assembly and plain cap
WW007/23	Multilumen tubing set
WW007/26	Declogging tool
WW007/30	4 l Waste bottle with level sensor assembly and plain cap
WW007/31	O ring set for bottles
WW007/32	Plate carrier pads (4)
WW007/33	1 l Wash bottle with level sensor assembly and plain cap
WW007/35	2 l Wash bottle with plain cap
WW007/36	Prime trough liner
WW007/38	1 l Plain bottle with plain cap
1012150	AC blank head (*Fig. 4.6*, *Fig. 7.4*)
24072540	4 l Wash bottle with level sensor assembly and LS cap
24072660	Accessory kit Wellwash AC (*Fig. 7.4*)

11.4 List of recommended spare parts

Code	Item	1-2 unit(s)/year	10 units/year
WW007/1	1 x 12 Wash head	1	1
WW007/11	1 x 8 Wash head	1	1
WW007/6	1 l Wash bottle with level sensor (LS) assembly and LS cap	1	2
WW007/7	2 l Wash bottle with level sensor assembly and LS cap	1	2
WW007/8	4 l Waste bottle with level sensor assembly and LS cap	1	2
WW007/23	Multilumen tubing set	1	3
WW007/29	O ring pack for heads	1	10
WW007/31	O ring set for bottles	1	10
WW007/32	Plate carrier pads (4)	1	10
WW007/36	Prime trough liner	1	2

12 GLOSSARY AND ABBREVIATIONS

aspirate = Removing fluids by suction.

Auto-Sip = Function carried out prior to shaking on washed microplates or strips filled to 300 µl/well by sucking part of the liquid away from the wells.

BMU = bottle module unit

EIA = enzyme immunoassay

EN = European Norm

EU = European Union

FAQ = frequently asked questions

IEC = International Electrotechnical Commission

LINK PROTOCOL = A program can contain max. four protocols. The protocols of a program are sequentially linked. The amount of linked protocols can vary from program to program. Note that the LINK PROTOCOL No. 1 equals the main protocol.

prime = The operation of filling a pump intake with fluid to expel the air.

PTFE = polytetrafluorethylene

purge = To clean and flush out liquids from the tubing.

residual aspiration volume = The smallest volume of liquid remaining in the microplate well after washing has been completed.

rinse = An important sequence in the washing of microplates, either part of the wash protocol or a separate step. To remove unwanted matter or fluid from the microplate by washing it quickly with rinse solution, for example, deionized distilled aqua.

soak time = The soak period between a washing cycle in microplate washing protocols. The soak time can vary in steps from, for example, 0 s to some 60 min. The shaking option is generally available only with a soak time of > 0 s.

washer = washer unit + bottle module unit

wash head = Interchangeable, disposable twin-strip 2 x 8-way, 2 x 12-way or 1 x blanking heads allowing either 1 x 8, 2 x 8 (default setting), 1 x 12 or 2 x 12-way processing.

wash volume = Volume of the wash buffer used in microplate washing.

12.1 Keywords for web pages

EIA
ELISA
enzyme immunoassay
immunoassay
microplate
microplate coating
microplate washing
Microtiter plate
microwell plate
sandwich assay
separation technique(s)
solid phase assays
Thermo Fisher Scientific
Thermo Scientific
washer
washing
Wellwash

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APPENDIX A. THERMO SCIENTIFIC WELLWASH AC BRIEF USER'S GUIDE

- Switch the Wellwash AC on (p. 32).
- Add the wash liquids and rinse liquid to the bottles (p. 30).
- Load the microplate to be washed onto the instrument (p. 30).
- Select the desired protocol from the keypad and display (p. 32).
- Carry out the row selection (pp. 33, 34, 50 and 59).
- Press the **START** button (p. 56).
- After the end of the run, remove the microplate (p. 60).
- Maintain your Wellwash AC instrument (p. 61).

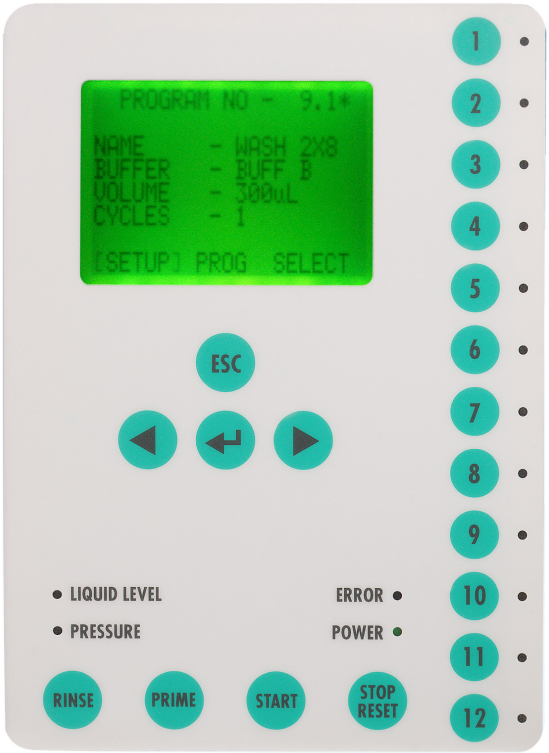

Fig. Appendix A.1 Wellwash AC keypad and display

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APPENDIX B. THERMO SCIENTIFIC WELLWASH AC FEEDBACK FORM

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Internet e-mail address	

	Excellent	Above expectations	As expected	Below expectations	Comments
Reagent kit/Instructions	☐	☐	☐	☐	
Instrument/User manual	☐	☐	☐	☐	
Operational reliability	☐	☐	☐	☐	
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