402 Dilutor Dispenser
User's Guide

Solutions at Work for You

GILSON®
SOLUTIONS AT WORK FOR YOU

402 Dilutor Dispenser
User's Guide

 November 2003

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Safety

Read this section carefully before installing and operating the instrument.

For safe and correct use of the instrument, it is essential that both operating and service personnel follow generally accepted safety procedures as well as the safety instructions given in this document, the 402 Dilutor-Dispenser User's Guide.

The instrument described in this document is a syringe operated pump for transferring liquids. It should only be used in the laboratory or similar indoor environment for analytical purposes, by qualified personnel. If an instrument is used in a manner not specified by Gilson, the protection provided by the instrument may be impaired.

Voltages present inside the instrument are potentially dangerous. If there is a problem with the instrument, the power cable should be removed until qualified service personnel have repaired it. This is to prevent anyone from inadvertently using the instrument, thus causing possible harm to themselves, or damage to the instrument itself.

The leakage current of this instrument is within the limits allowed by international safety standards for laboratory equipment. An efficient ground connection is imperative for the physical protection of the user.

Power supply cord reference 7080316106 is for use in France and Germany. Power supply cord reference 7080316105 is for use in USA and Canada. For other countries contact your local Gilson distributor. You must only use the type of fuse described in this document: 1.0 Amp type "T" slow blow.

Adequate protection including clothing and ventilation must be provided if dangerous liquids are used in the analytical work. In case of incidental spillage, carefully wipe with a dry cloth, taking into account the nature of the spilled liquid and the necessary safety precautions.

Cleaning, dismantling, maintenance, and repair should only be performed by personnel trained in such work, and who are aware of the possible dangers involved.

[1] Individual components: parts of the valve, the Tee junction, and the syringes (except for the 25 mL syringe) may be autoclaved after dismounting (121°C, 0.1 MPa, 20 min).

This instrument[1] must not be sterilized, using an autoclave, or any other mechanical device. When you need to clean an instrument, use one of the three following methods:

1 - a clean dry cloth,
2 - a cloth dampened with water,
3 - a cloth dampened with soapy water.

If a cloth dampened with soapy water is used to clean the instrument, only domestic soap may be used. No other form of detergent or chemical may be used.

These electronic and hazard symbols appear on the 402 Dilutor Dispenser:

Symbol	Explanation
~	Alternating current
	PROTECTIVE CONDUCTOR TERMINAL
I	On (Supply switch)
O	Off (Supply switch)
	Caution, risk of electric shock
	Caution (refer to User's Guide)

Introduction 1

The following chapter describes the instrument, the service and warranty conditions.

Notational Conventions

The conventions in this *User's Guide* are as follows.

Used in the stand-alone mode, this instrument is referred to as '402 Dilutor-Dispenser' or simply 402.

Specific keys to press on the Gilson Keypad are represented in bold capitals, for example: 'key in the value and press **ENTER**'; where **ENTER** is a key on the keypad.

For a soft-key that must be pressed, the function of that key is represented in bold, for example: 'Press **Prime** to prime the pump'.

The Gilson Keypad displays on-screen messages as normal typeface inside a frame.

Overview

The 402 Dilutor-Dispenser, is used to transfer liquids between vials according to user defined protocols (Methods). You program the 402 Dilutor-Dispenser via the keypad, which includes an LCD screen, for communication purposes.

You may store a total of 99 linkable Methods using the keypad. Each Method consists of one or more of the following tasks: Dilute, Dispense, Mix, Pipette, and Rinse. In addition three functions for direct manipulation are available: Priming, Titration, Volume Measurement.

Gilson's 402 Dilutor-Dispenser is available in two configurations: Single-syringe, or Dual-syringe. The 402 Dilutor-Dispenser is very versatile; it may be fitted with seven sizes of syringe. The standard 402 Dilutor-Dispenser is equipped with a hand-held probe for aspirating and dispensing liquids. Optionally, the probe may be fitted with disposable tips (Gilson Diamond® Tips, D200 and D1000).

This versatility means that your 402 Dilutor-Dispenser may be used for a wide variety of applications including the chemical field where the ability to handle large volumes or high dilution ratios may be appreciated, and the biological field where small volumes and protection against cross-contamination are important (see Autoclavability, page 6-5). It can even be used with corrosive liquids (see Chemical Compatibility, Appendix B).

Refer to Appendix A for lists of the standard equipment, additional accessories and spare parts. The 402 DD is supplied with a tubing kit for connecting to a solvent reservoir. Syringes are not included in the standard equipment; you should order syringe(s) appropriate to your Method (volume, systematic error and flow rate requirements; refer to Appendix C). Also, a Tee junction kit (not including the syringe) is available for upgrading a Single-syringe Dilutor-Dispenser to the Dual-syringe version.

Overview

Good Laboratory Practice (GLP) is facilitated by the following:

→ codes to protect the program files against unauthorized modification,

→ counters for the number of syringe and valve operating-cycles,

→ checking protocol for the hydraulic specifications (IQ/OQ procedures),

→ correction of the syringe-piston stroke to compensate for environmental factors (temperature, viscosity, etc.).

Unpacking

Your 402 Dilutor-Dispenser is shipped in a box together with its various accessories. The original box and packing material should be kept in case the equipment has to be returned to your Gilson distributor.

You should check off the parts received in the box against the parts list (refer to Appendix A), at the time that you receive the shipment, even if the 402 is not to be used immediately. Your Gilson distributor should be notified immediately of any inconsistencies between the contents of the box and the parts list, or if any of the parts appear to have been damaged in transit.

Warranty

If the 402 Dilutor-Dispenser does not appear to function correctly, first verify the electrical connections are correct and that the instrument is switched ON. Contact your Gilson distributor for technical advice or possibly a service visit. Any service required will be given within the warranty conditions assured by your Gilson distributor.

Customer Service

Gilson and its worldwide network of authorized distributors provide you with four types of assistance: sales, technical, applications and service.

Customer Service personnel are able to serve you more efficiently if you provide the following information:

- The serial number and model number of the equipment involved.
- The installation procedure you used.
- A concise list of the symptoms.
- A list of operating procedures and conditions you were using when the problem arose.
- A list of other devices connected to the system (if any) and a system diagram showing the connections.
- A list of other electrical connections in the room.

Description 2

The following chapter describes the mechanics and hydraulics of the Dilutor-Dispenser.

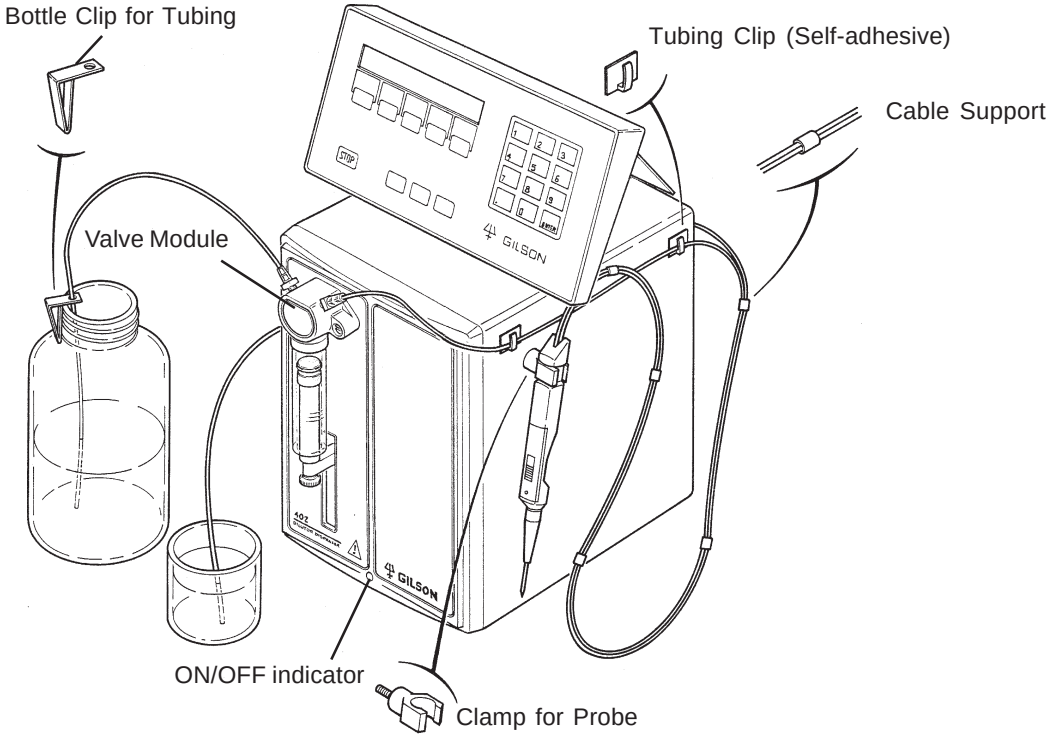
Two models of 402 Dilutor-Dispenser are available: Single-syringe and Dual-syringe. Each model comes with a keypad, a probe, and accessories. You order and fit the syringe(s), from those described on page 2-6, most suited to your application.

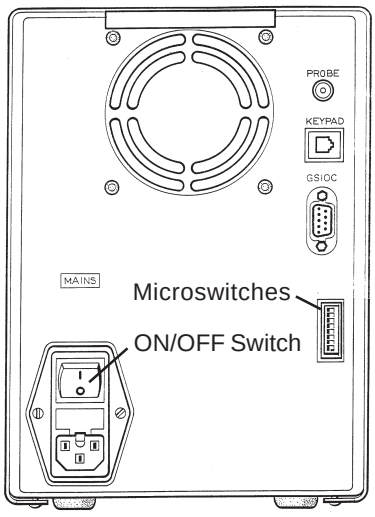
Your 402 is delivered with the appropriate modules fitted. If later, you decide to convert a Single-syringe model into a Dual-syringe model, you must order and fit a Tee-junction module to the right-hand side of your dilutor; the left-hand always contains a Valve module.

Single-syringe Model

The Single-syringe model has a Valve module at the left, and a blanking plate at the right.

The Valve module includes one motor to operate the syringe and another motor to switch the valve. It is a liquid transfer station that can be used to deliver up to 25 mL in one stroke, and down to 1 µL (typical value), with high accuracy.





Front Panel

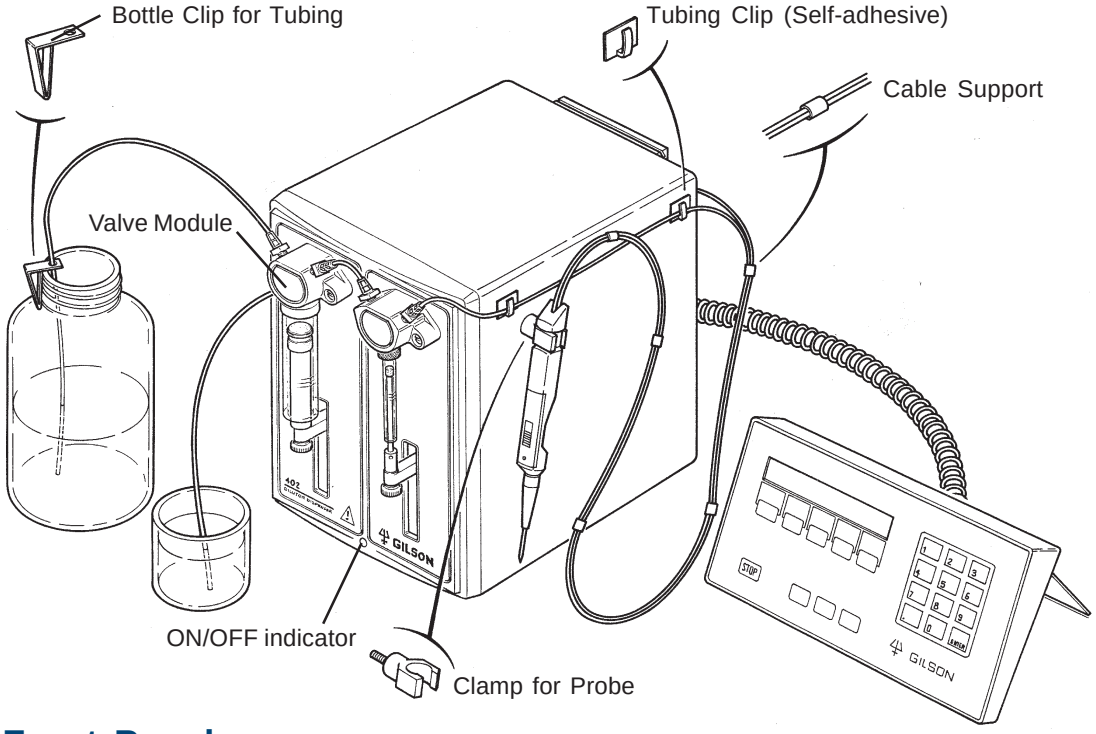
The front panel holds the hydraulic components and is fitted with an ON/OFF indicator.

Rear Panel

The rear panel holds a socket for connecting the keypad, a connector for the probe, the ON/OFF switch, and voltage selector/fuse holder. There is also a Gilson Serial Input Output Channel (GSIOC) connector, which is a communications channel to link the 402 Dilutor-Dispenser with other equipment, if required. There is also a bank of microswitches for use in setting up the communications channel.

Dual-syringe Model

The Dual-syringe model is fitted with a Valve module at the left and a Tee-junction module at the right. The modules are linked by plastic tubing.



Front Panel

The front panel holds the hydraulic components and is fitted with an ON/OFF indicator.

The Valve module includes one motor to operate the syringe and another motor to switch the valve. The Tee-junction module has only one motor, to operate the syringe.

The Dual-syringe model may be fitted with syringes of different volumes. The left syringe is the large volume syringe and is used to deliver a large volume of liquid in a minimum time. The right syringe can be used to transfer smaller volumes with high reproducibility and accuracy (refer to Appendix C for Technical Data). The benefits of this configuration are a large dilution ratio with the best reproducibility and fast transfer times.

Rear Panel

This is the same for both models.

Keypad and Probe

Keypad

The keypad includes an LCD display (two 24-character lines), membrane touch-keys, and a connecting cord.

Numeric keys: the keypad has the numbers 0 to 9, a decimal point key, and the Enter key.

Five Soft-keys: the function of each key depends on the screen that is displayed (e.g. Next, Prev, Chge...).

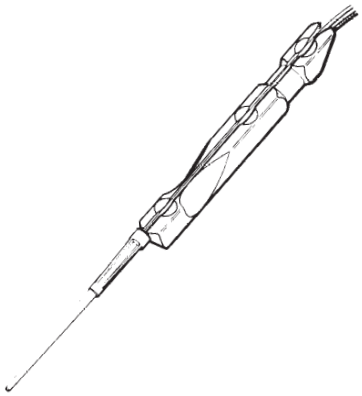
STOP key: Press this key to stop the current action (Method or direct manipulation).

HELP key: Press this key to access help messages relating to the current screen.

ESC key: Press this to quit a menu or return to the first menu of the software branch.

CLEAR key: Press this key to cancel a value and return to the previous value before validating it.

Probe

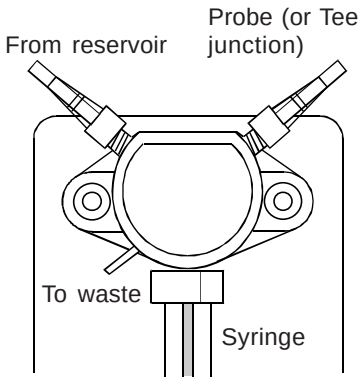


The assembled probe fitted with the standard probe nozzle is shown opposite. Assembly and installation of the standard probe is described in Chapter 3.
A kit is available to enable you to fit Gilson's Diamond® tips (D200, D1000) to the probe (see Chapter 3).

Hydraulic Components

Valve

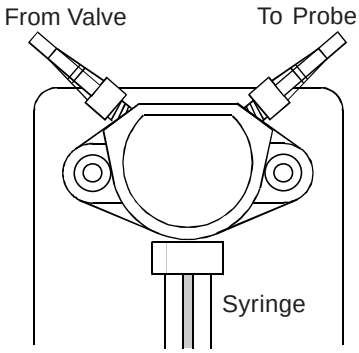
The two-position valve, which is fitted to the left-hand side of the 402, has three ports. It switches the syringe port to either the reservoir or to the probe side (see opposite figure).



The valve, which has a 0.5 sec rotation period, is driven by a stepper motor. It is designed to withstand a million rotations, when used with water. The liquid contact surfaces of the valve, which is autoclavable, are in PEEK and ceramic (121°C, 0.1 MPa, 20 min).

Tee Junction

The Tee-junction, which is fitted to the right-hand side of the dual-syringe model, has three ports: the inlet from the valve, the outlet to the probe, and the syringe port (see opposite figure).



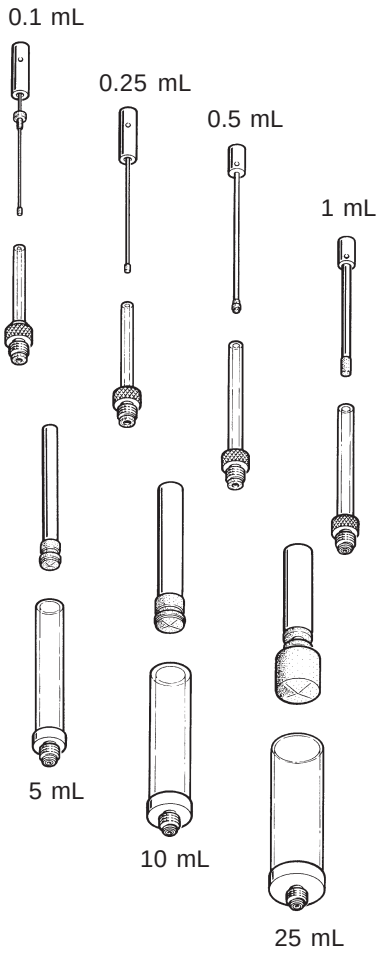
The Tee-junction, which has no internal moving parts, includes 2 channels, each 1.5 mm in diameter oriented at 120°. The liquid contact surfaces of the Tee-junction, which is autoclavable, are in PEEK.

Syringes

The choice of syringe allows the 402 Dilutor-Dispenser to handle volumes from 1 µL to 25 mL with low values of systematic and random error. The 402 Dilutor-Dispenser is able to transfer liquid as follows:

- from 1 µL to 10 mL from the probe (transfer tubing volume of up to 10 mL),
- up to 25 mL from the reservoir, in one stroke,
- up to 99 mL from the reservoir, in several strokes.

When using the Dual-syringe model, a theoretical dilution ratio of 1/25000 is achieved in one stroke of both sample and diluent syringes. However, you are advised not exceed a ratio of 1/500 for any given dilution, in order to stay within the RSD range (after efficient mixing).



There are seven syringe sizes available for the 402, all except the 25 mL are autoclavable. The lifetime of all pistons (see Chapter 6), when they are used with water at a pressure of up to 0.3 MPa is over 30000 cycles (each cycle contains 2 strokes: one up and one down).

The available syringe sizes are:

Part Number	Description
25025341	0.1 mL
25025342	0.25 mL
25025347	0.5 mL
25025343	1 mL
25025344	5 mL
25025345	10 mL
25025346	25 mL

Syringe Materials

Part of the syringe	Material
Syringe body	Borosilicate glass
Syringe adapter	316L stainless steel
Piston	Stainless steel (models up to 1 mL) Aluminum
Piston nose	PTFE/Ekonol (PTFE for the 25 mL)

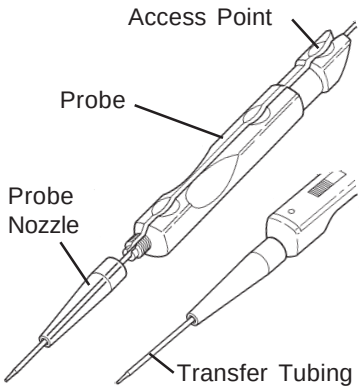
Installation 3

This chapter explains how to install the fuses, syringes and hydraulics according to your system requirements.

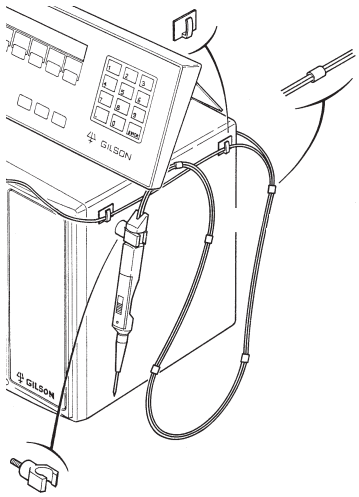
This chapter explains how to add the extra module to upgrade your 402 to a dual syringe pump.

Assembling the Probe

For Standard Use



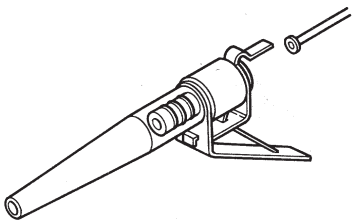
When you want to increase the length of tubing protruding from the probe, you must first carefully lift the tubing out of the handle, otherwise you will damage the tubing.



In standard use the probe is used with the 2 mL tapered transfer-tubing (see opposite figure).

1. Thread the tapered end of the transfer-tubing through the plastic 'tunnels' in each of the 5 pre-mounted cable supports (see figure below).
2. Lay the tubing on the probe's groove such that about 4 cm of the tapered end protrudes from the end of the probe.
3. Push the tubing into the groove in the probe at the 3 round access points using (for example) the rounded end of a pencil. Do not press on the tubing with your fingernail.
4. Push the tapered end of the tubing through the standard tip, then screw the tip onto the end of the probe.
5. Plug the end of the control cable into the socket, labeled 'PROBE' at the back of the 402.
6. Fit the clamp for probe at the right-hand side of the 402 (see opposite figure).
7. Mount the probe on the clamp.
8. Connect the other end of the tubing to the outlet of the Valve (Single-syringe) or the Tee-junction (Dual-syringe).
9. Use the 402 Software to check (and change, if necessary) the configuration using the Conf (Vol) menu.

Adapter Kit for Disposable Tips



The ability to use Diamond Tips will extend the use of your 402 into the biological field, where protection against cross-contamination is important, and in the chemical field to protect the tubing from corrosive liquids.

You must fit a tip-holder to the probe when you want to use Gilson's Diamond tips. An adapter kit (reference F4015015) is available to permit you to fit them to the probe. The kit includes two sizes of tip-holder (with built-in tip ejector), and a special non-tapered 2 mL transfer tubing, as follows.

2 Special adapters for the probe
1 D200 tips, pack of 10
1 D1000 tips, pack of 10
1 Transfer-tubing (outlet) non-tapered, FEP (2 mL)

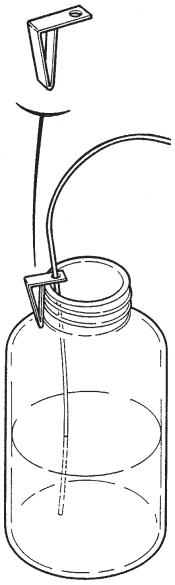
1. Lay the tubing on the probe's groove such that the end with the small washer is just at the orifice of the probe.
2. Push the tubing into the groove in the probe at the 3 round access points using the rounded end of a pencil (for example). Do not press on the tubing with your fingernail.
3. Screw the tip-holder onto the end of the probe.
4. Plug the end of the control cable into the socket, labeled 'PROBE' at the back of the 402.
5. Fit the clamp at the right-hand side of the 402 (see on the previous page).
6. Mount the probe on the clamp.
7. Connect the other end of the tubing to the outlet of the valve (Single-syringe) or the Tee junction (Dual-syringe).
8. Inform the 402 Software of the new configuration using the Conf (Vol) menu.
9. Fit a tip to the holder. In use, when you change a tip, **wipe the end of the tip-holder first, to remove any liquid from the orifice. Do not twist the probe to the left, when fitting a tip, otherwise the tip-holder will unscrew itself.**

(1) The small washer is important in that it helps to ensure that fluid does not leak from the junction between the tip-holder and the orifice of the probe.

(2) The special 'S' shaped metallic clips, which are pre-mounted, are for supporting the tubing on the black control cable. The tubing for use with the tip-holder will not pass through the plastic 'tunnels' in the pre-mounted cable supports. However, to make the metallic clip easier to attach, you can push these black tubing-supports to the end of the cable.

Connecting the Tubing

Tubing connectors should be hand-tightened, tools should not be used as their use will damage the connector's thread.



Single-syringe Model

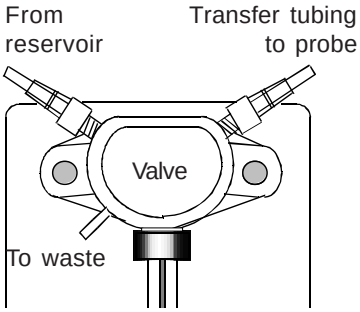
Valve Inlet Tubing

A length of Fluoride Ethylene Propylene (FEP) tubing, supplied with the 402, is used to connect the inlet port to the solvent reservoir. Screw the connector into the inlet port (left-hand) of the valve and put the other end into the reservoir. A bottle clip is provided to hold the tubing securely in the reservoir (see opposite Figure).

An alternative tubing, fitted with a connector at one end and a 20 µm filter at the other, is available as an accessory (reference 3645357).

Waste Tubing

Connect a suitable length of tubing from the waste outlet of the valve to a suitable receptacle. The valve releases liquid through the waste outlet if the pressure inside the valve is too high. For the pressure limits of the valve, refer to Appendix C, Technical Data.



Transfer Tubing (Probe)

This tubing (FEP) allows the transfer of samples aspirated from the probe and prevents the contamination of the syringe(s). The size of transfer tubing is chosen as a function of the volumes of samples, reagents, and air gaps that have to be handled via the probe. The total volume transferred must be less than the volume of the transfer tubing.

The transfer tubing connects the outlet port (right-hand) of the valve to the probe. A 2 mL tapered tubing is supplied as standard; 1 mL, 5 mL, and 10 mL are available as additional accessories.

Self-adhesive clips are provided for holding the transfer tubing securely against the side of the 402.

The 1 mL transfer tubing is recommended for transferring volumes smaller than 1 mL. To avoid movements of the tubing that could affect the precision, the 5 mL and 10 mL transfer tubings are rolled and held by magnets on the left-side of the 402.

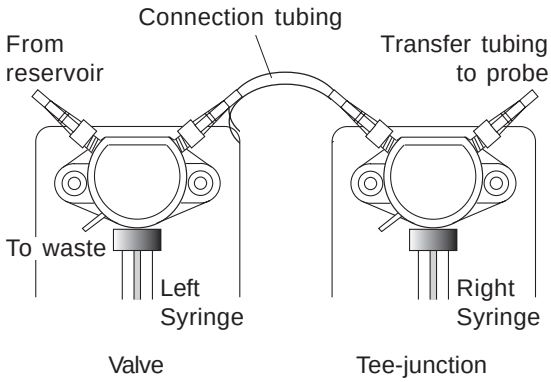
After assembling the probe, the other end of the tubing is installed by screwing the connector into the right-hand port of the valve. When you use Gilson Diamond Tips, the special non-tapered tubing, included in the kit, must be fitted.

Dual-syringe Model

Valve Inlet Tubing

A length of Fluoride Ethylene Propylene (FEP) tubing, supplied with the 402, is used to connect the inlet port to the solvent reservoir. Screw the connector into the inlet port (left-hand) of the valve and put the other end into the reservoir. A bottle clip is provided to hold the tubing securely in the reservoir.

An alternative tubing, fitted with a connector at one end and a 20 µm filter at the other, is available as an accessory (reference 3645357).



Valve Waste Tubing

Connect the length of tubing (supplied as standard) to the waste outlet of the valve, and put the other end into the waste or any other suitable receptacle. The valve releases liquid through the waste outlet, if the pressure inside the valve is too high (see Appendix C, Technical Data).

Connection Tubing (Valve to Tee-junction)

This tubing has connectors at both ends and is used to connect from the valve outlet port (right-hand) to the Tee-junction inlet port (left-hand). It is made of FEP and has the following dimensions: 70 x 3 x 2 mm. It is autoclavable (20 min. at 0.1 MPa, 121 °C).

Transfer Tubing (Probe)

This tubing (FEP) allows the transfer of samples aspirated from the probe and prevents the contamination of the syringe(s). The size of transfer tubing is chosen as a function of the volumes of samples, reagents, and air gaps that have to be handled via the probe. **The total volume transferred must be less than the volume of the transfer tubing.**

Connecting the Tubing

The transfer tubing connects the outlet port (right-hand) of the Tee-junction to the probe. A 2 mL tapered transfer-tubing is supplied as standard ; 1 mL, 5 mL, and 10 mL are available as additional accessories.

Self-adhesive clips are provided for holding the transfer tubing securely against the side of the 402 (see previous page).

The 1 mL transfer tubing is recommended for transferring volumes smaller than 1 mL. To avoid movements of the tubing that could affect the precision, the 5 mL and 10 mL transfer tubings are rolled and held by magnets on the left-side of the 402.

After assembling the probe, the other end of the tubing is installed by screwing the connector into the right-hand port of the Tee-junction. When you use Diamond tips, the special non-tapered tubing, included in the kit, must be fitted.

Electrical Connections

The rear panel of the 402 Dilutor-Dispenser houses:

- sector block containing the power socket, fuse drawer and ON/OFF switch,
- keypad connector,
- probe connector,
- GSIOC connector.

Sector Block

The sector block contains the power socket, fuse holder and ON/OFF switch. Your 402 can be connected to a 100-120 VAC or a 220-240 VAC supply. In either case, two 1A type "T" slow blow fuses must be installed (reference 6730104006).

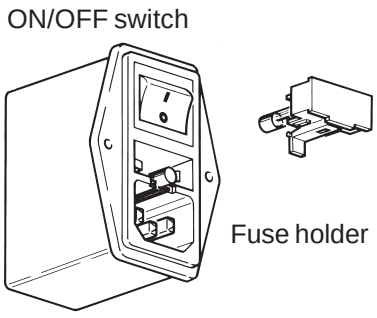
Voltage Selector

The instrument has no physical voltage selector. The 402 Dilutor-Dispenser can be connected to 100 or 240 V. Power control is carried out electronically on the power supply board.

Installing the Fuses

For safety reasons, your 402 is delivered without the fuses installed. You must install two 1A type "T" slow blow fuses (reference 6730104006), as follows:

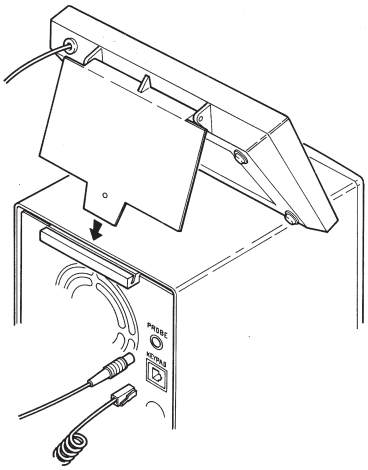
1) Disconnect the power lead from the instrument.
2) Use a small screwdriver to pry open the fuse holder drawer.
3) Pull the drawer gently towards you, to open the fuse receptacle.
4) Push the fuses into position.
5) Push the fuse holder back into the sector block.



In the figure, the drawer containing the fuses is shown separated from the sector block. In fact the drawer hinges downwards; it is not advisable, nor necessary, to remove it completely from the block.

Connecting the Power Cord

Make sure that the ON/OFF switch is in the OFF (down) position. Connect the power cord to the power socket at the rear of the instrument and then to the power supply source. When the ON/OFF switch is put to the ON position, the instrument initializes; the valve motor rotates the spindle and stops with the valve set to the outlet position. The piston motor raises the piston to the upper position.



Connecting the Keypad

Switch off the 402 Dilutor-Dispenser, before connecting or disconnecting the keypad.

Grip the connector, at the end of the coiled connection cable, so that you squeeze the clip between your thumb and index finger. Then, plug the connector into the socket on the rear panel labeled 'KEYPAD' (see figure). You must grip the connector in the same way when disconnecting the keypad.

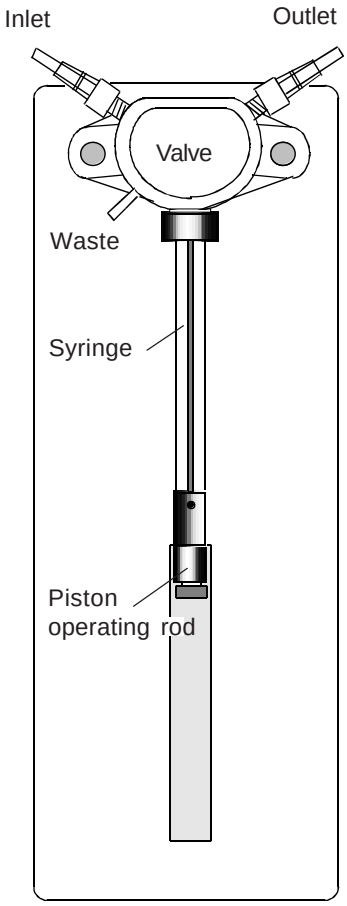
The coiled connecting cable enables you to use the keypad beside the 402 (as in Chapter 2), or even at some distance away from it. However, you can also install the keypad on top of the 402; to do this you should insert the tab on the rear support of the keypad into the slot on top of the 402 and then gently push the tab in as far as it will go.

Connecting the Probe

Grip the connector, at the end of the black connection cable, between your thumb and index finger. Then plug the connector into the socket on the rear panel labeled 'PROBE'.

Syringes

The 402 Dilutor-Dispenser is supplied without syringes. Order a syringe (or syringes), appropriate to your Method, for your 402 Dilutor-Dispenser. Mount the syringe on the valve or Tee-junction.



Assembling a Syringe

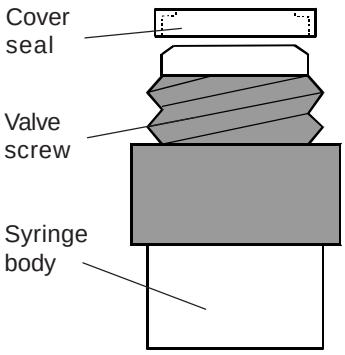
The syringe and its piston are supplied assembled. However, if you remove the syringe from the piston, ensure that the piston and the piston nose are free from dust and contamination before reinserting the piston into the syringe.

Wet the piston nose (with water), insert the piston nose into the syringe body, and then push the piston into the syringe.

Fitting a Syringe

Before fitting one of the smaller syringes (100 µL, 250 µL, 500 µL and 1 mL), prime it manually by placing its open end in the solvent reservoir, then aspirate using the piston. This manual prime is not necessary for the 5 mL, 10 mL and 25 mL syringes.

You must use the keypad software to lower the piston operating rod. You should therefore refer to Chapter 4, which describes the complete procedure for fitting a syringe. When changing a syringe, you should first undo the piston securing-screw in order to free the piston assembly from the piston operating-rod.



The 100 µL, 250 µL and 500 µL syringes are supplied with a cover seal to ensure an airtight fit between the syringe and the valve or Tee. Refer to the opposite figure for the correct orientation of the cover seal.

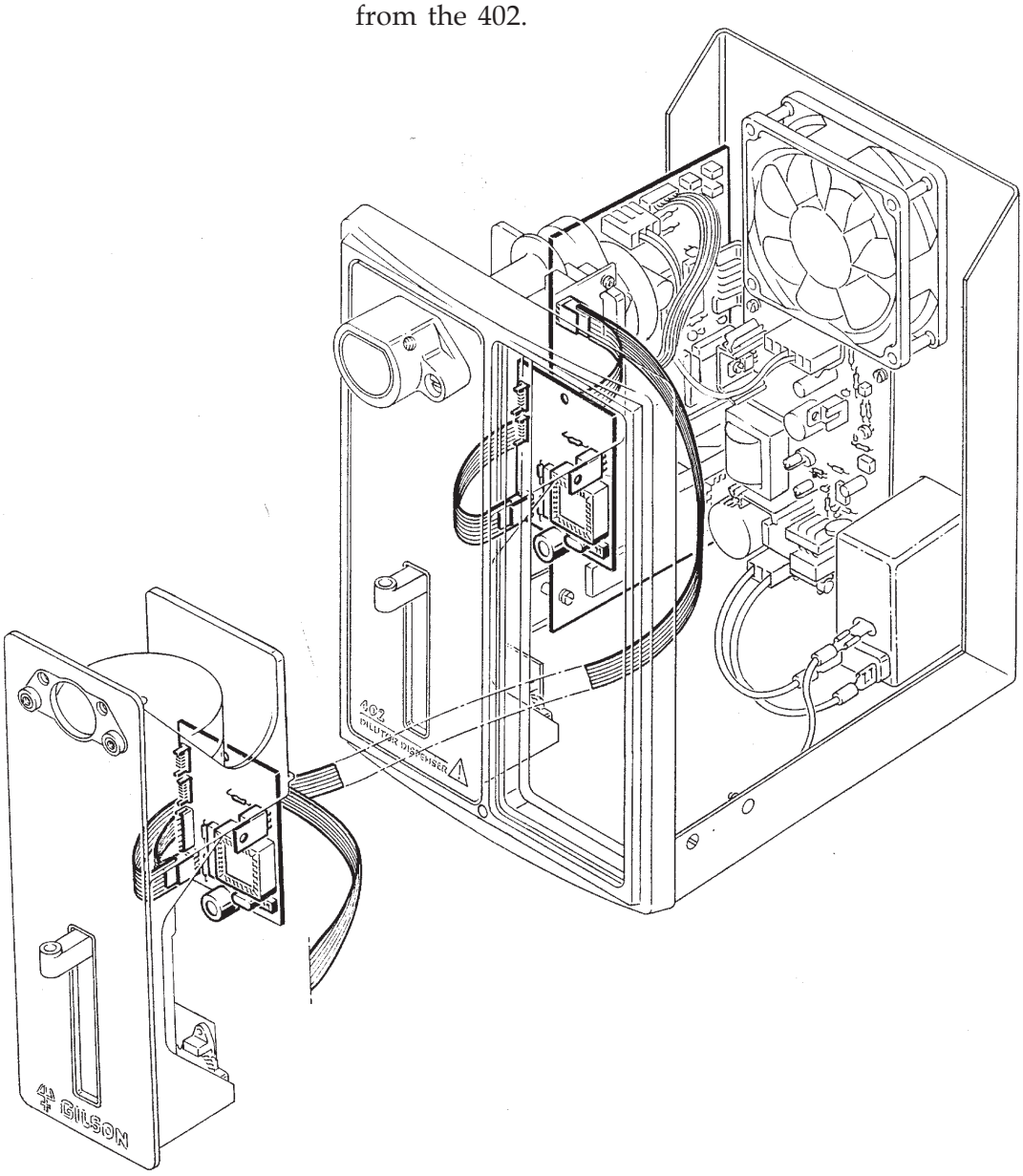
If you change the syringe size, don't forget to change the declared syringe volume in your software's system configuration.

Upgrading to Dual-syringe Model

The single syringe 402 can be upgraded to improve the versatility of the system.

To upgrade to the Dual-syringe 402, you must install a Tee-junction module (kit reference F4015010) at the right-hand-side of the 402. You must first install the syringe module (includes motor etc.) and then fit the Tee-junction.

Before installing the module: make sure that the ON/OFF switch is in the OFF position, remove the power cord, and disconnect any hydraulic connections from the 402.



Removing the Cover

1) Undo the four screws (with two washers) at the base of the 402 that secure the top cover. Place the 402 in the upright position, pull the sides of the cover outwards, and then lift off the cover.

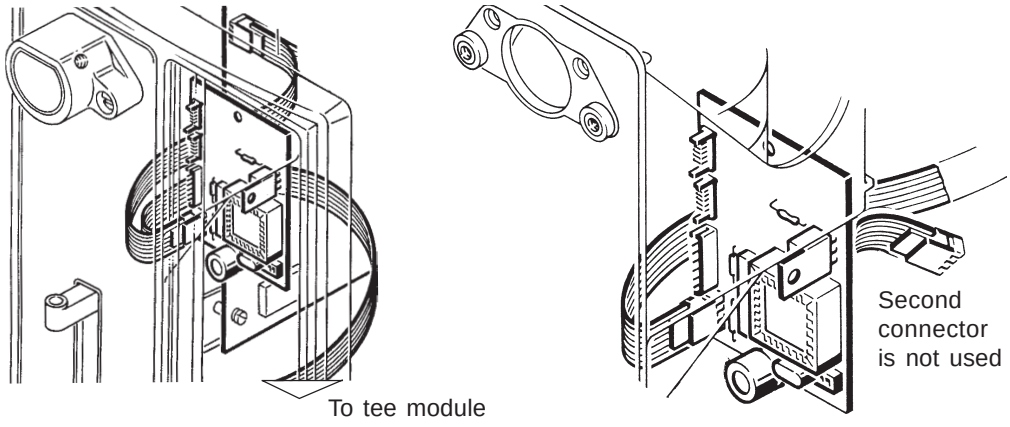
2) Undo the two nuts inside the front panel (near the top) that secure the blanking plate, then remove the blanking plate.

Connecting the Flat Cable

There is a flexible flat cable inside the 402 (attached to the lower chassis with Velcro) that connects the logic board to the Valve module. Detach the cable from the lower chassis, then use the free connector to connect to the motor drive board on the upgrade module. With reference to the opposite figure, the loose-end of the flat cable (with the second connector) and the connecting cable may be re-attached, using their Velcro strips.

1. Hold the module upright, in front of the 402 front panel.

2. Thread the flat cable through the aperture for the module and connect it to the syringe motor drive board on the Tee module.



Inserting the Module

Do not try to force the module into position as this may affect the alignment of the component parts. You should proceed carefully as follows.

1) Tilt the top of the module inwards and carefully insert the upper part of the module into the front aperture. When the syringe drive motor is inside the aperture, tilt the module into the upright position.

2) Push the module into the aperture, making sure that none of the cables become trapped between the module and the edges of aperture. The module rests on a rubber strip that dampens vibrations and helps ensure the module is fitted correctly.

3) Secure the module in place at the top using the two screws (provided).

4) Replace the cover by pulling the sides outwards slightly and lowering the it over the 402. Insert and tighten the four screws at the base of the 402 that secure the cover to the lower chassis. Do not forget to reinstall the washers, which are designed to ensure that the cover and chassis are connected electrically.

5) Install the Tee-junction on the front of the module using the two screws provided.

6) Install the syringe as described page 3-9.

7) Connect the hydraulic tubing according to pages 3-4 and 3-5.

8) Reconnect the power cord and switch the instrument ON.

Operation - Standard Use 4

This chapter describes how to operate the 402 in standard use. Chapter 5 contains more detailed and advanced information, together with less frequently used options. You are advised to read the first section of Chapter 5, 'Correct Use of the 402', before proceeding.

To use your 402 Dilutor-Dispenser, you must first install the hardware (syringe, probe, keypad, etc.) suitable to your Method, and then inform the 402's software of the installation, this is called 'Configuration'. Then, you write and run your Method, which is stored as a file in your 402's memory.

Essential Steps

Here is a summary of the things you must do, and the order in which you should do them.

1) Check that you have received all standard parts.
2) Connect the keypad.
3) Fit the fuses and connect the power supply cord.
4) Assemble and connect the probe (including the support).
5) Connect the tubings.
6) Switch on the power supply.
7) Enter the configuration details using the keypad.
8) Fit the syringe or syringes.
9) Create and save a Method as a numbered file.
10) Prime the Dilutor-Dispenser.
11) Run the Method.

Standard Parts

If you have a Single-syringe or a Dual-syringe, check that you have received all the parts in Appendix A.

Connect the Keypad

Connect the keypad as described in Chapter 3.

Fit the Fuses and Connect the Power

Fit the fuses and connect the power supply cord (see Chapter 3).

Assemble and Connect the Probe

Assemble and connect the probe (see Chapter 3).

Connect the Tubing

If you have a Single-syringe 402, install the tubings as described in Chapter 3, page 3-4. You must connect 3 pieces of tubing: inlet (reservoir), transfer (probe), and waste.

If you have a Dual-syringe 402, install the tubings as described in Chapter 3, page 3-5. You must connect 4 pieces of tubing: inlet (reservoir), Valve to Tee-junction, transfer (probe), and waste.

Switch-on

1) Switch on your 402 (the power switch is on the back panel): the indicator light on the front panel comes on, the keypad is illuminated, and briefly displays messages giving the software version numbers, *Initialization Screen 1*, for example. This is followed immediately by *Initialization Screen 2*.

2) Put the end of the probe into any container suitable for waste liquids, then press the white key immediately below **OK**.

   The syringe-piston operating-rod(s) move to their uppermost positions, while the *Homing Screen* is displayed on the keypad.

3) Then the *Start-up Screen* is displayed. After switching on, Method 1 is always shown on the screen even if the file has not yet been created (New). [When you want to run or edit any other file, you must first key in its number, then press **ENTER**.]

Initialization Screen 1

Initialization Screen 2

Homing Screen

Start-up Screen

Soft-keys

Four soft-touch keys are accessible from the *Start-up Screen*: **Conf** (Configuration), **Edit**, **Man** (Direct Manipulations), and **File**; the fifth '**Run**' appears after you save a Method file. They are called soft-keys because they vary from screen-to-screen; you must press the white key immediately below the corresponding 'label' (e.g. **Conf**) in order to carry out the desired action.

Pressing a soft-touch key leads you to a series of screens containing menus and sub-menus that enable to perform functions related to the key pressed.

To operate your 402, you must use **Conf**, **Man**, and **Run**. Five prefabricated Methods (files 90-94, see Chapter 5) are supplied as part of the software; however, you will often want to use **Edit** to create your own Method files.

Function	Press Key
Enter the configuration of the Dilutor-Dispenser	**Conf**
Create or modify a Method	**Edit**
Save the Method as a file in the 402's memory	**Edit**
Direct manipulation of the Dilutor-Dispenser	**Man**
Run a Method	**Run**
File transactions (Delete, Copy, Lock, Dir.)	**File**

Configuration (Conf)

You only have to enter the Configuration details one-time; the 402 keeps this information in its memory, even after you switch off. The next time you switch on the 402, the Configuration and all Methods previously saved as files will be available to modify or run.

The software must be given details about syringe sizes, flow rates, etc. You enter this information using the configuration function, which you access by pressing the Conf soft-key (see *Configuration Screen*).

Configuration Screen

As a minimum, you must enter the volume of syringe(s) that you are going to fit to your 402, check that the default flow rates are appropriate (or enter suitable values), and check the transfer (probe) tubing volume is correctly specified (standard is 2 mL).

The use of the soft-keys is as follows:

- **Vol** is used for the probe (transfer) tubing and 'Air gap' volumes,
- **Syr** is used to enter syringe related parameters and activate the syringe exchange function.
- **Flow** is used to enter default flow rates for liquid coming from the reservoir,
- **Count** is used to consult or to reset various counters (see Chapter 5),
- **Etc** is used to switch on and off the Beeper and Autorefill function.

Volume(s)

Check that the configured volume for the probe tubing is the same as the size fitted.

Press the **Vol** soft-key, you see the *Tubing Volume Screen.*

Tubing Volume Screen

Next is used to go to the next screen,
Chge is used to select the tubing size (see *Tubing Volume Screen*),
Prev is used to go to the previous screen (see *Air Gap Volume Screen*).

Air Gap Volume Screen

If you want to change the configured volume, press **Chge** (until you reach the correct value); when the volumes are the same press **ENTER**, press the **ESC** key to return to the *Configuration Screen,* or press **Next**, after which you see the *Air Gap Volume Screen.*

Key in the 'Air gap volume', press **ENTER** to confirm then press the **ESC** key to return to the *Configuration Screen* (see Chapter 5, for a definition of Air Gap).

Syringe(s)

You must check that the configured volumes are the same as the sizes to be fitted. Press the **Syr** soft-key.

Syringe Screen

The use of the soft-keys is as follows:

Next is used to go to the next screen,
Prev is used to go to the previous screen,
Corr is used to supply a correction factor (see Chapter 5),
Chge is used to select the size(s) of syringe(s),
Exch is used to lower the piston rods.

To change a syringe size, press the **Chge** soft-key until you reach the corresponding volume, then press **ENTER** to confirm. Press **Exch** if you are ready to lower the piston rods, or when you have two syringes, press **Next**. Check that the configured volume for the right syringe is the same as the size to be fitted. Press the **Chge** soft-key until you reach the corresponding volume, then press **ENTER** to confirm. Press **Exch** if you are ready to lower the piston rods or press the **ESC** key to return to the *Configuration Screen.*

Whenever you change the configured volume, the software reminds you to 'Exchange Syringes' before allowing you to quit the configuration screen. Go directly to page 4-7, which explains how the 'Exchange Syringes' function works, unless you need to change flow rates, etc.

Flow Rates

Flow rates should be specified according to the sizes of syringe and tubing fitted to the 402. Refer to Chapter 5 for more details, the maximum values are given in the Tables, these are used as default values by the software.

Press the **Flow** soft-key; the *Air Flow Screen* appears.

Air Flow Screen

Next is used to go to the next screen (see *Air Flow Screen*),
Prev is used to go to the previous screen (see *Resv flow Screen*).

Air Flow is the rate in mL/min. that air is drawn into the transfer tubing when aspirating air.

Resv Flow Screen

Key in the required value, then press **ENTER**. Press the **ESC** key to return to the *Configuration Screen* or press **Next** to go to the *Resv Flow Screen*.

Resv (Reservoir) Flow is the rate in mL/min. that solvent is aspirated from the reservoir by the left syringe.

Prime Flow Screen

Key in the required value, then press **ENTER**. Press the **ESC** key to return to the *Configuration Screen* or press **Next** to go to the *Prime Flow Screen*.

Prime Flow is the rate in mL/min. that liquid is transferred by either syringe when priming.

Key in the required value, then press **ENTER**. Press the **ESC** key to return to the *Configuration Screen*.

Other Items

Beeper Screen

Press the **Etc** soft-key; the *Beeper Screen* appears. This is to set an alarm when an error occurs, and to warn that liquid is going to be dispensed to waste.

To switch between ON and OFF, press the **Chge** soft-key, then press **ENTER** to confirm.

Autorefill Screen

Press **Next** to go to the *Autorefill Screen*. Press the **ESC** key to return to the *Configuration Screen*.

When you set Autorefill to ON, the left-hand syringe re-aspirates diluent automatically for the next cycle, while you are (for example) aspirating air via the probe. This feature enables you to work faster with the 402.

To switch between ON and OFF, press the **Chge** soft-key, then press **ENTER** to confirm. Press **Prev** to go to the *Beeper Screen*. Press the **ESC** key to return to the *Configuration Screen*.

Start-up Screen

This completes the basic configuration process, press **ESC** to return to the *Start-up Screen*.

Fit the Syringe(s)

1) First you must lower the piston rod(s), as follows:
   - press the **Conf** key to access the *Configuration Screen*:
   - press the **Syr** soft-key (ensure that the size is correct before continuing),
   - press the **Exch** soft-key.

   'Please wait ...' appears on the screen whilst the piston rod(s) descend; then 'Exchange the Syringe(s)'.
2) Screw the assembled syringe into the valve or Tee until tight (do not over-tighten).
3) Align the threaded recess on the piston-button with the piston holding screw.
4) Tighten the piston holding screw.
5) Press the **Done** soft key: 'Put probe into waste' appears on the screen.
6) Put the end of the probe into the waste or any other suitable container.
7) Press the **Run** soft key:
   Whilst the syringe-piston operating-rod(s) move to their uppermost positions, the *Homing Screen* is displayed. When they reach their uppermost positions a *Counter Screen* appears.
8) Press the ESC key: the *Configuration Screen* reappears.
9) The next step is described below.

Configuration Screen

Syringe Screen

Counter Screen

Creating a Method (Edit)

Introduction

In this section you will find the basic information required to enter and save your Method as a file. The steps are as follows:

- describe the Method on paper (protocols and parameters),
- use the keypad to enter the Method as a file (one or more tasks used sequentially),
- save the Method as a file.

Alternatively, you could run an adapted copy of one of the five pre-fabricated files (90-94). See Chapter 5 for details.

In-run Prompts

You can defer some parameters (volumes and flow rates) by entering a question mark (?) in place of the value. You enter the actual value after pressing the **RUN** key. This feature is particularly useful when optimizing parameters. In the following example, the aspirate flow rate (Asp Flow) is submitted as an unknown. Then, each time the Method is run, you can submit a different value (6, 12, 18). After which you evaluate the results and select the most appropriate value for use in the Method.

Method Example

Dispense equal volumes of various samples, rinse the probe after distribution.

Common (Fraction) Volume = 20 µL,
Number of fractions = 3.

Aspirate flow rate from 6 to 18 mL/minute,
dispense flow rate = 6 mL/minute.
In this example 'Aspirate flow rate' will be submitted as an in-run prompt.

Extra volume = 5 µL.
You aspirate an extra volume of sample, to avoid diluting the last fraction with solvent. This extra volume is sent to the Waste, after distributing the last fraction.

Rinse with 500 µL of solvent.

When using the software, remember that the 'HELP' key is available with most screens.

Start-up Screen

```
Method 1   [New]
File Edit Conf    Man
```

Task Selection Screen

```
Choose a task:
 Dil Disp Pip RinseMore
```

Entering the Method

Beginning at the *Start-up Screen*, key in the file number for your Method, then press **ENTER**.

Then press **Edit**; the *Task Selection Screen* appears.

You can now access the screens for the required task and enter the task related parameters. The following screens show how to enter the information (described above) for each task.

In general you must press the **Chge** soft-key to select an option, then press **ENTER** to confirm the option selected. Press the **Next** soft-key to cycle forward through the screens, press Prev to cycle backwards, or **ESC** when you reach the extremity of a software branch.

For the Dispense task, press **Disp**; you see the first parameter screen, *Dispense Screen (1).*

Press **Chge** until you see 'Source: PROBE', press **ENTER** to confirm, then press **Next**.

Press **Chge** until you see 'Fraction vol: SAME', press **ENTER** to confirm, then press **Next**.

Key in the number of fractions (up to 99 are possible) to dispense (3 in this example), press **ENTER** to confirm, then press **Next**. Key in the 'Common vol:' (20), press **ENTER** to confirm, then press Flow.

At 'Asp. Flow', key in a typical flow rate (6), then press the question mark (**?**) soft-key, press **ENTER.**

Press **Next**, key in the flow rate (6), press **ENTER**; *Dispense Screen (5)* appears.

Press **ESC** *Dispense Screen (4a)* reappears. Press **Extra**; *Dispense Screen (6)* appears.

Key in the 'Extra vol: '(5), press **ENTER** to confirm, then press **ESC**, *Dispense Screen (4)* reappears.

Press **ESC**, *Dispense Screen (7)* appears.

This completes the parameter set for the first task (Dispense). If you need to verify (or change) any of the parameters, you would press the Param key. However, in this example you continue by pressing **ADD**; *Task Selection Screen 2* appears.

Press soft-key for required task: **Rinse**; you now see the *Rinse Screen*.

Key in the rinse volume (500), press **ENTER**. Press **ESC**; *Task Edit Screen* appears.

Press **ESC**, the *Save Screen* appears.

Press **Yes**; *Run Screen* appears (the name of the first task to be run appears, in this example 'Dispense'); you are now ready to prime the 402, after which you can run the Method that you have just created.

Dispense Screen (1)

```
Source:  PROBE
Prev Next    Chge
```

Dispense Screen (2)

```
Fraction vol:  SAME
Prev Next    Chge
```

Dispense Screen (3)

```
Nb of fractions:  3
Prev Next
```

Dispense Screen (4a)

```
Common vol:  20  µl
Prev Adj  Flow  ?  Extra
```

Dispense Screen (4b)

```
Asp  flow:  6    ml/min
  Next           ?  Deflt
```

Dispense Screen (5)

```
Disp flow:  6    ml/min
Prev             ?  Deflt
```

Dispense Screen (6)

```
Extra vol:        0  µl
                  ?
```

Dispense Screen (7)

```
1:  DISPENSE
    Add Param Ins  Del
```

Task Selection Screen 2

```
Choose a task:
Dil Disp Pip Mix  Rinse
```

Rinse Screen

```
Volume:  -----.-    µl
                    ?
```

Task Edit Screen

```
2:  RINSE
Prev  Add Param Ins  Del
```

Save Screen

```
Save this method ?
 Yes                 No
```

Run Screen

```
Method 1  DISPENSE
File Edit Conf  Run  Man
```

Prime the 402 (Man)

Prime is used to thoroughly clean out all fluid pathways with fresh solvent and to clear bubbles from the tubings.

Manipulation Screen

Press the **Man** soft-key, the *Manipulation Screen* appears.

Initialization Screen 2

Press **Prime,** *Initialization Screen 2* appears. [**Measure** and **Titrate** are described in Chapter 5.]

You should prime the 402 before each run, to ensure that all fluid pathways contain fresh solvent and no air bubbles.

Put the probe-end of the transfer-tubing into a suitable the waste container, then press **OK**.

Priming starts immediately and the message 'Priming ...' appears on the screen; during which time solvent is expelled at the probe-end of the transfer tubing.

Press **STOP,** or the **End** soft-key, when you are satisfied that all fluid pathways have been primed with fresh solvent and are free of air bubbles.

Pressing End

When you press **End**, the motion of the syringe(s) ceases and 'Homing ...' appears on the screen until the syringe(s) have returned to their uppermost positions.

Pressing STOP

You can press **STOP** at any time, however, this key is more for use if a problem arises (such as a leak).

Abort Screen

When you press **STOP**, the motion of the syringe(s) ceases and the *Abort Screen* appears. Press **Proceed**, when you want to continue the prime from the point at which it was stopped (for example, to refill the solvent reservoir).

Press **Abort**, when you want to stop priming; *Initialization Screen 2* reappears. Ensure that the probe-end of the transfer-tubing is in a suitable waste container, then press **OK**.

'Homing ...' appears on the screen until the syringe(s) have returned to their uppermost (home) positions, during which time any liquid contained in the transfer-tubing is expelled from the probe-end. After this the *Action Screen* reappears.

Press **ESC** to return to the start-up screen for the current file.

Whenever you see 'Homing' on the screen, the syringe piston(s) are returned to their uppermost position(s). As a result, some (or all) of the liquid contained in the transfer-tubing will be expelled from the probe-end. You must ensure that the probe end of transfer-tubing is already in a suitable waste container.

Running a Method (Run)

Introduction

Run Screen (1)

Run Screen (33)

The **Run** soft-key appears, after you have entered your Method. Press **Run** to start the Method currently shown on the screen (at the first task, in this example Dispense).

If you want to run a different program, you must key in its file number and press **ENTER**, before pressing **Run**.

After pressing **Run,** a series of in run screens appears. During the run, you must follow the instructions on the screen, and press the command button on the probe when prompted to do so by the command light on the probe.

You press the command button on the probe to aspirate and to dispense:

- a **steady light** means you are going to aspirate or dispense liquid,
- a **flashing light** means you are going to aspirate air.

When you have finished, or wish to change programs, press **STOP**, to instantly halt the program.

Pressing STOP

Abort Screen

When you press **STOP**, the motion of the syringe(s) ceases and the *Abort Screen* appears. Press **Proceed**, when you want to continue with your Method.

Press **Abort**, when you want to stop. Unless the syringe(s) are already at their uppermost (home) positions, *Initialization Screen 2* reappears.

Ensure that the probe-end of the transfer-tubing is in a suitable waste container, then press **OK**. 'Homing ...' appears on the screen until the syringe(s) have returned to their home positions, during which time any liquid contained in the transfer-tubing is expelled from the probe-end. After this the *Action Screen* reappears.

Press **ESC** to return to the start-up screen for the current file.

Whenever you see 'Homing' on the screen, the syringe piston(s) are returned to their uppermost position(s). As a result, some (or all) of the liquid contained in the transfer-tubing will be expelled from the probe-end. You must ensure that the probe end of transfer-tubing is already in a suitable waste container.

Method Example

This section describes how to run Method 33 (created as above).

In Run Screen (1)

```
Asp flow:      6    ml/min
M33/T 1: DISPENS / 1
```

(i) Press **Run**, you see *In Run Screen 1*. M33/T 1: DISPENS/1 means Method 33 Task 1, Dispense Task, first cycle.

The cursor moves from side-to-side below the parameter value field, indicating that you must enter a value (or validate the current value, in this example 6 mL/min.). Key in the required flow rate (for example, 12 mL/min.) and press **ENTER**. [Similar screens would appear for any other parameters that you had entered as a question mark (?).] The command light flashes and you see alternately *In Run Screens 2a* and *2b* (about every half a second).

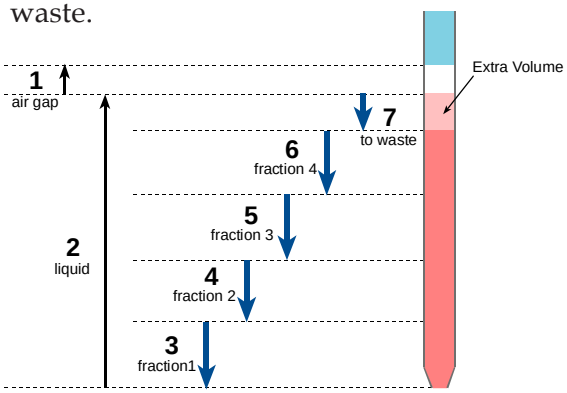
In Run Screen (2a)

```
Ready to aspirate
M33/T 1: DISPENS / 1
```

In Run Screen (2b)

```
10  µl  air
M33/T 1: DISPENS / 1
```

In the Dispense task, you aspirate an air gap, then liquid. After aspirating, you dispense the liquid in several fractions, finally the 'Extra volume' is sent to waste.



(ii) Press the command button to aspirate AIR. The command light is steady and you see alternately *In Run Screens 3a and 3b.*

In Run Screen (3a)

```
Ready to aspirate
M33/T 1: DISPENS / 1
```

In Run Screen (3b)

```
65 µl sample
M33/T 1: DISPENS / 1
```

(iii) Put the tip of the transfer-tubing into the sample then press the command button to aspirate liquid. The command light is steady and you see alternately *In Run Screens 4a* and *4b.*

In Run Screen (4a)

```
Ready to dispense
M33/T 1: DISPENS / 1
```

In Run Screen (4b)

```
20 µl Fraction 1
M33/T 1: DISPENS / 1
```

(iv) Put the tip of the transfer-tubing into a recipient vessel then press the command button to dispense the fraction, the command light is steady. Repeat for the other fractions. The command light is steady and you see alternately *In Run Screens 5a* and *5b.*

In Run Screen (5a)

```
Ready to dispense
M33/T 1: DISPENS / 1
```

In Run Screen (5b)

```
to WASTE
M33/T 1: DISPENS / 1
```

(v) Put the tip into the waste then press the command button to dispense the 'Extra volume'. The command light is steady and you see alternately *In Run Screens 6a* and *6b.*
M33/T 2: RINSE 1 means Method 33 Task 2, Rinse, first cycle.

In Run Screen (6a)

```
Ready to dispense
M33/T 2: RINSE / 1
```

In Run Screen (6b)

```
500 µl reservoir
M33/T 2: RINSE / 1
```

(vi) Put the tip of the transfer-tubing into the waste then press the command button to rinse. The command light goes out while the tubing is being rinsed. Then, you are returned to *In-run Screen 1* for the next sample. At his point you may continue to cycle through *In-run Screens 1 to 6*, or end the run by pressing **STOP**, in which case you see the *Abort Screen*.

Abort Screen

```
Abort or proceed ?
Abort Proceed
```

Press '**Abort**' to confirm that you wish to stop and you are returned to the *Run Screen*. Alternatively, you can bring the 402 to a halt by switching off the power, in which case you must ensure that the probe end of transfer-tubing is in a suitable waste container before switching on again.

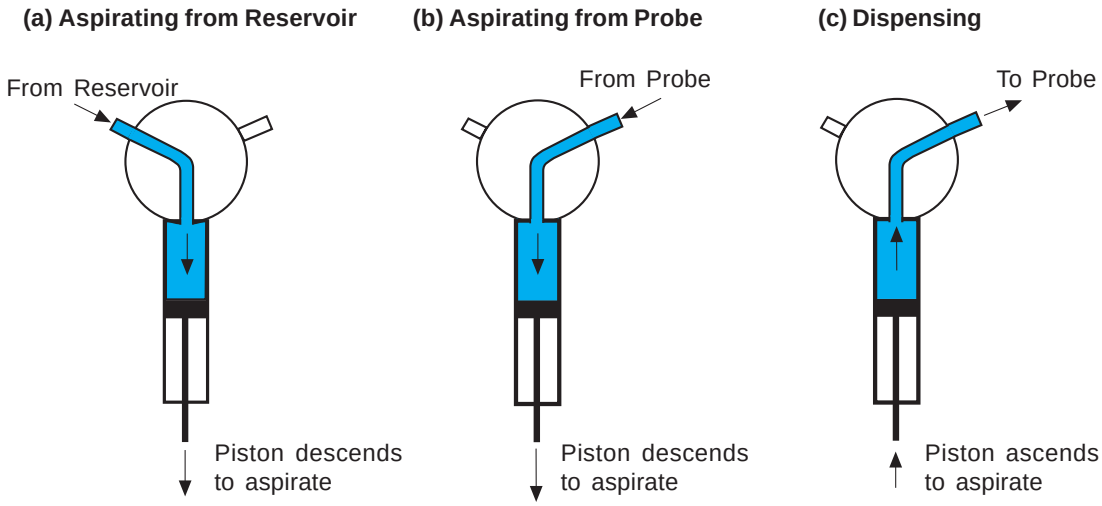
Operation - Advanced Use 5

This chapter explains in details how liquids are aspirated and dispensed using the 402 Dilutor-Dispenser and gives in depth details of various software functions.

Correct Use of a 402

Single-syringe Model

- Samples and reagents are aspirated from the probe side.
- **Liquid aspirated from the probe side may not enter the syringes.** Thus, the tubing that connects the syringe to the probe, called *transfer tubing*, has to be carefully chosen to accommodate the volumes of samples and reagents defined in the Method.
- **Liquids should be separated by an air gap to minimize contamination.**
- If a drop of liquid is present at the end of the tubing after dispensing, you must include this drop in the result vial.
- Syringe functionality is shown below.



Dual-syringe Model

- Samples and reagents are aspirated from the probe side.
- Liquid aspirated from the probe side may not enter the syringes. Thus, the tubing that connects the syringe to the probe, called *transfer tubing*, has to be carefully chosen to accommodate the volumes of samples and reagents defined in the Method.
- Liquids should be separated by an air gap to minimize contamination.

- If a drop of liquid is present at the end of the tubing after dispensing, you must include this drop in the result vial.
- The larger capacity syringe must always be mounted on the left-hand side.
- Only the left-hand syringe aspirates the liquid from the reservoir (diluent and rinsing liquid).
- If the capacity of the right-hand syringe is superior to the total volume aspirated (volumes of samples, reagents, air gaps), the right-hand syringe aspirates and delivers liquids from the probe.
- If the capacity of the right-hand syringe is inferior to the total volume to be aspirated (including air gaps), the left-hand syringe will be used to aspirate all liquids.
- Syringe functionality is shown below, steps **(a)** to **(e)**.

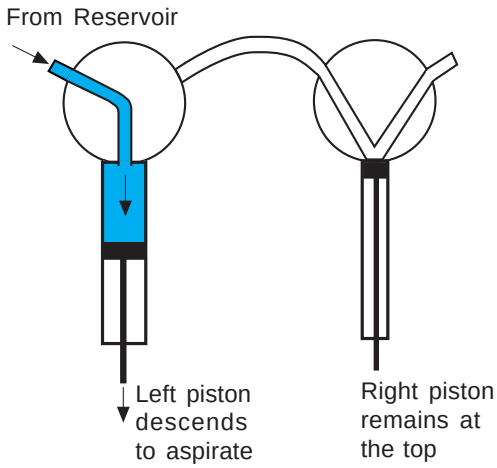
Left-hand Syringe Aspirating (from Reservoir)

1. The valve switches to connect the left-hand syringe to the reservoir.
2. The piston of the right-hand syringe remains in the top position.
3. The left-hand piston descends to aspirate the specified volume of liquid from the reservoir.

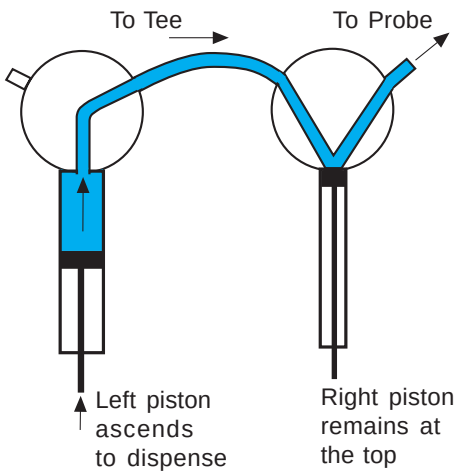
Left-hand Syringe Dispensing (from Reservoir)

1. The valve switches to connect the left-hand syringe to the Tee-junction and probe.
2. The piston of the right-hand syringe remains in the top position to prevent liquid from entering the syringe.
3. The left-hand piston ascends to dispense the specified volume of liquid from the reservoir.

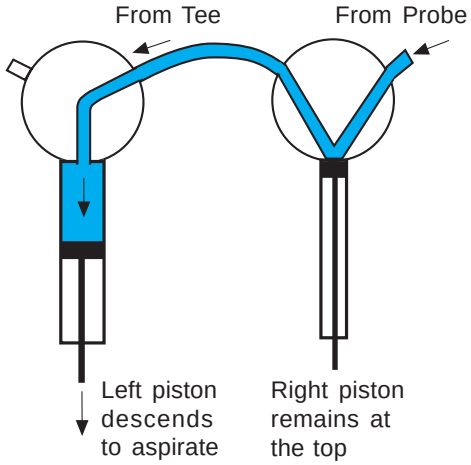
(a) Left-hand Syringe Aspirating from Reservoir



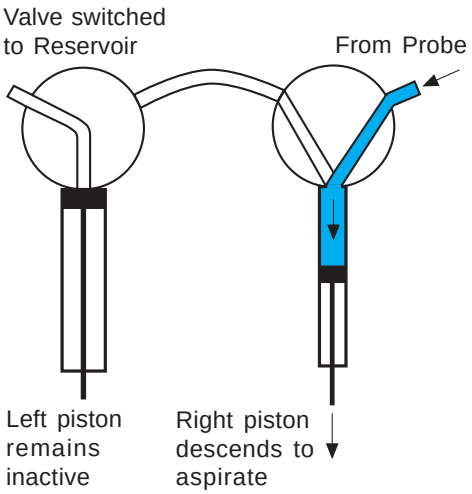
(b) Left-hand Syringe Dispensing



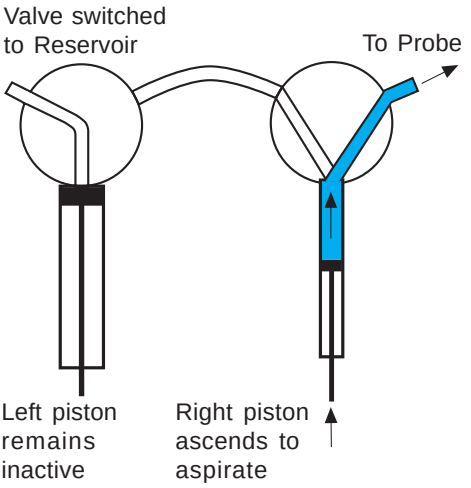
(c) Left-hand Syringe Aspirating from Probe



(d) Right-hand Syringe Aspirating from Probe



(e) Right-hand Syringe Dispensing to Probe



Aspirating Large Volumes via the Probe

1. The valve switches to connect the left-hand syringe to the Tee-junction and probe.
2. The piston of the right-hand syringe remains in the top position to prevent liquid from entering the syringe.
3. The left-hand piston descends to aspirate the specified volume of sample liquid.

Aspirating Small Volumes via the Probe

1. The valve switches to connect the left-hand syringe to the reservoir, thus disconnecting the left-hand syringe from the right syringe.
2. The piston of the left-hand syringe remains in the top position.
3. The right-hand piston descends to aspirate the specified volume of sample.

Right-hand Syringe Dispensing to Probe

1. The valve switches to connect the left-hand syringe to the reservoir, thus disconnecting the left-hand syringe from the right-hand syringe.
2. The piston of the left-hand syringe remains in the top position.
3. The right-hand piston ascends to dispense the specified volume of sample.

Software

You must first enter the configuration details for your 402 Dilutor-Dispenser. Then you may do one of three things:

(i) Perform a direct manipulation (Prime, Measure, Titrate).

(ii) Run a prefabricated Method (files 90 - 94).

(iii) Create your own Method.

A Method consists of a file saved in the 402's memory, which can hold up to 99 files. Each file will contain one or more of the following tasks: Dilute (Dil), Dispense (Disp), Pipette (Pip), Rinse, and Mix. You can use Link to combine Methods so that they operate sequentially.

Each task consists of a series of instructions and parameters. Some of the parameters may be defined as in-run prompts (entered as a question mark); in which case you are prompted to enter the variable's value each time you run the Method. To make and run a Method file, you must follow the procedures 1 to 5.

Each procedure is activated by pressing the appropriate soft-key, each of which gives access to a specific menu. The **RUN** key only appears after you have saved your Method (i.e. after having entered the tasks and parameters).

	Function	Press Key
1	Enter the configuration of the Dilutor-Dispenser	**Conf**
2	Create or modify a Method	**Edit**
3	Save the Method as a file in the 402's memory	**Edit**
4	Direct manipulation of the Dilutor-Dispenser	**Man**
5	Run a Method	**Run**
6	File transactions	**File**

In carrying out these procedures, you must observe some general rules.

1 Press **ENTER**, to confirm your entry, after keying in any value or number[1].

2 Press **ENTER**, to confirm your choice, after selecting any option[1].

3 Press the **Prev** soft-key to go back to the previous screen.

[1]After keying a value (or selecting an option), you must press **ENTER** to make the soft-keys reappear.

4 Press the **Next** soft-key to go to the following screen.

5 Press the **Chge** soft-key to choose an option or to select from a list of possible values.

6 Press the **ESC** key to return to the level of the previous screen or menu.

7 Press **CLEAR** to remove the value (before pressing **ENTER**) and return to the previous value.

8 Press **Deflt** to select the default value or option.

Entering the Configuration (CONF)

Configuration Screen

You have to tell the controlling software how your 402 Dilutor-Dispenser is configured (syringe sizes, flow rates, etc.). Press the **CONF** key; you see the *Configuration Screen.*

Press Key	To Change	What Items
Vol	Volumes	Transfer Tubing, Air Gap.
Syr	Syringe	Sizes, Correction, and to change.
Flow	Flow-rates	Air, Prime, Reservoir.
Count	Counters	Number of cycles for syringe(s) and valve.
Etc	Switch On/Off	Beeper and Autorefill function.

Tubing Volume Screen

Volume(s)

Press the **Vol** soft-key, you see the *Tubing Volume Screen.*

The use of the soft-keys is as follows:

Next is used to go to the next screen (from *Tubing Volume Screen*),

Chge is used to select the tubing size,

Prev is used to go to the previous screen (from *Air Gap Volume Screen*),

Check that the configured volume for the probe tubing is the same as the size fitted. For the standard probe, you can select from: 1, 2, 5, 10 mL (tapered tubing).

When using disposable tips, you must select the size of tip (Micro or Large Volume), and application type for Micro Tips only (Air or Liquid). When you use disposable tips, the 'Extra Volume' parameter is automatically changed to 'Air Push Volume'.

If you want to change the configured volume, press **Chge** (until you reach the correct value); when the volumes are the same press **ENTER**, press the **ESC** key to return to the *Configuration Screen,* or press **Next**, after which you see the *Air Gap Volume Screen.*

Key in the 'Air gap volume', press **ENTER** to confirm then press the **ESC** key to return to the *Configuration Screen.*

Air gaps may be used to separate liquids in the transfer tubing; the default value for 'Air gap volume' is 10 µl, which gives a column of air 6 mm long in the standard transfer-tubing (2 mL).

Syringe(s)

Syringe Screen

Check that the configured volumes for the syringes are the same as the sizes to be fitted. Press the **Syr** soft-key.

The use of the soft-keys is as follows:

Next is used to go to the next screen,

Prev is used to go to the previous screen,

Corr is used to supply a correction factor for the syringe travel,

Chge is used to select the size(s) of syringe(s),

Exch is used to lower the piston rods (see page 4-7).

- **Change Size**

  If the volumes are the same press **ENTER** to confirm. Or, to change a syringe size, press the **Chge** soft-key until you reach the corresponding volume, then press **ENTER** to confirm. Press the **ESC** key to return to the *Configuration Screen.*

  When you have two syringes, press **Next**; check that the configured volume for the right syringe is the same as the size fitted; if the volumes are the same press **ENTER** to confirm. Or, to change a syringe size, press the **Chge** soft-key until you reach the corresponding volume, then press **ENTER** to confirm. Press the **ESC** key to return to the *Configuration Screen.*

  Whenever you change the configured volume, the software reminds you to 'Exchange Syringes' before allowing you to quit the configuration screen. [You use **Exch** to lower the piston rods.]

When you specify left and right syringe capacities (left must be > right), you must enter compatible volumes. An error message is displayed if you try to enter an incompatible volume, in which case you may need to change the volume of the other syringe, before entering the volume of the one that provoked the error message.

Syringe Correction Screen

- **Correction Factor**

  To compensate for the effects of temperature and viscosity, a factor may be applied to all liquid volumes. This factor should be calculated from gravimetric assays (see page 5-33).

  With the Dual-syringe model, you must first select the syringe to which the correction applies. Starting from the *Configuration Screen*, press **Syr**, then use **Next** (or **Prev**) to select the right-hand or left-hand syringe.

  Press **Corr**, you then see the *Syringe Correction Screen*. Key in a factor between 0 and 9.9 (%), press **ENTER** to confirm. Press **ESC**, then use **Prev** (or **Next**) to select the other syringe (if fitted), enter the correction in the same way; press **ESC** (twice) to return to the Configuration Screen.

When you turn the syringe correction factor ON, a plus sign (+) appears after the file number, as a reminder.

Air Flow Screen

Resv Flow Screen

Prime Flow Screen

Flow Rates

Press the **Flow** soft-key; the *Air Flow Screen* appears.

Air Flow is the rate in ml/min. that air is drawn into the transfer tubing when aspirating air.

Key in the required value, then press **ENTER**. Or, press **Deflt** to use the default value (4 mL/min).

Press the **ESC** key to return to the *Configuration Screen* or press **Next** to go to the *Resv Flow Screen*.

'Resv asp:' is the rate in mL/min. that solvent is aspirated from the reservoir by the left syringe.

Key in the required value, then press **ENTER**. Or, press **Deflt** to use the default value. Press the **ESC** key to return to the *Configuration Screen* or press **Next** to go to the *Prime Flow Screen*.

Prime Flow is the rate in mL/min. that liquid is transferred by the syringe(s) when priming.

Key in the required value, then press **ENTER**. Or, press **Deflt** to use the default value. Press the **ESC** key to return to the *Configuration Screen*. The flow-rate limits depend on the volume of the syringe(s) and type of tubing used, see pages 5-31 and 5-32.

Counters

Under normal use you should expect to fit new (or refurbished) syringes after 30000 cycles with water. This feature is made easy by the 402, which automatically counts the number of operating cycles performed by the syringe(s) and valve. (A cycle is completed when the syringe leaves its home position.) You should only need to reset these counters after changing one or more of these items. To do this, press **Count**, the *Syringe Counter Screen* appears.

Syringe Counter Screen

Press **Chge**, then key in the number from which you wish the new count to start, followed by **ENTER**. Press **Next** to go to the second syringe (if fitted) or to the valve.

Press **Chge**, then key in the number from which the new count is to start, followed by **ENTER**. Do this for each counter that you want to change; followed by **ESC** to return to the Configuration Screen.

Other Items

Press the **Etc** soft-key; the *Beeper Screen* appears. This is to set an alarm when an error occurs, and to warn that liquid is going to be dispensed to waste.

Beeper Screen

To switch between ON and OFF, press the **Chge** soft-key, then press **ENTER** to confirm.

Press **Next** to go to the *Autorefill Screen*. When you set Autorefill to ON, the left-hand syringe re-aspirates diluent automatically for the next cycle, while you are (for example) aspirating air via the probe. This feature enables you to work faster with the 402.

Autorefill Screen

To switch between ON and OFF, press the **Chge** soft-key, then press **ENTER** to confirm. Press **Prev** to go to the *Beeper Screen*. Press the **ESC** key to return to the *Configuration Screen*.

Creating a Method (EDIT)

You use the keypad to enter the Method as a file (one or more tasks used sequentially).

Key in the file number for your Method, then press **ENTER**; press **Edit**. Now, one of two situations can arise:

Task Selection Screen

(i) if you have **not** entered a syringe correction factor in the configuration process, the *Task Selection Screen* appears, after which you press a soft-key

Syringe Correction Screen

to access the required task and its parameters,

(ii) if you have entered a syringe correction factor in the configuration process, the *Syringe Correction Screen* appears first, after which you select ON or OFF using the **Chge** soft-key, press **ENTER**, and then **Next**, after which the *Task Selection Screen* appears; you can now access the screens for the task and enter the task related parameters (see page 5-15).

When using the Edit function to create or edit a Method, you should press the **Chge** soft-key to select an option, then press **ENTER** to confirm the option selected. Pressing **ENTER** moves you automatically to the next screen. Press the **Next** soft-key to cycle forward through the screens, or press **Prev** to cycle backwards.

Saving a Method

Save Screen

When you have created, or modified your Method, you are prompted by the software as follows:

Normally you press **Yes**, and you are returned to the *Run Screen*. Other file manipulations are below.

File Manipulations (FILE)

File Menu Screen

Press the **FILE** soft-key, the *File Menu Screen* appears.

The use of the soft-keys is as follows:
Del is used to delete a Method file,
Copy is used to copy a Method file,
Dir is used to access the file directory,
Lock is used to enter your access code.

File Lock Screen

A plus sign (+) after the file number, indicates that the syringe correction function is ON. An asterisk (*) means that the file is locked.

Delete a File

Delete Screen

This action applies to the **file currently selected**; so to delete another file you must first key in the number of the file to be deleted and press **ENTER**. Press **Del**, the *Delete Screen* appears.

If you select **No** you are returned to the *File Menu Screen*.

When you select **Yes**, the file is deleted from the directory and you see the *New-File Directory Screen*.

Press **ESC** to return to the *New File Screen*, or press **Dir** to access the file directory.

New File Directory Screen

New File Screen

Copy a File

This action applies to the **file currently selected**; so to copy another file you must first key in the number of the file to be copied and press **ENTER**.

Press **Copy**, the *Copy Screen* appears.

Key in the file number to which the file currently selected is to be copied, press **ENTER**, the *Copy Method Screen* appears.

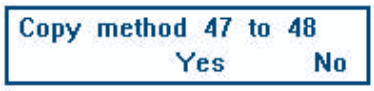
Normally, you select **Yes**, in which case you are returned to the *File Menu Screen.*

When you select **No** or **Prev** you are also returned to the *File Menu Screen.*

If the destination file already exists (and is not locked), you are asked to confirm that you wish to overwrite; select **Yes** and the Method previously stored in the destination file is destroyed.

Copy Screen

Copy Method Screen

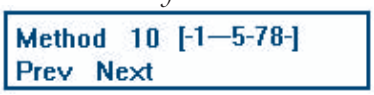


File Directory

The file directory allows you to visualize the file numbers currently assigned. Press **Dir**, the file directory for the first set of file numbers appears (1 to 9). Thereafter, a file directory exists for each decade (range of ten numbers), for example Method 10 [-1—5-78-]; in this example, files 11, 15, 17 and 18 exist. You use the **Prev** and **Next** keys to move between decades.

Files may be numbered from 1 to 99; so the last decade is Method 90. You press the **ESC** key to return to the *File Menu Screen.*

File Directory Screen



Lock (or Unlock) a File

To prevent changes to a Method, you can lock the corresponding file. This action applies to the file currently in memory; so to lock another file you must first key in the number of the file to be locked and press **ENTER**.

Press **Lock**, key in your code (any number between 1 and 9999), then press **ENTER**, followed by **ESC**. The file is now locked, the *Unlock File Screen* appears.

Unlock File Screen

Locked File Screen

To unlock this file you must key in the code that was used to lock the file. You may not edit a locked file, so the **Edit** soft-key is replaced by the **View** soft-key, which allows you to browse through the contents of that file, without making any changes.

However, you are permitted to copy a locked file. After copying the original file remains locked but the copied file is unlocked automatically by the software.

Direct Manipulations (MAN)

Action Screen

You can either perform one of three direct manipulations (**Prime**, **Measure**, **Titrate**) by pressing the corresponding soft-key. Press the **Man** soft-key, the *Action Screen* appears.

Prime

Initialization Screen

You should prime the 402 before each run, to ensure that all fluid pathways contain fresh solvent.

Press **Prime,** *Initialization Screen 2* appears.

Put the probe-end of the transfer-tubing into a suitable waste container, then press **OK**.

Priming starts immediately and the message 'Priming ...' appears on the screen; during which time solvent is expelled at the probe-end of the transfer-tubing.

Press **STOP,** or the **End** soft-key, when you are satisfied that all fluid pathways have been primed with fresh solvent and that there are no bubbles in the tubing.

Pressing End

When you press **End**, the motion of the syringe(s) ceases and 'Homing ...' appears on the screen until the syringe(s) have returned to their uppermost positions.

Pressing STOP

Abort Screen

You can press **STOP** at any time, however, this key is more for use if a problem arises (such as a leak).

When you press **STOP**, the motion of the syringe(s) ceases and the *Abort Screen* appears. Press **Proceed**, when you want to continue the prime from the point at which it was stopped (for example, to refill the solvent reservoir).

Press **Abort**, when you want to stop priming; *Initialization Screen 2* reappears. Ensure that the probe-end of the transfer-tubing is in a suitable waste container, then press **OK**. 'Homing ...' appears on the screen until the syringe(s) have returned to their uppermost (home) positions, during which time any liquid contained in the transfer-tubing is expelled from the probe-end. After this the *Action Screen* reappears.

Press **ESC** to return to the start-up screen for the current file.

Whenever you see 'Homing' on the screen, the syringe piston(s) are returned to their uppermost position(s). As a result, some of the liquid contained in the transfer-tubing will be expelled from the probe-end. You must ensure that the probe end of transfer-tubing is already in a suitable waste container.

Measure

You can measure a volume (e.g. supernatant after centrifugation).

Measure Screen

- Press **Measure,** the *Measure Screen* appears.
  For a Dual-syringe 402, press the **Chge** soft-key to select LEFT or RIGHT. You are advised to select the left-hand syringe if the volume to be measured seems to be significantly larger than the capacity of the right-hand syringe.
  The maximum volume that you can measure is limited to the volume of the aspirating syringe or the transfer tubing size, whichever is the smaller.

Flow Rate Screen

- Press **ENTER**, the *Flow Rate Screen* appears.
  Key in the flow rate at which you want the volume measurement to take place, and then press **ENTER**. The default flow rate is half the maximum possible for the combination of syringe and transfer tubing in use (refer to page 5-31).

Press **Run**, then follow the instructions given on the screen; you press the command button on the probe to aspirate, when prompted to do so by the command light on the probe:

- a **steady light** means you are to aspirate (or dispense) liquid,
- a **flashing light** means you are to aspirate air via the probe.

Measurement Screen

After completely aspirating the liquid being measured, you see (for example) the *Measurement Screen.*

Procedure

1) Aspirate all the liquid contained in the source vial, plus an air cushion, to ensure that you have aspirated all the liquid. You should press the command button to stop aspirating when you can see the air/liquid interface in the transfer tubing.
2) Press the **Asp** key to reverse the direction of flow; (**Asp** is replaced by **Disp**).
3) With the tip of the tubing in the vial, press the command button to start dispensing the air cushion.
4) While carefully watching the air/liquid interface, press the command button to stop dispensing at the instant the liquid arrives at the tip of the tubing[1].
5) Read the volume shown on the screen (496.7 µL in the example).
6) With the tip of the tubing in the vial, press the command button to dispense the liquid back into the source vial.
7) Before repeating this procedure with other vials, remember to reverse the direction of flow by pressing the **Disp** key again (**Disp** is replaced by **Asp**).

Conclude the current measurement by pressing **STOP** or **End** (see **Prime** for details).

[1]High precision is obtained by performing this action at a low flow rate. And, because the piston accelerates after pressing the command button, you are advised to start-and-stop dispensing by repeatedly pushing the command button with an increasing frequency as the liquid nears the tip.

Titrate

The use of this direct manipulation is the same as classical titration (using a burette) where the idea is to run a quantity of reagent into a sample that includes a pH indicator, up to the point where the color changes. With 402, you may also use titrate to fill plates, vials, or bottles.

To titrate, you aspirate a known volume of reagent, dispense part of the volume required into the sample, agitate the sample, dispense a small amount, agitate again, dispense a smaller amount, agitate again, etc., as you move in finer and finer steps towards the point where you have added the precise volume required to change the color.

This is realized using the 402 by pressing the probe's command button with increasing rapidity as you approach the neutralization point. Care must be taken in selecting the dispense flow rate.

- Press **Titrate,** *Titrate Screen (1)* appears. Select either reservoir or probe as the source using the **Chge** soft-key, then press **ENTER** to confirm your choice.
- Press the **Next** soft-key, key in the volume to aspirate, then press **ENTER,** *Titrate Screen (2)* appears. Normally, you would aspirate sufficient liquid for several titrations.
- Press the **Next** soft-key, *Titrate Screen (3)* appears.
- Follow the instructions given on the screen; you press the command button on the probe to aspirate and to dispense, when prompted to do so by the command light on the probe:
  - a **steady light** means you are to aspirate or dispense liquid,
  - a **flashing light** means you are to aspirate air via the probe.

Titrate Screen (1)

Titrate Screen (2)

Titrate Screen (3)

Read the volume on the screen, *Titrate (4) Screen* (for example), after completing each titration.

Titrate Screen (4)

Conclude the current titration by pressing **STOP** or **End** (see **Prime** for details).

Tasks - Detailed Descriptions

Your Method may consist of one or more of the following tasks. Each task consists of a pre-defined protocol, from which you select the required mode of operation, and into which you insert the required parameter values.

In-run Prompts

For optimization purposes, all volumes and flow rates, which can be entered as parameters in a task, can be defined as In-run Prompts. When editing the task, you key in a value, and then a question mark (**?**), the corresponding flashing value has to be validated or changed before the Method runs. It is not necessary to re-edit the method to modify the chosen parameter.

Keys

The use of the soft-keys is as follows:

- **Prev** is used to go to the previous task (or screen within a task),
- **Next** is used to go to the next task (or screen within a task),
- **Add** is used to add a task to the Method (after the task displayed),
- **Param** is used to access the parameters for the current task,
- **Ins** is used to insert a task (before the task displayed),
- **Del** is used to remove the task currently displayed.

Parameters

The following list summarizes the parameters used by the tasks; it gives the maximum and minimum values for each parameter. The maximum values are mostly unambiguous. However, in the case of volumes aspirated via the probe, **the total volume** of fluids (air and liquids) aspirated by a task **can never exceed the internal volume of the transfer tubing**.

The maximum values listed for volumes aspirated via the probe are guidelines that you should follow when considering parameter values to enter. In some cases you may be able to key in a larger value but this will provoke a self explanatory error message, immediately after entry. Even then, depending on the task, you may key in a series of parameter values, for which the software will then calculate the total volume. If the transfer-tubing volume is exceeded, you will be advised of the required configuration.

For example, you have configured you 402 with the standard 2 mL transfer tubing. In a task, where you can aspirate more than one liquid (e.g. sample and reagents), the total volume of all fluids adds up to 2110 µL. The software issues a warning message (for example, 'Tubing too small'). You press the **OK** key to acknowledge the message, after which will you see 'Parameters Incompatible!' on the screen. At this point you can either press **Quit** and reconfigure the 402 or press **OK** and renter one or more of the volumes entered in the task.

When you configure your 402 for use with disposable tips, the 'Extra volume' parameter is replaced automatically by 'Air-push volume' in the Dilute, Distribute and Pipette tasks, corresponding to the special requirements of this type of configuration; refer to pages 5-33, 5-34 for additional information.

Parameter	Minimum	Maximum
Air-gap Volume (in Configuration)	0	Transfer-tubing Volume
Dilution Ratio (Dual-syringe)	1	100000
Dilution Ratio (Single-syringe)	1	500
Number of Serial Dilutions	1	12
Number of Reagents	0	12
Number of Fractions	1	12 if volumes are different, 99 if the same.
Number of Cycles (mixing)	0	12
Sample Volume (Vs)	0.1	Volume of transfer-tubing - air gap(s)
Reagent Volume (Vr)	0.1	Volume of transfer-tubing - air gap(s)
Diluent Volume (reservoir)	0.1	99.999 mL
Diluent Volume (via probe)	0.1	Volume of transfer-tubing - air gap(s)
Common Volume (reservoir)	0.1	99.999 mL
Common Volume (via probe)	0.1	Volume of transfer-tubing - air gap(s)
Total Volume (/)	0.1	99.999 mL
Total Volume (via probe)	0.1	Volume of transfer-tubing - air gap(s)
Extra Volume	0.1	100 µL
Final Volume (adjust via probe)	0.1	Volume of transfer-tubing - air gap(s)
Final Volume (adjust from reservoir)	0.1	99.999 mL
Flow Rate - Aspirate (mL/min.)	0.01	See page 5-31
Flow rate - Dispense (mL/min.)	0.01	See page 5-32

Chaining Tasks

Because of the flexibility of the software many combinations of the tasks are possible in your Method. However, **it is better to avoid certain combinations of task** such as Dispense *followed by* Dilution.

The reason is that Dispense distributes the fractions into several tubes, whereas Dilute, Mix, and Rinse operate on a tube by tube basis.

So, if Dilute follows Dispense, the software will first dispense the number of fractions specified (into a series of tubes), then one tube will be diluted, and then the software will start the second dispense cycle.

When editing a Method containing (for example) Dispense followed by Dilution, the software issues a warning message indicating that it would be better if Dispense could be placed at the end of the chain.

Dilute

Three types of dilution task are available 'Normal', 'Unknown', and 'Serial'. Three modes are available for 'Normal' and 'Serial': Total Volume, Diluent Volume, and Dilution Ratio. The first action is to select the type of dilution task that you are going to use, by pressing the appropriate soft-keys.

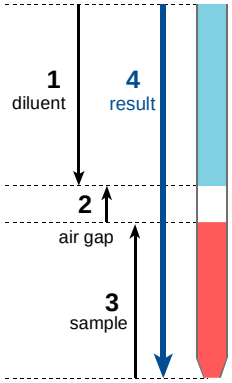
If you specify a volume of sample greater than that of the right-hand syringe, the left-hand will be used to aspirate the sample.

Dilute Normal

You use Dilute Normal to dilute samples, with diluent from the reservoir or via the probe, and add up to 12 reagents. There are 3 modes of entering the parameters, in each mode you supply Sample Volume (Vs) plus one of the following variables: Dilution Ratio (Rd), Diluent Volume (Vd), and Total Volume (Vt). The software calculates the remaining variables, taking into account the volumes of the added reagents (Vr).

$$Vt = Vs \times Rd,\ Vd = Vt - Vs - Vr$$

For example, after selecting Dilution Ratio Mode, you enter Sample Volume = 10 and Dilution Ratio = 3, Reagent Volume (total) = 9; the software calculates the Total Volume as 30 and the required Diluent Volume as 11. In any mode, pressing the **Data** soft-key gives the calculated values for the other two parameters.



1. Aspirate the required volume of diluent (in opposite figure, from the reservoir).
2. Aspirate an air gap (specified in configuration).
3. Possibly, Aspirate reagent(s) then the sample (with an air gap between each liquid).
4. Dispense all into recipient vessel.

Typical Task Entry

Screens: / *Key to press:*

Screens:	Key to press:
Method 48 (New) File Edit Conf Man	Key in the File # (e.g. **48**), Press **ENTER**
	Press **Edit**
Choose a task: Dil Disp Pip RinseMore	Press **Dil**
Type of dilute task: Normal Unknown Serial	Press **Normal**
Source: RESV Prev Next Chge	Press **Chge** to select source, press **ENTER,** then **Next**.
Mode: DILUTION RATIO Prev Next Chge	Press **Chge** to select the mode, press **ENTER,**
Mode: DILUTION VOL Prev Next Chge	
Mode: TOTAL VOL Prev Next Chge	

Press **Next**, then key in the sample volume, press **ENTER.**

Depending on the mode, you see one of three screens after pressing **Next.**

Key in the value, press **ENTER.**

Optionally, for any mode, you can display the variables calculated by the software by pressing **Data**.

Optionally, you can modify the flow rates; press **Flow**,

For any mode, key in a value for Asp flow, press **ENTER**, press Next**,** key in a value for Disp flow, press **ENTER**.

Optionally, for any mode, you can supply up to 12 reagents, press **Rea**g, key in number of reagents, press **ENTER**.

Press **Next**, then for each reagent, key in volume press **ENTER.**

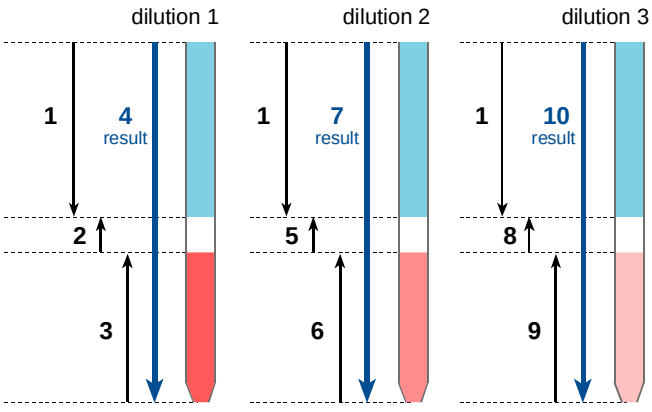
After the data are entered the Reag key changes to **REAG.**

Press **ESC** until you see this screen (three times if you have added reagents);

Press **ESC** again to reveal the *Save Screen*; select **Yes**, the Method is then saved, after which you see the *Run Screen.*

Dilute Serially

You use Dilute Serially to dilute samples, with diluent from the reservoir or via the probe. You also have the option to mix after dilution, but the addition of reagents is restricted to Dilute Normal and Dilute Unknown.



There are 3 modes of entering the parameters, in each mode you supply Sample Volume (Vs) plus one of the following variables:
Dilution Ratio (Rd), Diluent Volume (Vd), and Total Volume (Vt). The software calculates the remaining variables. In any mode, pressing the Data soft-key gives the calculated values for the other two parameters.

For each dilution in the series:
Vt = Vs x Rd, Vd = Vt - Vs

For example, after selecting Dilution Ratio Mode, you enter Sample Volume = 10 and Dilution Ratio = 3; the software calculates the Total Volume as 30 and the required Diluent Volume as 20.

1. When diluent comes from the reservoir (RESV); aspirate the required volume of diluent (for all dilutions, up to the capacity of the left-hand syringe). If diluent comes from the probe, an air gap is aspirated before the diluent, and the required volume of diluent is aspirated (for all dilutions, up to the capacity of the right-hand syringe, after which the left-hand syringe is used).
2. Aspirate an air gap (specified in configuration).
3. Aspirate sample.
4. Dispense all into the recipient vessel.
5. Aspirate an air gap (specified in configuration).
6. Aspirate diluted sample.
7. Dispense all into the recipient vessel.
8. Aspirate an air gap (specified in configuration).
9. Aspirate diluted sample.
10. Dispense all into the recipient vessel.
11. And so on ...

Typical Task Entry

Screens:

Key to press:

Key in the File # (e.g. **48**),
Press **ENTER**
Press **Edit**

Press **Dil**
Press **Serial**

Press **Chge** to select source, press **ENTER,** then **Next**.

Press **Chge** to select mode, press **ENTER,**

Press **Next,** key in a number of serial dilutions, press **ENTER.**

Press **Next,** then key in the sample volume, press **ENTER.**

Depending on the mode, you see one of three screens after pressing **Next.**

Key in the value, press **ENTER.**

Optionally, for any mode, you can display the variables calculated by the software by pressing **Data**.

Optionally, you can modify the flow rates; press **Flow**,

For any mode, key in a value for Asp flow, press **ENTER**, press **Next;** key in a value for Disp flow, press **ENTER**.

Optionally, for any mode, you can mix the diluted liquid; press **Mix**. The volume used for mixing is 90% of the diluent volume.

Key in number of cycles, press **ENTER**. After the data are entered the **Mix** key is shown as **MIX**.

Press **ESC**

Press **ESC** again to reveal the *Save Screen*; select **Yes**, the Method is then saved, after which you see the *Run Screen*.

Dilute Unknown

You use Dilute Unknown to dilute an unknown sample volume, with diluent from the reservoir or via the probe, and add up to 12 reagents. The Dilution Ratio mode is used to enter the parameters, in this mode you supply the Dilution Ratio, the Sample Volume being measured when you press **Run**. The software calculates the Total Volume and the required Diluent Volume.

Typical Task Entry

Press **ENTER**

Press **Edit**

Press **Dil**

Press **Unknown**

Press **Chge** to select source, press **ENTER,** then **Next**.

Optionally, you can modify the flow rates; press **Flow**,

For any mode, key in a value for Asp flow, press **ENTER**, press **Next;** key in a value for Disp flow, press **ENTER**.

Key in the ratio, press **ENTER**.

Press **Next**.

Optionally, you can supply up to 12 reagents, press **Reag**, key in number of reagents, press **ENTER**.

Press **Next**, then for each reagent, key in volume press **ENTER.** After the data are entered the **Reag** key changes to **REAG.**

Press **ESC** until you see this screen (three times if you have added reagents)

Press **ESC** again to reveal the *Save Screen*; select **Yes**, the Method is then saved, after which you see the *Run Screen.*

Run Procedure

Press **Run**

Select the syringe (for the Dual-syringe 402 only), press the **Chge** soft-key to select LEFT or RIGHT, press **ENTER** to confirm.

You are advised to select the left-hand syringe if the volume to be measured seems to be significantly larger than the volume of the right-hand syringe.

The maximum volume that you can measure is limited to the volume of the aspirating syringe or the transfer tubing size, whichever is the smaller.

Press **Next**,

Key in the flow rate at which you want the volume measurement to take place, and then press ENTER. The default flow rate is half the maximum possible for the combination of syringe and transfer in use (refer to pages 5-31, 5-32).

Press **Run**, press the command button, aspirate the air gap:

Insert the tip of the tubing into the liquid to be measured press the command button once to start the measurement and a second time to stop. **Refer to page 5-12 for details of the measuring process**. At the end, the measured volume is shown on the screen.

At his point you can either aspirate diluent from the reservoir or via the probe. When you aspirate from the reservoir, the diluent volume and the measured volume are chained together in the transfer tubing and are dispensed together. If you use the probe, or if reagents are added, the liquids are dispensed in three steps:

(i) you dispense the measured sample,

(ii) you aspirate the diluent, reagents, and measured sample,

(iii) you dispense all of the above into a vial.

If for any reason you want to repeat the measurement (e.g. you need to select the LEFT syringe instead of the RIGHT), put tip of the transfer-tubing back into the original container, then press **Redo** to discharge the liquid.

When you are ready to dilute the previously measured sample, press **End**. The command light is steady and you see alternately the next pair of screens.

Ready to aspirate M33/T 1: DILUTE /1	447.3 µl reservoir M33/T 1: DILUTE /1

Press the command button, diluent is drawn from the reservoir; the command light is steady and you see alternately the next pair of screens.

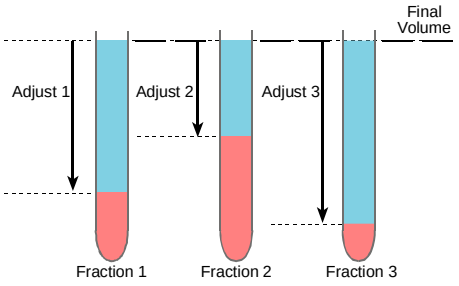
Ready to dispense M33/T 1: DILUTE /1	497 µl result M33/T 1: DILUTE /1

Put the tip of the transfer-tubing back into a suitable recipient vial then press the command button to dispense the diluted sample. After which you are returned to the following screen for the next cycle. If you want to quit at this point you must press the **STOP** key.

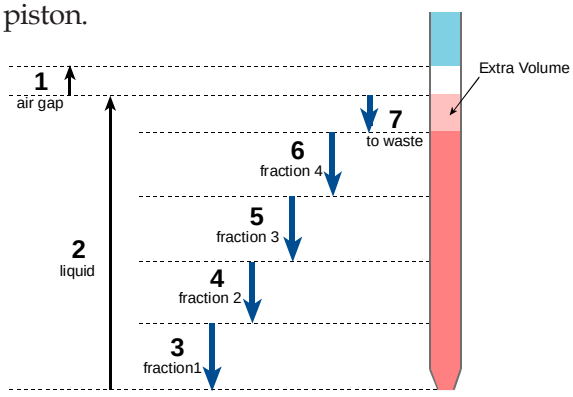
Syringe used: RIGHT Next Chge

Dispense

This task is used to dispense liquid from the reservoir or from the probe, in equal or unequal fractions, into one or more vessels. You may adjust the final volumes in the recipient vessels to a predetermined final volume, with liquid via the reservoir or the probe. If the source is the reservoir, you can dispense a volume greater than the capacity of the left-hand (or only) syringe, which will complete this operation with several strokes of the piston.



When you use this task to aspirate and dispense via the probe, you may also aspirate an 'Extra volume'. The 'Extra volume' is aspirated to ensure that the accuracy of the first volume of liquid is maintained (when it is dispensed) and that the first fraction is not contaminated by liquid coming from the reservoir. The 'Extra volume', which is aspirated with the first



volume of liquid, is dispensed, at the end of the process, into the waste.

When you configure disposable tips in air mode, 'Extra volume' is replaced by 'Air push volume' in this task.

1. Aspirate an air gap.
2. Aspirate liquid via the probe.
3. Dispense fractions via the probe.
4. Dispense extra volume to waste.

Typical Task Entry

Key in the File # (e.g. **45**), **ENTER.**

Press **Edit.**

Disp, then press **Chge** to switch source.

Now, you may select one of two modes, where:

(a) Fractions are equal,
(b) Fractions are different.

Press **Chge** to change modes, then **ENTER**, **Next**.

Key in number of fractions, then **ENTER**, **Next**.

For SAME mode, key in 'Common volume', for DIFFERENT mode, key in volume for fraction 1.

Press **Next**, key in volume for fraction 2, **Next**, etc.

Press **ENTER**, **Next**.

Optionally press **Extra** (only if source is probe),

Key in 'Extra volume', press **ENTER**, **ESC.**

At the last volume screen the **Adj** key replaces **Next**.

Optionally, press **Adj**.

Press **Chge** to switch source, **ENTER**, then **Next.**

Key in the final volume, **ENTER**, **ESC.**

After the data are entered the **Adj** key is shown as **ADJ.**

Optionally at the last of the volume screens, press **Flow**.

Key in a value for Asp flow, press **ENTER.**

Press **Next.**

Key in a value for Disp flow, press **ENTER.**

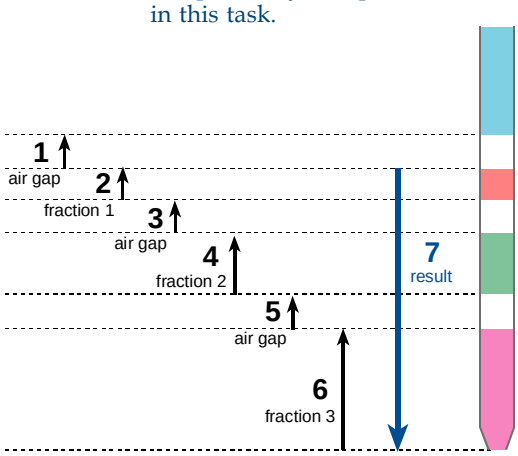
Press **ESC** (twice).
Press **ESC.**

Pipette

You use this task to aspirate a series of fractions via the probe, then dispense the total volume aspirated into a recipient vessel. Each liquid aspirated is separated by an air gap (if air gap is configured as > 0).

You may also aspirate an 'Extra volume' to ensure the accuracy of the first fraction. This 'Extra volume', which is aspirated with the first fraction, is dispensed at the end of the process, into the waste.

When you configure disposable tips in air mode, 'Extra volume' is replaced by 'Air push volume' in this task.



1. Aspirate an air gap.
2. Aspirate the first fraction (with 'Extra volume', if specified).
3. Aspirate an air gap.
4. Aspirate the second fraction.
5. Aspirate an air gap.
6. Aspirate the third fraction.
7. Dispense all except 'Extra volume' into recipient vessel.
8. Dispense 'Extra volume' to waste.

Key to press

Key in the File # (e.g. **45**), **ENTER**
Press **Edit,**

Press **Pip**, then select one of two modes, where:
(a) Fractions are equal,
(b) Fractions are different.

Press **Chge** to switch modes. Press **ENTER**, then **Next**.

Key in number of fractions, press **ENTER**, then **Next**.

For SAME mode, key in common volume, for DIFFERENT mode, key in volume for fraction 1, press **Next**, key in volume for fraction 2, **Next**, etc.

Press **ENTER**, then **Next**.

Optionally at the first of the volume screens, press **Flow**.

Key in a value for Asp flow, press **ENTER.**

Press **Next.**

Key in a value for Disp flow, press **ENTER.**

Optionally at the first of the volume screens, press **Extra,**

Key in 'Extra volume', press **ENTER.**

Press **ESC** (twice).

Press **ESC.**

Rinse

The purpose of this task is to minimize carry-over by flushing the transfer-tubing and syringes with solvent from the reservoir, between tasks. The syringe, most appropriate to the volume specified, is used to pump a volume of liquid from the reservoir through the tubing.

Typical Task Entry

Key in file # (**45**), **ENTER.**

Press **Edit.**

Press **Rinse.**

Key in volume, **ENTER.**

Press **ESC.**

Press **ESC.**

Mix

You use this task to mix either by dispensing a predetermined volume of air through the liquid or by aspirating the liquid from a vial and dispensing it back into the same vial several times.

You are advised against using the air mixing technique when the liquids to be mixed are oxidizable or surface active.

Typical Task Entry

Key to press:

Key in file # (**44**) **ENTER.**

Press **Edit.**

Press **More.**

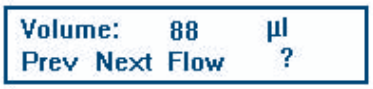
Press **Mix**, then select the mixing mode (air or asp/disp).

Press **Chge** to switch modes.

Press **ENTER**, then **Next**.

Key in volume, press **ENTER.**

Optionally, press **Flow**.



- For AIR mode, key in a value for Disp flow, press **ENTER**. This mode uses the configured value for Asp. Flow (default = 4 mL/min).

- For ASP/DISP mode only, key in a value for Asp flow, press **ENTER**, press **Next**, then key in a value for Disp flow, press **ENTER**. Press **Next**, then key in number of cycles.

Press **ENTER.**

Press **ESC.**

Press **ESC.**

Link

The purpose of this task is to join Methods so that they will be executed serially.

What it Does

Link creates a file (Link File) in which the file numbers corresponding to the Methods to be linked are placed. When you press **Run** the Methods are executed in the order in which they were entered in the Link File.

Example

You want to create Link File #44, which is to contain 4 Methods:

#7 Dilute,
#8 Rinse,
#9 Mix,
#8 Rinse.

Key in Link File number (44), press **ENTER**, press **Edit**.

The only criterion is that the number of the Method file to be linked must exist. If it does not exist, you will see the error message 'Method does not exist'.

At the *Task Menu Screen* press **More**, press **Link**.

Key in the file number of the first Method to link (7), press **ENTER**, press **Next**.

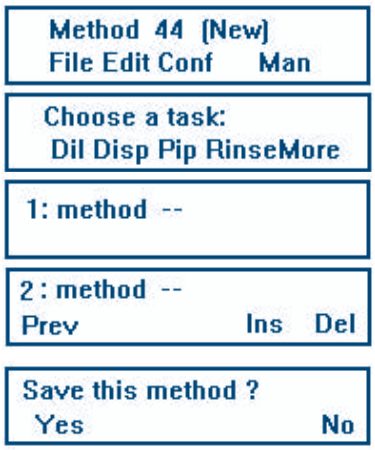
Key in the file number of the second Method to link(8), press **ENTER**, press **Next**.

Key in the file number of the third Method to link(9), press **ENTER**, press **Next**.

Key in the file number of the fourth Method to link(8), press **ENTER**, press **Next**.

After a file is linked in this manner it can not be deleted.

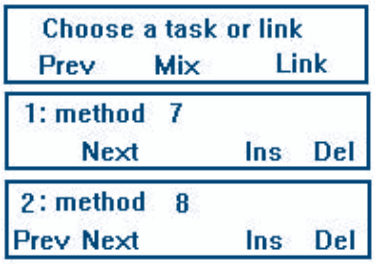
Press **ESC** to access the Save Screen, press **Yes**.



Typical Task Entry

Key to Press:

File # (**44**) **ENTER**



Edit

More

Link

File # **(7) ENTER**

Next

File # **(8) ENTER**

Etc until all file numbers have been entered then:

ESC

Prefabricated Methods

Five prefabricated Methods, to run or to adapt, are present in the 402's memory as file numbers 90 to 94. Although the tasks are the same, the parameters vary according to whether you have a Single-syringe or a Dual-syringe 402.

Configuration

Standard equipment with a 2 mL transfer tubing.

Left-hand (or only) syringe: 5 mL.

Right-hand syringe (if fitted): 500 µL.

Default values are used for parameters not listed.

File Number	TASK/Parameter	Value for use with Dual-syringe Model	Value for use with Single-syringe Model
Method 90	Dilute Normal		
	Dilution Ratio	10	10
	Sample Volume	200	1000
	Rinse	300	1500
Method 91	Dilute Serially		
	Total Volume	3000	3000
	Sample Volume	100	1000
	Nb of Dilutions	3	3

File Number	TASK/Parameter	Value for use with Dual-syringe Model	Value for use with Single-syringe Model
Method 92	Dispense		
	Sample Source	Reservoir (RESV)	Reservoir (RESV)
	Fractions	Same	Same
	Nb of Fractions	3	3
	Common Volume	1000	1000
Method 93	Dispense		
	Sample Source	Probe	Probe
	Fractions	Different	Different
	Nb of Fractions	3	3
	Fraction 1	50	500
	Fraction 2	100	700
	Fraction 3	200	500
	Adjust Source	Reservoir (RESV)	Reservoir (RESV)
	Final Volume	1000	1000
Method 94	Pipette		
	Fractions	Different	Different
	Nb of Fractions	4	4
	Fraction 1	50	300
	Fraction 2	80	400
	Fraction 3	100	500
	Fraction 4	200	600

Running a Method (RUN)

The **Run** soft-key appears, after you have entered your Method. Press **Run** to start the Method currently shown on the screen. If you want to run a different program, you must key in its file number and press **ENTER**, before pressing **Run**. In either case a series of in run screens appears, starting with the in-run prompts (if any).

In-run Prompts

Values for any parameters defined as in-run prompts (using a question mark) must be confirmed, or changed, before the Method runs.

After pressing **Run**, the software prompts you for action: you must press **ENTER** to confirm the value shown on the screen, or to change it, key in a new value and then press **ENTER**.

When the Method runs you must follow the instructions on the screen. You press the command button on the probe to aspirate and to dispense, when prompted to do so by the command light on the probe:

- a **steady** light means you are to aspirate or dispense liquid,
- a **flashing** light means you are to aspirate air via the probe.

When you have finished, or wish to change programs, press **STOP**, to instantly halt the program. Alternatively, you can bring the 402 to a halt by switching off the power, in which case you must ensure that the probe end of transfer-tubing is in a suitable waste container before switching on again.

Pressing STOP

When you press **STOP**, the motion of the syringe(s) ceases and the *Abort Screen* appears. Press **Proceed**, when you are ready to continue with your Method.

Press **Abort**, when you want to stop; *Initialization Screen 2* reappears. Ensure that the probe-end of the transfer-tubing is in a suitable waste container, then press **OK**. 'Homing …' appears on the screen until the syringe(s) have returned to their uppermost positions, during which time any liquid contained in the transfer-tubing is expelled from the probe-end.

Whenever you see 'Homing' on the screen, the syringe piston(s) are returned to their uppermost position(s). As a result, some (or all) of the liquid contained in the transfer-tubing will be expelled from the probe-end. You must ensure that the probe end of transfer-tubing is already in a suitable waste container.

Additional Information

Flow Rates

Flow rates depend on the nature of the liquid (viscosity), the capacity of the syringe, and the internal diameter of tubing. For liquids transferred via the probe, it is possible to adjust the aspirate and dispense flow rates according to the nature of the liquid (e.g. viscous liquids must be aspirated slowly). The default value for 'Air flow rate' is 4 ml/min. Whatever the capacity of the syringe(s).

In Configuration

In the configuration menus, you can modify the air flow rate and the flow rates of liquids coming from the Reservoir (*Prime flow rate* and *Reservoir aspirate flow rate*).

Configuration Flow Rates

Syringe size	Flow rate (mL/min)
100 µL	4
250 µL	10
500 µL	20
1 mL	40
5 mL	120
10 mL	120
25 mL	120

In Methods (Tasks)

In the Flow menu of each task, you can adjust the flow rates of liquid aspirated via the probe. Maximum values (see tables) are given according to syringe capacity and internal diameter of the tubing. These maximum values have been optimized **without air gap**. When using air gap, it is recommended that you decrease these values.

Flow rates may be optimized using in-run prompts: when you enter a question mark in the place of a value (in task edit), that value has to be validated before the run. **Optimization of flow rates is essential to assure maximum rapidity and volumetric precision**. The default values used by the software are shown in bold in the tables that follows.

When using Titrate or Measure, you are advised to halve the maximum values shown in the tables.

Maximum Aspirate Flow Rate (No Air Gaps)

Tubing Type	Syringe Volume (µL) 100	250	500	1000	5000	10000	25000
1 ml	**4**	**10**	**20**	**40**	**120**	**120**	**120**
2 ml	**4**	**10**	**20**	**40**	**100**	**100**	**100**
5 ml	4	10	20	40	**80**	**80**	**80**
10ml	4	10	20	30	30	**30**	**30**
Micro Tips (liquid)	**4**	**10**	20	40	120	120	120
Micro Tips (air)	**4**	**10**	20	40	120	120	120
Large Tips (air)	4	10	**20**	**40**	120	120	120

Maximum Dispense Flow Rate (No Air Gaps)

Tubing Type	Syringe Volume (µL) 100	250	500	1000	5000	10000	25000
1 mL	**4**	**10**	**20**	**40**	**120**	**120**	**120**
2 mL	**4**	**10**	**20**	**40**	**120**	**120**	**120**
5 mL	4	10	20	40	**120**	**120**	**120**
10 mL	4	10	20	40	120	**120**	**120**
Micro Tips (liquid)	**4**	**10**	20	40	120	120	120
Micro Tips (air)	**4**	**10**	20	40	120	120	120
Large Tips (air)	4	10	**20**	**40**	120	120	120

Recommended Flow Rate with an Air Gap (10 µL)

Syringe size	Flow rate (mL/min)
100 µL	4
250 µL	10
500 µL	20
1 mL	30
5 mL	Asp: 30 - Disp: 50
10 mL	Asp: 30 - Disp: 50
25 mL	Asp: 30 - Disp: 50

Flow Rates - Dual-syringe Model

Flow rates are the values entered in Flow menus (Asp Flow or Disp Flow).

- It is not possible to enter a flow rate greater than the maximum without entering an air gap for the left-hand syringe.
- If a flow rate (aspirate or dispense) is greater than the maximum for the right-hand syringe, the left-hand syringe aspirates and dispenses at the selected flow rate. The right-hand syringe aspirates and dispenses as its maximum flow rate.
- If a flow rate is equal to or smaller than the maximum for the right-hand syringe, both syringes aspirate and dispense at the selected flow rate.

Example

When using the 2 mL tapered transfer-tubing, a 5 mL syringe at the left-hand side and a 500 µL syringe at the right-hand side, the default aspirate flow rates are respectively 100 mL/min and 20 mL/min. The dispense flow rate, accessible by pressing **Deflt** soft-key, is 120. The implicit flow rate of the small syringe is 20 mL/min.

If the value of the flow rate is between 120 and 20, the flow rate of the left-hand syringe takes this value and the flow rate of the right-hand syringe is 20. To reduce to the flow rate of the right-hand syringe, it is necessary to enter values below 20 mL/min.

Syringe Correction Function

A correction factor may be applied to all volumes of liquid to compensate for the effects of temperature (for example, when the 402 is used in a culture room) or for the effects of viscosity. This factor should be calculated from gravimetric assays and entered in the Configuration menu. With the Dual-syringe model, you may apply different corrections to each syringe.

When the syringe correction is switched on, a plus sign (+) appears after the Method number. All volumes in all the tasks are affected by this correction, when it is switched on. At the start of a task edit, a message appears to inform you of the status (*Syringe Correction Screen*, see page 5-8).

A correction factor of 1% (for example) under the same condition of temperature and pressure increases the volume of liquid aspirated or dispensed by this amount.

The correction allows you to increase the volume transferred, for example: 250 µL syringe, nominal value is 100 µL, the actual value (after gravimetric measurements) is 99 µL. In this case, a 1% correction results in a nominal value of 101 µL, and an actual value of 100 µL. The application of a 1 % correction factor effectively reduces the capacity of the syringe by 1 %.

You should follow the procedure for gravimetric analysis described in the Operational Qualification (OQ) document that accompanies this User's Guide. Check the accuracy and RSD of the volumes with the liquid to be transferred under the conditions of pressure and temperature of the working environment.

Use of Disposable Tips

Using the disposable tip kit, Gilson D200 tips or Gilson D1000 tips can be mounted at the end of the probe. Two modes are available: air and liquid.

Air Mode

The use of 402 in 'Air Mode' is, for those users familiar with Gilson's pipettes, the same as that of 'Pipetman'.

Gilson D200 tips are used for volumes from 1 µL to 78 µL (with a 100 µL syringe, minimum recommended air-push-volume is 20 µL). Gilson D1000 tips are used for volumes from 50 µL to 900 µL (minimum recommended air-push-volume is 100 µL).

The liquid is ejected with an *Air push volume* of at least **20 µL** when using a Gilson D200 tip and **100 µL** when using a Gilson D1000 tip. An automatic software correction of 2% of the piston stroke is made to improve accuracy with Gilson D200 and D1000 tips. For example, when using a Gilson D200 tip, if an Air push volume of 20 µL is chosen, the maximum sample volume will be 78 µL; this volume will be handled with the 100 µL syringe. For the dual syringe model, the left syringe operates if the volume exceeds 78 µL; for the single syringe model, an error message is displayed.

A disposable tip should **not** be fitted, when priming the 402 in 'Air Mode'. Droplets of liquid adhering the tubing after purging must be wiped from the end, before fitting a tip.

To minimize carry-over, dilution can be performed with one or more tips. If one tip is used, you use the Dilute task where the diluent and the sample are separated by an air gap (volume defined in the Configuration menu). When several tips are used, you use multiple runs of the Dispense task to transfer the liquids, changing the tips where appropriate: one to aspirate and dispense the diluent, one to aspirate and dispense each sample.

Liquid Mode

You can use this mode in the same way as the standard tip with tapered tubing. However, it is recommended not to use an air gap, or at least to use it in a way that keeps the air gap in the disposable-tip. The use of Gilson D200 tips does not adversely affect the performance of the 402.

The Gilson D200 tip is installed to protect the end of the probe against corrosive chemicals, and by changing the tips within a task.

A disposable tip should be fitted, when priming the 402 in 'Liquid Mode'. The following flow rates are suggested when priming: small syringes up to 10 mL/min, larger syringes at least 80 mL/min.

Maintenance 6

This chapter explains how to perform the routine maintenance procedures.

The only maintenance operations necessary for the 402 DD are:

- Cleaning the exterior of the instrument.
- Cleaning of the valve, Tee, syringe assemblies and the tubings.
- Replacement of the piston syringe after approximately 30 000 cycles.

Cleaning

Cleaning the Exterior

The instrument cover and front panel may be cleaned. Ensure that the instrument is switched OFF and the power cord is removed when you clean the instrument.

When you need to clean the instrument, use one of the three following methods:

1) A clean dry cloth.
2) A cloth dampened with water.
3) A cloth dampened with soapy water.

If a cloth dampened with soapy water is used to clean the instrument, only domestic soap may be used. No other form of detergent or chemical may be used.

Parts in the liquid flow path may be cleaned with ethanol or bleach (10 % Sodium Hypochlorite).

Cleaning the Valve

The surfaces of the ceramic stator and rotor inside 402's valve are treated to give optimum airtight operation. If the valve has been used with alcohol based liquids, and then left unused for a while, a grinding noise may be heard during valve switching the next time the pump is used. This is because of friction between the ceramic surfaces. To correct this problem, you should disassemble the valve and clean the ceramic surfaces with a damp cloth.

The valve must be cleaned after using the 402 with corrosive or hazardous liquids, if leakage has occurred, or if liquid flows back into the waste tubing, or if the dilutor has been left unused for a while after pumping alcohol based liquids. The valve must be dis-mounted from the 402 and separated from the syringe, then disassembled. The valve can then be cleaned or autoclaved. It is not necessary to autoclave the valve axle or the spring.

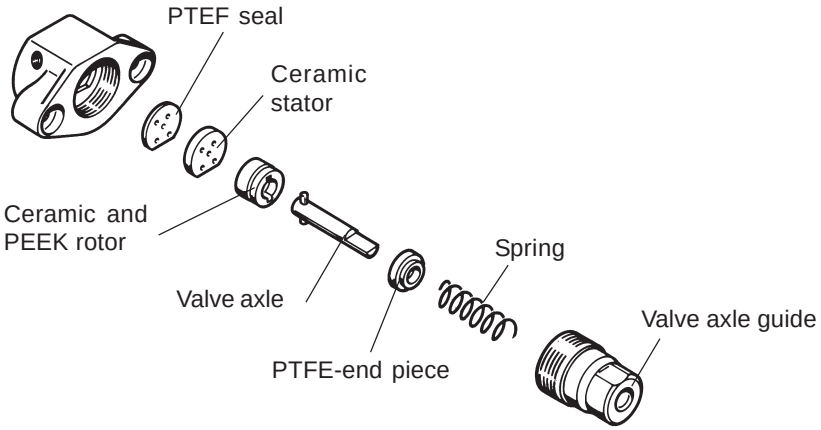
Dismounting the Valve

1) Disconnect all tubings from the valve.
2) Separate the syringe from the valve.
3) Undo the two screws securing the valve to the 402 front plate and remove the valve.

Disassembling the Valve

Hold the valve body firmly in one hand, undo the valve axle guide, using a 17 mm open ended spanner. Separate the axle guide from the body of the valve.

1) Pull the axle away from the valve main body.
2) Remove the ceramic stator from the valve axle.
3) Tap the valve inner body against a clean, solid surface to remove the spring and PTFE spring cover.
4) Do not remove the inner ceramic surface from the valve main body.
5) The parts can be cleaned with a non-abrasive cloth dampened with alcohol, or by autoclaving them.
6) Dry the components using a lint-free cloth.
7) Check that the ceramic parts are dry **and wait for them to cool to room temperature** before reassembling the valve.



Cleaning the Tee Junction

The Tee junction is a single piece. Apart from dismounting it from the 402, there is no disassembly procedure. The Tee junction can be cleaned or autoclaved.

1) Disconnect the inlet and outlet tubing from the Tee junction.
2) Dismount the Tee junction and syringe assembly and separate the syringe from the Tee junction.
3) Undo the two screws securing the Tee junction to the 402 front plate and remove the Tee junction.
4) Autoclave the Tee junction.
5) Reinstall the Tee junction by following the instructions given in Chapter 3.

Cleaning

The 25 mL syringe is not autoclavable, all of the other size syringes are autoclavable.

Cleaning the Syringe Assembly

You must dismount the syringe and piston assembly from the instrument and then separate the syringe and piston assembly before cleaning or autoclaving them.

1) Dismount the Syringe assembly from the instrument.
2) Undo the piston securing screw to free the piston assembly from the piston operating rod.
3) Lower the piston operating rod; for Gilson soft-ware there is a change syringe program that lowers the piston operating rod - use this software option to lower the piston operating rod away from the syringe piston. Refer to your *software User's Guide* for the precise sequence. This allows you to dismount and mount the syringe and valve/Tee assembly without the risk of damaging the syringe.
4) Undo the syringe from the body of the valve or Tee.
5) Remove the piston and syringe assembly from the pump.
6) Pull the piston out of the syringe body. For large syringes; 5, 10 and 25 mL syringes, you must screw the piston securing screw back into the bottom of the piston and pull on the screw to remove the piston from the syringe barrel.
7) Clean or autoclave the two parts **(except the 25 mL syringe)**.
8) Ensure that the syringe and piston assembly have cooled to room temperature before reas-sembling the syringe and piston. Ensure that the piston and the piston nose are free from dust or contamination before introducing the piston into the syringe. Wet the piston nose (water will suffice) before inserting the piston in the syringe. Insert the piston nose in the syringe body and push the piston into the syringe.
9) Remount the syringe assembly on the valve or Tee. Screw the threaded end of the syringe body into the valve or Tee.
10) Lower the piston so that it comes into contact with the piston holding screw.
11) Tighten the piston holding screw so that the piston assembly is secured against the piston operating rod.

Autoclaving

Certain parts of the 402 can be autoclaved (20 min. at 0.1 MPa, 121° C). They must be removed from the instrument for autoclaving.

The autoclavable parts are:

- The valve (disassembled) or the Tee-junction.
- The syringe (except the 25 mL syringe).
- The piston assembly.
- PTFE and FEP tubing.

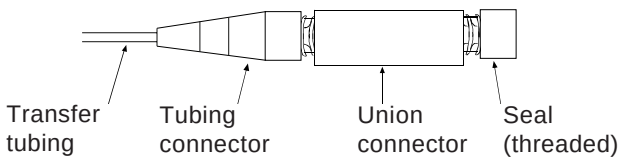
Autoclaving the Tubing

The tubing can be cleaned or autoclaved.

This procedure prevents the end of the tubing from deforming. It is only necessary for the first time you autoclave the tubing.

Precautions to take when autoclaving the tubing:

1) **To preserve the flanged end of the tubing, perform the following steps for the *first time* that you autoclave these components.**
2) Insert and tighten the flanged end of the inlet tubing into one end of the PVDF union connector. Tighten the flanged end of the outlet tubing to the other end of the PVDF union connector. Connect the other end of the inlet tubing to the filter.
3) Autoclave the tubing while connected to the union connector.
4) Disconnect the PVDF union connector.
5) Autoclave the tubing a second time to sterilize the interior of the tubing.



Item	Part Number
100 µL piston kit	F4015072
250 µL piston kit	F4015073
500 µL piston kit	F4015074
1 mL piston kit	F4015075
5 mL piston kit	F4015076
10 mL piston kit	F4015077
25 mL piston kit	F4015078

Changing the Syringe Piston Assembly

For all syringe sizes, it is necessary to replace the piston assembly after approximately 30 000 cycles (using water).

The correct reference piston kit must be ordered:

Replacing the Piston

1) Dismount the Syringe assembly from the instrument, as described page 3-9.
2) Pull the piston out of the syringe body.
3) Reassemble the syringe and piston as described page 6-7.
4) Remount the syringe assembly on the valve or Tee junction.

Changing the Piston Syringes and Piston Noses

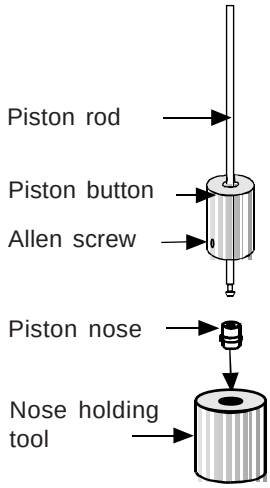
The piston nose should be replaced after the pump has performed approximately 30 000 cycles. All piston noses are replaceable, the process is relatively easy, but for most pistons (except the 25 mL pistons), special tools are required to mount the piston nose.

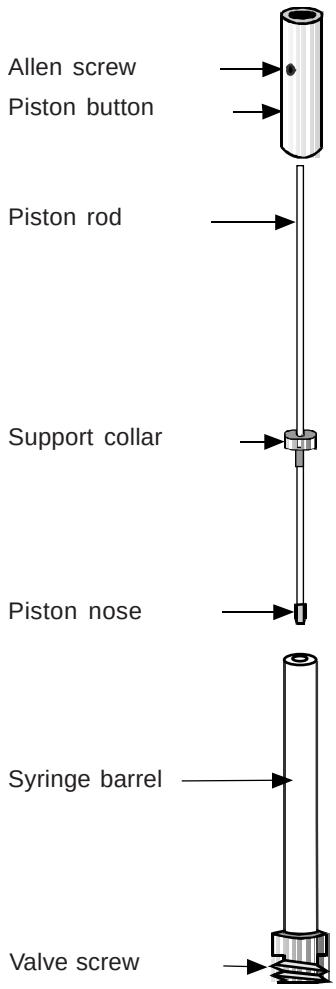
	Part Number	Description
100 µL Piston:	F4015062	5 x piston noses, 2 x support collars and mounting tool (for 100 and 250 µL pistons).
	F4015072	1 piston assembly kit
250 µL Piston:	F4015063	5 x piston noses and mounting tool (for 100 and 250 µL pistons)
	F4015073	1 piston assembly kit
500 µL Piston:	F4015064	5 x piston noses and mounting tool kit
1 mL Piston:	F4015065	5 x 1 mL piston noses and mounting tool
	F4015005	1 nose mounting tool
5 mL Piston:	F4015066	1 x piston nose plus O-ring
	F4015003	Piston nose mounting kit
10 mL Piston:	F4015067	1 x piston nose plus O-ring
	F4015004	Piston nose mounting kit
25 mL Piston:	F4015068	1 x piston nose

Changing the 100 and 250 µL Piston Noses

Part Number	Description
F4015062	5 x piston noses, 2 x support collars and mounting tool (for 100 and 250 µL pistons)
F4015063	5 x piston noses and mounting tool (for 100 and 250 µL pistons)

To optimize the fitting of the 100 µL and 250 µL syringes on the syringe pump valve, each syringe is supplied with a cover seal. The orientation of this seal must be respected to ensure that the connection with the syringe is airtight. Figure page 6-10 shows the correct orientation of the cover seal on a syringe.



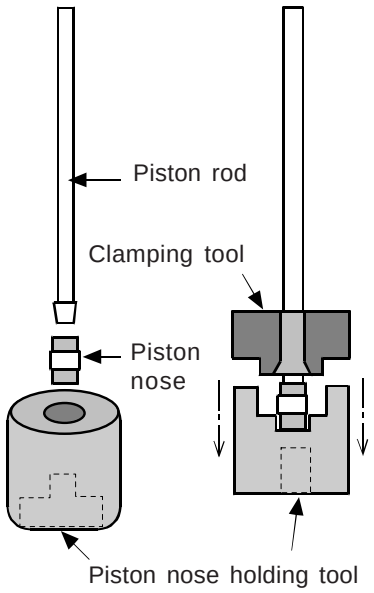


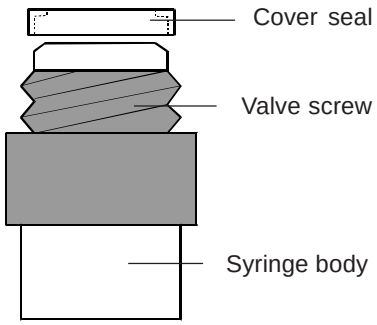
1. Remove the syringe from the pump as described in Chapter 4.
2. Slide the piston out of the syringe barrel.
3. Remove the piston nose from the piston rod by carefully pinching the piston nose with a pair of cutters and gently pulling the piston nose off the piston rod. Take care not to damage the end of the piston rod when removing the nose. *(It is possible to remove the nose by pinching it between the thumb and forefinger nails and pulling.)*
4. Remove any remaining debris of the original piston nose from the end of the rod.
5. The 100 µL and 250 µL pistons have a narrow rod that may be damaged if handled incorrectly. In order to fit a new piston nose without unduly bending the piston rod, undo the Allen screw that secures the piston button to the piston rod. Slide the button down the piston rod to within 10 mm of the end of the rod where the new piston nose is to be mounted and re-tighten it in position.
6. Put the new piston nose in its recess in the piston nose mounting tool. The 100 µL and 250 µL piston noses use a common tool. One face of the tool has a recess for the 100 µL piston nose, the other face has a recess for the 250 µL piston nose.
7. Hold the piston button and gently push the end of the piston rod into the new piston nose.
8. Remove the piston assembly from the piston nose holder. Slacken the piston button and slide it away from the piston rod.
9. Dip the piston nose in distilled water and slide the piston assembly into the syringe.
10. Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops *(the nose is level with the end of the syringe)*.
11. **For the 100 µL piston only,** insert the support collar. The support collar should be replaced after around 60 000 strokes.
12. Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.
13. Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.
14. Remount the syringe on the pump as described in Chapter 4.

Changing the 500 µL Piston Noses

Part Number	Description
F4015064	5 x 500 µL piston noses and mounting tool kit

1. Remove the syringe from the pump as described page 6-4.
2. Slide the piston out of the syringe barrel.
3. Remove the piston nose from the piston rod by carefully pinching the piston nose with a pair of cutters and gently pulling the piston nose off the piston rod. Take care not to damage the end of the piston rod when removing the piston nose.
4. Remove any remaining debris of the original nose from the end of the piston rod.
5. Put the new piston nose in its recess in the piston nose holding tool.
6. Turn the tool upside down and place the piston assembly.
7. Slacken the piston button and remove it from the piston rod. Slide the clamping tool down the piston rod and press the 2 tools firmly against each other. A slight rotation of the clamping tool ensures a correct fitting.
8. Remove the tools away from the piston assembly.
9. Dip the piston nose in distilled water and slide the piston into the syringe.
10. Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops *(the nose is level with the end of the syringe)*.
11. Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.
12. Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.
13. Make sure of the presence of the plastic cover when re-mounting the syringe on the pump as recommended below.
14. Remount the syringe on the pump as described page 6-4.





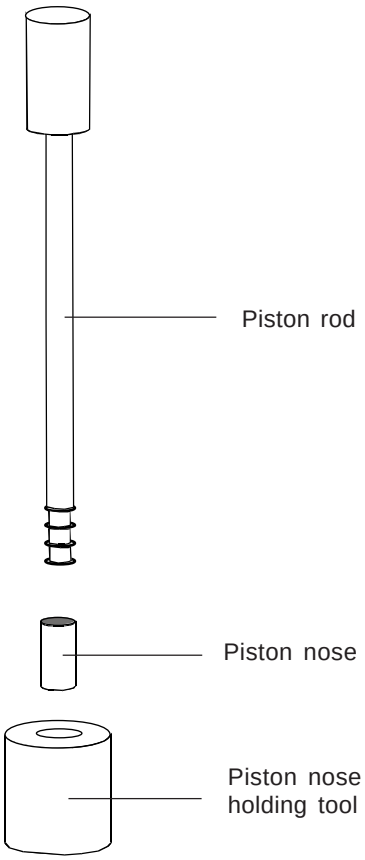
Before Mounting a 500 µL Syringe: To optimize the fitting of the 500 µL syringe on the Dilutor valve, the 500 µL syringe is supplied with a cover seal. The orientation of this seal must be respected to ensure that the connection with the syringe is airtight. (See the opposite figure).

Changing the 1 mL Piston Noses

Part Number	Description
F4015065	5 x 1 mL piston noses and mounting tool.
F4015005	1 nose mounting tool.

You need the special tool for mounting the piston nose on the 1 mL piston. The nose push-fits onto the piston shaft.

1. Remove the syringe from the pump as described page 6-4.
2. Slide the piston out of the syringe barrel.
3. Remove the piston nose from the piston rod by carefully pinching the piston nose with a pair of cutters and gently pulling the piston nose off the piston rod. Take care not to damage the end of the piston rod when removing the piston nose.
4. Remove any remaining debris of the original nose from the end of the piston rod.
5. Put the new piston nose in its recess in the piston nose holding tool.
6. Turn the tool upside down and place the piston assembly.
7. Press the piston shaft firmly into the piston nose holding tool. A slight rotation of the piston shaft ensures a correct fitting.
8. Slacken the piston button Allen screw and remove the piston button from the piston rod.
9. Remove the tool from the piston assembly.
10. Dip the piston nose in distilled water and slide the piston into the syringe.
11. Hold the syringe upright with the threaded end of the syringe resting on a flat, clean surface. Slide the piston into the syringe until the piston stops *(the nose is level with the end of the syringe)*.
12. Slide the piston button against the body of the syringe and tighten the Allen screw that secures the piston button onto the piston rod.
13. Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.
14. Remount the syringe on the pump as described page 6-4.



Changing the 25 mL Piston Noses

You don't need a special tool for mounting the piston nose on the 25 mL piston. The nose screw-fits onto the piston shaft.

Part Number	Description
F4015068	1 x 25 mL piston nose.

1. Remove the syringe from the pump as described page 6-4.
2. Slide the piston out of the syringe barrel. It may be necessary to screw the piston securing screw back into the bottom of the piston and pull on the screw to remove the piston from the syringe barrel.
3. Hold the piston nose firmly in one hand and unscrew the nose from the piston shaft.
4. Screw a new piston nose on the shaft.
5. Slide the piston into the syringe and complete the piston nose fitting by screwing the shaft until the piston nose turns with the piston shaft.
6. Remove the piston from the syringe and dip the piston nose in distilled water and slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.
7. Remount the syringe on the pump as described page 6-4.

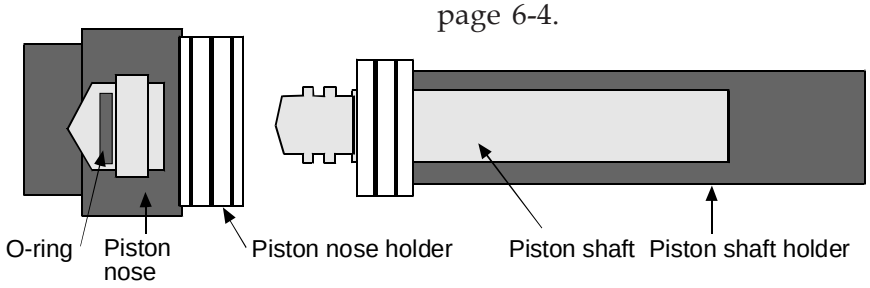
Changing the 5 mL and 10 mL Piston Noses

The piston nose mounting kits are composed of a piston nose holder and a piston shaft holder.

Part Number	Description
F4015003	5 mL piston nose mounting kit.
F4015004	10 mL piston nose mounting kit.
F4015066	1 x 5 mL piston nose and O-ring.
F4015067	1 x 10 mL piston nose and O-ring.

1. Remove the syringe from the pump as described page 6-4.
2. Slide the piston out of the syringe barrel. It may be necessary to screw the piston securing screw back into the bottom of the piston and pull on the screw to remove the piston from the syringe barrel.
3. Remove the piston nose from the shaft by carefully pinching the piston nose with a pair of cutters and gently pulling the piston nose off the shaft. Take care not to damage the end of the shaft when removing the piston nose.
4. Remove any remaining debris of the original piston nose from the end of the shaft.

5. Insert the new piston nose in the recess of the piston nose holder. Make sure that the aperture is facing outward and the O-ring is inside the seal.
6. Place the piston shaft in the piston shaft holder.
7. Screw the two parts of the tool together until tight.
8. Unscrew the tool, the piston nose should be correctly seated on the shaft.
9. Dip the piston nose in distilled water and slide the piston into the syringe.
10. Slide the piston up and down in the syringe five or six times to ensure a smooth operation between the piston and syringe.
11. Remount the syringe on the pump as described page 6-4.



Troubleshooting 7

This chapter explains how to diagnose possible problems and how to overcome them.

Mechanical Problems

Problem	Possible Cause	Solution
Valve does not fit on to the 402.	Valve axle not properly aligned with the motor drive.	Ensure that the flat on the axle is aligned with the drive slot on the motor.
Valve moves during aspirate or dispense.	Valve mounting screw not tight.	Check that the mounting screws, syringe and syringe mounting screw are all tight.
Syringe does not move properly.	Tubing blocked.	Check that the inlet tubing or transfer tubing is not blocked.
Valve sticks	Instrument left unused. 	Remove the valve (see page 6-2). Use the valve key, reference F123674 to turn the valve axle and turn the key to free the valve. Do not try turning the axle with your fingers, it is not possible to apply the necessary torque.

Hydraulic Problems

Problem	Possible Cause	Solution
Liquid leakage	Connections incorrectly made.	Tighten all tubing connections.
Liquid leaving by the waste tube.	Tubing blocked.	Check all tubing for blockages. Ensure that the inlet filter is clear.
	Dirt trapped between the ceramic surfaces.	Clean the valve. Refer to page 6-2.

Electrical Problems

Problem	Possible Cause	Solution
Instrument does not respond.	Power cord not connected.	Check power cord is properly connected.
	402 is not switched on.	Check ON/OFF switch.
	Fuse blown.	Check the fuses. See page 3-7.

Parts & Accessories Lists Appendix A

Parts lists for the 402 Dilutor Dispenser, consisting of Standard Equipment, Additional Accessories, and Spare parts.

402 Single Syringe

Part Number	Qty	Description
F410514	1	402 Dilutor Dispenser (Single-syringe)
F4015016	1	Probe (standard)
F40151403	1	Probe support
4011534125	1	Fixing screw for probe support
130221	1	Keypad
F4015032	1	Tubing, tapered transfer (probe), FEP (2 mL, 1300 x 1.5 mm id)
365118101	1	Clip for reservoir bottle
F1410108	2	Plastic seals for autoclaving (PVDF)
F1410153	2	Union connector for autoclaving (PVDF)
F4420577	1	Tubing, waste, FEP (200 x 3 mm id)
49967601	1	Tubing, inlet, FEP (600 x 1.5 mm id)
7080316106	1	Power cord 220-240 V
7080316105	1	Power cord 100-115 V
6730104006	5	1.0 Amp type T slow-blow fuses
54080181	2	Clips for tubing, self-adhesive
LT801310	1	402 Dilutor Dispenser User's Guide
LT801311	1	402 Dilutor Dispenser Quick Guide cards
LT804021	1	IQ Procedure
LT804035	1	Quality Control Certificate
LT804046	1	OQ Procedure

402 Dual Syringe with Tee Junction Configuration

Part Number	Qty	Description
F410515	1	402 Dilutor Dispenser (Dual-syringe)
F4015016	1	Probe (standard)
F40151403	1	Probe support
4011534125	1	Fixing screw for probe support
130221	1	Keypad
F4015032	1	Tubing, tapered transfer (probe), FEP (2 mL, 1300 x 1.5 mm id)
F4015002	1	Tubing, valve to Tee junction (70 x 2 mm id)
365118101	1	Clip for reservoir bottle
F1410108	2	Plastic seals for autoclaving (PVDF)
F1410153	2	Union connector for autoclaving (PVDF)
F4420577	1	Tubing, waste, FEP (200 x 3 mm id)
49967601	1	Tubing, inlet, FEP (600 x 1.5 mm id)
7080316106	1	Power cord 220-240 V
7080316105	1	Power cord 100-115 v
6730104006	5	1.0 Amp type T slow-blow fuses
54080181	2	Clips for tubing, self-adhesive
LT801310	1	402 Dilutor Dispenser User's Guide
LT801311	1	402 Dilutor Dispenser Quick Guide cards
LT804021	1	IQ Procedure
LT804035	1	Quality Control Certificate
LT804046	1	OQ Procedure

Additional Accessories

Part Number	Description
F4015015	Adapter kit for disposable tips
25025341	100 µL syringe
25025342	250 µL syringe
25025347	500 µL syringe
25025343	1 mL syringe
25025344	5 mL syringe
25025345	10 mL syringe
25025346	25 mL syringe
F4015031	Tubing, tapered transfer (probe), FEP (1 mL), (1 x 2 x 1300 mm)
F4015033	Tubing, tapered transfer (probe), FEP (5 mL), (1.5 x 2.1 x 3000 mm)
F4015034	Tubing, tapered transfer (probe), FEP (10 mL), (1.5 x 2 x 6000 mm)
3645357	Tubing, inlet FEP (640 x 2 mm id) with filter (20 µm)
F1410050	5 PVDF union connectors
3651181	Tubing clip
F4015010	Tee junction upgrade kit

Spare Parts

Part Number	Description
F4015072	100 µL piston kit
F4015073	250 µL piston kit
F4015074	500 µL piston kit
F4015075	1 mL piston kit
F4015076	5 mL piston kit
F4015077	10 mL piston kit
F4015078	25 mL piston kit

Chemical Compatibility Appendix B

This chapter contains information about the chemical compatibility of the syringes and the tubing.

Chemical Compatibility

Materials in Contact with Liquids

In the 402 Dilutor Dispenser flow-path, several materials are in contact with liquids:

FEP	Inlet tubing, Transfer tubing
PTFE/Ekonol	Piston nose of the syringes (except 25 mL)
PTFE	Piston nose of the 25 mL syringe
Borosilicate glass	Syringe
Ceramic	Valve
PEEK	Valve, Tee junction

Compatibility

The syringe assemblies and the tubings are compatible with a wide range of liquids:

Acetic acid (glacial)	Ethyl acetate
Acetone	Ethylene glycol
Acetonitrile	Hexane
Ammonium hydroxide	Hydrochloric acid - 37%
Benzene	Isooctane
Benzyl alcohol	Methanol
Boric acid	Nitric acid - 50%
Butanol	Propanol
Carbon tetrachloride	Sodium hydroxide - 30%
Chlorobenzene	Sodium hypochlorite -10%
Chloroform	Sulfuric acid - 96%
Cyclohexane	Toluene
Cyclohexanone	Trichloroethane
Dichloroethane	Trichloroethylene
Dichlorobenzene	Tetrahydrofuran
Diethyl ether	Toluene
Dimethylformamide	Xylene
Ethanol	

Technical Data Appendix C

This chapter contains the Technical Data concerning the 402 Dilutor Dispenser.

Hydraulics

Dilution Ratio

When using the dual syringe model equipped with a 25 mL syringe on the left and a 100 µL syringe on the right, the dilution ratio is 1/25000, but in order to stay within the RSD range a maximum ratio of 1/500 is recommended.

Minimum Volume

The minimum programmable transfer volume is 1 µL. However, precise and accurate transfer of such volumes depends on the following parameters:

- volumetric capacity of the syringe,
- size of the air gap used,
- geometry of the needle tip,
- flow rate used,
- nature of the liquid to be transferred.

Maximum Volume

The maximum volume that can be aspirated from a vial is limited to the capacity of the syringe or on the transfer tubing, whichever is the smaller. The total aspirated volume *(air gaps plus liquid volumes)* must be inferior to this volume.

Flow Rate

Flow rates depend on the nature of the liquid (viscosity), the capacity of the syringe, and the internal diameter of tubing. For liquids transferred via the probe, it is possible to adjust the aspirate and dispense flow rates according to the nature of the liquid (e.g. viscous liquids must be aspirated slowly). The default value for 'Air flow rate' is 4 mL/min. Wathever the capacity of the syringe(s).

Syringes

Syringe capacity (µL)	100	250	500	1000	5000	10000	25000
Maximum Flow (mL/min)	4	10	20	40	120	120	120
Minimum Specified Volume (µL)	10	25	50	100	500	1000	2500
Nominal Volume (µL)	100	250	500	1000	5000	10000	25000

Performance Specifications

The following values are obtained using a defined protocol. If this protocol is followed, the obtained values must be inferior or equal to the listed figures.

The values are obtained by pipetting de-ionized water (grade 3, ISO3696) at 21 °C ± 0.5 °C, relative humidity > 50 % and athmospheric pressure 1013 MPa.

Syringe capacity (µL)	Volume pipetted (µL)	Systematic error %	Systematic error µL	Random error %	Random error µL
100	10	1.8	0.18	0.8	0.08
	50	1.5	0.75	0.25	0.125
	100	1	1	0.15	0.15
250	20	1.5	0.38	0.8	0.2
	125	1.0	1.25	0.25	0.32
	250	0.8	2	0.15	0.38
500	50	1.5	0.75	0.50	0.25
	250	1.0	2.5	0.25	0.63
	500	0.8	4	0.15	0.75
1000	100	1.5	1.5	0.50	0.5
	500	0.8	4	0.25	1.3
	1000	0.6	6	0.15	1.5
5000	500	1.2	6	0.5	2.5
	2500	0.8	20	0.25	6.3
	5000	0.6	30	0.15	7.5
10000	1000	1.2	12	0.5	5
	5000	0.8	40	0.25	12.5
	10000	0.5	50	0.15	15
25000	2000	1.0	25	0.50	5
	12500*	0.8	100	0.25	31.3
	25000*	0.5	125	0.15	37.5

* Dispensing mode only.

Protocol

Configuration: 1 mL tubing for volumes up to 1 mL, tapered transfer-tubing of 2 mL (standard accessory) for volumes up to 2 mL, 5 mL or 10 mL tapered transfer tubings are used for volumes up to 10 mL.

Transfer of de-ionized water using the *Pipette Task*, aspiration of liquid from a vial and delivery at the same flow rate into another vial containing water.

The same specifications are obtained in the *dispensing mode* with liquid from the reservoir.

See OQ Document for procedure and calculations.

For 1 % syringe capacity, typical values are given.

Syringe capacity (µL)	Volume pipetted (µL)	Accuracy %	Accuracy µL	RSD %	RSD µL
100	1	5.0	0.05	3.0	0.03
250	2.5	3.0	0.075	2.0	0.05
500	5	3.0	0.15	2.0	0.1
1000	10	3.0	0.3	1.0	0.1
5000	50	3.0	1.5	0.8	0.4
10000	100	3.0	3	0.5	0.5
25000	250	3.0	7.5	0.5	1.25

Typical values (all syringes)

Syringe capacity %	Max. accuracy ± A %	Max.error imprecision RSD %
100	0.50	0.10
50	0.80	0.20
10	1.00	0.50

Junction Tubing

(between valve and Tee)

Material: FEP, with two PVDF union connectors.

Tubing dimensions: 2.0 mm i.d., 70 mm length.

Tubing dead volume: 220 µL.

Mechanics

Valve

Type: Three port, two position.

Angle between ports: 120°.

Valve drive: Stepper motor.

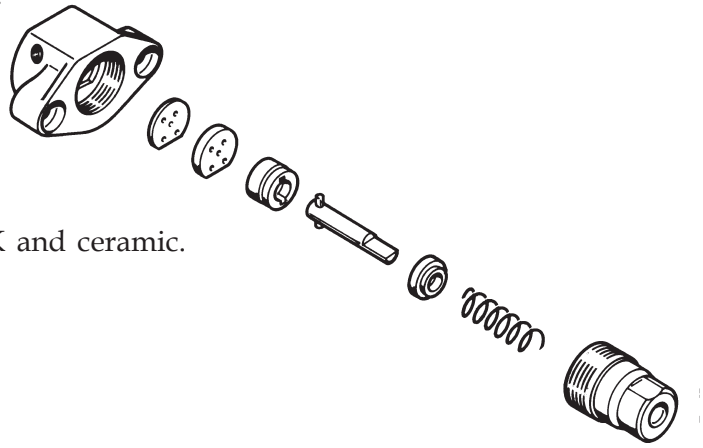
Rotation time: 0.5 Second.

Liquid contact materials: PEEK and ceramic.

Lifetime: 1 000 000 cycles.

Dead volume: 123 µL.

Maximum Pressure: 0.8 MPa.



Tee Junction

Type: Three port, no moving parts.

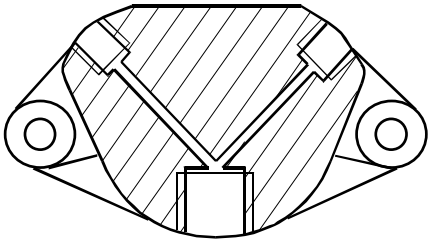
Diameter of channels: 1.5 mm.

Length of channels: 14 mm.

Angle between channels: 120°.

Liquid contact material: PEEK.

Dead volume: 51 µL.



Cross section of Tee

Syringes

Piston drive: Stepper motor.

Piston displacement control: Coded disk.

Piston movement resolution: 1.6 µm.

Minimum piston travel time: 1.5 seconds for one complete stroke.

Maximum syringe displacement: 60 mm ± 20 µm.

Minimum syringe speed: 60 mm in 10 hours.

Maximum syringe speed: 60 mm in 1.5s.

Environmental

Conformity to Norms

Refer to separate leaflet LT801354 'Declaration of Conformity'.

Storage

Indoor use only.

Installation: Category II.

Altitude:	operating	up to 2000 m.
	storage	up to 4600 m.
Temperature range:	operating	4°C to 40°C.
	storage	-15°C to +40°C.

Pollution degree 2.

Humidity: Maximum relative humidity 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

Power Requirements

Frequency: 50 to 60 HZ.

Voltage: 100 to 240 V ac, mains supply voltage fluctuations should not exceed ±10% of the nominal voltage.

Power rating: 110 VA.

Size and Weight

Dimensions: (W x D x H) 70 x 215 x 240 mm (all models).

Weight: single syringe model: 5kg
dual syringe model: 7kg

Error Messages Appendix D

This chapter contains the Error Messages concerning the 402 Dilutor Dispenser.

Error Messages

Error Message	Cause/Possible Action
Adjust volume too small	In DISPENSE, you have, you have entered a value for “Final vol.” that is too small. “Final vol.” > volume of biggest fraction dispensed.
Asp flow missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE, DISPENSE, PIPETTE, and MIX tasks).
Diluent volume missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE task).
Disp flow missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE, DISPENSE, PIPETTE, and MIX tasks).
DISP task in wrong place	Within a Method, DISPENSE must follow DILUTE or MIX. To DISPENSE before DILUTE you should create a Method file containing only the DISPENSE task.
Incorrect flow rates	Use flow rates that correspond to the configured syringe size(s); refer to page 5-31.
Left syr life exhausted!	For the Dual-syringe model: piston of left-hand syringe may need replacing.
LINK method not allowed!	You can’t link files that are already linked.
Max sample vol. reached	In DILUTE UNKNOWN, you need a larger syringe/transfer-tubing to measure volumes greater than the maximum reached with the existing configuration.
Mechanical problem: Help	Occurs when the valve or a syringe jams; switch off and correct the problem: the syringe and/or valve need servicing (clean or change).
Method does not exist!	First, you must create the Method to be linked, then enter its file number using LINK.
Method used in link file	You have attempted to delete a Method number that has been assigned in LINK. You must delete the file containing LINK, before deleting the Method.
Method xxx is locked	Unlock Method file, to continue with this action.
Mix volume is missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see MIX task).
Nb mixes is missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see MIX task).
No room to copy meth xxx	You need to free up space by deleting one or more Methods.
Not enough memory!	Reduce the size and/or number of stored Method files.

Error Message	Cause/Possible Action
Parameters incompatible!	Refer to page 5-16.
Ratio impossible	Dilution ratio calculated by software is not valid; check parameters using formulae given in page 5-18 (DILUTE task) and correct one or both of the other values.
Ratio missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE task).
Reservoir not allowed	Liquids must be aspirated using the probe.
Right syr life exhausted!	For the Dual syringe model: piston or right-hand syringe may need servicing (refer to page 6-6).
Sample too small	Enter a larger value for Sample Volume. Verify parameters in the task.
Sample volume missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE task).
Syr capacity too small	Check volumes used in the task correspond to the configured syringe size(s).
Syringe Life Exhausted!	For the Single syringe model: piston syringe may need servicing (refer to page 6-6).
Total volume is missing!	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE task).
Total volume missing	Re-enter Method, supplying the missing parameter, when prompted to do so (see DILUTE task).
Total volume too small	Enter a larger value for the Total Volume, or check the volumes used in the task.
Valve life exhausted!	Valve may need cleaning or servicing (refer to page 6-2).
xxx exists, overwrite?	Select another file number, unless you want to overwrite file xxx.

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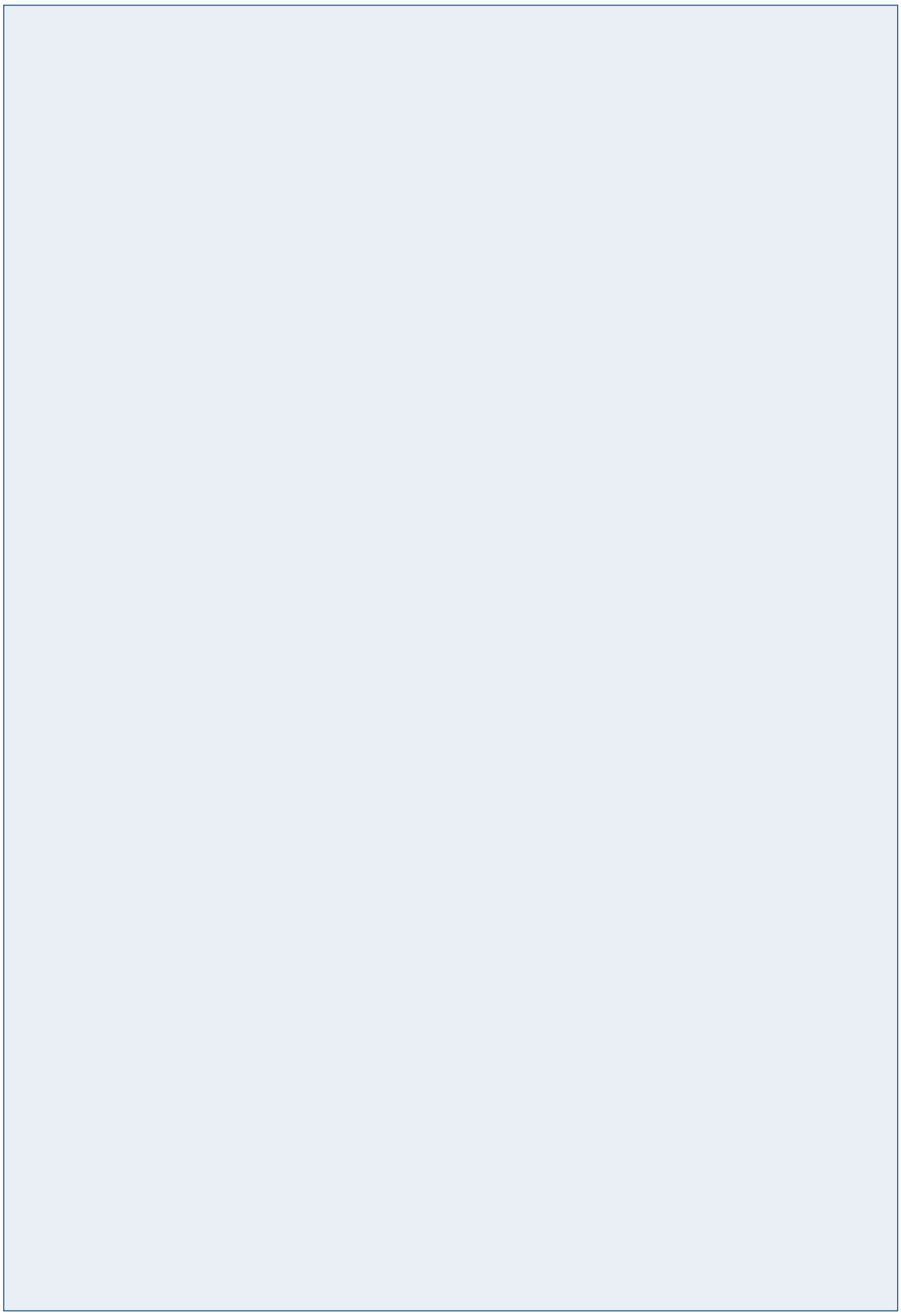

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