DIAWasher

User Manual

Conformity

The product complies with the general safety and performance requirements of the following regulation: EU Regulation 2017/746 on in vitro diagnostic medical devices (IVDR)

It also complies with the European standard:

EN 61010-1:2010;

EN 61010-2-101:2017;

EN 62304:2016,

EN 62366-1:2021,

EN 13612:2002,

EN 61326-1:2013 and

EN 61326-2-6:2013.

Conformity is confirmed provided the device is installed and used in accordance with the requirements described in the manual.

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For software version 5.1e
Base UDI-DI: 912000735DIAWASHERUK
REF: ELX5O/8

CE

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Using this manual

Please read this manual carefully before using the device.

It is important that you familiarise yourself with the device and its functions before performing clinical diagnostic tests.

This user manual contains instructions for the installation, daily use and maintenance of the DIAWasher.

Please retain all packaging materials for future storage, transport and maintenance.

If you encounter any problems, please contact your dealer.

Notes: Tips, advice and suggestions are shown in italics for clarity.

Warning: The relevant warning or precaution must be strictly observed to ensure that the device operates in accordance with the specifications. Precautions are printed in bold as shown here.

Symbols on the appliance

This symbol indicates that the marked part is hot during operation of the device. Do not touch the marked part, as you may burn yourself.
The symbol is located on the lamp holder of the optical system.

Warning! This indicates that the marked area may cause injury and/or damage to the device.

This symbol indicates the product's serial number, enabling a specific product to be identified.

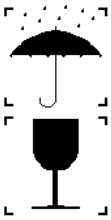
This symbol indicates that the product is an accessory to an *in vitro* diagnostic device. The symbol may also be used for *in* vitro diagnostic devices themselves.

This symbol indicates the manufacturer of the product. The manufacturer's name and address are provided.

This symbol indicates the date on which the product was manufactured.

CE marking in accordance with Regulation (EU) 2017/746 (IVDR).

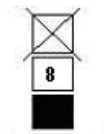
Biological risks
Indicates that the product is associated with potential biological risks.



Store in a dry place! The device must be protected from moisture.

Fragile, handle with care!
The device should be handled with care during transport to prevent damage.

The packaging must remain upright. Do not tip over.



Stacking limit: This symbol indicates that the stack height must not exceed 8 layers to avoid damaging the appliance.

This symbol indicates the temperature range to which the product can be safely exposed.

Warnings and safety instructions

Please read the following warnings carefully before use and follow them strictly.

- **The components used in some tests may pose a biological hazard. When operating the device, always wear protective clothing and safety goggles, and fit the protective cover.**
- **Some of the steel pins on the wash head are sharp and may cause injury if touched. Keep your hands and fingers away from the working area whilst the device is in operation. Always switch off the device before replacing the wash head. Do not touch the wash head whilst the device is in operation.**
- **If the device is in operation and the waste bottle tips over, switch off the power switch immediately. The device may discharge a small amount of waste liquid through a device at the bottom. This waste liquid must be treated as biohazardous material.**
- **Please wear rubber gloves during maintenance and wash your hands after each procedure.**
- **Do not touch the reagents or the patient sample with bare hands.**
- **A blocked wash head leads to poor suction and dosing. In this case, rinse the wash head with distilled water and clean the blocked opening with a thin needle. If the problem cannot be resolved in this way, you must replace the wash head.**
- **Please ensure proper earthing**
- **The AC power supply must be stable and must not be shared with high-power electrical appliances.**
- **When unplugging the power cable, make sure to grip the plug and not the cable itself.**
- **Switch off the device immediately and contact the seller if the device emits smoke, a strange smell or a strange noise.**
- **Ensure that you disconnect the power supply and switch off the main processor when carrying out maintenance work or removing the outer cover for other reasons.**
- **Report serious incidents or potential serious incidents relating to the DIAWasher to the manufacturer and your competent authority in accordance with the requirements.**

WASTE DISPOSAL

- To protect the environment and public health, it is recommended that consumables, wear parts, liquid waste and end-of-life equipment are not disposed of in the environment.
- Ensure that the disposal of liquid waste, consumables, wear parts and end-of-life equipment is carried out in accordance with applicable laws and regulations.

Intended use

DIAWasher is an instrument to be used as accessory for DIAReader and DIALAB ELISA kits for quantitative or qualitative ELISA measurements from human serum or plasma. DIAWasher is intended to be used for the automated cleaning of enzyme conjugates bound to microplates or microstrips (solid-phase washing). For professional laboratory in vitro diagnostic use only.

1. General information

1.1 Brief introduction

1.1.1 Features of the device

1) Large liquid crystal display and graphical user interface.
2) Support for single- and three-channel washing systems for washing ELISA plates and strips with flat, U- and V-bottoms, as well as standard 96-well plates or other plate types.
3) Convenient programming of wash time, liquid volume and soak time. Plate washing, strip washing and skip washing are programmable.
4) Automatic positioning as well as manual positioning to ensure precision.
5) The design of the dual-pin wash head reduces cross-contamination.
6) Waste bottles feature an auto-alarm function with a liquid sensor.
7) 8- and 12-well wash heads available

1.2 Technical specifications of the device

Washing head:	8- or 12-position
Number of wash programs	10
Capacity of the storage bottles:	Wash bottle, distilled water bottle and waste bottle, 2 liters each
Washing protocols	100
Wash cycles	Max. 99
Soaking/shaking time	0–24 h
Mode	Plate and strip washing
Accuracy:	± 5
Residual volume	< 1 µl
Wash volume	10–3000 µl/well
Resolution	1 µl
Incubator temperature	25°C/30°C/37°C fixed
Temperature accuracy	±5%
Temperature stability	±5%
Temperature uniformity	± 1 °C
Warm-up time	6 min.
Display	Liquid crystal display
Interface	RS-232 bidirectional communication port
External dimensions	450 mm (L) × 390 mm (W) × 190 mm (H)
Weight	13 kg
Power supply	220 V AC, 50 Hz
Input power	140 VA
Operating environment	5° C－～ －40° C, relative humidity ≤83%
Fuse	T3.15AL 250 V, Φ5×20

1.3 Construction

Front view:

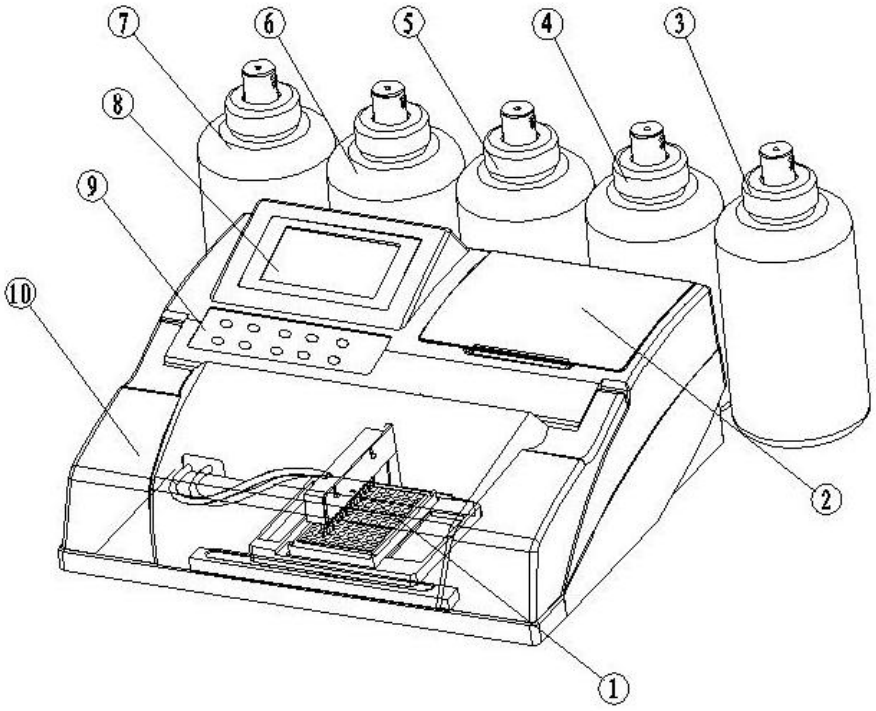


Fig. 1-1 Front view of the device

1	ELISA plate	6	Wash bottle 3
2	Incubation cover	7	Bottle of distilled water
3	Waste bottle	8	LCD screen
4	Wash bottle 1	9	Keyboard
5	Wash bottle 2	10	Transparent cover

Rear view

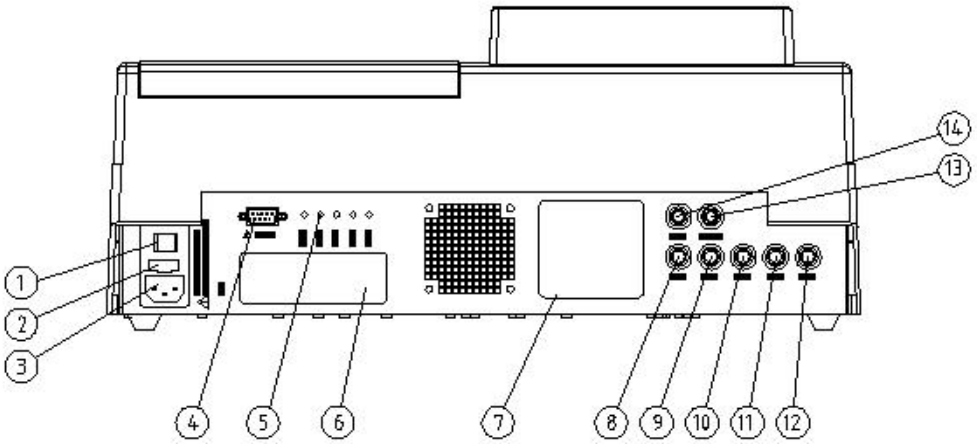


Fig. 1-2 Rear view of the device

1	Power switch	8	Waste bottle connection 1
2	Fuse	9	Connection for wash bottle 1
3	Power input	10	Washing bottle connection 2
4	RS-232 interface	11	Rinsing bottle 3 connection
5	Sensor interface	12	Distilled water bottle connection
6	Label	13	Vent
7	Wiring diagram	14	Waste bottle connection 2

1.4 Keyboard

Fig. 1-3 Schematic diagram of the keyboard

START	Start process; Save parameter changes.
CANCEL	Cancel the current operation; Cancel saving and exit parameter editing.
^	Back to top

v	Down
＋	Changing parameters (increase, up, left)
－	Change parameters (decrease, down, right)
PRIME	Start priming process (quick access key)
SELECT	Switch between coarse and fine adjustment
RINSE	Start the rinsing process (quick access button)
ASPR	Starts the single aspiration/single dispensing process (quick access button)

1.5 How the device works

The main components of the DIAWasher are: a suction pump, a wash head, a vacuum pump, and bottles for the wash solution(s) and the waste solution. Principle: A specific volume of wash solution from the wash bottle is drawn in by the suction pump and then dispensed evenly by the wash head into the individual wells of the microtiter plate; after an optional programmable soak time for the wash solution and shaking of the plate, the wash solution is pumped out of the wells into the waste bottle by the vacuum pump. At the same time, the liquid level of the currently used bottle is reported.

The wash bottle, the suction pump and the dispensing pin (a thin metal tube on the wash head) form the inflow system of the DIAWasher. The dispensing of up to three types of wash liquid and the distilled water is controlled by four corresponding solenoid valves.

The suction pin (relatively thick metal tube of the wash head), the waste bottle and the vacuum pump form the drainage system of the microplate washer. The negative pressure generated by the vacuum pump is transmitted via the waste bottle to the liquid suction pin, whilst the liquid in the microtiter plates flows into the waste bottle under atmospheric pressure.

2. Installation of the device

To set up the device, the following requirements must be met:

- Ambient temperature: 5° C – 40° C;
- Relative humidity ⩽ 83%;
- No direct sunlight or high dust concentration;
- No electromagnetic radiation
- A sufficiently large, smooth and stable tabletop.

2.1 Unpacking the

Unpack the device and the transport packaging.

- Check that all accessories are present according to the enclosed list. Included are: 2 fuses, the 8-needle cleaning head, dust cover, power cable, short and long cleaning needles, user manual, separate box containing the 3 bottles plus corresponding hose connectors
- Remove the device.

Note: Keep the box and packaging material for future storage and transport. Please contact the dealer if any accessories are missing.

2.2 Installing bottles and hoses

Open the bottles' packaging box and remove the bottles, hoses, alarm signal cable, etc.

- Installing the bottles: Place the waste bottle, wash bottle 1, wash bottle 2, wash bottle 3 and the distilled water bottle on the rear of the unit, one after the other from left to right, as shown in Fig. 1-1 and Fig. 2-1.
- Connecting the hoses: Connect the hoses for the waste bottle, wash bottle 1, wash bottle 2, wash bottle 3 and distilled water bottle to the rear of the unit in the order of the bottles from left to right, as shown in Fig. 1-2 and 2-1. When doing so, connect the vacuum port of the waste bottle to the top of the hose (matching the same interface color).
- Connecting the liquid sensor: As shown in Fig. 2-1, connect the signal lines for the waste bottle, wash bottle 1, wash bottle 2, wash bottle 3 and the distilled water bottle to the rear of the unit from left to right, in the order of the bottles.

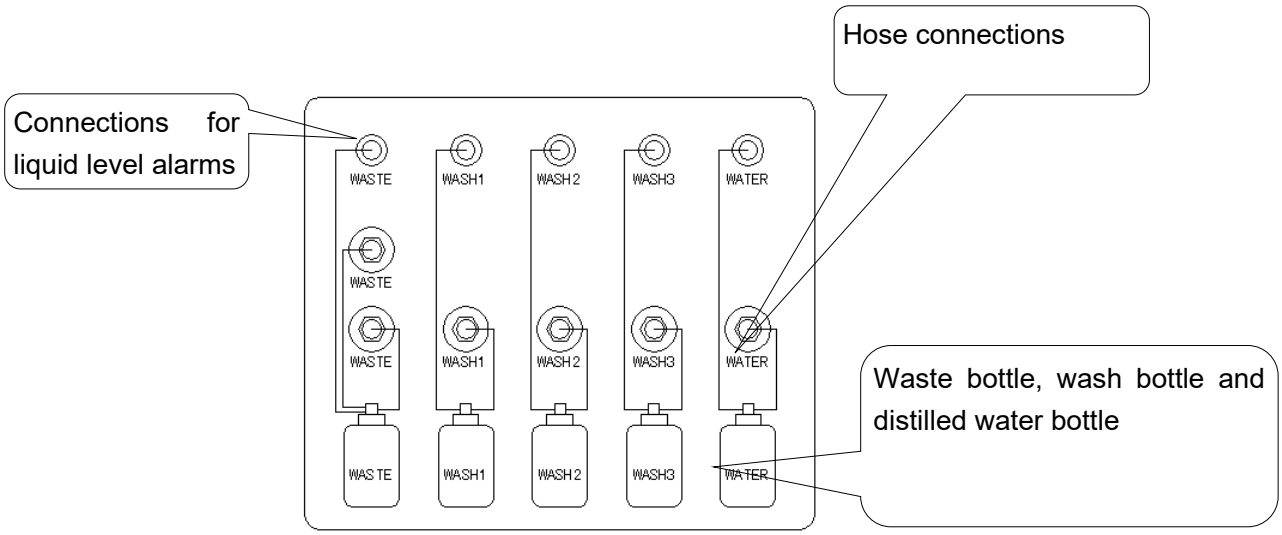


Fig. 2-1 Wiring diagram for hoses and signal cable

Note: The device operates on the principle of atmospheric pressure; therefore, the neck of the waste bottle and all hose connections must be sealed.

2.3 Installing the wash head

- Screw the two ends of the dosing tube and the drain tube onto the correspondingly colored tube connectors.
- Hang the wash head on the left-hand side of the bracket and ensure that the two pins on the side click into the groove of the bracket.

2.4 Starting the device

- Fill the wash bottles and the distilled water bottle with cleaning fluid and distilled water respectively.
- Take the power cable out of the accessory bag and connect one end to the power socket on the back and the other end to a 220 V power source.
- Start the device by pressing the power switch on the back of the device.

3. Settings and calibration of the device

The DIAWasher's system settings can be configured by the user via the system settings menu. To ensure the device operates correctly, the system must be set up properly.

Note: Incorrect system settings may result in liquid overflowing, plates not being washed effectively, or damage to the wash head.

Once the device has started up, the system parameters are first initialized and a check is carried out to see if the programs need updating. The system then flushes the pipework (see section 4.4 for information on parameter settings) using pre-programmed flushing fluid. If the CANCEL button is pressed during this process, the filling operation is cancelled. If the selected wash bottle contains no liquid, the device automatically cancels the filling process and returns to the main menu. Once initialization is complete, the device automatically returns to the main menu, as shown in Fig. 3-1. Use the △, ▽, + and – buttons to navigate the menu selection up, down, right and left. The selected menu is highlighted.

In the main menu, pressing the START button takes you to the corresponding menu sequence, whilst pressing the CANCEL button displays the system logo. From the logo screen, pressing any button takes you back to the system's main screen.

The menu names ASPR/DISP and PRIME/RINSE indicate that the corresponding ASPR, PRIME and RINSE buttons on the keypad can be used to access the relevant menu directly.

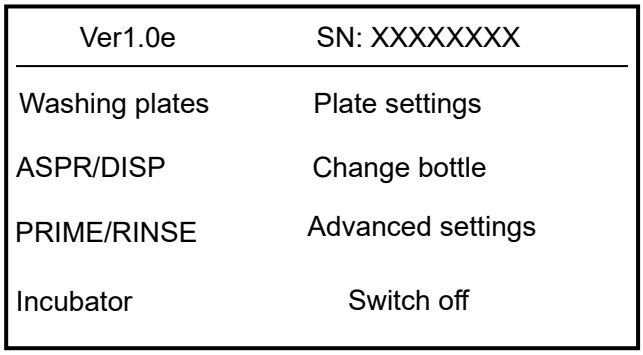


Fig. 3-1 Main menu

3.1 Advanced settings

Here you can adjust the device's general settings, such as the LCD contrast ratio, the motor's stroke limit and the system's timeout. In the main menu, use the △, ▽, + and – buttons to select 'Advanced Settings' and press the START button to access the advanced settings program, as shown in Fig. 3-2. Use the △ and ▽ buttons to select the relevant programs.

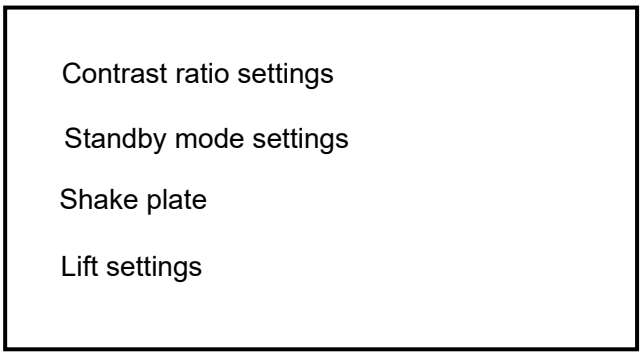


Fig. 3-2 Advanced settings

3.1.1 Adjusting the LCD contrast ratio

Use the △ and ▽ buttons to select 'Contrast ratio settings'. Press the START button to access the contrast ratio adjustment menu, as shown in Fig. 3-3.

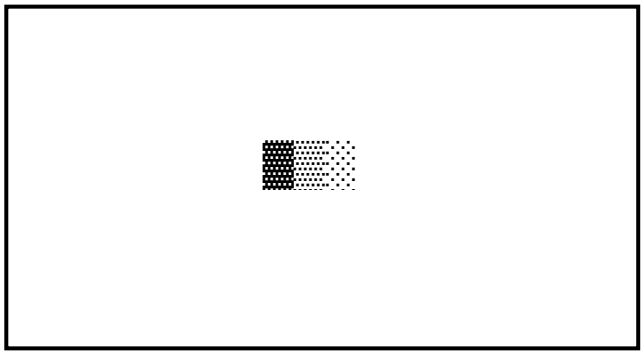


Fig. 3-3 Contrast ratio settings

Pressing the + button increases the contrast ratio and darkens the color; pressing the – button decreases the contrast ratio and lightens the color. Once you have set the optimal value, press START to save the setting and return to the previous menu. The new contrast ratio value is stored in the DIAWasher's FlashROM. The next time the device is started, the contrast ratio of the LCD display will be set to the new value. Press the CANCEL button during the setting process to exit without saving.

The DIAWasher has 64 contrast levels.

3.1.2 Standby mode settings (Hang-up settings)

After a certain period of inactivity, the device can switch to standby mode. This time can be set by the user; the default is 20 minutes. The time can be increased or decreased using the + and – buttons. Pressing SELECT allows you to switch between changing the time by 1 or 10 minutes. Press START to save and exit, and press the CANCEL button to exit without saving, as shown in Fig. 3-4.

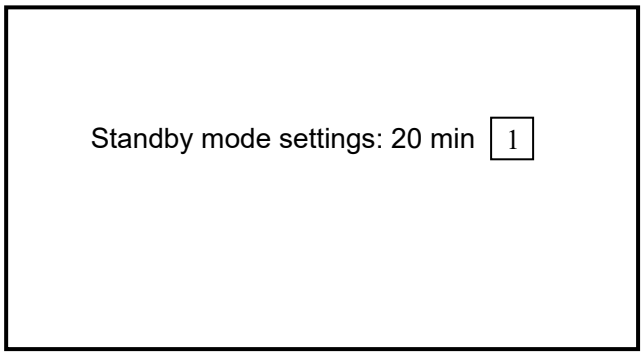


Fig. 3-4 Standby mode settings

When the device switches to standby mode, the line is flushed first.

In standby mode, press any key to end the process and return to test mode. When standby mode ends, the machine automatically flushes the pipes with the pre-programmed cleaning fluid.

3.1.3 Shaking plates

The user can shake the plate during the wash cycle or independently of it. The "∧" and "∨" buttons can be used to select "Plate shaking". Press START to access the "Plate shaking" screen, as shown in Fig. 3-5.

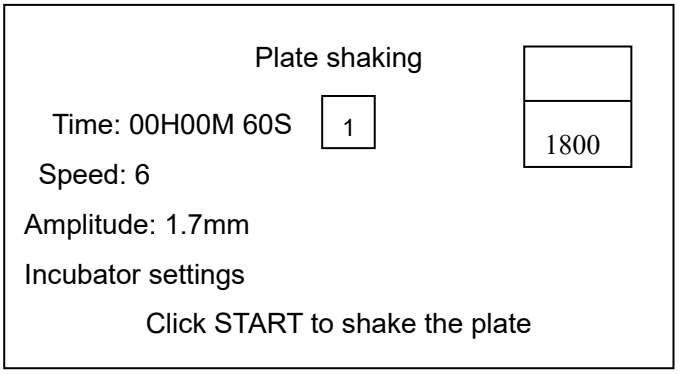


Fig. 3-5 Shaking the plate

Use the '∧' and '∨' buttons to select the time, speed and amplitude of the plate shaking. Press + and – to adjust the values. The shaking intensity and time are adjustable. There are 10 speed levels; the higher the value, the faster the speed. The amplitude is the distance of the back-and-forth movement and can be set to 0.1–2.0 mm. The maximum shaking time is 23H 59M 59S.
The intensity of the plate shaking in the 'Plate Washing' menu depends on the intensity set in the 'Plate Shaking' menu.

The settings for the optional incubator are also available in the “Plate Shaking” menu. For further information on incubation, see Chapters 4–5. The maximum incubation time is 18 hours. Plate shaking and incubation can be carried out independently of one another.

Press START to save the changes and shake the plate. The shaking time is displayed. Press the SELECT button twice to start the incubation time. Press CANCEL to end the process.

3.1.4 Motor limit settings

The user can adjust the motor’ s range of motion in both the horizontal and vertical directions. Use the △ and ▽ buttons to select ‘Stroke Settings’ and press START to access the stroke settings program, as shown in Fig. 3-6.

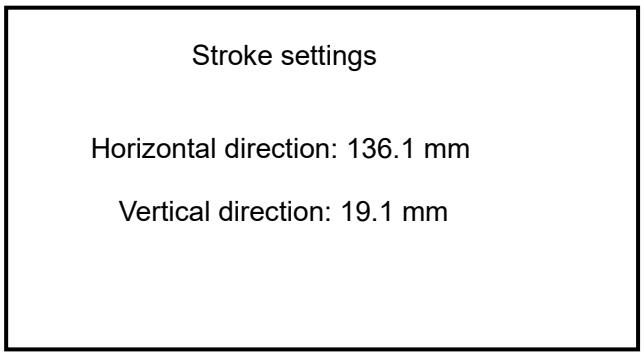


Fig. 3-6 Stroke settings

Use the △ and ▽ buttons to select ‘Horizontal direction’ or ‘Vertical direction’. Use the + and – buttons to set the maximum stroke range.

Press START to save the changes. At the same time, the corresponding motor will automatically move to the pre-programmed position. Press CANCEL to exit the process without saving.

3.1.5 Suction Pump Speed Settings

Use the △ and ▽ buttons to select “Asp. Pump speed settings” and press START to access the pump settings program, as shown in Fig. 3-7. Use the ＋ and － buttons to set the appropriate value for the pump speed. Pressing the ＋ button switches the pump on, pressing the － button switches it off, and the status bar displays “on” or “off” respectively.

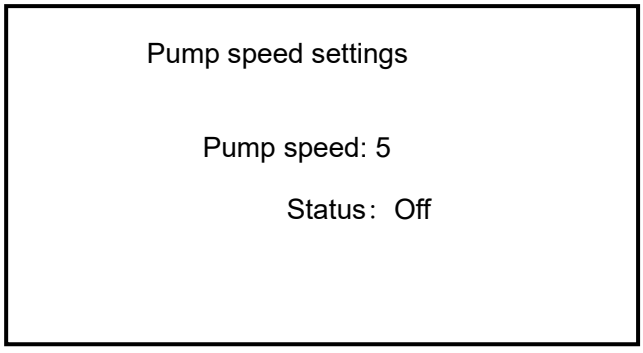
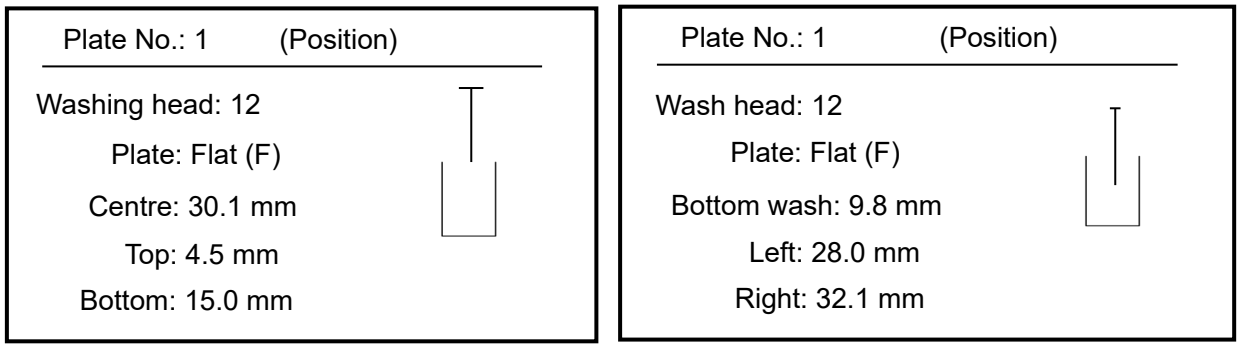


Fig. 3-7 Settings for the suction pump speed

Note: The unit was set to the optimum position before leaving the factory. Please do not make any unauthorized adjustments. Otherwise, the unit's plate washing performance will be impaired.

3.2 Plate settings

The user can pre-program 10 types of plate parameters. Use the △, ▽, + and – buttons to select 'Plate settings'. Pressing START takes you to the plate settings program, as shown in Fig. 3-8. Use △ and ▽ to select the parameters to be changed, and use the + and – buttons to change the corresponding parameter values. Pressing START saves the changes and exits the program; pressing CANCEL exits the program without saving.



(a) Parameter interface one (b) Parameter interface two

Fig. 3-8 Screen showing plate parameter settings

The parameter descriptions and specific modification procedures are as follows:

1. Plate No.: Code number of the plate type, selected between 1 and 10;
2. Wash head: An 8/12-way wash head can be selected; the default value is 12;
3. Plate settings: You can choose between flat type (F), U-type (U) and V-type (V), where the letters in brackets are their code numbers. The default setting is flat type (F);
4. Centre: The center position. Corresponds to the center position of the first strip of the microtiter plates. The + and – buttons are used to adjust the setting by 0.1 mm.
5. Top: Top position. Corresponds to the top level (upper aspiration position) of the first microplate strip. The + and – buttons are used to adjust the setting in 0.1 mm increments.
6. Bottom: Bottom position. Corresponds to the bottom position (liquid dispensing position) of the first microplate strip. The + and – buttons are used to adjust the setting in 0.1 mm increments.
7. Bot. wash: Lower wash position. Corresponds to the middle position (lower wash position) in the vertical direction of the first microplate strip. The + and – keys are used to adjust the setting in 0.1 mm increments.
8. Left: Left position. Corresponds to the left position of the first microplate strip. The + and – buttons are used to adjust the setting in 0.1 mm increments.
9. Right: Position on the right-hand side. Corresponds to the right-hand position of the first

microplate strip. The + and – keys are used to adjust the setting in 0.1 mm increments.

Tips for using the keyboard:

In the vertical direction, the + key moves the cursor up, whilst the – key moves it down; in the horizontal direction, the + key moves the cursor to the left, whilst the – key moves it to the right.

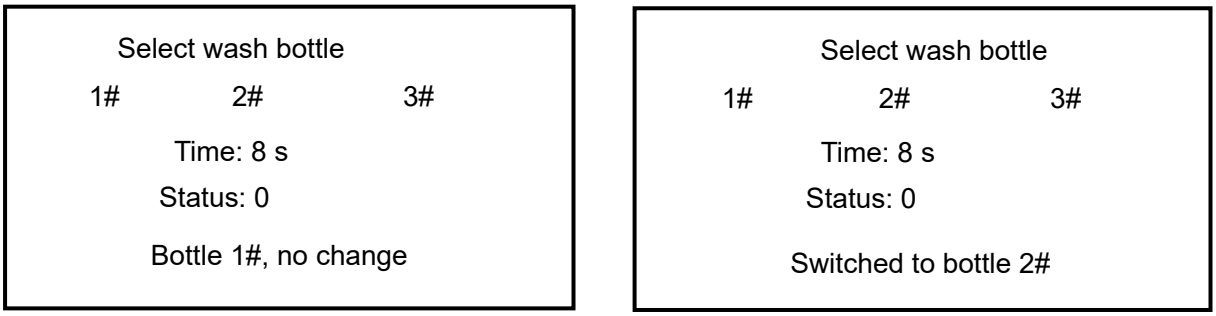
Note: The position parameters must be set in accordance with the longer pin of the wash head and the first strip of the microtiter plates; otherwise, the plate washing function cannot be performed normally.

3.3 Changing bottles (optional)

The DIAWasher can conveniently switch between up to three wash bottles. Use the △, ▽, + and – keys to select 'Change bottle', and press START to launch the wash bottle change program, as shown in Fig. 3-9.

Use the △ and ▽ buttons to select the bottle number or the switch-over time. Use the + and – buttons to change the switch-over time. When the bottle number changes, 'Switched to bottle X#' is displayed at the bottom of the user interface, as shown in Fig. 3-9 (b). Press START to begin changing the wash bottle; otherwise, the current bottle number remains as shown in Fig. 3-9 (a) and the wash bottle is not changed.

During the changeover process, the pipework is first flushed with distilled water. For information on the settings for the flushing time, see section "4.4.2 – Flushing". The status displays "Rinsing X". The tubing is then filled with the wash fluid from the selected wash bottle. The status displays "Filling X". During operation, pressing the CANCEL button cancels the process. The wash fluid from the current wash bottle continues to be used.



(a) No switching instructions (b) Switching instructions

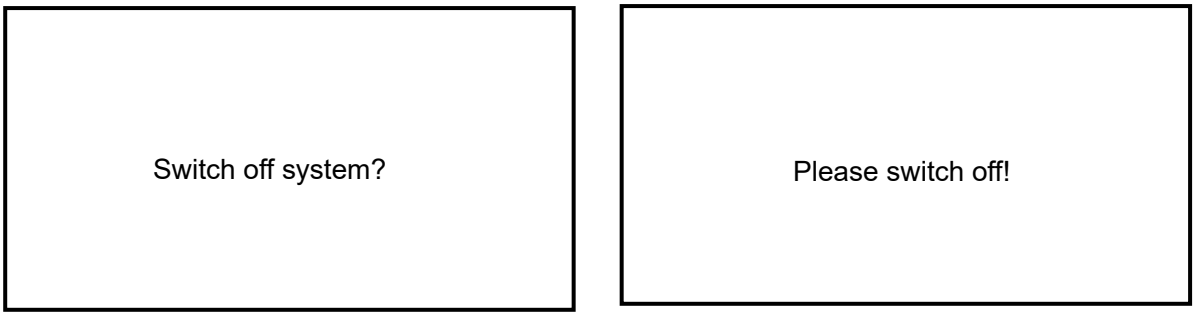
3-9 Switching between wash bottles

Note: The basic model has only one wash bottle

3.4 Switching off the device

The user can switch off the unit directly or select the “Switch off” program in the main menu. The system will then automatically flush the pipework with distilled water, save the current plate washing program number and prompt the user to switch off the system, as shown in Fig. 3-10.

Press START to switch off the device; press the CANCEL button to return to the system’s main menu and continue operation.



(a) Switch off? (b) Prompt to switch off

Fig. 3-10 Switch off system

Note: We strongly recommend that you run the “Shut down system” program before switching off the unit: The system automatically flushes the pipework with distilled water and saves the current code number of the plate washing program

4. Operating the instrument

4.1 Plate holder and ELISA plates

When the device is in standby mode, the wash head is in the standby position; in front of the standby position is the device's plate holder, on which the ELISA plates can be placed.

Warning: *ELISA plates must* only *be placed on or removed from the plate holder* when the device is in standby mode*; failure to do so may result in accidents that could cause damage to the device or injury to the operator.*

The DIAWasher supports ELISA plates with specifications such as 12x8, 12x4 and 8x6, etc., but not all wash heads (available as an option) can be used with all plates. When selecting a wash head, the following should be taken into account:

Wash head / ELISA plates	8 pins	12 pins
12-× -8	Available	Available
12-× -4	Not available	Available
8× 6	Available	Not available

When inserting the ELISA plates, ensure they are correctly aligned. When using an 8-well wash head, the edges with the 8 microtiter wells of the ELISA plate must be aligned parallel to the wash head. When using a 12-well wash head, the edges with the 12 microtiter wells of the ELISA plate must be aligned parallel to the wash head.

When inserting the ELISA plates, hold both sides of the long edge of the ELISA plate with your right hand and insert it from top to bottom into the cross groove so that the rear edge of the ELISA plate lies flush against the rear edge of the nearest groove.

Note: Please operate the device strictly in accordance with the instructions described above, as failure to do so may result in incorrect dosing, liquid spillage or damage to the wash head.

4.2 Washing the plates

4.2.1 Confirmation of parameters

Use △, ▽, + and – to select 'Disc Cleaning', then press START to access the parameter confirmation menu, as shown in Fig. 4-1. From top to bottom and left to right, the parameters are as

follows:

1. Program No.: Code number of the current program; use + and – to select the program. Press SELECT to switch the increment of the +/- keys between single and ten-unit steps
2. Settings: If the parameters of the current program need to be changed, they can be edited in the “Settings” menu.
3. 1(12-F): Indicates that the plate type setting with code number ‘1’ is selected. ‘12’ stands for a 12-position wash head, whilst ‘F’ means that the position of this program is set according to type F.
4. Plate: Plate washing methods.
5. 12-pin: Indicates that the setting for a 12-well wash head is being used.
6. 350 µL: Indicates that the dispensed liquid volume for each well of the plate is 350 µL;
7. 1#: Indicates that bottle 1# is being used for washing. For information on changing bottles, see “3.3 Changing bottles”.
8. 3 times: Number of wash cycles; e.g. 3 times
9. BW-N/BW-Y: No bottom wash/bottom wash; if the number of wash cycles is two or more, the preceding plate wash cycles do not include a bottom wash, but the final wash cycle includes a bottom wash;
10. Single/Double: Single suction / Double suction. If the number of wash cycles is at least two or more, single suction is performed during the previous wash cycles; however, double suction is performed during the last wash cycle;
11. Asp2.0/3.0s: Suction 2.0 seconds / 3.0 seconds. If the number of wash cycles is at least 2 or more, the liquid suction time for the previous wash cycles is 2 seconds; however, in the last cycle, the suction time is 3 seconds.
12. Soak10/15s: If the number of wash cycles is at least 2 or more, the soaking time for the previous wash cycles is 10 seconds; however, in the final cycle, the soaking time is 15 seconds.
13. Shaking 10/15 s: If the number of wash cycles is at least 2 or more, the plate shaking time for the previous wash cycles is 10 seconds; in the last cycle, however, the shaking time is 15 seconds.

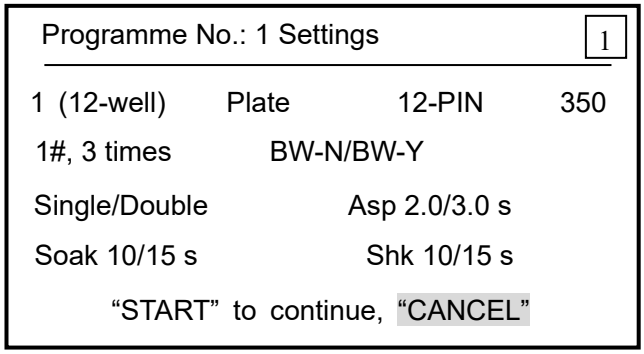
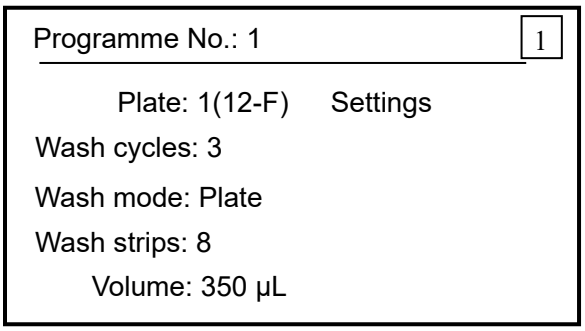


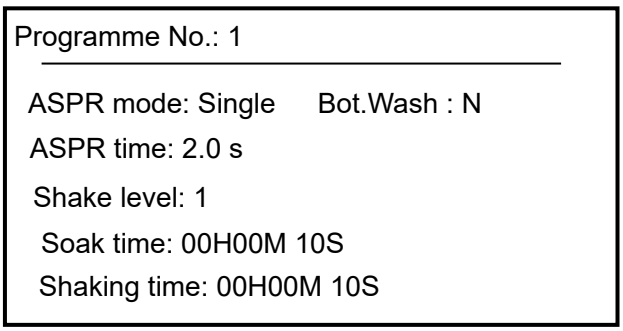
Fig. 4-1 Confirmation of plate washing parameters

4.2.2 Parameter settings

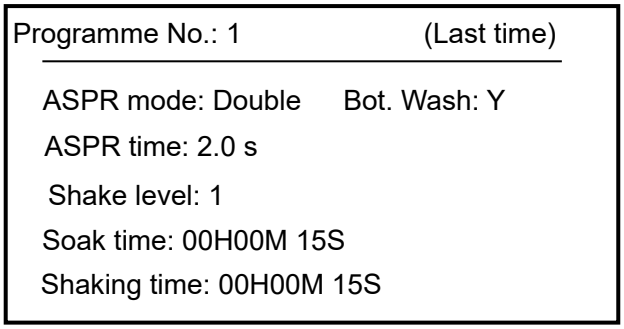
If the parameters in Fig. 4-1 do not meet your requirements, use △ and ▽ to select “Settings” and press START to access the parameter setting program, as shown in Fig. 4-2:



(a) Parameter settings 1



(b) Parameter settings 2



(c) Parameter settings 3

Fig. 4-2 Parameter settings

The parameter descriptions and detailed settings are as follows:

1. Program No.: Code number of the program; the program can be selected using the + and – buttons. Pressing SELECT allows you to switch between incrementing the program number by 1 or 10.
2. Plate: Settings for the plate type; the program for the plate type settings is 1–10; the letters in brackets (AA-B) indicate: AA stands for the type of wash head, whilst B stands for a plate type (flat, U- and V-type respectively).
3. Settings: Enter the settings for the plate type program. For detailed instructions, refer to section “4.2 Plate type setting”.
4. Wash cycles: Set the number of plate wash cycles. You can select between 1 and 99 cycles.
5. Wash mode: choice between plate washing and strip washing.
6. Wash strips: Depending on the type of wash head, the number of strips is set to 8 or 12 by default (Note: The wash head can only be configured under ‘Plate settings’; see ‘4.2 Plate settings’ for details); “Wash Strips” is similar to “4.2.3” “Plate Wash Process” and can be changed directly.
7. Volume: The dispensing volume, i.e. the amount of wash liquid dispensed for each well of the

plate, can be set to between 10 and 3000 µl. Use SELECT to switch between changing the volume by 1 or 10.

8. ASPR mode: Aspiration method, single or double aspiration.
9. Bot. wash: Bottom wash; selection of whether or not to perform the bottom wash;
10. ASPR time: Aspiration time, setting of the aspiration time, adjustable from 0.1 to 10 seconds; SELECT can be used to switch between a time change of 0.1 or 1;
11. Shk. grade: Plate shaking intensity. The intensity can be set from 1 to 3;
12. Soak time: The time between the end of the wash liquid dispensing and the start of the wash liquid suction can be set from 0 seconds to 23 hours 59 minutes and 59 seconds.
13. Agitation time: Can be set from 0 seconds to 23 hours 59 minutes and 59 seconds.

If the number of wash cycles is 2 or more, the system prompts you to enter the parameter settings for the last wash, as shown in Fig. 4-2 (c). '(Last time)' is displayed in the top right-hand corner of the screen, and the detailed parameter settings correspond to points 8 to 13.

Note: ***If certain parameters are set to relatively large values, the SELECT button can be used to flexibly set the increment to 0.1, 1 or 10. The current increment value is displayed to the right of the modified parameters.***

4.2.3 Plate washing

Once the parameters in Fig. 4-1 have been confirmed as correct and the program number has been selected, the program number is highlighted. Press START to start the plate washing process, as shown in Fig. 4-3. The settings for the strip number and position are as follows:

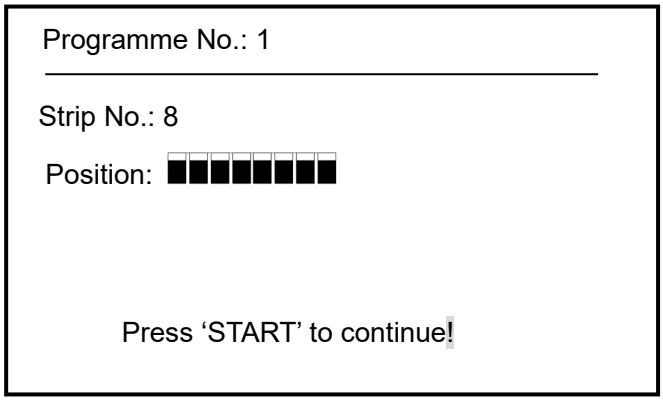


Fig. 4-3 Main menu: Wash cycle

"Strip No." refers to the number of strips on the plates to be washed. When selecting a 12-pin wash head, the strip number can be selected between 1 and 8 strips. If an 8-pin wash head is selected, the strip number can be set between 1 and 12 strips. This parameter corresponds to the "Wash strip" parameter under "4.2.2" (Wash parameters). However, it applies only to the current wash cycle and is not saved.

"Position" indicates the position to be washed, and the △ and ▽ buttons can be used to select the strip. Pressing + confirms the wash; pressing – cancels the wash.

Once you have confirmed the strip numbers and the position, place the ELISA plates to be washed on the plate holder and press START to begin the wash cycle, as shown in Fig. 4-4.

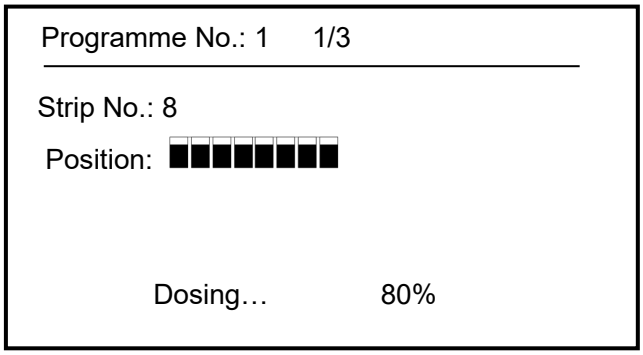


Fig. 4-4 Status of the plate wash

The 'Program No.' displays the selected program. On the right-hand side, '1/3' indicates that the wash cycle is running three times and that the first cycle is currently in progress. Status information such as "Draining…", "Bottom cleaning", "Dosing…", " ", "Shaking…" and "Soaking…" etc. is displayed at the bottom center of the screen; at the same time, the progress of the current process is shown as a percentage on the right-hand side.

During the plate washing process, pressing CANCEL cancels the plate washing process and

displays an error message, as shown in Fig. 4-5. After a short time, the system automatically returns to the parameter confirmation screen.

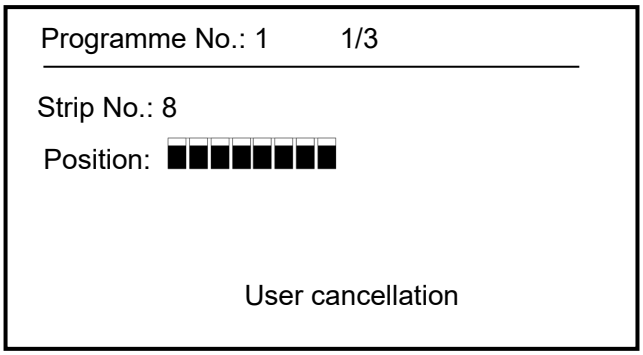
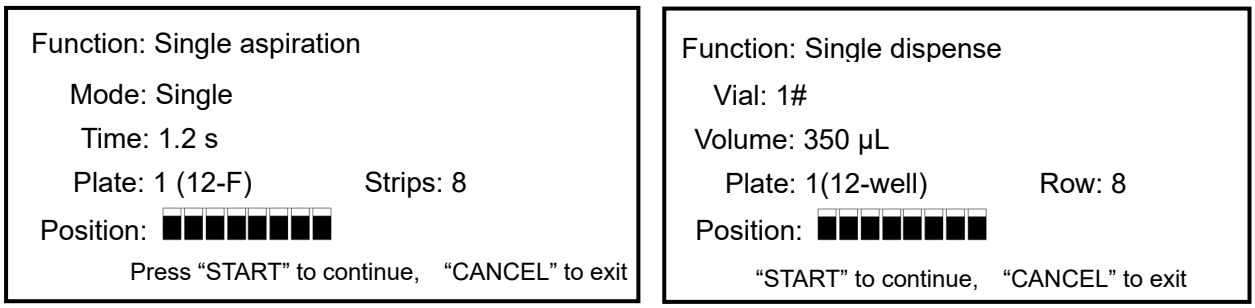


Fig. 4-5 “User cancellation” screen

Note: If, during the wash cycle, the machine detects that the wash bottle is empty or the waste bottle is full, the cycle will stop automatically and the bottle number will be displayed in the bottom left-hand corner of the screen. Fill the relevant empty wash bottle with wash fluid or empty the waste bottle. Make sure you have inserted the bottle correctly. Press CANCEL to end the process, or START to continue.

4.3 Single Aspiration / Single Dispensing

Use the △, ▽, + and – buttons to select the “ASPR/DISP” option and press START to call up the single aspiration/single dispensing program, as shown in Fig. 4-6. Press + and – in the “Function” options to switch between “Single aspirate” and “Single dispense”.



(a) Simple aspiration (b) Single dispensing

Fig. 4-6 Interface for single aspiration/single dispensing

4.3.1 Single aspiration

As shown in Fig. 4-6(a), “Single aspiration” means that the wash fluid is aspirated according to specified parameters, but no dispensing takes place. The parameters are as follows:

Mode: Displays the liquid aspiration method, which can be selected between single and double aspiration.

Time: The liquid aspiration time can be set between 0.1 and 10.0 seconds. Use SELECT to change the time in increments of 0.1 and 1.

Plate: Select the plate type program. ‘1’ indicates the program number and ‘(12-F)’ means that this program is used for a 12-pin wash head and the position is set according to the flat ELISA plates.

Strip: Set the strip number for single aspiration.

Position: Settings for liquid aspiration from the strip. Pressing the + button confirms the liquid aspiration; pressing the – button cancels it.

Once you have set the parameters, press START to save them and start the single aspiration.

4.3.2 Single dispensing

As shown in Fig. 4-6(b), “single dispensing” means that the washing liquid is dispensed into the microtiter plates according to the specified parameters, but is not aspirated. The parameters are as follows:

Bottle: Bottle number for dispensing. For information on changing the bottle, see under “3.3 Changing the bottle”.

Volume: The dispensing volume of the wash liquid for a single well can be set between 10 and 3000 µl. Use SELECT to choose between a volume change of 1 or 10.

Plate: Select the plate type program. “1” indicates the program number, whilst “(12-F)” means that this program is used for a 12-pin wash head and the position is set according to the flat ELISA plates.

Strip: Set the strip number for dispensing.

Position: Strip for dispensing. Press + to confirm dispensing and press – to cancel dispensing.

Once you have set the parameters, press START to save and start the process. Pressing the CANCEL button cancels the process.

4.4 Priming and rinsing

Select the “PRIME/RINSE” menu, use the “ ∧ ” and “ ∨ ” buttons to switch between Prime and Rinse, and press START to select the relevant function; see Fig. 4-7

Fig. 4-7 “PRIME/RINSE” menu

4.4.1 Prime

Press “ ∧ ” and “ ∨ ” to select “Prime”, then press “START” to access the Prime menu.

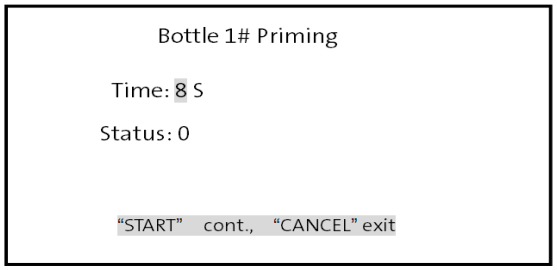


Fig. 4-8: Priming

Once you have set the priming time, press START to save the setting and start priming. “Status” displays the elapsed priming time. “Bottle 1#” indicates that the liquid in wash bottle 1# is being used for priming. Press CANCEL to stop the process and exit the menu.

Note: Set the priming time to 6–8 seconds.

4.4.2 Rinse

Use △, ▽, + and – to select the RINSE option and press START to launch the program for rinsing the lines, as shown in Fig. 4-9. Press the + and – buttons to adjust the rinse time.

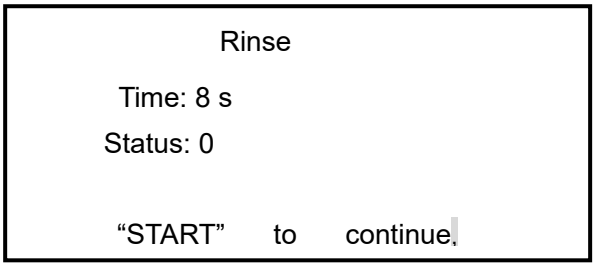


Fig. 4-9 Flushing

Time: The flushing time can be set between 1 and 60 seconds.

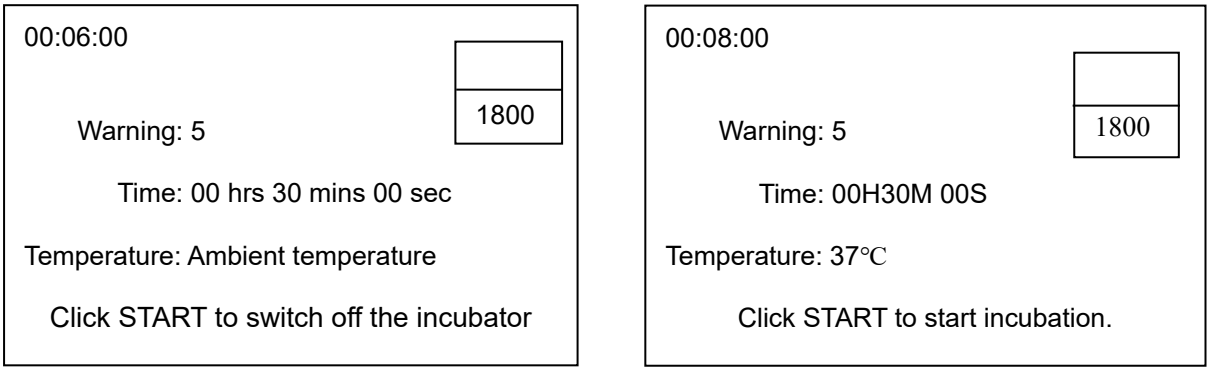
Once you have set the flush time, press START to save the setting and begin flushing the pipes. The actual flush time is displayed under ‘Status’.

Note: The prime and flush time should not be too long; it is usually around 8 seconds.

4.5 Incubator

4.5.1 Parameter settings

Use the "∧ ", "∨ ", "+" and "–" buttons to select the "Incubator" option. Press START to access the incubator settings interface (see Fig. 4-10). Use the "∧ " and "∨ " buttons to select the desired item and press "+" and "–" to edit the parameters.



(a) Switch off the incubator (b) Switch on the incubator

Fig. 4-10 Incubator parameter settings

Warning: Once incubation is complete, the system emits a warning tone. This can be set to 'Off' or '1–10', where 'Off' means no warning tone is emitted, and '1–10' indicates the number of warning tones.

Time: The incubation time can be set to 0–18 hours. Press the SELECT button to switch between 1-second and 10-second increments.

Temperature: The incubation temperature can be set to "Ambient temperature", "25", "30" or "37°C". Press START to save the settings and start the incubation program. Press CANCEL to exit without saving.

Note: Once the temperature has been set to '25℃', '30℃' or '37℃', the incubator operates continuously. If the incubator temperature is set to 'Ambient', the incubator switches off automatically.

4.5.2 Incubation process

The incubation mode is displayed in the top right-hand corner when the incubator is set to 25, 30 or "37°C", as shown in Fig. 4-10-(b). The first line displays the elapsed time, whilst the second line displays the programmed incubation time. The incubation mode is not displayed when the temperature is set to "Ambient".

Place a microplate on the incubator and press SELECT twice to display the incubation mode (top right-hand corner). Once the programmed incubation time has elapsed, the unit will emit a beep in accordance with the programmed settings.

Warning: Do not touch the incubation plate with your hand whilst the incubator is heating up to avoid scalding. Furthermore, the incubator is under high voltage. Therefore, whilst the device is in operation, the incubation plate must not be touched by hand or with conductive objects such as metal items, etc., to avoid electric shock.

5. Maintenance

5.1 Regular maintenance of the plate holder

There are usually liquid residues on the plate holder which can corrode the metal clamp. If there is too much liquid, it can run over the edge of the plate holder and enter the device. It is therefore important to remove liquid residues from the plate holder regularly. Use tweezers to remove liquid residues with a small piece of absorbent cotton. However, take care to ensure that the tips of the tweezers do not scratch the surface of the plate holder.

Note: Organic solvents, oils and corrosive liquids must not be used to clean the plate holder or the surface of the device.

5.2 Regular maintenance of the wash head

The wash head is one of the main components of the microplate washer. Its condition affects the accuracy of the dispensing volume and the amount of wash liquid. It is therefore very important to maintain the wash head.

Particles suspended in the cleaning fluid can block the dosing line. Therefore, please always use fresh cleaning fluid and check regularly for the presence of suspended particles. The dosing and suction pins can become blocked due to crystallisation of the washing fluid. To prevent crystallisation, please remember to always carry out the rinse cycle (RINSE) after finishing work.

If the dosing volume of one row of the plate is significantly lower than that of the other rows, the corresponding dosing pin (thinner and shorter pin) is blocked. If the residual liquid volume in one row of the plate is significantly higher than that of the other rows, the corresponding liquid suction pin (thicker and longer pin) is blocked. If this is the case, remove the wash head from the holder whilst the device is in standby mode. Use a thin pin to clean the blocked dosing or suction pins. Then place the wash head back onto the mounting arm and press RINSE to flush it. If the dispensing pin is severely blocked, the procedure described above must be repeated several times.

5.3 Replacing the fuse

The fuse is of the specification T3.51AL 250V. The steps for replacing the fuse are as follows:

- Take the fuse from the accessories bag.
- Unscrew the two fuse caps on the back of the machine.
- Clamp the fuse in the center of the metal tab on the cover, then secure the fuse caps onto the fuse wire base.

5.4 Emptying the waste bottles

The sensor in the waste bottle can detect the liquid level. When the waste liquid reaches its maximum level, the device will no longer draw in any liquid and the liquid in the waste bottle must

be disposed of. :

- Hold the waste bottle by the cap and lift it slightly.
- Turn the waste bottle clockwise until the cap comes off.
- Empty the waste liquid and return the empty bottle to its original position.
- Replace the cap.
- Hold the cap firmly and turn the bottle anti-clockwise until the cap is tightly sealed.

Note: 1. If the cap is not tightened sufficiently, the bottle's seal cannot be guaranteed, which may impair suction performance. Do not tighten the cap too much, as this may damage it.

2. When opening the waste bottle, do not turn the cap; turn the bottle only to prevent the sensor cable from being severed.

3. The DIAWasher is a precision instrument; please ensure you carry out daily maintenance.

4. The device's wash head is a precision component. Please do not use whole blood to prevent the wash head from becoming blocked.

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6. System errors and solutions

In the event of a system error, the DIAWasher stops all movement of the mechanical parts and notifies the user. The buzzer emits a long beep and the error message is displayed on the screen.

The most common error messages are 'Wash bottle empty', 'Water bottle empty' and 'Waste bottle full'. To resolve these errors, proceed as follows:

1. Water bottle empty: Refill the water bottle with distilled water.

2. Wash bottle empty: Either switch to another wash bottle using “Change bottle” or refill the current bottle with fresh wash liquid.

3. Waste bottle full: Check the waste bottle. If it is full, empty the bottle and reconnect it. If the bottle is not full, check that the liquid level sensor cable is correctly connected to the port on the back of the device.

Note: If an error occurs whilst using the device that you cannot resolve yourself, or if an error occurs repeatedly, please contact your dealer.