Thermo Scientific Multidrop® 384

User Manual

Rev. 3.4

Part of Thermo Fisher Scientific

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Thermo Scientific Multidrop® 384

User Manual

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CONTENTS

1 SAFETY SYMBOLS AND MARKINGS 6

2 ABOUT THE USER MANUAL 7

3 INTRODUCTION TO THE MULTIDROP 384 8

4 FUNCTIONAL DESCRIPTION 10

5 INSTALLATION 15

6 ROUTINE OPERATION 21

7 MAINTENANCE 36

8 TECHNICAL SPECIFICATIONS 60

9 TROUBLESHOOTING 66

10 WARRANTY CERTIFICATE 71

11 ORDERING INFORMATION 72

12 GLOSSARY AND ABBREVIATIONS 75

13 INDEX 77

14 TABLE OF FIGURES 81

APPENDIX 1. THERMO SCIENTIFIC MULTIDROP 384 BRIEF USER'S GUIDE 83

APPENDIX 2. THERMO SCIENTIFIC MULTIDROP 384 FEEDBACK FORM 84

APPENDIX 3. ADDRESSES 85

TABLE OF CONTENTS

1 SAFETY SYMBOLS AND MARKINGS 6

2 ABOUT THE USER MANUAL 7

3 INTRODUCTION TO THE MULTIDROP 384 8

3.1 INTENDED USE 8
3.2 PRINCIPLE OF OPERATION 8
3.3 ADVANTAGES OF USING THE MULTIDROP 384 9

4 FUNCTIONAL DESCRIPTION 10

4.1 INSTRUMENT LAYOUT 10
4.1.1 Front view 10
4.1.2 Back view 13
4.2 MULTIDROP 384 MICROPLATE DISPENSER 14

5 INSTALLATION 15

5.1 INSTALLATION CHECK LIST 15
5.2 WHAT TO DO UPON DELIVERY 15
5.2.1 How to unpack 15
5.2.2 Checking delivery for completeness 15
5.2.3 Checking for damage during transport 16
5.2.4 Environmental requirements 16
5.2.5 Things to avoid 16
5.2.6 Technical prerequisites 16
5.3 SETUPS BEFORE YOU PUT THE INSTRUMENT INTO OPERATION 17
5.3.1 Installation procedure 17
5.3.2 How to ensure startup 18
5.4 OPERATIONAL CHECK 19
5.5 OPERATING PRECAUTIONS AND LIMITATIONS BEFORE OPERATION 20

6 ROUTINE OPERATION 21

6.1 OPERATIONAL CHECK LIST 21
6.2 SWITCHING ON 21
6.3 HOW TO INSERT THE PRIMING VESSEL AND THE DISPENSING CASSETTE 22
6.4 HOW TO INSERT AND ADJUST THE PLATE ADAPTER 25
6.5 HOW TO USE THE CONTROL PANEL 30
6.5.1 Control panel indicators 30
6.5.2 Control panel thumbwheels (digital switches) 30
6.5.3 Control panel keys 31
6.6 HOW TO SELECT THE 96 / 384-WELL PLATE 31
6.7 HOW TO PRIME 32
6.8 DISPENSING 32
6.8.1 How to dispense automatically 32
6.8.2 How to dispense manually into the specified column(s) 33
6.8.3 How to dispense multiple volumes 33
6.8.3.1 Dispensing tenfold and hundredfold volumes 33
6.8.4 After use 34
6.9 SHUTDOWN 35
6.10 GUIDELINES FOR USE 35

7 MAINTENANCE 36

7.1 REGULAR AND PREVENTIVE MAINTENANCE 36
7.1.1 General 36
7.1.2 Immediate 36
7.2 HOW TO WASH THE DISPENSING CASSETTE 37
7.3 HOW TO AUTOCLAVE THE DISPENSING CASSETTE 37

7.4 How to replace the fuses 38
7.5 How to recalibrate the dispensing cassette 40
7.5.1 Volumetric calibration 40
7.5.2 Gravimetric calibration 42
7.6 How to change the tubing set 45
7.6.1 Changing the tip band 45
7.6.2 Fitting the new tubing set step by step 46
7.7 Disposal of materials 57
7.8 Decontamination procedure 57
7.9 How to pack for service 58
7.10 Service contracts 58
7.11 Disposal of the instrument 58

8 TECHNICAL SPECIFICATIONS 60

8.1 General specifications 60
8.2 Safety specifications 61
8.2.1 Live parts 61
8.3 In conformity with the requirements 62
8.4 Remote control to Multidrop 384 63
8.4.1 Hardware for the computer port 63
8.4.2 Multidrop 384 PC interface 63

9 TROUBLESHOOTING 66

9.1 Troubleshooting guide 66
9.2 FAQs about the Multidrop 384 67
9.3 Hazards 68
9.3.1 Electrical 68
9.3.2 Mechanical 68
9.3.3 Environmental 68
9.3.4 Defects and abnormal stresses 69
9.4 Service request protocol 69
9.4.1 Decontamination 69
9.4.1.1 Certificate of Decontamination 70

10 WARRANTY CERTIFICATE 71

10.1 Warranty Certificate 71

11 ORDERING INFORMATION 72

11.1 Instruments 72
11.2 Dispensing cassettes 72
11.3 Spare parts for dispensing cassettes 73
11.4 Priming vessels (consumables) 73
11.5 List of accessories 73
11.6 List of plates (consumables) 73
11.7 List of spare parts 74
11.8 List of recommended spare parts 74

12 GLOSSARY AND ABBREVIATIONS 75

12.1 Keywords for web pages 76
12.2 Literature 76

13 INDEX 77

14 TABLE OF FIGURES 81

APPENDIX 1. THERMO SCIENTIFIC MULTIDROP 384 BRIEF USER'S GUIDE 83

APPENDIX 2. THERMO SCIENTIFIC MULTIDROP 384 FEEDBACK FORM 84

APPENDIX 3. ADDRESSES 85

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Contact information

Thermo Fisher Scientific Oy
P.O. Box 100, FI-01621 Vantaa, Finland
Tel. +358-9-329 100, Fax +358-9-3291 0415
www.thermo.com

1 SAFETY SYMBOLS AND MARKINGS

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

SAFETY SYMBOLS USED IN THE MULTIDROP 384

Power ON

Power OFF

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

WARNING MARKINGS USED IN THE DOCUMENTATION

Caution: risk of electric shock.

Caution: biohazard risk.

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

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

2 ABOUT THE USER MANUAL

This user manual has been written for the end user (for example, laboratory technician) and provides information on the Thermo Scientific Multidrop 384 microplate dispenser. This manual contains the installation and operating instructions for the Multidrop 384 microplate dispenser.

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

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

- Review safety precautions
- Install the Multidrop 384
- Carry out dispensing procedures
- Recalibrate the dispensing cassette
- Perform basic maintenance procedures
- Troubleshoot the instrument performance

This user manual also describes features and specifications of the Multidrop 384 hardware and onboard software.

Chapter 6 ROUTINE OPERATION explains the dispensing principles and procedures.

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

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

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

3 INTRODUCTION TO THE MULTIDROP 384

There are two models of the Multidrop 384:

- 5840150 Multidrop 384, 220−240 V 50/60 Hz
- 5840157 Multidrop 384, 110−120 V 50/60 Hz

Each Multidrop 384 comes with one dispensing cassette:

- 24072670 Standard tube dispensing cassette (with 40 cm tubing set)

3.1 Intended use

The Multidrop 384 microplate dispenser is intended for professional research use by trained personnel. The instrument is intended for automated dispensing of up to eight different reagents simultaneously into microplates and strips in 96 or 384-well plate format. Use for self-testing is excluded.

3.2 Principle of operation

The Multidrop 384 is an automatic, programmable, eight-channel microplate dispenser. It has a peristaltic pump for rapid and continuous dispensing of liquids into 96 and 384-well microplates. It can dispense 1 to 8 different reagents from external liquid reservoirs into different rows and can be used in most microtitration techniques, for example, in the fields of bacteriology, cell biology, hematology, immunology, toxicology and virology. It is particularly useful in the pharmaceutical industry. The Multidrop 384 is lightweight, transportable and compact on a laboratory bench. It can dispense 20 µl into the entire 384-well microplate in 20 seconds or 20 µl into the entire 96-well microplate in 5 seconds.

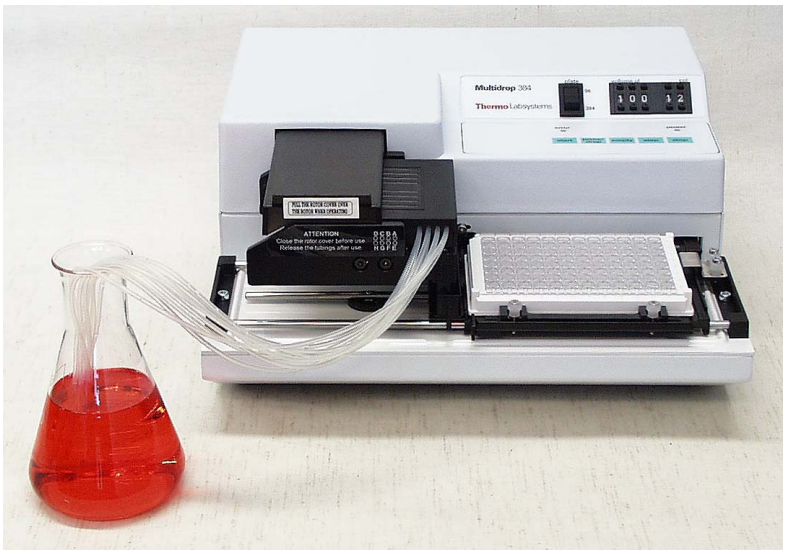


Fig. 3.1 Multidrop 384 microplate dispenser

3.3 Advantages of using the Multidrop 384

The Multidrop 384 microplate dispenser provides several advantages relating mainly to the principle of operation in that it has:

- Superior accuracy and precision
- A flexible volume range
- High-speed continuous dispensing
- Robot compatibility and versatile remote control commands
- An autoclavable, detachable and calibrateable dispensing cassette

The Multidrop 384 is an automated microplate dispenser designed for high-throughput screening and microvolume dispensing into 384 and 96-well plates.

The Multidrop 384 can dispense up to eight different reagents with high accuracy, precision and speed. It fills a 384-well plate with 20 µl/well in 20 seconds or a 96-well plate in 5 seconds. With a volume range of 5 – 100 µl for 384-well plates and 5 – 395 µl for 96-well plates, the Multidrop 384 offers superior flexibility for a wide range of applications.

All reagent lines can be backflushed to the reagent bottle, minimizing the loss of expensive reagents. From 1 to 24 columns can be selected for 384-well plates and from 1 to 12 columns for 96-well plates.

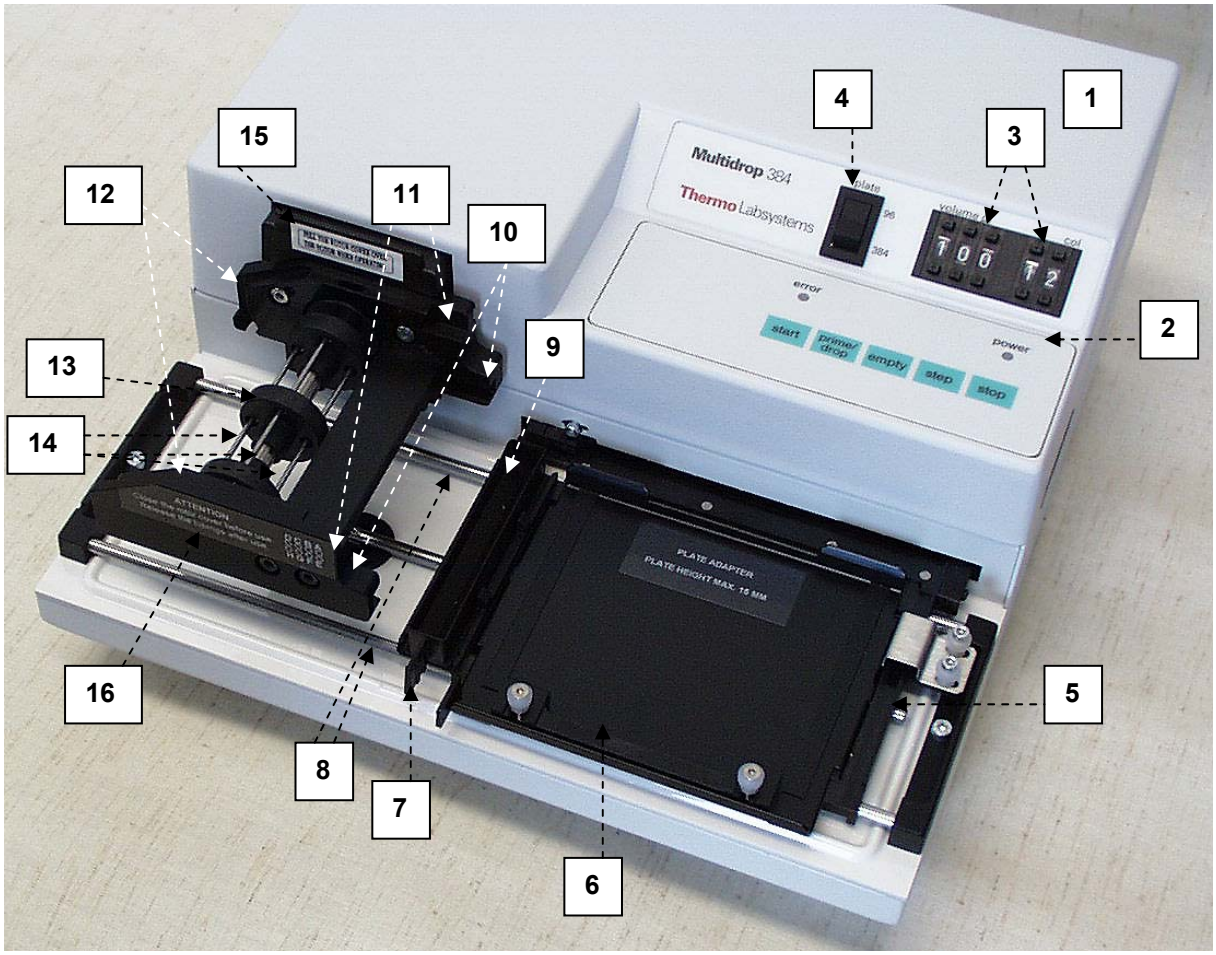
To ensure sterility and avoid cross contamination, the dispensing cassette is detachable and autoclavable.

The Multidrop 384 can be used as a standalone instrument or added to robotic systems via an RS-232 serial port.

4 FUNCTIONAL DESCRIPTION

4.1 Instrument layout

4.1.1 Front view

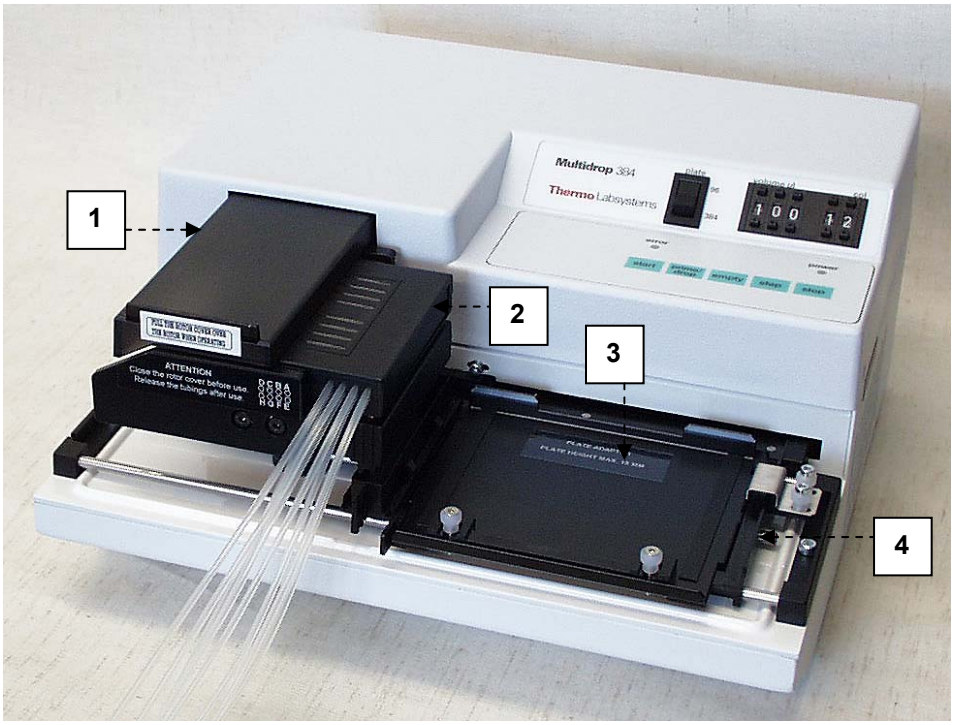


1 Instrument cover
2 Control panel
3 Thumbwheels for selecting the volume (**volume µl**) and number of columns (**col**)
4 Plate switch (**plate**) for selecting the 96/384-well plate (= rocker switch)
5 Plate carrier
6 Plate adapter
7 Plate adapter lock
8 Transfer rails
9 Priming vessel
10 Lower part slots
11 Upper part slots
12 Rest position slots of the upper part
13 Pump rotor
14 Rotor needles
15 Rotor cover not pulled over the rotor
16 Pump body

Fig. 4.1 Multidrop 384 front view (A)

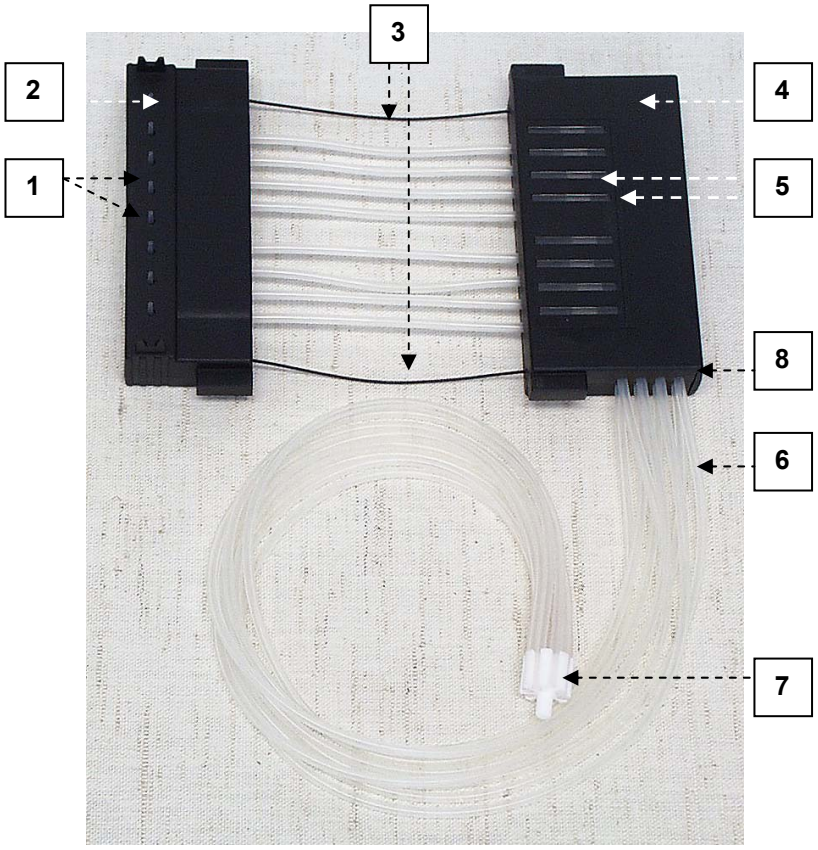
1 Mains switch (ON/OFF)
2 Instrument cover retaining screws
3 Cooling-air outlet

Fig. 4.2 Multidrop 384 front view (B)



1 Rotor cover pulled over the rotor
2 Standard tube dispensing cassette attached
3 Plate adapter
4 Plate carrier

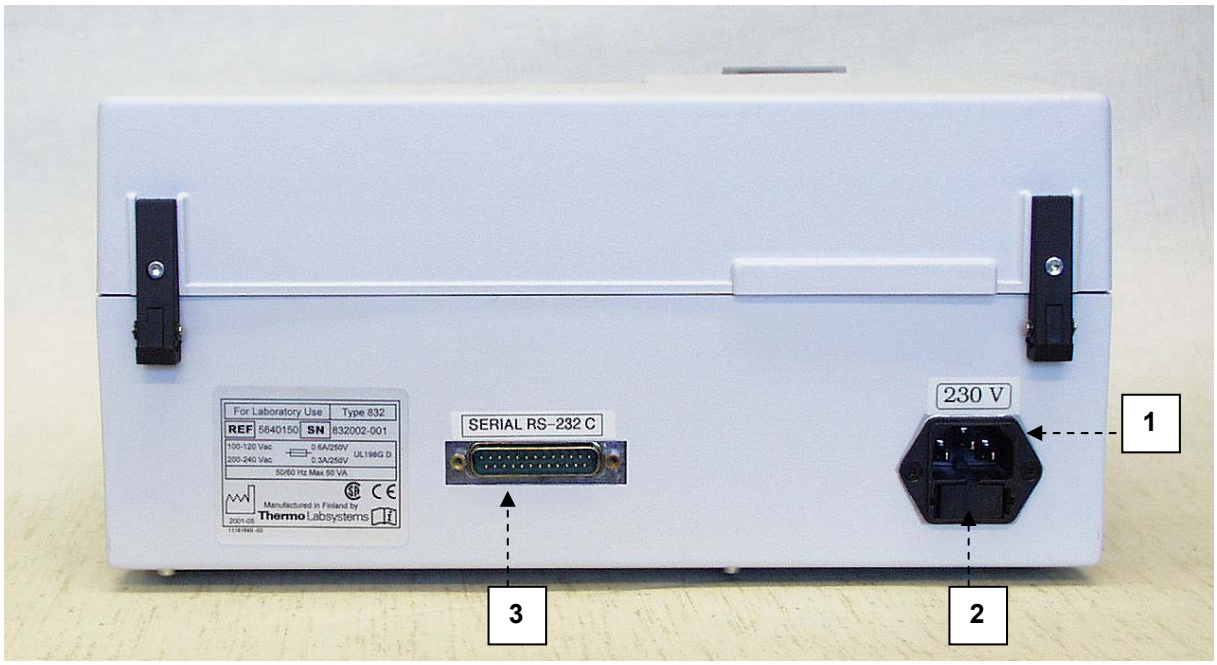
Fig. 4.3 Multidrop 384 front view (C)



1 Tips (8)
2 Lower part of dispensing cassette with tips
3 Tension limiting wires (2)
4 Upper part of dispensing cassette with tubes
5 Sight strips (8)
6 Tubes (A – H)
7 Tubing weight, eight tubes
8 Calibration screw cover

Fig. 4.4 Close-up of the Multidrop 384 standard tube dispensing cassette

4.1.2 Back view



1 Mains input socket
2 Fuses in the fuse holder cap
3 RS-232C serial interface connector

Fig. 4.5 Multidrop 384 rear view

4.2 Multidrop 384 microplate dispenser

The Multidrop 384 microplate dispenser (*Fig. 4.6*) automates dispensing into microplates. The microprocessor-based system permits volumes between 5 – 100 µl for 384-well plates and 5 – 395 µl for 96-well plates to be selected (in 5 µl increments) and then dispensed simultaneously into eight wells (one column of a 96-well microplate). Setting the volume to be dispensed and the number of columns per plate (maximum 12 columns in 96-well plates and 24 columns in 384-well plates) is carried out using thumbwheels.

The movement of the microplate is automatic:

In the 96-well plate mode, the columns with 8 wells are filled starting from column 1 up to the column number set, after which the plate carrier will return to the home position. In the 384-well plate mode, the columns with 16 wells must be filled in two phases: first every other row (A, C, ..., M, O) is filled starting from column 1 up to the set column number. Then the plate carrier shifts sideways so that the remaining rows (B, D, ..., N, P) are filled in the opposite order, from the set column number back to column 1.

Normally, the microplate moves through the instrument automatically, but a semiautomatic mode is possible by using the **step** and **drop** keys, which control dispensing into any column of the plate.

The dispensing cassette contains eight individual tubes. The dispensing cassette is detachable. Each reagent can have a separate dispensing cassette. Alternatively, the same dispensing cassette can be used with several reagents using the backflush feature. Refer to section 11.2 Dispensing cassettes.

The latest technology has been used in the manufacture of the dispensing cassette which includes an injection molded manifold. All dispensing cassettes can be autoclaved and Thermo Fisher Scientific guarantees them up to 50 autoclavings. After this amount it is recommended you replace the cassette.

To avoid damaging the tubes, follow the dispensing cassette maintenance, washing, autoclaving and storage instructions carefully (see the instructions in sections 6.8.4 After use, 7.2 How to wash the dispensing cassette and 7.3 How to autoclave the dispensing cassette).

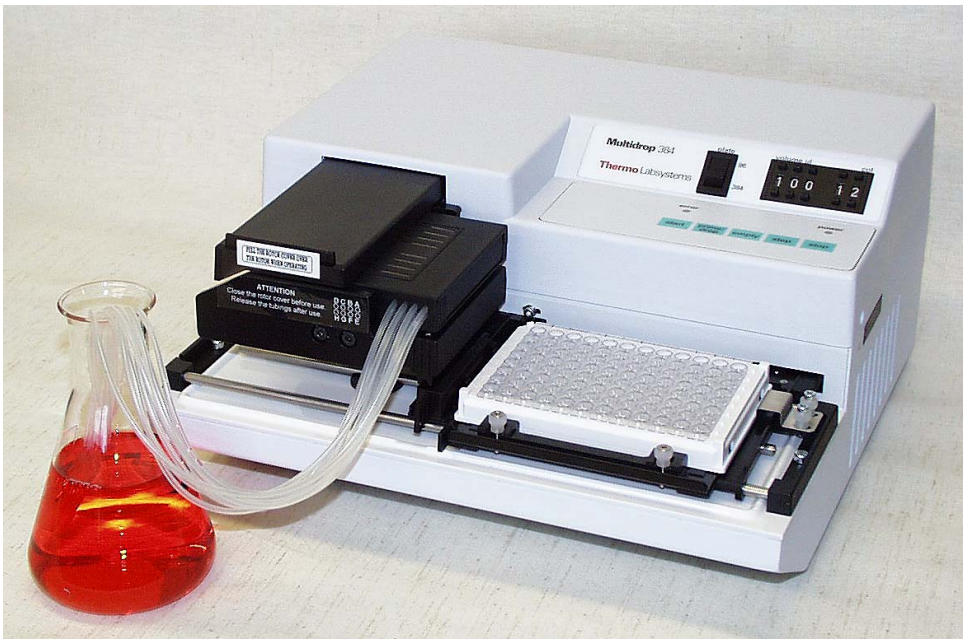


Fig. 4.6 Multidrop 384 microplate dispenser

5 INSTALLATION

5.1 Installation check list

The chapter on installation will contain an outline of the points mentioned in the check list below.

Tick	*Item*
❑	Unpack the Multidrop 384 instrument carefully. Refer to *5.2.1*. Keep the original packaging and packing material for future transportation.
❑	Check the delivery for completeness. Refer to *5.2.2*.
❑	Check for damage during transport. Refer to *5.2.3*.
❑	Place the dispenser on a normal laboratory bench taking into account both the environmental and technical prerequisites. Refer to *5.2.4* and *5.2.6*. Leave sufficient clearance on both sides and at the rear of the unit.
❑	Install the instrument. Refer to *5.3.1*.
❑	Connect the mains supply cable to the mains input socket. See *5.3.2*.
❑	Carry out the operational check. Refer to *5.4*.

5.2 What to do upon delivery

5.2.1 How to unpack

Move the unpacked instrument to its site of operation. Unpack the Multidrop 384 instrument and accessories carefully with the arrows on the transport package pointing upwards. The following notes and instructions are sent with the instrument and are immediately available when you open the package:

- Warranty Certificate card
- packing instructions/packing list
- *Multidrop 384 User Manual*

Caution: Do not touch or loosen any screws or parts other than those specially designated in the instructions. Doing so might cause misalignment and will invalidate the instrument warranty.

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

5.2.2 Checking delivery for completeness

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

5.2.3 Checking for damage during transport

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

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

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

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

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

5.2.4 Environmental requirements

When you set up your Multidrop 384, avoid sites of operation with excess dust, vibrations, strong magnetic fields, direct sunlight, draft, excessive moisture or large temperature fluctuations.

- Make sure the working area is flat, dry, clean and vibration-proof and leave additional room for accessories, cables, reagent bottles, etc.
- Make sure the ambient air is clean and free of corrosive vapors, smoke and dust.
- Make sure the ambient temperature range is between +10°C (50°F) and +40°C (104°F).
- Make sure relative humidity is between 10% and 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 384 does not produce operating noise at a level that would be harmful. No sound level measurements are required after installation.

Warning: Do not operate the instrument in an environment where potentially damaging liquids or gases are present.

5.2.5 Things to avoid

Do not smoke, eat or drink while using the Multidrop 384. Wash your hands thoroughly after handling test fluids. Observe normal laboratory procedures for handling potentially dangerous samples. Use proper protective clothing. Use disposable gloves. Be sure the working area is well-ventilated.

Never spill fluids in or on the equipment.

5.2.6 Technical prerequisites

Place the instrument on a normal laboratory bench. The net weight of the entire equipment is approx. 6.2 kg [13.7 lbs.] and the dispensing cassette 124 g [0.3 lb.].

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

5.3 Setups before you put the instrument into operation

5.3.1 Installation procedure

The following procedure may be carried out by any properly skilled person using standard tools. In case the local voltage does not correspond to the label at the rear of the instrument on top of the mains input socket (*Fig. 4.5*), follow the next installation procedures.

Warning: Ensure the mains switch (*Fig. 4.2*) on the rear of the left side panel is in the OFF position. Also ensure the mains supply cable is disconnected (*Fig. 5.3*).

1. Remove the instrument cover retaining screws (*Fig. 5.1* and *Fig. 4.2*) and lift up the cover.

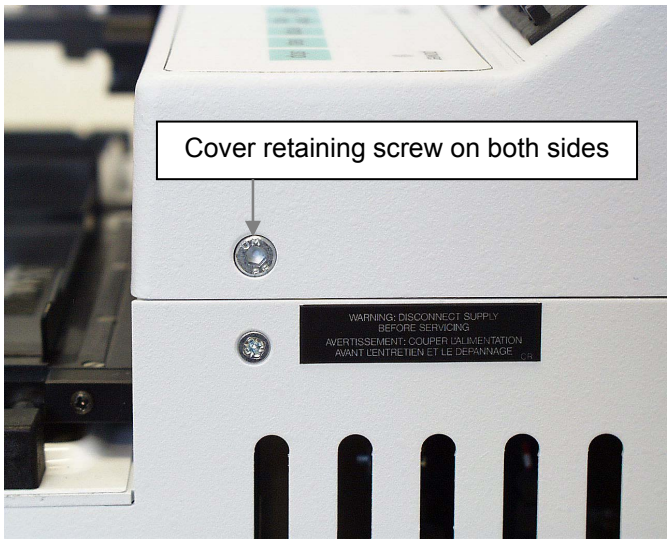


Fig. 5.1 Location of the cover retaining screws

2. Check that the voltage selector switch (*Fig. 5.2*) is in the correct position, that is, the voltage selected corresponds to the local voltage.

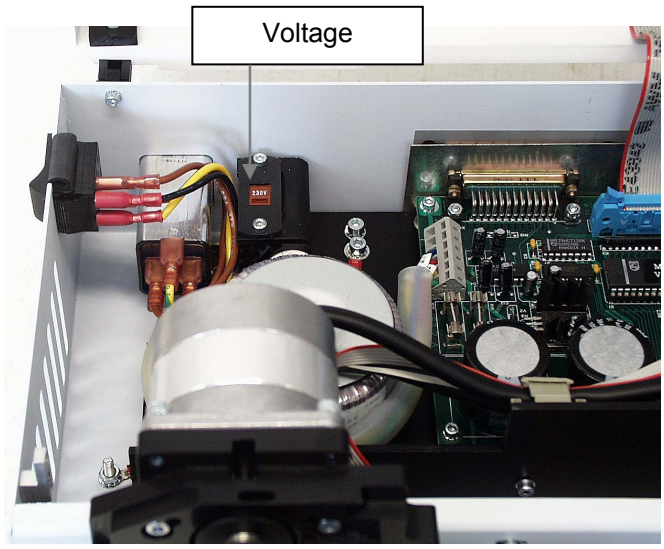


Fig. 5.2 Location of the voltage selector

3. Visually check that you did not leave any loose parts inside the instrument.
4. Close the cover and fasten the cover retaining screws.

5.3.2 How to ensure startup

1. **Warning:** Ensure the mains switch (*Fig. 4.2*) on the rear of the left side panel is in the OFF position.

2. Connect the mains supply cable to the mains input socket (*Fig. 4.3* and *Fig. 5.3*) at the bottom of the back panel. If you need to use any other type of mains supply cable than supplied, use only cables certified by the local authorities.

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

Warning: Never operate your instrument from a power outlet that has no ground connection. Never use a mains supply cable other than the Thermo Scientific mains supply cable designed for your region.

Fig. 5.3 Connecting the mains supply cable

5.4 Operational check

The following procedure should be completed without the dispensing cassette to confirm the correct functioning of the dispenser prior to normal use.

1 Connect the mains supply cable (*Fig. 5.3*).
Switch the instrument on using the mains switch (*Fig. 4.2*).

- If the instrument starts:
  - The green **power** LED will light up
  - The plate carrier will return to the home position
- If the instrument does not start:
  ☞Pull the rotor cover over the rotor
  ☞Check the mains cable connection

2 Press **prime/drop** to prime
- The pump rotor will rotate
- If the pump rotor does not rotate:
  ☞Pull the rotor cover over the rotor
- If the red **error** LED lights up:
  ☞Insert the priming vessel, press the **stop** key and prime again

3 Press **start**
- Starts the dispensing cycle
- If the dispensing cycle does not start:
  ☞Pull the rotor cover over the rotor
- If the red **error** LED lights up:
  ☞Press the **stop** key, then press the **prime** key and finally press the **start** key again
  ☞Insert the priming vessel, press the **stop** key, then press the **prime** key and finally press the **start** key again

4 **plate** (plate switch)
- Dispenses liquid into the 384 or 96-well microplates
- Try the alternative plate formats by pressing the **start** key

5 **step**
- Advances the microplate by one column
- If the microplate does not advance:
  ☞Pull the rotor cover over the rotor

6 After **step** press **prime/drop**
- To dispense a preselected volume into the column selected by steps
- The plate carrier will return to the home position after reaching the last column

After **step** press **start** (partial filling of the tubing)
- To dispense the selected volume automatically from the set column to the last column

7 **empty**
- The pump rotor will rotate
- If the pump rotor does not rotate:
  ☞Pull the rotor cover over the rotor

8 **stop**
- Terminates the operation and returns the plate to the home position

For more information on the control panel, refer to section 6.5 How to use the control panel.

5.5 Operating precautions and limitations before operation

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

2. Always ensure that the local supply voltage in the laboratory conforms to that specified on the type label on the back of the instrument.

6 ROUTINE OPERATION

6.1 Operational check list

The chapter on routine operation will contain an outline of the points mentioned in the check list below.

Tick	*Item*
❑	Switch on the instrument. Refer to *6.2*.
❑	Insert the priming vessel and the dispensing cassette. Refer to *6.3*.
❑	Use the plate adapter for the plate carrier to function. Refer to *6.4*.
❑	Pull the rotor cover over the rotor. Refer to *6.3*.
❑	Familiarize yourself with the control panel. Refer to *6.5*.
❑	Press the plate switch (**plate**) to position 96 or 384 according to the plate type you use. Refer to *6.5.2*.
❑	Prime all the eight channels so that there are no air bubbles in the tubes. Refer to *6.7*.
❑	Carry out dispensing either manually or automatically. Refer to *6.8*.
❑	After all the plates have been dispensed, press the **empty** key to return the reagent or liquid from the tubes to the reservoir. Refer to *6.8.4*.
❑	Wash the dispensing cassette by priming it with deionized distilled water when not in use. Refer to *6.8.4* and *7.2*.
❑	After washing, store the dispensing cassette in the rest position. Refer to *6.8.4* and *7.2*.
❑	Maintain the instrument regularly. Refer to Chapter *7*.

Note: Keep the dispensing cassette in the rest position when the dispensing cassette is not in use.

6.2 Switching on

Switch on the instrument by using the mains switch on the left-hand side of the instrument (*Fig. 4.2*).

The green **power** LED will light up.

6.3 How to insert the priming vessel and the dispensing cassette

1. Ensure that the priming vessel is inserted correctly into its slot on the left of the plate carrier (*Fig. 6.1*). You have fastened it correctly when it snaps slightly and is inserted into the sensor slot.

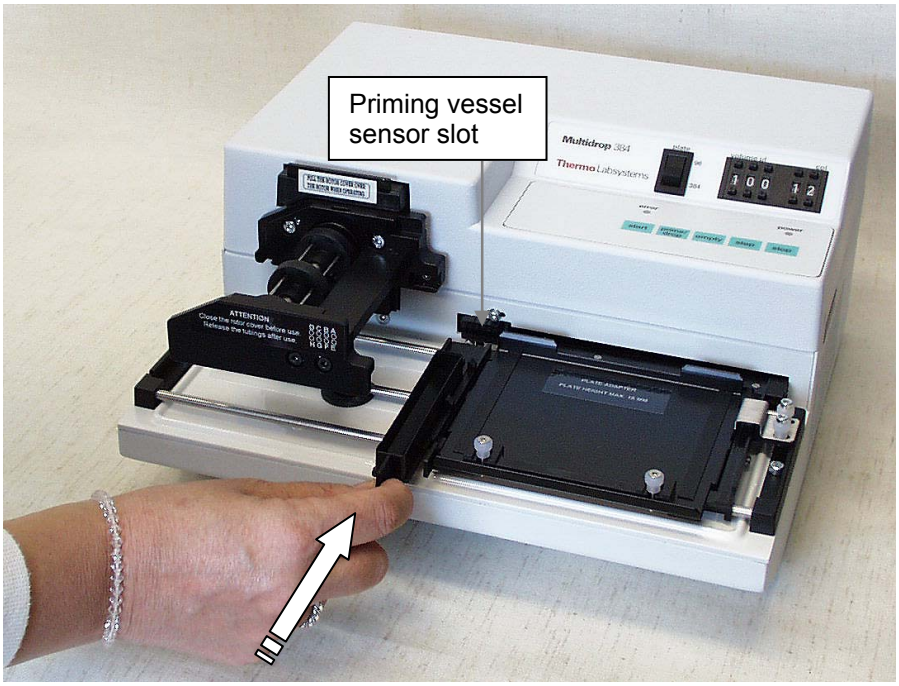


Fig. 6.1 Inserting the priming vessel into place

2. Take the lower part of the cassette into your right hand with the dispensing tips pointing down and the upper part into your left hand (*Fig. 6.2*).

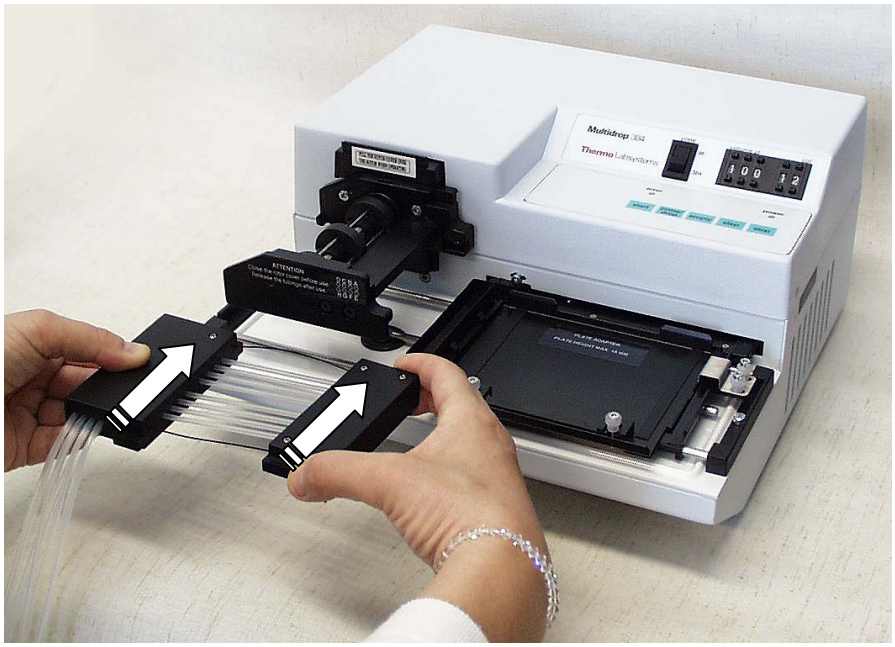


Fig. 6.2 Inserting the standard tube dispensing cassette

3. Carefully place the eight tubes below the pump rotor and insert the lower part of the cassette into the lower part slots of the pump body (*Fig. 6.3*). Check that the tubes are freely placed below the rotor and the tension limiting wires below the rotor shaft.

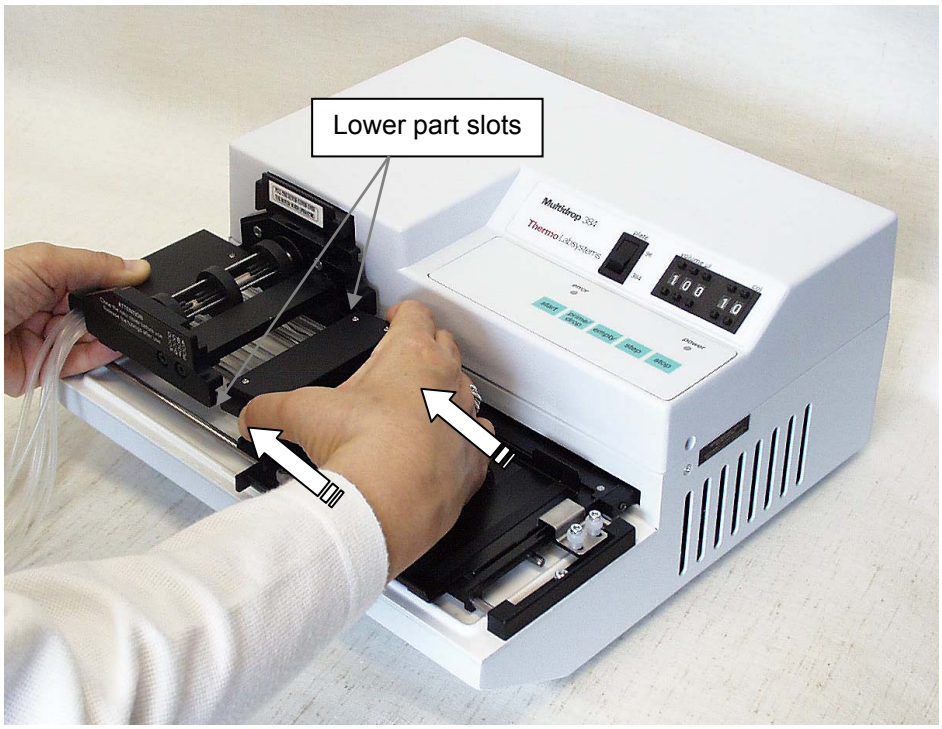


Fig. 6.3 Inserting the lower part of the dispensing cassette into its slots

4. Take a firm grip on the upper part of the cassette with your right hand and carefully pull the tubes around the rotor until the upper part reaches and fits into the upper part slots of the pump body (*Fig. 6.4* and *Fig. 4.1*).

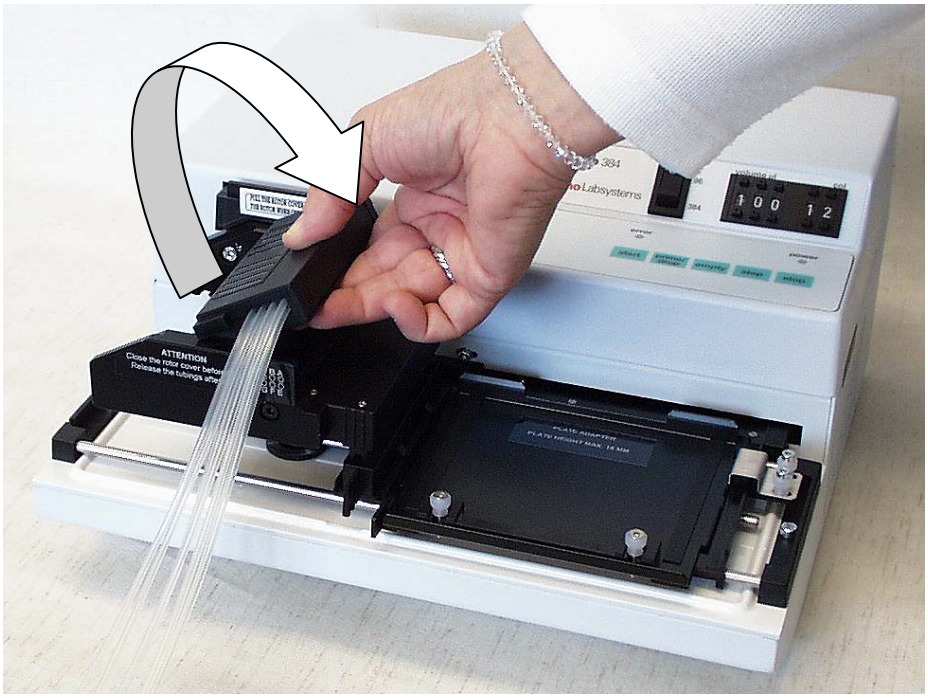


Fig. 6.4 Inserting the upper part of the dispensing cassette

Note: The tension limiting wires are designed to prevent the user from pulling the tubes too much as excessive tension may damage the tubes or change the calibration of the cassette.

5. Double-check that both the upper and the lower parts are properly placed into their corresponding slots (*Fig. 6.3* and *Fig. 6.5*).

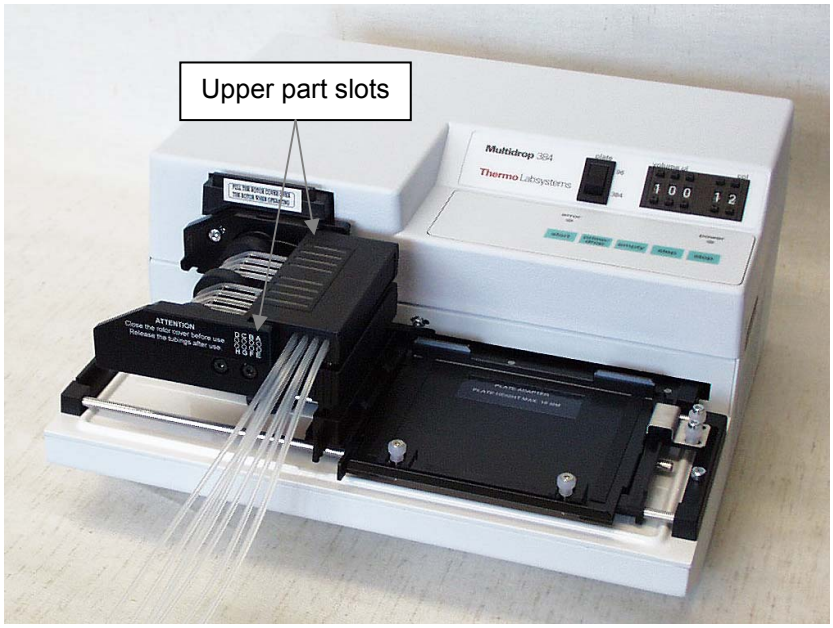


Fig. 6.5 Lower and upper parts of the dispensing cassette inserted evenly into their slots

6. Ensure that all the tubes are evenly placed on the rotor needles, four tubes on each half of the rotor.

7. Ensure also that the tension limiting wires have a loose fit around the rotor shaft.

8. **PULL THE ROTOR COVER OVER THE ROTOR** (*Fig. 6.6*). The plate carrier will then return to the furthest right of the instrument, that is, the home position. The microswitch controls that the cover is properly placed over the rotor. The Multidrop 384 is now ready for priming.

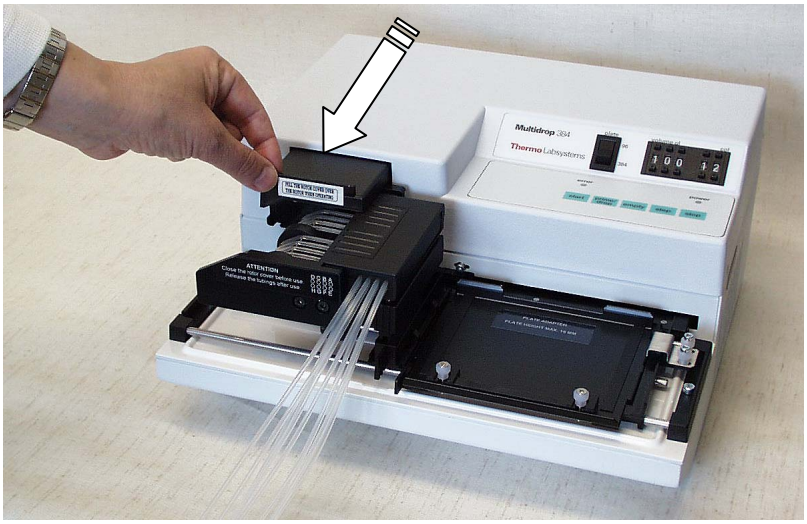


Fig. 6.6 Pulling the rotor cover over the rotor

Note: If the rotor cover is not pulled over the rotor, the instrument will not function.

Note: It is recommended you change the dispensing cassette or tubing set after dispensing about 3000 – 5000 96-well plates, depending on the dispensing frequency and the liquids used.

Note: Keep the dispensing cassette in the rest position when the dispensing cassette is not in use.

6.4 How to insert and adjust the plate adapter

The Multidrop 384 requires a plate adapter for the plate carrier to function. Two different plate adapters are included (*Fig. 6.7*).

The PLATE ADAPTER, PLATE HEIGHT MAX. 15 MM, is suitable for plates approximately 15 mm high, for example, 96-well plates and some 384-well plates.

The PLATE ADAPTER, PLATE HEIGHT MAX. 11 MM, is suitable for lower plates, for example, 384-well plates.

Fig. 6.7 Two different plate adapters

The plate adapter is inserted into the plate carrier in the following way:

1. Open the plate adapter lock located in the front left corner of the plate carrier (*Fig. 6.8*). Select the plate adapter according to the height of the plate.

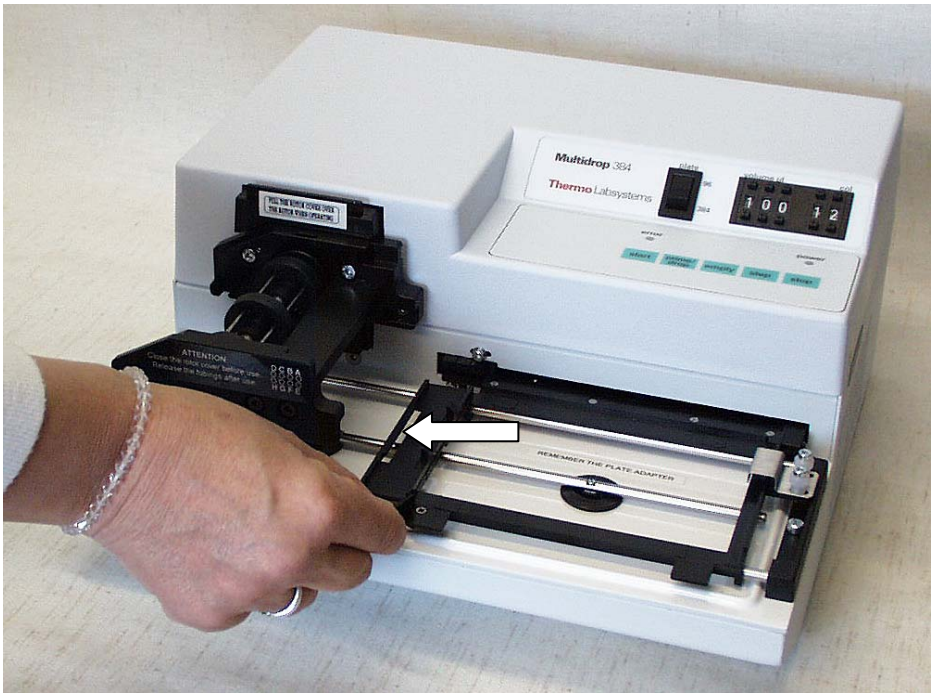


Fig. 6.8 Opening the plate adapter lock

2. Take the plate adapter in your left hand and lower the right end. Place the plate adapter into the right end corner of the plate carrier (*Fig. 6.9*).

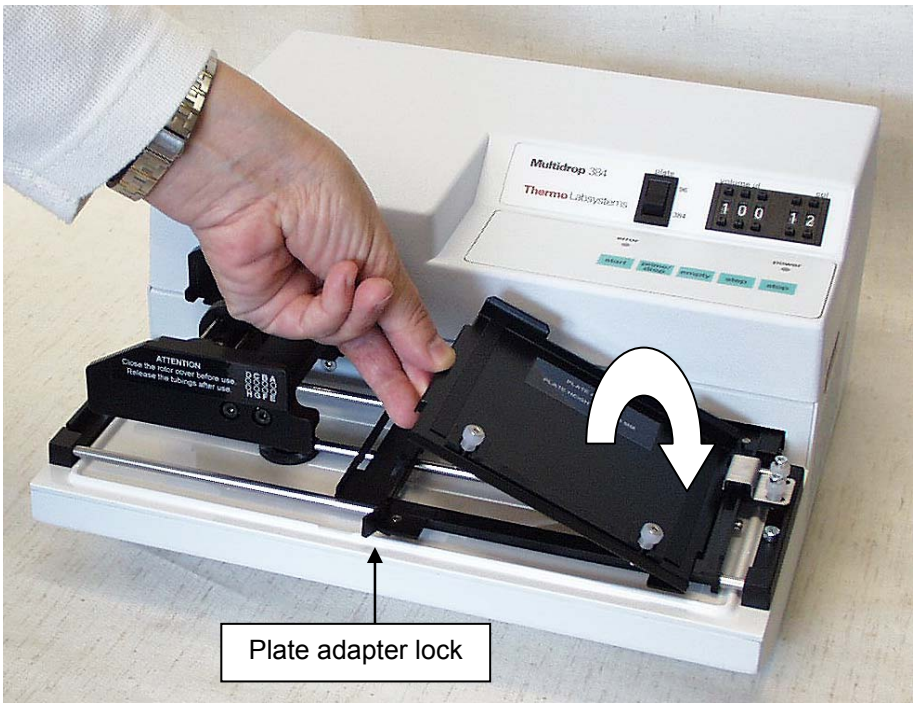


Fig. 6.9 Placing the right end of the plate adapter

3. Then press the left end of the plate adapter onto the plate carrier (*Fig. 6.10*).

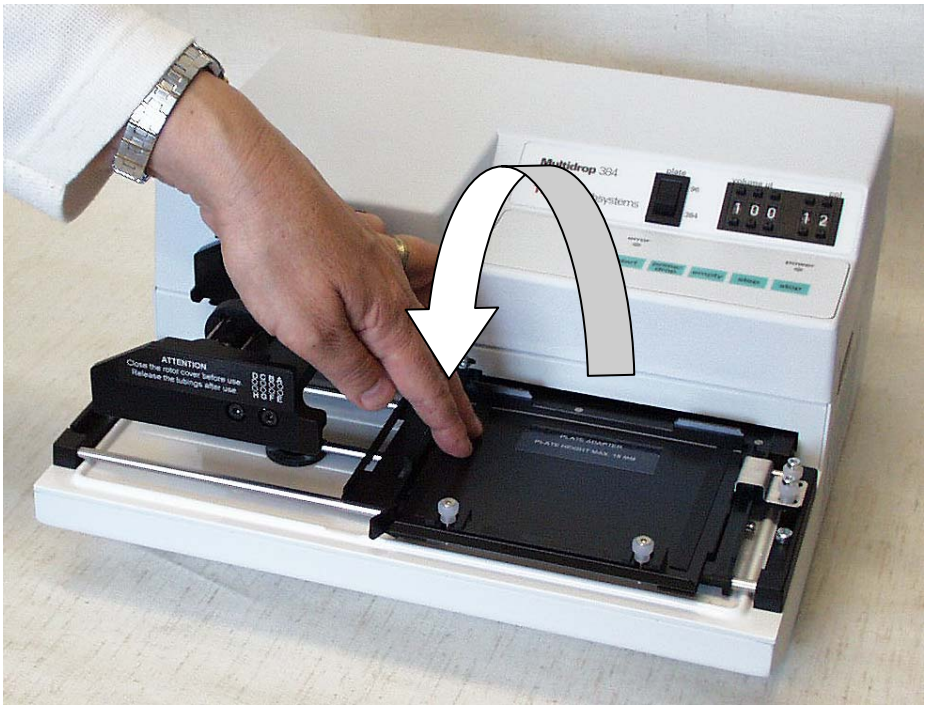


Fig. 6.10 Pressing the left end of the plate adapter

4. Lock the plate adapter into place with the plate adapter lock located in the front left corner of the plate carrier (*Fig. 6.11*).

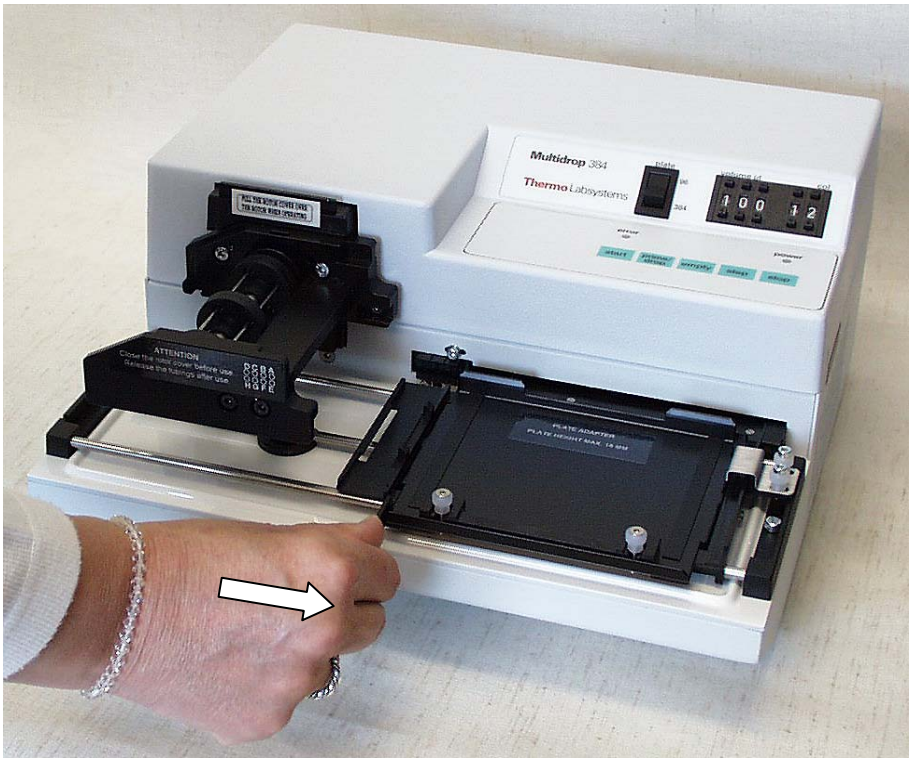


Fig. 6.11 Closing the plate adapter lock

5. To adjust the plate size, loosen first the two attached plastic-covered screws on the right of the plate carrier (*Fig. 6.12*).

Fig. 6.12 Loosening the screws on the right of the plate carrier

6. Then loosen the two attached plastic-covered screws at the front of the plate adapter (*Fig. 6.13*).

Fig. 6.13 Loosening the screws at the front of the plate adapter

7. Insert the microplate onto the plate adapter. Push the microplate at the same time towards the left-hand top corner of the plate adapter while you fasten the front screws (*Fig. 6.14*).

Fig. 6.14 Fastening the front screws of the plate adapter

8. Then fasten the screws to the right of the plate carrier, pushing the microplate simultaneously towards the left-hand corner of the plate adapter (*Fig. 6.15*). If the instrument is used for robotics, leave sufficient moving space for the microplate according to the robotic specifications.

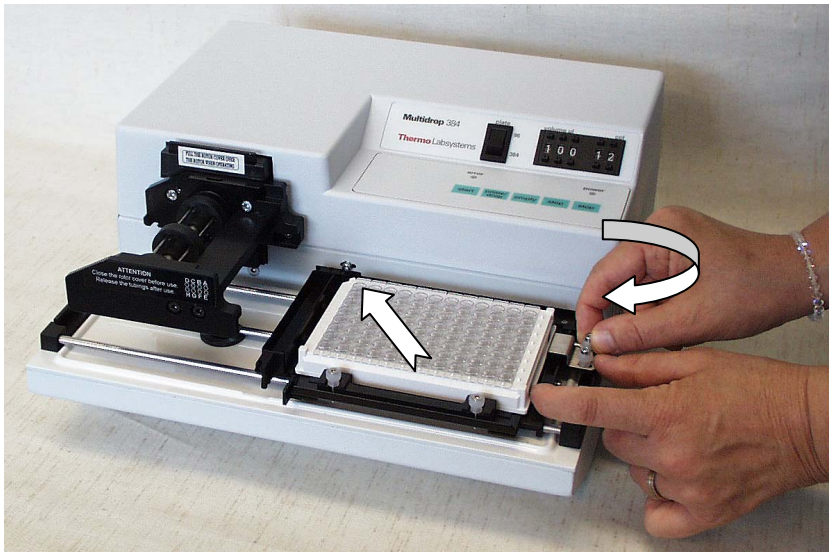


Fig. 6.15 Fastening the screws to the right of the plate carrier

Note: Ensure the dispensing cassette is attached and the rotor cover has been pulled over the rotor.

6.5 How to use the control panel

The keypad has an embossed, tactile membrane with five keys. There are two control panel indicators (LEDs) in all.

The control panel is shown in *Fig. 6.16*.

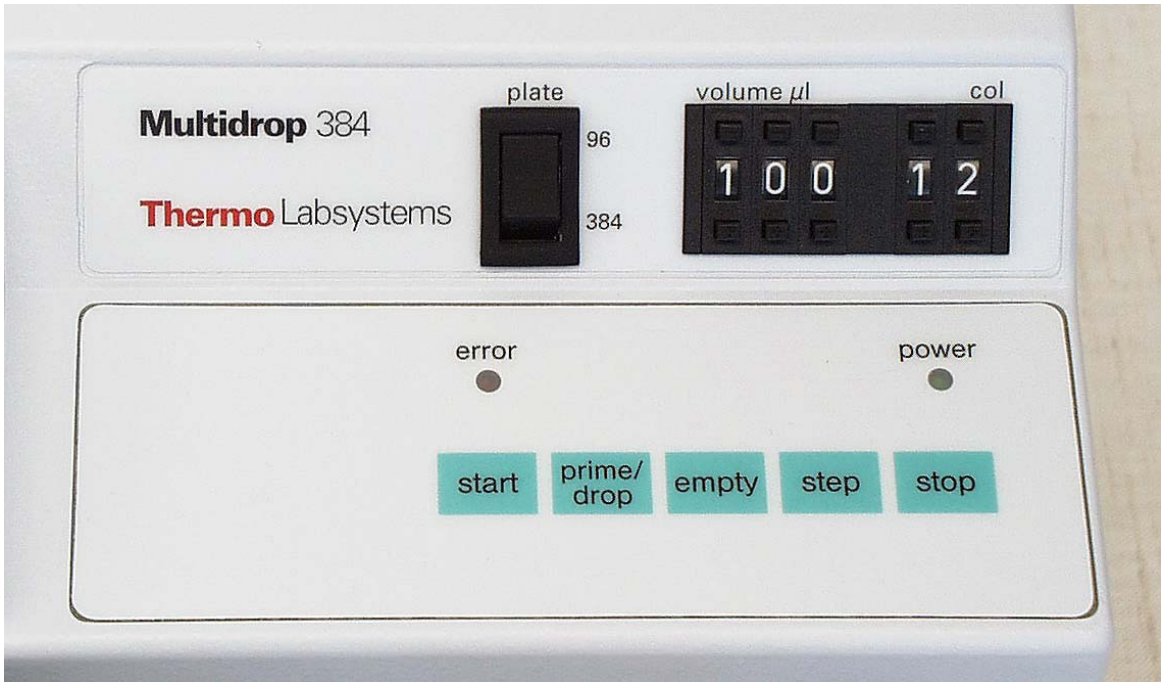


Fig. 6.16 Multidrop 384 control panel

6.5.1 Control panel indicators

power The green **power** LED indicates that the dispenser is powered.

error The red **error** LED shows when the dispenser has some kind of error.

6.5.2 Control panel thumbwheels (digital switches)

plate 96/384-well switch: sets the plate carrier movement and dispensing for 96 or 384-well plates.

volume µl Reagent volume thumbwheels: sets the volume to be dispensed per well.

col Column thumbwheels: sets the number of columns per plate, up to 12 with 96-well plates or up to 24 with 384-well plates.

6.5.3 Control panel keys

start	Starts the dispensing cycle.
prime/ drop	Primes the cassette if the tips are above the priming vessel. Primes continuously as long as the user presses the key. Dispenses the adjusted volume if the tips are above the wells.
empty	Empties the liquid from the tubes to the liquid reservoir.
step	Advances the microplate by one column.
stop	Terminates the operation and returns the plate to the home position.

6.6 How to select the 96 / 384-well plate

- Press the plate switch (**plate**) down into position 96 or 384 according to the plate type to be used (*Fig. 6.17*).
- Select the number of columns (**col**) between 1 and 24 in the 384 mode.
- Select the number of columns (**col**) between 1 and 12 in the 96 mode (*Fig. 6.17*). Note that if you set the column selection above 12 in the 96 mode, the red **error** light will light up and the dispensing operation will be terminated.

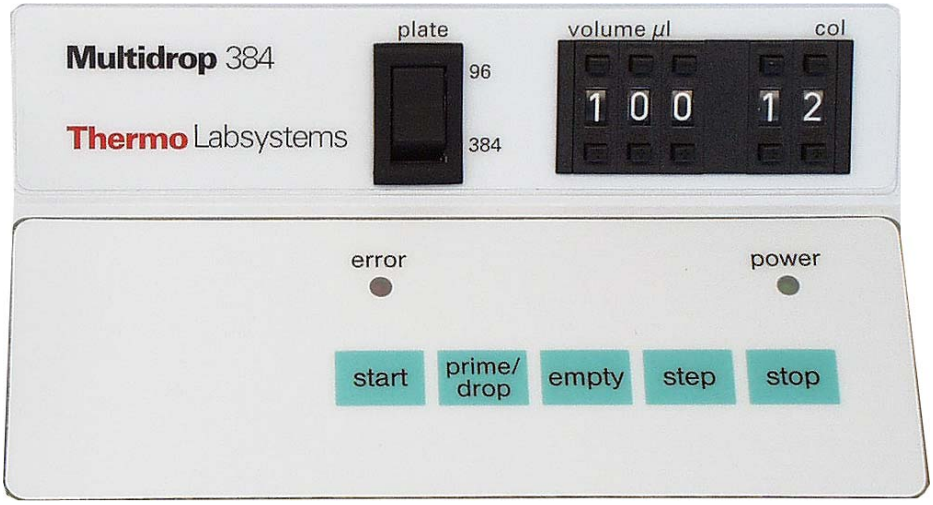


Fig. 6.17 Multidrop 384 control panel

6.7 How to prime

Note: Ensure that the instrument is sufficiently level on the table to prevent liquids from overspilling when priming.

Note: Ensure that the liquid temperature is close to the calibration temperature of 22°C. Differences greater than ± 2°C will cause an error in the results.

Note: Silicon tubing (silicon rubber) is resistant to a number of chemical liquids. Most water solutions typically used in a medical laboratory can be dispensed with the Multidrop 384. Some strong substances may, however, harm the silicone tubing and cause swelling or breaking. If the substance has even a slight effect on silicone, the calibration of the cassette may be affected and the cassette may become unusable.

1. Place the eight tube ends into the same liquid reservoir or into different reservoirs taking care that all tube ends are below the liquid level. Use the tubing weight provided if possible.

2. Check that the priming vessel is firmly inserted next to the plate carrier. The Multidrop 384 will not operate if the priming vessel is not completely inserted into its slot.

3. Press the **prime/drop** key until all eight channels are dispensing continuously into the priming vessel and there are no more air bubbles in the tubes. It is recommended you fill the priming vessel two or three times with the reagent to be used before starting the actual dispensing in order to bring the tubes into working condition.

Note: If you press the **prime/drop** key at the same time as the rotor cover is pulled over the rotor, the program enters into the volumetric calibration mode.

Note: You can empty the contents of the priming vessel back into the reagent reservoir by pulling the priming vessel out of its slot if necessary. It is recommended you do this if you use expensive reagents. Therefore, wash the priming vessel always after each use to avoid any cross contamination. If you use several liquids at the same time in different rows, you can order a special eight-cavity priming vessel for this purpose to prevent mixing the liquids. Also a self-draining (flow-through) priming vessel is available. Refer to section 11.4 Priming vessels (consumables).

6.8 Dispensing

6.8.1 How to dispense automatically

1. Set the required reagent volume per well. The permitted volume range is 5 – 100 µl for 384-well plates and 5 – 395 µl for 96-well plates.

2. Set the required number of columns to be dispensed per plate.

3. Place the microplate onto the plate carrier equipped with a suitable plate adapter. Refer to section 6.4 How to insert and adjust the plate adapter.

4. Press the **prime/drop** key to prime the tubes. Refer to section 6.7 How to prime.

5. Press the **start** key. The Multidrop 384 will now automatically dispense the preselected volume of reagent into the preselected number of columns. When dispensing has been completed, the plate carrier will automatically return to its home position.

6. Now you can dispense any number of plates by only changing the plate and pressing **start**.

Note: Check that there is always enough liquid in the reservoir and ensure that all the tube ends are below the liquid level. Use the tubing weight supplied.

Note: Check after each dispensing that the priming vessel has not filled up. Empty it if necessary, otherwise the liquids may spill over during operation. Note that the Multidrop 384 always primes itself before each plate filling to ensure maximum accuracy and precision. It is recommended you empty the priming vessel after dispensing 30 – 40 plates. Alternatively, use the self-draining priming vessel.

6.8.2 How to dispense manually into the specified column(s)

1. Set the desired reagent volume. The permitted volume range is 5 − 100 µl in the 384-well plate mode and 5 − 395 µl in the 96-well plate mode.

2. Place the microplate onto the plate carrier equipped with a suitable plate adapter.

3. Use the **step** key to move the plate carrier column by column until you reach the desired column.

4. Press the **prime/drop** key. The Multidrop 384 will now dispense the preselected volume into the column desired. The plate carrier will return to the home position after reaching the last column. If you use the **start** key, the instrument will automatically dispense the selected volume from the set position to the last column selected.

Note: If you have pressed either the **stop** or **empty** key, the Multidrop 384 refuses to start dispensing before you have pressed the **prime/drop** key once again.

6.8.3 How to dispense multiple volumes

Ten- or hundredfold volumes can be dispensed compared to the volume chosen.

6.8.3.1 Dispensing tenfold and hundredfold volumes

1. Press the **stop** and **prime/drop** keys simultaneously.

2. Having done that first, release the **stop** key and then the **prime/drop** key. Note that the Multidrop 384 is in the volumetric calibration mode.

3. Now you can push the plate carrier into the desired dispensing position.

4. Set one tenth of the volume required on the thumbwheel. Then press the **start** key and a tenfold volume will be dispensed.

5. Set one hundredth of the volume required on the thumbwheel. Then press the **step** key and a hundredfold volume will be dispensed.

6.8.4 After use

After all the plates have been dispensed, press the **empty** key to return the reagent or liquid from the tubes to the reservoir. This saves expensive reagents.

If there is only a short break in dispensing, no washing or cleaning of the tubes is necessary. However, after pressing the **empty** key, release the tubing tension by pulling the upper part of the cassette from its slots and place it into its rest position slots located on the left-hand side of the rotor (*Fig. 6.18*).

If there is a longer break (for example, a day), wash the dispensing cassette by priming it with deionized distilled water or with special washing detergent if necessary. In the end, rinse the washing detergent away with deionized distilled water.

After washing, store the dispensing cassette in the rest position (*Fig. 6.18*).

Note: Keep the dispensing cassette in the rest position when the dispensing cassette is not in use.

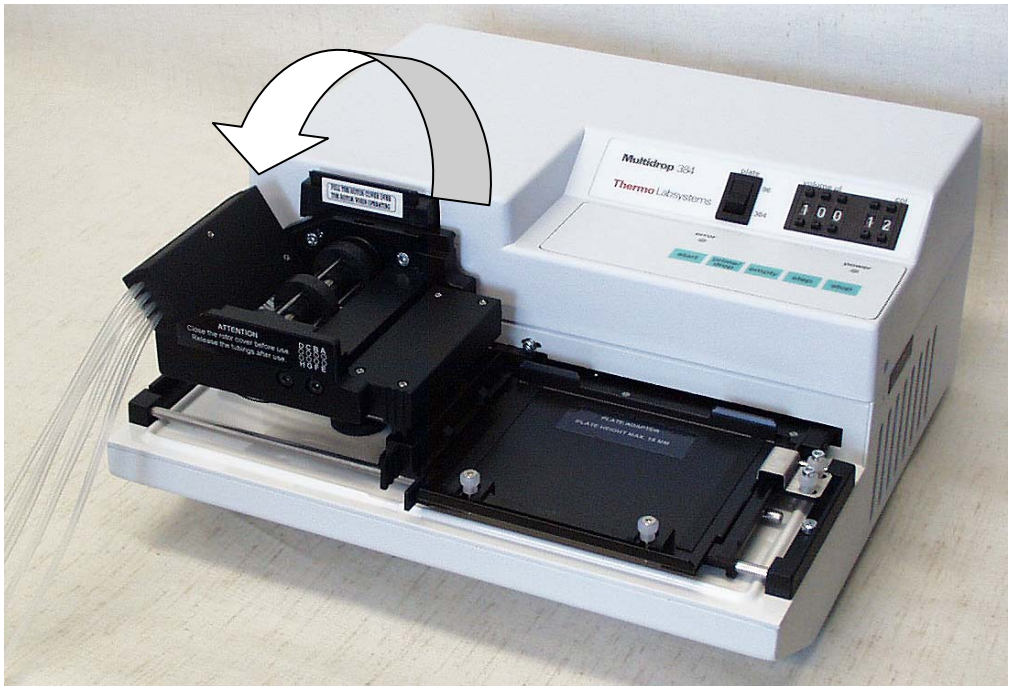


Fig. 6.18 Rest position of the dispensing cassette

6.9 Shutdown

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

After all the plates have been dispensed, press the **empty** key to return the reagent or liquid from the tubes to the reservoir. This saves expensive reagents.

If there is only a short break in dispensing, no washing or cleaning of the tubes is necessary. However, after pressing the **empty** key, release the tubing tension by pulling the upper part of the cassette from its slots and place it into its rest position slots located on the left-hand side of the rotor (*Fig. 6.18*).

If there is a longer break (for example, a day), wash the dispensing cassette by priming it with deionized distilled water or with special washing detergent if necessary.

After washing, store the dispensing cassette in the rest position (*Fig. 6.18*).

Switch the Multidrop 384 off by pressing the mains switch (*Fig. 4.2*) at the end of the left side panel of the instrument into the OFF position.

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

If you have spilt infectious agents on the dispenser, disinfect with 70% alcohol or some other disinfectant (see section 7.8 Decontamination procedure).

6.10 Guidelines for use

- When the **error** LED is on, the **start** or **step** keys will not function.
- To clear the error and continue the dispensing procedure, press the **stop** key and wait until the plate carrier has returned to the home position. The dispensing procedure can then be restarted.
- If you press the **stop** key, all operations will stop. The plate carrier is automatically returned to the home position. The Multidrop 384 will now require priming again.
- Preventative maintenance should be followed closely to keep the microplate dispenser in the best condition for maximum reliability. A poorly maintained instrument will not give the best results.

7 MAINTENANCE

7.1 Regular and preventive maintenance

7.1.1 General

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

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

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

Clean the outside of the instrument and the plate carrier with clean low-pressure compressed air or a cloth dampened with water or a mild detergent when necessary.

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

Clean the control panel with a mild laboratory detergent.

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

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

The dispensing cassette is autoclavable. Do not autoclave any other part of this instrument.

7.1.2 Immediate

Although the Multidrop 384 is constructed from high-quality materials, you must immediately wipe away spilled saline solutions, solvents, acids or alkaline solutions from outer surfaces to prevent damage and wipe with deionized distilled water.

7.2 How to wash the dispensing cassette

Wash the tubes by priming them first with tap water and then with deionized distilled water. Make sure that all the tubes are washed properly.

If cleaning with water is insufficient, use a mild laboratory detergent and then prime with large amounts of tap water followed by deionized distilled water.

The dispensing cassette can be dried at room temperature.

After washing, store the dispensing cassette in the rest position (*Fig. 6.18*).

If the instrument is not used for a couple of hours, insert the dispensing cassette into the rest position. Refer to section 6.8.4 After use. Handle the dispensing cassette with great care so that you do not damage the tubes and dispensing tips. These factors will affect the service life of the dispensing cassette.

7.3 How to autoclave the dispensing cassette

The standard tube dispensing cassette (Cat. no. 24072670) can be autoclaved 50 times with the same tubes.

The autoclaving conditions of the dispensing cassette are as follows: 1 bar pressure at 121°C for 20 minutes.

Note: After autoclaving, the dispensing cassette must cool down to room temperature before use.

7.4 How to replace the fuses

1. Switch off (*Fig. 4.2*) and unplug the instrument from the mains input socket (*Fig. 4.5*).

2. Remove the fuse holder cap with a screwdriver or similar tool. Press both ends of the fuse holder cap with the tool (*Fig. 7.1* and *Fig. 7.2*).

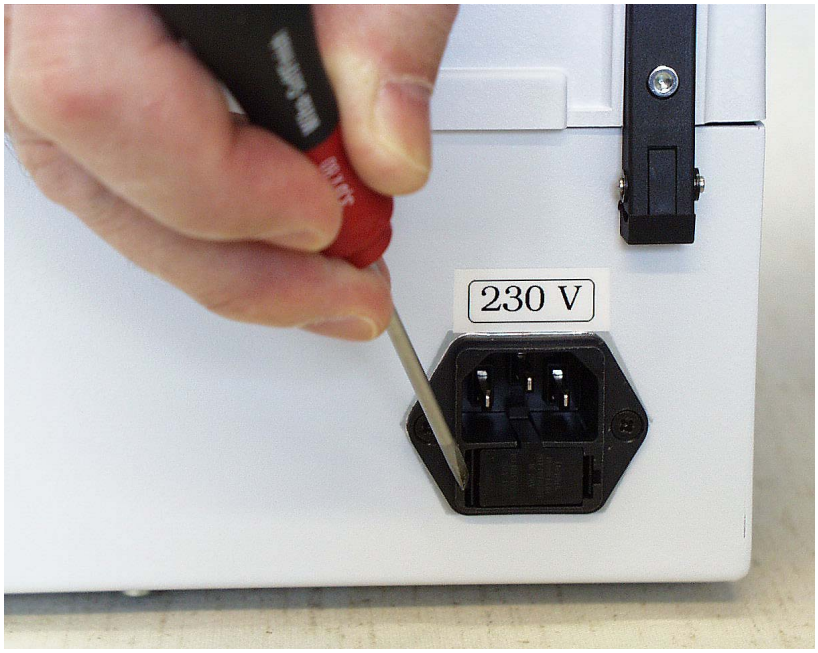


Fig. 7.1 Removing the fuse holder cap (A)

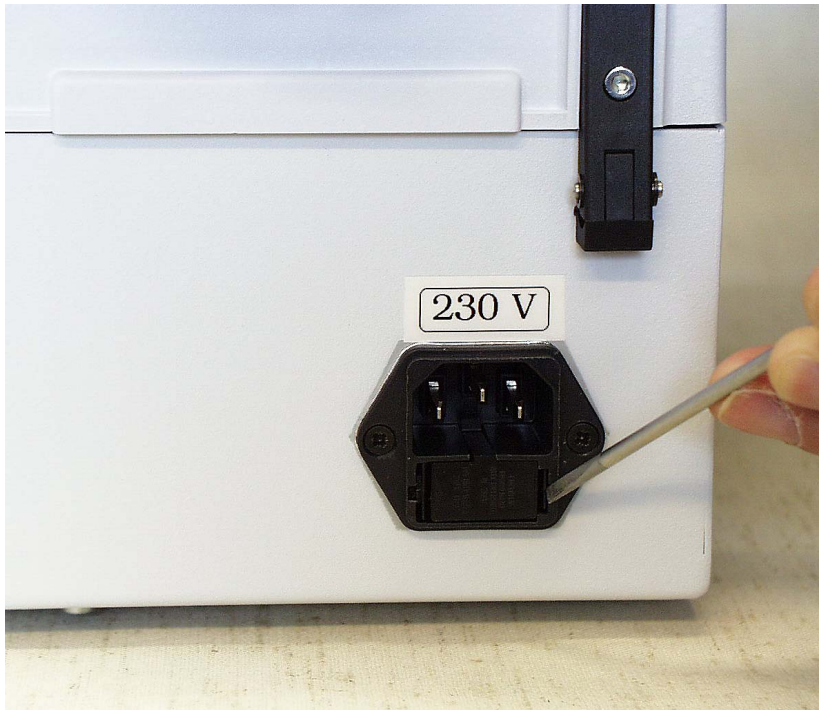


Fig. 7.2 Removing the fuse holder cap (B)

3. Check the fuses in the fuse holder cap (*Fig. 7.3*).

Fig. 7.3 Fuse holder cap with fuses

4. Replace the blown fuse with the same type and push the fuse holder cap back into its position (*Fig. 7.4*).

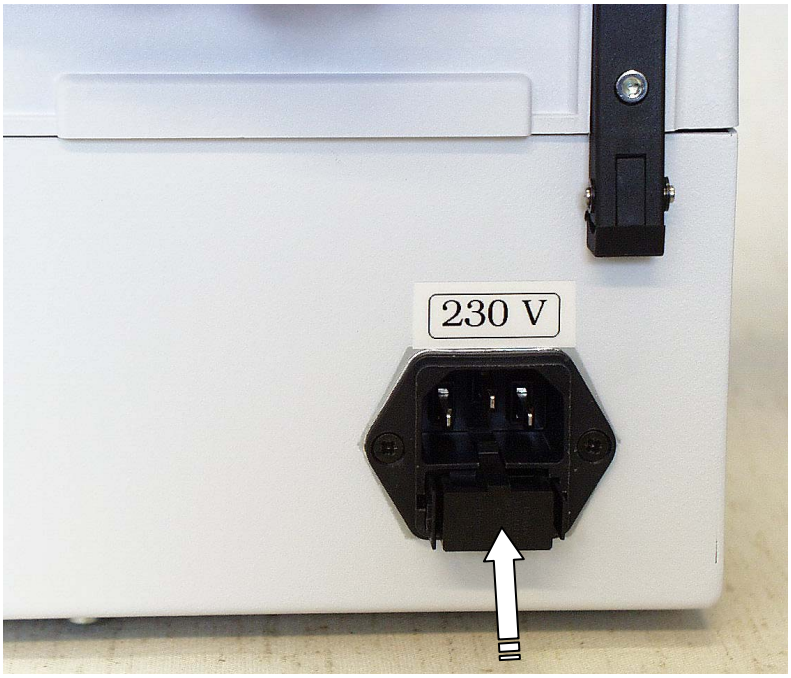


Fig. 7.4 Inserting the fuse holder cap

5. Reconnect to the mains input socket and switch the power on.

7.5 How to recalibrate the dispensing cassette

The dispensing cassette has been calibrated by the manufacturer with deionized distilled water at 22°C ± 2°C. It is recommended you recalibrate the cassette after dispensing about 1000 96-well plates or after every three months. It is also recommended you recalibrate the dispensing cassette if you have forgotten the cassette in the Multidrop 384 under tension for prolonged periods, for example, a weekend or longer.

Two different calibration methods are described below, that is, volumetric calibration and gravimetric calibration.

7.5.1 Volumetric calibration

For volumetric calibration, use the following steps:

1. Remove the priming vessel and microplate.

2. Install the dispensing cassette into the Multidrop 384 if it is not already installed. Place the dispensing cassette into the rest position (*Fig. 6.18*). Refer to section 6.3 How to insert the priming vessel and the dispensing cassette.

3. Install the tube of the calibration device into the tip of the channel to be recalibrated (*Fig. 7.5*), for example, A.

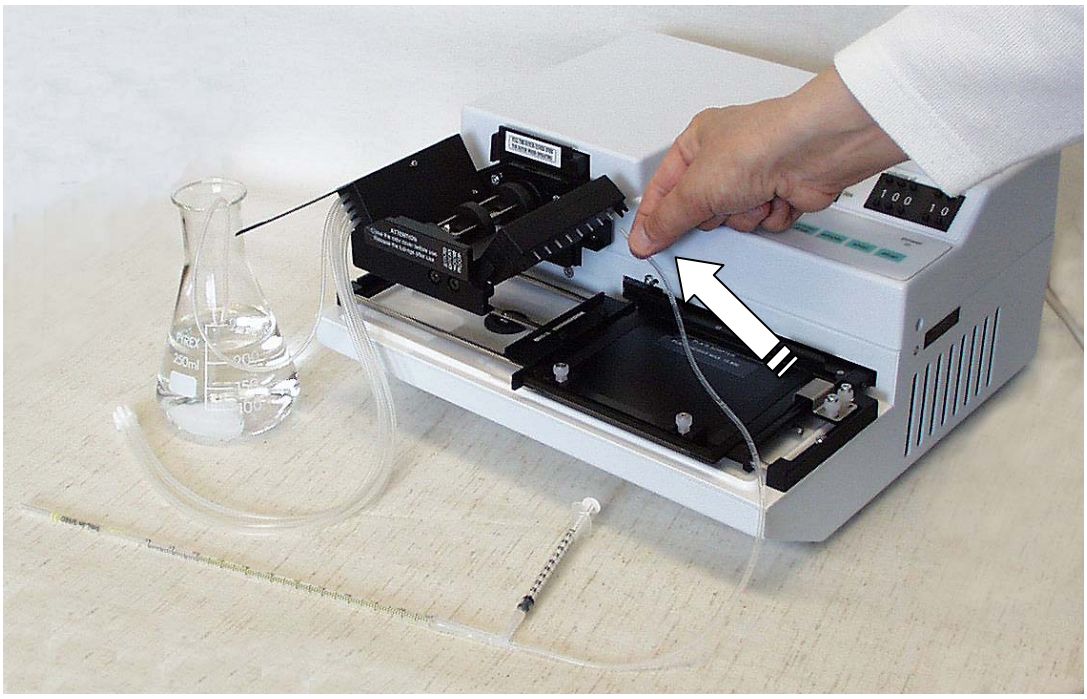


Fig. 7.5 Placing the tube onto the tip of channel A

4. Insert the dispensing cassette into the working position so that the lower and upper parts of the dispensing cassette are inserted into their slots (*Fig. 6.5*).

5. Pull the rotor cover over the rotor.

6. Place the tube of channel A into the reservoir with water at room temperature (working temperature).

7. Open the calibration screw cover on the upper part of the cassette (*Fig. 7.7* and *Fig. 4.4*).

8. Set the volume to 100 µl.

9. Press the **stop** and **prime/drop** keys at the same time. After that first release the **stop** key and then the **prime/drop** key. This brings the Multidrop 384 into the volumetric calibration mode.

10. Press the **start** key as many times until the water enters the calibration pipette.

Note: Take care not to press the **step** key accidentally or otherwise 10 ml of water will be dispensed.

11. Adjust the water level in the pipette to the lower mark by pulling or pushing the syringe piston (*Fig. 7.6*).

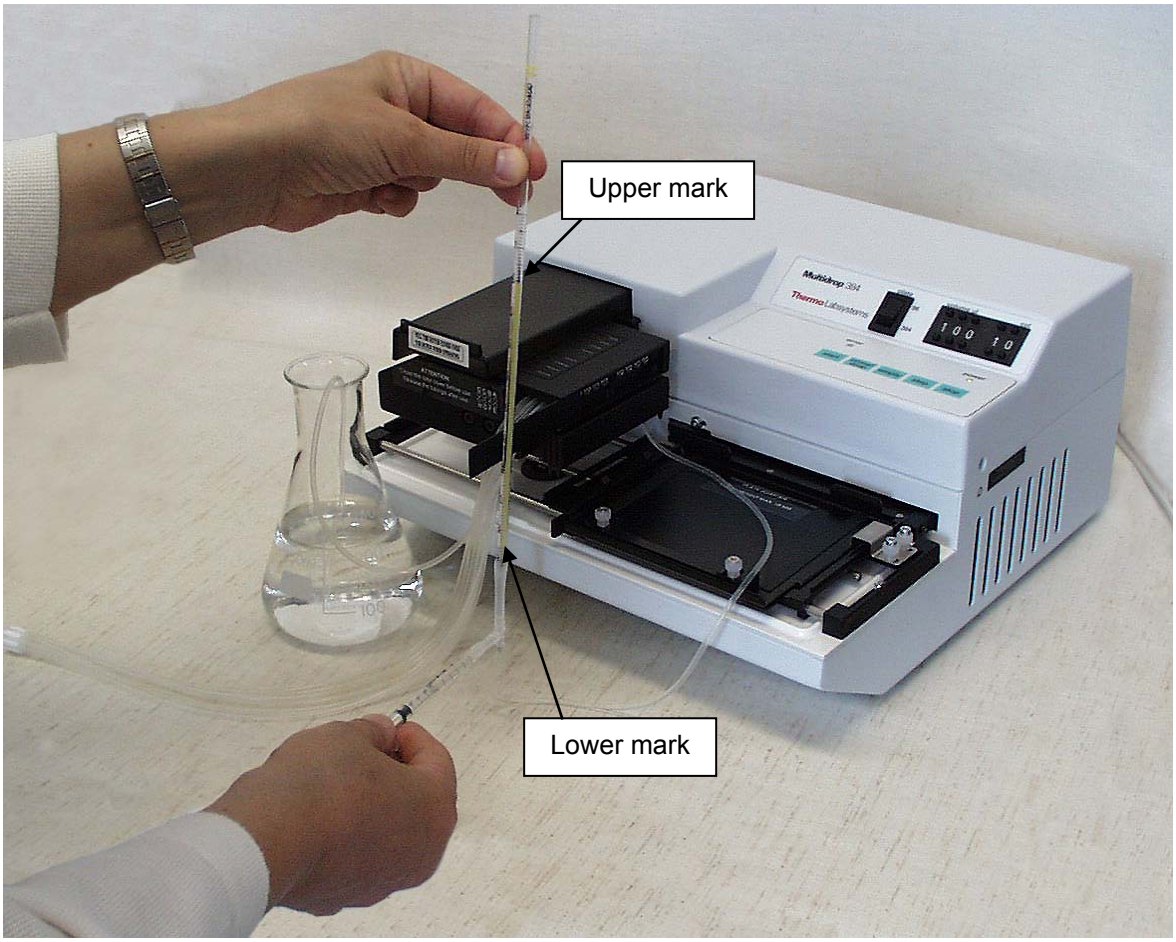


Fig. 7.6 Adjusting the liquid level first to the lower mark and then to the upper mark

12. Press the **start** key and wait until the water level stops. It should be at the upper mark, 1000 µl (± 1.5%) (*Fig. 7.6*).

13. If the volume is higher than 1000 µl, turn the calibration screw (*Fig. 7.7*) clockwise with a screwdriver; one turn for each 10 µl (1% from the volume dispensed); if the volume is lower than 1000 µl, turn in the opposite direction.

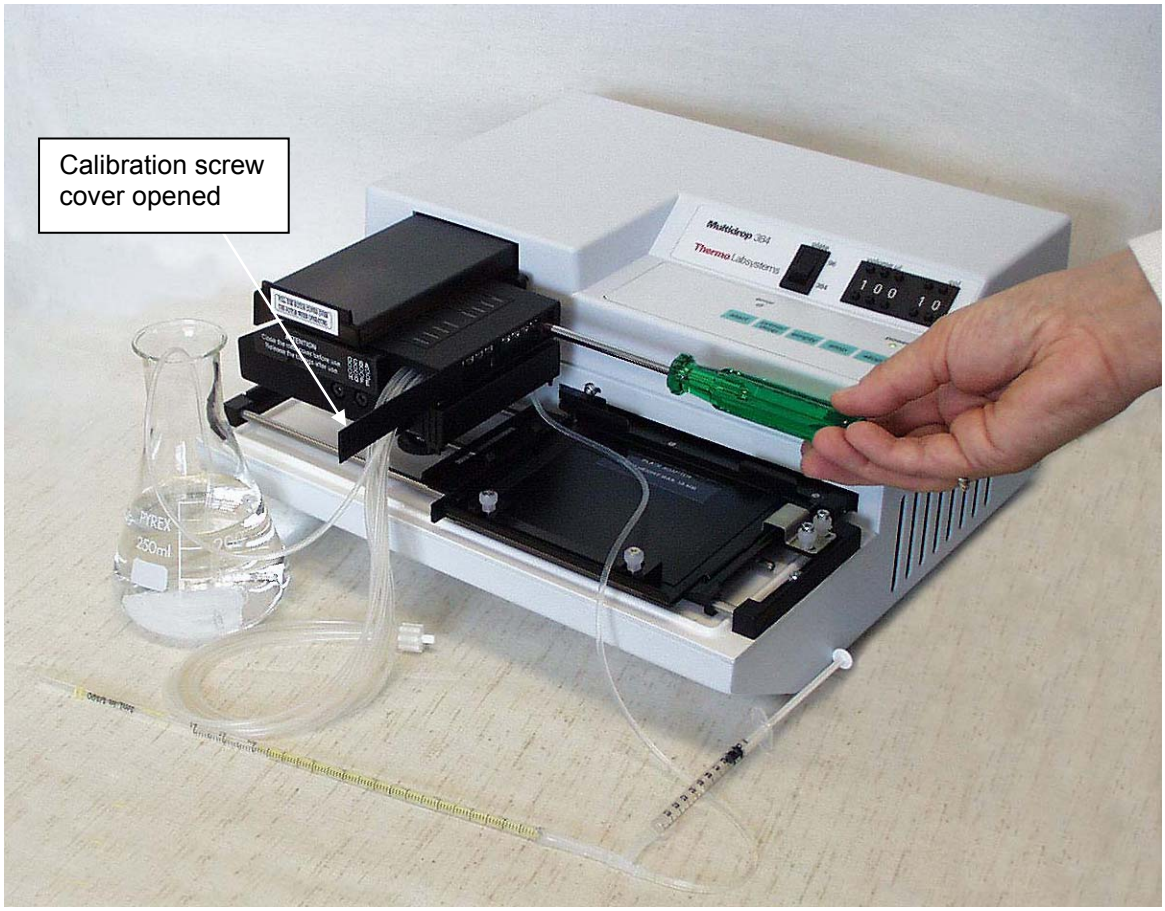


Fig. 7.7 Screwing the calibration screws according to the calibration results

14. Press the **empty** key and adjust the water level in the pipette to the lower mark and repeat Steps 10 to 13 until the result is 1 ml. Three accurate calibrations must be obtained.

15. Change the tube to the next channel and repeat Steps 10 to 14.

16. After all the channels have been recalibrated, press the **stop** key to reset the Multidrop 384 into normal operation and reinstall the priming vessel.

17. Close the calibration screw cover.

7.5.2 Gravimetric calibration

For gravimetric calibration, use the following steps:

1. Install the dispensing cassette into the working position so that the lower and upper parts of the dispensing cassette are inserted into their slots (*Fig. 6.5*).

2. Pull the rotor cover over the rotor.

3. Ensure that the priming vessel is installed. Refer to section 6.3 How to insert the priming vessel and the dispensing cassette.

4. Ensure that you have the plate adapter for 15 mm high plates installed. Refer to section 6.4 How to insert and adjust the plate adapter.

Note: Keep the dispensing cassette in the rest position when the dispensing cassette is not in use.

5. Place the tube of channel A into the reservoir with water at room temperature (working temperature).

6. Use 8 x 12 well microstrips and adjust the Multidrop 384 for 100 µl in 10 columns and set the plate switch (**plate**) for 96-well plates (*Fig. 7.8*).

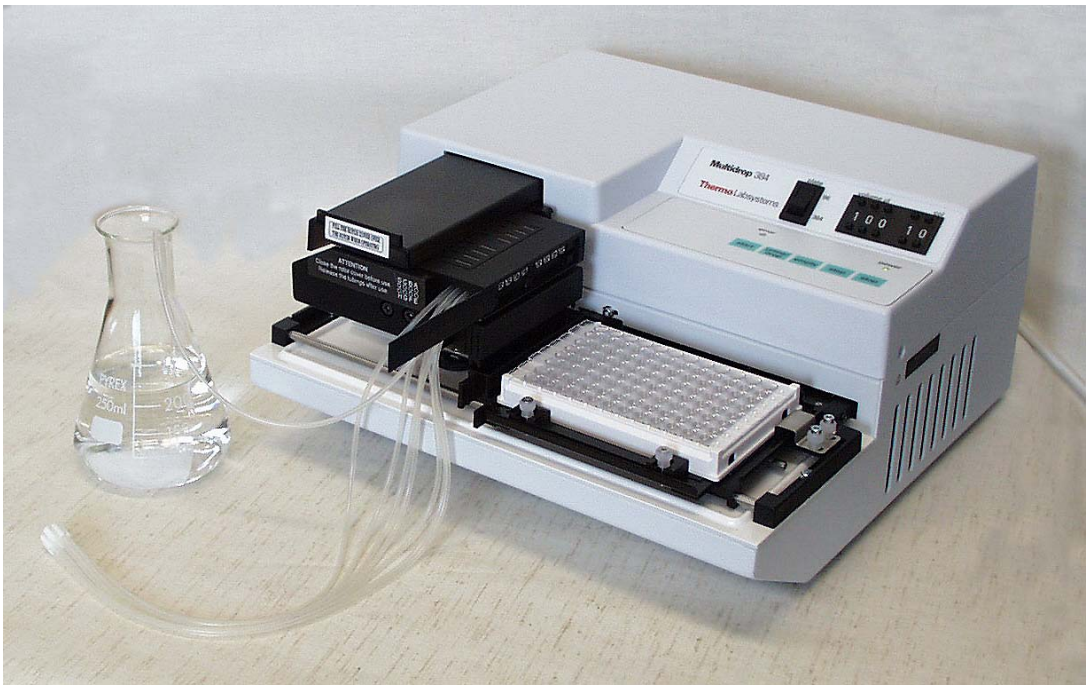


Fig. 7.8 8 x 12 well microstrips adjusted onto the plate adapter

7. Press the **prime/drop** key to prime the tubes. Refer to section 6.7 How to prime.

8. Open the calibration screw cover on the upper part of the cassette.

9. Tare an analytical balance (resolution 0.01 mg) with one empty, dry 1 x 12 well microstrip.

10. Place the microstrip into the microplate frame on the row corresponding to the channel to be recalibrated (from A to H). Press the **start** key.

11. Weigh the filled microstrip (*Fig. 7.9*). The balance should now read 1000 mg ± 20 mg.

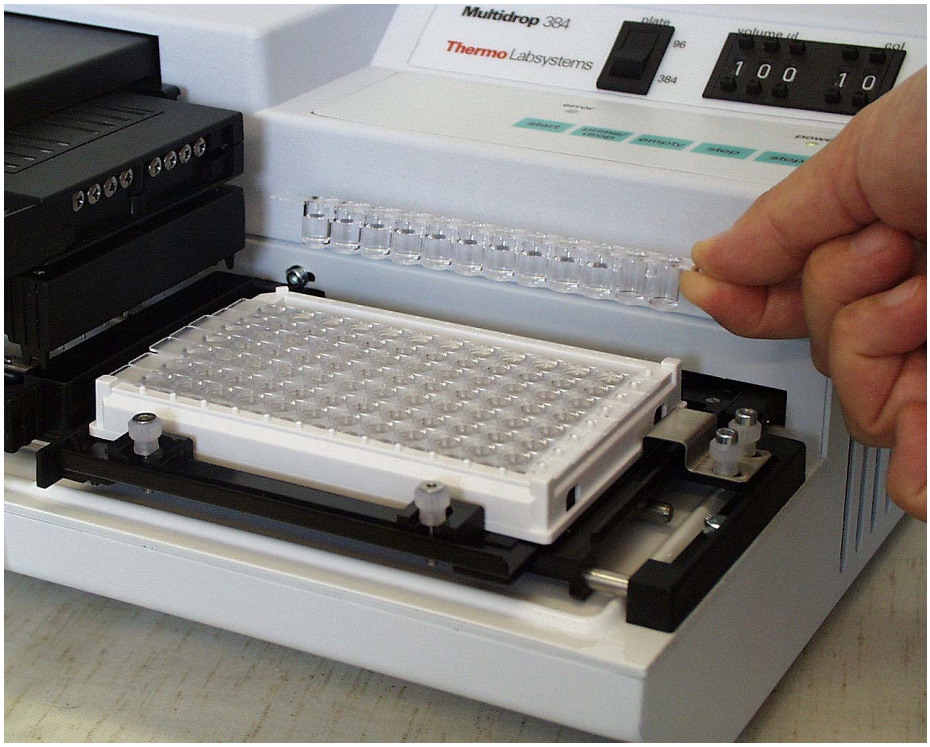


Fig. 7.9 Removing the filled microstrip to be weighed

12. If the balance reads less than 980 mg, turn the calibration screw counterclockwise: one turn for each 10 mg (1% from the volume dispensed). If the balance reads more than 1020 mg, turn in the opposite direction (*Fig. 7.10*). Recheck the delivery after each adjustment using Steps 9 to 11. Three acceptable calibrations must be obtained.

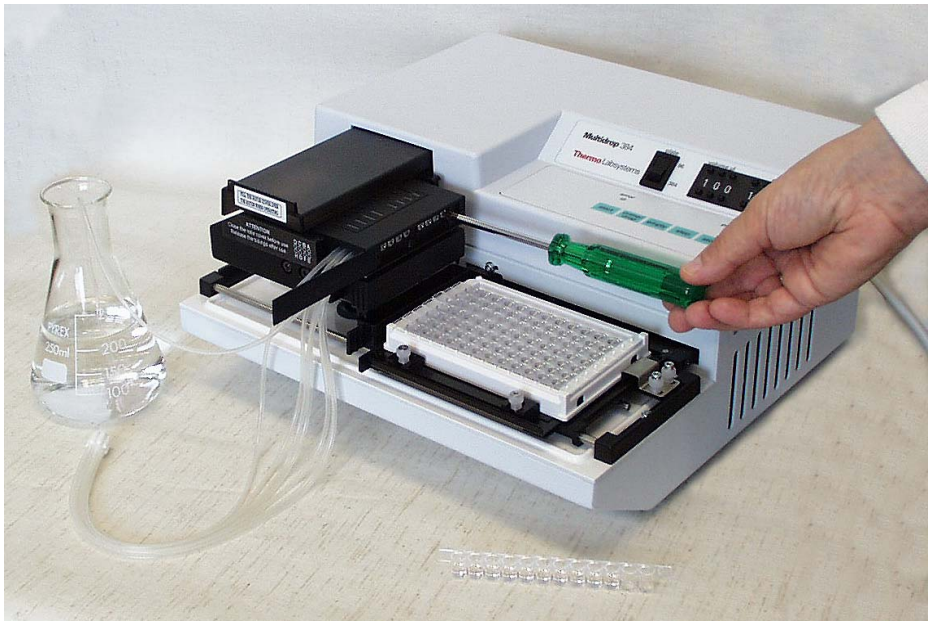


Fig. 7.10 Screwing the calibration screw according to the calibration results

13. Continue in the same way with each channel until all eight channels have been recalibrated.

14. Close the calibration screw cover.

7.6 How to change the tubing set

7.6.1 Changing the tip band

1. Place the dispensing cassette onto the laboratory bench with the dispensing tips pointing down.
2. Unfasten the four cover retaining screws of the lower part of the dispensing cassette (*Fig. 7.11*).

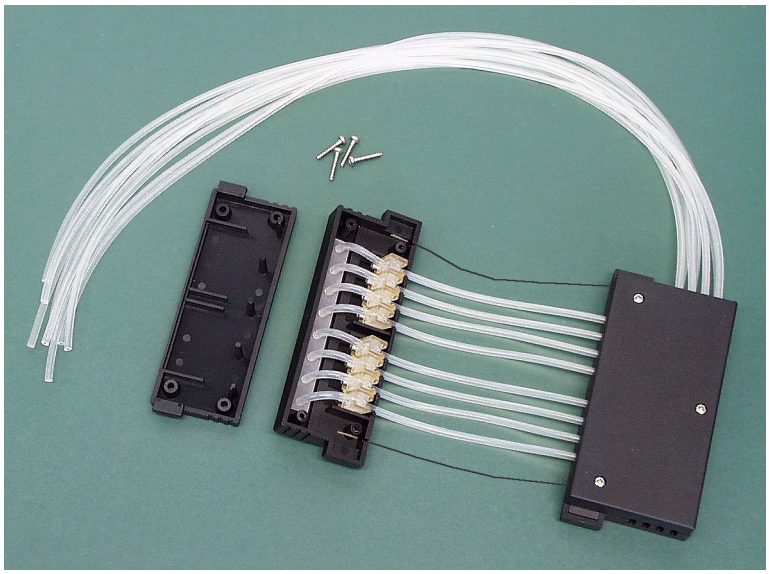


Fig. 7.11 Removing the cover plate of the lower part of the dispensing cassette

3. Remove the tip manifold, the tube fasteners and the rest of the tubing from the lower part of the dispensing cassette. Then detach the tip band from the tubing by pulling the tubes away from the tip band (*Fig. 7.12*).

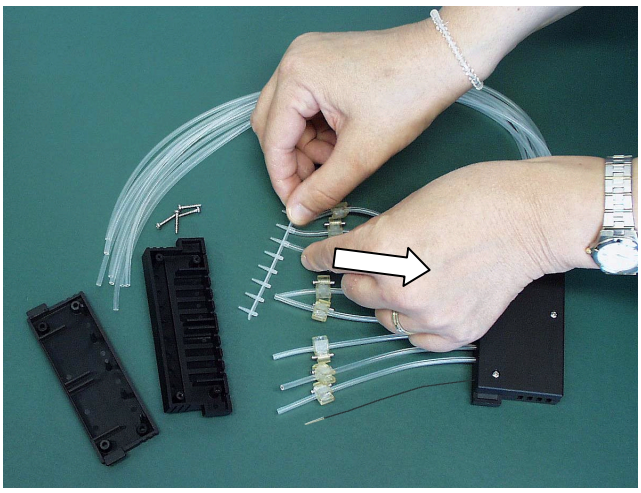


Fig. 7.12 Removing the old tip band

4. Replace the tip band (*Fig. 7.13*). The tips of the tip band must not be clogged in any way but be clean to function correctly (*Fig. 7.14*).

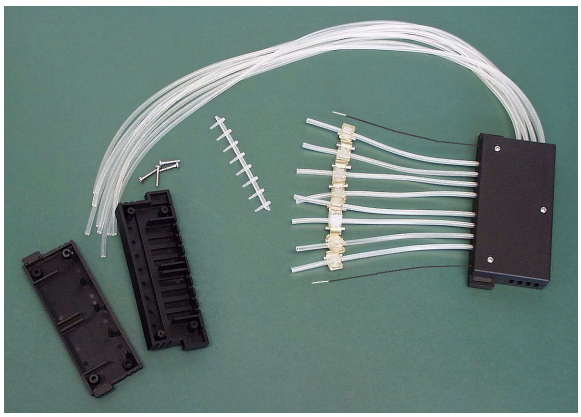


Fig. 7.13 Tip band removed

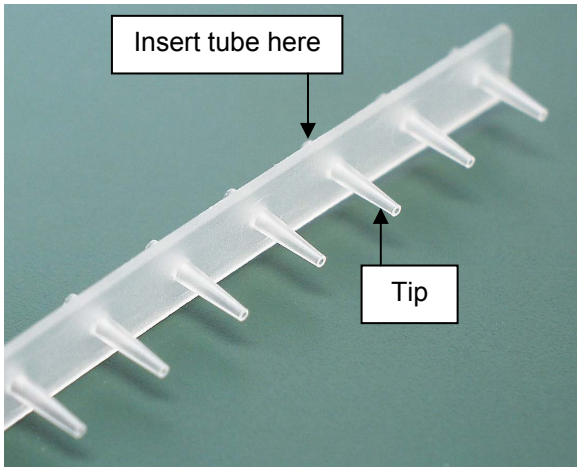


Fig. 7.14 New tip band

7.6.2 Fitting the new tubing set step by step

1. First place the new tubing set onto the laboratory bench with the tip band attached (*Fig. 7.15*). Ensure that you have saved the eight calibration screws and the tubing weight from the previous tubing set.

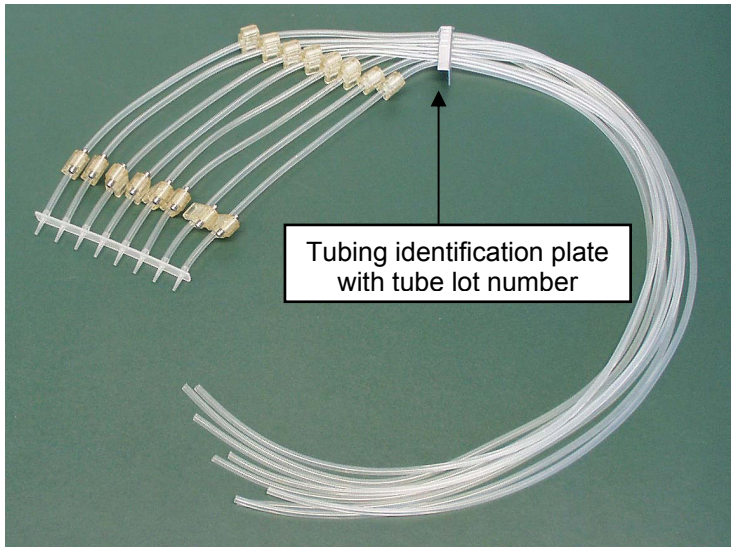


Fig. 7.15 New tubing set with the tip band attached

2. Remove the four cover retaining screws on the lower part of the dispensing cassette, the tubes with the tube fasteners and the tip manifold with the tips, the three cover retaining screws on the upper part of the dispensing cassette, the two tension limiting wires, the calibration screws and the tubes with the tube fasteners. Save the calibration screws and the tubing weight for further use when installing the new tubing set.

3. Insert the tip manifold so that the tips go through the holes in the lower part of the dispensing cassette (*Fig. 7.16*) and guide the tubes through the eight openings in the side wall by pressing the small cubic tube fasteners into place (*Fig. 7.17*). Ensure that each tube is in its designated opening (*Fig. 7.18*).

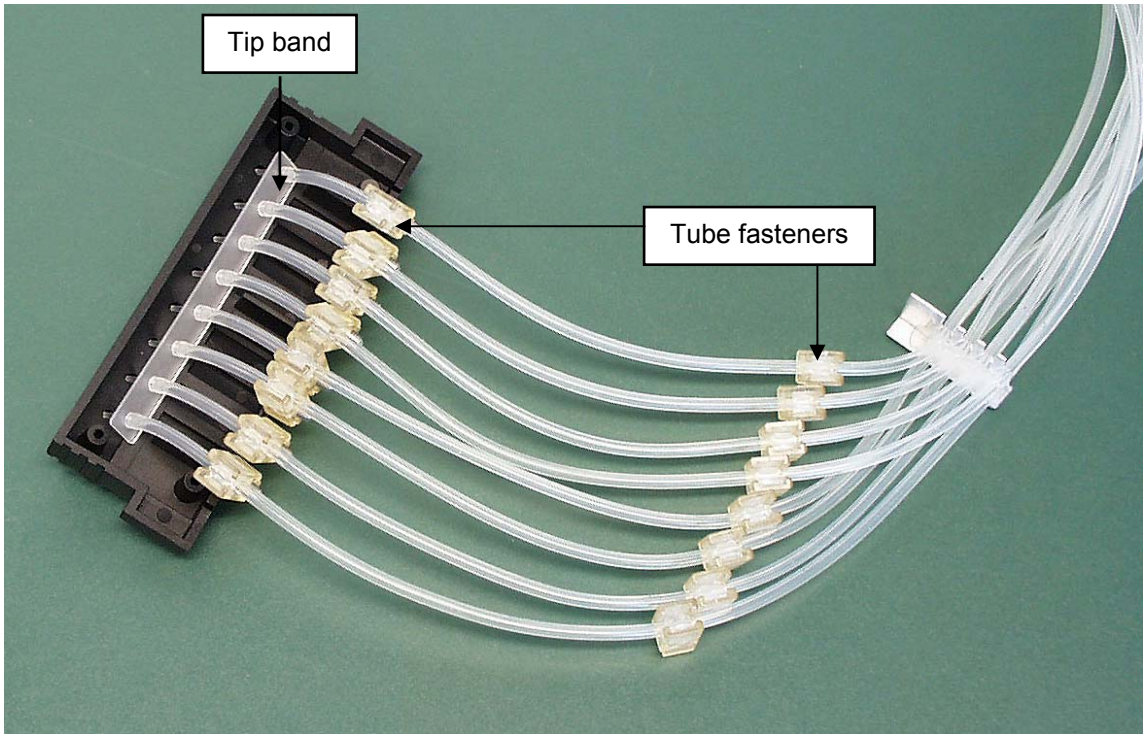


Fig. 7.16 Inserting the tip manifold into the lower part of the dispensing cassette

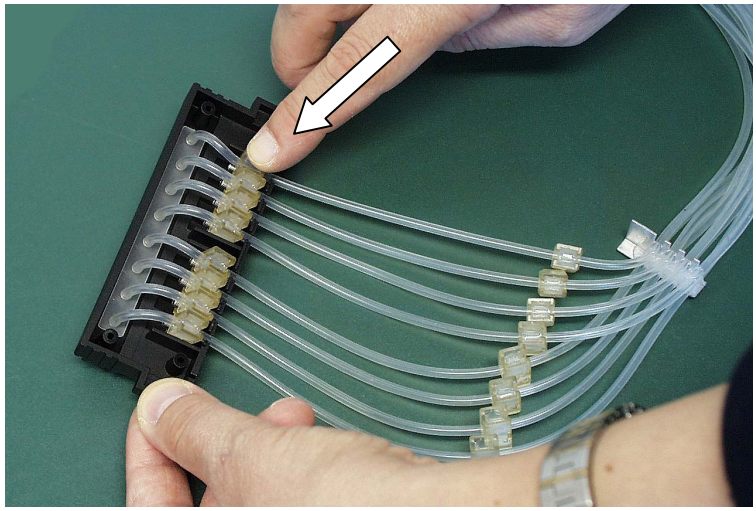


Fig. 7.17 Pressing the tube fasteners into place

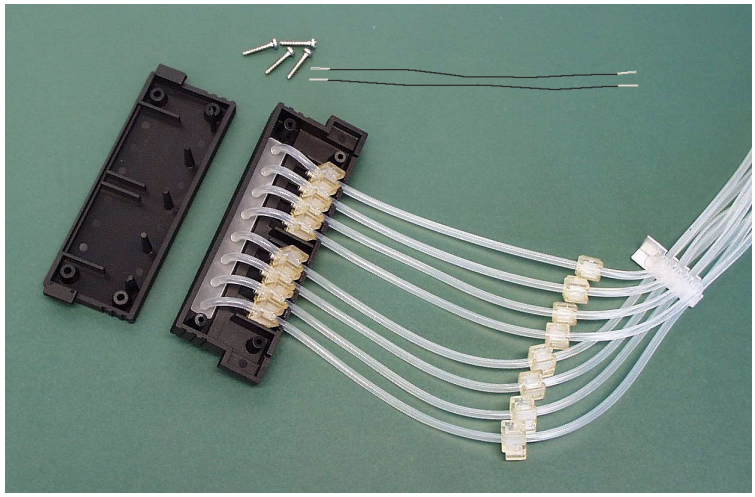


Fig. 7.18 New tubing inserted into the lower part of the dispensing cassette

4. Attach the tension limiting wires into their slots (*Fig. 7.19*).

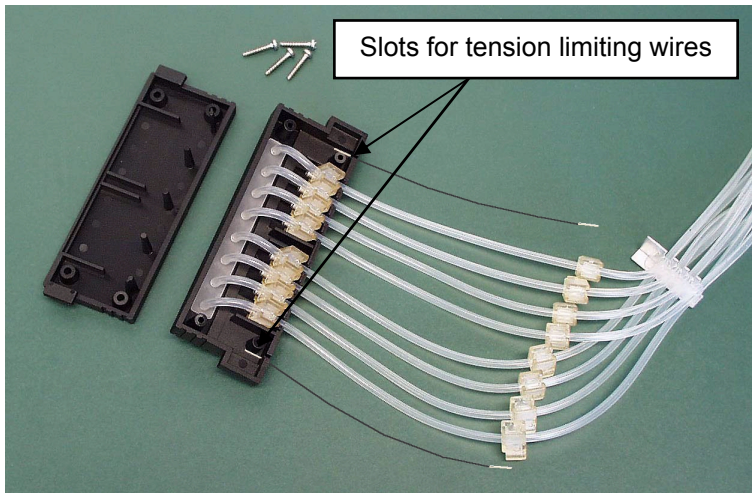


Fig. 7.19 Tension limiting wires attached

5. Fasten the four cover retaining screws of the lower part of the dispensing cassette (*Fig. 7.20*).

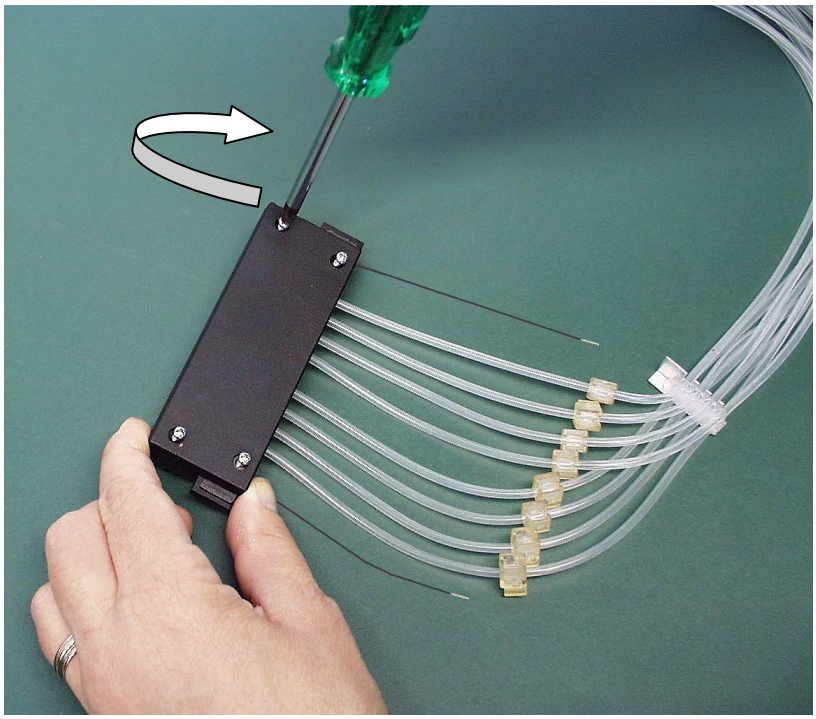


Fig. 7.20 Replacing the lower part cover of the dispensing cassette

6. Once the lower part of the dispensing cassette has been fitted, place the remaining parts belonging to the upper part of the dispensing cassette onto the laboratory bench (*Fig. 7.21*).

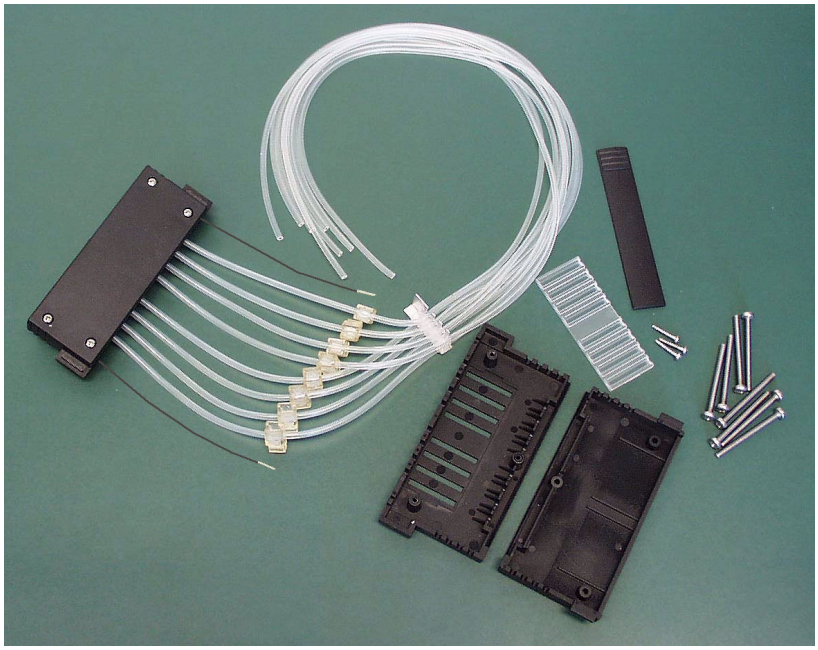


Fig. 7.21 Parts belonging to the upper part of the dispensing cassette

7. First place the plastic sight window with the grooves pointing upwards onto the bottom cover of the upper part of the dispensing cassette, if it is not already there (*Fig. 7.22*).

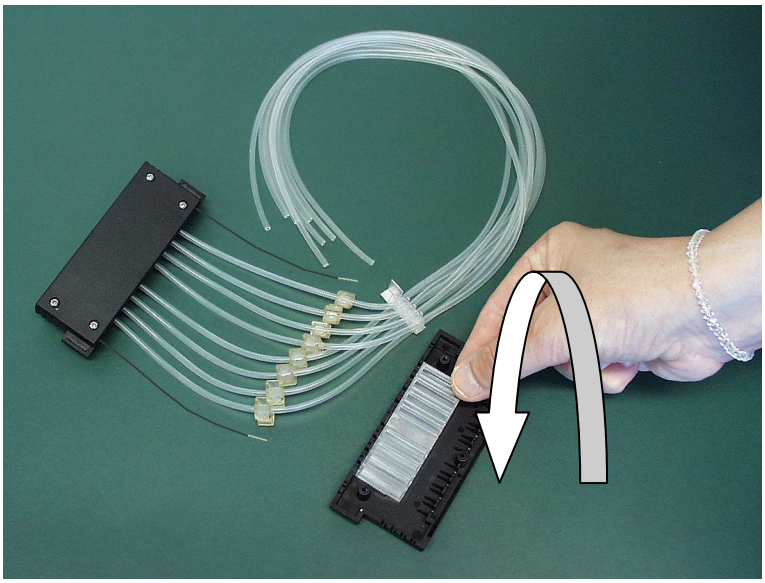


Fig. 7.22 Placing the sight window

8. After that press the white tubing identification plate into place on the right-hand side of the bottom cover of the upper part of the dispensing cassette (*Fig. 7.23*).

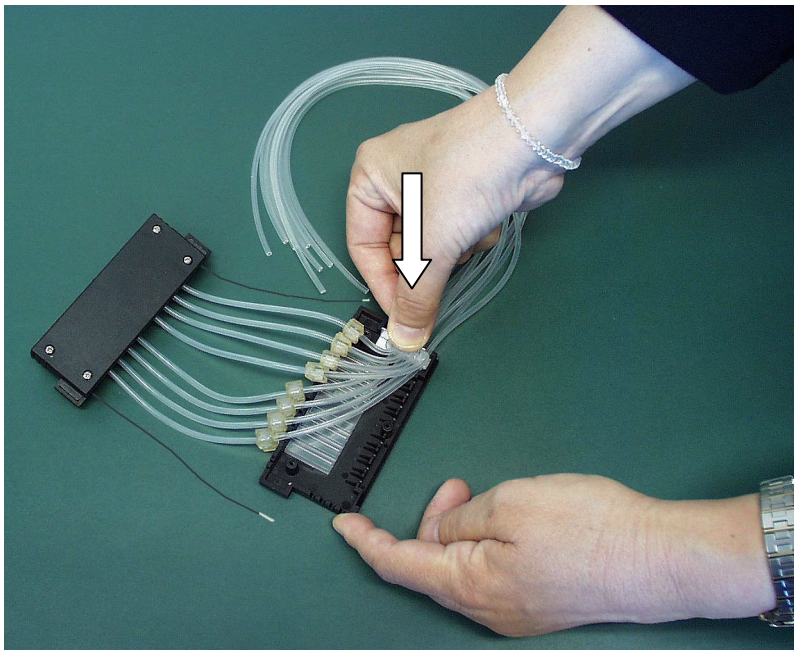


Fig. 7.23 Pressing the tubing identification plate into place

9. Then press each tube fastener into place in its groove on the plastic sight window (*Fig. 7.24*).

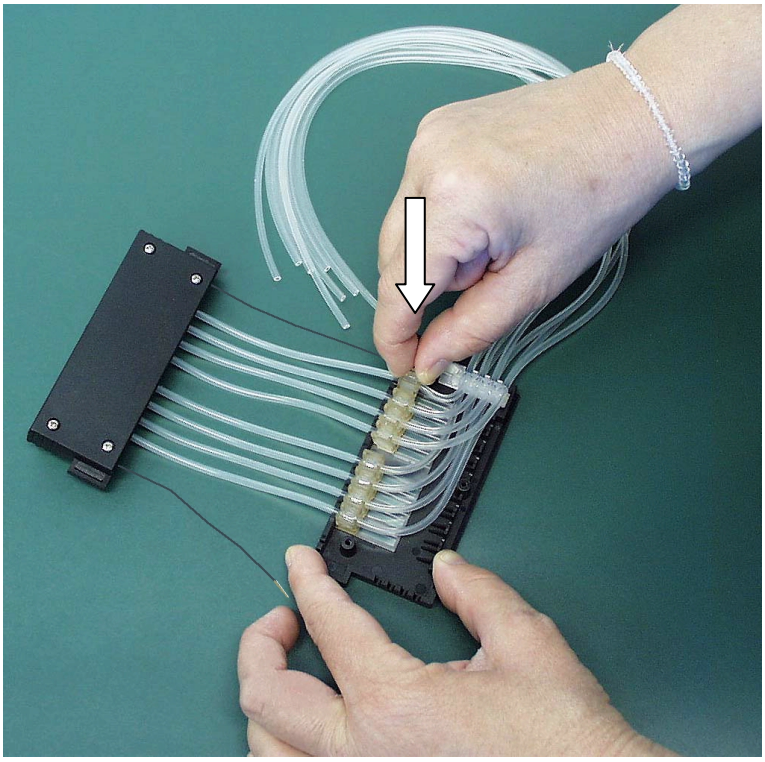


Fig. 7.24 Pressing the tube fasteners into place

10. Fasten the calibration screws from the previous tubing into their places using a hexagonal screwdriver (*Fig. 7.25*).

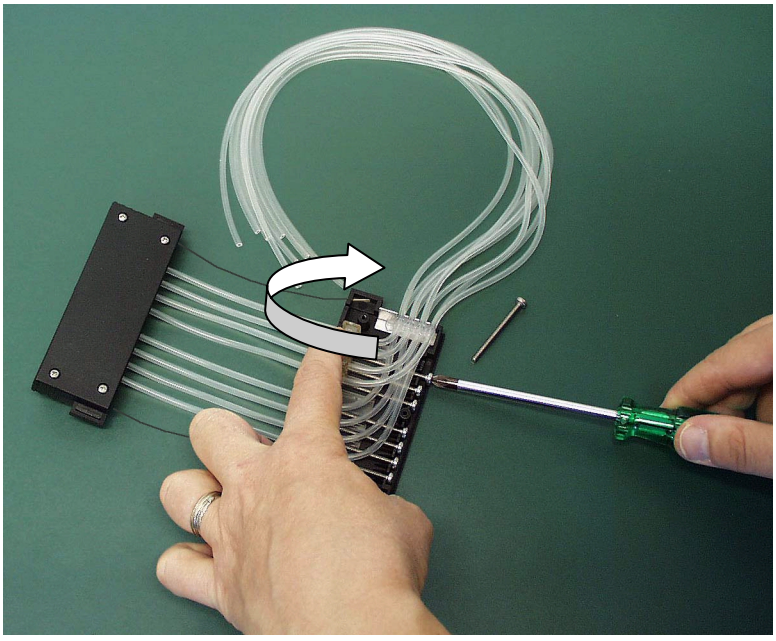


Fig. 7.25 Fastening the calibration screws

11. Insert the tension limiting wires into their slots into the upper part of the dispensing cassette (*Fig. 7.26*).

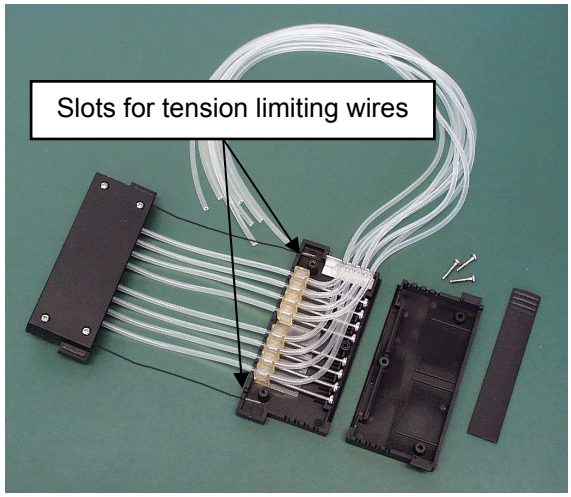


Fig. 7.26 Calibration screws fastened

12. Replace the upper part cover of the dispensing cassette carefully (*Fig. 7.27*).

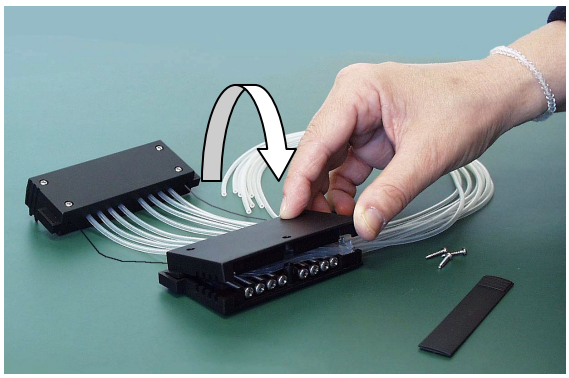


Fig. 7.27 Replacing the cover of the upper part of the dispensing cassette

13. Ensure you do not get the tubing trapped or bent between the bottom and upper cover of the upper part of the dispensing cassette (*Fig. 7.28*).

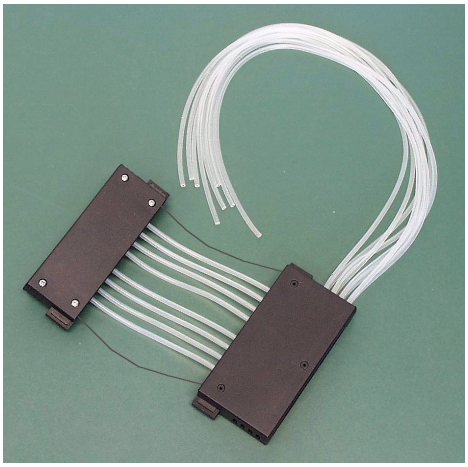


Fig. 7.28 Ensuring the tubing does not get trapped

14. Fasten the three cover retaining screws of the upper part of the dispensing cassette, leaving the front screw slightly open (*Fig. 7.29*).

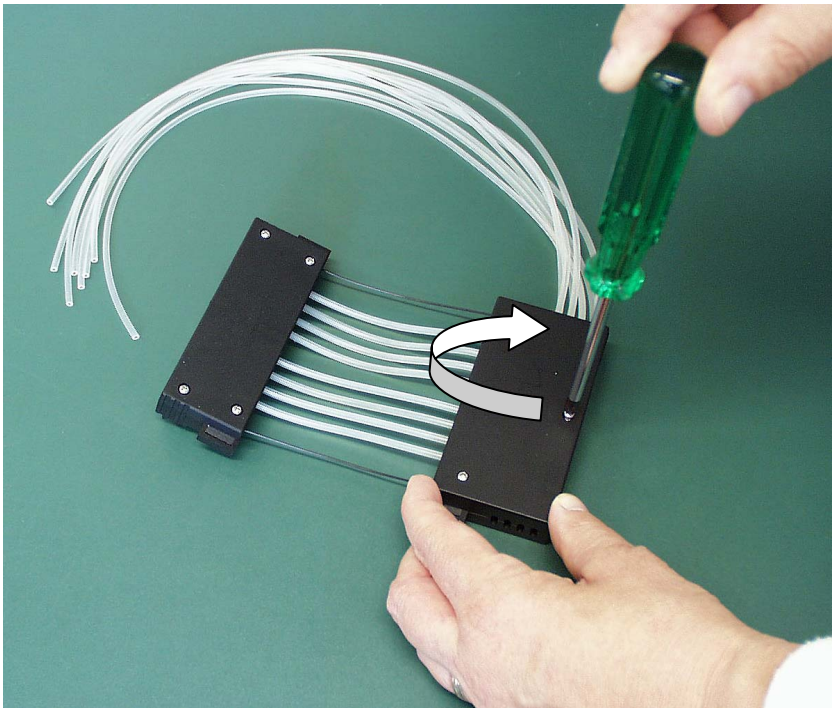


Fig. 7.29 Fastening the cover retaining screws

15. Insert the calibration screw cover easier by lifting or bending the upper cover slightly (*Fig. 7.30*).

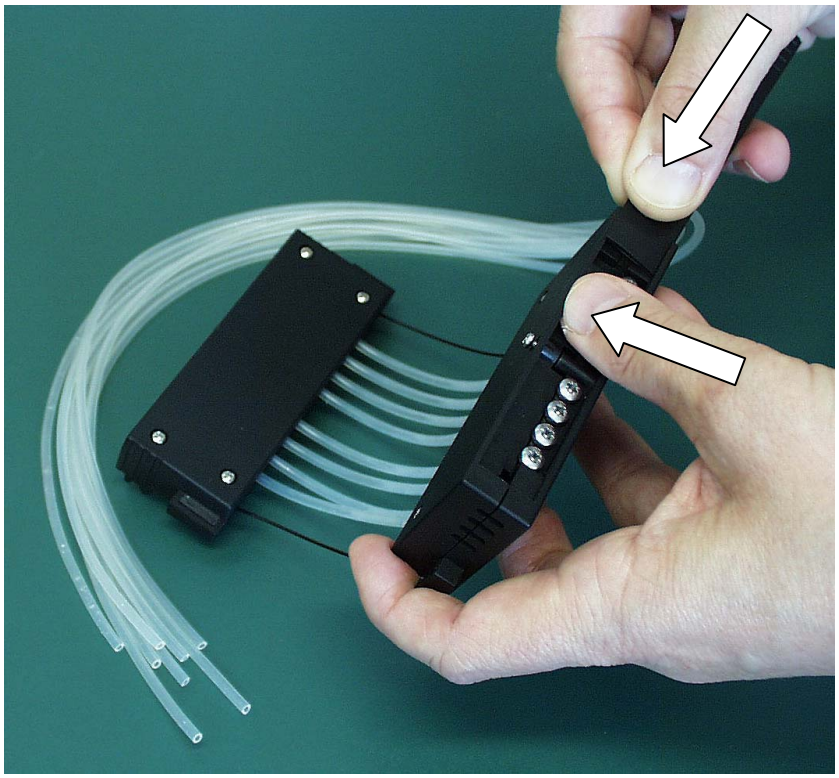


Fig. 7.30 Inserting the plate on the calibration screws

16. Fasten the front cover retaining screw (*Fig. 7.31*). *Continued below*.

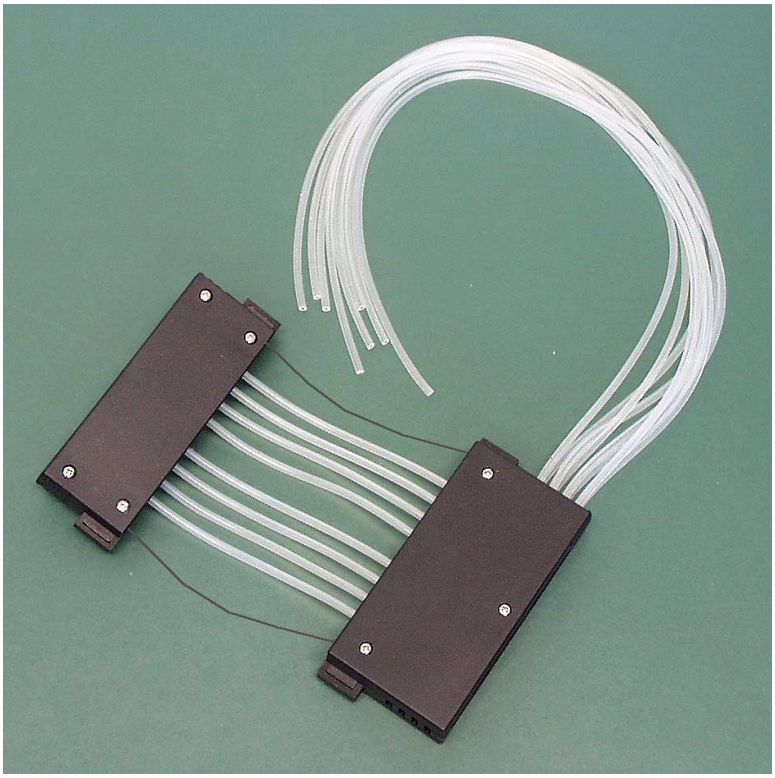


Fig. 7.31 Lower and upper part of the dispensing cassette fitted

17. Turn the dispensing cassette so that the eight sight strips are visible (*Fig. 7.32*). Look at the eight sight strips in the upper part of the dispensing cassette. You will notice that the tubes are not precalibrated. First open the calibration screw cover. For precalibration of the dispensing cassette, adjust the tube fasteners in the sight strips roughly to the middle using a hexagonal screwdriver (*Fig. 7.33*).

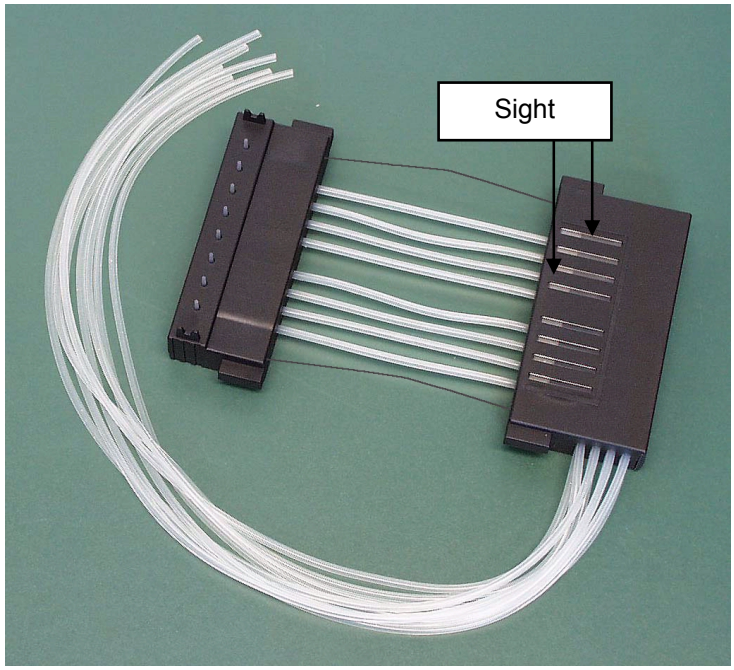


Fig. 7.32 Dispensing cassette before precalibration

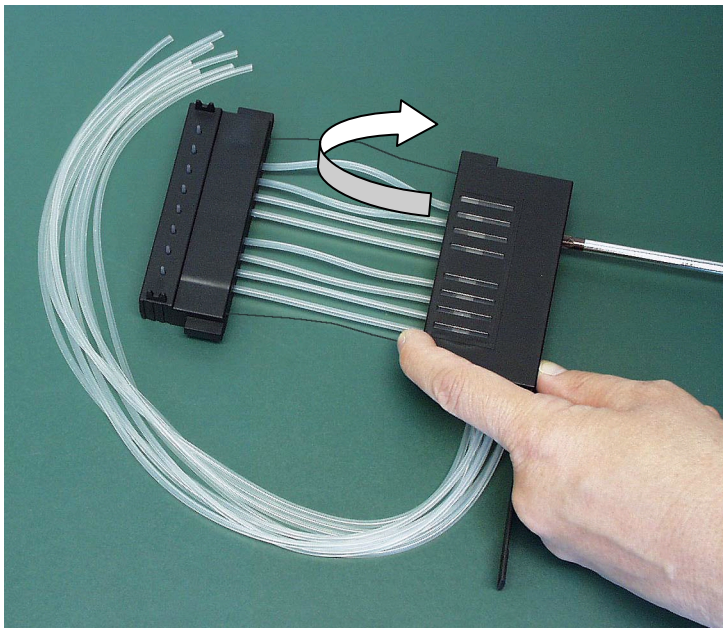


Fig. 7.33 Precalibrating the dispensing cassette

18. When the tube fasteners have all been adjusted roughly to the middle of the sight strip, close the calibration screw cover (*Fig. 7.34*).

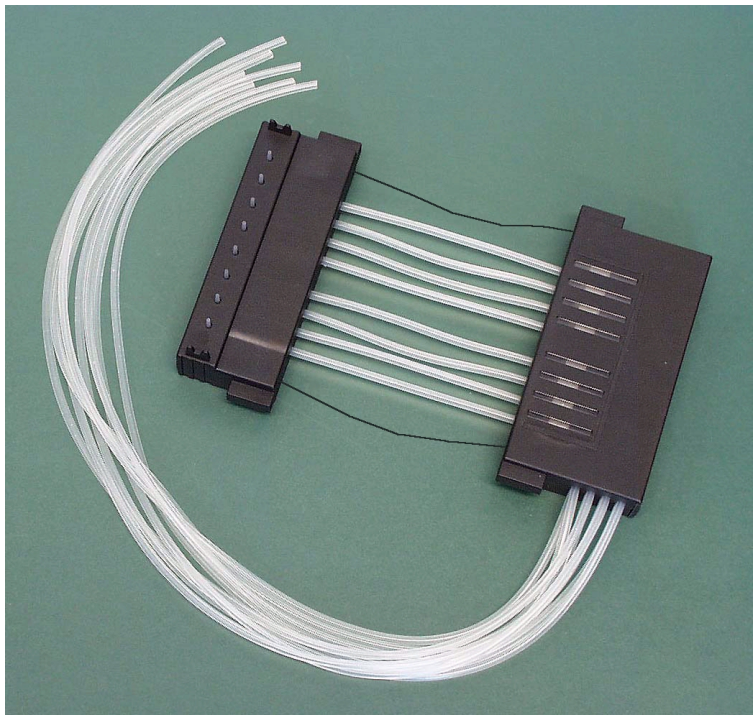


Fig. 7.34 Dispensing cassette precalibrated

19. Insert the eight tubes into the tubing weight either at this stage or earlier (*Fig. 7.35*). The new tubing set has now been successfully fitted.

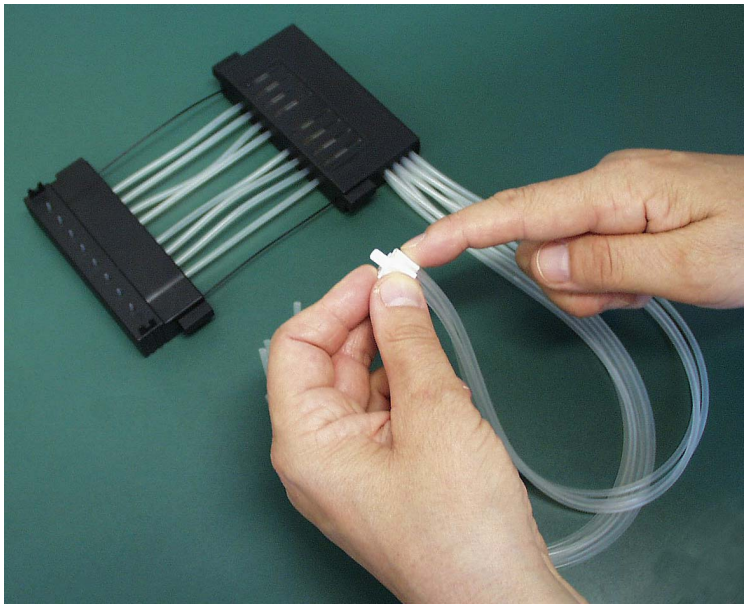


Fig. 7.35 Inserting the tubes into the tubing weight

20. Calibrate the dispensing cassette according to the instructions in section 7.5 How to recalibrate the dispensing cassette.

7.7 Disposal of materials

Refer to local regulations for the disposal of infectious material.

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

7.8 Decontamination procedure

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

You must perform the complete decontamination procedure before shipping the instrument to Thermo Fisher Scientific Oy, for example, for repair, or relocating the instrument from one laboratory to another. Refer to section 7.9 How to pack for service. Decontamination is not required for the proper functioning of the instrument.

Examples of decontaminants

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

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

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

Do not autoclave any other parts of the instrument except the dispensing cassette.

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 container.

3. Switch the power OFF and disconnect the mains supply cable (*Fig. 4.2*).

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

5. Place the plate adapter and dispensing cassette, for example, in 1 – 3% Virkon solution or 200 ml 4% glutaraldehyde solution for 10 min and rinse them with deionized distilled water.

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

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

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

9. Remove the instrument from the bag.

10. Clean the instrument using a mild detergent.

11. Remove any stains using 70% ethanol.

12. Flush the fluid path of the instrument with deionized distilled water using the priming procedure.

13. The dispensing cassette must be autoclaved.

14. Also wash and disinfect the reagent containers.

15. 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.

7.9 How to pack for service

When you ship the instrument for service remember to:

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

See section 8.1 for details on storage and transportation temperatures.

7.10 Service contracts

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

7.11 Disposal of the instrument

1. Decontaminate the instrument prior to disposal. See sections 7.8, 9.4.1 and 9.4.1.1 on decontamination. Also wash and disinfect the dispensing cassettes prior to disposal.

2. 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 proposals for the procedures vary by country.

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

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

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

8 TECHNICAL SPECIFICATIONS

8.1 General specifications

Overall dimensions	310 mm (12.2 in.) (W) x 320 mm (12.6 in.) (D) x 155 mm (6.1 in.) (H)	
Weight (total)	***Instrument*** 6.2 kg [13.7 lbs.] ***Dispensing cassette*** 124 g [0.3 lb.]	
Mains power supply	100 – 120 Vac, 50/60 Hz, nominal (operating range 90 – 130 Vac) 200 – 240 Vac, 50/60 Hz, nominal (operating range 180 – 256 Vac)	
Power consumption	50 VA max.	
Heat dissipation	171 BTU max.	
Fuses	2 x 300 mA for 200 – 240 V, UL 198G Time Delay, 5 x 20 mm 2 x 600 mA for 100 – 120 V, UL 198G Time Delay, 5 x 20 mm	
Operating conditions (indoor use only)	+10°C – +40°C	
Transportation conditions	-40°C – +70°C, packed in transport packaging	
Storage conditions	-25°C – +50°C, packed in transport packaging	
Autoclaving conditions of the dispensing cassette	pressure: 1 bar temperature: 121°C time: 20 min autoclavings: 50 times	
Control panel	Keys: **start**, **prime/drop**, **empty**, **step**, **stop** Selection switches: **plate** (= 96/384), **volume µl**, **col** (= column)	
Interface	Serial RS-232C	
	384-well dispensing	**96-well dispensing**
Dispensing volume	5 – 100 µl in 5 µl increments	5 – 395 µl in 5 µl increments
Dispensing speed	20 s/20 µl into 384 wells	5 s/20 µl into 96 wells
Dispensing accuracy	± 3% or ± 1 µl, whichever is greater *5 µl*: ± 3% or ± 1 µl, whichever is greater *20 µl*: ± 2% (typical*) *100 µl*: ± 1% (typical*) Valid when counted for the entire plate	
Dispensing precision	*5 µl*: CV ≤ 10% or SD ≤ 0.6 µl, whichever is greater *10 – 395 µl*: CV ≤ 3.0% or SD ≤ 0.4 µl, whichever is greater *5 µl*: ≤ 10% (typical) *20 µl*: ≤ 1.5% (typical) *100 µl*: ≤ 1% (typical) Valid when counted for the entire plate	

* using the calibration procedure in section 7.5 the accuracy can be improved to ± 1.5%

8.2 Safety specifications

8.2.1 Live parts

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

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

The Multidrop 384 fulfils the following requirements:

EN 61010-1:1993 + A2:1995/IEC 61010-1:1990 + A1:1992 + A2:1995
taking into account US and CA National differences
EN 61010-1:2001 (Ed. 2)

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

Notes

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

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

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

8.3 In conformity with the requirements

The Multidrop 384 bears the following markings:

Type 832
100 − 120 Vac, 200 − 240 Vac 50/60 Hz, 50 VA
CE mark
CSA monogram

The Multidrop 384 conforms to the following requirements:

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

Safety performance:

EN 61010-1:1993 + A2:1995/IEC 61010-1:1990 + A1:1992 + A2:1995
taking into account US and CA National differences
EN 61010-1:2001 (Ed. 2)

EMC performance:

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

Test standards and	**Performance limits**
EN 55022:1998	Class B, 150 kHz − 1 GHz
EN 61000-3-2:1995 + A1:1998 + A2:1998 + A13:1997 + A14:2000	Class A
EN 61000-3-3:1995	
ANSI C63.4:1992	Class B, 450 kHz − 1 GHz
EN 61000-4-2:1995 + A1:1998	4 kV CD, 8 kV AD, Criteria B
EN 61000-4-3:1996 + A1:1998	3 V/m, 80 MHz − 2 GHz, Criteria A
EN 61000-4-4:1995	1 kV, Criteria B
EN 61000-4-5:1995	2 kV line to ground, 1 kV line to line, Criteria B
EN 61000-4-6:1996	3 V_{rms}, 150 kHz − 80 MHz, Criteria A
EN 61000-4-8:1994	3 A/m, Criteria A
EN 61000-4-11:1994	30%/10 ms, Criteria B 60%/100 ms, Criteria C 100%/20 ms, Criteria B > 95%/5 s, Criteria C

8.4 Remote control to Multidrop 384

The interface system consists of the serial RS-232C computer port which is used for computer control.

8.4.1 Hardware for the computer port

The character length is 10 bits with 1 start bit, 8 data bits, 1 stop bit and no parity. The format cannot be changed.

The following signals are connected to the computer port DB-25 connector at the rear of the instrument:

DB-25 CONNECTOR	
Pin no.	*Signal name*
2	TxD
3	RxD
4	RTS
7	GND
20	DTR

Signal description

2: TxD, transmit data (output)
3: RxD, receive data (input)
7: GND, signal ground
4/20: RTS/DTR (handshake lines)

The handshake lines:
RTS/DTR are not in use in the standard Multidrop 384.

8.4.2 Multidrop 384 PC interface

Baudrate	9600
Parity	None
Data bits	8
Stop bits	1
Handshake	XON/XOFF

Commands

Commands to the Multidrop 384 have two to three fields as described in the following syntax. The first letter identifies the command. Then a numeric argument field is optional for some and required for other commands. The numeric field immediately follows the uppercase letter without any separating characters. The last character of a command is a linefeed character <LF> or a carriage return character <CR>. Commands may also be terminated to <CR><LF> or <LF><CR>, since the instrument ignores empty commands.

In the following list of commands, the command arguments in square brackets are optional.

D<LF> Dispense the volume set by the 'V' command to the entire plate.
Primes 10 µl into the priming vessel before dispensing.

E<LF> Empty the pump. A volume of 880 µl is pumped backwards.

G<LF> Dispense the plate using parameters from the plate switch and the volume/columns thumbwheels. This command has the same effect as pressing the **start** key. This command has been added to version 1.7.

M[c]<LF> Dispense the given number of columns starting from the current column. If the column count is not given, one column is dispensed. The dispensing volume is set by the 'V' command. After the command is completed, the dispensing tips remain at the last column dispensed. If this command is received when the plate is in the home position, dispensing starts from column 1. ER3 is reported if more columns are requested than left over from the current column to the last column of the plate.

N<LF> Report the internal software version of the instrument.

O<LF> Drive the plate out to the priming position.

P[v]<LF> Prime the given volume. For a 96-well plate the volume must be in the range of 5 to 1000 µl. For a 384-well plate the range is 5 to 100 µl. The volume must be dispensed in 5 µl increments. If the volume is not given, 200 µl is primed. If the plate is not in the home position when the command is received, it is first driven into home position.

Q<LF> Reset the instrument. There is no response to this command.

S[c]<LF> Drive the requested column under the dispensing tips. Valid columns are 1 to 12 for a 96-well plate and 1 to 24 for a 384-well plate. If the column is not given, the steps are one column forward or the plate returns to home position after the last column.

Tt<LF> Set the plate type assumed for all other commands except the ‘G’ command. At startup the default type is read from the plate switch.

t = 0 96-well plate
t = 1 384-well plate
This command has been added to version 1.7.

V<LF>
VER<LF> Report the internal software version of the instrument just like the ‘N’ command.

Vv<LF> Sets the volume for dispensing. For a 96-well plate the volume must be in the range of 5 to 1000 µl. For a 384-well plate the range is 5 to 140 µl. The volume must be dispensed in 5 µl increments.

Zs<LF> Shake the plate the desired amount of time. The time is seconds and may range from 1 to 60.

Responses and error codes

The instrument sends a response to each command after the command has been executed. The only exception is the 'Q' command, for which there is no response.

The response to an 'N' command is as follows:

Mdrop384 Vr.l[-b]<CR><LF>

where:
r is the release number;
l is the level number, and
b is the optional branch number.

The response to other commands, if the command is executed successfully, is as follows:

OK<CR><LF>

If an error is detected, the response is one of the following:

ER3<CR><LF> Unrecognized command or invalid command argument.
ER4<CR><LF> The pump is not primed.
ER5<CR><LF> The priming vessel is not inserted into its slot.
ER6<CR><LF> Hardware error. The instrument stops and must be reset manually.

9 TROUBLESHOOTING

9.1 Troubleshooting guide

The problems covered below are considered as faults that require repair or corrective work. If the installation procedure is carefully followed, no faults should arise. However, if problems do occur or reoccur, contact authorized technical service immediately.

Error	*Cause*	*Action*
No power to the instrument	The instrument has not been connected to the mains.	Connect the instrument to the mains.
	A fuse has blown.	Replace the blown fuse, refer to section 7.4.
The keys do not function		Check that the rotor cover is over the rotor.
		Check that the priming vessel is properly inserted into its slot.
Drop on the end of the tip exceptionally large	The tip is defective or clogged.	Clear the tip with a needle or replace the tip strip.
	The tube is defective.	Replace the tubes.
	The dispensing cassette is not properly installed.	Reinstall the cassette.
Large air bubbles in the tubes	The instrument is not primed.	Prime, refer to section 6.7.
Poor dispensing accuracy and precision	The dispensing cassette is not properly installed.	Reinstall the cassette.
	The tubes are worn out.	Replace the tubes.
	There is friction on one of the rotor needles. Bearing malfunction.	The rotor needles should spin without any friction. If even a slight friction is present, contact authorized technical service.
Liquid being dispensed does not fall into the required well of the microplate	The dispensing cassette is not properly installed.	Reinstall the cassette.
	The tip is defective or clogged.	Clear the tip with a needle or replace the tip strip.
Plate carrier moves incorrectly	There is foreign matter in the way of the carrier.	Remove the foreign matter.
	The drive band of the drive wheel is worn out or broken.	Contact authorized technical service.
	The drive wheel is loose.	Contact authorized technical service.
	The drive wheel is not properly adjusted.	Contact authorized technical service.
Instrument does not function		Contact authorized technical service.
The **error** LED operates when trying to **prime**	The priming vessel is not present.	Insert the priming vessel.
	There is dirt in the priming vessel sensor.	Clean the priming vessel sensor.

9.2 FAQs about the Multidrop 384

Q1: Can the same dispensing cassette be used in all Multidrop models?
A1: No, use only dispensing cassettes designed for Multidrop 384. It is not possible to use small tube dispensing cassettes.

Q2: How many times can the dispensing cassette be autoclaved?
A2: Fifty times.

Q3: What are the autoclaving conditions for the dispensing cassette?
A3: The autoclaving conditions are as follows: 1 bar pressure at 121°C for 20 min.

Q4: What is the dead volume of the standard 40 cm tubing set?
A4: The dead volume is about 5.6 ml. Note that you do not waste the reagent due to the special backflush feature of the Multidrop 384, with which you can empty your reagents from the tubing back into the original container.

Q5: What liquid is recommended to be used for washing the Multidrop 384 tubes?
A5: It is recommended you use deionized distilled water and/or detergent solutions, for example, 0.2 – 1% Tween followed by deionized distilled water.

Q6: What is the material of the Multidrop 384 priming vessel?
A6: The Multidrop 384 priming vessel is made of black polypropylene (PP).

Q7: What is the material of the dispensing cassette tip band?
A7: The tip band (*Fig. 7.14*) material is polypropylene (PP). The melting temperature of the material is 160 – 165°C.

Q8: **Can ultraviolet light be used for sterilization?**
A8: Ultraviolet rays can be used to sterilize objects, for example, the surface of the Multidrop 384 instrument and other areas where destruction of bacteria is necessary.

Q9: **When should I calibrate the dispensing cassette?**
A9: The dispensing cassette needs to be calibrated when the silicone tubes have been changed. It is also recommended you recalibrate the dispensing cassette after dispensing about 1000 96-well plates or after every three months. The dispensing cassette must also be recalibrated if it has been forgotten under tension for prolonged periods, for example, a weekend or longer.

Q10: **What is the dead volume of the 2 m tubing set?**
A10: The dead volume is about 24 ml.

9.3 Hazards

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

The following recommendations are given to ascertain added user safety.

9.3.1 Electrical

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

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

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

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

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

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

9.3.2 Mechanical

The dispensing cassette 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** key on the control panel.

9.3.3 Environmental

Infectious samples and corrosive fluids are commonly used with this equipment. The 'hands-off' nature of the system allows the user to 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 before and after the dispensing process, and this should be done with utmost care. Hand and eye protections should always be worn as well as corrosive resistant laboratory coats.

Observe normal laboratory procedures for handling potentially hazardous samples.

9.3.4 Defects and abnormal stresses

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

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

1. shows visible damage;
2. fails to perform the intended functions;
3. has been subjected to prolonged storage under unfavorable conditions, or
4. has been subjected to severe transport stresses.

9.4 Service request protocol

If the Multidrop 384 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.

The 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 in and forward the Warranty Claim Technical Sheet to the Thermo Fisher Scientific technical service department.

Check section 7.9 How to pack for service. You will find instructions on how to proceed before shipping the instrument for service.

Check that any necessary decontamination procedure has been carried out before packing. See sections 9.4.1 and 9.4.1.1 on decontamination. Refer also to section 7.8 Decontamination procedure. Ensure that the 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.

9.4.1 Decontamination

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

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

9.4.1.1 Certificate of Decontamination

The decontamination procedure is required prior to shipping the instrument to Thermo Fisher Scientific Oy, for example, for repair. If, for any reason, the instrument is shipped back to Thermo Fisher Scientific Oy, it must be accompanied by a dated and signed Certificate of Decontamination, which must be attached to the outside of the package containing the instrument. See section 7.8 Decontamination procedure.

Failure to confirm decontamination will incur additional labor charges or at worst the items will be returned for proper cleaning.
Before returning any instrument(s) or item(s), ensure that they are fully decontaminated. Confirm A or B status:

Name: _____

Address: _____

Tel./Fax: _____

Name: _____ Serial no.: _____

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

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

Specific information about contaminants: _____

_____

Decontamination procedure[1]: _____

_____

_____

Date and place: _____

Signature: _____

Name (block capitals): _____

*) The signature of a Radiation Safety Officer is also required when the unit has been used with radioactive materials.
This unit is certified by the undersigned to be free of radioactive contamination.

Date and place: _____

Signature: _____

Name (block capitals): _____

PHOTOCOPIABLE

[1] Please include decontaminating solution used.

10 WARRANTY CERTIFICATE

10.1 Warranty Certificate

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

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

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

This guarantee is subject to the following exclusions:

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

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

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

Note: Consumables are not included in the warranty.

11 ORDERING INFORMATION

11.1 Instruments

Code	*Instrument*
5840150	Multidrop 384, 220 – 240 V 50/60 Hz
5840157	Multidrop 384, 110 – 120 V 50/60 Hz

11.2 Dispensing cassettes

Code	*Dispensing cassette*
24072670	Standard tube dispensing cassette (with 40 cm tubing set)
24072671	Standard tube dispensing cassette 5-pack
24072672	Standard tube dispensing cassette 10-pack
24072677	Long standard tube dispensing cassette (length of tubing 50 – 200 cm in 10 cm increments, please specify the length when ordering)
24070300	Dispensing cassette Machined covers (with 40 cm tubing set) (*Fig. 11.1*)
24070307	Special dispensing cassette Multidrop, Machined covers (length of tubing 50 – 200 cm in 10 cm increments, please specify the length when ordering)

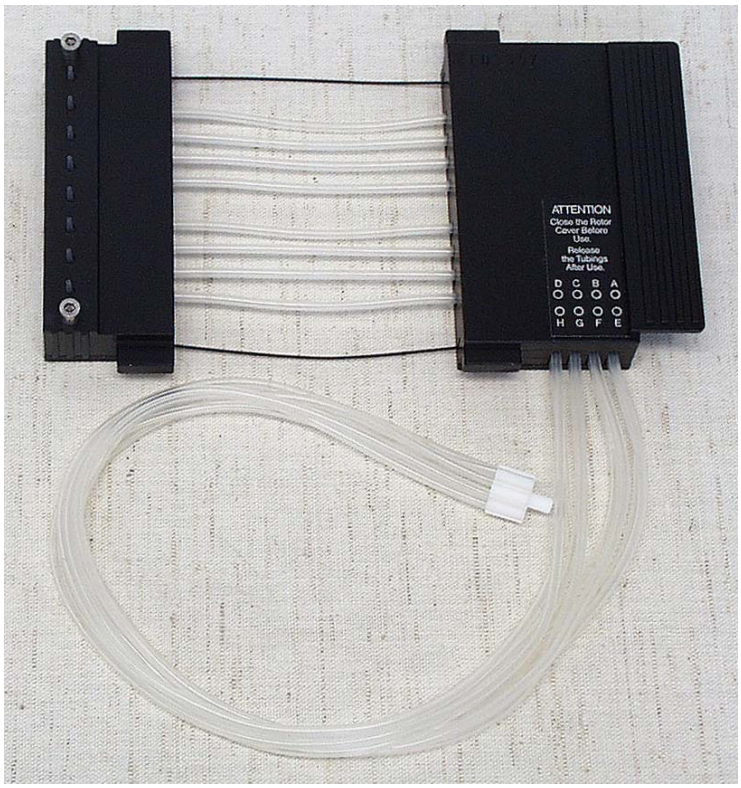


Fig. 11.1 Dispensing cassette Machined covers

11.3 Spare parts for dispensing cassettes

Code	Item
24070290	Tubing set for dispensing cassette (with 40 cm tubing set)
24070297	Special tubing set for dispensing cassette, special tubing set Multidrop (length of tubing 50 – 200 cm in 10 cm increments, please specify the length when ordering)
1046200	Tube tip manifold
1190780	Tubing weight, eight tubes
1002430	Tubing weight, one tube
2805980	Tube holder assembly

11.4 Priming vessels (consumables)

Code	Priming vessel
1046240	Priming vessel, one cavity
1046241	Priming vessel, eight cavities
10260315	Self-draining priming vessel

11.5 List of accessories

Code	Item
1507010	*Multidrop 384 User Manual*
2406910	Volumetric calibration device
1610641	Dust cover
24071790	Plate adapter (max. 15 mm height)
24071800	Plate adapter (max. 11 mm height)
2305290	Serial cable F9/F25

11.6 List of plates (consumables)

Code	Item	Qty
	96-well microplates	
3355	Immulon 1B Plate, Flat bottom	50 pcs/box
9502227	96 Well Plate UB, Flat bottom	50 pcs/box
7571	Microlite 1 + Plate, Flat bottom	50 pcs/box
9502887	White 96 Well Plate UB, Flat bottom	50 pcs/box
7605	Microfluor 1 Black Plate, Flat bottom	50 pcs/box
9502867	Black 96 Well Plate UB, Flat bottom	50 pcs/box
6310	Immulon 1 B 1x12 Strip Plate, Flat bottom	100 pcs/box
	384-well microplates	
95040000	384 Round Well Plate	50 pcs/box
95040020	White 384 Round Well Plate	50 pcs/box

11.7 List of spare parts

Code	Item	Qty
1210810	Fuse 300 mA	10 pcs/box
1210850	Fuse 600 mA	10 pcs/box

11.8 List of recommended spare parts

Cat. no.	Item	1 – 2 unit(s) / year	10 units / year
10478101	Carriage		1
1093270	Tooth belt	1	4
1100420	Transfer rail		2
1190760	Tension limiting wire	4	6
1210810	Fuse 0.6 A slow 5 x 20 (115 V)	1	1
1210850	Fuse 0.3 A slow 5 x 20 (230 V)	1	1
2003350	MUKEY PCB		1
2004330	MUDROP-03 PCB		1
2004340	MUBCD-02 PCB (384)	1	3
2304720	Microswitch assembly		1
2304860	Flat cable		1

12 GLOSSARY AND ABBREVIATIONS

dispense	To distribute (pipette) liquid into the wells of the preselected strips or microplate.
dispensing cassette	The dispensing cassette contains eight individual tubes. The dispensing cassette is detachable. Each reagent can have a separate dispensing cassette. Alternatively, the same dispensing cassette can be used with several reagents using the backflush feature. Refer to section 11.2 Dispensing cassettes. The dispensing cassettes contain either Machined or Extruded covers. The tubing length also varies from 40 cm to a selectable length of 50 to 2000 cm. All dispensing cassettes can be autoclaved up to 50 times. To avoid damaging the tubes, follow the dispensing cassette maintenance, washing, autoclaving and storage instructions carefully. Refer to sections 6.8.4 After use, 7.2 How to wash the dispensing cassette and 7.3 How to autoclave the dispensing cassette.
EIA	enzyme immunoassay
empty	The operation of discharging the contents of the tubing of fluid.
EN	European Norm
EU	European Union
FAQ	frequently asked questions
home position	The plate carrier is positioned to the furthest right of the transfer rails (*Fig. 4.1*).
IEC	International Electrotechnical Commission
plate adapter	The Multidrop 384 requires a plate adapter for the plate carrier to function. Two different plate adapters are included: the PLATE HEIGHT MAX. 15 MM plate adapter is suitable for plates approximately 15 mm high and the PLATE HEIGHT MAX. 11 MM plate adapter is suitable for lower plates. Insert the plate adapter correctly. Refer to section 6.4 How to insert and adjust the plate adapter.
PP	polypropylene
prime	The operation of filling a pump intake with fluid to expel the air.

12.1 Keywords for web pages

automated dispensers
automated fluid dispensing
automated liquid handling
dispensing
drug discovery
EIA
ELISA
enzyme immunoassay
immunoassay
liquid handling
microplate
microplate dispenser
Microtiter plate
microwell plate
multidispense
multidrop
Multidrop
Multidrop 384
multidrops
plate
robotic platform
sandwich assay
separation technique(s)
solid phase assay(s)
Thermo Fisher Scientific
Thermo Scientific

12.2 Literature

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13 INDEX

A

Abbreviations 75
Accessories 15, 16, 73
Addresses 85
Advantages of using the Multidrop 384 9
Application 5, 6, 9, 76, 84

B

Bottle 9

C

Cable 15, 17, 18, 19, 57, 61, 68, 73, 74, 81
Calibration 12, 24, 32, 33, 40, 41, 42, 43, 44, 46, 47, 51, 52, 53, 55, 60, 73, 81, 82
  screw cover 12, 41, 42, 43, 44, 53, 55
Channels 40, 42, 43, 44, 81
Check 15, 16, 17, 18, 19, 21, 23, 24, 32, 33, 39, 66, 69, 83
Clean 16, 34, 35, 36, 37, 46, 58, 66, 70
Col 14, 19, 30, 31, 33, 60, 64, 83
Columns 10, 14, 19, 30, 31, 33, 60, 64, 83
Consumables 32, 71, 73
Control panel 10, 19, 21, 30, 31, 36, 60, 68, 81, 82, 83
  indicators 30
  keys 31
Cover retaining screws 11, 17, 18, 45, 47, 49, 53, 54, 81, 82

D

Dead volume 67
Decontamination 58, 69, 70
  Certificate of 58, 69, 70
Decontamination procedure 35, 57, 58, 69, 70
Dimensions 60
Directives 62
Disclaimer 5
Dispenser 7, 8, 9, 14, 15, 19, 30, 35, 76
Dispensing. 7, 8, 9, 11, 12, 14, 16, 19, 21, 22, 23, 24, 25, 29, 30, 31, 32, 33, 34, 35, 36, 37, 40, 42, 43, 45, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 60, 64, 66, 67, 68, 72, 73, 75, 76, 81, 82, 83
  accuracy 60
  cassette.. 7, 8, 9, 11, 12, 14, 16, 19, 21, 22, 23, 24, 25, 29, 34, 35, 36, 37, 40, 42, 43, 45, 47, 48, 49, 50, 52, 53, 54, 55, 56, 57, 58, 60, 66, 67, 68, 72, 73, 75, 81, 82, 83
  precision 60
  volume 60, 64
Disposal of instrument 58
Disposal of materials 57

E

Empty 19, 21, 31, 32, 33, 34, 35, 42, 43, 57, 60, 63, 64, 67, 75, 83
Environmental requirements 16
Error 19, 30, 31, 32, 35, 65, 66
  code 65
Extruded covers 8, 12, 72, 75, 81

F

FAQ 67, 75
Frequently asked questions 67
Fuse holder cap 13, 38, 39, 81

Fuses 13, 38, 39, 66, 74, 81

G

Gravimetric calibration 40, 42
Guidelines for use 35

H

Hazard 6, 68
Home position 14, 19, 24, 31, 33, 35, 64, 75
How to autoclave the dispensing cassette 14, 37, 75
How to change the tip band 45
How to disinfect the instrument 35, 57, 69, 70
How to dispense automatically 32
How to dispense manually into the specified column(s) 33
How to dispense multiple volumes 33
How to fit the new tubing set 46
How to install the Multidrop 384 ..... 15, 17, 19, 20, 21, 61
How to pack for service 57, 58, 69
How to prime 32, 43
How to recalibrate the dispensing cassette 40, 56
How to replace the fuses 38
How to select the 96/384 well plate 31
How to shutdown 14, 34, 35, 37, 75
How to switch on 21
How to troubleshoot the instrument 66
How to use the control panel 19, 30
How to wash the dispensing cassette 14, 37, 75

I

Indicators 30
Installation 7, 15, 16, 17, 40, 42, 47, 61, 66
  check list 15
Instrument layout 10
Intended use 8

K

Keys 14, 30, 31, 33, 35, 41, 60, 66
Keywords for web pages 76

L

LED 19, 21, 30, 35, 66
Literature 76
Live parts 61
Lower part 10, 12, 22, 23, 24, 45, 47, 48, 49, 81

M

Machined covers 72, 82
Mains 11, 13, 15, 17, 18, 19, 21, 35, 38, 39, 57, 60, 61, 66, 68, 81
  switch 11, 17, 18, 19, 21, 35
Maintain 21, 36, 58, 83
Maintenance 7, 14, 21, 35, 36, 58, 61, 68, 69, 75, 83
Microplate dispenser 7, 8, 9, 14, 35, 76, 81
Microstrip 5, 43, 44, 57, 81
Microswitch 24, 74
Mode 14, 31, 32, 33, 41
Multidrop 384 ..... 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 24, 25, 30, 31, 32, 33, 35, 36, 40, 41, 42, 43, 61, 62, 63, 67, 69, 72, 73, 74, 75, 76, 81, 82, 83

O

Operating precautions and limitations 20

Operational check 15, 19, 21
  list 21
Ordering information 7

P

Packing 15, 58, 69
  instructions 15, 58
  list 15
  materials 58
Plate 7, 8, 9, 10, 11, 14, 19, 21, 22, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 40, 41, 42, 43, 44, 45, 50, 53, 55, 57, 60, 64, 66, 67, 73, 74, 75, 76, 81, 82, 83
  adapter 10, 11, 21, 25, 26, 27, 28, 29, 32, 33, 42, 43, 57, 73, 75, 81, 83
  adapter lock 10, 26, 27, 81
  carrier 10, 11, 14, 19, 21, 22, 24, 25, 26, 27, 28, 29, 30, 32, 33, 35, 36, 66, 75, 81
  switch 10, 19, 21, 31, 43, 64
  type 21, 31, 64, 83
Polypropylene tubing 67, 75
Precalibration 55, 56, 82
Prime 10, 19, 21, 22, 24, 31, 32, 33, 34, 35, 37, 40, 41, 42, 43, 58, 60, 64, 65, 66, 67, 73, 75, 81, 83
Prime/drop 19, 32, 33, 41, 43, 60, 83
Priming vessel 10, 19, 21, 22, 31, 32, 33, 40, 42, 65, 66, 67, 73, 81, 83
Protocol 69
Pump body 10, 23
Purge 75

R

Remote control 9, 63
Rest position 10, 21, 25, 34, 35, 37, 40, 43, 81, 83
Robotic 9, 29, 76
Robotics 29, 76
Rocker switch 10, 21, 31, 43
Rotor 10, 11, 19, 21, 23, 24, 25, 29, 32, 34, 35, 40, 42, 66, 81, 83
  cover 10, 11, 19, 21, 24, 25, 29, 32, 40, 42, 66, 81, 83
  needles 10, 24, 66
  shaft 23, 24
Routine 21, 36
Run 83

S

Samples 16, 57, 68
Service 36, 37, 57, 58, 66, 69
  contracts 58
  pack for 57, 58, 69
  request protocol 69
Shutdown 35
Sight strips 12, 55, 56
Sight window 50, 51, 81
Silicone tubing 32, 47, 67
Slots 22, 32, 65, 66
Software 7, 64
Spare parts 73, 74
  recommended 74
Specifications 7, 29, 60, 61
  general 60
  safety 61
Startup 18, 21, 64
Step 14, 19, 31, 33, 35, 41, 46, 60
Switching on 18
Symbols 6

T

Table of Figures 81
Tension limiting wires 12, 23, 24, 47, 48, 52, 74, 81
Thumbwheels 33
Tip 40, 45, 46, 47, 66, 67, 73, 81
  band 45, 46, 47, 67, 81
  manifold 45, 47, 73, 81
Transfer rails 10, 74, 75
Transport 15, 16, 58, 60, 69
  damage 15, 16
  package 15, 16, 58
Troubleshooting 66, 69
  guide 66
Tubes 32, 33, 40, 42, 43, 45, 47, 48, 51, 55, 56, 66, 73, 81
Tubing 8, 12, 19, 25, 32, 33, 34, 35, 45, 46, 47, 48, 50, 51, 52, 56, 67, 72, 73, 75, 81, 82
  identification plate 50, 81
  set 8, 25, 45, 46, 47, 56, 67, 72, 73, 81
  weight 12, 32, 33, 46, 47, 56, 73, 82

U

Unpack 15
Upper part 10, 12, 22, 23, 24, 34, 35, 40, 41, 42, 43, 47, 49, 50, 52, 53, 54, 55, 81, 82
User manual 7, 15, 73

V

View 10, 11, 13, 14
  front 10, 11, 81
  internal 14
  rear 13, 81
Voltage 16, 17, 20, 62, 68, 81
  selector 17, 81
Volumetric calibration 32, 33, 40, 41, 60, 73

W

Warnings 16, 17, 18
Warranty 7, 15, 71
Weight 12, 16, 32, 33, 46, 47, 56, 60, 73

14 TABLE OF FIGURES

Fig. 3.1 Multidrop 384 microplate dispenser 8
Fig. 4.1 Multidrop 384 front view (A) 10
Fig. 4.2 Multidrop 384 front view (B) 11
Fig. 4.3 Multidrop 384 front view (C) 11
Fig. 4.4 Close-up of the Multidrop 384 standard tube dispensing cassette 12
Fig. 4.5 Multidrop 384 rear view 13
Fig. 4.6 Multidrop 384 microplate dispenser 14
Fig. 5.1 Location of the cover retaining screws 17
Fig. 5.2 Location of the voltage selector 17
Fig. 5.3 Connecting the mains supply cable 18
Fig. 6.1 Inserting the priming vessel into place 22
Fig. 6.2 Inserting the standard tube dispensing cassette 22
Fig. 6.3 Inserting the lower part of the dispensing cassette into its slots 23
Fig. 6.4 Inserting the upper part of the dispensing cassette 23
Fig. 6.5 Lower and upper parts of the dispensing cassette inserted evenly into their slots 24
Fig. 6.6 Pulling the rotor cover over the rotor 24
Fig. 6.7 Two different plate adapters 25
Fig. 6.8 Opening the plate adapter lock 26
Fig. 6.9 Placing the right end of the plate adapter 26
Fig. 6.10 Pressing the left end of the plate adapter 27
Fig. 6.11 Closing the plate adapter lock 27
Fig. 6.12 Loosening the screws on the right of the plate carrier 28
Fig. 6.13 Loosening the screws at the front of the plate adapter 28
Fig. 6.14 Fastening the front screws of the plate adapter 29
Fig. 6.15 Fastening the screws to the right of the plate carrier 29
Fig. 6.16 Multidrop 384 control panel 30
Fig. 6.17 Multidrop 384 control panel 31
Fig. 6.18 Rest position of the dispensing cassette 34
Fig. 7.1 Removing the fuse holder cap (A) 38
Fig. 7.2 Removing the fuse holder cap (B) 38
Fig. 7.3 Fuse holder cap with fuses 39
Fig. 7.4 Inserting the fuse holder cap 39
Fig. 7.5 Placing the tube onto the tip of channel A 40
Fig. 7.6 Adjusting the liquid level first to the lower mark and then to the upper mark 41
Fig. 7.7 Screwing the calibration screws according to the calibration results 42
Fig. 7.8 8 x 12 well microstrips adjusted onto the plate adapter 43
Fig. 7.9 Removing the filled microstrip to be weighed 44
Fig. 7.10 Screwing the calibration screw according to the calibration results 44
Fig. 7.11 Removing the cover plate of the lower part of the dispensing cassette 45
Fig. 7.12 Removing the old tip band 45
Fig. 7.13 Tip band removed 46
Fig. 7.14 New tip band 46
Fig. 7.15 New tubing set with the tip band attached 47
Fig. 7.16 Inserting the tip manifold into the lower part of the dispensing cassette 47
Fig. 7.17 Pressing the tube fasteners into place 48
Fig. 7.18 New tubing inserted into the lower part of the dispensing cassette 48
Fig. 7.19 Tension limiting wires attached 48
Fig. 7.20 Replacing the lower part cover of the dispensing cassette 49
Fig. 7.21 Parts belonging to the upper part of the dispensing cassette 49
Fig. 7.22 Placing the sight window 50
Fig. 7.23 Pressing the tubing identification plate into place 50
Fig. 7.24 Pressing the tube fasteners into place 51
Fig. 7.25 Fastening the calibration screws 51
Fig. 7.26 Calibration screws fastened 52
Fig. 7.27 Replacing the cover of the upper part of the dispensing cassette 52

FIG. 7.28 ENSURING THE TUBING DOES NOT GET TRAPPED 52
FIG. 7.29 FASTENING THE COVER RETAINING SCREWS 53
FIG. 7.30 INSERTING THE PLATE ON THE CALIBRATION SCREWS 53
FIG. 7.31 LOWER AND UPPER PART OF THE DISPENSING CASSETTE FITTED 54
FIG. 7.32 DISPENSING CASSETTE BEFORE PRECALIBRATION 55
FIG. 7.33 PRECALIBRATING THE DISPENSING CASSETTE 55
FIG. 7.34 DISPENSING CASSETTE PRECALIBRATED 56
FIG. 7.35 INSERTING THE TUBES INTO THE TUBING WEIGHT 56
FIG. 11.1 DISPENSING CASSETTE MACHINED COVERS 72
FIG. APPENDIX 1. 1 MULTIDROP 384 CONTROL PANEL 83

APPENDIX 1. THERMO SCIENTIFIC MULTIDROP 384 BRIEF USER'S GUIDE

- Insert the dispensing cassette to be used (p. 22).
- Check that the rotor cover is pulled over the rotor (p. 21).
- Check that the priming vessel is installed (p. 22).
- Use the correct plate adapter (p. 25).
- Switch the Multidrop 384 on (p. 21).
- Load the microplate to be dispensed onto the instrument (p. 25).
- Select the desired plate type, volume and column(s) from the control panel (p. 30).
- To prime the tubes, press the **prime/drop** key until the reagent flows from the tips into the priming vessel (p. 32).
- Press the **start** key to start dispensing (p. 31).
- After the end of the run, remove the microplate (p. 34).
- Press the **empty** key to remove the reagent from the dispensing cassette (p. 34).
- Put the dispensing cassette into the rest position (p. 34).
- Maintain your Multidrop 384 instrument and dispensing cassette (p. 36).
- Switch off the instrument (p. 35).

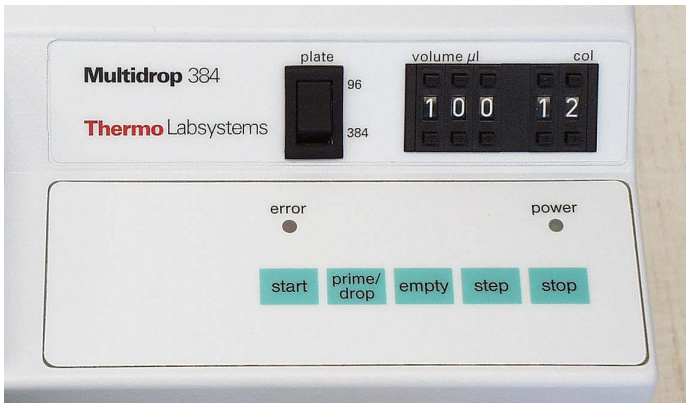

Fig. Appendix 1. 1 Multidrop 384 control panel

APPENDIX 2. THERMO SCIENTIFIC MULTIDROP 384 FEEDBACK FORM

Cat. no.	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 research 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
Reagent kit/Instructions	☐	☐	☐	☐	
Instrument/User manual	☐	☐	☐	☐	
Operational reliability	☐	☐	☐	☐	
Design	☐	☐	☐	☐	
Ease of use	☐	☐	☐	☐	
Operational costs	☐	☐	☐	☐	
Customer support	☐	☐	☐	☐	

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Further applications desired:

Where did you first learn about the product?

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

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Manufactured by:

Thermo Fisher Scientific Oy
P.O. Box 100, FI-01621 Vantaa, Finland
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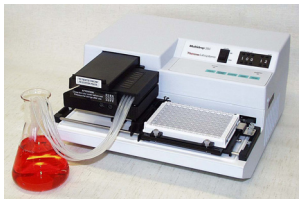

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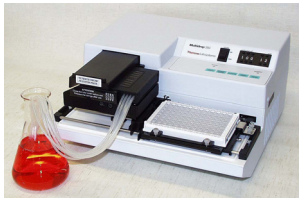

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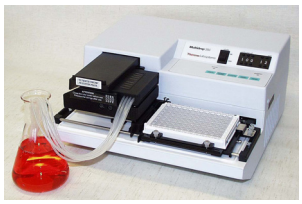

Thermo Fisher Scientific Oy
Microplate Instrumentation
Ratastie 2, P.O. Box 100
FI-01621 Vantaa
Finland

www.thermo.com

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