Thermo Scientific Multidrop® Combi nL

User Manual

Rev. 1.0

Thermo SCIENTIFIC

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About This User Manual

Intended users

This user manual is written for the actual end user, for example, research scientist or laboratory technician, and provides information on the Thermo Scientific Multidrop Combi nL, including the installation and operating instructions.

Read the manual in its entirety before operating the instrument.

How to use this user manual

This user manual is designed to give you the information to:

- Review safety precautions
- Set up the Multidrop Combi nL
- Use the Multidrop Combi nL internal software
- Carry out dispensing procedures
- Perform basic cleaning and maintenance procedures
- Troubleshoot the instrument performance

This user manual also describes all the features and specifications of the Multidrop Combi nL instrument. Refer to Chapter 7: “Technical Specifications”.

In Chapter 4: “Routine Operation” you find explanations of the dispensing principles and procedures and on how to use the Multidrop Combi nL internal software.

In Chapter 9: “Troubleshooting Guide” you find explanations of error and warning messages and a problem-solving guide. The user should be familiar with the contents of Chapter 5: “Maintenance”. For ordering information, refer to Chapter 10: “Ordering Information”.

For more information

For PC software-related issues, refer to the *Thermo Scientific FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

For the latest information on products and services, visit our websites at:

`http://www.thermo.com`
`http://www.thermo.com/multidrop`

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

Safety symbols and markings

These symbols are intended to draw your attention to particularly important information and alert you to the presence of hazards as indicated.

Safety symbols and markings used on the Multidrop Combi nL

The following symbols and markings appear on the type label and the instrument itself.

Power ON ▲



Power OFF ▲



Serial number ▲



Catalog number ▲



Date of manufacture ▲



Consult instructions for use ▲



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

Warning and other markings used in the documentation

The following symbols and markings appear in this user manual.



Warning Risk of electric shock. ▲



Warning Biohazard risk. ▲



Warning Risk of injury to the user(s). ▲



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



Note Marks a hint, important information that is useful in the optimum operation of the system, or an item of interest. ▲

Instrument safety and guidelines for use

- Always follow basic safety precautions when using the Multidrop Combi nL to reduce the risk of injury, biohazardous contamination, fire, or electric shock.
- Read this user manual in its entirety prior to operating the instrument. Failure to read, understand, and follow the instructions in the manual may result in damage to the instrument, injury to laboratory and operating personnel or poor instrument performance.
- Observe all “Warning”, “Caution”, and “Note” statements as well as safety symbols and markings on the instrument and in the documentation.
- The Multidrop Combi nL is intended for laboratory research use only. Observe proper laboratory safety precautions, such as wearing protective clothing and following approved laboratory safety procedures.
- Use of the Multidrop Combi nL in ways other than those described in the documentation supplied with the equipment may result in injury to persons or damage to the property. Avoid unintended use of the equipment, for example, using incompatible materials, making unauthorized modifications, using incompatible or damaged parts, using unapproved auxiliary equipment or accessories, or operating equipment in excess of maximum ratings.
- Do not touch the dispensing valves or the tubing inlet to ensure trouble-free dispensing. Thermo Fisher Scientific assumes no liability for the use of third-party dispensing valves.
- Preventative maintenance instructions should be followed closely to keep the instrument in the best condition for maximum reliability. A poorly maintained instrument will not give the best results.

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Chapter 1
Introduction to the Multidrop Combi nL

The Multidrop Combi nL (Figure 1–1) is an automatic, programmable, eight-valve microplate bulk reagent dispenser for nanoliter to microliter volume dispensing. It covers the volume range 50 nl to 50 µl. It has a pressure/vacuum based dispensing system for rapid and continuous dispensing of liquids into 96, 384 and 1536-well plates. It can dispense 50 nl into the entire 384-well plate in 6 seconds or 50 nl into the entire 1536-well plate in 21 seconds.

The Multidrop Combi is lightweight, transportable and compact on a laboratory bench.



Figure 1–1. Multidrop Combi nL microplate dispenser

The instrument model available is:

- 5840400 Multidrop Combi nL, 100 – 240 V 50/60 Hz

Each Multidrop Combi nL comes with a pressure/vacuum system reservoir that has to be installed. Once the reagent reservoir is connected, the instrument is ready for use.

Intended use

The Multidrop Combi nL is intended for professional research use by trained personnel. It is intended for automated nanoliter to microliter volume dispensing of reagent into a variety of microplates and strips in 96, 384 or 1536-well plate format. Use for self-testing is excluded.

Principle of operation

The Multidrop Combi nL (Figure 1–1) can be:

1. used as a standalone instrument with internal software using the keyboard and display,

2. controlled more flexibly with a PC, with FILLit Software, via an RS-232 or a USB serial port, or

3. used as part of an automation system.

Pressure/vacuum system

The Multidrop Combi nL has a pressure/vacuum based dispensing system that the instrument controls. The liquid is pushed through a microsolenoid dispensing valve by means of compressed air into a well. The reagent can be dispensed into rows, columns or wells.

The pressure system can also produce vacuum, which is used for the backflush of reagents (Empty function).

Dispensing applications

Reliable low-volume dispensing can be carried out with the Multidrop Combi nL.

With a volume range of 50 nl to 50 µl for 96, 384 and 1536-well plates with dispensing heights from 5 to 55 mm, the Multidrop Combi nL offers outstanding flexibility for a wide range of applications.

Multidrop Combi nL can be used, for example, in cell and bead-based assays and to a greater extent in drug discovery screening processes for dispensing protein solutions (BSA), detergents, dyes and different kinds of solutions. Compounds of interest are often solubilized in DMSO that is ready calibrated and in store in the instrument.

The viscosity of the solutions vary considerably. Viscosity describes a fluid's internal resistance to flow and can be thought of as a measure of fluid friction. Thus, water is "thin", having a lower viscosity, while glycerol is "thick", having a higher viscosity. The instrument can calibrate the valve open times and dispense with great accuracy liquids with different viscosities. Enzyme or antibody solutions, which often contain glycerol, can be reliably dispensed with the Multidrop Combi nL.

Calibrations

The standalone instrument has five calibrated liquids in store and is immediately ready for use. The liquid factor feature can be used to calibrate set volume points in instrument standalone use.

The instrument can easily calibrate a new liquid with the Multidrop Combi nL PC software. Calibrations are created, calculated and transferred with FILLit Software.

For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

Advantages of using Multidrop Combi nL

The Multidrop Combi nL microplate dispenser has several operational advantages:

- Flexible low-volume range of 50 nl – 50 µl
- Flexible dispensing height of 5 – 55 mm
- High-speed dispensing of column, row and well-specific volumes
- Superior precision covering the whole volume range
- Easy-to-use visual user interface
- PC software for increased flexibility
- Backflush feature for reagent recovery
- Excellent robot compatibility

Chapter 2
Functional Description

Instrument layout

This section shows the front and back views of the Multidrop Combi nL instrument.

Front view

The front view of the Multidrop Combi nL instrument is shown in Figure 2–2.

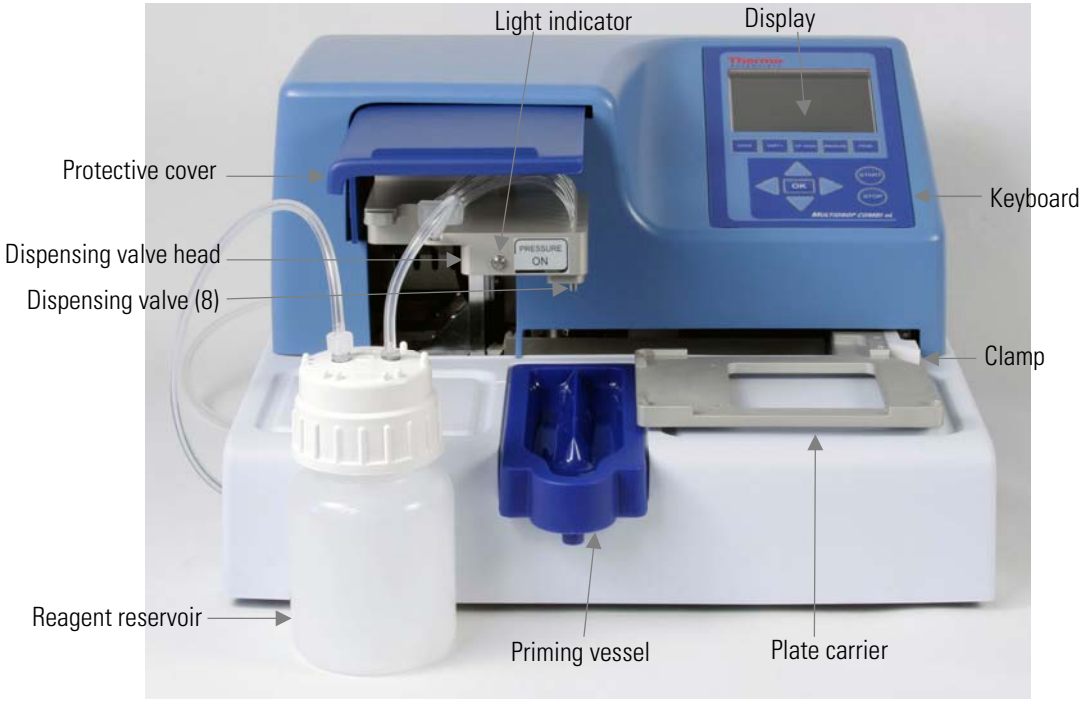


Figure 2–2. Multidrop Combi nL front view

The close-up of the Multidrop Combi nL keyboard and display is shown in Figure 2–3.



Figure 2–3. Close-up of the Multidrop Combi nL keyboard and display

Back view

The back view of the Multidrop Combi nL instrument is shown in Figure 2–4.



Figure 2–4. Multidrop Combi nL back view

Chapter 3
Installation

Delivery check

This section covers the relevant procedures to be carried out on receipt of the instrument.

Checking delivery

Check the enclosed packing list against order. In case of any deviations, contact your local Thermo Fisher Scientific representative or Thermo Fisher Scientific Oy.

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.

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

Unpacking

Move the packed instrument to its site of operation. To prevent condensation, the instrument should be left in its protective, antistatic plastic wrapping until the ambient temperature has been reached. Unpack the Multidrop Combi nL instrument and accessories carefully with the arrows on the transport package pointing upwards. Remove the instrument from the package and place it on a level surface. Refer to the enclosed packing instructions.

The following notes and instructions are sent with the instrument and are immediately available when you open the package:

- Unpacking instructions
- Warranty Certificate card
- Packing instructions/Packing list
- *Multidrop Combi nL User Manual* and *Quick Reference Guide*
- Transportation discrepancy report

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.

Requirements

When you set up your Multidrop Combi nL, avoid sites of operation with excess dust, vibrations, strong magnetic fields, direct sunlight or UV light, draft, excessive moisture or large temperature fluctuations.

- Make sure the working area is flat, dry, clean and vibration-proof and leave additional room for accessories, cables, and reagent bottles.
- 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 80% (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 Multidrop Combi nL does not produce operating noise at a level that would be harmful. No sound level measurements are required after installation.

Place the instrument on a normal laboratory bench. The net weight of the entire equipment is approx. 9.6 kg (21.2 lbs.).

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

Precautions and limitations

- Always ensure that the local supply voltage in the laboratory conforms to that specified on the rating label on the back of the instrument (Figure 2–4).
- Do not smoke, eat or drink while using the Multidrop Combi nL.
- Wash your hands thoroughly after handling test fluids.
- Observe normal laboratory procedures for handling potentially dangerous samples.
- Wear proper protection clothing, such as disposable gloves and laboratory coats, according to good laboratory practice.
- Ensure that the working area is well ventilated.
- Never spill fluids in or on the equipment.

Installation setups

This section describes the installation setups that you must carry out before operating or relocating the instrument.

Warning Ensure that the mains switch (Figure 2–4) at the left of the back panel is in the OFF position. Also ensure that the mains supply cable is disconnected. ▲

Releasing the transport lock

The instrument has a transport lock (Figure 3–5).

Make sure the red transport lock is released before operating the instrument.

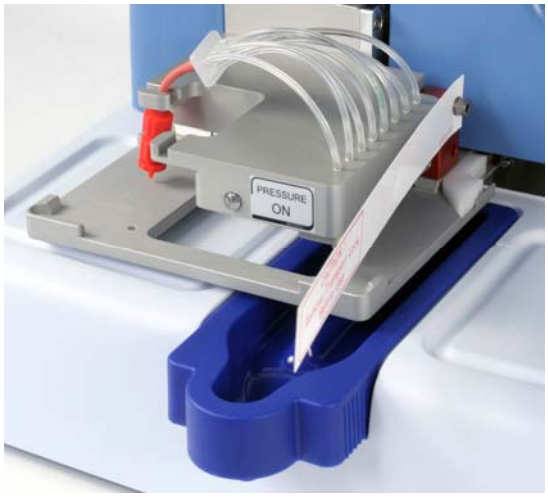
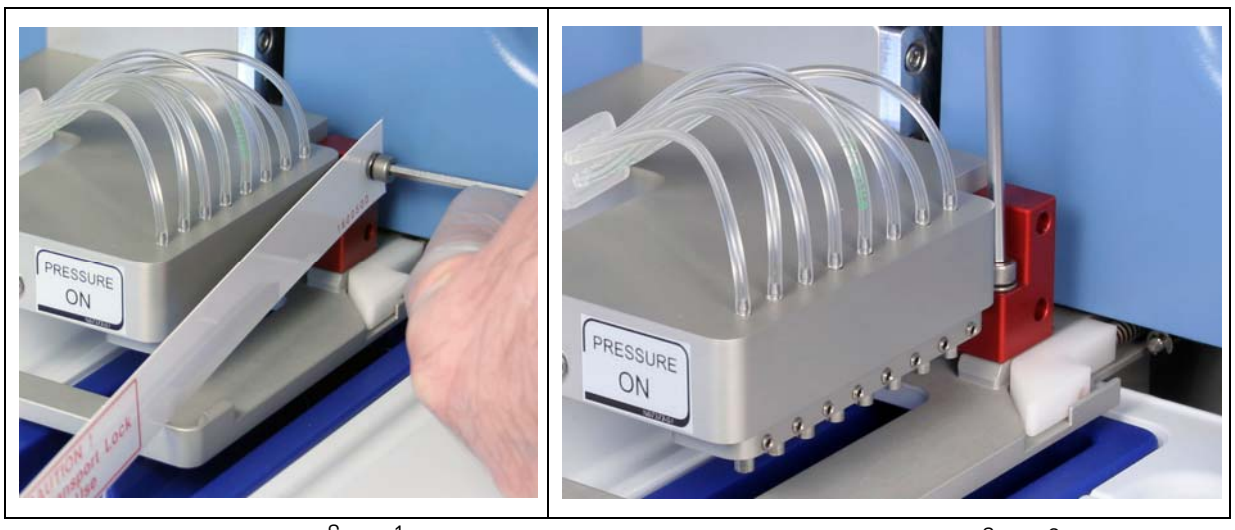


Figure 3–5. Transport lock and transport lock tag present

1. Unscrew the two screws marked 1 and 2 of the transport lock with the hexagonal screwdriver supplied (Figure 3–6) so that the track mechanism is loosened.



Screw 1 Screw 2

Figure 3–6. Removing the transport lock

2. Remove the screws, the transport lock piece and the transport lock tag from the screw marked 1 (Figure 3–6). Keep the tag for future relocation or transportation of the instrument. The transport lock is now released.

3. After that fasten the **red** transport lock piece to the back panel of the dispenser with the same screws for storage (Figure 3–7). Keep the transport lock there until needed for future relocation or transportation of the instrument.



Figure 3–7. Transport lock storage

Installing the priming vessel

To install the priming vessel, follow the steps below:

1. Insert the **blue** priming vessel (Cat. no. N07271) into its slot on the left of the plate carrier by pressing it over a snap lock (Figure 3–8).



Figure 3–8. Inserting the priming vessel

2. Insert a priming vessel tube assembly or cap (Cat. no. N05843) into the drain of the priming vessel or a vessel underneath the drain.

Installing the pressure/vacuum system reservoir

To install the pressure/vacuum system reservoir, that is, the reagent reservoir, follow the steps below:

1. Remove the **red** luer plugs from the left side of the pressure/vacuum system box and from the reagent reservoir (Figure 3–9). The red luer plugs avoid particles from entering the pressure/vacuum system unnecessarily.



Figure 3–9. Removing the red luer plugs

2. Connect the luer connector of the hosing to the pressure/vacuum system box (Figure 3–10). Connect the other end of the hosing through a similar luer connector to the reagent reservoir (Figure 3–11) for producing pressure and vacuum.



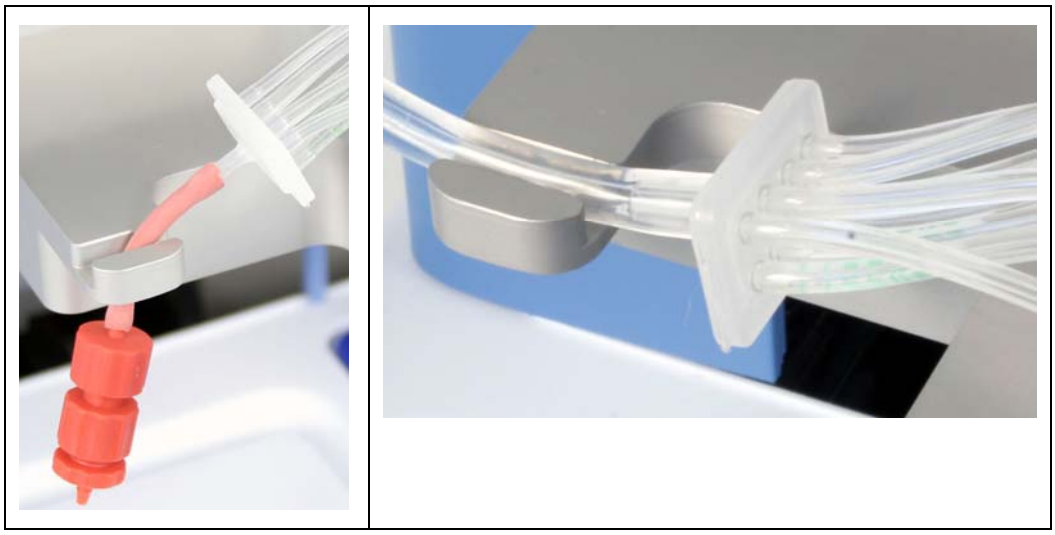
Figure 3–10. Connecting the hosing to the pressure/vacuum system



Figure 3–11. Connecting the hosing to the reagent reservoir

3. Detach the red manifold transport plug assembly (Figure 3–12 A).

4. Fit the reagent reservoir hosing on top of the bottle to the manifold (Figure 3–12 B) of the dispensing valves. It is enough to insert the hosing only halfway onto the manifold tube connector. Finally insert the hosing into the groove intended for it (Figure 3–13).



A B

Figure 3–12. Close-up of the manifold

Caution To detach the manifold tube connector, pull the hosing off. Do not twist the hosing. ▲



Figure 3–13. Reagent reservoir connected to the instrument

Operational check

Complete the following procedure to confirm the correct functioning of the dispenser prior to normal use.

1. Connect the instrument to a correctly installed line power outlet which has a protective conductor also called earth or ground. Switch the instrument on using the mains switch (Figure 2–4).

Warning Interruption of the protective conductor inside or outside the instrument or disconnection of the protective conductor terminal may make the instrument dangerous. ▲

- If the instrument starts properly:
  - The display lights up.
  - The plate carrier moves to the home position and the dispensing valve lifting mechanism to the up position.
  - The clamp (Figure 3–14) opens.



Figure 3–14. Priming vessel inserted into place

2. Ensure that the priming vessel is inserted correctly into its slot (Figure 3–14).

3. Pull the protective cover over the dispensing valve head.



4. Press **PRESSURE**.

- The pump starts and the instrument raises the pressure.
- The light indicator blinks while the instrument regulates the pressure.
- The light is stable once the pressure has been reached.



Caution Unfastening the tubing while the pressure is on can cause a hazardous situation, flood or spillage.

- Check that there is always enough liquid in the reagent reservoir and ensure that the filter is below the liquid level.
- Check after each dispensing that the priming vessel is not filled up if the tube drain is not used. ▲



5. Press **PRIME**.

- The lifting mechanism is lowered and the dispensing valves are opened as long as you press **PRIME**.



6. Press **START**.

- The dispensing protocol selected with the user interface is started.
- The clamp (Figure 3–14) tightens the microplate against the lower left corner of the plate carrier.

If the protocol or predispense is not started, follow the instructions on the display or check Chapter 9: “Troubleshooting Guide”.

Chapter 4
Routine Operation

Dispensing valves

The dispensing system of the Multidrop Combi nL is based on a pressure/vacuum system that the instrument controls.

The liquid to be dispensed into a well is pushed through a microsolenoid valve by means of compressed air. The pressure system can also produce *vacuum*, which is used for the **Empty** function. The principle of the pressure system is shown below (Figure 4–15).

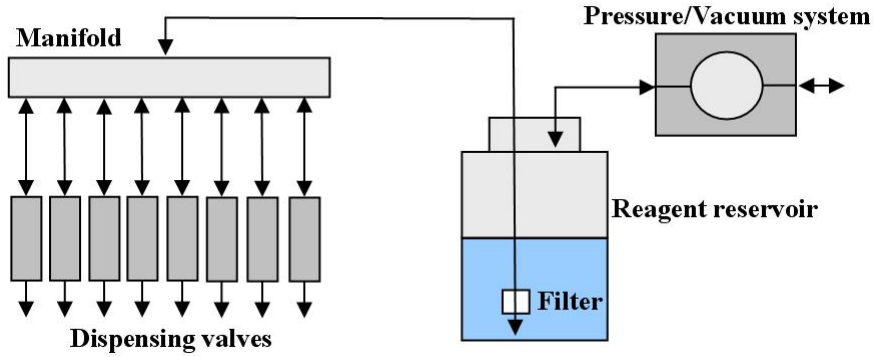


Figure 4–15. Principle of the pressure/vacuum dispensing system

The eight microsolenoid dispensing valves are inserted into the dispensing valve head. The modular design is shown below (Figure 4–16).



Figure 4–16. Eight dispensing valves inserted into the manifold

The dispensing valves are suitable for high-precision and high-speed dispensing of liquids. The valve nozzle bore geometry is designed to achieve an optimum droplet forming when the dispensed liquid volume is discharged from the valve. The wetted components are made from chemically resistant materials. The wetting materials of the microsolenoid dispensing valves, Cat. no. N07494, consist of: stainless steel, polyetheretherketone (PEEK), sapphire, and ruby.

The functional principle of the valve is:

Not activated: Closed and **Activated: Open**

Depending on the loading pressure at the reagent reservoir, the duration of the opening pulse determines the dispensing volume.

Calibration

A calibration defines the valve open times for different volumes at a certain air pressure. Calibrations are created, calculated and transferred with the Multidrop Combi nL PC software.

Calibration is a combination of a liquid to be dispensed and a speed. The calibration can be calibrated to ensure accurate dispensing with the instrument.

A calibration contains a series of five calibration points, of which each consists of a volume/time pair. Each calibration point has a fixed valve open time. The *approximate* dispensing volumes change according to the liquid properties and dispensing speeds. Refer to the example with water, Speed 3, in Table 4–1.

Table 4–1. Calibration point vs. dispensing volume and dispensing times

Calibration point	Dispensing volume	Number of dispensings
1	60 nl	300
2	100 nl	200
3	350 nl	90
4	3.5 µl	18
5	70 µl	2

The dispensed liquids may have different properties, which affect the valve open time needed to achieve the required volume. Thus, several different calibrations are needed to achieve accurate dispensing results.

For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

Reagent reservoir

There are different possibilities for holding the reagent to be dispensed. The liquid to be dispensed can be kept directly in the reagent reservoir of the pressure/vacuum system (Figure 4–17). There is a white reagent filter of 43 µm at the bottom of the 250 ml reagent reservoir that filters the solution to be dispensed. Nevertheless, all reagents still have to be filtered before use.



Figure 4–17. Reagent reservoir connected

A 1000 ml reagent reservoir (Cat. no. N07490) with a longer tubing is also available for larger volumes often used in automated systems.

Warning If other reagent reservoirs than recommended by Thermo Fisher Scientific are used, we are not liable for any damages arising out of their use. ▲

In nanodispensing, however, there might be a shortage of reagent. A separate reagent vessel or tube filled with the liquid to be dispensed can be inserted into the reagent reservoir. Standard laboratory test tubes, 50 ml and 15 ml, can be placed inside the reagent reservoir as such, but you will need a tube holder to keep smaller test tubes upright. You can remove the reagent filter if you use separate small reagent tubes. The solution is filtered beforehand with a suitable filter.

The 43 µm white reagent filter (Cat. no. N07493) can be replaced by pulling the filter away from the end of the tube (Figure 4–18). In some maintenance situations, for example, when cleaning a leaking or clogged dispensing valve, it is easier to remove both the filter and the connective tube from the cap of the reagent reservoir. Refer to “How to clean a leaking dispensing valve” on page 77.

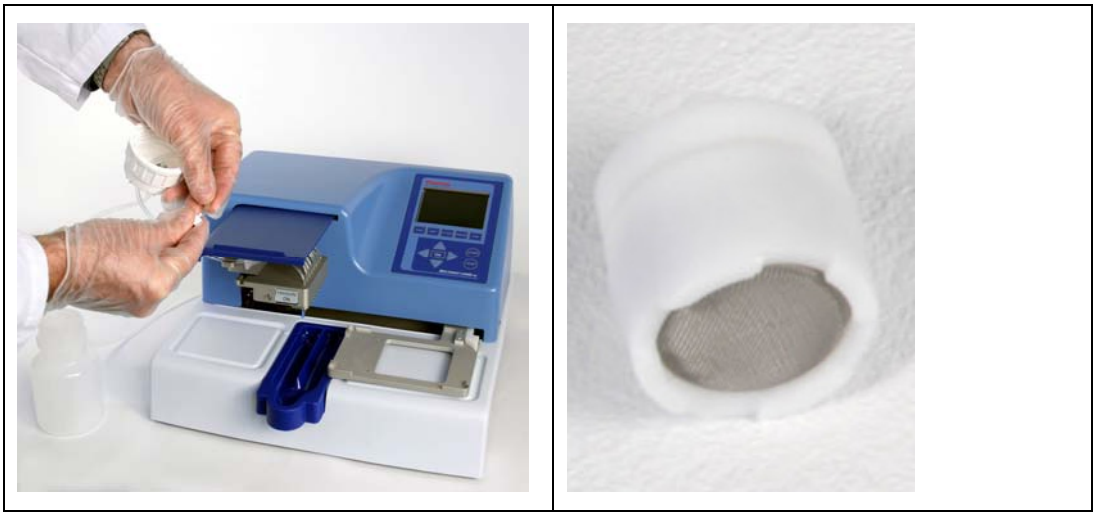


Figure 4–18. Removing the reagent filter

Control panel

This section describes the Multidrop Combi nL control panel and internal software.

Keyboard

The keyboard is shown in Figure 4–19.



Figure 4–19. Keyboard of the Multidrop Combi nL

Keys

The relevant keys and control buttons are described in detail below.



The arrow keys are used to select, modify and change the parameters and to navigate in the display.



The **OK** button is used to accept the selection.



The **START** button is used to start the dispensing protocol.



The **STOP** button is used to stop the protocol at any time. The plate and dispensing valve head are returned to the home position. While editing values, the changes can be discarded by pressing the **STOP** button.

The **STOP** button is also used to stop the shaking action.

Note In addition, the **STOP** button is used as an "Esc" (Escape)/ "Cancel" button. ▲

PRIME

The **PRIME** button is used to fill the tubings of the dispensing valves and predispense.
Predispenses as long as you press the button.

EMPTY

The **EMPTY** button is used to empty the liquid from the tubings and dispensing valves into the liquid reservoir (backflush option).
The **EMPTY** button is also used for cleaning the dispensing valves and tubes. Refer to Chapter 5: "Maintenance".
Empties as long as you press the button.

SHAKE

The **SHAKE** button is used to shake the plate linearly. The shaking is started by pressing the **SHAKE** button and stopped by pressing the **STOP** button.

PRESSURE

The **PRESSURE** button is used to raise the pressure at startup. Once the pressure has been reached, pressing the **PRESSURE** button again releases the pressure. Therefore you can toggle with the **PRESSURE** button. However, raising the pressure is started by pressing the **PRESSURE** button and stopped only by pressing the **STOP** button if the pressure has not yet been reached.

Note Pushing in the protective cover releases the pressure. ▲

TIP WASH

The **TIP WASH** button is used to remove persistent air bubbles from the hosing/microsolenoid valves and to open clogged dispensing valves.
The tip washing is started by pressing the **TIP WASH** button. The liquid comes in pulses and one channel at a time to maintain a maximum flow through the dispensing valve.
Tip washes as long as you press the button.

Display

The main view in the display is shown in Figure 4–20.

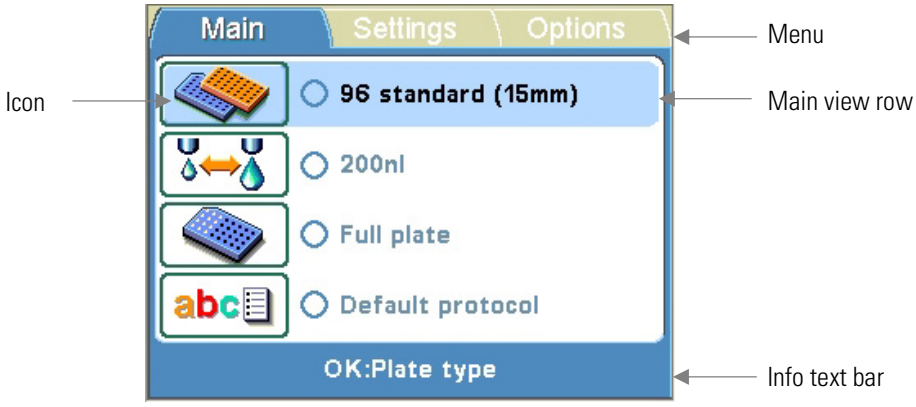


Figure 4–20. Main view on the display of the Multidrop Combi nL



There are three *menus* in the Multidrop Combi nL user interface: **Main**, **Settings** and **Options**. In routine use you mainly navigate in the **Main** menu. In advanced level options there are two extra menus, **Settings** and **Options**. You can navigate between these three menus using the **Left** and **Right** arrow keys.

The *main view row* is either colored (active) or uncolored (inactive).

All the descriptive *icons* used in the main view are shown in Table 4–2 below.

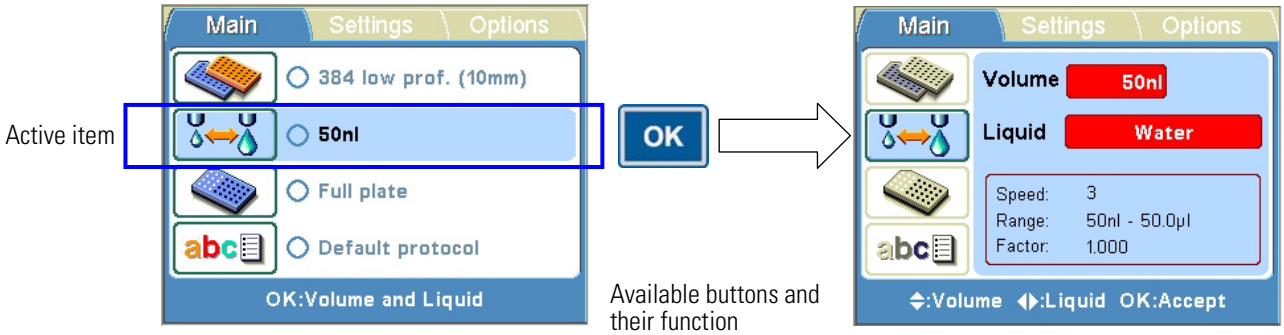
The *info text bar* shows explanatory information on how to proceed and which keys to use.

Navigating

This section visualizes navigation in the Multidrop Combi nL user interface.



The main view changes according to the selections you make either with the **Up** and **Down** arrow keys or the **OK** button. The available buttons and their function are shown on the info text bar.



The color of the items, for example, the icon and main view row, in the main view changes when they are selected (active/inactive).



To move from one menu to another, make sure you are in the main view of one of the menus and use the **Left** and **Right** arrow keys.

The main views of each menu tab are shown below.



Table 4–2. Icons in the main view

Menu	Icon	Function
Main		"Plate type" on page 37
		"Dispensing volume and liquid" on page 39
		"Column/Row selection" on page 40
		"Save and edit protocol" on page 54
Settings		"Dispensing speed" on page 48
		"Shaking" on page 47
		"Dispensing offsets" on page 48
		"Predispensing volume" on page 50
		"Dispensing direction" on page 51
Options		"Device information" on page 59
		"Computer interface" on page 60
		"Startup protocol" on page 61
		"Instrument settings" on page 62
		"Calibration" on page 63

Dispensing

You can immediately start dispensing by following the quick start guidelines below. Routine dispensing only requires to key in a few buttons.

1. Power ON the instrument.

2. 

   Insert the priming vessel and install the reagent reservoir and the reagent. Close the protective cover.

3. 

   Make sure you are in the **Main** menu.

4. 

   Select the plate type and insert the plate.

5. 

   Select the dispensing volume and the liquid.

6. 

   Press the **PRESSURE** button and wait till the pressure has risen.
   Only at startup!

7. 

   Keep the **PRIME** button down until the tubings are completely filled.

8. 

   Press the **START** button to start the protocol. The instrument dispenses the plate.

9. 

   Press the **EMPTY** button to empty the dispensing tubing.

10. 

    Power OFF the instrument. The pressure will be released.

Using FILLit PC software

The operation of the Multidrop Combi nL dispenser can also be controlled by an external computer and run on FILLit Software for Multidrop Combi nL. In addition to the Multidrop Combi nL internal software features, you can use multistep protocols, that is, protocols with several steps (e.g. Dispense, Shake, Empty, etc.), and create new calibrations for new liquids. The user can also download to the instrument protocols with one dispense step and an additional shake step or transfer protocols from one instrument to another. Calibrations can also be transferred to the internal software.

For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

Using internal software

This section describes procedures related to the Multidrop Combi nL internal software.

Dispensing parameters

This section describes the relevant dispensing parameters required to create and edit a protocol. All these parameters are set in the **Main** menu.

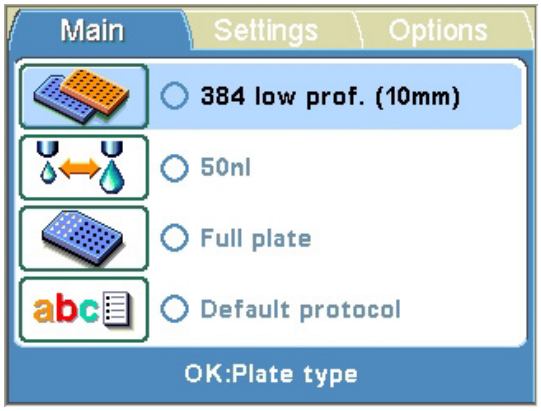
Note Make the plate type selection first because all the other parameters are dependent on the plate type. ▲

Caution Make sure the plate lid (if used) is removed before dispensing. ▲

Plate type

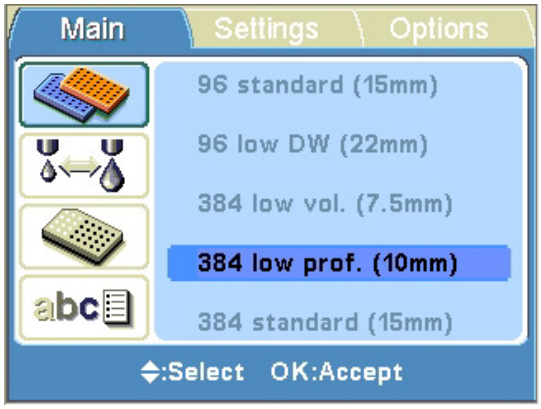
Go to the **Main** menu.







Press **OK**.





Select the plate type using the **Up** and **Down** arrow keys.



Press **OK** to accept the selection.

The available plate types and the default parameter values are given in Table 4–3. Each plate type has a selected default maximum dispensing volume and dispensing height, which is automatically set by the instrument.

Table 4–3. Default parameter values for different plate types

Plate type	Max. dispensing volume * (µl)	Dispensing height (mm) **
96-well standard (15 mm)	500	16
96-well low DW (deep well) (22 mm)	600	23
384-well low volume (7.5 mm)	25	8.5
384-well low profile (10 mm)	70	11
384-well standard (15 mm)	130	16
384-well DW (22 mm)	200	23
1536-well low volume (5 mm)	2	6
1536-well standard (10.5 mm)	13	11.5



* You can dispense without warning to the maximum dispensing volume, but once the maximum is exceeded, a warning appears and you have to press **OK** to continue dispensing.
** The default dispensing height is 1 mm above the selected plate.



Note If the default plate values do not agree with yours, change the dispensing offset and height values in the **Settings** menu. You can save the plate values for future use. ▲

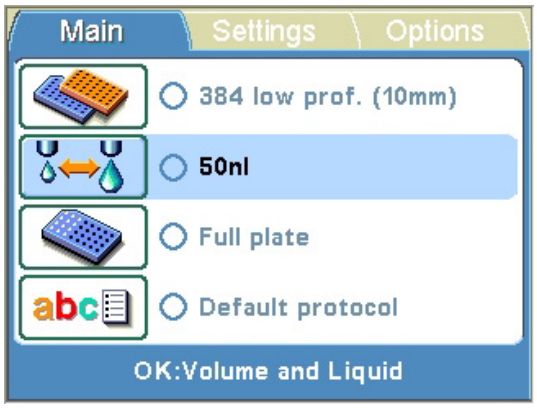


Note You can also select more plates or define new plates with FILLit Software and download them to the instrument, if needed. ▲

Dispensing volume and liquid

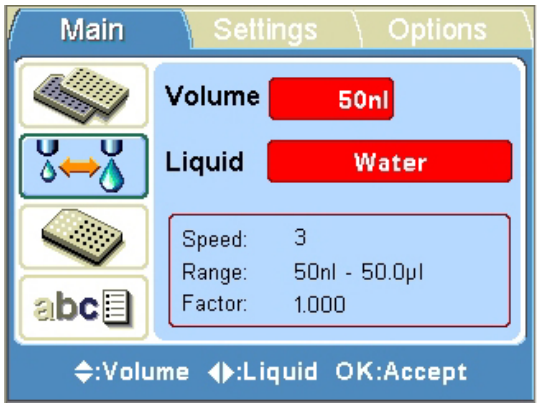


Go to the **Main** menu. Select the **Volume and Liquid** row.





Press **OK**. The default dispensing volume for the selected plate type is shown.





Select the *dispensing volume* (**Volume**) using the **Up** and **Down** arrow keys. You can speed up the selection by holding down the arrow key continuously.



Then select **Liquid** (Calibration) using the **Left** and **Right** arrow keys.

The different liquids set are:

- Water
- 1% BSA (bovine serum albumin)
- 30% glycerol
- DMSO (dimethyl sulfoxide)
- Methanol

If you have a different liquid than the five liquids mentioned above, you can calibrate the new liquid with FILLit Software or use the liquid factor to calibrate the set volume.

The optimal speed, dispensing volume range and the liquid factor for the dispensed liquid are displayed in the **Volume and Liquid** window.

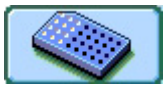
The default maximum dispensing volumes and dispensing heights for different plate types are given in Table 4–3.

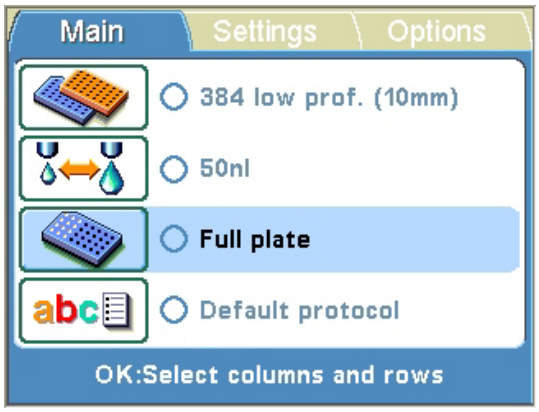


Accept the selections using the **OK** button.

Column/Row selection

You can dispense either into the whole plate or only into certain selected columns or rows. Go to the **Main** menu. Select the **Select columns or rows** row.







Press **OK**.

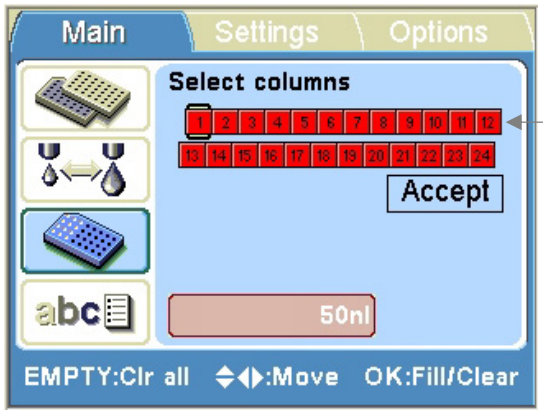
Full plate





If you want to dispense into all the wells of the plate, select **Full plate** if it is not already shown on the screen. If you want to dispense only into some of the wells, select **Select columns…** or **Select rows...** using the **Down** arrow key.

Column selection



Column number



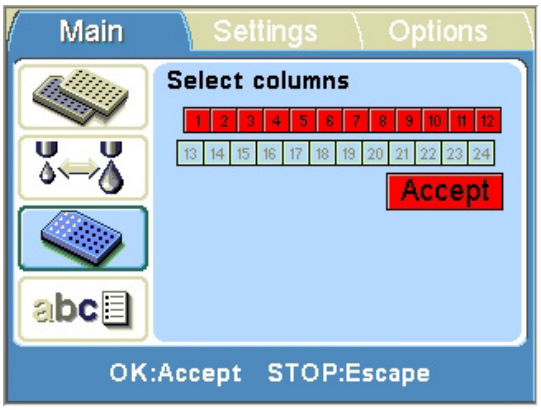
Use the arrow keys to move from one column to the next.



Press the **OK** button every time to select a column. The selected column changes from red (filled) to uncolored (empty). Use the **OK** button to toggle between a filled or empty column.



Use the **Down** arrow key and select **Accept** and press **OK** after selecting all the columns you wish.

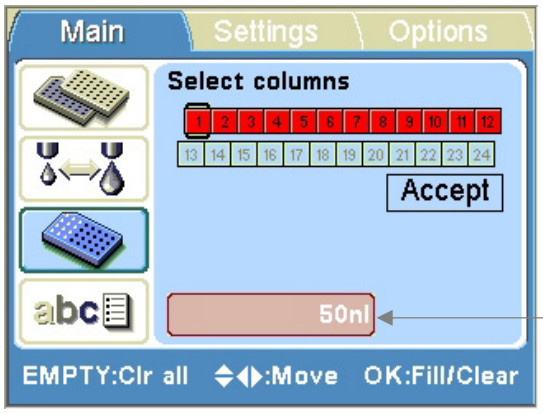




You can press the **STOP** button to exit the column selection without making any changes.

Setting the column volume

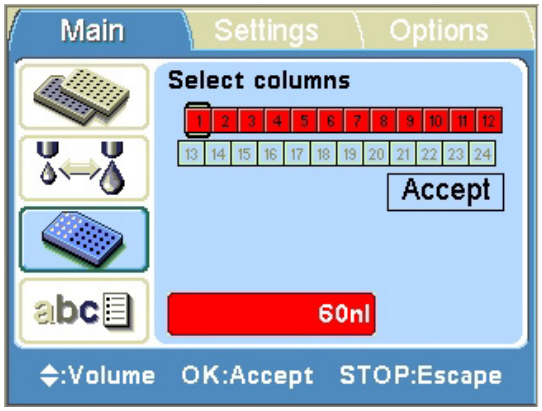
The dispensing volume selected in the **Volume and Liquid** window (see "Dispensing volume and liquid" on page 39) is shown in the bottom left box. You can adjust the dispensing volume for each individual column.



Volume value box



Press the **OK** button for 0.5 seconds. The **Volume value** box is now activated (bright red). Adjust the dispensing volume of the column where the cursor is located using the **Up** and **Down** arrow keys.





Press **OK** after selecting the desired volume.

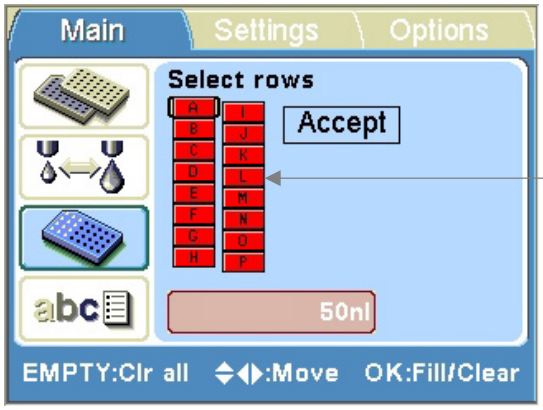


Use the **Down** arrow key and select **Accept** and press **OK** after selecting the column volumes you wish.



You can press the **STOP** button to exit the volume selection without making any changes.

Row selection





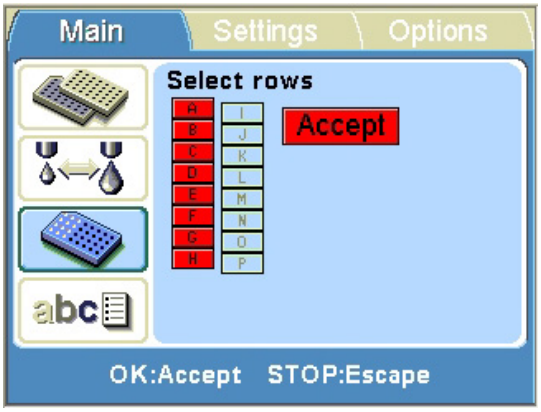
Use the arrow keys to move from one row to the next.



Press the **OK** button every time to select a row. The selected row changes from red (filled) to uncolored (empty). Use the **OK** button to toggle between a filled or empty row.



Use the **Down** arrow key and select **Accept** and press **OK** after selecting all the rows you wish.

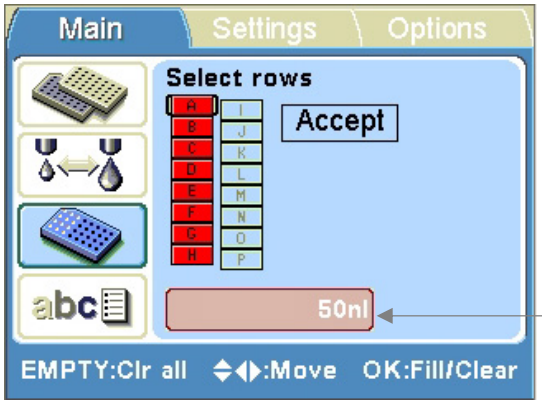




You can press the **STOP** button to exit the row selection without making any changes.

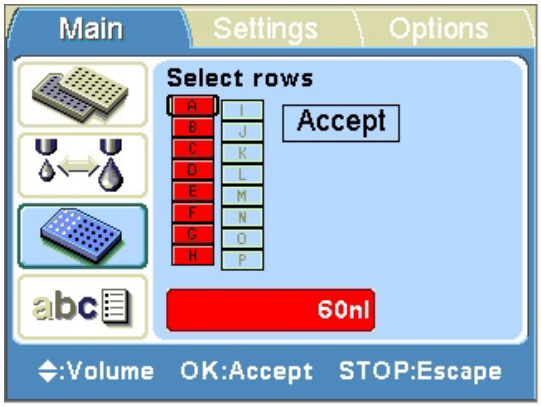
Setting the row volume

The dispensing volume selected in the **Volume and Liquid** window (see "Dispensing volume and liquid" on page 39) is shown in the bottom left box. You can adjust the dispensing volume for each individual row.





Press the **OK** button for 0.5 seconds. The **Volume value** box is now activated (bright red). Adjust the dispensing volume of the row where the cursor is located using the **Up** and **Down** arrow keys.





Press **OK** after selecting the desired volume.



Use the **Down** arrow key and select **Accept** and press **OK** after selecting the row volumes you wish.



You can press the **STOP** button to exit the volume selection without making any changes.

Selecting columns and rows (Selected wells)

You can first select columns of a microplate with a certain volume and then select rows of the same microplate with another volume, or vice versa. Where the selected columns and rows cross each other, the wells will be filled with the row or column volume that was last selected when such a protocol is executed.

Refer to the example plate in Figure 4–21 where the 100 nl row selection overwrites the 50 nl column selection made first.

In general, be careful if you choose to carry out cross-dispensing where selected wells are concerned.

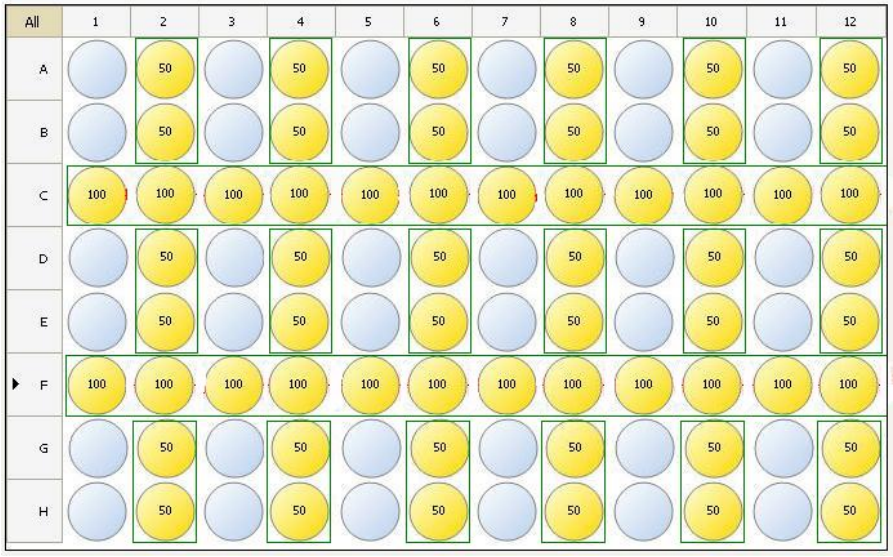


Figure 4–21. Example of dispensing with selected wells

Protocol settings

This section describes the additional parameters that supplement the plate type you have selected. These additional parameters are set in the **Settings** menu. The values shown in the **Settings** menu are those set for the plate type that is selected in the **Main** menu.

Note The protocol settings do not normally have to be changed in routine use. ▲

Note An exclamation mark will appear in the menu tab and in the circle on the main view row in question when the setting differs from the default setting. ▲



The changes made to the protocol settings only remain in the instrument memory if the protocol is saved with a name (see “Save and edit protocol” on page 54). If the protocol is not saved, the changes only remain effective until the plate type is changed or the instrument is switched off.

Dispensing speed



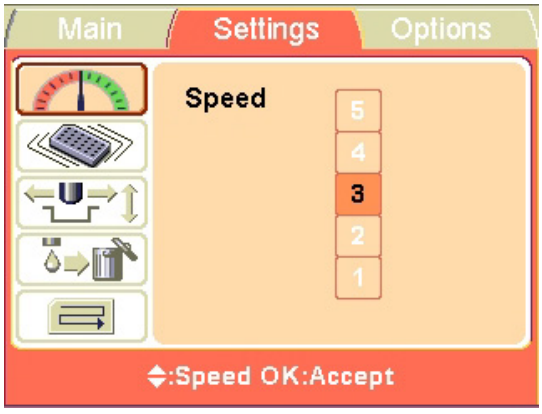
The default dispensing speed (that is, the pressure) is automatically set according to the liquid used. Refer to the **Volume and Liquid** window shown in "Dispensing volume and liquid" on page 39. However, you can change the dispensing speed if the liquid has been calibrated for several speeds.

Go to the **Settings** menu.

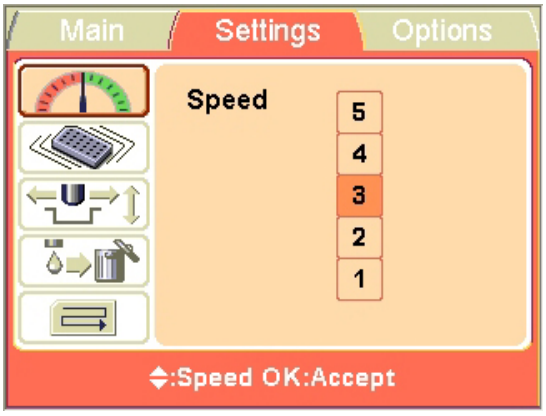




Press **OK**.



E.g. 1% BSA



E.g. Water



Use the **Up** and **Down** arrow keys to select the speed. The available and calibrated speeds are colored **black**. On the other hand, the unavailable and uncalibrated speeds are colored white. The available range is **1** to **5**. To use unavailable speeds, the liquid first has to be calibrated using the unavailable speed.



Press **OK**.

The optimal dispensing speeds for different liquids are factory set. For example, the optimal dispensing speed for water is **3**. If a higher density solution is dispensed, it requires a greater speed to dispense the corresponding volume. You can decrease the speed, for example, to reduce foaming.

The relationship between the dispensing speed and pressure is presented in Table 4–4.

Table 4–4. Relationship between dispensing speed and pressure

Dispensing speed	Pressure
Speed 1	3 psi
Speed 2	4 psi
Speed 3	5 psi
Speed 4	6 psi
Speed 5	7 psi

Shaking



The Shake function allows you to shake the plate immediately after dispensing it without any additional selection steps.

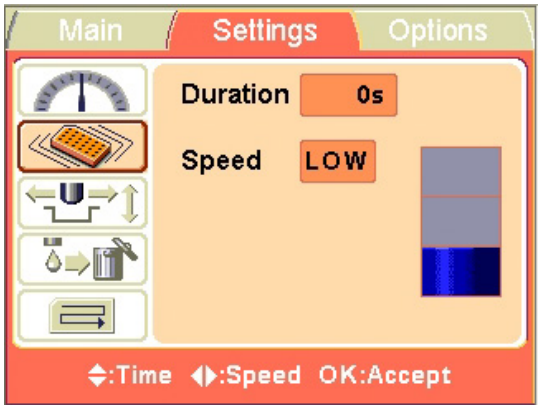
By default, the shaking is turned OFF.

Go to the **Settings** menu. Select the **Shaking** row.





Press **OK**.





Use the **Up** and **Down** arrow keys to select the duration of the shake. You can set the time in increments of 1 s. The maximum shaking period is 120 s. The default duration is 0 s.



Use the **Right** and **Left** arrow keys to select the speed of the shake. The available speed settings are *Low*, *Med* (Medium) and *High*. The default speed is *Low*.

The speed settings with regard to the movement distance in millimeters (mm) and the frequency (cycles per second) in hertz (Hz) are presented in Table 4–5.

Table 4–5. Speed settings vs. distance movement and frequency

Speed	Movement distance (mm)	Frequency (Hz)
Low	2	10
Medium	1	15
High	1	20



Press **OK**.

Dispensing offsets

This main view row includes both the dispensing height and the dispensing offset functions.



Go to the **Settings** menu. Select the **Offsets** row.





Press **OK**.

The track mechanism and the dispensing valve head move to the setting position. When you adjust the height, the dispensing valve head moves next to the plate. On the other hand, when you adjust the X/Y offset, the dispensing valve head moves over the first column of the plate, but the default is always 1 mm above the plate. Adjust the optimal offset values visually.



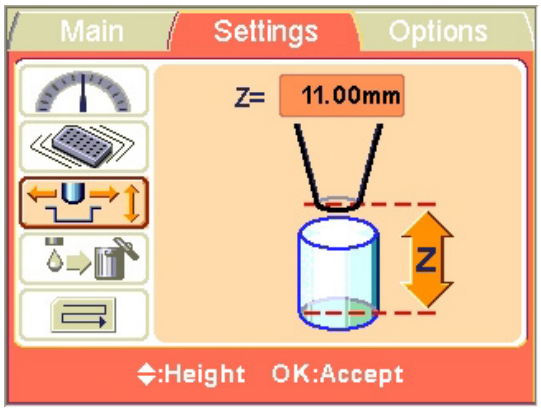


Use the **Up** and **Down** arrow keys to select the dispensing height and/or the dispensing offset.



Press **OK**.

Height The default dispensing height depends on the plate type (see Table 4–3). You can change the dispensing height values if the plate used is not the standard one specified in the plate type list.





Use the **Up** and **Down** arrow keys to set the dispensing height. While you change the offset value, the dispensing valve lifting mechanism moves * accordingly. The height is set in 0.05 mm increments in both the up and down directions. The minimum height value depends on the selected plate type (see Table 4–3). The default dispensing height is 1 mm above the selected plate.



Note You can adjust the dispensing height of low profile plates below the plate height. ▲

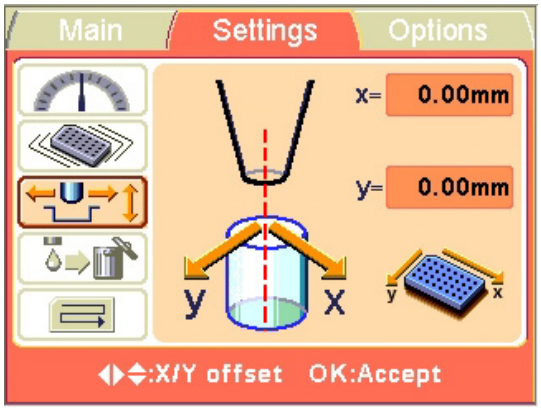


Press **OK**. If the **OK** button is not pressed within 60 seconds, the adjustments are disregarded and the main view returns to the **Settings** menu.

* z-axis = the dispensing valve lifting mechanism moves

X/Y offset

The default dispensing X/Y offset is 0.0/0.0 mm. You can change the x- and y-axis offset values if the plate used is not the standard one specified in the plate type list (see Table 4–3).





Use the **Left** and **Right** arrow keys to set the dispensing X/Y offset in the x-axis and the **Up** and **Down** arrow keys to set it in the y-axis direction. While you change the offset values, the dispensing valve head moves * accordingly. The offset is set in 0.05 mm increments in both the + and – directions. The maximum offset value depends on the selected plate type.



Press **OK**. If the **OK** button is not pressed within 60 seconds, the adjustments are disregarded and the main view returns to the **Settings** menu.

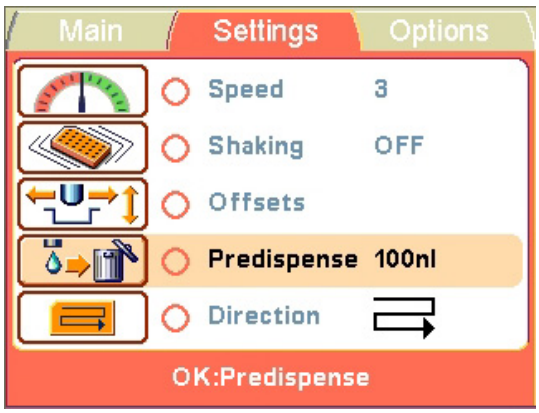
* y-axis = the dispensing valve head moves;
x-axis = the plate carrier moves

Predispensing volume



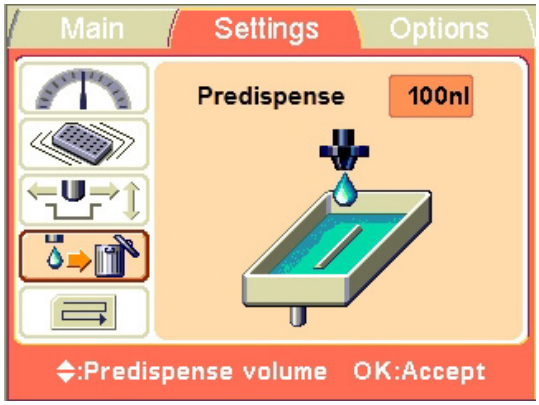
You can change the predispensing volume – the volume that is automatically dispensed before the start of plate filling, if necessary. The default predispensing value is 100 nl (= 2 x 50 nl). Some more viscose solutions used may sometimes require extra predispensing.

Go to the **Settings** menu. Select the **Predispense** (**Prime**) row.





Press **OK**.





Use the **Up** and **Down** arrow keys to set the predispensing volume. The volume ranges from 0 to 200 nl in 50 nl increments. Note that the predispensing value can be zero if predispensing is not required.



Press **OK**.

Dispensing direction

The row wise dispensing direction, being the fastest option, is default for each plate type. However, you may change the dispensing direction, if necessary.

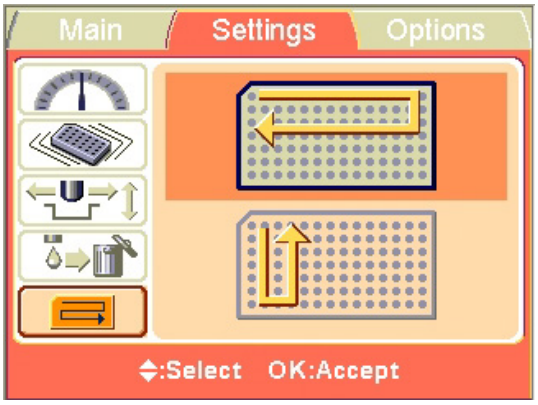


Go to the **Settings** menu. Select the **Dispensing direction** row.





Press **OK**.



Row wise direction

Column wise direction



Use the **Up** and **Down** arrow keys to set the dispensing direction, *row wise* or *column wise*. Note that the whole action is only effective when 384 or 1536 plate types are selected.



Press **OK**.

The Dispensing direction function is useful in assays where reaction times are critical.

With the 96-well plate selection, the columns with 8 wells are filled starting from column 1 according to the selected columns, after which the plate carrier returns to the home position and the dispensing valve lifting mechanism to the up position. Row wise and column wise dispensing show no difference in 96-well plate dispensing.

With the 384-well plate selection, the columns with 16 wells are filled in two phases: first every other row (A, C, E, G, ... O) starting from the columns selected and then the dispensing valve head carrier shifts sideways so that the remaining rows (B, D, F, H, ... P) are filled in the opposite order. If column wise dispensing is used, it shifts the dispensing valve head carrier first sideways filling 16 wells and then the plate carrier moves dispensing over the next column.

With the 1536-well plate selection, the columns with 32 wells are filled in four phases: first every fourth row (A, E, I, M … AC) and then the dispensing valve head carrier shifts sideways above the rows (B, F, J, N … AD), which are then filled in the opposite order. After three shifts the remaining rows (D, H, L, P … AF) are filled. Column wise dispensing shifts the dispensing valve head carrier sideways three times filling 32 wells and then the plate carrier moves the dispensing valve head over the next column.

Running a protocol

Note that multistep protocols, that is, protocols with several steps (e.g. Dispense, Shake, Empty, etc.), can be run with FILLit Software for Multidrop Combi nL. You can also download protocols with one dispense step and an additional shake step to the instrument. For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

To run a dispensing protocol, follow the steps below.

Note Do not dispense extensively without any liquid to avoid overheating of the pump.

- Check that there is always enough liquid in the reagent reservoir and ensure that the reagent filter is below the liquid level. Use a test tube placed inside the reagent reservoir if a limited amount of liquid is available.
- Check after each dispensing that the priming vessel is not filled up if the tube drain is not used. ▲

1. 

Make sure you are in the **Main** menu.

2. 
Select the plate type.

3. 

Select the dispensing protocol from the protocol list. Only protocols for the selected plate type are shown.

4. 

Press the **PRESSURE** button and wait till the pressure has risen. *Only required at startup!*

5. 

Keep the **PRIME** button down until the tubings are completely filled.

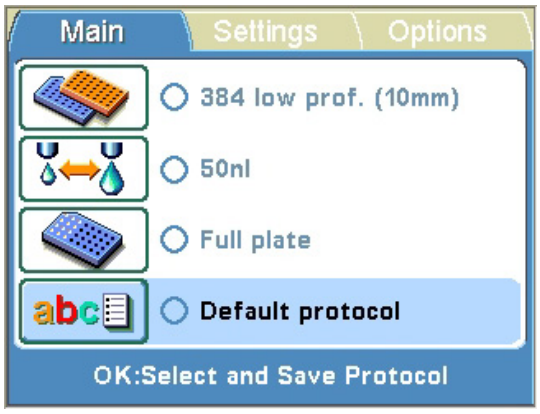
6. 

Press the **START** button to start the protocol.

Save and edit protocol

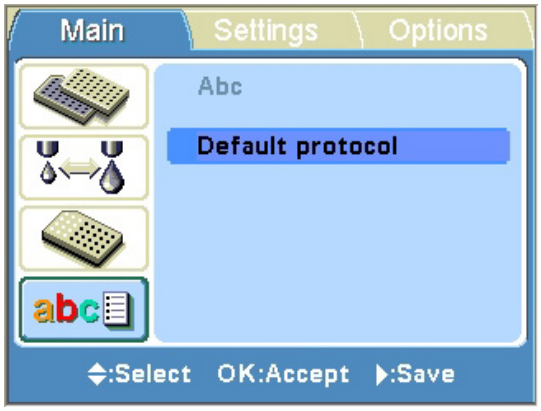


Go to the **Main** menu. Select the **Select and Save Protocol** row.





Press **OK**.





Press the **Right** arrow key to name/save the name of your protocol.



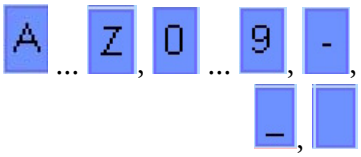
Enter the name of your protocol.



Use the arrow keys to choose the character you want.



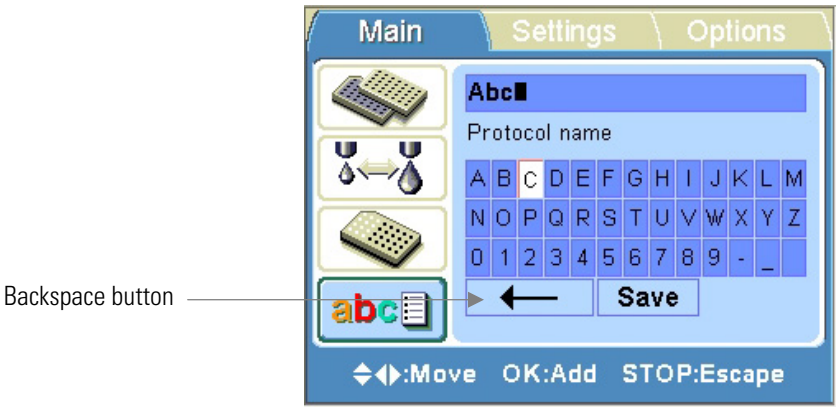
Press **OK** to enter the character.

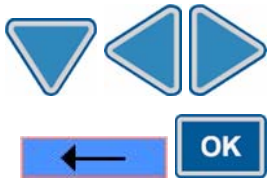


The available characters are **a** to **z**, **0** to **9**, hyphen (-), underscore (_) and space.



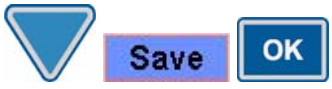
Note Use maximum 20 characters, including the space character. Some of the characters are broader than the others, whereby some of the names can display less than 20 characters in the protocol list, shown as three dots at the displayed name. The protocol name is automatically capitalized. ▲





To remove characters, use the **Backspace** button. Use the **Down** arrow key (and if needed, the **Left** and **Right** arrow keys) to select the **Backspace** button and then the **OK** button to remove the character(s).



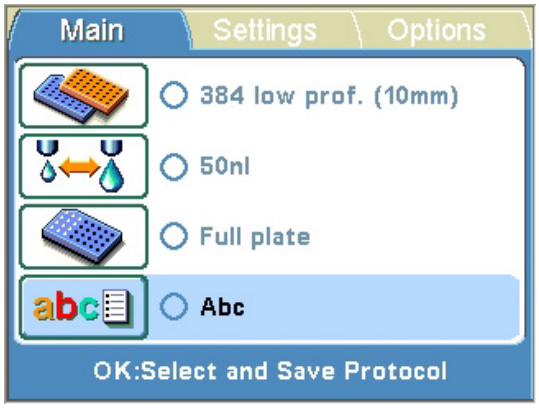


Use the **Down** arrow key to select the **Save** button and then press the **OK** button to save the edited protocol name.

The sandglass window will appear while the Save action is in progress.

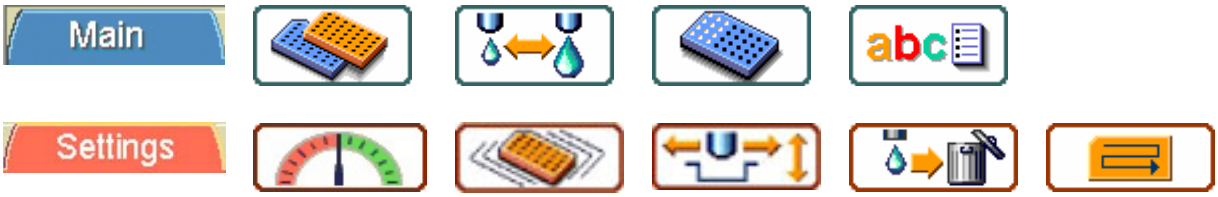


The protocol name is now shown on the **Select and Save Protocol** row.



You can create a maximum of 100 protocols, including the factory-defined protocols.

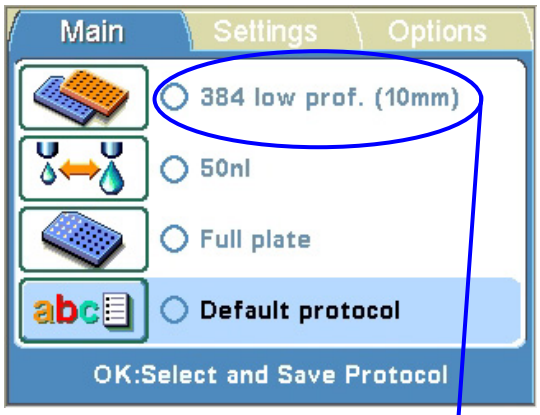
When you save the protocol, all the following parameters are saved:



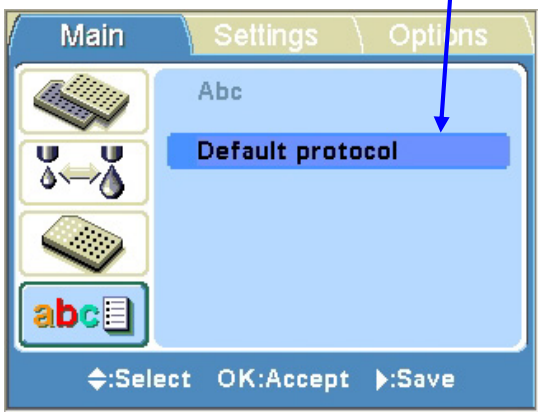
Select protocol



To select an existing protocol for a particular plate type, first select the plate type (see “Plate type” on page 37) and then select the **Select and Save Protocol** row.



Press **OK**.



Opens protocols for 384-well plates.



Select the protocol using the **Up** and **Down** arrow keys.



Press **OK** to accept the selection.

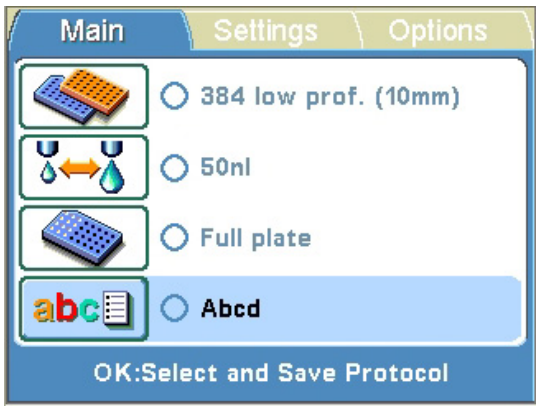
The protocol is now selected.



Note In the protocol list only the protocols made for the plate type in question are shown. ▲

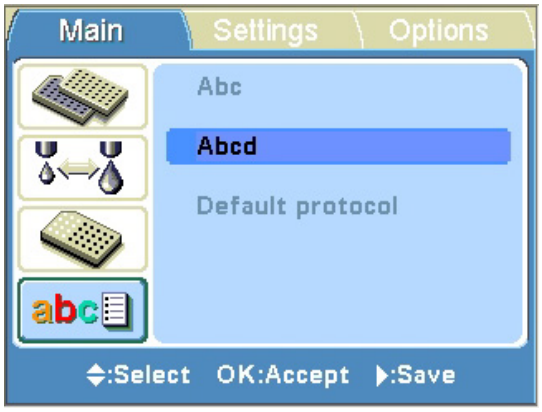
Delete protocol

To delete an existing protocol for a particular plate type, first select the plate type (see “Plate type” on page 37) and then select the **Select and Save Protocol** row.





Press **OK**.





Select the protocol using the **Up** and **Down** arrow keys.



Press the **Right** arrow key to enter the edit mode.



Delete button



To delete the protocol, use the **Delete** button. Use the **Down** arrow key (and if needed, the **Left** and **Right** arrow keys) to select the **Delete** button and then the **OK** button to delete the protocol. *You cannot delete default protocols* (the **Delete** button is not activated). Also, if you have selected a protocol to be *a startup protocol*, it *cannot be deleted*.

The protocol is now deleted.

Caution Before deleting, always check that you have selected the item you wish to delete. ▲

Instrument options

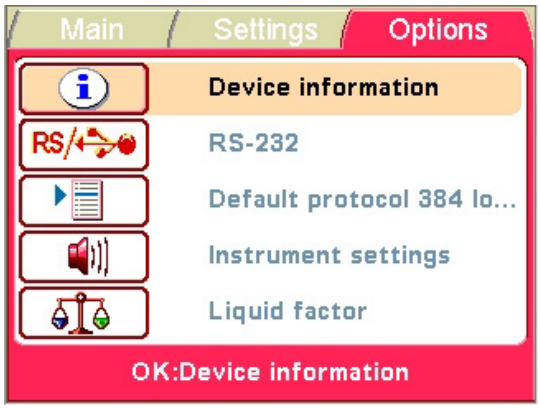
This section describes the instrument parameters. All these parameters are set in the **Options** menu. The values shown in the **Options** menu remain in the instrument memory and are instrument specific, not protocol specific.

Note You do not normally have to change the instrument options in routine use. ▲

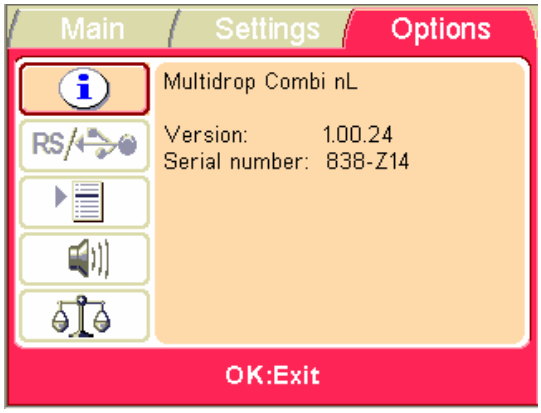
Device information

The device information shows the name of the instrument, the internal software version and the serial number of the instrument unit.

Go to the **Options** menu.



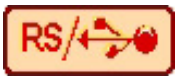
Press **OK**.



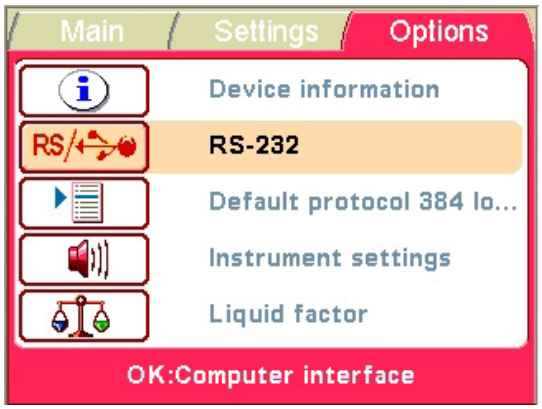
Press **OK** to exit.

Computer interface

There are two types of computer interfaces available: RS-232 and USB.



Go to the **Options** menu. Select the **Computer interface** row.





Press **OK**.



This selection also has to be done when you use the instrument through FILLit Software. Refer to Chapter 2: “Installing FILLit Software” in the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).



Use the **Up** and **Down** arrow keys to select the computer interface in use.



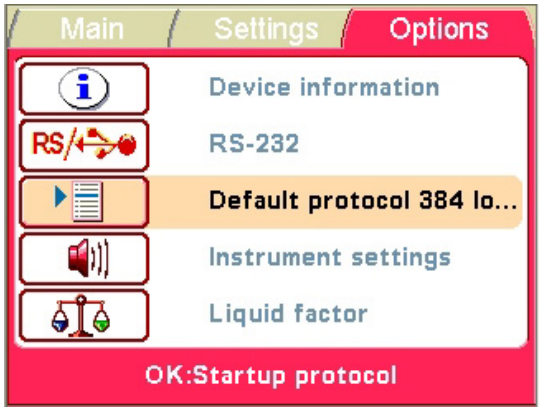
Press **OK**.

Startup protocol



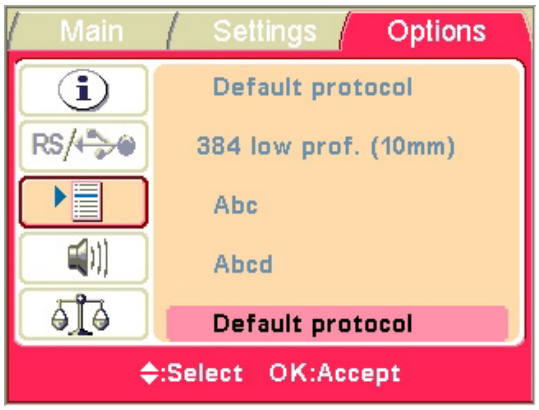
You can set which protocol is automatically selected in the **Main** menu when the Multidrop Combi nL is powered on.

Go to the **Options** menu. Select the **Startup protocol** row.





Press **OK**. All protocols stored in the instrument memory are displayed.



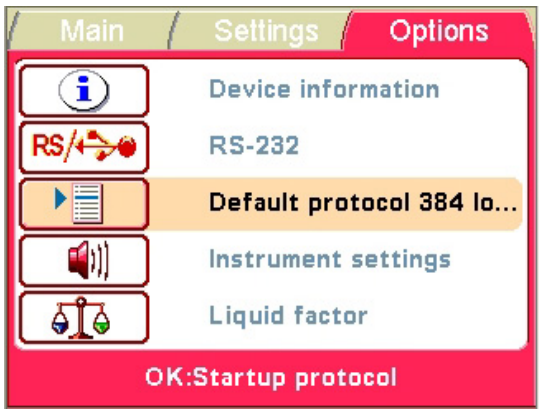


Use the **Up** and **Down** arrow keys to select the startup protocol. The protocols are listed grouped and indented under each plate type.



Press **OK**.

The protocol name is appended with the plate type.



When the instrument is started up the next time, the plate type and the protocol are those just selected.

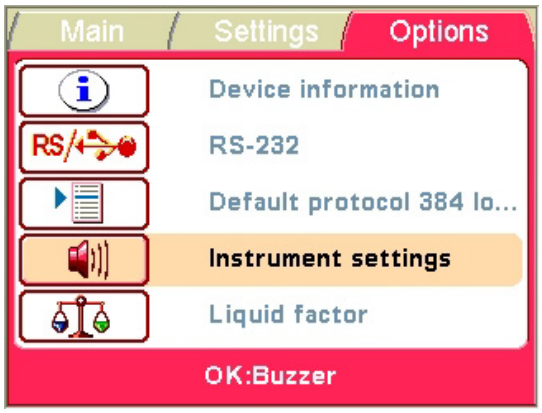
Note that the sandglass window always appears while the Save action is in progress in the **Options** menu.



Instrument settings

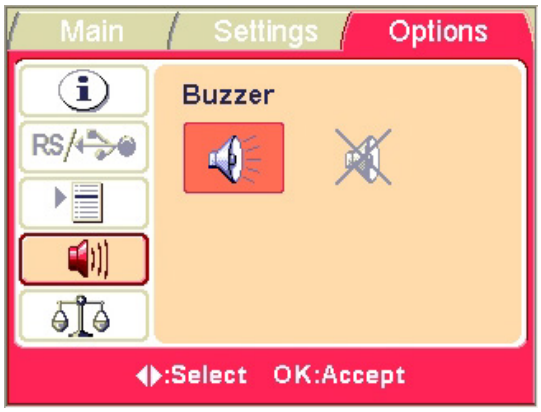


You can choose whether or not the instrument produces a sound for different functions. Note that all functions make a certain sound. Go to the **Options** menu. Select the **Instrument settings** (**Buzzer**) row.





Press **OK**.





Use the **Left** and **Right** arrow keys to select whether the buzzer (audible sound) is On or Off.



Press **OK**.

Calibration



You can calibrate the dispensing valves for different liquids. Calibration of the Multidrop Combi nL instrument is routinely carried out with the PC software. For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

For more information on calibrations, refer also to “Calibration” on page 30 and “Dispensing volume and liquid” on page 39.

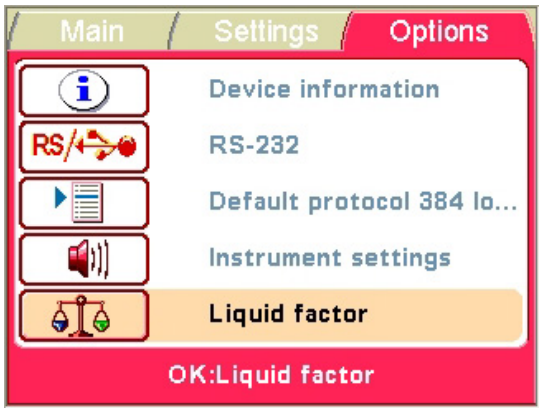
Liquid factor (standalone calibration)

Liquid factor is a step where *dispensing accuracy* can be verified and corrected at one selected volume.

Factor is a correction factor which can be used, for example, after speed (pressure) or liquid change, where there is no calibration curve for a new speed or a new liquid.

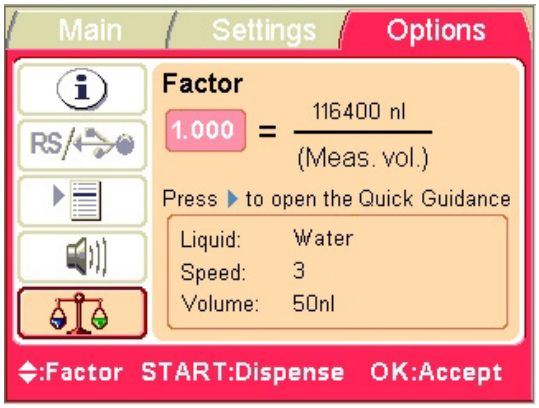
First, dispensing of multiple dispenses into a microplate strip is carried out according to the volume selected in the Main > **Volume and Liquid** window. Then a gravimetric measurement of the strip is performed. After that the results are entered into the formula and a new liquid factor is calculated. Refer to “Accuracy check” on page 64 and “Factor calculation “ on page 66.

Go to the **Options** menu. Select the **Liquid factor** row.





Press **OK**.



You set the Liquid, for example, Water in the **Volume and Liquid** window of the Main menu. Refer to "Dispensing volume and liquid" on page 39. Five liquids are factory set.

Dispense the selected volume, measure the weight of the dispensed liquid and calculate the liquid factor. Refer to "Factor calculation" on page 66.



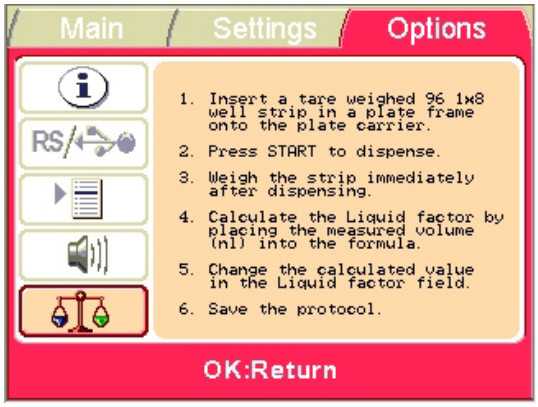
Use the **Up** and **Down** arrow keys to select the factor for the liquid used. The default settings for the liquid, the dispensing speed and the dispensing volume are presented in the **Factor** window.



Use the **Left** arrow key to check the dispensing volume.



Use the **Right** arrow key to open the **Quick Guidance** window.



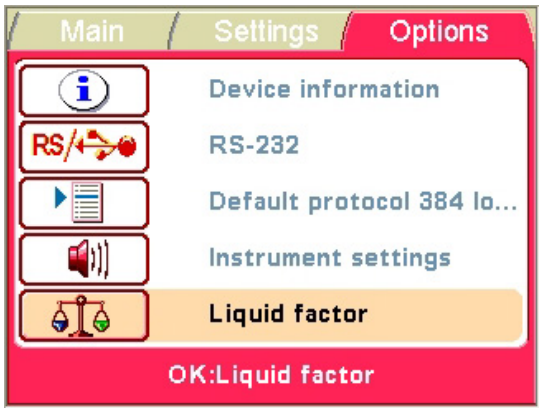


Press **OK**.

Accuracy check

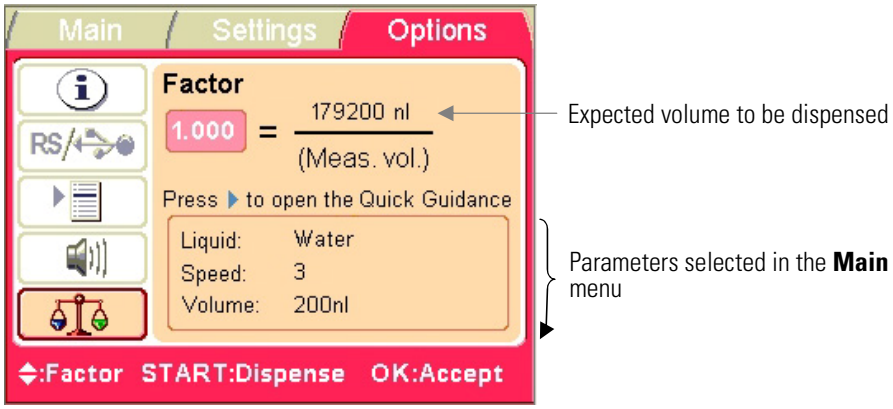
To perform an accuracy check and **factor** calculation (see "Factor calculation" on page 66), follow the procedures below:

- Go to the **Options** menu. Select the **Liquid factor** row.





- Press **OK**.



- Take the **first** strip (**column 1**) of a 96 well 1x8 strip plate (Thermo Scientific Microtiter 96 1x8 Strip Plate, Cat. no. 95029350, or equivalent) and use an analytical balance (four digits) to set the tare weight to zero.



Note You can also measure the mass of the empty strip and calculate the difference after weighing the dispensed liquid to obtain the net value. However, the easiest way is to set the tare weight of the empty strip to zero so that the net mass of the dispensed liquid can be obtained from the balance without any calculations. ▲

- Place the plate onto the plate carrier of the Multidrop Combi nL.



- Press **START** on the keyboard to start dispensing (or **STOP** to escape) at the liquid, speed and volume set in Main > **Volume and Liquid**. The liquid is dispensed into the empty strip a default number of times, depending on the set volume, to obtain a measurable amount of mass.

  The expected volume necessary to be dispensed is shown above the line, for example, 179200 nl, in the screenshot above.

- Measure the mass of the strip immediately to avoid evaporation.

ACCURACY CALCULATION:

Convert the obtained mass to volume (nl) and calculate the accuracy as follows:

ACCURACY% = 100*Measured volume-Set volume/Set volume

- Measured volume (in nanoliters) = 1000000*Dispensed liquid mass (in grams)/Density of the liquid (g/cm^3)
- Set volume (in nanoliters) = Expected total volume in the dispensed strip at the selected volume setting and calibration (**Main** menu).

Note Calibration curves are calculated from gravimetric results and volume calculations are always carried out by using density correction, so real volumes are obtained. The difference between liquid mass and volume in water is around 0.3% at normal room temperatures and may be omitted in the accuracy check; but with liquids having a different density to water, the mass conversion to real volumes should also be carried out in the accuracy check step. ▲

Example: Accuracy check with water at 200 nl volume set.

1. Measured liquid mass = 0.1815 g
2. Conversion to volume (nanoliters): 1000000*0.1815/0.9969 (water density at 22°C) = 182064 nl
3. ACCURACY% = 100*182064 nl-179200 (Expected volume)/179200 = 1.6%

For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

Factor calculation

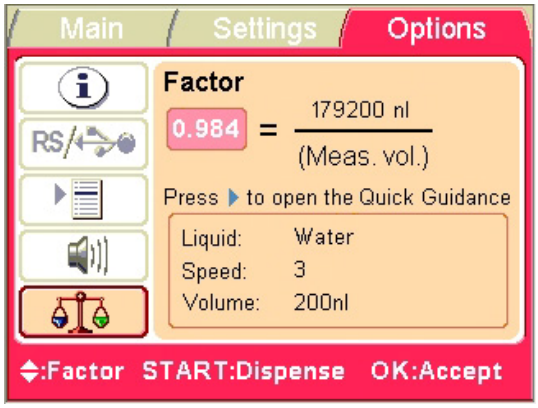
To perform a factor calculation, follow the steps below:

1. Calculate the correction factor by dividing the expected dispensing volume (in the factor formula) by the measured volume as follows:

Factor = Expected volume (nl)/Measured dispensed volume (nl)

Factor in the previous example would be 179200 nl/182064 nl = **0.984**,

which means that the instrument dispenses 0.984 times liquid compared to the value in the calibration curve. Refer to “Accuracy check” on page 64.





2. The value of the factor can be changed with the **Up** and **Down** arrows in the **Liquid factor** window. The default value is 1.000 and when changed, the volume dispensed will be changed in proportion to the factor. In this case the instrument dispenses 0.984 times liquid compared to the value in the calibration curve.

3. Save the protocol.

Note The factor affects the whole calibration curve throughout the volume range, and the volumes are changed, respectively, in the same proportion as the check volume (Figure 4–22). The Liquid factor is, however, protocol sensitive and must be saved with the protocol. The liquid factor does not affect the calibration curve itself. ▲

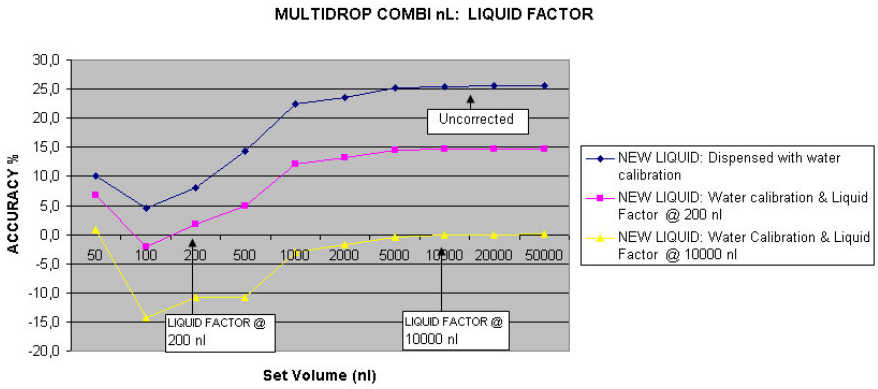


Figure 4–22. Calibration curve vs. factor and volume changes

Note If only the speed, which relates to the pressure, has been changed without any liquid change, the factor may be valid through the dispensing range (50 nl – 50 µl). A new accuracy check should be done after the dispensing volume is switched:
a) if the accuracy check and Liquid factor adjustment have been made after the liquid change, and
b) if the physical properties (viscosity, surface tension, etc.) of the new liquid differs from the one in the calibration curve used.
However, in this case it is recommended to create a new calibration curve by using FILLit Software. ▲

For more information, refer to the *FILLit Software for Multidrop Combi nL User Manual* (Cat. no. N07173).

Screen saver

The Multidrop Combi nL screen saver shown below appears when the instrument has not been used for 20 minutes. You can close the screen saver and return to the previous display by pressing any key.



Shutdown

To shut down the Multidrop Combi nL, follow the steps below:

Warning Remove any microplates still on the instrument. Dispose of all microplates and strips as biohazardous waste. ▲

1. After use, remove the reagent from the tubings. Press the **EMPTY** button to backflush the reagent if needed. However, just to empty the tubings, press the **PRIME** button.

   Rinse the tubings with distilled and filtered laboratory-grade water by emptying the reagent reservoir, rinsing it first with filtered laboratory-grade water and then by topping it up with water. Alternatively, you can use a spare reagent reservoir supplied with the instrument, and fill it with filtered laboratory-grade water.

2. If there is only a short break in dispensing, no washing or cleaning of the tubes is necessary, depending of course on the liquid used. For example, crystallizable buffer solution requires immediate washing and cleaning of the tubes after use.

3. If there is a longer break, rinse the tubings with distilled and filtered laboratory-grade water. Refer to the sections under "Regular and preventive maintenance" on page 72.



Warning Before a prolonged standby, run the tubings dry to avoid microbial growth from developing. ▲

4. Switch the Multidrop Combi nL off by pressing the mains switch (Figure 2–4) at the left of the back panel of the instrument into the OFF position. The pressure is released.



Note To pause operation and hold the instrument on standby, just push the protective cover in to release the pressure. ▲

5. Wipe the instrument surfaces with a soft cloth or tissue paper moistened with deionized distilled water, a mild detergent (e.g. dishwashing liquid) or soap solution.

6. If you have spilt infectious agents on the dispenser, disinfect with 70% alcohol or some other disinfectant (see "Decontamination procedure" on page 84).

Emergency situations

In case there is any abnormal situation during operation, such as fluids spilling inside the instrument, follow the steps below:

1. Switch OFF the instrument (Figure 2–4).

2. Unplug the instrument immediately from the power supply.

3. Carry out appropriate corrective measures. However, do not disassemble the instrument.

4. If the corrective measures taken do not help, contact authorized technical service or your local Thermo Fisher Scientific representative.

Chapter 5
Maintenance

Maintenance checklist

This chapter on maintenance contains an outline of the tasks/procedures mentioned in the checklist below (Table 5–6). Contact local authorized technical service or your local Thermo Fisher Scientific representative for assistance, if necessary.

Table 5–6. Maintenance checklist

Procedure	Daily	Weekly	Monthly	Yearly
Keep the instrument free of dust. See "Regular and preventive maintenance" on page 72.	✓			
Wipe away spilled saline solutions, solvents, acids or alkaline solutions from outer surfaces immediately to prevent damage, and wipe with deionized distilled water. See "Regular and preventive maintenance" on page 72.	✓			
If any surfaces have been contaminated with biohazardous material, disinfect with a mild sterilizing solution. See "Regular and preventive maintenance" on page 72.	✓			
Clean the case of the instrument and the dispensing area periodically. See "Regular and preventive maintenance" on page 72.		✓		
Clean the tubings when necessary. See "How to clean the tubings" on page 73.	✓			
Clean the reagent reservoir when necessary. See "How to clean the reagent reservoir" on page 82.	✓			
Clean the plate carrier when necessary. See "How to clean the plate carrier" on page 83.		✓		
Clean the priming vessel when necessary. See "How to clean the priming vessel" on page 83.		✓		
Maintain the dispensing valves daily. See "Daily maintenance" on page 76.	✓			
Maintain the dispensing valves periodically. See "Daily maintenance" on page 76.			✓	
Clean the leaking or clogged dispensing valves (tips) when necessary. See "How to clean a leaking dispensing valve" on page 77 and "How to clean a clogged dispensing valve" on page 79.			✓	
Replace the dispensing valve when necessary*. See "Replacing a dispensing valve" on page 79.				

Continued

Cont.

Procedure	Daily	Weekly	Monthly	Yearly
Replace the tubing set and a manifold, if necessary*. See "Replacing a tubing set and a manifold" on page 81.				
Ensure proper shutdown. See "Shutdown" on page 68.	✓			
Service the instrument regularly.				✓
Decontaminate the instrument when relocating the instrument or sending it for service. See "Decontamination procedure" on page 84.				✓
Refit the transport lock when relocating the instrument or sending it for service. See "How to refit the transport lock" on page 86.				✓

✓ = depending on the laboratory conditions and the use and configuration of the instrument

* = when necessary

Regular and preventive maintenance

For reliable daily operation, keep the instrument free of dust and liquid spills. To prevent unnecessary wear or hazards, follow the routine and service procedures described below at regular intervals.

Clean the outside of the instrument periodically with a cloth dampened with water or a mild detergent (e.g. dishwashing liquid) or 70% ethanol when necessary. Immediately wipe away spilt saline solutions, solvents, acids or alkaline solutions from outer surfaces to prevent damage.

Abrasive cleaning agents are not recommended, because they are likely to damage the plastic instrument cover.



Caution Always switch the instrument off and disconnect the power cable before cleaning the dispenser. ▲



Caution The surfaces can be cleaned with most laboratory detergents. Dilute the cleaning agent as recommended by the manufacturer. Do not expose the surfaces to concentrated acids or concentrated alcohols for prolonged periods of time as damage may occur. ▲

It is recommended to service the instrument at least yearly. Refer to "Service contracts" on page 88.

If you believe that liquid has entered the Multidrop Combi nL, first switch the instrument off (Figure 2–4) and unplug the instrument. Carry out corrective measures. Refer to "Emergency situations" on page 69 and "Decontamination procedure" on page 84 for aid. If necessary, contact your local Thermo Fisher Scientific representative or the Thermo Fisher Scientific technical service department. Refer to "Packing for service" on page 87 and "Service request protocol" on page 100.

Warning There are no user-serviceable components inside the instrument. The operator should not remove the instrument cover. ▲

Warning If any surfaces are contaminated with biohazardous material, a mild sterilizing solution should be used. ▲

Caution Do not autoclave any part of this instrument except the priming vessel, reagent reservoir, and the tubing set and the manifold. ▲

How to clean the tubings

This section is divided into daily maintenance and maintenance procedures when foreign particles have to be removed from the tubings.

Daily maintenance

The basic maintenance procedure should be performed regularly and on a daily basis to ensure proper tubing operation:

1. Filter all reagents, detergents, solutions and water before use to remove solid particles.

2. Rinse the tubings with distilled and filtered laboratory-grade water always after using the instrument.

Warning Before a prolonged standby, run the tubings dry to avoid microbial growth from developing. ▲

Removing foreign particles

If there is reason to suspect that particles have entered the tubings, clean the tubings.

Note To ensure trouble-free dispensing, do not touch the dispensing valves or the tubing inlet. Thermo Fisher Scientific assumes no liability for the use of third-party dispensing valves. ▲

To clean the tubings, follow the steps below:

1. First carry out the following *backflush procedure*:

- Empty the reagent reservoir or fit an empty reagent reservoir and remove the reagent filter at the bottom of the reagent reservoir by pulling it off by the end of the cap tube (Figure 5–23).



Figure 5–23. Removing the reagent filter

- Place a disposable reagent basin (Cat. no. 9510027) or a 96-well plate filled with *detergent*, for example, filtered 1% Micro-90 [International Products Corporation] or equivalent, under the dispensing valves so that the liquid is in contact with the valves (Figure 5–24).



Figure 5–24. Cleaning the tubings using a reagent basin

- Press the **EMPTY** button for several minutes.
- Place another disposable reagent basin or a 96-well plate filled with *distilled and filtered laboratory-grade water* under the dispensing valves so that the liquid is in contact with the valves (cf. Figure 5–24).
- Press the **EMPTY** button for several minutes.

Detaching the dispensing valve tube ends is only recommended if the basic cleaning procedures, tip washing and emptying, are not considered sufficient.

2. Detach the flexible dispensing valve tube ends (Figure 5–25).



Figure 5–25. Detaching a dispensing valve tube end

3. Place the tube ends into a waste container, for example, a decanter.

4. Add water or detergent, for example 1% Micro-90, into the reagent reservoir.

5. Press the **PRIME** button to raise the pressure. This action leads to fluid dripping into the waste container from the valve tube ends.

6. When you have rinsed enough, release the pressure by pressing the **PRESSURE** button or by pushing the protective cover in.

7. Repeat Steps 3 to 5 with the fluids you want to use, if necessary.

8. Prime with distilled and filtered laboratory-grade water.

9. Reattach the 43 µm reagent filter into the reagent reservoir (replace, if necessary) by pushing the reagent filter into the cap tube end.

10. Prime with distilled and filtered laboratory-grade water.

11. Reconnect the valve tube ends to the dispensing valves (Figure 5–26).



Figure 5–26. Reconnecting a dispensing valve tube end

12. Finally prime once again with distilled and filtered laboratory-grade water.

Disinfecting the liquid path

The Multidrop Combi nL liquid path components can be disinfected with isopropanol, 10% bleach (for example, sodium hypochlorite), or 70% ethanol by running the disinfectant through the liquid path.

Routine maintenance of the dispensing valves (tips)

To obtain optimal performance and a maximum useful life for the dispensing valves, it is important that the recommended cleaning maintenance instructions are followed.

If the dispensing valve is leaking or clogged, refer to “How to clean a leaking dispensing valve” on page 77 and/or “How to clean a clogged dispensing valve” on page 79.

Routine maintenance of the dispensing valves covers the sections described below.

Daily maintenance

The basic maintenance procedure should be performed regularly and on a daily basis to ensure proper dispensing valve operation:

1. Filter all reagents, detergents, solutions and water before use to remove solid particles.

2. Rinse the tubings with distilled and filtered laboratory-grade water always after using the instrument.



Warning Before a prolonged standby, run the tubings dry to avoid microbial growth from developing. ▲

Tip washing

To routinely remove, for example, persistent air bubbles from the hosing and microsolenoid dispensing valves, use tip washing. The tip washing is started by pressing the **TIP WASH** button. A sequence of operations are carried out to remove the debris or air bubbles. The liquid comes in pulses and one liquid channel at a time to maintain a maximum flow through the dispensing valve.

Emptying

To routinely clean the tubes and microsolenoid dispensing valves, use emptying. The emptying is started by pressing the **EMPTY** button. The **EMPTY** button is also used for emptying the remaining liquid from the tubings and dispensing valves (backflush option).

Periodic maintenance

Periodic maintenance constitutes, for example, cleaning a leaking or clogged dispensing valve, replacing a dispensing valve or replacing a tubing set and a manifold. The procedures are all explained in detail below.

How to clean a leaking dispensing valve

Foreign particles can cause leakage of a dispensing valve (tip) (Figure 4–16 and Figure 5–30). A dispensing valve leaks when a droplet forms on the end of the dispensing valve while the pressure is on.

To clean a leaking dispensing valve, follow the steps below:

1. Press the **TIP WASH** button several times. The liquid comes in pulses and one channel a time to maintain a maximum flow through the dispensing valve.

2. However, if the dispensing valve is still leaking, try the following *backflush procedure*:

- Empty the reagent reservoir or fit an empty reagent reservoir and remove the reagent filter and the tube from inside the cap of the reagent reservoir (Figure 5–27).



Figure 5–27. Removing the reagent filter with tube

- Place a disposable reagent basin filled with *detergent*, for example, filtered 1% Micro-90 or equivalent, under the dispensing valves so that the liquid is in contact with the valves (Figure 5–24).
- Press the **EMPTY** button for several minutes.
- Place another disposable reagent basin now filled with *distilled and filtered laboratory-grade water* under the dispensing valves so that the liquid is in contact with the valves (cf. Figure 5–24).
- Press the **EMPTY** button for several minutes.

3. Clean the reagent reservoir.

4. Replace the 43 µm reagent filter and the tube into the cap of the reagent reservoir.

5. Add distilled and filtered laboratory-grade water into the reagent reservoir. Close the cap.

6. Press the **PRIME** button to rinse the tubing.

7. Try to dispense.

8. Repeat this entire procedure, Steps 2 to 7, if the dispensing valve is still leaking.

9. Now the instrument is ready for dispensing.

How to clean a clogged dispensing valve

Foreign particles can cause partial or complete clogging of a dispensing valve. Partial clogging can be observed when the dispensing spray starts to slant or a droplet forms on the valve end during dispensing. If the dispensing valve is completely clogged, no fluid comes through the valve.

To clean a clogged dispensing valve, follow the steps below:

1. Follow the Steps 1 to 7 above in "How to clean a leaking dispensing valve" on page 77.

2. Repeat this entire procedure, Steps 2 to 7, if the dispensing valve is still clogged. See Step 1 above.

If the dispensing valve is still clogged after the cleaning attempts, replace the dispensing valve. For more information, refer to "Replacing a dispensing valve" on page 79.

Replacing a dispensing valve

If the cause for the dispensing valve change is clogging of the valve, first clean the tubings and the reagent reservoir. For more information, refer to "How to clean the tubings" on page 73 and "How to clean the reagent reservoir" on page 82.

To replace a dispensing valve, follow the steps below:

1. Release the pressure by pressing the **PRESSURE** button or by pushing the protective cover in. The indicator light is off when the pressure has been totally released.

2. Detach the flexible dispensing valve tubing (Figure 5–25).

3. Unfasten the valve screw with the 1.5 mm hexagonal screwdriver supplied (Figure 5–28).



Figure 5–28. Unfastening the dispensing valve

4. Pull the dispensing valve downwards (Figure 5–29).



Figure 5–29. Pulling the dispensing valve downwards

5. Replace the dispensing valve with a new one (Figure 5–30).

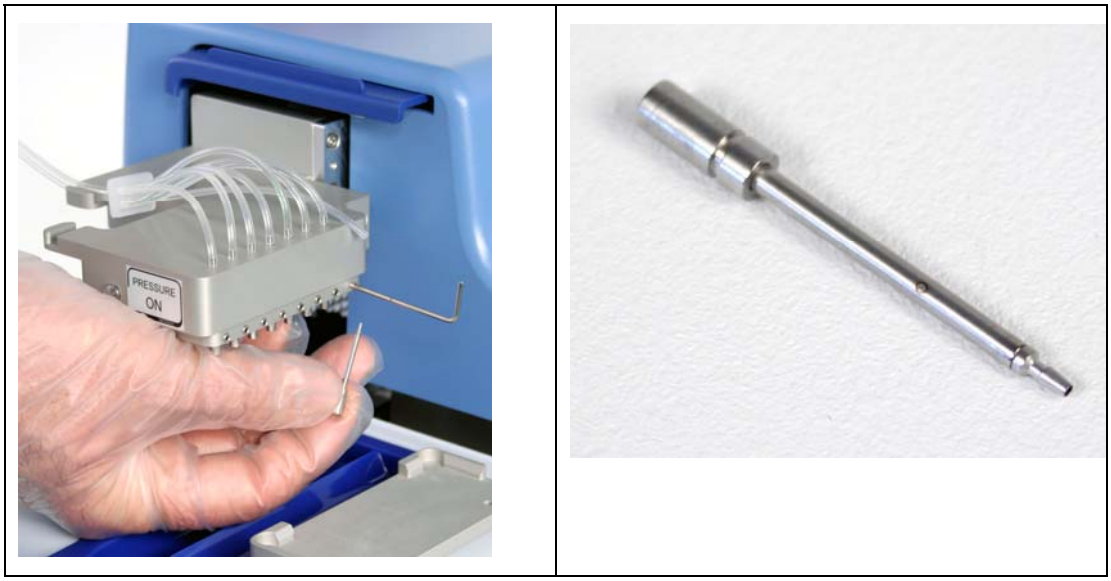


Figure 5–30. Replacing the dispensing valve

6. Fasten the valve screw.

7. Reattach the dispensing valve tubing (Figure 5–26).

8. Finally prime with distilled and filtered laboratory-grade water to ensure the proper functioning of the dispensing valve.

Note The instrument does not have to be recalibrated when you change a dispensing valve, because the valve performance is consistent. ▲

Replacing a tubing set and a manifold

To replace a tubing set and a manifold (Figure 5–31), follow the steps below:

1. Detach the flexible tube ends from the eight dispensing valves (Figure 5–25).

2. Detach the hosing from the reagent reservoir and discard the tubing set and manifold.

3. Wash the reagent reservoir. For more information, refer to “How to clean the reagent reservoir” on page 82. Replace the reagent filter.

4. Reconnect the new hosing to the reagent reservoir and the manifold of the new tubing set and place the dispensing valve tube ends into a waste container, for example, a decanter.

5. Prime the tubing with distilled and filtered laboratory-grade water.

6. Reconnect the flexible dispensing valve tube ends to the dispensing valves (Figure 5–26) and press the hosing into the groove (Figure 5–31).



Figure 5–31. Replacing the tubing set and manifold

7. Prime the tubing to ensure the proper functioning of the dispensing valves.

Note The manifold is not changed separately but always simultaneously in conjunction with the tubing set replacement. ▲

How to clean the reagent reservoir

Clean the reagent reservoir (Figure 2–2 and Figure 4–17) regularly after use and when you change the reagent.

To clean the reagent reservoir, follow the steps below:

1. Detach the reagent reservoir.

2. Rinse or wash the reagent reservoir with water or detergent when necessary.

3. Finally rinse with distilled and filtered laboratory-grade water.

4. Dry the reagent reservoir before use.

5. Reconnect the reagent reservoir.

The standard 250 ml reagent reservoir (Cat. no. N07489) is made of clear polypropylene (PP) and can be autoclaved. The autoclaving

conditions of the reagent reservoir are:
1 bar pressure at 121°C for 20 minutes.

A bigger, autoclavable, 1000 ml reagent reservoir (Cat. no. N07490) with a longer tubing assembly is also available.

How to clean the plate carrier

Clean the plate carrier (Figure 2–2) when it gets dirty and if you spill liquids on it during use. To clean the plate carrier, follow the instructions below.

Caution Clean the plate carrier surface if needed using a soft cloth or tissue paper soaked in a mild detergent solution (e.g. dishwashing liquid), soap solution or 70% ethanol. Wipe up spills immediately. Do not use formaldehyde or strong alkaline solutions. ▲

If you have spilt infectious agents on the plate carrier, decontaminate according to “Decontamination procedure” on page 84.

Warning Ensure that the bottom of each microplate is dry. Fluid on the bottom of a microplate may present a contamination hazard. Use proper laboratory practices when handling any hazardous materials. ▲

How to clean the priming vessel

Clean the priming vessel (Figure 5–32) once it gets dirty during use.

To clean the priming vessel, follow the steps below:

1. Unfasten the priming vessel by sliding it off towards yourself (Figure 5–32).



Figure 5–32. Unfastening the priming vessel

2. Rinse or wash the priming vessel with water or detergent when necessary.

3. Fasten the dried priming vessel by sliding it back over the snap lock (Figure 3–8).

The priming vessel is made of **blue** polypropylene (PP) and can be autoclaved. The autoclaving conditions of the priming vessel are:
1 bar pressure at 121°C for 20 minutes.

Disposal of materials

Follow laboratory and country-specific procedures for the disposal of biohazardous or radioactive waste. Refer to local regulations for the disposal of infectious material.



Warning The samples can be potentially infectious. Dispose of all used plates, strips, disposable gloves, syringes, disposable tips, and so on as biohazardous waste. ▲

Decontamination procedure

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.

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

It is strongly recommended to perform the complete decontamination procedure before relocating the instrument from one laboratory to another or before sending it to 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



Caution If local or laboratory regulations prescribe regular decontamination, it is not advisable to use formaldehyde, since even small traces of formaldehyde negatively affect the enzyme being used in EIA tests resulting in bad test results. ▲



Warning The decontamination procedure should be performed by authorized trained personnel wearing disposable gloves, protective glasses and clothing in a well-ventilated room. ▲

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. Empty the reagent reservoir. Ensure that you are wearing disposable gloves.

3. Switch OFF the power (Figure 2–4) and disconnect the mains supply cable.

4. Disinfect the outside of the instrument using a cloth dampened with 70% ethanol.

5. Place the instrument in a large plastic bag.

6. Place a cloth soaked in the prepared solution into the bag. Ensure that the cloth does not come into contact with the instrument.

7. Close the bag firmly and leave the instrument in the bag for at least 24 hours.

8. Remove the instrument from the bag.

9. Clean the instrument using a mild detergent (e.g. dishwashing liquid).

10. Remove any stains using 70% ethanol.

11. Disinfect the liquid path of the instrument with isopropanol, 10% bleach (for example, sodium hypochlorite), or 70% ethanol. Last, flush with distilled and filtered laboratory-grade water.

12. Wash and disinfect the reagent reservoir.

13. The priming vessel and the reagent reservoir can be autoclaved. All the tubings can be autoclaved in the same bag with the reagent reservoir.

14. After performing this decontamination procedure, enclose a signed and dated Certificate of Decontamination both inside the transport package and attached to the outside of the package (see Appendix A: “Certificate of Decontamination”).

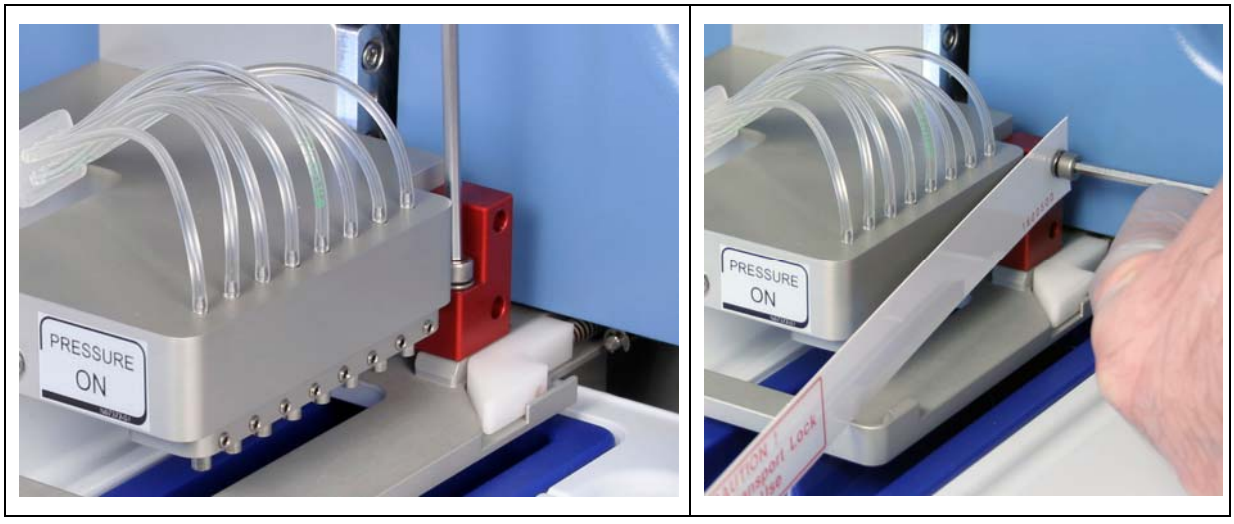
How to refit the transport lock

1. Remove the red transport lock from the back panel of the instrument (Figure 5–33).



Figure 5–33. Transport lock storage location

2. Adjust the dispensing valve lifting mechanism height and plate carrier position to fasten screw 2 of the transport lock (Figure 5–35). Then fasten screw 1 and the transport lock tag to the dispensing valve head. The transport lock is now fastened (Figure 5–35).



Screw 2 Screw 1

Figure 5–34. Refitting the transport lock

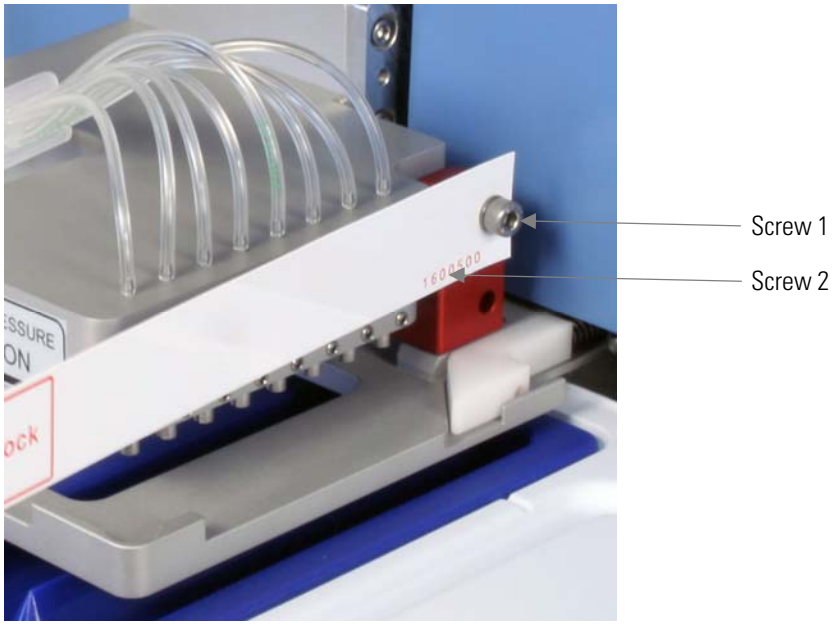


Figure 5–35. Transport lock fastened

Packing for service

To pack for service, follow the guidelines presented below.

Caution It is important that the instrument is thoroughly decontaminated before it is removed from the laboratory or any servicing is performed on it. ▲

Prior to shipping the instrument for service, remember to specify the fault when you are in touch with your local Thermo Fisher Scientific representative or the Thermo Fisher Scientific technical service department.

This procedure assumes that the original dispenser packaging materials are being used.

When you ship the instrument for service, remember to:

- Empty the tubings of the dispenser and remove any loose items from the plate carrier, for example, plates and priming vessels before decontamination.
- Switch the power OFF and disconnect the mains power supply cable.
- Decontaminate the instrument beforehand.
- Install the transport lock of the instrument. Refer to “How to refit the transport lock” on page 86.
- Replace the **red** luer plugs to avoid particles from entering the pressure/vacuum system unnecessarily (Figure 3–9).
- Replace the **red** manifold transport plug assembly (Figure 3–12).

- Pack the instrument according to the enclosed packing instructions.
- Use the original packaging to ensure that no damage occurs to the instrument during shipping. Any damage incurs additional labor charges.
- Replace the foam absorbers of the instrument and lower the dispenser into the carton. Refer to the packing instructions.
- Place the accessories box into the carton and fit this between the foam absorbers on top of the instrument.
- Inform about the use of hazardous materials. Enclose a dated and signed Certificate of Decontamination (see Appendix A: "Certificate of Decontamination") both inside and attached to the outside of the package, in which you return your instrument (or other items).
- Enclose the instrument serial number as well as the return authorization number (RGA) given by your local Thermo Fisher Scientific representative.
- Seal the box carefully and securely. Make sure all required information is clearly indicated on the outside of the carton and enclosed as instructed.

Refer to "General specifications" on page 91 for details on storage and transportation temperatures.

Service contracts

It is recommended to maintain and service the instrument regularly every 12 months on a contract basis by the manufacturer's trained service engineers. This ensures that the product is properly maintained and gives trouble-free service. Contact the Thermo Fisher Scientific technical service department for more details.

Disposal of the instrument

If the Multidrop Combi nL has to be disposed of, follow the guidelines below.



Warning Decontaminate the instrument before disposal. Refer to "Decontamination procedure" on page 84 and "Certificate of Decontamination" on page 101 about decontamination. ▲

Follow laboratory and country-specific procedures for biohazardous or radioactive waste disposal.

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

Pollution degree	2 (see “Safety specifications” on page 92)
Method of disposal	Electronic waste Contaminated waste (Infectious waste)



WEEE symbol 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 Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at **www.thermo.com/WEEERoHS**. ▲

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

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

Chapter 6
Technical Specifications

General specifications

Thermo Fisher Scientific reserves the right to change any specifications without prior notice as part of our continuous product development program. The general specifications are presented in Table 6–7.

Table 6–7. General specifications

General specifications		
Overall dimensions	355 mm (14 in.) (W) x 375 mm (14.8 in.) (D) x 220 mm (8.6 in.) (H)	
Weight (total)	9.6 kg (21.2 lbs.)	
Mains power supply	100 – 240 Vac, 50/60 Hz, nominal (operating range 90 – 256 Vac)	
Power consumption	100 VA max.	
Heat dissipation	341 BTU max.	
Fuses	none	
Operating conditions (indoor use)	+10°C to +40°C	
Transportation conditions	-40°C to +70°C, packed in transport packaging	
Storage conditions	-25°C to +50°C, packed in transport packaging	
Autoclaving conditions of the priming vessel and reagent reservoir	pressure: 1 bar temperature: 121°C time: 20 min	
Control panel	Keys: arrow keys, **OK**, **START**, **STOP**, **PRIME**, **EMPTY**, **SHAKE, PRESSURE, TIP WASH**	
Interface	Serial RS-232C, USB 1.1 (2.0 compatible)	
Plate types	96, 384 and 1536-well plates	
Dispensing volume range	**Standalone instrument** 50 – 999 nl, in 1 nl increments 1.00 – 9.99 µl, in 10 nl increments 10.0 – 50.0 µl, in 100 nl increments	**FILLit Software** in 1 nl increments
Dead volume	< 1.2 ml*	
Dispensing speed	384-well plate: 50 nl in 6 seconds 1536-well plate: 50 nl in 21 seconds	1 µl in 8 seconds 1 µl in 27 seconds
Dispensing accuracy	< 1 µl: ± 5% > 1 µl: ± 2%	
Dispensing precision (CV%)	50 nl: CV ≤ 10% 0.5 µl: CV ≤ 5% 1-10 µl: CV ≤ 4% > 10 µl: CV ≤ 2%	

* Reagent recovery option available

Safety specifications

This section describes the safety specifications for the Multidrop Combi nL instrument.

Live parts

The instrument is safe to operate with the covers fitted and they must not be removed during operation. 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.



Warning The instrument uses voltages dangerous for human beings. Before removing any covers, disconnect the instrument from the power supply.

In conformity with the requirements

The Multidrop Combi nL bears the following markings:
Type 838
100 – 240 Vac, 50/60 Hz, 100 VA
CE

The Multidrop Combi nL conforms to the following requirements:
2006/95/EC (Low Voltage Directive)
89/336/EEC (Electromagnetic Compatibility Directive EMC)
FCC Part 15, Subpart B/Class B (July 2004)
2002/96/EC (Waste of Electrical and Electronic Equipment)

Safety performance:
EN 61010-1:2001 (Ed. 2) taking into account 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 to +40°C
Humidity	maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C
Mains supply fluctuations	± 10% from nominal

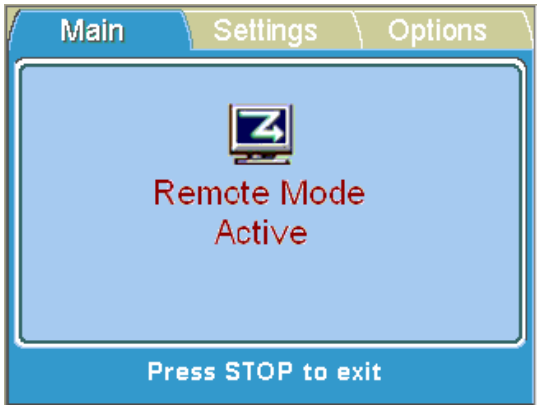
EMC performance:	
EN 61000-6-3:2001	Generic standards – Emission standard for residential, commercial and light-industrial environments
EN 61000-6-1:2001	Generic standards – Immunity standard for residential, commercial and light-industrial environments
EN 61326-1:1997 + A1:1998 + A2:2001 + A3:2003	Product family standard

Test standards	**Performance limits**
EN 55022:1998 + A1:2000 + A2:2003	Class B, 150 kHz – 1 GHz
EN 61000-3-2:2000	Class A
EN 61000-3-3:1995 + A1:2001	
ANSI C63.4:2003	Class B, 150 kHz – 30 MHz; 30 MHz – 1 GHz
EN 61000-4-2:1995 + A1:1998 + A2:2001	4 kV CD, 8 kV AD, Criteria B
EN 61000-4-3:2002 + A1:2002	3 V/m, 80 MHz – 2 GHz, Criteria A
EN 61000-4-4:2004	1 kV, Criteria B
EN 61000-4-5:1995 + A1:2001	2 kV line to ground, 1 kV line to line, Criteria B
EN 61000-4-6:1996 + A1:2001	3 V_{rms}, 150 kHz – 80 MHz, Criteria A
EN 61000-4-8:1993 + A1:2001	30 A/m, Criteria A
EN 61000-4-11:1994 + A1:2001	30%/10 ms, Criteria B 60%/100 ms, Criteria B 100%/10 ms, Criteria B 100%/5 s, Criteria C

Remote control to Multidrop Combi nL

The Multidrop Combi nL can be used as part of an automated system.

When the Multidrop Combi nL is in remote mode, the main view is as shown below. For more details, refer to the *Multidrop Combi nL Remote Control Command Sets* (Cat. no. D05871) document. Contact your distributor or local Thermo Fisher Scientific representative to obtain the document in PDF format.



The instrument has two alternative computer interfaces: RS-232 and USB.

Note It is recommended to use USB to improve the reliability of traffic in robot applications. ▲

Note The interface to use is selected from the Multidrop Combi nL user interface. ▲

Chapter 7
Frequently Asked Questions

Q&As

Q1: What liquid is recommended for washing the Multidrop Combi nL hosing?

A1: It is recommended that you use distilled and filtered laboratory-grade water and/or a detergent solution, for example, filtered 1% Micro-90, followed by distilled and filtered laboratory-grade water.

Q2: Do particles in the reagent affect dispensing?

A2: Yes. It is recommended that you ensure that there are no particles > 40 µm in the reagent to avoid blockage of the dispensing valves. Filter all reagents, detergents, solutions and water before use to remove any solid particles present.

Q3: What materials come into contact with liquids to be dispensed?

A3: The standard Multidrop Combi nL materials that come into contact with liquids to be dispensed are:

- *Reagent reservoir*: polypropylene (PP)
- *Reagent filter*: stainless steel AISI 316, and polytetrafluoroethylene (PTFE, Teflon)
- *Tubings*: chemical resistant tubing
- *Tube connector*: polypropylene (PP)
- *Manifold*: polypropylene (PP)
- *Dispensing valve*: stainless steel, polyetheretherketone (PEEK), sapphire, and ruby

Q4: What should you do if the liquid foams during dispensing?

A4: Some liquids foam more easily than others. One option is to reduce the speed (that is, the pressure). There are five dispensing speeds available: **1** to **5**.

Q5: Do you need specific plate adapters for the Multidrop Combi nL?

A5: No, the Multidrop Combi nL has a fixed plate adapter and does not use any external plate adapters.

Q6: What is the material of the Multidrop Combi nL priming vessel?

A6: The Multidrop Combi nL priming vessel (Cat. no. N07271) is made of blue polypropylene (PP).

Q7: Can the Multidrop Combi nL priming vessel be autoclaved?

A7: Yes, it can be autoclaved.

Q8: Can the Multidrop Combi nL reagent reservoir be autoclaved?

A8: Yes, it can be autoclaved.

Q9: Where can you see the Multidrop Combi nL internal software version number?

A9: When the instrument is powered on, the version number appears on the top of the screen during the startup animation.

Device information under the Options menu also provides the internal serial number.

Q10: What is the orifice of the dispensing valve?

A10: The orifice is 100 µm.

Q11: Do you need to recalibrate the instrument when a dispensing valve is changed?

A11: No, you do not have to recalibrate the instrument, because the valve performance is so consistent.

Chapter 8
Troubleshooting Guide

Note Do not use the instrument if it appears that it does not function properly. ▲

Error and warning codes

When an error is detected, the current operation is terminated. After an error, it is best to abort the current run and restart from the beginning after the problem is fixed. The Multidrop Combi nL internal software has the following error messages (Table 8–8).

Table 8–8. Error messages reported

Error	Cause	Action
Plate X position error.	Plate carrier cannot move	Power off/on (or contact service).
Plate Y position error.	Plate carrier cannot move	Power off/on (or contact service).
Z position error.	Dispensing valve lifting mechanism cannot move	Power off/on (or contact service).
No more memory for storing user data.	Too many protocols saved	Delete protocols that are not used.
Not primed!	Predispensing undone	Press the **PRIME** button.
Missing prime vessel.	Priming vessel missing	Insert the priming vessel.
Protective cover not in place.	Protective cover not in place	Pull the protective cover over the dispensing valve head.
Pressure failure.	When tubes or plugs are not fastened properly	Check that the tube attachments and caps are properly tightened.

Examples of a few *error messages* that appear in the Multidrop Combi nL internal software are shown below.



OK PRIME Press **OK** to acknowledge the error and then press **PRIME**.



OK Press **OK** to acknowledge the error and then insert the priming vessel.



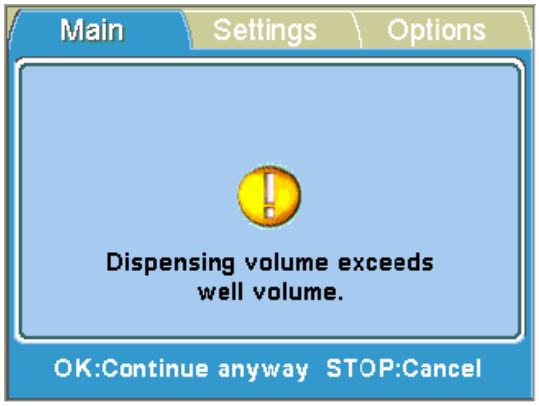
OK Press **OK** to acknowledge the error and then pull the protective cover over the dispensing valve head.



OK

Press **OK** to acknowledge the error and then tighten the tube attachments and caps properly.

There are three warning messages that can appear in the main view of the Multidrop Combi nL internal software. An example of a *warning message* is shown below.



OK

Press **OK** to acknowledge the warning and then reselect the dispensing volume.

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.

Electrical

Ensure that the mains supply cable supplied with the unit is always used.

The mains plug should only be inserted into a socket outlet provided with a protective ground contact.



Warning There are no user-replaceable parts inside the instrument. The user should not remove the cover from the Multidrop Combi nL. ▲

The same precautions applicable when using any electrical equipment should 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.

Mechanical

The dispensing valve 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 dispensing cycle. If it is necessary to stop the operation of the equipment, press the **STOP** button on the control panel.

Environmental

Infectious samples and corrosive fluids are commonly used with this equipment. The "hands-off" nature of the system allows the user to dispense into 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 with utmost care. Always wear hand and eye protections as well as corrosive resistant laboratory coats.



Warning Observe normal laboratory procedures for handling potentially hazardous samples. ▲

Defects and abnormal stresses

Whenever it is likely that the protection against safety hazards has been impaired, make the instrument inoperative and secure against any unintended operation.

The protection is likely to be impaired if, for example, the instrument:

- Shows visible damage.
- Fails to perform the intended functions.
- Has been subjected to prolonged storage under unfavorable conditions.
- Has been subjected to severe transport stresses.

Service request protocol

If the Multidrop Combi nL requires service, contact your local Thermo Fisher Scientific representative or the Thermo Fisher Scientific technical service department. Do not under any circumstances send the instrument for service without any prior contact. It is imperative to indicate the fault and nature of the required service. This will ensure a faster return of the instrument to the customer.

Your local Thermo Fisher Scientific representative or distributor will take care of sending a complaint form (that is, the Warranty Claim Technical Sheet) to the Thermo Fisher Scientific technical service department. The Warranty Claim Technical Sheet contains a more detailed description of the fault, symptom or condition. Give all the necessary information to the distributor, who will fill out and forward the Warranty Claim Technical Sheet to the Thermo Fisher Scientific technical service department.

Check "Packing for service" on page 87. You will find instructions on how to proceed before shipping the instrument for service to Thermo Fisher Scientific Oy.

Check that any necessary decontamination procedure has been carried out before packing. Refer to "Decontamination procedure" on page 84 and "Certificate of Decontamination" on page 101. Ensure that the Certificate of Decontamination (see Appendix A: "Certificate of Decontamination") as well as the return authorization number (RGA) are sent with the instrument.

The Thermo Fisher Scientific technical 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.

Certificate of Decontamination

The decontamination procedure is required before 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. Refer to Appendix A: "Certificate of Decontamination" and "Decontamination procedure" on page 84.

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. Refer to Appendix A: "Certificate of Decontamination".

Chapter 9
Ordering Information

Contact your local Thermo Fisher Scientific representative for ordering and service information. Ordering information codes are presented in Table 9–9 through Table 9–11.

Multidrop Combi nL

Table 9–9. Instrument catalog number

Code	Instrument / System
5840400	Multidrop Combi nL, 100 – 240 V, 50/60 Hz

List of accessories

Table 9–10. Codes for accessories

Code	Item
N07171	*Multidrop Combi nL User Manual*
N07173	*FILLit Software for Multidrop Combi nL User Manual*
5188020	FILLit Software for Multidrop Combi nL
N07271	Priming vessel, Multidrop Combi nL
N05843	Priming vessel tube assembly and cap
N07494	Dispensing valve, Multidrop Combi nL
N07493	Reagent filter 43 µm PTFE/AISI 316 (5 pcs/box)
N07497	Reagent reservoir 250 ml Nalgene propylene w/o tube connectors
N07489	Reagent reservoir 250 ml polypropylene accessory assembly (incl. reagent reservoir, reagent filter, tubings, and manifold)
N07490	Reagent reservoir 1000 ml polypropylene accessory assembly (incl. reagent reservoir, reagent filter, tubings, and manifold)
N07491	Tubing set and manifold for reagent reservoir 250 ml
N07492	Tubing set and manifold for reagent reservoir 1000 ml
N07495	Tubing assembly from reagent reservoir to pressure/vacuum system
9510027	Reagent basin, 60 ml (5 pcs/box)
1210550	Cord Mains EURO
1210520	Cord Mains UL/CSA
2305290	Serial cable F9/F25
N04001	Cord USB 2.0 A-B 1.8-2.0 m
0300033	Tool 3mm DIN911 Allen key Handled

Continued

Cont.

Code	Item
N07523	Tool 1.5mm DIN911 Allen key Zn

List of plates

Table 9–11. Codes for plates

Code	Item	Quantity
	96-well microplates	
95029350	Microtiter 96 1x8 Strip Plate*	50 pcs/box
3355	Immulon 1B Plate, Flat bottom	50 pcs/box
9502227	Cliniplate 96, Flat bottom	50 pcs/box
9502887	White 96 Cliniplate, Flat bottom	50 pcs/box
9502867	Black 96 Cliniplate, Flat bottom	50 pcs/box
6310	Immulon 1 B 1x12 Strip Plate, Flat bottom	100 pcs/box
95040450	Microtiter 96 Deep Well Plate	50 pcs/box
	384-well microplates	
8555	Immulon 384 Square Well Plate	50 pcs/box
8155	White Microlite 384 Square Well Plate	50 pcs/box
8255	Black Microfluor 384 Square Well Plate	50 pcs/box

* recommended for calibration

Appendix A
Certificate of Decontamination

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): _____

PHOTOCOPIABLE

[1] Please include decontaminating solution used.

Appendix B
Thermo Scientific Multidrop Combi nL Feedback Form

Instrument: Thermo Scientific Multidrop Combi nL ☐ Instrument serial no.:

PURCHASED BY	**PURCHASED FROM**
Company/Institute	Distributor
Department	Address
Address	
Tel.	Tel.
Fax	Date of delivery
Internet home page	
Date of purchase	
Your application area	
Dr. ☐ Mr. ☐ Mrs. ☐ Ms. ☐	Job title/Position
Surname (block capitals)	First name (block capitals)
Internet e-mail address	

	Excellent	Above expectations	As expected	Below expectations	Comments
Instrument installation	☐	☐	☐	☐	
Ease of use	☐	☐	☐	☐	
Flexibility	☐	☐	☐	☐	
User manual	☐	☐	☐	☐	
Software	☐	☐	☐	☐	
Customer support	☐	☐	☐	☐	
Overall	☐	☐	☐	☐	

Additional instrument and/or software features desired:

Did you encounter any problems?

Where did you first learn about the product?

Would you like to receive information about other Thermo Scientific products?

Glossary

backflush (empty) The operation of discharging the contents of the tubing of fluid.

calibration Performed with FILLit Software to obtain a series of calibration points for a liquid. The dispensed liquids may have significantly different properties, which affect the valve open time needed to achieve the same volume.

CE Marking "Conformité Européene" = European Conformity. CE Marking on a product is a manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety and environmental protection legislations, the product may be legally placed on the market and thus the CE Marking ensures the free movement of the product within EU.

current protocol In standalone mode the current protocol is the protocol affected by changes through the user interface. In remote mode it is the protocol affected by computer commands.

decontamination Removal or neutralization of radiologic, bacteriological, chemical or other contamination.

dispense To distribute liquid into the wells of the preselected strips or microplate.

dispensing height The valve position on top of the microplate. The distance between the bottom surface of the plate carrier to the tip of the dispensing valve (Table 4–3).

dispensing valve A normally-closed 2/2-way micro fluid valve for high precision and high speed dispensing of liquids.

EIA Enzyme immunoassay.

empty To draw back to the liquid bottle all the liquid in the hoses and valves.

EN European Norm.

EU European Union.

home position The plate carrier is positioned to the furthest right of the transfer rails.

IEC International Electrotechnical Commission.

liquid factor Standalone calibration of the liquid used at a set volume point. The factor varies according to the density of the liquid. The Liquid factor step comprises dispensing, gravimetric measurement and a series of calculations. Refer to “Calibration” on page 63.

manifold A common coil block of propylene into which the eight dispensing valve tubes are inserted (Figure 3–12).

predispense The volume that is automatically dispensed before filling each plate.

prime Filling the liquid path with solution to be dispensed.

priming vessel An external waste container of blue propylene for excess priming liquid, which can also be equipped with a tube drain or cap (Figure 3–14).

protective cover The blue sliding cover that is pulled over the dispensing valve head when the instrument is on (Figure 2–2). To pause operation and hold the instrument on standby, the protective cover is pushed in to release the pressure.

remote control Running mode allowing a remote computer to operate the dispenser. Refers to use in automated systems.

tip wash (purge) A sequence of operations to remove persistent air bubbles and debris from the hosing/solenoid dispensing valves and to open clogged dispensing valves.

USB Universal serial bus.

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