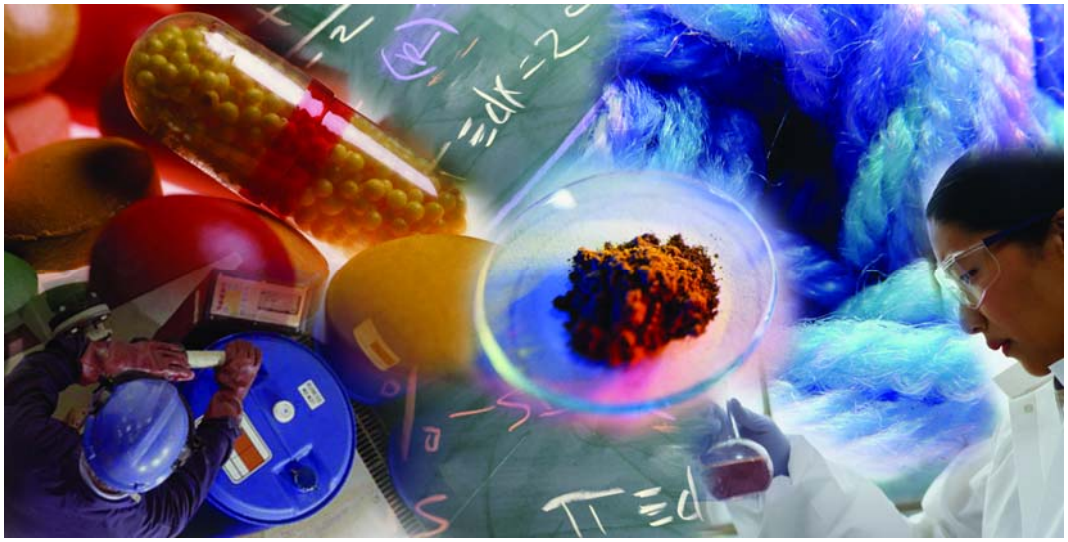
LIQUID SIPPER SAMPLING ACCESSORY



User's Guide

PerkinElmer®
For the Better

Release History

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Any comments about the documentation for this product should be addressed to:

User Assistance
PerkinElmer Ltd
Chalfont Road
Seer Green
Beaconsfield
Bucks HP9 2FX
United Kingdom

Or emailed to: info@perkinelmer.com

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Produced in the UK.

Contents

Conventions Used in this Manual

Normal text is used to provide information and instructions.

Bold text refers to text that is displayed on the screen.

UPPERCASE text, for example ENTER or ALT, refers to keys on the PC keyboard. '+' is used to show that you have to press two keys at the same time, for example, ALT+F.

All eight digit numbers are PerkinElmer part numbers unless stated otherwise.

Definitions

Operator: Person operating equipment for its intended use.

Responsible Body: Individual or group responsible for the use and maintenance of equipment, and for ensuring that operators are adequately trained.

Notes, cautions and warnings

Three terms, in the following standard formats, are also used to highlight special circumstances and warnings.

NOTE: A note indicates additional, significant information that is provided with some procedures.

CAUTION	*We use the term CAUTION to inform you about situations that could result in **serious damage to the instrument** or other equipment. Details about these circumstances are in a box like this one.*
D	***Caution (Achtung)*** *Bedeutet, daß die genannte Anleitung genau befolgt werden muß, um einen **Geräteschaden** zu vermeiden.*
DK	***Caution (Bemærk)*** *Dette betyder, at den nævnte vejledning skal overholdes nøje for at undgå en **beskadigelse af apparatet**.*
E	***Caution (Advertencia)*** *Utilizamos el término **CAUTION** (ADVERTENCIA) para advertir sobre situaciones que pueden provocar **averías graves en este equipo** o en otros. En recuadros éste se proporciona información sobre este tipo de circunstancias.*
F	***Caution (Attention)*** *Nous utilisons le terme **CAUTION** (ATTENTION) pour signaler les situations susceptibles de provoquer de **graves détériorations de l'instrument** ou d'autre matériel. Les détails sur ces circonstances figurent dans un encadré semblable à celui-ci.*
I	***Caution (Attenzione)*** *Con il termine **CAUTION** (ATTENZIONE) vengono segnalate situazioni che potrebbero arrecare **gravi danni allo strumento** o ad altra apparecchiatura. Troverete informazioni su tali circostanze in un riquadro come questo.*
NL	***Caution (Opgelet)*** *Betekent dat de genoemde handleiding nauwkeurig moet worden opgevolgd, om **beschadiging van het instrument** te voorkomen.*
P	***Caution (Atenção)*** *Significa que a instrução referida tem de ser respeitada para evitar a **danificação do aparelho**.*

WARNING

*We use the term WARNING to inform you about situations that could result in **personal injury** to yourself or other persons. Details about these circumstances are in a box like this one.*

D

Warning (Warnung)
*Bedeutet, daß es bei Nichtbeachten der genannten Anweisung zu einer **Verletzung** des Benutzers kommen kann.*

DK

Warning (Advarsel)
*Betyder, at brugeren kan blive **kvæstet**, hvis anvisningen ikke overholdes.*

E

Warning (Peligro)
*Utilizamos el término **WARNING** (PELIGRO) para informarle sobre situaciones que pueden provocar **daños personales** a usted o a otras personas. En los recuadros como éste se proporciona información sobre este tipo de circunstancias.*

F

Warning (Danger)
*Nous utilisons la formule **WARNING** (DANGER) pour avertir des situations pouvant occasionner des **dommages corporels** à l'utilisateur ou à d'autres personnes. Les détails sur ces circonstances sont données dans un encadré semblable à celui-ci.*

I

Warning (Pericolo)
*Con il termine **WARNING** (PERICOLO) vengono segnalate situazioni che potrebbero provocare **incidenti alle persone**. Troverete informazioni su tali circostanze in un riquadro come questo.*

NL

Warning (Waarschuwing)
*Betekent dat, wanneer de genoemde aanwijzing niet in acht wordt genomen, dit kan leiden tot **verwondingen** van de gebruiker.*

P

Warning (Aviso)
*Significa que a não observância da instrução referida poderá causar um **ferimento*** ao usuário.

Introduction

Figure 1 The Liquid Sipper Sampling Accessory

The Liquid Sipper Sampling Accessory can be used with the Spectrum 100 and Spectrum 100N spectrometers. This *User's Guide* contains details for using the Liquid Sipper Sampling Accessory with both FT-IR and FT-NIR instruments.

Multimedia tutorial

Shipped with your spectrometer was a CD marked *Spectrum Multimedia CD*. This contains a multimedia tutorial for this sampling accessory providing the following:

- Overview and Installation;
- Theory and Operating Principles;
- Using the Liquid Sipper Sampling Accessory;
- Maintenance;
- Troubleshooting.

We suggest that after following the instructions in this *User's Guide* to install the accessory for the first time, you work through the multimedia tutorial.

The tutorial also includes a test you can take to receive a certificate for your training file.

Much of the information in this *User's Guide* is presented in more detail in the multimedia tutorial.

What is the Liquid Sipper used for?

The Liquid Sipper Sampling Accessory is used for analyzing liquid samples using automated sampling and flushing techniques. The accessory can deal with a wide variety of liquids from aqueous or organic solutions to more viscous liquids including light oils.

How it works

The liquid from which the spectrum is to be collected is drawn up a probe into a flowcell by a peristaltic pump. The peristaltic action is created by the cam of the pump squeezing flexible tubing that is routed around the pump, inside the pump housing. The beam passes through the flowcell and out to the detector.

The Liquid Sipper Sampling Accessory

The Liquid Sipper Sampling Accessory, as shown in Figure 1 and Figure 2, has the following features:

- A stainless steel probe, which can be raised and lowered into the liquid to be sampled;
- A shelf on the front of the accessory where the sample is placed on a stainless steel drip tray;
- Two buttons on the top of the accessory, used for selecting the Sample and Flush cycles;
- A programmable, variable speed, peristaltic pump located at the front of the accessory, and accessible through a door;
- An access cover to the flowcell compartment;
- A removable flowcell;
- A waste disposal port on the front of the accessory, underneath the shelf.

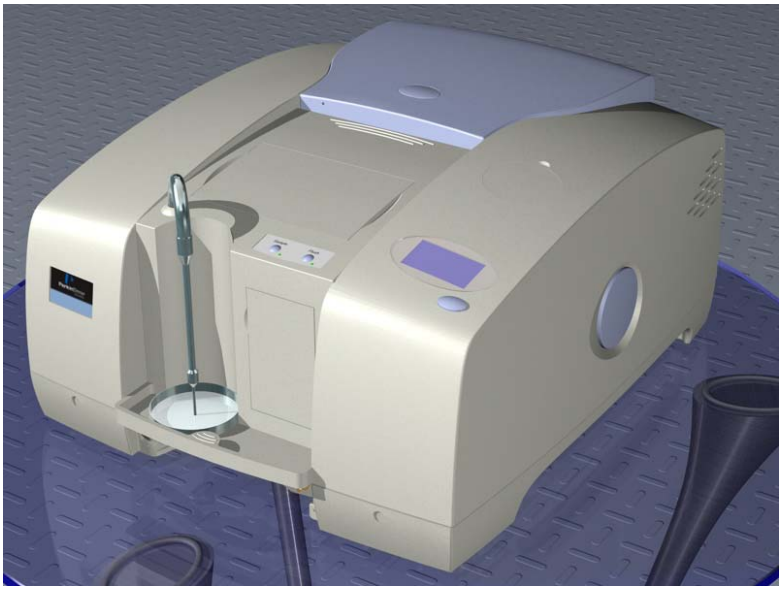


Figure 2 Liquid Sipper accessory installed in the instrument

Options

The following options are available:

- A filter installed on the end of the probe when sampling liquids that contain suspended solid particles;
- A range of flowcells to accommodate different liquids;
- A range of tubing to accommodate different samples.

Installing the Accessory

Before installing for the first time

Before you install the accessory in your instrument for the first time, you will need to perform the following pre-installation tasks:

- Place the drip tray on the shelf;
- Install the flowcell;
- Fit the waste tube.

Placing the drip tray on the shelf

➢ Place the drip tray on the accessory shelf under the probe ensuring the lip of the drip tray is uppermost.

Figure 3 shows the correct orientation of the drip tray.

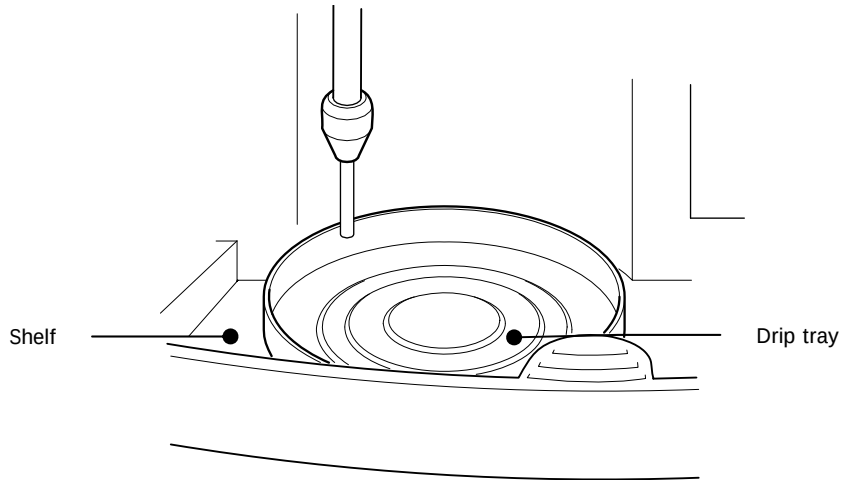


Figure 3 Drip tray orientation

Installing the flowcell

1. Remove the flowcell access cover located on the top of the accessory.

2. Ensuring correct orientation (Figure 4), hold the flowcell just above the flowcell compartment.

3. Fit the tubing from the probe to the lower connection on the flowcell and the tubing from the pump to the upper connection on the flowcell, tightening the two nuts finger tight, as shown in Figure 4.

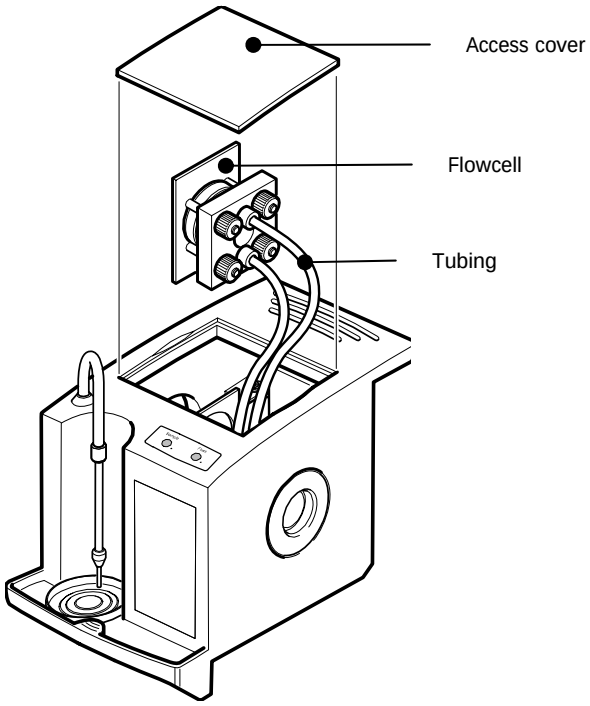


Figure 4 Flowcell orientation and tubing connected

4. Slide the flowcell into its holder ensuring the tubing is not twisted or trapped.

5. Refit the flowcell access cover.

Fitting the waste tube

1. Push one end of the waste tubing onto the waste connector port below the accessory shelf, as shown in Figure 5.

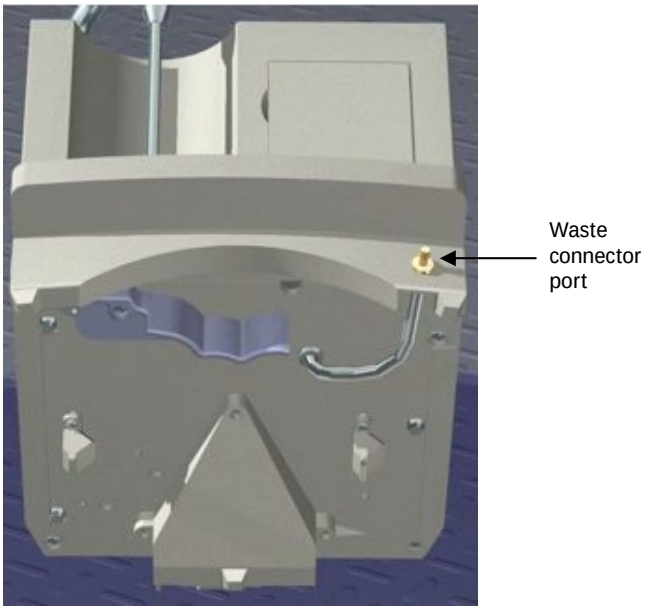


Figure 5 Waste connector port

2. Put the free end of the tube into a waste container which should be positioned at least 90 cm below the waste connector port.

Disposal of waste

CAUTION	*Ensure all local and national regulations covering waste disposal are complied with when disposing of liquids from the Liquid Sipper Sampling Accessory.*

Fitting the accessory

The Liquid Sipper Sampling Accessory can be simply installed into the sample compartment of the instrument, after first removing any other sampling accessory currently fitted.

1. Raise the sample area cover (if fitted) to the vertical position, press the release clip and lift the cover upwards, clear of the spectrometer.
   Store it in a safe place for future re-use.

2. Reach in under the base of the current accessory and pull the blue release handle towards you to release the accessory.

3. Now simply slide the accessory out of the sample area, as shown in Figure 6.
   Store it in a safe place for future re-use.

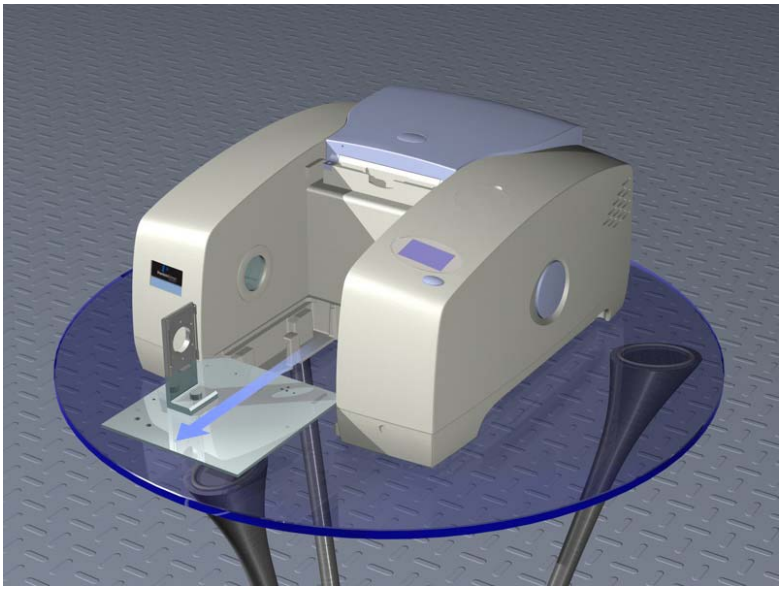


Figure 6 Removing the standard sample slide

4. Slide in the Liquid Sipper Sampling Accessory as shown in Figure 7, rest the back of it on the ledge in the sample area and slide it into position. Push it firmly home to ensure that the multiway connector on the rear of the Liquid Sipper Sampling Accessory mates properly with the spectrometer connector, and the blue release handle clicks into the engaged position.

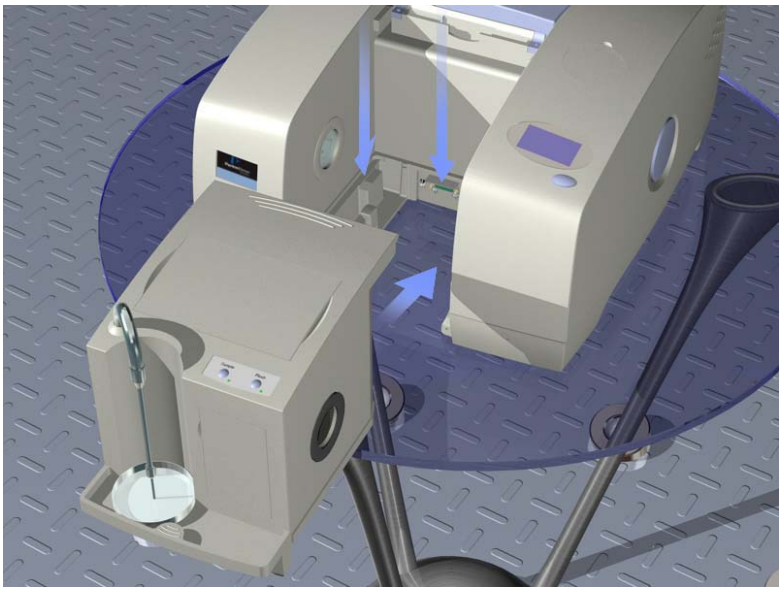


Figure 7 Installing the Liquid Sipper Sampling Accessory

Software update

When the Liquid Sipper Sampling Accessory is installed, the software detects the presence of the accessory and you will be prompted to collect a new background spectrum.

The Scan and Instrument Setup dialog, obtained by selecting **Scan** on the Instrument menu, updates to show that you now have the Liquid Sipper Sampling Accessory in position (see Figure 8).

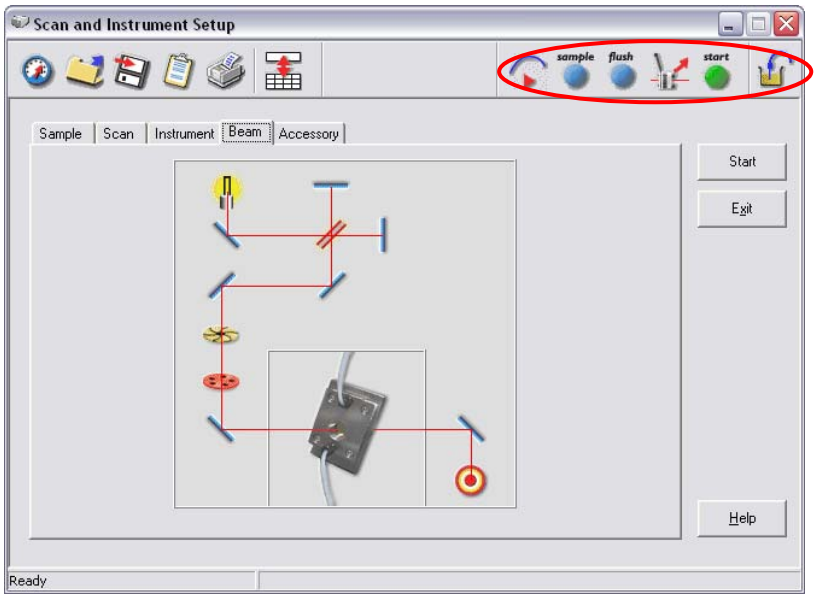


Figure 8 Scan and Instrument Setup dialog with liquid sipper icons circled

Your accessory is now ready for use.

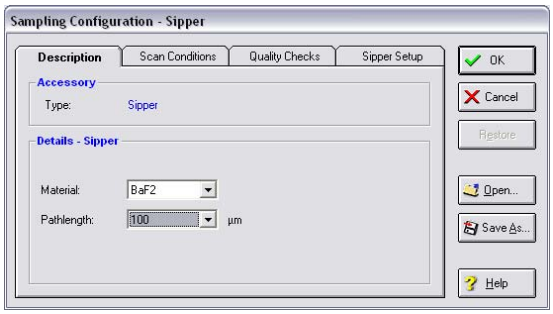
Setting Up the Sampling Configuration

NOTE: To access the **Sampling Configuration - Sipper** dialog you will need to be an Advanced user. From the Setup menu in Spectrum, select **Options**. In the Options dialog, select the **Instrument** tab, and then select **Advanced**. For further information about user levels see the on-screen Help.

You can set up the sample and flush buttons, in the software and on the accessory, from the **Sampling Configuration** dialog.

1. From the Setup menu in Spectrum, select **Instrument**.
   The Scan and Instrument Setup dialog is displayed.

2. Select **Accessory Configuration** from the Setup menu.
   The Sampling Configuration - Sipper dialog is displayed.



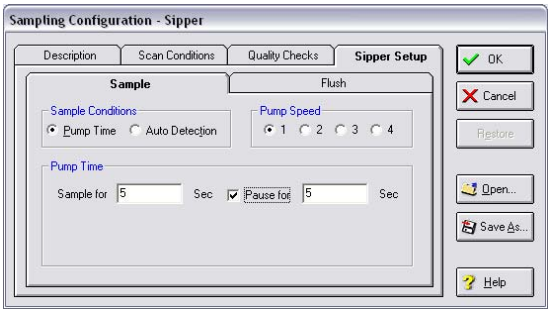
3. On the **Description** tab, select the **Material** and **Pathlength** corresponding to the cell currently installed, from the drop-down lists.
   The default mid-infrared cell provided with the Liquid Sipper is a 100 µm KBr cell. The default near-infrared cell is a 1 mm CaF_2 cell.

Setting up for sampling

There are two ways of setting up your Liquid Sipper Sampling Accessory for collecting samples. The simplest method is by setting the pump time and pause time. The other method is auto-detection where the software checks for the presence of a sample. This is carried out by checking for peaks above a nominated threshold in a given part of the spectrum.

Setting Pump Time

1. From the Sampling Configuration - Sipper dialog select the Sipper Setup tab.



2. On the Sample sub-tab, select **Pump Time**.

3. Set the **Pump Speed** required.

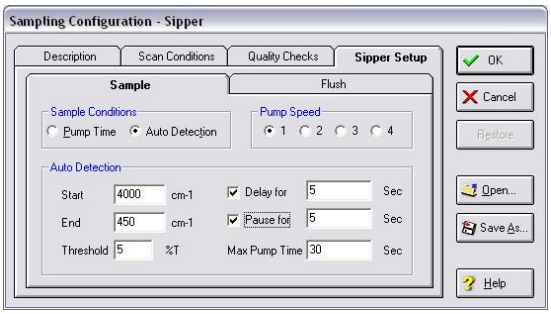
4. Set the time to **Sample for** in seconds.

5. If required, select **Pause for** and set the time you want the software to wait after the pump stops before collecting scans.

Setting Auto Detection

1. From the Sampling Configuration - Sipper dialog select the Sipper Setup tab and then the Sample sub-tab.

2. Select **Auto detection**.



3. Set the **Pump Speed**.

4. Set up the area of the spectrum to be checked (**Start** and **End**) and the %T **Threshold** that has to be reached before the software will collect scans.

5. Set up the event sequence as required. You can configure the event sequence to include the following:

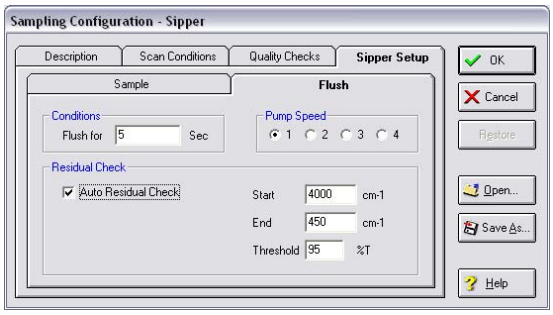
    - A delay, where the pump draws the sample into the flowcell but does not confirm the presence of a sample (**Delay for**).

    - A pause after the sample has been detected before the spectrum is collected (**Pause for**).

    - A maximum pumping time so that if a sample is not detected the pump stops running (**Max Pump Time**).

Setting up for flushing

1. From the Sampling Configuration - Sipper dialog select the Sipper Setup tab and then the Flush sub-tab.



2. Set the **Flush for** time in seconds.

3. Set the **Pump Speed** required.

4. If required, select **Auto Residual Check** and enter the **Start**, **End** and **Threshold** parameters.

   This will check at the end of a flush to see if peaks above the set threshold occur between the range set.

Saving the configuration

- To save any Sample and Flush programs select **Save As** from the dialog.

  This enables you to save the configuration for use later.

Using the Accessory

Do not attempt to run the pump with the cover removed. Do not put your fingers in the rotor while it is moving.

WARNING

If the equipment is used in a manner not specified herein the protection provided by the equipment may be impaired.

WARNING

Getting ready to collect data

1. Raise the probe by pulling vertically upwards.
2. Place the container with the sample in it on the drip tray.
3. Push down on the probe to lower it into the sample, as shown in Figure 9. Make sure that only the tip of the probe enters the liquid.

Figure 9 Sample container in place, probe lowered into sample

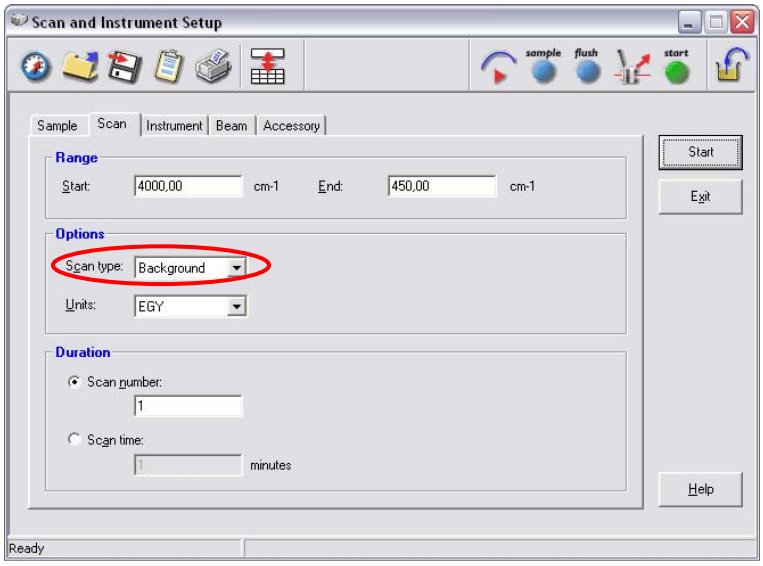
Collecting a background scan

Before you can collect sample scans, you will need an appropriate background scan.

1. Select **Scan** on the Instrument menu.

   The Scan and Instrument Setup dialog is displayed. The amount of information displayed will depend on your user level.

2. Select the **Scan** tab.



3. Select **Background** as the **Scan type**.

4. Click **Start** to begin collecting data.

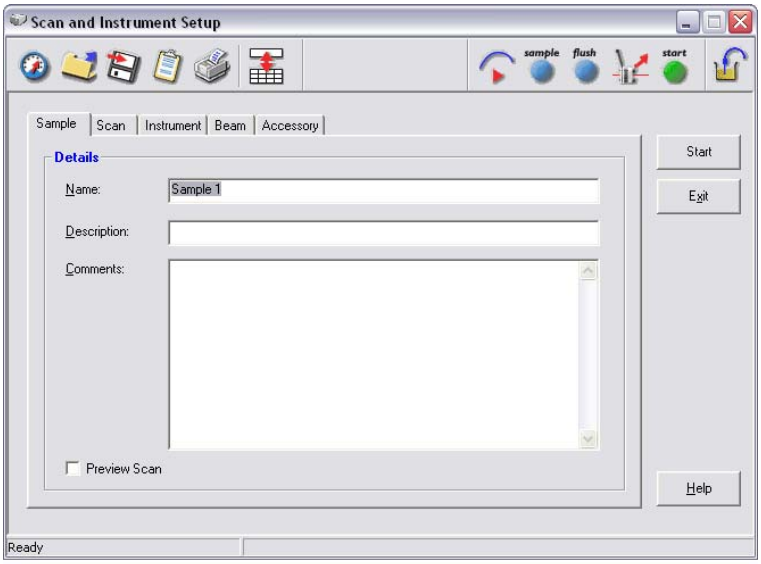
   The flowcell is automatically moved out of the beampath while the background scan is collected. The background scan is collected and you are now ready to collect a sample scan.

Alternatively, click  to collect a background scan.

Scanning a sample

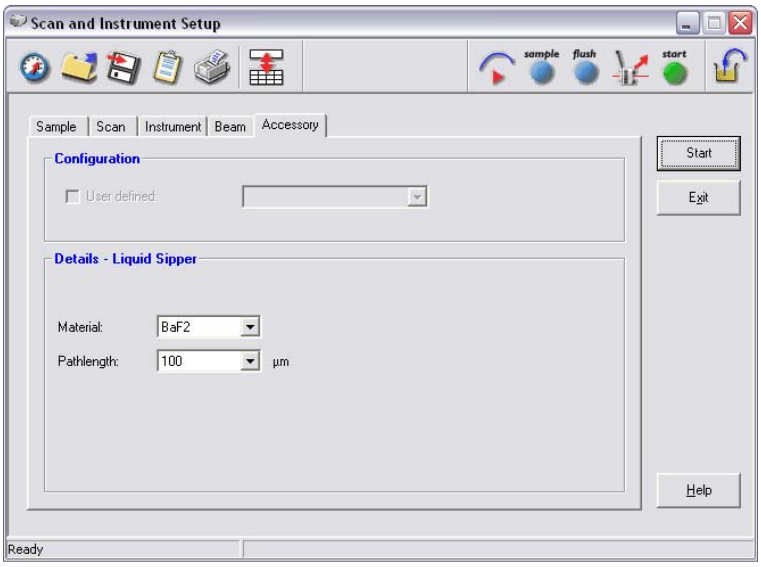
1. Select **Scan** on the Instrument menu.

   The Scan and Instrument Setup dialog is displayed. The amount of information displayed will depend on your user level.



2. Enter the sample details, scan parameters and instrument settings as required.

3. Select the **Accessory** tab.



4. If the Configuration section is available, select **User defined** and then choose the required configuration.

   For more information see *Setting Up the Sampling Configuration* starting on page 15. In this case the Liquid Sipper **Material** and **Pathlength** details are displayed but cannot be changed.

5. To start collecting data, click on 

.

Starting a scan from the liquid sipper

- Alternatively, if the sampling parameters are already set up, push the **Sample** button located on top of the Liquid Sipper (see Figure 10).

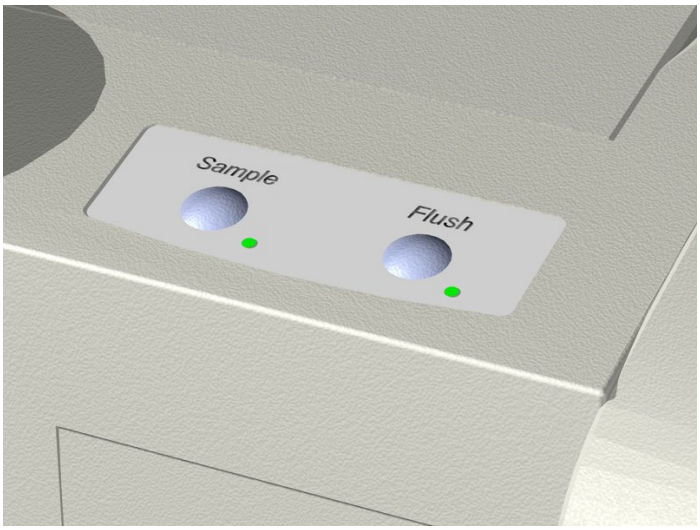


Figure 10 Sample and Flush buttons on the liquid sipper

Flushing

	Do not use solvents that will damage the flowcell or the tubing.
CAUTION	*For example, do not use water to flush the KBr flowcell.*

- With the correct configuration selected on the Accessory tab, simply click on 

.

  OR

  Push the **Flush** button on the top of the accessory.

Flushing with the next sample

If you are routinely using similar sample types you may not need to flush the Liquid Sipper with solvent, but simply flush through one sample with the next. This can be done by using the Flush program or by using a long enough Pump Time or Delay in your Sample program to ensure the previous sample has been pushed through before the scan takes place.

Starting and stopping the pump

You can manually start or stop the pump without collecting data. Simply click 

to start the pump, the icon then changes to 

, which you can click to stop the pump.

NOTE: This is particularly useful when monitoring, where you can view the changes in the spectrum or energy as the pumping progresses.

Moving the flowcell

The flowcell can be moved in and out of the beampath by selecting the flowcell tool from the Scan and Instrument Setup dialog. The icon shows the current position of the flowcell and the way it will move when the tool is clicked. Thus  denotes that the flowcell is in the beampath. When it is clicked, the flowcell will move out of the beampath, and the icon will change to  .

Maintenance

NOTE: Maintenance must be performed by a responsible body.

Preventative Maintenance

You should check for wear and leaks in the tubing especially around the pump rotor each day before using the Liquid Sipper Sampling Accessory, and if you encounter problems during routine operation.

Cleaning the Liquid Sipper Sampling Accessory

You can clean the outside of the Liquid Sipper Sampling Accessory, including the shelf, using a damp cloth. Mild detergent may be used, if necessary. Always perform a patch test on an inconspicuous area before you clean the entire Sampling Accessory.

The drip tray can be removed from the Sampling Accessory and cleaned using a strong detergent.

Avoid spilling liquid into the Sampling Accessory. Clean all external spills immediately. If anything that is spilled enters the accessory, remove the accessory from the spectrometer if currently installed, and contact a PerkinElmer Service Engineer.

WARNING

Do not run the pump while the cover is removed. Do not put your fingers in the rotor while it is moving.

The following instructions are also given in the *Liquid Sipper Sampling Accessory Multimedia Tutorial*.

Adjusting the probe

Under normal conditions the probe is manually raised and lowered to enable the container to be placed in the drip tray. Should the probe become loose, the following instructions detail how to tighten it.

1. Reach under the accessory and pull the blue release handle towards you, to release the accessory from the instrument.

2. Slide the accessory out of the instrument sufficiently to gain access to the probe friction adjustment screw access hole on the side of the accessory, as shown in Figure 11.

Figure 11 Probe friction adjustment screw access hole

3. Using a suitable flat blade screwdriver inserted in the access hole, tighten the screw sufficiently to ensure the probe is not loose, but can still be raised and lowered without undue force.

4. Slide the accessory back into the instrument until it locks firmly into the connector at the rear of the sample area.

5. Ensure the free end of the waste tube still feeds into the waste container.

Replacing the flowcell

The following instructions detail how to remove and install a complete flowcell. Later in the manual are instructions for *Replacing the spacer in the flowcell* (page 26) and *Replacing flowcell windows* (page 28).

WARNING

If you have been analyzing hazardous liquids, pump a suitable solvent such as heptane or ethanol through the Liquid Sipper before performing any maintenance.

1. Remove the flowcell access cover located on top of the accessory.
2. Noting its installed orientation, carefully lift the flowcell vertically out of its holder, ensuring none of the tubing is caught.
3. Holding the flowcell just above the accessory, as shown in Figure 12, disconnect the tubing from the flowcell by undoing the two connectors.

NOTE: Be careful not to spill any fluid that may remain in the tubing or the flowcell, and wipe up any residue.

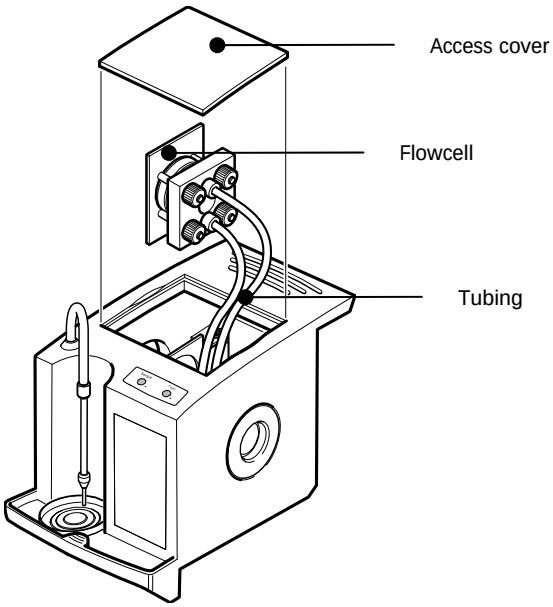


Figure 12 Flowcell removed from accessory

4. Ensuring the replacement flowcell is orientated correctly, position it just above the flowcell compartment.
5. Fit the tubing from the probe to the lower connection on the flowcell and the tubing from the pump to the upper connection on the flowcell, tightening the two nuts finger tight.
6. Slide the flowcell vertically downwards into its holder, ensuring the tubing is not twisted or trapped.
7. Refit the flowcell access cover.

Replacing the spacer in the flowcell

The following cell spacers are available:

Cell spacer	PerkinElmer part number
100 µm	L1201905
50 µm	L1201904
0.5 mm	L1202053
1 mm	L1200254

WARNING

If you have been analyzing hazardous liquids, pump a suitable solvent such as heptane or ethanol through the Liquid Sipper before performing any maintenance.

The spacer determines the pathlength of the flowcell, and can be replaced to produce shorter or longer pathlengths. The following instructions detail how to change the spacer.

WARNING

Always wear disposable gloves when handling windows.

CAUTION

Always handle windows by their edges, do not touch the flat surfaces of a window.

1. Referring to *Replacing flowcell windows* on page 25, remove the flowcell from the accessory.

2. Undo the four nuts securing the flowcell and slide the parts off as required until you have removed the spacer, as shown in Figure 13.

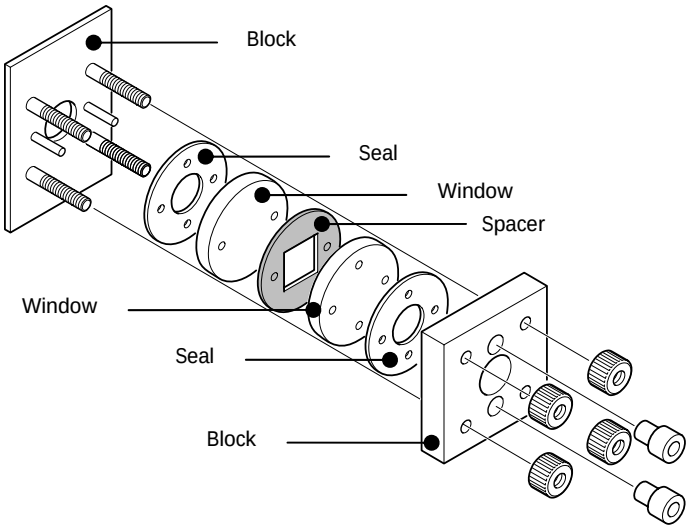


Figure 13 Flowcell; spacer highlighted

3. Fit the new spacer.

4. Refit the flowcell parts, ensuring that the window with four holes is oriented so that the grooves point towards the spacer.

5. Refit the nuts, ensuring they are not overtightened.

6. Re-install the flowcell.

Replacing flowcell windows

The following flowcell windows are available:

Flowcell window	PerkinElmer part number
KBr	L1200308
CaF_2	L1200309
BaF_2	L1200310
NaCl	L1200307

WARNING

If you have been analyzing hazardous liquids, pump a suitable solvent such as heptane or ethanol through the Liquid Sipper before performing any maintenance.

The standard mid-infrared flowcell supplied has KBr windows whilst the standard near-infrared flowcell has CaF_2 windows. Different flowcell window materials are appropriate for different types of sample. The following instructions detail how to replace the flowcell windows.

WARNING

Read the Safety information provided with the windows before removing them from the packaging.

Always wear disposable gloves when handling windows.

CAUTION

Always handle windows by their edges, do not touch the flat surfaces of a window.

1. Referring to *Replacing the flowcell* on page 25, remove the flowcell from the accessory.
2. Undo the four nuts securing the flowcell and slide the parts off as required until the flowcell windows are accessible.
3. Replace the windows, as shown in Figure 14.

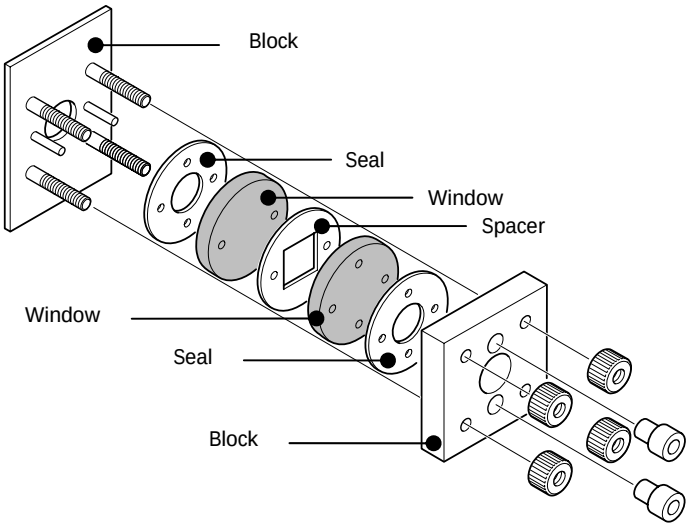


Figure 14 The Flowcell with the windows highlighted

4. Refit the flowcell parts, ensuring that the window with four holes is oriented so that the grooves point towards the spacer.

5. Refit the nuts, ensuring they are not overtightened.

6. Re-install the flowcell.

Selecting and replacing peristaltic pump tubing

WARNING

If you have been analyzing hazardous liquids, pump a suitable solvent such as heptane or ethanol through the Liquid Sipper before performing any maintenance.

Different types of tubing are appropriate for different sample types and conditions, so you may need to change the standard Viton tubing for a more appropriate material:

Material	Details	PerkinElmer part number
Viton	A black synthetic rubber with resistance to concentrated acids, solvents (excluding acetone), ozone, radiation, and temperatures up to about 300 °C.	L1202006
Silicone	A translucent medical/food grade tubing which is odourless, non-toxic, and has FDA and USP Class VI approvals. It is also autoclavable and resistant to temperatures up to 250 °C	L1202036
Autoprene	An opaque thermo-plastic rubber which is FDA food grade and USP Class VI medical grade material. It is by far the most resistant to wear.	L1202035
Tygon	A clear, non-toxic tubing, with excellent chemical resistance, handling virtually any inorganic chemical.	L1202037

It should also be noted that peristaltic pump tubing, because of its use, will wear over time and will need to be replaced. The following instructions detail how to replace peristaltic pump tubing.

WARNING

Make sure that the instrument is switched off at the power switch, or remove the accessory from the instrument before performing this procedure.

1. Ensure the instrument is switched off, or the accessory is removed from the instrument.
2. Open the pump access door.
3. Lever off the plastic cover over the pump.
   Use the indentation in the door frame as a leverage point.
4. Disconnect the inlet and outlet connections of the pump tubing (black Viton as standard) by removing the white connectors from the sample transfer tubing (yellow Tygon as standard).
5. Carefully remove the pump tubing.
   Manually turning the pump rotor will assist you.
6. Fit the replacement tubing by inserting the two connections into the sample transfer tubing free ends.
7. Route the tubing around the pump rotor, ensuring that there are no twists or kinks in the tubing.
   Manually rotating the pump rotor will assist you.
8. Close the pump access door.

Replacing the tubing inside the probe

WARNING

If you have been analyzing hazardous liquids, pump a suitable solvent such as heptane or ethanol through the Liquid Sipper before performing any maintenance.

Due to wear and tear, or contamination, it may be necessary to replace the Teflon tubing (part number 02508063) inside the probe arm that goes to the flowcell. The following instructions detail how to replace this tubing.

NOTE: 900 mm of tubing is required.

1. Referring to *Replacing the flowcell* on page 25, remove the flowcell from the accessory and disconnect the probe tubing from the flowcell.
2. Fully raise the probe arm by pulling it vertically.
3. Remove the end fitting from the probe and pull on the metal tube until the connection with the plastic tube is visible, as shown in Figure 15.

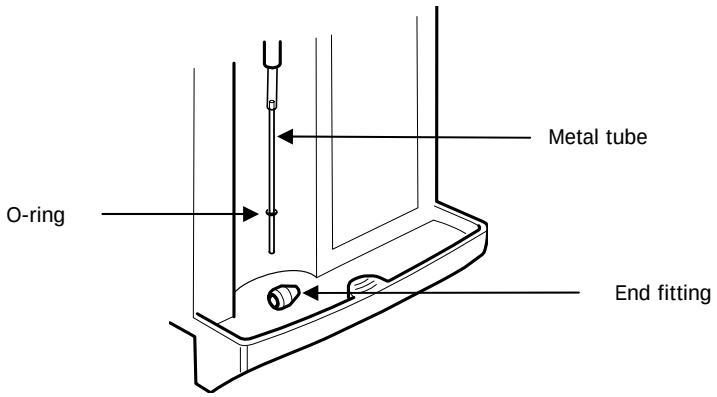


Figure 15 Removing the tubing from the probe

4. Remove the metal tube from the plastic tubing.
5. Pull the plastic tubing from the flowcell end until it is completely drawn out of the probe.
6. Fit the replacement tubing by inserting from the probe end, pushing it through until about 25 mm remains protruding from the probe.
7. Refit the metal tube, pushing it about 10 mm into the plastic tubing.
8. Push the tube and tubing up into the probe until 40-50 mm of the metal tube remains protruding.
9. Refit the end fitting.
10. Fit a nut and ferrule onto the other end of the tubing, as shown in Figure 16**.**

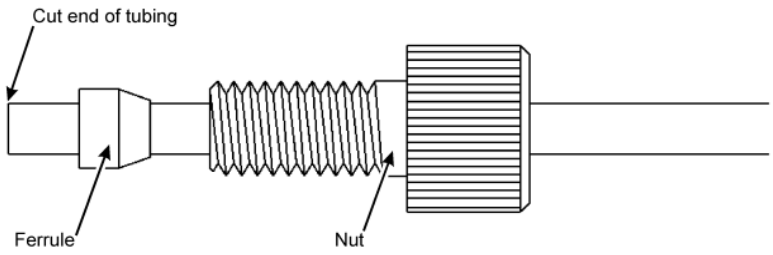


Figure 16 Fitting a nut and ferrule onto the tubing

11. Connect the tubing to the flowcell by screwing the nut in until it is finger-tight.

NOTE: Make sure that the tubing is pushed against the bottom of the hole while you are screwing the nut into the hole. Tighten the nut sufficiently to compress the ferrule onto the tubing.

12. Refit the flowcell.

Spares and Consumables

Item	PerkinElmer part number
Tygon tubing (sample transfer tubing and waste tubing)	L9001004
Teflon tubing	02508063
Tefzel ferrule	09920535
Knurled nut for ferrule	09920536
Sipper cell kit (no windows)	L1200306
KBr cell windows	L1200308
CaF_2 cell windows	L1200309
BaF_2 cell windows	L1200310
NaCl cell windows	L1200307
Filter	L1201989
100 μm cell spacer	L1201905
50 μm cell spacer	L1201904
0.5 mm cell spacer	L1202053
1 mm cell spacer	L1202054
Viton peristaltic pump tubing	L1202006
Autoprene peristaltic pump tubing	L1202035
Silicone peristaltic pump tubing	L1202036
Tygon peristaltic pump tubing	L1202037

Appendix : The Optional Filter (L1201989)

To allow for samples that have suspended solid particles an optional filter can be fitted to the end of the sipper probe. The filter contains an 80 μm mesh.

Figure 17 The optional filter

1. Fully raise the probe arm.
2. Remove the end fitting from the probe and pull on the metal tube until the connection with the plastic tube is visible, as shown in Figure 18.

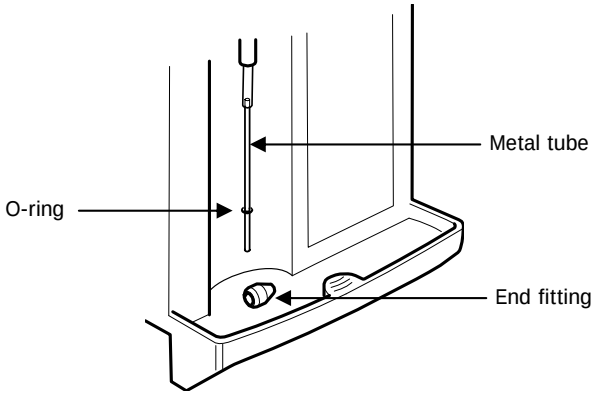


Figure 18 Removing the standard fittings

3. Remove the metal tube from the plastic tubing.
4. Remove the O-ring from the metal tube.
5. Slide the end fitting onto the filter tube.
6. Fit the O-ring onto the filter tube about 40-50 mm from the filter.
7. Push the filter tube into the plastic tube about 10 mm.
8. Push the tubing back into the probe and fit the end fitting to the end of the probe so that the end of the probe looks like Figure 19.

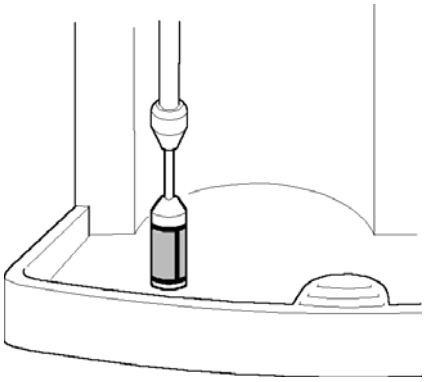


Figure 19 The filter in place

NOTE: If the filter becomes blocked, remove it from the probe and either flush solvent through it or clean it ultrasonically.