

Chapter 1

Introduction

The FlexiSpense 2 MK2 is a liquid dispenser for microplates and other rectangular test containers.

1.2 Specifications and features

1.21 Features

Height adjustable manifold

Deep-well, standard-well and low profile microplates can be used

Low dead volume and pump-back capability

Save expensive reagents

Long life piston pump

High precision over life time

Flexible dispensing patterns

Start and stop position as well as skipping columns can be programmed

Complete inert liquid path

Only PTFE, ceramic, PVDF™ and glass in contact with liquid

High dispensing speed

Less than 15 seconds for a 96 well plate and 16 seconds for a 384 well plate

1.22 Specifications:

Volume range:	5 µl or 10µl to 2.5 ml
Volume increments:	5 or 10 µl as standard, other volume increments on request
Accuracy:	+/- 1.5%
Precision	+/- 1%
Manifold:	8- channel
Dispensing speed:	14 sec.(96 well, 100 µl per well) 16 sec. (384 well, 20 µl per well)
Plate formats:	96- and 384 well plates
Display:	Alphanumeric LCD with backlight, 2 x 20 character
Number of programs:	up to 15
Power:	85 to 260 V, 47 – 400 Hz, max. 70 Watt
Computer interface:	RS232
Environmental Conditions: (Operational)	Humidity 5 to 90%, non-condensing, maximum altitude 2000 m. temperature 5 to 40°C
Dimensions:	28 x 41.2 x 27.5 cm (W x D x H) 11.2 x 16.5 x 11 in

1.3 Order numbers and accessories

FlexiSpense 2 MK 2 with 8-channel autoclavable manifold, power cord, operator manual, spare fuses, manifold cleaning wire

Order number: G013415

Pump unit 50 µl (2 – 5µl / channel)

Order number: B013356

Pump unit 100 µl(6 – 11µl / channel)

Order number: B013356

8-channel manifold

Order number B013348

Dispense tube set with fittings

Order number S027001

Chapter 2

Installation

2.1 Introduction

This chapter contains the necessary information for installing the instrument. The installation procedures involve unpacking, power requirements and environmental requirements.

2.2 Unpacking and Inspection

The instrument is shipped in one carton that includes:

- Instrument,
- Pump unit
- Accessories
- Power cord
- Instruction manual (This manual)

2.2.1 Unpacking Procedure

1. Visually inspect, the container for damage, before opening it.
Report any damage immediately to the forwarding agent or to the delivery carrier.
2. Place the carton in an upright position and open it.
3. Remove the upper cardboard box carefully.
4. Lift the instrument out of the carton and place it on a flat surface, free from dust, vibration and away from direct sunlight.
5. Visually inspect the instrument for loose, bent or broken parts.
Report any damage immediately.
6. Compare the instrument's serial number, attached on the rear panel of the instrument, against the serial number of the instrument, on the delivery (shipping) note.
7. Check the instrument accessories against the delivery (shipping) note.
8. Please save all packing materials, as they maybe required for later transportation.

2.3 Power requirements

The instrument has an universal power supply which requires no setting for the local voltage. The voltage must be in the range from 85 to 264 V AC, 48 to 400 Hz.

WARNING:

For safe operation of the equipment it is mandatory that it is connected to a wall socket equipped with a ground (earth) connector.

Ensure, that the voltage supplied to the instrument is correct to this specification and the correct rating and type of fuses are fitted.

Fuse Ratings: T 2.5 A

For instructions how to change fuses please refer to chapter 4 of this manual.

2.4 Environmental requirements

The instrument should be placed on an even surface that is free from dust, solvents and acidic vapors. Vibration and direct sunlight should be avoided.

Before the instrument is installed and switched on, it should be left to stand for at least 2 hours, so there is no possibility of condensation causing a damage or malfunction..

2.5 Instrument installation procedure

The following procedures detail the necessary steps to be followed when installing the Instrument.

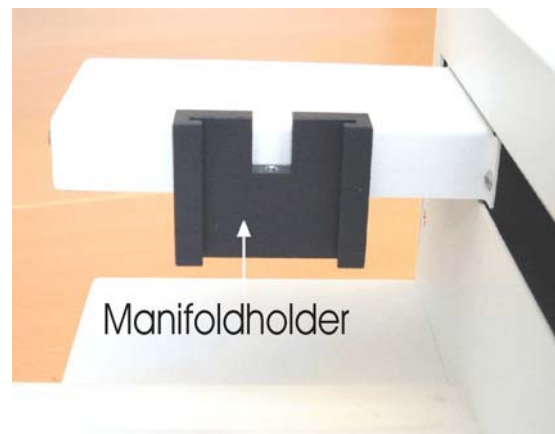
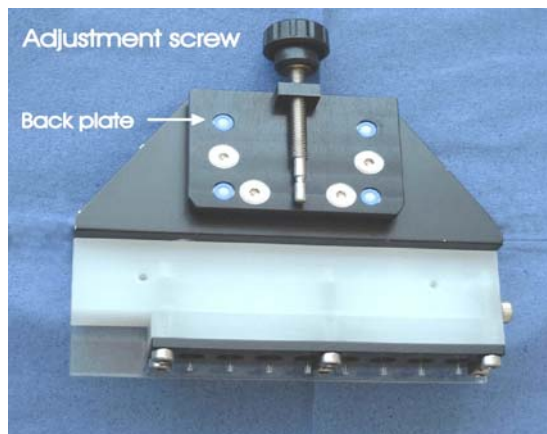
1. Place the instrument into the required position

Ensure, that the distance between the back panel of the instrument and the wall, is at least 5 cm.

Remove all packing material and transport lock tapes.

2. Remove all packing material from the pump module. Place the pump module on the top cover with the pump head showing to the right so that the connector at the bottom of the pump head mates with the 9-pin connector in the top cover. Secure the pump module with a knurled screw on both sides of the pump module.
3. Unpack the manifold. Slide the back plate of the manifold in the groove of the manifold holder on the dispense arm. Push the adjustment screw downward to snap it into the holder.
4. Slide the short silicon inlet tube on the fitting at the lower port of the pump head.
5. Place the tube holder into the hole of the holder block on the pump housing and secure it with the knurled screw.

6. Connect the Manifold with the pump.
To connect the manifold with the pump use the Teflon tubing with the green nuts on both ends.
Screw one of the green nuts into the upper port of the pump head and the other one into the port of the manifold. Make sure that the connections are tight to avoid leaking.
Put the tube into the tube holder.
7. Ensure that the mains power switch at the back panel of the dispenser is in the OFF position.
8. Insert the power cable into the mains power socket in the back panel of the instrument.
9. Switch the dispenser on.



Manifold B013348



Fitting with correct position of the ferrule

Chapter 3

Operation

3.1 Basic operation rules

3.1.1 Display description

The first (upper) line of the LCD display shows current options or actions, the second line gives the description of the current possible key commands.

3.1.2 Special key functions:

- ↑ Scrolls the menu upwards, increments a numeric value by one
- ↓ Scrolls the menu downwards, decrements a numeric value by one
- Moves the cursor to the right, in case a well position is indicated the column number will be incremented.
- ← Moves the cursor to the left
- ↵ Enter key, confirms a selection
- ESC** Escape key, leaves the current selection.
- CL** Erases a numeric input, respectively sets the default value.

3.2 Operation

After the instrument is switched on, the arm moves to the home position and the display shows the main menu. Now you can select the required operation.

Prime	-	- prepares the system for operation
Setup		- Plate programming, erase a plate, language selection
Program		- programming of the dispensing
Run		- activate a dispensing program
Back		- pumps the liquid back

3.21 Prime

After the selection 'Prime' is confirmed, the arm moves to the prime position, if not already there. Press the key 'YES' to start the prime procedure. If the prime volume is not sufficient, repeat the prime procedure. Priming is very important to achieve a low channel-to-channel variation.

3.22 Setup

The menu setup has the following menu options:

- Plate def.
- Plate del.
- Min.Volume
- Pump
- Pmp. Speed
- Workspace
- Manifold
- Language
- Exit

3.22.1 Plate def. (Plate definition)

This menu option allows to define and edit plate formats.

Plate formats for the current dispenser configuration are already defined. A plate must have a 4.5 respectively 9 mm well spacing in the row axis to fit for the standard manifold.

NOTE: Before starting the definition of a new plate make sure that the set height of the manifold shows enough clearance between the tips of the manifold and the top surface of the microplate.

To define new plate formats proceed like follows:

Select the menu **Plate def.** Press the arrow up key until an undefined plate ID. is shown.

Plate ID:	5 (undef)		
↑	↓	ESC	↵

Press the **ENTER** to confirm that a new plate will be defined.

Now you can enter an alphanumeric name for the new plate, for example the number of wells for the plate. The name can be up to six digits.

NAME:
→ ↑ CL ESC ↵

Press the arrow up key until the desired first digit is displayed. Press → to move to the second digit. Select the desired character. If you want more characters press the key → again and select the next character up to a maximum of six. If the entered text is wrong, press **CL** to erase the input. When the text is correct, press **ENTER**.

The next message is shown on the display then:

last Pos.:	H/3
↓ →	ESC ↵

Now the designation of the last well position should be entered. This is defined as the well located in the bottom right corner, e.g. P-24 for a 384 well plate. Based on this input the instrument calculates the number of rows and columns for the new plate format.

Press the ↓ key until the desired row character is displayed, then press the → key to select the desired column number. When the last well has been entered correct, press **ENTER**.

The next menu option is to define the positions of the plates and the respective first and last column. This action is performed by means of a so-called teach-in function.

sel. Plate:	1.Plate
↑ ↓	ESC ↵

The '1.Plate' position is the one located at the back of the instrument. When a sample plate has been placed on the plate holder press the ENTER key. The arm moves to a default position for the particular plate position and the position of the 1st column can be defined now.

1. Plate	88/104
E ← X → H	E ← Y → H OK

By means of the key E and H you can move the dispensing arm in the X (front/back) and Y /left / right) direction. 'E' is the abbreviation for End position, which is the utmost front respective left position. 'H' is the abbreviation for Home position, which is the utmost back respective right position.

Move the dispensing arm with the manifold so that the utmost right dispense tip is near the center of the well A1 and confirm this position. No precise positioning is required in this step.

The display shows now:

Fine adjust:	?	YES
ESC	NO	YES

Confirm that you want the fine adjustment with the YES key. Now a precise positioning in small increments can be performed.

1. Plate	88/26
E ← X → H	E ← Y → H OK

Now make sure that the tips are in line with the column 1 and the utmost right tip is above the center of well A1.

After the position has been defined, press the OK key , then save this position.

Now the 1st column position for the 2nd plate must be defined. The second plate is located in the front position of the plate holder.

sel. Plate	2. Plate
↑ ↓	ESC ↵

Confirm that you want to define the position of the second plate. The display shows now the following:

2. Plate	333/88
E ← X → H	E ← Y → H OK

The procedure is identical to the definition of the first column of the 1st plate.

Move the dispensing arm with the manifold close to the center of the first column of the 2nd plate and conform with the OK key.

Fine adjust ?	YES
ESC	NO YES

Press YES to allow the fine adjustment. The next menu allows the precise definition of the dispensing position in single steps of the motor.

2. Plate	1152/733
E ← X → H	E ← Y → H OK

After the fine adjustment has been performed press the key OK.

Store position	YES
ESC	NO YES

To save the programmed position press YES.

Pos. H/12:	633/322
E ← X → H	E ← Y → H OK

Now you should define the position of the last (front side) wells. This is done for the first (back side) plate only, the coordinates for the second plate are calculated automatically.

Move the manifold with the ← → keys so that the tips of the manifold are approximately above the last (front side) column. Press the OK key to conform the position. The display prompts you now to confirm that you want to enter the fine adjustment. Confirm this message. The X and Y position can be aligned in small increments now. Move the manifold first in the X-direction above the center of the wells, then align the manifold tips in the Y-direction so that left side tip is above the left well, e.g. well P-24 in case of a 384-well plate.

Confirm the position with the OK key, the plate setup is finished.

3.22.2 Plate del(ete)

This menu option allows to erase an already programmed plate definition

3.22.3 min(imum) Vol(ume)

The minimum volume menu option allows to enter the minimum pump volume. This volume is defined as the volume per channel that is dispensed during one revolution of the pump motor.

The setting for the minimum volume will depend on the configuration of the instrument. It can be set in 1 µl steps from 5 µl onwards. If the minimum volume is changed, the display prompts if the existing dispense programs should be erased. Because a modification of the minimum volume may cause a wrong dispensing volume for existing dispense programs, the existing programs should be erased. Only in cases the modification of the volume is for trial purposes the dispense programs may stay untouched.

WARNING: The change of the setting for the minimum volume does not change the actual dispensed volume per revolution. To change the actual volume a mechanical adjustment of the pump is required. This adjustment should only be performed by trained service personnel. The setting of the minimum pump volume in this menu option is to inform the software about the actual pump volume only.

3.22.4 Pump

The pump sub-menu enables the modification of the pump speed indices Pump speed 1, 2 and 3. These speed indices can be chosen within the dispensing programs.

The following table shows typical speed setting for an instrument with an 8-channel manifold.

Speed index	5µl/revolution	10µl/revolution
1	2800	2000
2	3000	2300
2	3200	2600

Note: These values are heavily dependent on the manifold, the liquid to be dispensed and the volume increments.

Depending on the liquid characteristics like viscosity and surface tension a lower or higher speed index may improve the dispensing accuracy. Especially in case that some droplets may be seen at the tips of the manifold a different speed will reduce the problem.

3.22.5 Pmp. Speed

This option allows to define the pump speed index for prime and back pumping. For most cases a setting to **3** gives the best result.

3.22.6 Workspace

In case of the FlexiSpense 2 ST (single tip version) this menu option allows to choose either a configuration for microplates or tube racks. For the standard FlexiSpense 2 leave the setting to **PLATE**.

3.22.7 Manifold

When the Workspace has been set to PLATE only a 8-channel manifold is possible.

3.22.8 Language

The dialogue language can be selected using this menu option.

3.22.7 Exit

Confirming this message terminates the setup menu.

3.23 Program

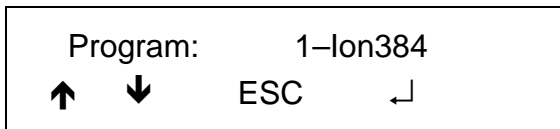
This menu should be chosen when you want to establish or edit a dispensing program. Up to 15 dispensing programs can be stored.

Note: The shown display messages may vary with different models and configuration.

The display will show:

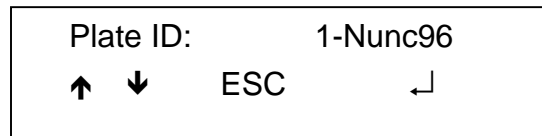


Choose the programming mode by pressing the ENTER key.



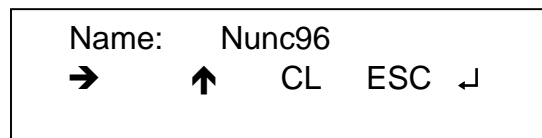
You can edit an existing program by overwriting the values or establish a new one using a free (undefined) program number.

You can select the desired program number (1 to 15) by scrolling with the up -- down arrow keys. When the desired number is displayed, press **ENTER**. The display will present:



This first programming step is to select the desired plate format. You can select from the predefined formats (see 1.22.2) by means of the arrow keys. After the desired plate is displayed, press **ENTER**.

Now you can define the name of the program. This name can be up to 6 characters long.



As default the plate name is shown. When you want to use this name press ENTER. Otherwise press the CL key to erase the shown name. By means of the ↑ key you can choose a character or number for the first digit of the name. After the first digit has been

chosen press key → to move to the next digit. Select the desired character using the same method as before. Repeat the procedure until the desired name has been established.

The next programming steps will depend on whether a 96- or 384-well plate has been selected. In case of a 384-well plate the dispensing direction and mode can be programmed, for 96-well plates continue with defining the start position as shown below.

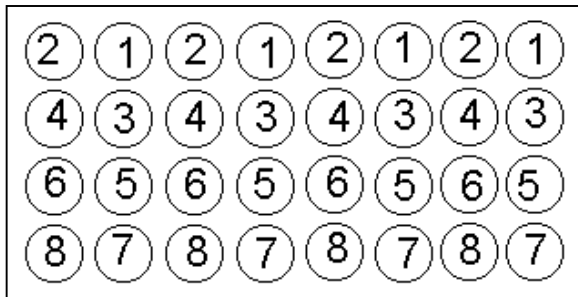
Disp. Vertical	YES
ESC	NO YES

Serpentines	YES
ESC	NO YES

There are four different dispensing modes to choose from:

- Dispensing Vertical NO/Serpentines NO

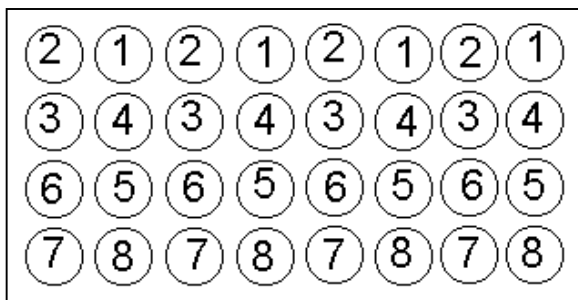
If dispensing vertical and serpentines is switched to NO then the dispensing will take place as shown in *Drawing 1*.



Drawing 1: NO/NO

- Dispensing vertical NO/Serpentines YES

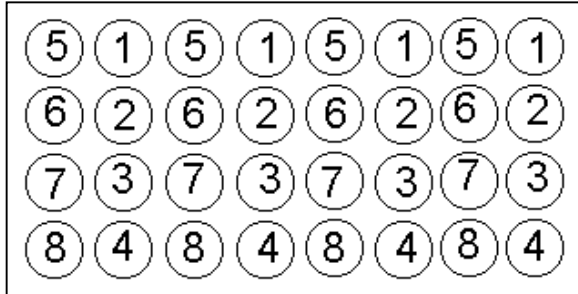
If dispensing vertical is switched to NO and Serpentines to YES then the dispensing will take place as shown in *Drawing 2*



Drawing 2: NO/YES

- Dispensing vertical YES/Serpentines NO

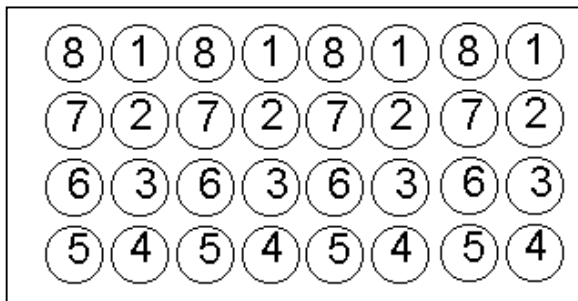
If dispensing vertical is switched to YES and Serpentine to NO then the dispensing will take place as shown in *Drawing 3*.



Drawing 3

- Dispensing vertical YES/Serpentine NO

If both dispensing vertical and serpentine are switched to YES then the dispensing will take place as shown in *Drawing 4*. This is the fastest dispensing mode.



Drawing 4

After choosing a dispensing mode you have to define the start position. In case of 96-well plates only the columns 1 ...12 can be selected, in case of 384-well plates columns 1..24 as well as rows A or B can be selected.

Start pos.:	A/1
↓ → CL ESC ↵	

Select the start position with the cursor keys and confirm the selection with the ENTER key. After the start position has been defined the End position can be chosen.

Endposition:	P/24
↓ → CL ESC ↵	

The procedure is the same as for the start position.

For all plate you can select if all columns between the start and the end column should be filled or not.

```
Use Col. 1 ?   1 1 1 1 1 1 1
←  ↑  →      ESC  ↵
```

With the **left / right** keys you can select a column. The active column is indicated by an underline and also shown in the message **Use Col. x**. To disable dispensing into the selected column press the **up key**. The character 1 is changed to a Zero (0) then, indicating that this column will be omitted during the dispense run.

The next message prompts you to choose the dispensing volume.

```
Volume:       200
←  ↑  CL  ESC  ↵
```

The available volume increment is depending on the pump setting, it is either 5 or 10µl. When the volume has been defined, press **ENTER**.

The next option for the dispensing program is to choose the pump speed (Dispensing speed). Three steps are possible, 1 is the lowest and 3 the highest speed.

```
Pmp. Speed:   2
←  ↑  CL  ESC  ↵
```

Confirm the setting and the display will show the last screen for the programming mode.

```
Prime:   0
↓  ↑  CL  ESC  ↵
```

This menu option allows you to define if a so-called pre-prime should be performed before each dispensing run. Especially in cases of low dispense volumes and long delays between consecutive dispense run the pre-prime can improve the dispensing accuracy. Typically a volume of 5 or 10µl is sufficient.

The programming procedure is finished now, If you want to define another dispensing program, choose a new program number and proceed as above. To terminate the program mode press the **ESC** key.

3.23 RUN

To run a program, select Run from the main menu and press **ENTER**.

The display will show:

Program:	1-96
↑ ↓ CL ESC ↵	

Now you can choose one of the programmed dispensing procedure. Use the up/down arrow key to choose the desired program and confirm your selection with **ENTER**.

The display shows then:

No of plates:	1
↑ ↓ CL ESC ↵	

Choose the number of plates that should be filled with the up/ down arrow keys and confirm your selection with **ENTER**.

At the end of the list of dispensing programs you will see 'temp.def.', here you can enter a so-called temporary program. The programming of a temporary program follows the same rules as for a regularly program. Please note that a temporary program will be erased when the dispenser is switched off.

<p>NOTE: Make sure that the plates to be filled are already in place before you press the ENTER key. The dispensing process will start immediately after the ENTER key is pressed.</p>

During dispensing process the actual plate and well position is indicated. You can stop the dispensing by pressing the **STOP** key. After the dispensing is finished the arm moves back to the home position.

3.24 Back

The back function serves to delivers the liquid in the system back into the reservoir.

After the selection 'Back' is confirmed, the arm moves to the prime position. Make sure that the prime reservoir is in the correct position. Press the key 'YES' to start the back pump procedure. If the system is not completely emptied, repeat the Back procedure.

Chapter 4

Maintenance

4.1 Introduction

This chapter gives the instructions on how to maintain, clean and disinfect the 'Flexispense' instrument.

4.2 Cleaning the Instrument

This instrument is a precision instrument and requires regular cleaning to ensure the continued precision.

Liquid Spills

If any liquid is spilled on the instrument, it should be IMMEDIATELY removed so that the liquid does not attack the surface of the housing.

Regular cleaning

The housing of the instrument should be cleaned regularly with a mild household cleaning agent.

Warning: Do not use aggressive solutions

The plate platform should be cleaned with a dry cloth .

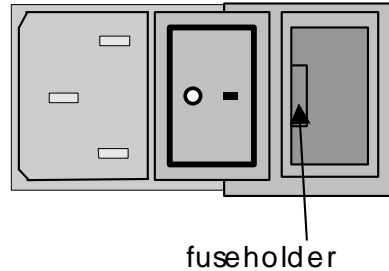
4.21 Cleaning the pump

Routine flushing with solvent before shut down will suffice for most applications.

Caution: Ceramic piston/cylinder sets are sensitive to neglect and may 'freeze' if allowed to dry out without adequate cleansing. Fill a loop of flexible tubing with fluid that will thin or neutralize the last fluid pumped. Then connect one end of the tube to the pump suction port, the other end to the discharge port. With this loop positioned above the pump head, the ceramic surfaces and seal areas stay moist and mobile for extended idle periods. If, however a piston does freeze in the cylinder, DO NOT TRY TO FORCE IT FREE. Contact your dealer on how to solve this problem.

4.3 Changing the Fuses

4.3.1 The following steps must be performed to replace the fuses, which are located at the power cable receptacle, in the rear panel of the instrument.



WARNING !

Before replacing fuses, disconnect the power cord. To avoid risk of fire, replace fuses only with same type and rating.

1. Switch off the instrument and unplug the power cord.
2. Open the plastic cover of the fuse compartment, by inserting a screw driver into the slot of the cover and pushing the cover out.
3. Pull the fuse holder away from the instrument.
4. Replace the defective fuses.

Ensure that the fuses have the correct rating.

85 to 264 Volts T **2.5 Amp**

5. Replace the fuse holder.
6. Reconnect the power cord and switch the instrument on

WARNING: If the fuses continues to blow, please call for service.

4.3.2 Power supply fuse:

The power supply fuse is inside the instrument located on the power supply board. This fuse is not user replaceable, replacement should be performed by a qualified service technician only. The rating of the fuse is F 3A.

4.4 Disinfecting Procedure

If the laboratory has no specific disinfecting procedure, the following procedure should be used to disinfect the instrument.

The instrument should be disinfected using a suitable disaffection solution.

1. Disconnect the instrument from the mains power supply.
2. Carefully wipe all the outside surfaces of the instrument and the plate area with a wad of cotton wool that has been soaked in the disaffection solution.

Ensure that disposable gloves are worn.

3. Place the instrument in to a large plastic bag.
4. Place a wad of cotton wool that has been soaked in the disinfecting solution in to the plastic bag.

Ensure that the wad is not touching the instrument.

5. Close and seal the plastic bag.
6. Leave the instrument to stand in the plastic bag for at least 24 hours.
7. After the standing time, remove the instrument from the plastic bag and wipe all the outside surfaces of the instrument and the plate support area with a wad of cotton wool which has been soaked in a 50% Alcohol solution.
8. Repeat the disinfecting procedure on any accessories which are also being moved or returned.

The pump can be disinfected by dispensing a sufficient amount of disinfectant fluid. After the disinfecting procedure dispense > 200 ml of distilled water to remove all disinfectant fluid from the liquid carrying parts.