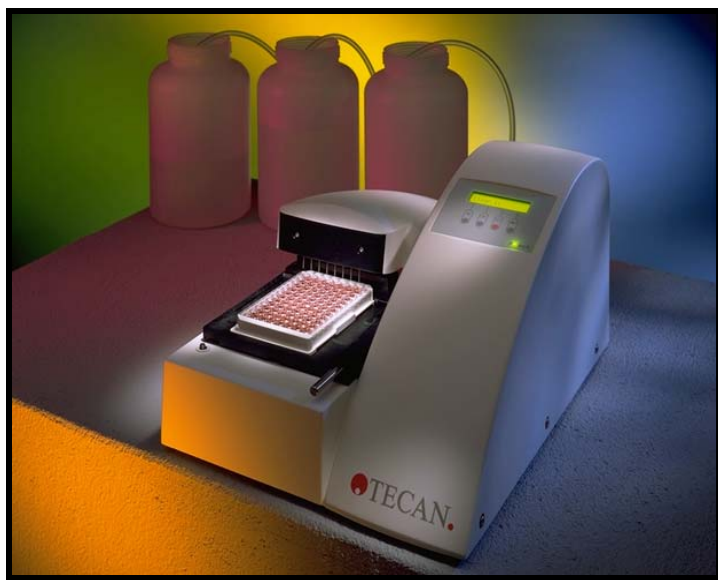




Technical Manual for

Columbus Washer



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WARNING

**CAREFULLY READ AND FOLLOW THE INSTRUCTIONS
PROVIDED IN THIS MANUAL BEFORE OPERATING THE
INSTRUMENT.**

Notice

Every effort has been made to avoid errors in text and diagrams, however, Tecan Austria GmbH assumes no responsibility for any errors which may appear in this publication.

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We would appreciate any comments on this publication.

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Declaration for EU Certificate

See the back of this manual.

About this Manual

This technical manual describes the servicing of the Columbus Washer, designed to wash microplates. It is intended only for service personnel.

This manual instructs how to:

- Install the instrument
- Operate the instrument
- Programming the wash procedure
- Definition on the wash parameters
- Cleaning and maintenance procedures

Warnings, Cautions and Notes

There are three types of informational notices used in this manual. These notices highlight important information or warn the user of a potentially dangerous situation. The following notices are:



Note
Gives helpful information.



Caution
Indicates a possibility of instrument damage or data loss if instructions are not followed.



WARNING
INDICATES THE POSSIBILITY OF SEVERE PERSONAL INJURY, LOSS OF LIFE OR EQUIPMENT DAMAGE IF THE INSTRUCTIONS ARE NOT FOLLOWED.

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1. General

1.1 Overview

This is a technical manual for servicing the Columbus Washer.

The instrument is a microprocessor controlled washer, designed to wash microplates.

The instrument can be fitted with either an 8, 12 or 16 way manifold or a 384 Well Manifold.

The manifolds are fitted with one aspirating and one dispensing needle per well.

The instrument can store up to nine software user-defined plate types including dispensing and aspirating positions as well as the shape of the plate.

The dispensing speed can be selected from five set speeds and dropwise.

These features allow the instrument to be used for all washing applications including Cell Washing applications.

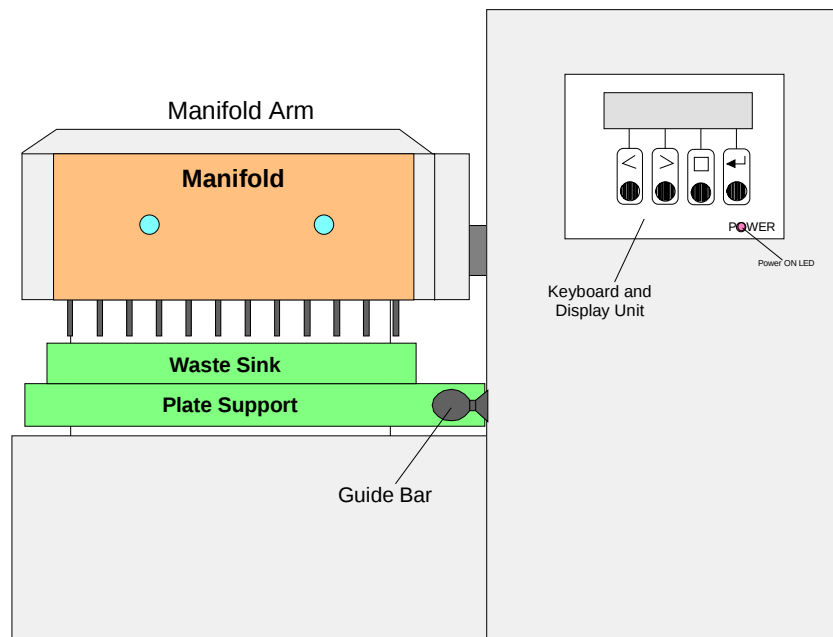


The instrument should only be opened by authorized personnel. Before the instrument is opened the mains power cable must be disconnected from the mains power socket.

Ensure that the instrument has been disinfected before it is serviced.

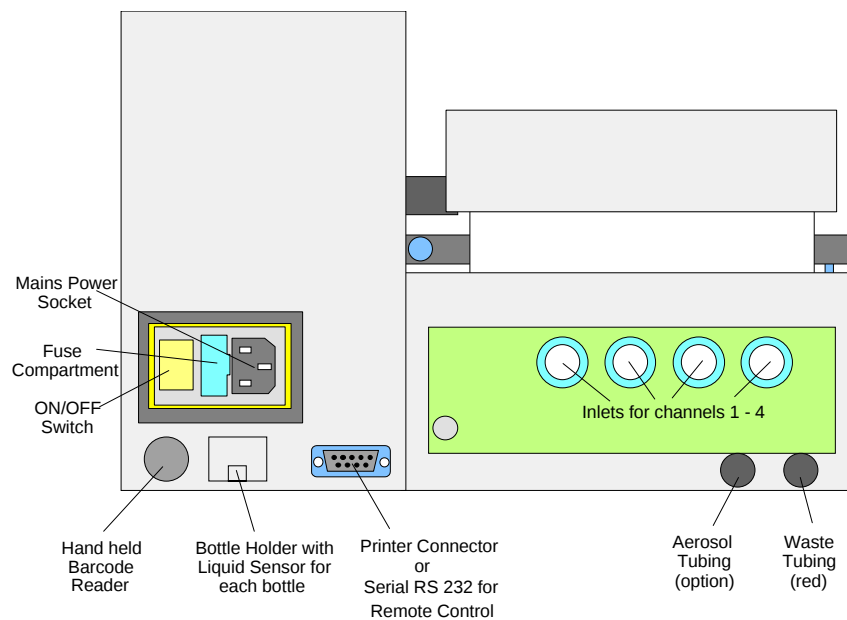
1.2 Instrument Description

The diagram below shows the main components of the instrument:

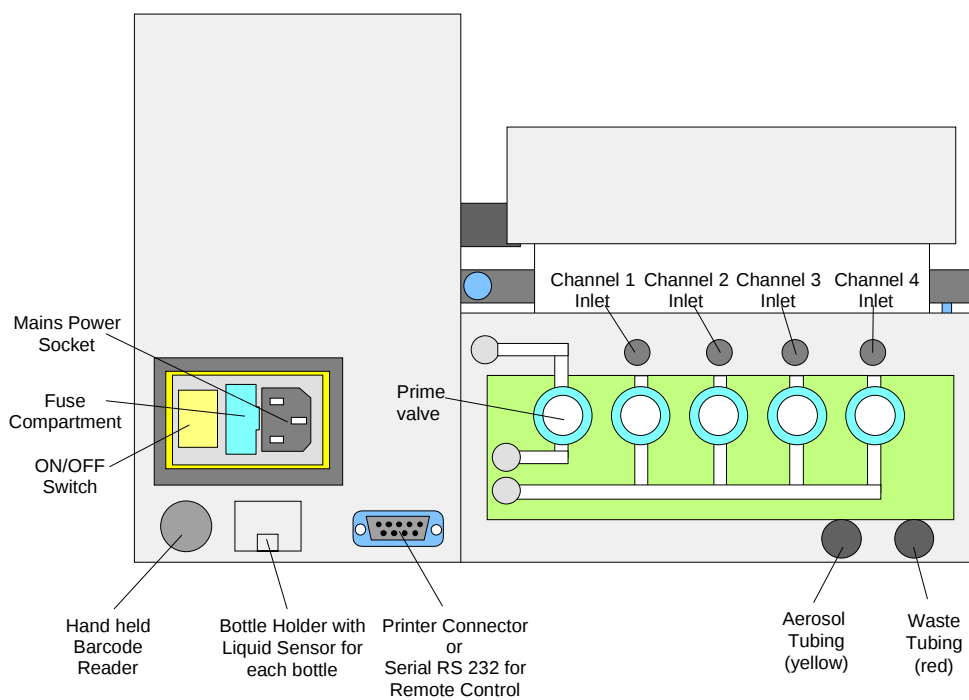


1.2.1 Rear Panel Connections

The instrument has the following connections on the back panel.

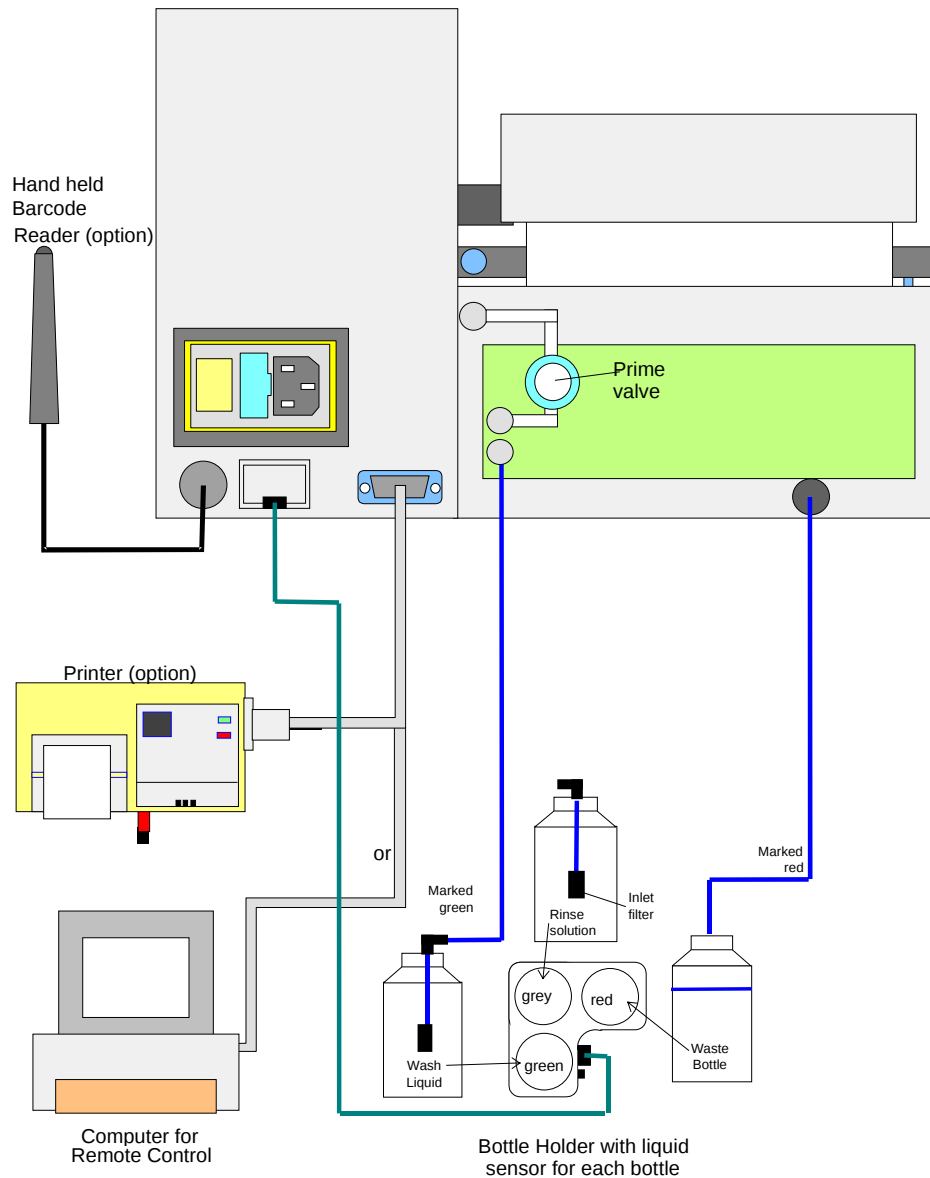


(Instrument with Pinch Valves)



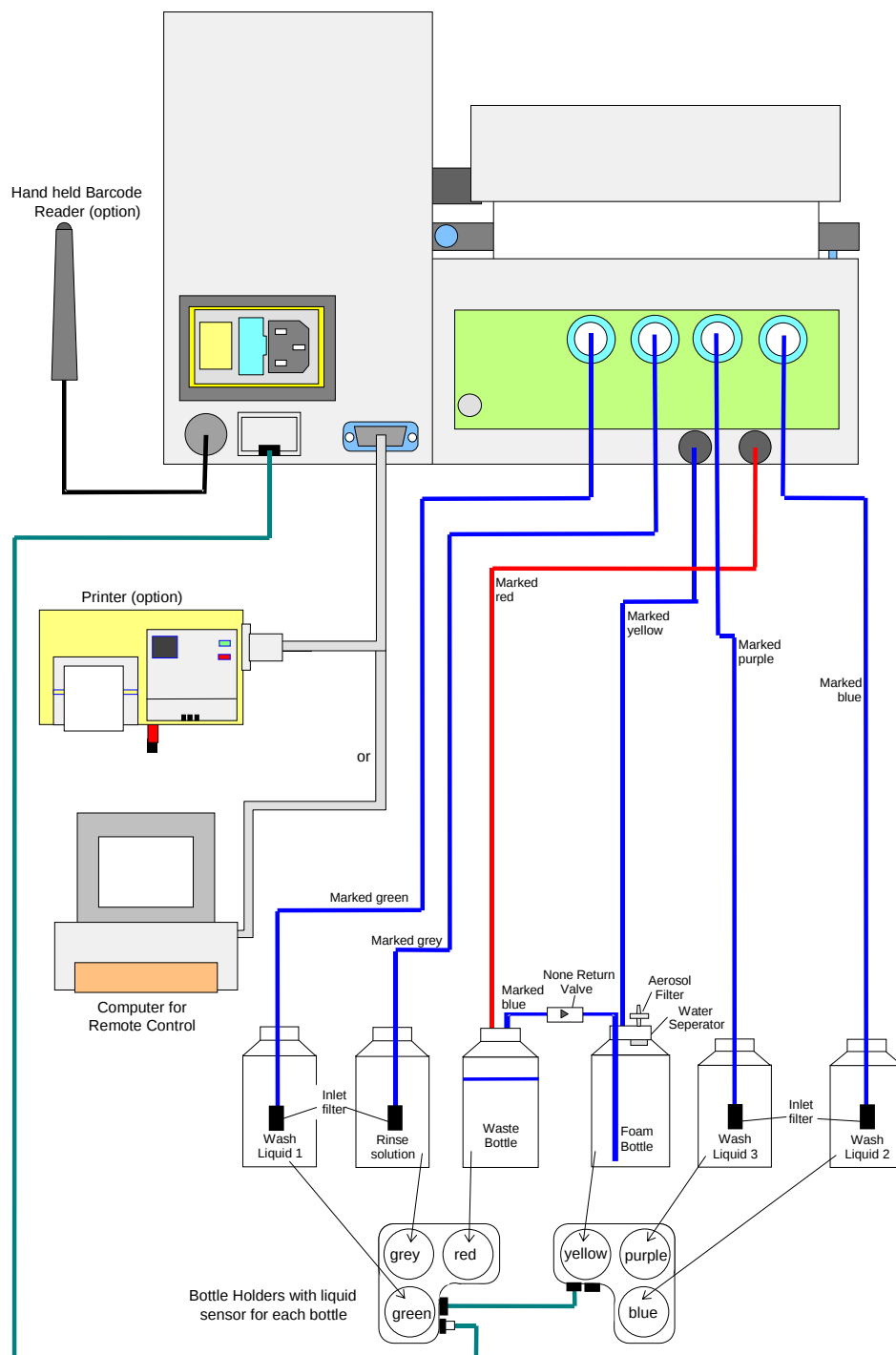
All connected devices must be proved and listed with regulations
EN 60950, UL 1950 or CSA C22.2 No. 950 for Data Processing Devices

1.2.2 Connection Diagram for Columbus (1 Liquid Channel)*



* Some of the instruments may include the prime valve.

1.2.3 Connection Diagram for Columbus (4 Liquid Channels)*



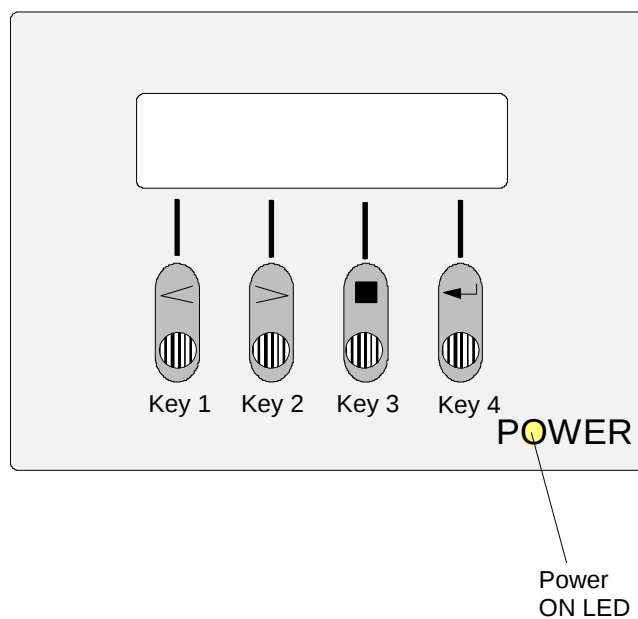
* Some of the instruments may include the prime valve.

1.2.4 Keyboard and Display Unit

The Washer is operated via a keyboard and a control panel consisting of a two row, sixteen digit Liquid Crystal Display (LCD) unit.

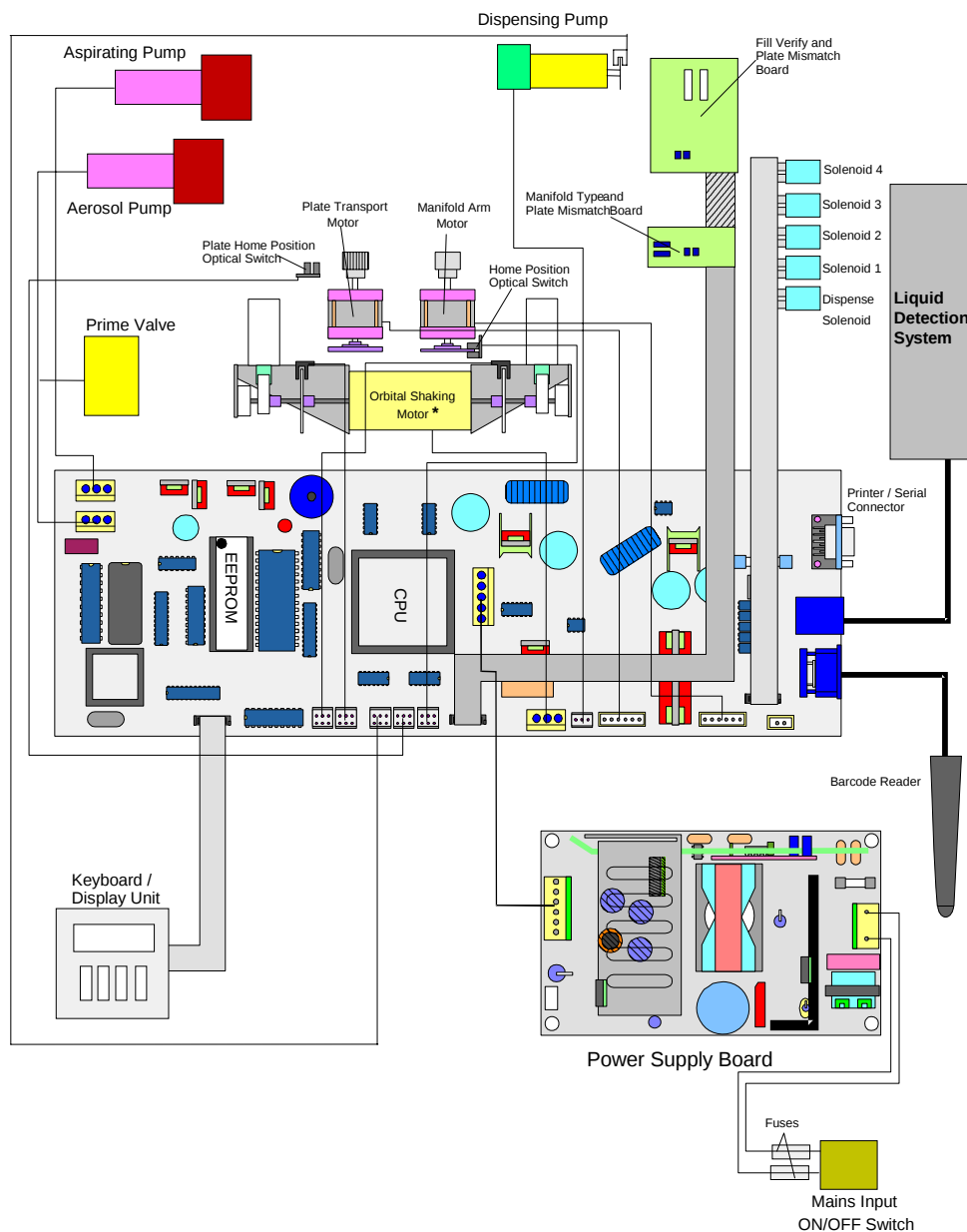
The top row of the display unit is used for messages and the bottom row for the key functions or options.

A Light Emitting Diode (LED) in the center of the letter "O" of the word "POWER" indicates when the Washer is switched ON.



1.3 Interconnection Diagram

The diagram below shows how the various parts of the instrument are interconnected.



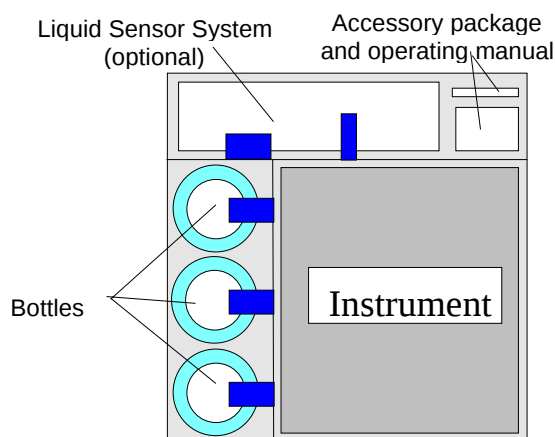
* The Orbital Shaking option is not used.

2. Installation Procedure

2.1 Unpacking and Inspection

The instrument is shipped in one carton, which contains:

- Instrument
- Accessory package which contains:
 - Spare manifold cover with two screws and Allen key
 - Operating manual
 - Mains power cable
 - Cleaning needles
 - 2 spare fuses
 - Solution tube
 - 3 spare O – ring seals for manifold
- Bottle set containing:
 - 3 x 2.5 l bottles for the standard instrument



2.2 Unpacking Procedure

1. Visually inspect the container for damage before it is opened.
Report any damage immediately.
2. To place the instrument, select a location that is flat, level, vibration free, away from direct sunlight, and free from dust, solvents and acid vapors. Allow 10 cm distance between the back of the instrument and the wall or any other equipment.
3. Place the carton in an upright position and open it.
4. Lift the instrument out of the carton and place it in the selected location.
5. Visually inspect the instrument for loose, bent or broken parts.
Report any damage immediately.
6. Compare the serial number on the rear panel of the instrument with the serial number on the packing slip.
Report any discrepancy immediately.
7. Check the instrument accessories against the packing list.
8. Save packing materials for future use.

2.3 Power Requirements

The instrument is designed to operate at either 100 - 120 volt or 220 - 240 volt.

No voltage setting is required as the washer automatically senses the supplied voltage.

The washer requires 2 x T 1.6 A / 250 V (slow blow) fuses.



WARNING

TO PREVENT THE RISK OF FIRE, THE MAINS FUSES SHOULD ONLY BE REPLACED WITH THE SAME TYPE AND RATING OF FUSE.

2.4 Installation Procedure



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

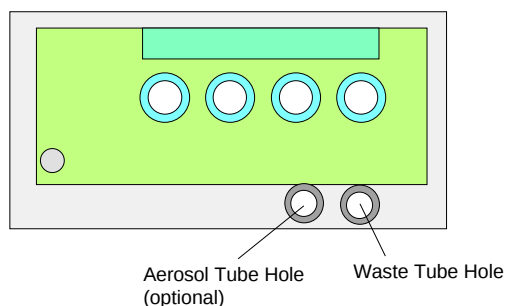
2.4.1 Installing the Instrument

- Unpack the instrument and check the contents.
See 2.2 Unpacking Procedure.
- Connect the solution tubes to the inlet connectors.
See 2.4.3 Connecting the Solution Tubes.
- Setup possible instrument options. *See page 2 – 5 and 2 – 6.*
- Connect instrument to the power supply. *See 2.4.7 Power Connections.*
- Define the plate parameters in the Adjust menu. *See chapter 3.*
- Program the wash procedure. *See chapter 3.*

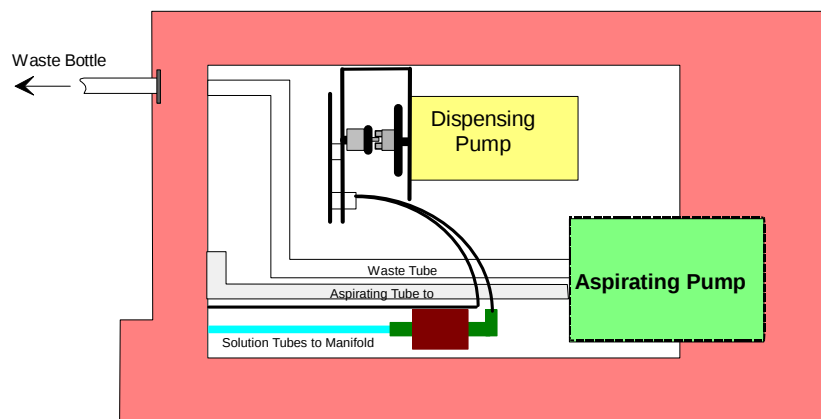
2.4.2 Connecting the Waste Tubing

Turn the instrument onto the right hand side.

Slide the waste tube through the hole in the back panel.



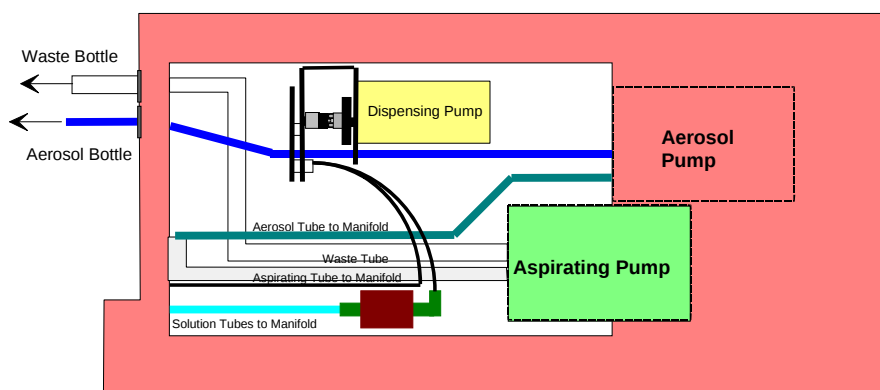
Connect the waste tube onto the top connector of the aspirating pump.

Standard Instrument

Turn the instrument back to the normal position.

Place the other end of the waste tubing into the waste bottle.

Connect the aerosol tube onto the aerosol pump if this option is fitted. This is not necessary for the standard instrument.

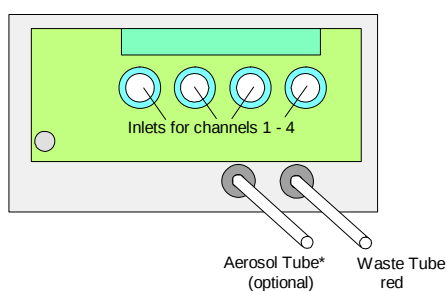
Instrument with Aerosol Protection Option

Turn the instrument back to the normal position.

Place the other end of the aerosol tubing into the aerosol bottle.

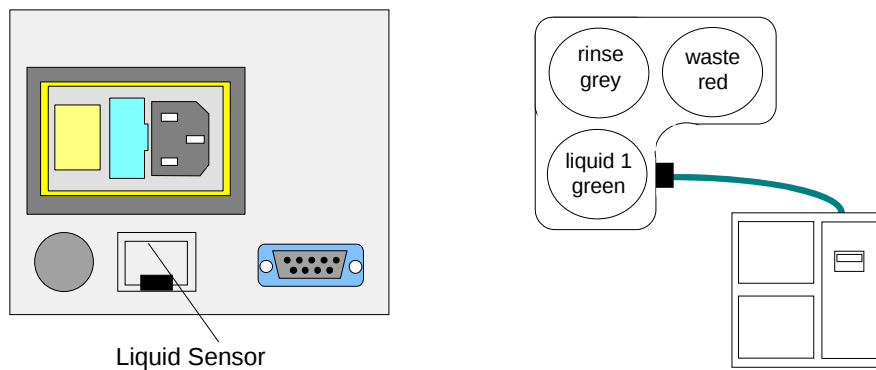
2.4.3 Connecting the Solution Tubes

The solution tubes are connected onto the inlet connectors on the back panel of the instrument. The instrument is supplied with four meters of tubing that can be cut to the required length (maximum 1 meter).

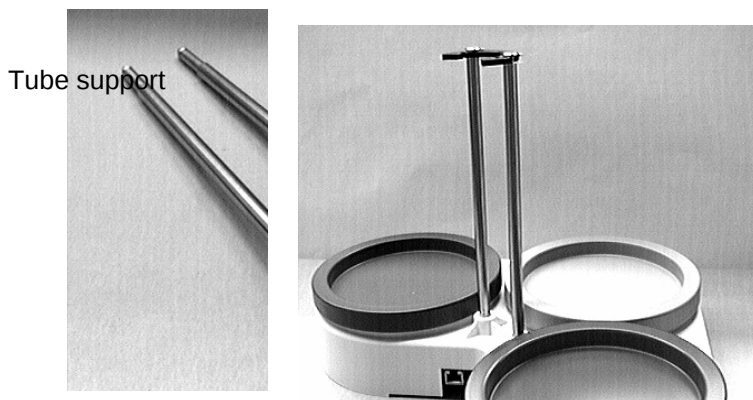


2.4.4 Fitting and Connecting the Liquid Sensors (Optional)

Connect the detector unit cable into the appropriate socket in the back panel of the instrument. The liquid sensor system can be extended to control up to four different liquid bottles and one waste bottle.



Fix the tube support in the bottle holder as shown below.

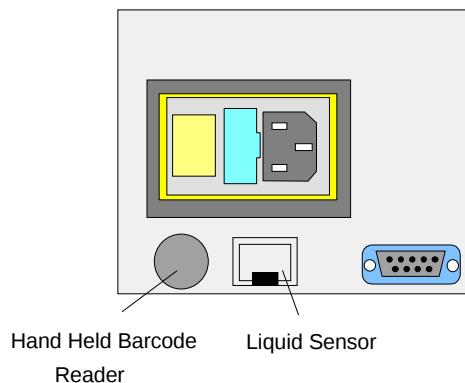


Insert the tubes and connect the bottle holder to the instrument.



2.4.5 Connecting the Barcode Reader (Optional)

Before the barcode reader can be connected to the instrument, the supplied barcode chips must be added to the main board. For more details contact your service technician.

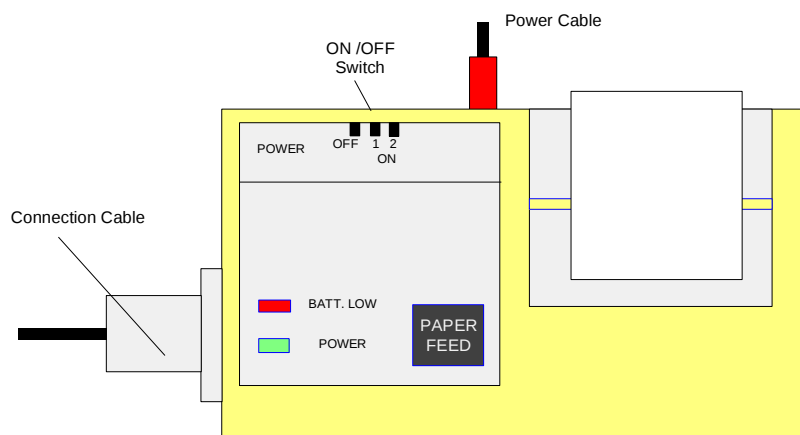


2.4.6 Connecting the Printer (Optional)

Before the printer can be connected to the instrument, the supplied chip must be added to the main board. For more details contact your service technician.

Connect the printer to the instrument using the supplied cable.

Connect the power supply cable to the printer.



2.4.7 Power Connections



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

Ensure that the on / off switch in the back panel of the instrument is in the off position.

Insert the mains power cable into the mains power socket on the rear of the instrument.

3. Firmware and Software Description

3.1 Instrument Software Features

The instrument has the following software features:

- **30 user definable washing programs**, permanently stored under the numbers 1 to 30.
- **Up to 60 processing steps per program**, each processing step can be identical or different from the previous step.
- **3 washing modes**, normal washing, bottom washing and overflow washing. Set by the Plate Type parameters.
- **Soak time**. selectable from 1 to 999 seconds.
- **Software selectable dispensing speeds**
- **Software selectable aspirating speeds**
- **Software selectable bottom position**, for aspiration contact to the bottom of the wells.
- **4 rinse modes**, the different rinse modes can be used to select how the instrument is rinsed before it is left to stand or switched OFF.
- **Automatic microplate centering**, the microplate is automatically centered before the start of the washing program.
- **Programmable strip selection**, the program can be defined so that the strips to be washed can be selected before starting the washing procedure.

3.2 Onboard Software Menus

The instrument can be used in the following onboard software menus.

3.2.1 Run

Selection of the run procedure to perform the selected program.

3.2.2 Prime

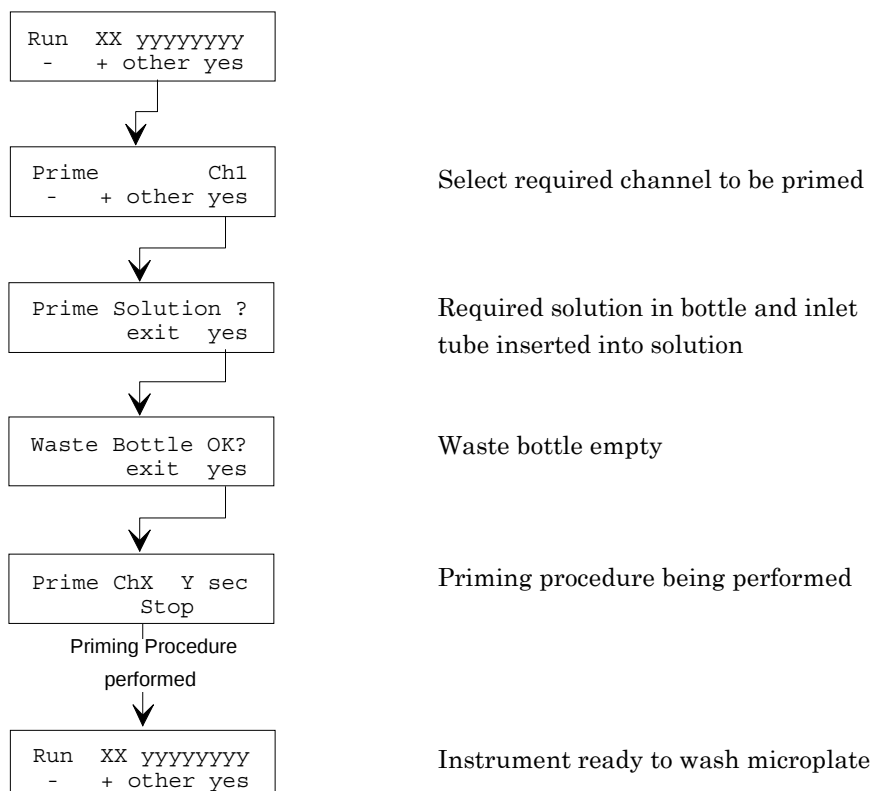
Before the instrument can be used, all dispensing channels must be primed with the required solution.

Ensure that the bottle of priming solution is always full at the beginning of the priming procedure and check that the inlet filters in the liquid tubes are clear.



Please ensure that the dispensing and aspiration pumps are not run for longer than a few minutes without liquid or they will be damaged.

The priming procedure is performed using the following procedure:



Caution

Do not use the instrument to aspirate or dispense any acidic solutions as this could damage the instrument.

3.2.3 Rinse

There are four Rinse modes to flush the liquid system and prevent needle blockages. They should be carried out when the instrument is left to stand or is switched off at the end of working.

The Rinse modes are:

Rinse Soak

Rinse Day

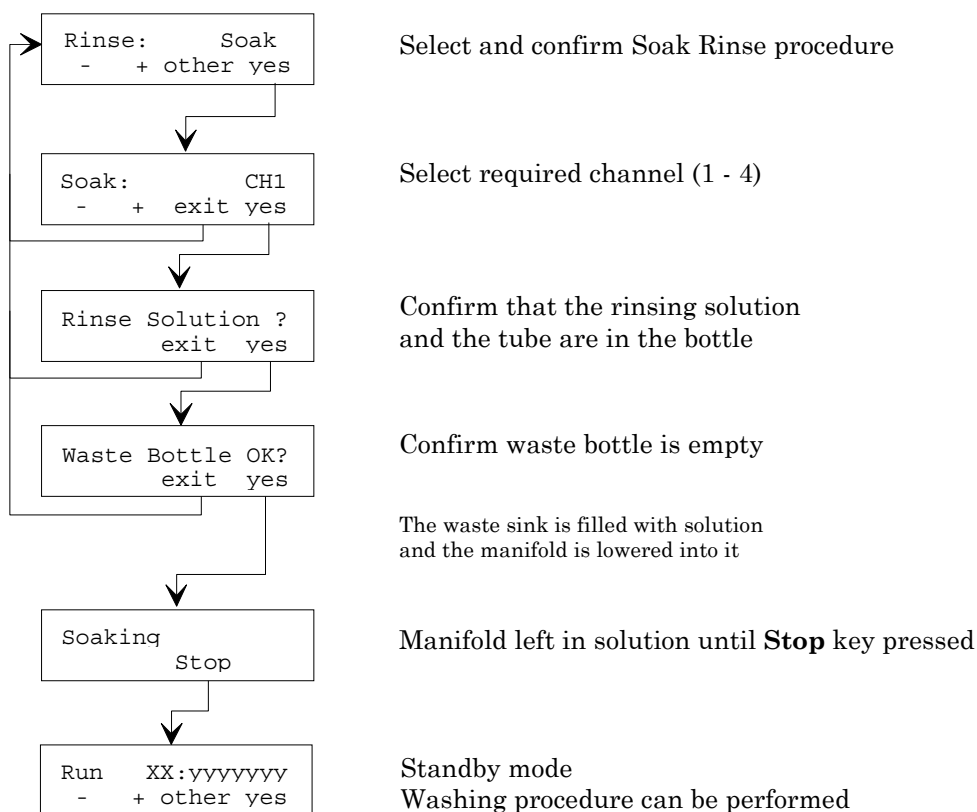
Rinse Night

Rinse Auto

Rinse: Soak

This procedure is used if the instrument is to be left to stand for a short time. (1/2 hr. or less).

With this procedure you can use either distilled water or wash solution.

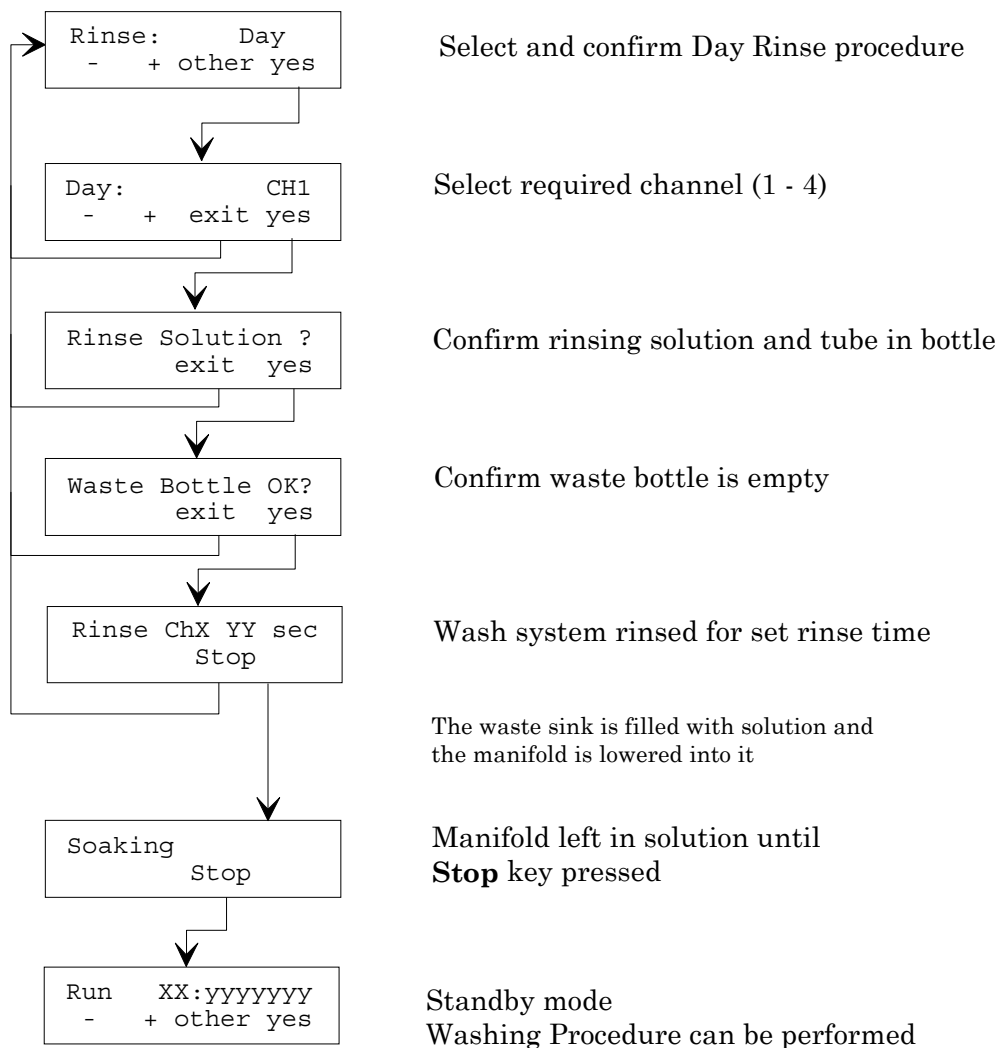


Rinse: Day

This procedure is used to rinse the wash solution system if the instrument is to be left standing for a longer time. Alternatively it can be used to rinse the wash solution system after the instrument has been left for a long time.

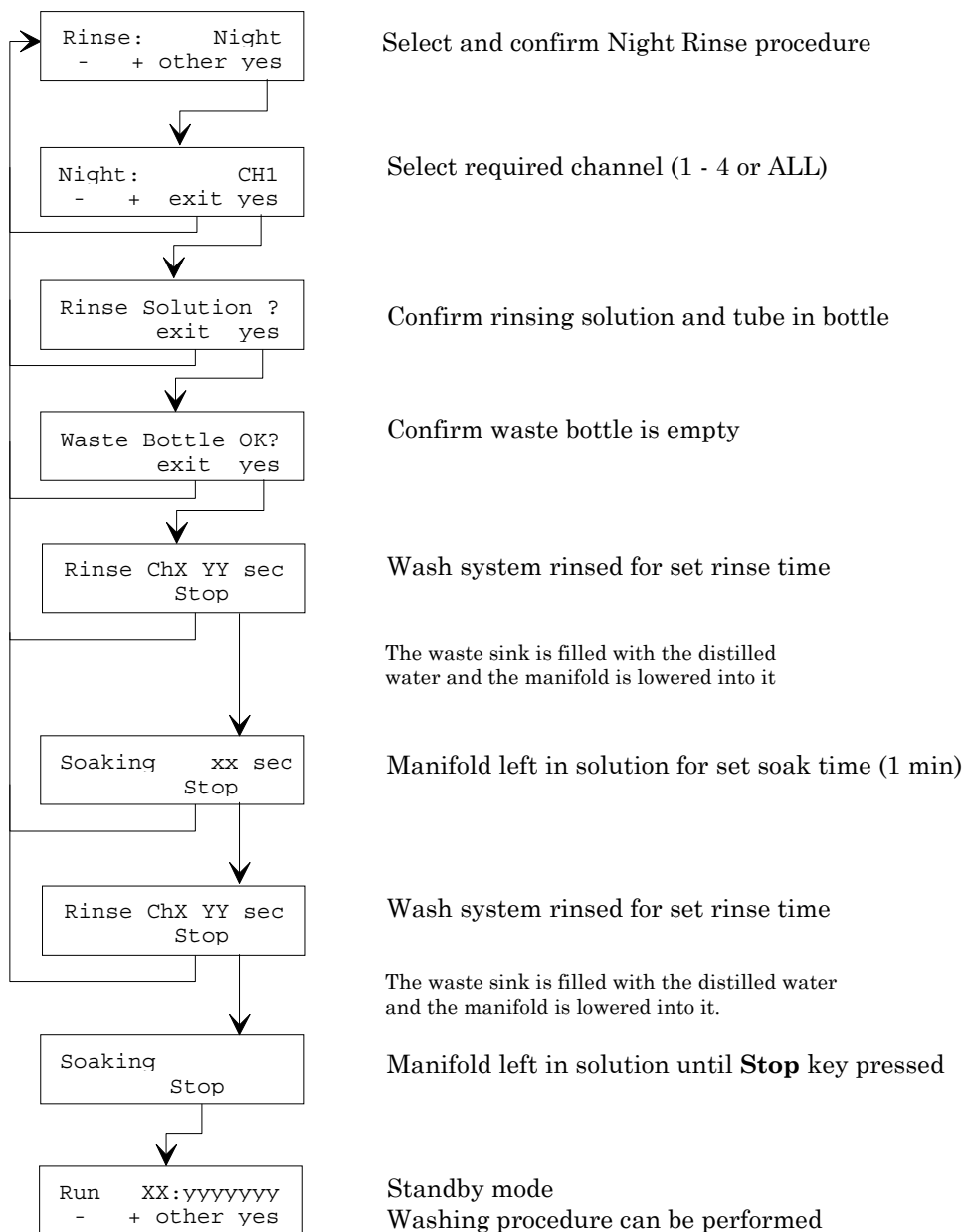
With this procedure you can use either distilled water or wash solution.

If the instrument is left to stand for 1 hr to 1/2 day, wash solution can be used, for longer times use distilled water.



Rinse: Night

This procedure is used to thoroughly rinse the wash solution system and leave the manifold soaking in the waste sink full of solution at the end of working. This procedure requires distilled water.



Rinse: Auto

This procedure is the same as the Rinse: Day procedure, except that the rinsing procedure is automatically repeated after a set repeat time. The repeat time can be set in the Adjust menu between 1 and 24 hrs.

3.2.4 Program

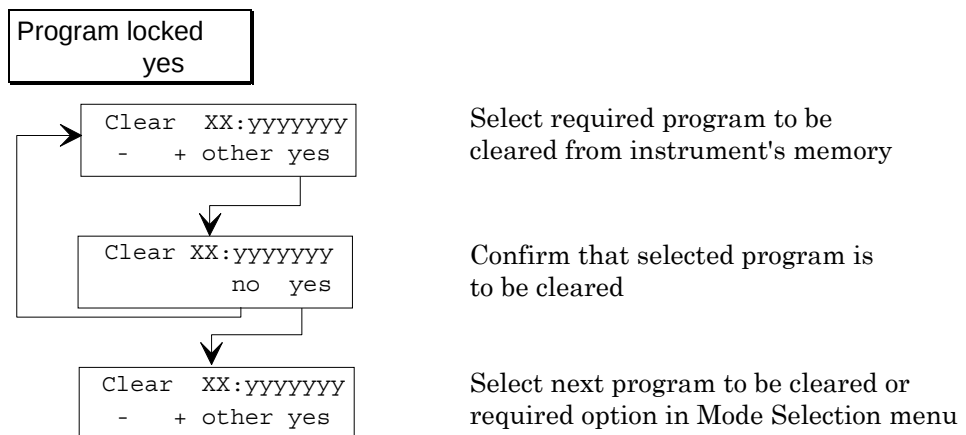
Selection of the programming procedure, to define the required program.



For more information about the programming procedure, see chapter 4 in the Columbus Operating Manual.

3.2.5 Clear

This submenu is used to clear a program from the instrument's memory. If the program is locked it can not be cleared and the following error message is displayed:



The function **Clear ALL** is available within the **Clear Program** option. This function enables you to clear all of the programs (excluding those that are locked!). The **Clear ALL** function is found before program 1 and after program 30. Use the cursor keys to skip through the programs and once **Clear ALL** is displayed press **yes** and all of the programs (with the exception of those that are locked) will be cleared.

This option is not to be confused with the **Clear ALL** function in the Service menu.

3.2.6 Show

Procedure to show the parameters for a program.



For more information about the Show procedure, see Columbus Operating Manual.

3.2.7 Adjust

The Adjust menu has the following options:

Plate Type	Adjustment procedure for setting the parameters for up to nine different types of microplates
Prime Time	Adjust the time that the Priming procedure is performed for.
Rinse Time	Adjust the time that the Rinsing procedure is performed for.
Autorinse	Adjust the time between the Autorinse cycles.
Kit Select	<i>This option is not available in this instrument.</i>
Date	Set the date
Time	Set the time
Sel. Manifold	Set the manifold that is fitted to the instrument
Adj. Liq. Sensor	The switch thresholds for the wash, rinse and waste liquid can be defined.
Exit Adjust	Exit from the Adjust menu.

Entering the Adjust Menu

When the instrument is in the standby mode and the following message is displayed:

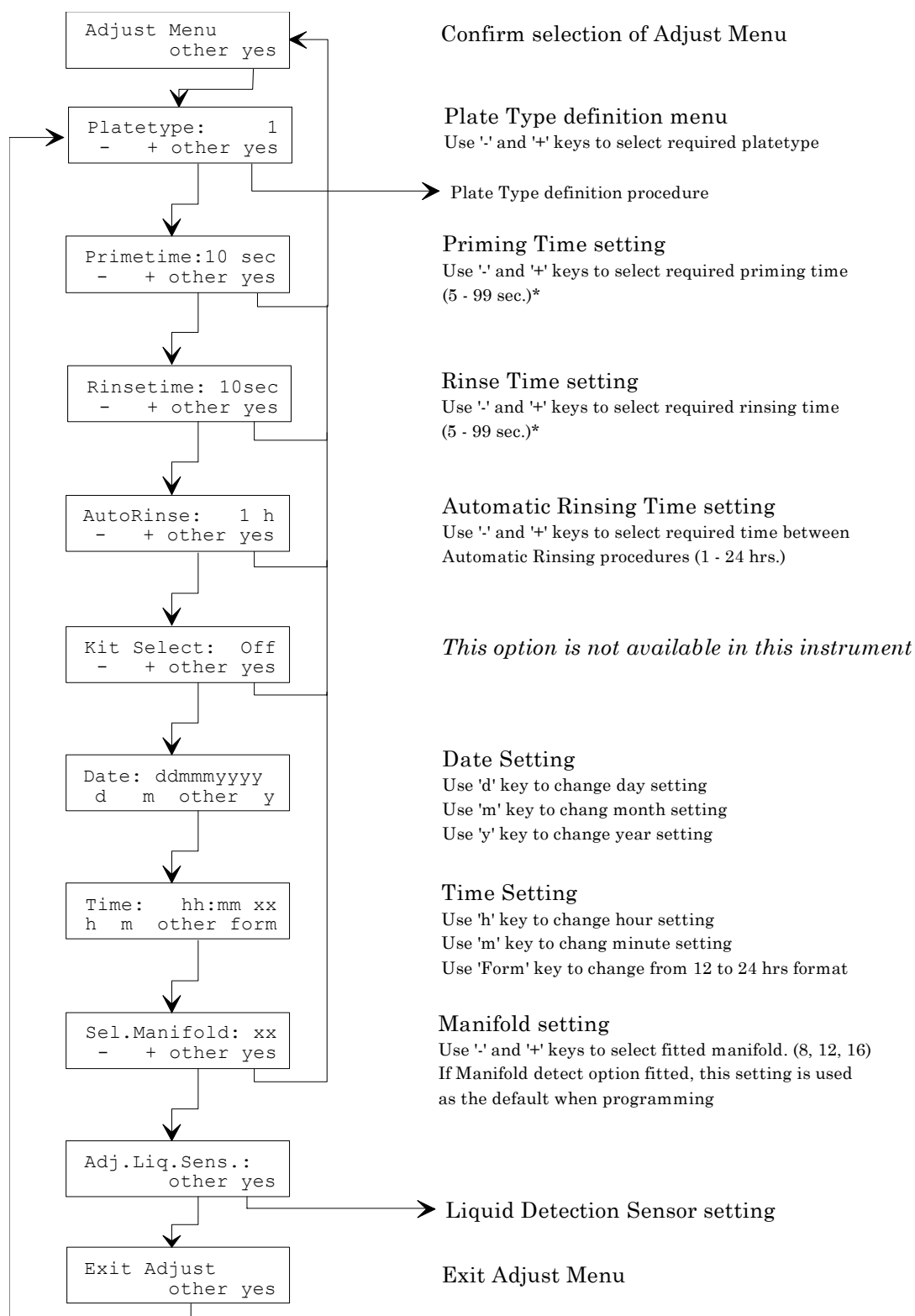
```
Run XX yyyyyyy
- + other yes
```

To select the Adjust menu, press **other** until the following message is displayed:

```
Adjust Menu
other yes
```

Select **yes** to enter the Adjust menu and then the various options in the Adjust menu can now be selected using **other**.

When the required option is displayed, press **yes** to enter the parameter setting procedure.



* Instruments that have the prime valve have a priming time of 8 - 99 seconds.

Adjust Plate Type

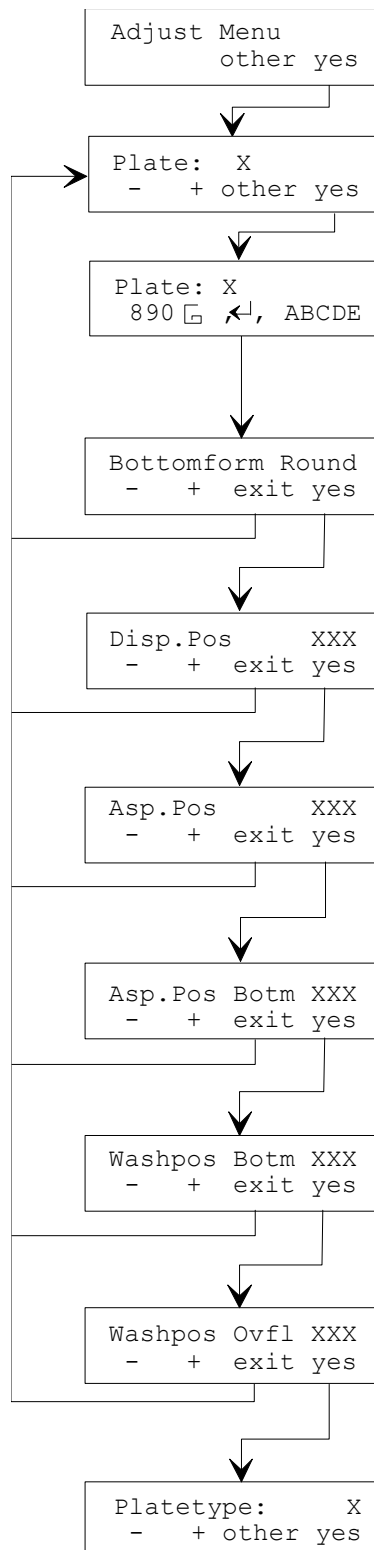
This option is used to set the following parameters for the different types of microplates. The default is a 96 well Greiner microplate.

The following parameters are set:

Parameters	Options
Plate type number	1 - 9
Bottom Form	Set whether the microplate has flat or round bottom wells.
Dispensing Position	Set the position in the wells where the solution will be dispensed.
Aspirate Position	Set the position in the wells where the solution will be aspirated.
Aspirate Position 2	Set the position in the wells for the crosswise aspiration procedure. (flat bottom wells only)
Bottom Position	Set the position of the aspirating needles for the bottom of the well.
Bottom Wash Position	Set the position of the aspirating needles for the bottom washing procedure.
Overflow Wash Position	Set the position of the aspirating needles for the overflow washing procedure.

Before starting the adjustment procedure, insert the microplate to be adapted into the plate support.

Round Bottom Plates



Confirm selection of Adjust menu

Plate Type definition menu

Use '-' and '+' keys to select required platetype (1 - 9)

Enter the required name for the plate (up to 8 characters). 1,2,3,4,5,6,7,8,9,0 & A-Z
To enter a name use the '<' and '>' keys to place a character between the commas. Confirm the selection with the '↵' key.
To delete the last character use the '[]' sign.
When the name is complete, confirm with the '↵' key.

Plate Bottom Form setting

Use '-' and '+' keys to select required bottom form (flat or round)

Set Dispensing position

Use '-' and '+' keys to move the plate support so that the dispensing needles are in the correct position

Set Aspirating position

Use '-' and '+' keys to move the plate support so that the aspirating needles are in the correct position

Set Bottom Aspirating position

Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for aspirating the bottom of the wells

Set Bottom Washing position

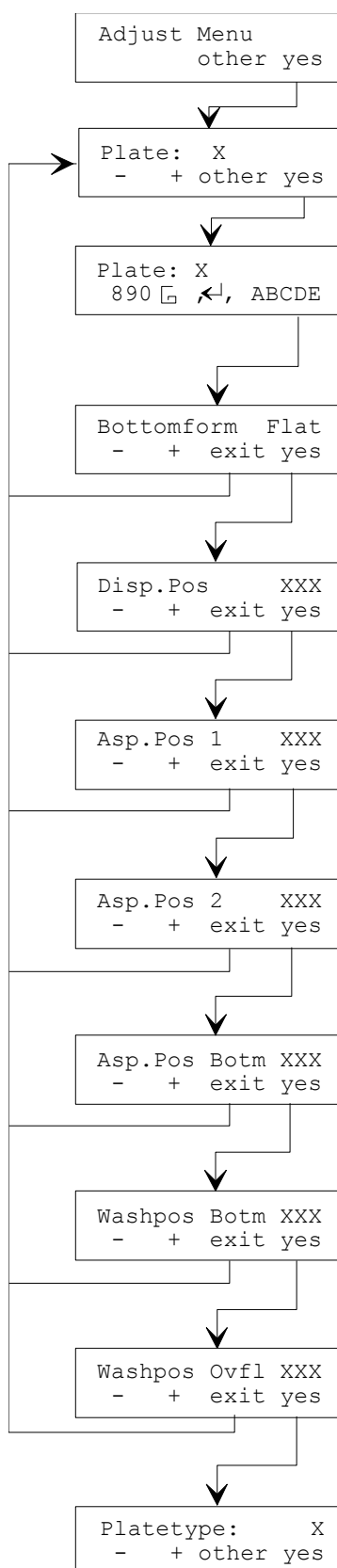
Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for the Bottom Washing procedure

Set Overflow Washing position

Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for the Overflow Washing procedure

Select plate type to be defined

Flat Bottom Plates



Confirm selection of Adjust menu

Plate Type definition menu

Use '-' and '+' keys to select required platetype (1 - 9)

Enter the required name for the plate (up to 8 characters). 1,2,3,4,5,6,7,8,9,0 & A-Z
To enter a name use the '<' and '>' keys to place a character between the commas. Confirm the selection with the '.' key. To delete the last character use the '[]' sign. When the name is complete, confirm with the '.' key.

Plate Bottom Form setting

Use '-' and '+' keys to select required bottom form (flat or round)

Set Dispensing position

Use '-' and '+' keys to move the plate support so that the dispensing needles are in the correct position

Set Aspirating position 1

Use '-' and '+' keys to move the plate support so that the aspirating needles are in the correct position

Set Aspirating position 2

Use '-' and '+' keys to move the plate support so that the aspirating needles are in the correct position

Set Bottom Aspirating position

Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for aspirating the bottom of the wells

Set Bottom Washing position

Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for the Bottom Washing procedure

Set Overflow Washing position

Use '-' and '+' keys to move the manifold so that the aspirating needles are in the correct position for the Overflow Washing procedure

Select Plate type to be defined

To enter the Plate type option, press **other** until the following message is displayed:

Plate: XXXXX - + other yes

Where X is the displayed plate type number and plate name.

Use the - and + keys to select the required plate type number that is to be defined. (1 - 9).

Pressing - decreases the displayed plate type.

Pressing + increases the displayed plate type.

When the required plate type is displayed press **yes** and the following message is displayed:

Bottomform Flat - + exit yes

Use the - and + keys to select the required bottom form of the wells. (flat or round).

When the required bottom form is displayed press **yes** to confirm the selection.

Flat Bottom Wells

The following procedure is used when a microplate with flat bottom wells is to be defined.

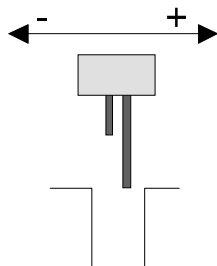
After **yes** has been pressed to confirm the selection of flat bottom wells, the instrument initializes the motors and moves the microplate under the manifold.

When the microplate is under the manifold, the following message is displayed:

Disp-Pos: XXX + exit yes

Where XXX is the displayed number of steps.

Use the - and + keys to move the microplate until the dispensing needles are in the correct position.

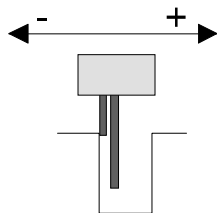


Pressing the - and + keys moves the microplate forwards and backwards so that the dispensing needles are positioned further back/forward in the wells.

When the dispensing needles are in the correct position, press **yes** and the following message is displayed:

Asp.Pos 1 XXX - + exit yes

Use the - and + keys to move the microplate until the aspirating needles are in the correct position for aspirating the side of the well.

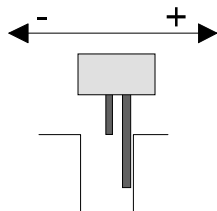


Pressing the - and + keys moves the microplate forwards and backwards so that the aspirating needles are positioned further back/forward in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Asp.Pos 2	XXX
-	+ exit yes

Use the - and + keys to move the microplate until the aspirating needles are in the correct position for aspirating the side of the well. (crosswise aspiration)

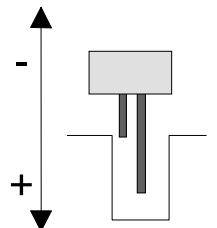


Pressing the - and + keys moves the microplate forwards and backwards so that the aspirating needles are positioned further back/forward in the wells.

When the aspirating needles are in the correct position press **yes** and the following message is displayed:

Asp.Pos Botm	XXX
-	+ exit yes

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the bottom of the well.

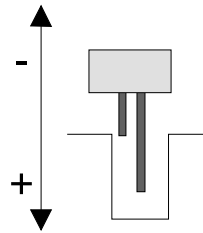


Pressing the - and + keys move the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Washpos Botm	XXX
-	+ exit yes

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the solution in the bottom washing position.

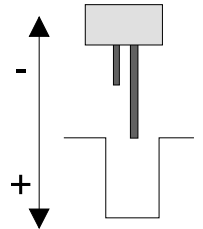


Pressing the - and + keys moves the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Washpos Ovfl XXX - + exit yes

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the solution in the overflow washing position.



Pressing the - and + keys move the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Platetype: X - + other yes

The parameters for the next plate type can be defined or press **other** for the next option in the Adjust menu.

Round Bottom Wells

The following procedure is used when a microplate with round bottom wells is to be defined.

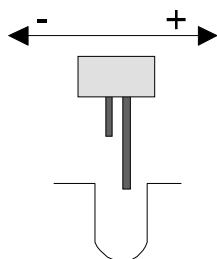
After **yes** has been pressed to confirm the selection of round bottom wells, the instrument initializes the motors and moves the microplate under the manifold.

When the microplate is under the manifold, the following message is displayed:

Disp.Pos	XXX
-	+ exit yes

Where XXX is the displayed number of steps.

Use the - and + keys to move the microplate until the dispensing needles are in the correct position.

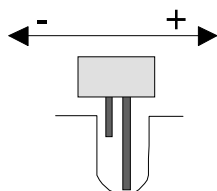


Pressing the - and + keys moves the microplate forwards and backwards so that the dispensing needles are positioned further back/forward in the wells.

When the dispensing needles are in the correct position, press **yes** and the following message is displayed:

Asp.Pos	XXX
-	+ exit yes

Use the - and + keys to move the microplate until the aspirating needles are in the correct position for aspirating the middle of the well.

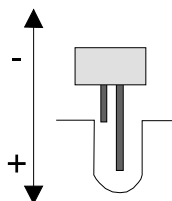


Pressing the - and + keys moves the microplate forwards and backwards so that the aspirating needles are positioned further back/forward in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Asp.Pos Botm	XXX
-	+ exit yes

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the bottom of the well.



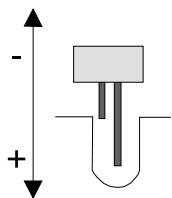
Pressing the - and + keys moves the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Washpos Botm XXX
- + exit yes

Where XXX is the displayed number of steps.

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the solution in the bottom washing position.

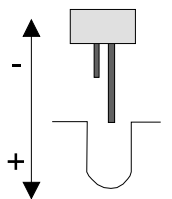


Pressing the - and + keys moves the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Washpos Ovfl XXX
- + exit yes

Use the - and + keys to move the manifold until the aspirating needles are in the correct position for aspirating the solution in the overflow washing position.



Pressing the - and + keys moves the manifold up and down so that the aspirating needles are positioned higher/lower in the wells.

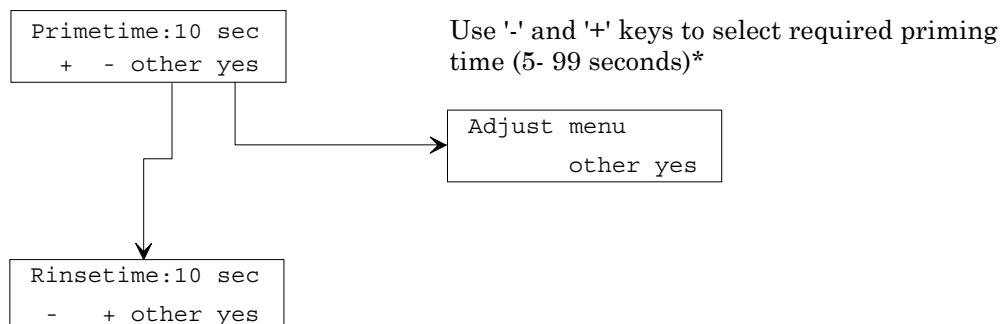
When the aspirating needles are in the correct position, press **yes** and the following message is displayed:

Platetype: X
- + exit yes

The parameters for the next plate type can be defined or press **other** for the next option in the Adjust menu.

Adjust Prime Time

This option is used to set the time that the Prime procedure is performed for.



To enter the Prime Time option, press **other** until the following message is displayed:

```

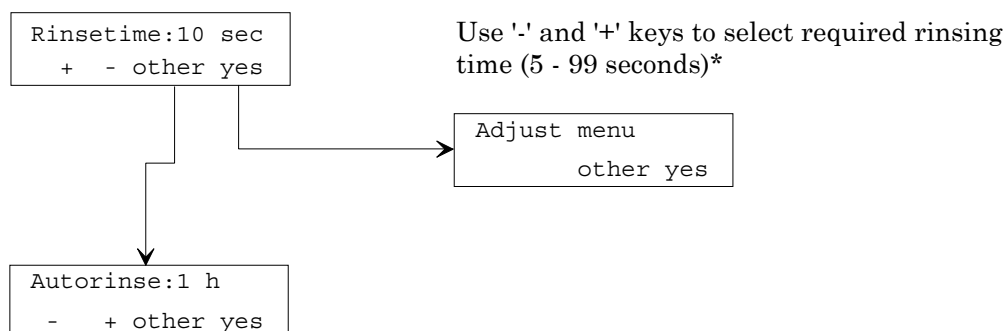
Primetime:10 sec
- + other yes
  
```

Use the - and + keys select the required priming time in seconds. (5 - 99 sec)*

When the required prime time is displayed, either press **other** to proceed to the next option or press **yes** to exit from the Adjust menu.

Adjust Rinse Time

This option is used to set the time that the rinse procedure is performed for.



To enter the Rinse Time option, press **other** until the following message is displayed:

```

Rinsetime:10 sec
- + exit yes
  
```

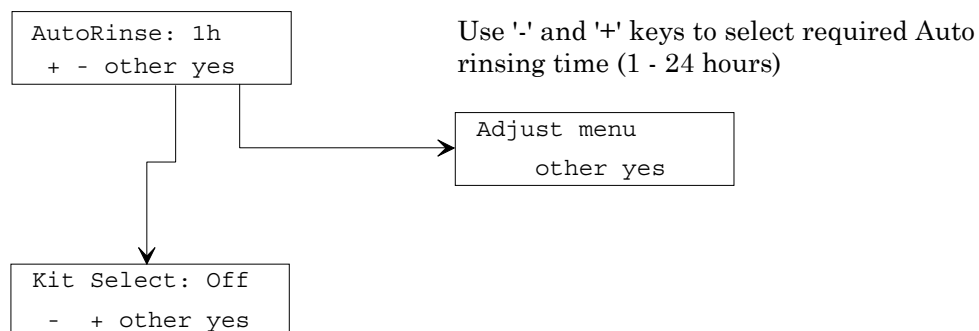
Use the - and + keys select the required rinse time in seconds. (5 - 99 sec)*

When the required rinse time is displayed, either press **other** to proceed to the next option or press **yes** to exit from the Adjust menu.

* Instruments that have the prime valve have a priming time of 8 - 99 seconds.

Adjust Auto Rinse

This option is used to set the time between the rinse procedures when the Autorinse mode is selected.



To enter the AutoRinse Time option, press **other** until the following message is displayed:

```
AutoRinse: 1 h
- + exit yes
```

Use the - and + keys select the required time in hours between each automatic rinse procedure. (1 - 24 hours)

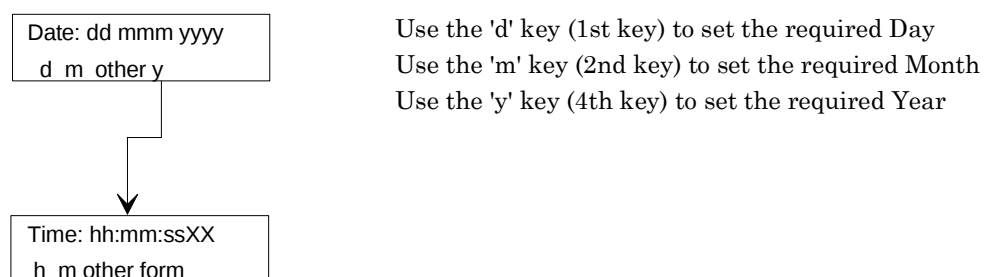
When the required time is displayed, either press **other** to proceed to the next option or press **yes** to exit from the Adjust menu.

Kit Select

This option is not available in the instrument.

Date

The setting for the date can only be altered if the Printer option is fitted.



To enter the Date option, press **other** until the following message is displayed:

```
Date:dd mmm yyyy
d m other y
```

Where dd mmm yyyy is the displayed date.

Use the **d**, **m** and **y** to set the required date.

Pressing **d** increases the displayed day setting

Pressing **m** increases the displayed month setting

Pressing **y** increases the displayed year setting

When the required date is displayed, press **other** to confirm the setting and the following message is displayed:

Time: hh:mm:ssXX
 h m other form

Time

The setting for the time can only be altered if the Printer option is fitted.

Time: hh:mm:ssXX
 h m other form

Use the 'h' key (1st key) to set the required Hour
 Use the 'm' key (2nd key) to set the required Minute
 Use the 'Form' key (4th key) to set the required form
 AM/PM or 24 hr.

Sel.Manifold: XX
 - + other yes

To enter the Time option, press **other** until the following message is displayed:

Time: hh:mm:ssXX
 h m other form

Where hh:mm:ss is the displayed time and XX is the time form (AM/PM).

Use the **h**, **m** and **form** to set the required time and format.

Pressing **h** increases the displayed hour setting

Pressing **m** increases the displayed minute setting

Pressing **form** changes the time format (a.m./p.m. or 24 hr.)

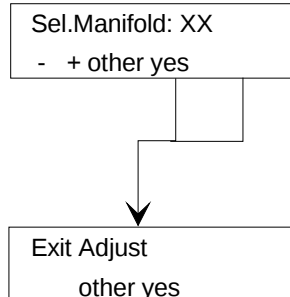
When the required time and format is displayed, press **other** to confirm the setting and the following message is displayed:

Sel.Manifold: XX
 - + other yes

Select Manifold

This option is used to set the type of manifold that is fitted.

This setting is used if neither the manifold detect option nor the fill verification option are fitted.



Use the '-' key (1st key) and '+' (2nd key) to set the setting for the manifold (8, 12 or 16 way)
Press 'yes' key (4th key) to confirm and save setting
Press 'other' key (3rd key) to move to next option without saving setting

To enter the **Select Manifold** option, press **other** until the following message is displayed:

Sel.Manifold: XX
- + other yes

Use the - and + keys to set the required manifold. (8, 12 or 16 way)

Press **other** to proceed to the next option without saving any changes in the setting.

Press **yes** to confirm the setting and proceed to the next option.

When **other** or **yes** has been pressed, the following message is displayed:

Adjust Liq. Sens.:
other yes

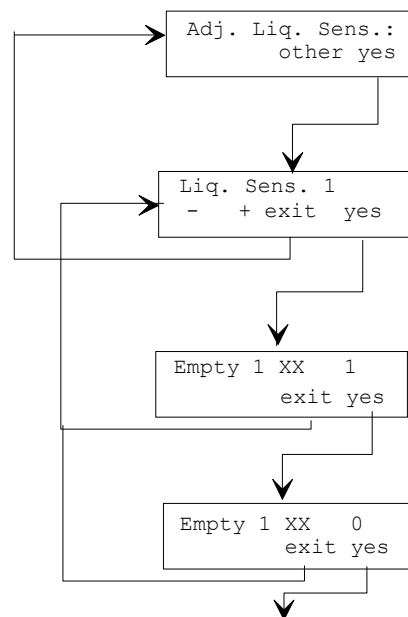
Adjust Liquid Sensors



Caution

This procedure must be performed when the instrument is installed.

Please prepare the bottles before performing the procedure below. The bottles marked green (wash solution) and gray (rinse solution) should be filled with 600ml of water and the bottle marked red (waste) should be filled with 2000 ml of water. Place all three bottles on the corresponding colored bottle holders. Go to the Adjust menu and select **Adj. Liq. Sens.** as described below:



Press **yes** to start the adjustment procedure

Using the - and + keys select the liquid sensor to be calibrated.

1 = Green (wash solution)

2 = Gray (rinse solution)

W = Red (waste)

Press **yes** to continue the adjustment procedure.

Check that the adjustment of the magnet screw has a blank value of between 5 and 20. *See photo1.*

XX = displayed sensor value (does not directly correlate to the volume of liquid in the bottles).

1 = values above limit

Press **yes** to confirm the limit.

XX = displayed value 0 = values below limit

Press **exit** to continue the adjustment of other sensors.

Use the cursor keys to repeat this procedure for the grey (rinse solution) and red (waste) bottles. See also below for more details.

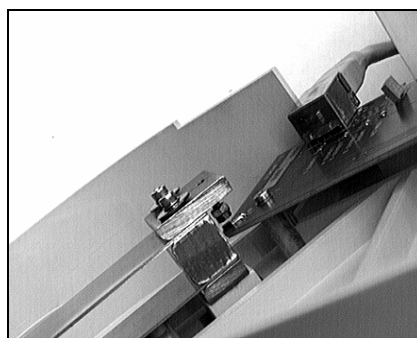


Photo 1

Check that the adjustment of the magnet screw has a blank value of between 5 and 20

If it was necessary to readjust the settings, secure the screws with adhesive.

Liquid Sensors 1 – 2 (3 – 4)

When a liquid sensor (1 - 2) has been selected, the following message is displayed:

Empty	S	XX	Y
	exit		yes

Where S = the sensor number, XX is the displayed value and Y = limit
(0 = values below limit, 1 = values above limit)

Adjust the volume of solution in the bottle to the lowest volume that can be used before starting the procedure.

When the minimal volume is in the bottle, press **yes** to confirm the value (volume).

Green bottle (wash solution) = 600 ml

Gray bottle (rinse solution) = 600 ml

When the sensor detects a volume less than this entered volume, it will display an error message either before starting the test procedure or after the procedure has been completed.

When the value has been set, press **exit** and the following message is displayed:

Liquid Sens. 1
- + exit yes

Use the < and > keys to set the next required sensor (1 – 2 or W)

Waste Sensor

When the waste sensor has been selected, the following message is displayed:

Full	W	XXX	Y
	exit		yes

Where W = Waste sensor, XXX is the displayed value and Y = limit
(0 = values below limit, 1 = values above limit)

Adjust the volume of solution in the waste bottle to the highest volume that can be used before starting the procedure.

When the maximum volume is in the bottle, press **yes** to confirm the value (volume).

Red bottle (waste) = 2000 ml

When the sensor detects a volume greater than this entered volume, it will display an error message either before starting the test procedure or after the procedure has been completed.

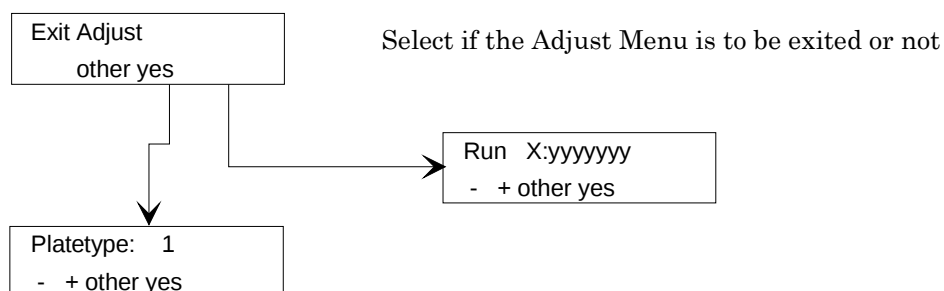
When all the sensors have been set, press **exit** and the following message is displayed:

Adj.Liq.Sens.:
other yes

Press **other** to proceed to the next option.

Exit Adjust

This option is used to exit from the Adjust menu.



When the following message is displayed:

Exit Adjust
other yes

Select if the Adjust menu is to be exited or not.

Remain in Adjust Menu

Press **other** to remain in the Adjust menu and the following message is displayed:

Platetype: 1
- + other yes

Select the required option in the Adjust menu.

Exit Adjust Menu

Press **yes** and the following message is displayed:

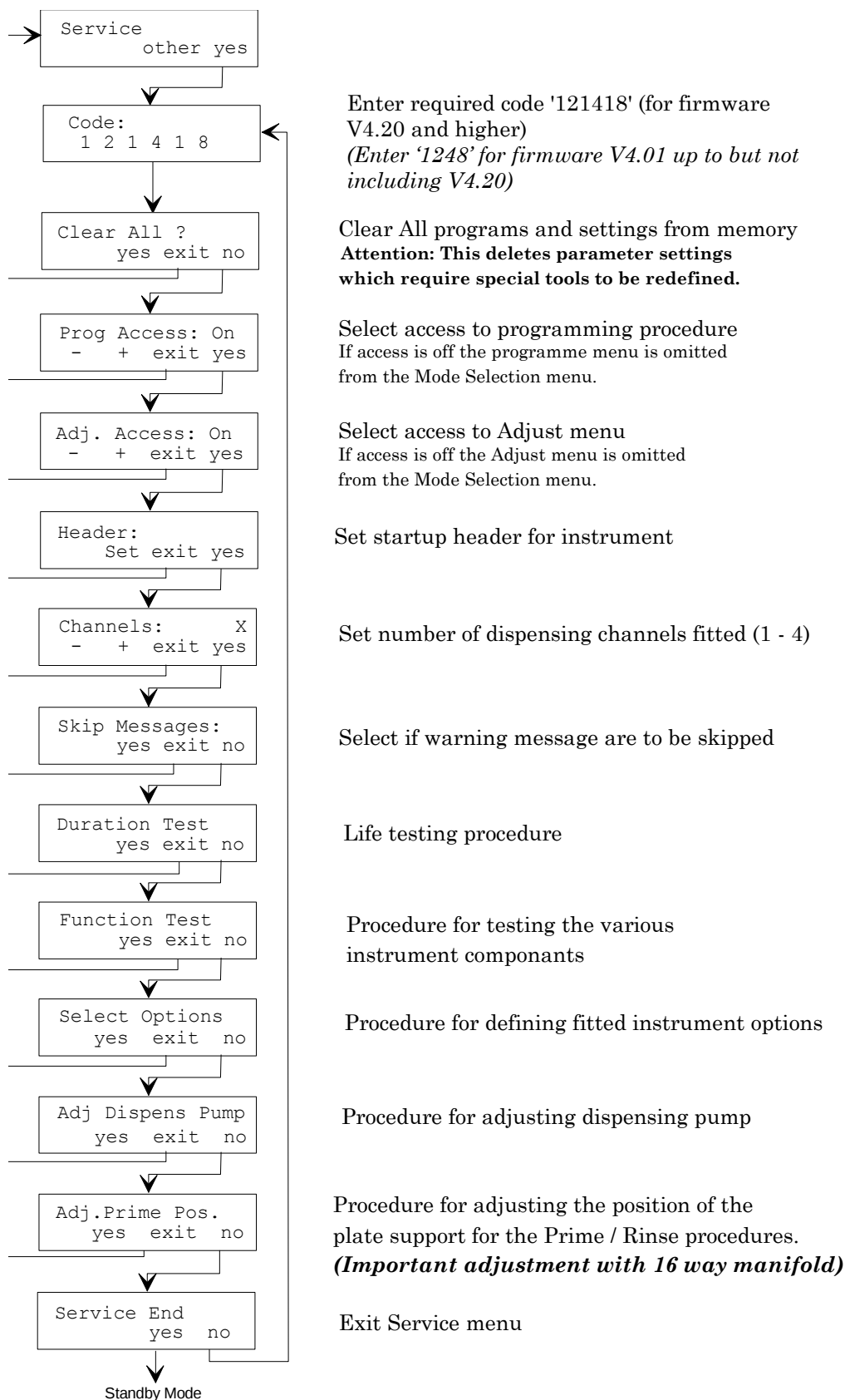
Run X:yyyyyy
- + other yes

The instrument is now in the Standby mode and can be used to wash a microplate.

3.2.8 Service Menu

The Service submenu has the following options:

Clear All ?	Procedure to clear all the defined programs and instrument settings from the memory.
Prog Access	Procedure to select if access to the programming procedure is allowed.
Adj. Access	Procedure to select if access to the Adjust menu is allowed.
Header	Procedure for defining the start-up header for the instrument.
Channels	Procedure for setting the number of dispensing channels to be used.
Skip Messages	Procedure to set if the reminder messages are to be displayed.
Duration Test	Procedure for life testing the instrument.
Function Test	Procedure for testing various instrument component.
Select Options	Procedure for defining fitted instrument options.
Adj. Dispens. Pump	Procedure for adjusting the dispensing pump.
Adj. Prime Pos.	Procedure for adjusting the position of the plate support for the Prime / Rinse procedures. (<i>Important adjustment with 16 way manifold</i>)
Adj. Plate Ref.	Procedure for adjusting the position of the manifold needles.



Entering the Service Menu

The Service menu is entered using the following procedure:

When the instrument has been switched on, it is in the standby mode and displays the message

```
Run XX yyyyyyy  
- + other yes
```

Where XX is the displayed program number and yyyyyyy the program name.

To select the Service menu, press **other** until the following message is displayed:

```
Service  
other yes
```

Press **yes** to enter the Service menu and the following message is displayed:

```
Code:  
1 2 1 4 1 8
```

The Service submenu can only be entered by entering the required code.

Enter required code '121418' (for firmware V4.20 and higher)

(Enter '1248' for firmware V4.01 up to but not including V4.20)

When the code has been correctly entered the first option of the Service menu is displayed:

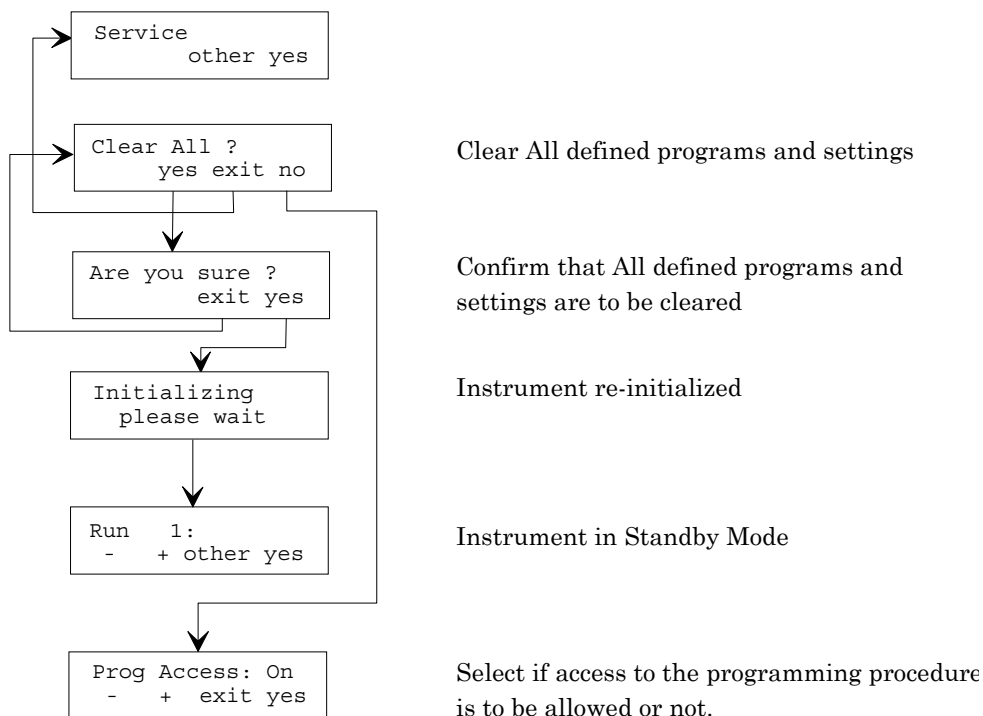
```
Clear ALL ?  
yes exit no
```

Clear ALL

This option is used to clear ALL the defined programs and instrument settings from the instrument's memory.



This deletes parameter settings, which require special tools to be redefined.



When the following message is displayed:

Clear ALL ?
yes exit no

Select if all the programs and settings are to be cleared or not.

Press **no** if all the programs are not to be cleared, the instrument then proceeds to the next option.

Press **exit** to exit from the Service menu.

Press **yes** to clear all the programs from the instrument's memory and the following message is displayed:

Are you sure ?
exit yes

This message is displayed as a control to ensure that the programs and settings are not accidentally cleared.

Press **exit** to return to the previous message.

Press **yes** to confirm that all the programs are to be cleared.

After **yes** has been pressed, all the programs and settings are cleared from the instrument's memory, the instrument is re-initialized and the following message is displayed:

```
Run 1:
- + other yes
```

The instrument is now in the Standby mode.

Re-program the instrument for the required programs and settings.

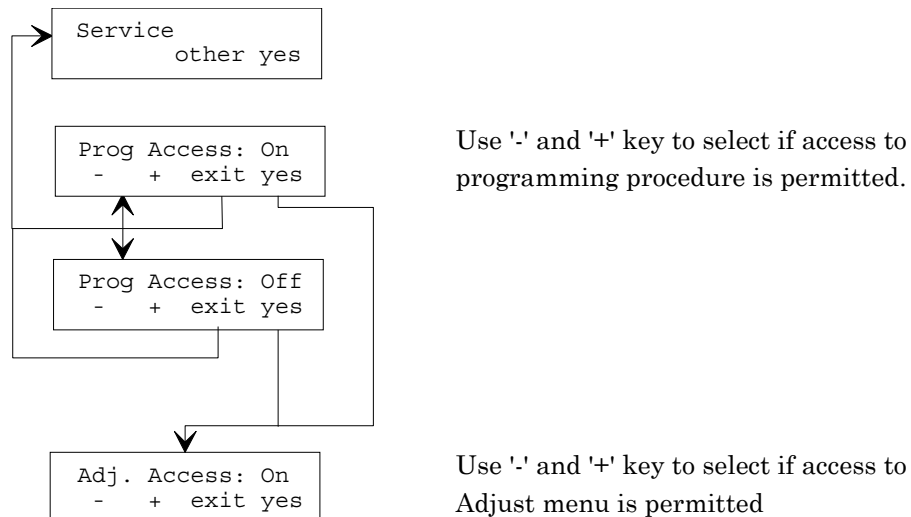
Instrument options, dispensing pump calibration, priming position.

The following options must be re-calibrated: the dispensing pump calibration, the liquid sensor and bottle management system and the X and Z offset value using adjustment plate.

The following data must be reprogrammed using the WinWash software (see software manual): test parameters, options and plate types.

Programming Access

This option is used to select if access to the programming procedure is permitted.



When the following message is displayed:

```
Prog Access: On
- + exit yes
```

Use the 1st and 2nd keys to select if access is permitted.

On = access permitted, Off = access NOT permitted

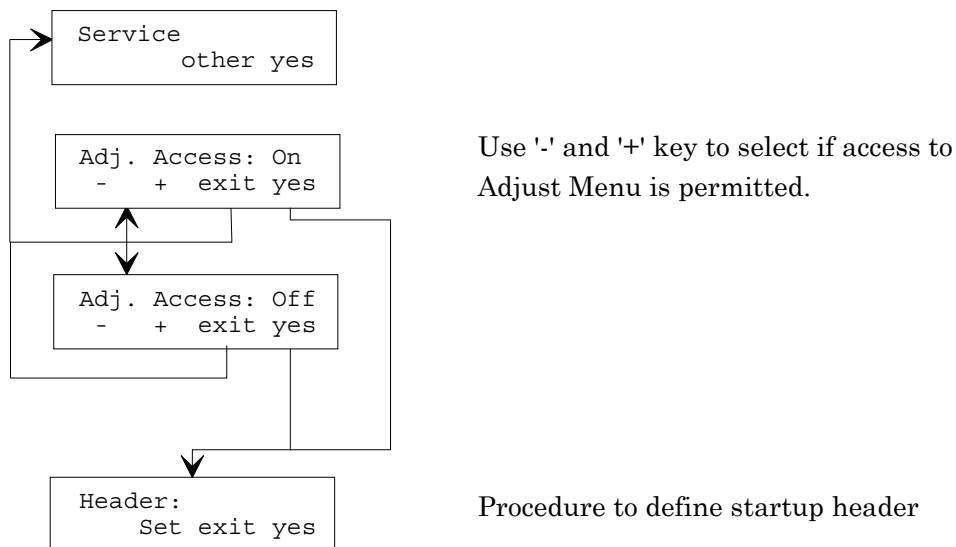
When the required setting is displayed, press **yes** and the following message is displayed:

```
Adj. Access: On
- + exit yes
```

When the access is not permitted, the menu point Programme is omitted from the Mode Selection menu.

Adjust Access

This option is used to select if access to the Adjust menu is permitted.



When the following message is displayed:

```
Adj. Access: On
- + exit yes
```

Use the 1st and 2nd keys to select if access is allowed or not.

On = Access allowed, Off = Access NOT allowed

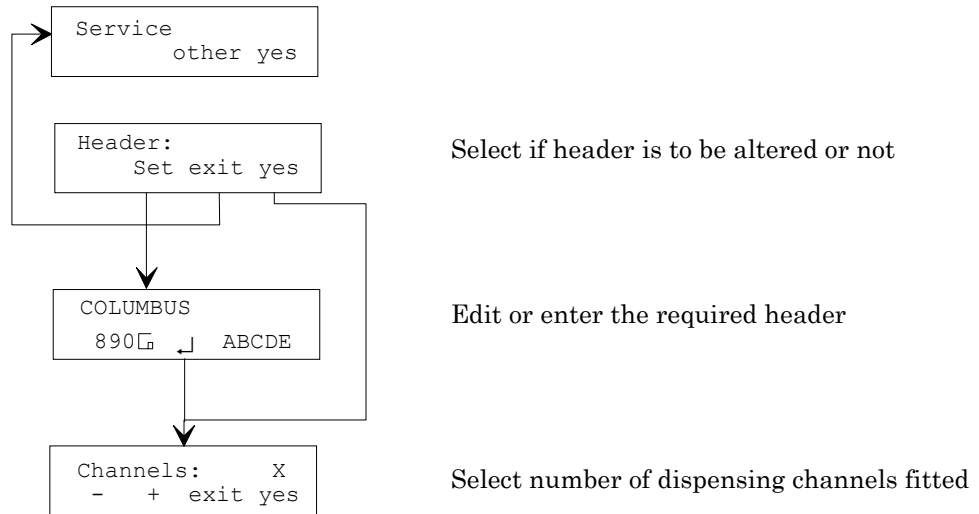
When the required setting is displayed press **yes** and the following message is displayed:

```
Header:
Set exit yes
```

When the access is not allowed, the Adjust menu is omitted from the Mode Selection menu.

Header

This option is used to define the start-up header for the instrument.



When the following message is displayed:

```
Header:
Set exit yes
```

Press **Set** to enter the header setting procedure.

Press **yes** to confirm the displayed header and proceed to the next option.

When **Set** has been pressed, the following message is displayed:

```
COLUMBUS
890 [clear] [confirm] ABCDE
```

In the bottom row of the display are shown the characters that can be selected for the header. A maximum of sixteen characters can be used.

The possible characters for the header are:

1234567890ABCDEFGHIJKLMNOPQRSTUVWXYZ

There are two special characters '[clear]' and '[confirm]'.

The character '[clear]' is used to clear the last entered character from the header.

The character '[confirm]' is used to confirm that the completed header has been entered and is used to exit from the header programming procedure.

To enter the required header, use the 1st and 2nd keys to scroll the characters across the display.

When the required character is displayed between the two highlighters in the middle of the display, press the 4th key. The character is then entered into the top line of the display.

After the selected character has been entered, the instrument returns to the start position with the '↵' character between highlighters. For example:

```
WASHER
890 [ ] , ↵ \ ABCDE
```

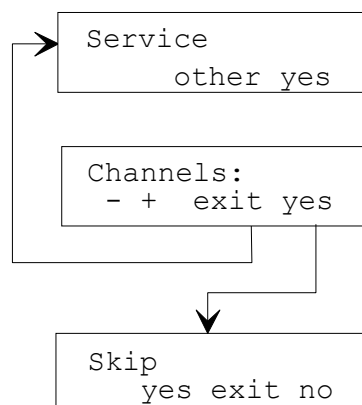
When the required header has been entered, the header programming procedure is exited by pressing the 4th key when the '↵' character is between the two highlighters.

The following message is displayed:

```
Channels:  X
- + exit yes
```

Channels

This option is used to select the number of dispensing channels that are fitted to the instrument.



Use '-' and '+' keys to define the number of dispensing channels fitted (1 - 4)

Select if warning messages are to be skipped or not.

When the following message is displayed:

```
Channels:  X
- + exit yes
```

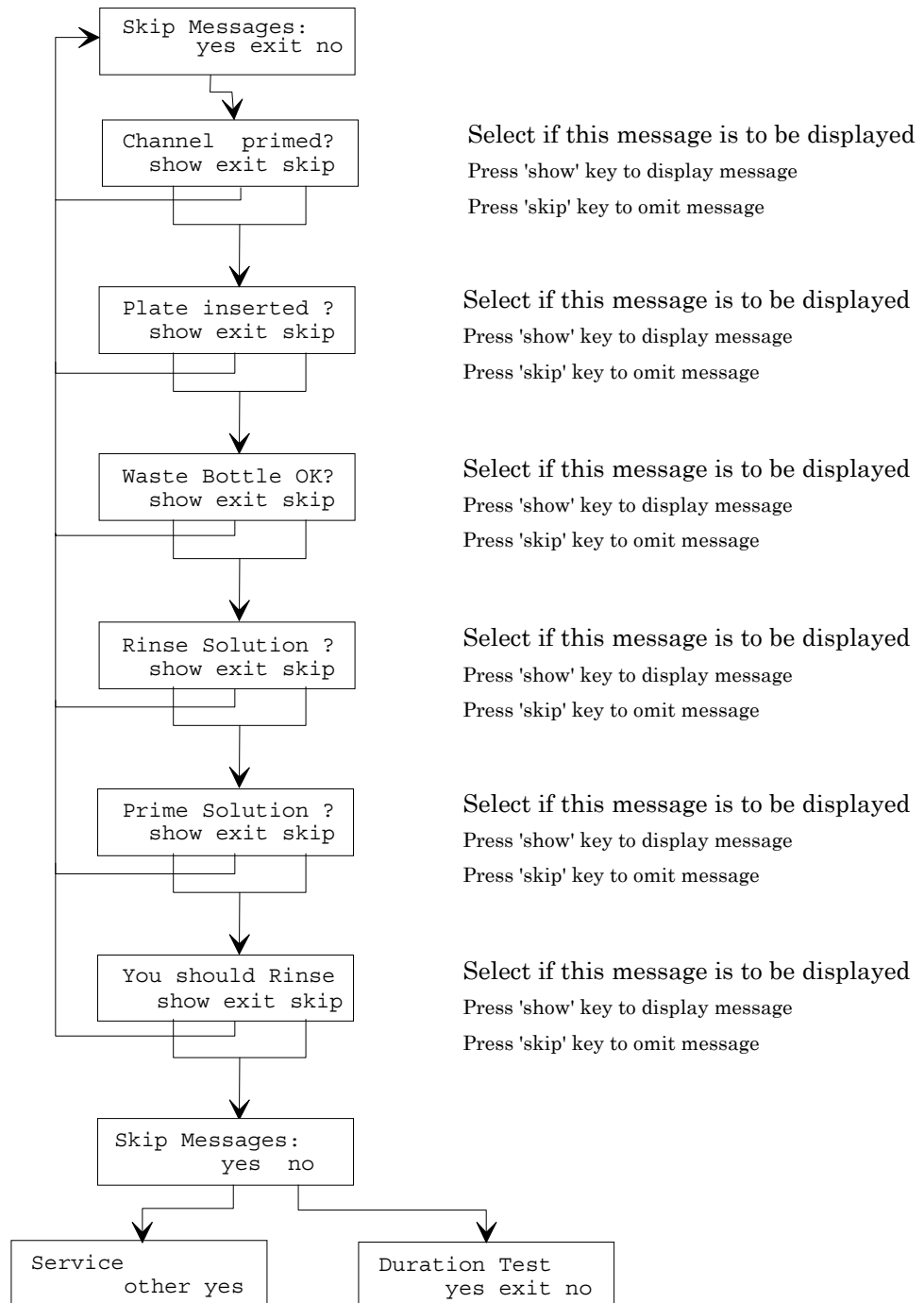
Use the 1st and 2nd keys to select the number of channels that are fitted and that can be used. (1 - 4)

When the required setting is displayed, press **yes** and the following message is displayed:

```
Skip Messages:
yes exit no
```

Skip Messages

This option is used to select if the warning messages are to be displayed or not.



When the following message is displayed:

Skip Messages: yes exit no

Press **no** if the warning messages are *not* to be skipped. The instrument then proceeds to the next option.

Press **yes** if the warning messages are to be skipped.

When **yes** is pressed, the following message is displayed:

Channel X primed? show exit skip

Press **show** if this message is to be displayed.

Press **skip** if this message is not to be displayed.

When the key for the required selection has been pressed, the following message is displayed:

Plate inserted ? show exit skip

Press **show** or **skip** and the following message is displayed:

Waste Bottle OK? show exit skip

Press **show** or **skip** and the following message is displayed:

Rinse Solution ? show exit skip

Press **show** or **skip** and the following message is displayed:

Prime Solution ? show exit skip

Press **show** or **skip** and the following message is displayed:

You Should Rinse show exit skip

Press **show** or **skip** and the following message is displayed:

Skip Messages: yes no

Press **yes** to exit from the Service menu.

Press **no** to proceed to the next option in the Service menu.

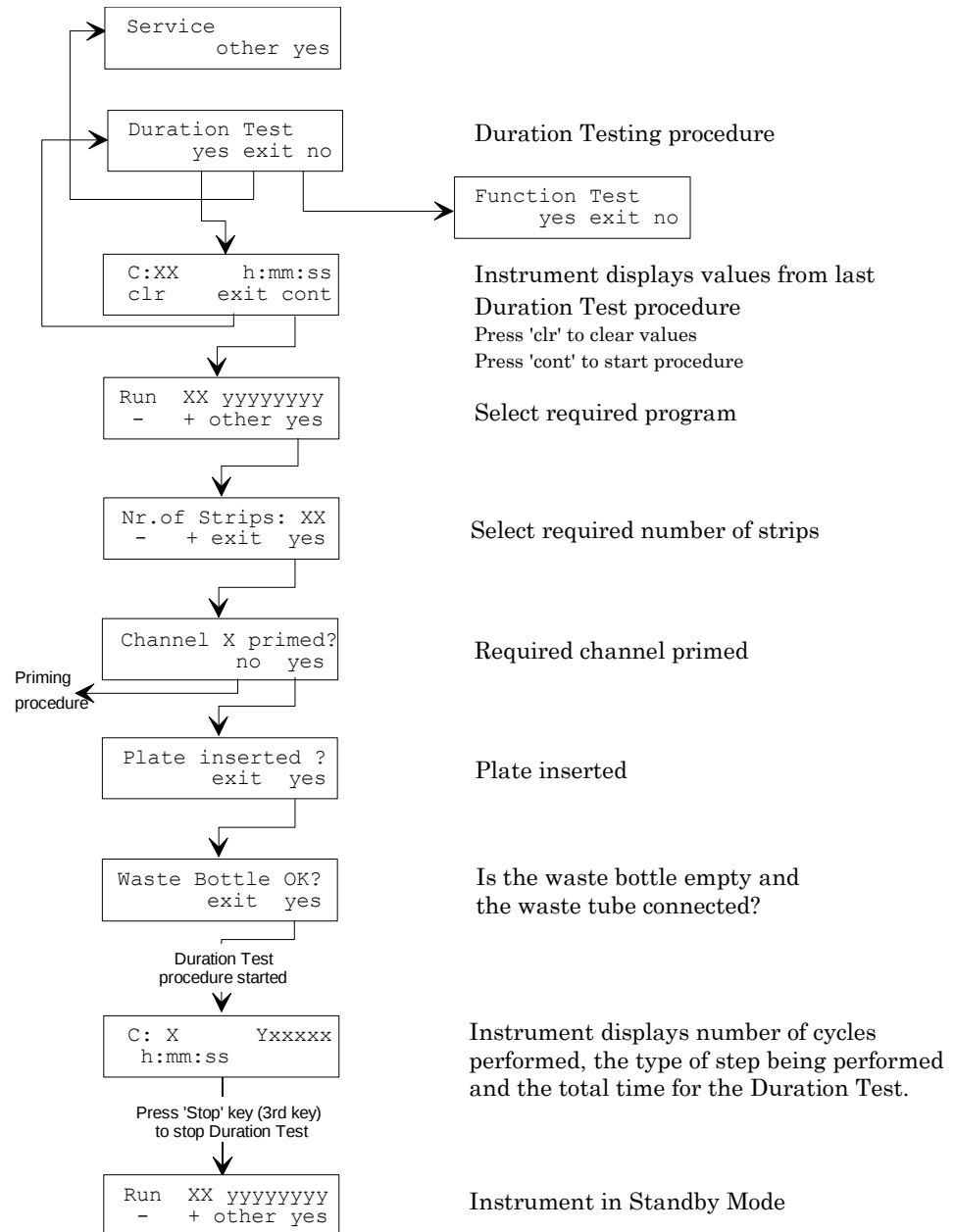
When **no** is pressed, the following message is displayed:

Duration Test yes exit no

Duration Test

This option is used to select the life test procedure for the instrument.

Before starting the Duration Test procedure, place a microplate into the plate support.



When the following message is displayed:

```
Duration Test
yes  exit  no
```

Press **no** if the life test procedure is *not* to be performed. The instrument then proceeds to the next option and the following message is displayed:

```
Function Test
yes  exit  no
```

Press **yes** to enter the life test procedure and the following message is displayed:

```
C:XX  h:mm:ss
clr  exit cont
```

This message displays the values from the last Duration Test procedure C:XX = number of cycles performed, h:mm:ss = time that the procedure was performed for.

Press **clr** to clear the values.

Press **exit** to return to the previous message.

Press **cont** to start the Duration Test procedure.

When **cont** is pressed, the following message is displayed:

```
Run  1:XXXXXXX
-    +  other yes
```

Use the - and + keys to select the required test that is to be used for the Duration Test procedure. *Any defined test procedure can be used.*

When the required test procedure is displayed, press **yes** to confirm the selection.

The following message is displayed:

```
Nr of Strips: XX
-    +  exit yes
```

Use the - and + keys to select the required number of strips to be used (1 - 12).

When the required number of strips is displayed, press **yes** to confirm the selection.

The following message is displayed:

```
Channel Xprimed?
no    yes
```

Where X is the displayed channel number.

This optional message can be displayed as a reminder to ensure that the instrument has been primed with the correct solutions.

If the required channel has *not* been primed, press **no** and the instrument automatically exits from the Run mode and enters the priming procedure.

If the required channel has been primed, press **yes** and the following message is displayed:

```
Plate inserted ?
exit  yes
```

This optional message can be displayed as a reminder to ensure that the microplate has been inserted into the plate support.

When the microplate has been inserted into the plate support, press **yes** and the following message is displayed:

Waste Bottle OK? exit yes

This optional message can be displayed as a reminder to ensure that the waste bottle is empty and that the waste tube is in the waste bottle.

This message is not displayed if Waste Full Sensor is fitted.

Press **yes** to confirm that the waste bottle is empty and the waste tube is inserted into the waste bottle and the instrument then starts the Duration Test procedure.

While the instrument is performing the Duration Test procedure, messages are displayed giving information about the procedure. For example:

C:XX Yxxxx h:mm:ss

Where C:XX = number of cycles performed, Yxxxx = the type of program step that is being performed and h:mm:ss = the time that the Duration Test has been performed for.

The life test procedure is repeated until the Stop key is pressed.

To stop the life test procedure, press **Stop** and the instrument then returns to the standby mode and the following message is displayed:

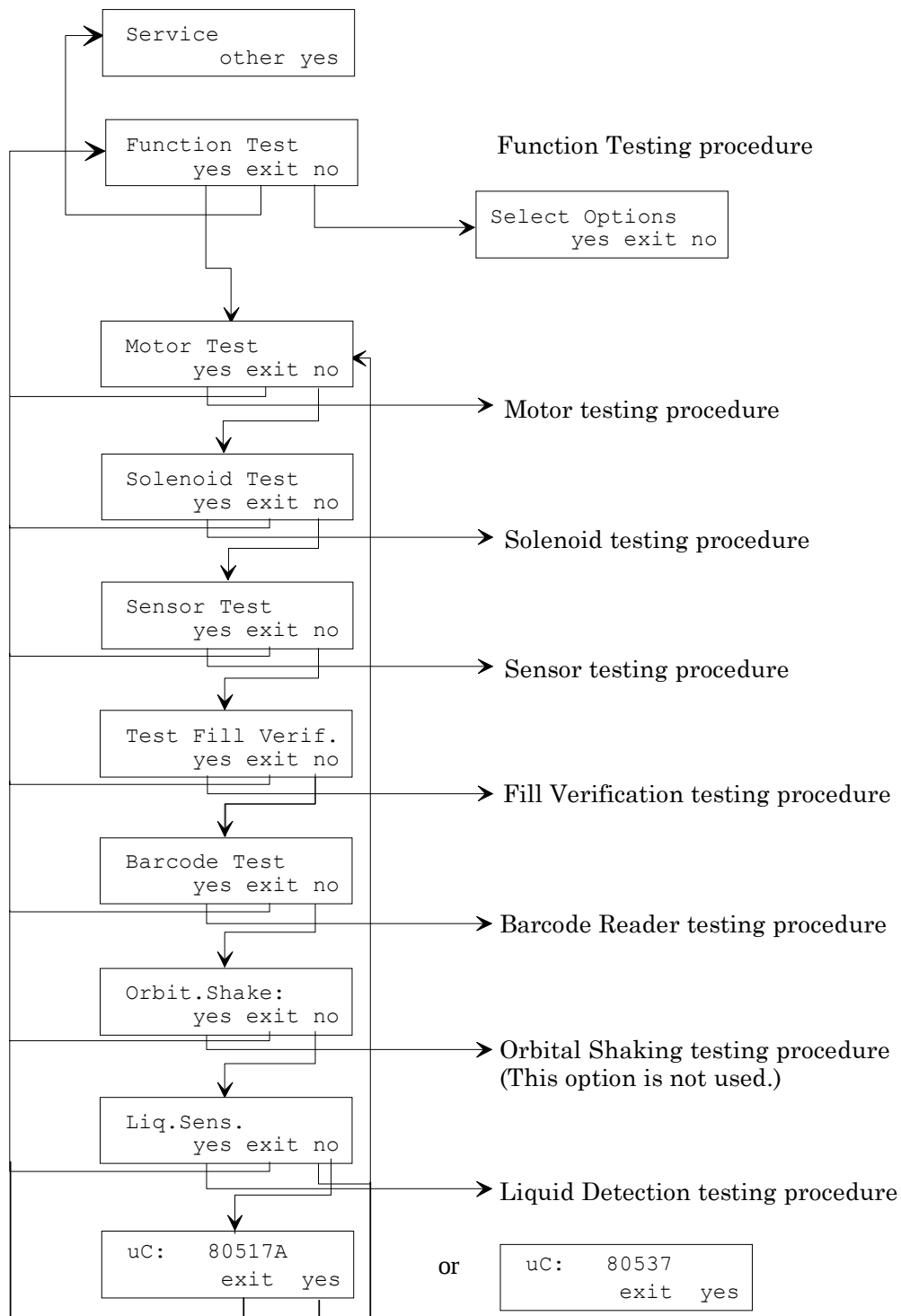
Run XX yyyyyyy - + other yes

If you wish to restart the Duration Test press the 4th key and the test will continue.

Where XX is the displayed program number and yyyyyyy the program name.

Function Test

This option is used to check various instrument component functions.



When the following message is displayed:

```

Function Test
yes exit no
    
```

Press **yes** to enter the Function Test procedure and the following message is displayed:

```
Motor Test
  yes  exit  no
```

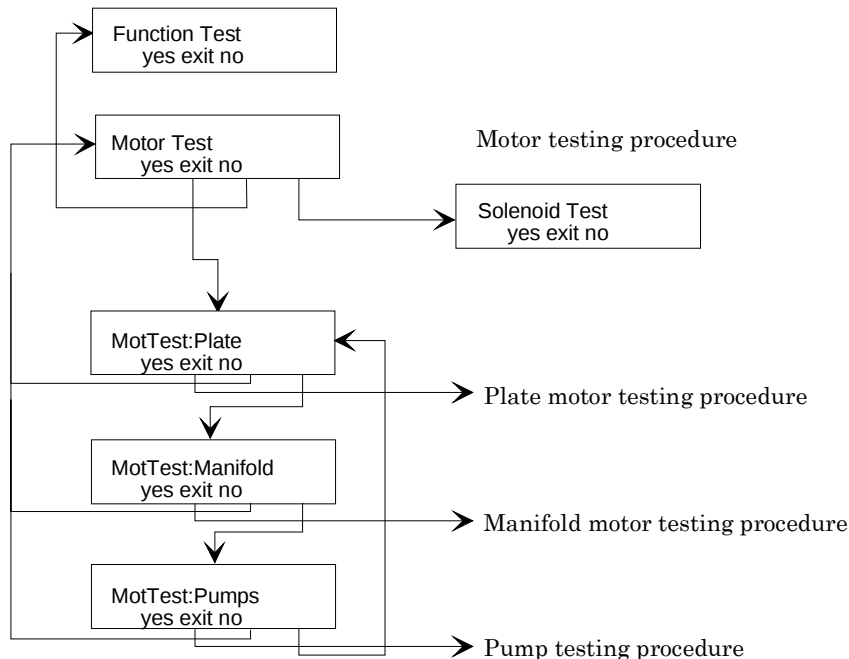
Use **no** to select the Function Testing procedure that is to be performed.

The following function test can be performed:

Motor Test	Test the various motors
Solenoid Test	Test the various solenoid valves
Sensor Test	Test the various sensors.
Test Fill Verif.	Test Fill Verify option
Barcode Test	Test Barcode Reader
Liq. Sens.	Test the Liquid Sensor System

Motor Testing

This option is used to check that the various motors are functioning correctly.



To enter the Motor Testing procedure, press **yes** when the following message is displayed:

```
Motor Test
  yes  exit  no
```

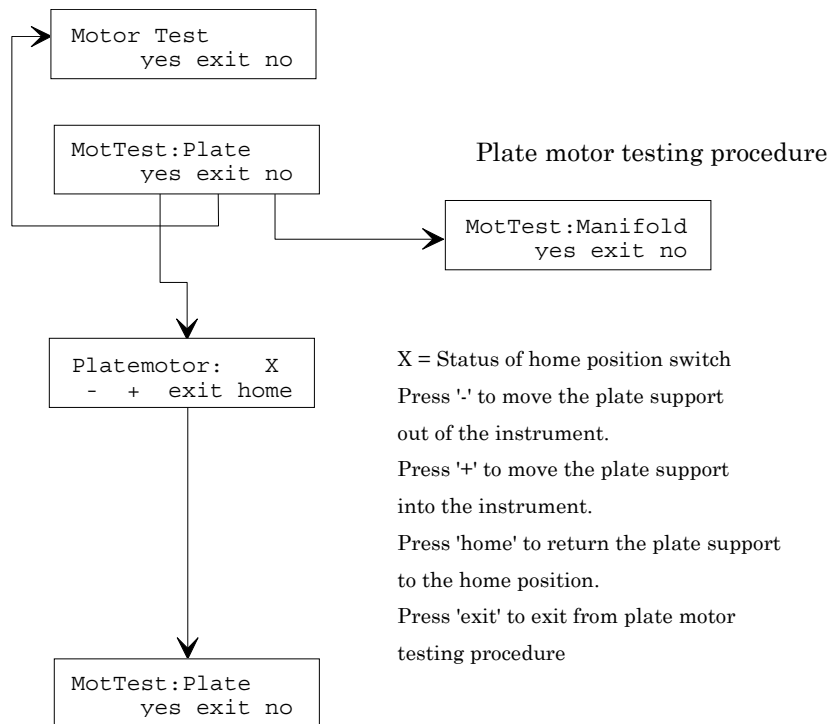
The following message is displayed:

```
MotTest:Plate
  yes  exit  no
```

Use **no** to select which type of motor is to be tested.

Plate Motor	Plate support movement (forwards and backwards)
Manifold Motor	Manifold movement (up and down)
Pumps	Aspirating, dispensing and aerosol pumps switched on or off

Plate Motor Testing



To test the plate support motor, press **no** until the following message is displayed:

```

MotTest:Plate
yes exit no
  
```

Press **yes** to enter the plate motor testing procedure and the following message is displayed:

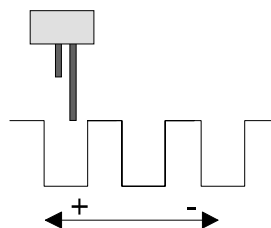
```

Platemotor: X
- + exit home
  
```

Where X is the displayed status of the home position switch.

Use the 1st and 2nd keys to move the plate support.

Pressing the - and + keys moves the plate support out of the instrument.



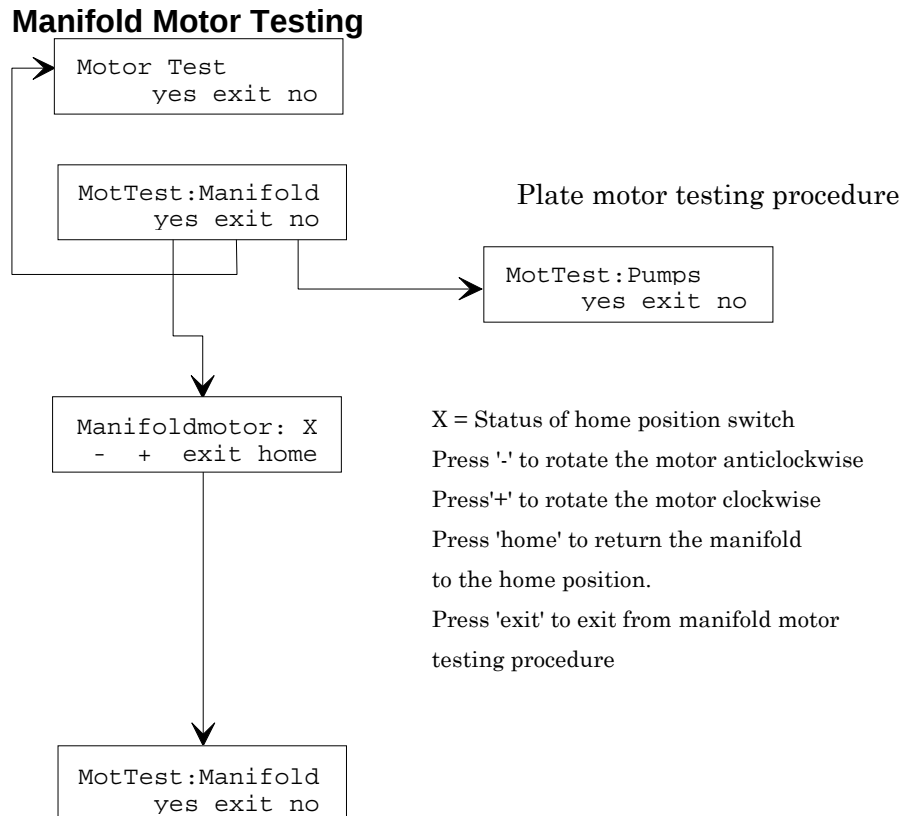
When the plate support has been moved away from the home position, pressing **home** returns the plate support to the home position.

When the plate support motor testing has been completed, press **exit** and the following message is displayed:

```

MotTest:Plate
yes exit no
  
```

Press **no** to select the next motor to be tested or press **exit** to return to the Select Testing option.



To test the manifold motor, press **no** until the following message is displayed:

```

MotTest:Manifold
yes exit no
  
```

Press **yes** to enter the manifold motor testing procedure.

The following message is displayed:

```

Manifoldmotor: X
- + exit home
  
```

Where X is the displayed status of the home position switch (1 = home position)

Use the 1st and 2nd keys to rotate the manifold motor.

Pressing - rotates the motor anticlockwise.

Pressing + rotates the motor clockwise.

When the manifold has been moved away from the home position, pressing **home** returns the manifold to the home position.

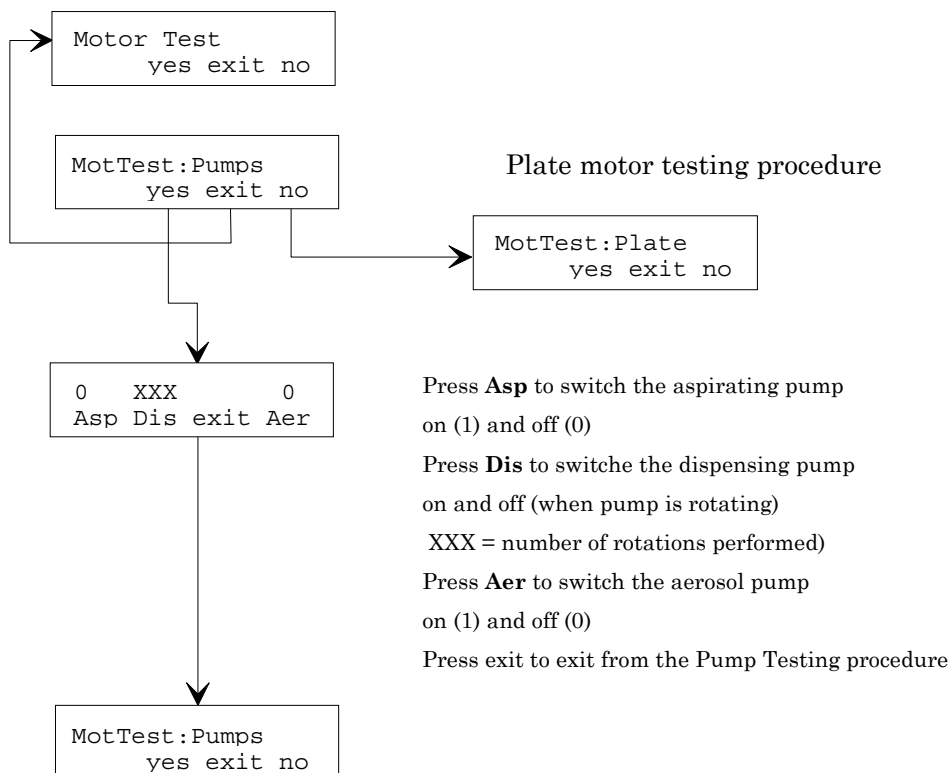
When the manifold motor testing has been completed, press **exit** and the following message is displayed:

```

MotTest:Manifold
yes exit no
  
```

Press **no** to select the next motor to be tested or press **exit** to return to the Select Testing option.

Pump Testing



To test the pump motors, press **no** until the following message is displayed:

```

MotTest:Pumps
yes exit no
  
```

Press **yes** to enter the Pump Motor Testing procedure.

The following message is displayed:

```

0 XXX 0
Asp Dis exit Aer
  
```

Pressing **Asp** starts and stops the aspirating pump.

Pressing **Dis** starts and stops the dispensing pump.

Pressing **Aer** starts and stops the aerosol pump (if fitted).

Aspirating Pump

To test the Aspirating pump, press **Asp** to start the pump.

When the pump is started, the pump status is changed from 0 to 1.

```

1 XXX 0
Asp Dis exit Aer
  
```

Check that the aspirating pump is running.

If the pump is not running, the possible causes are:

Pump is defective	Replace Pump
No power to the pump	Replace Main Board, Power Supply Board

Aerosol Pump*

To test the Aerosol pump, press **Aer** to start the pump.

When the pump is started, the pump status is changed from 0 to 1.

0	XXX	1
Asp Dis exit		

Check that the Aerosol pump is running.

If the pump is not running, the possible causes are:

Pump is defective Replace Pump

No power to the pump Replace Main Board, Power Supply Board

Dispensing Pump

To test the Dispensing pump, press **Dis** to start the pump.

When the pump is started, the number of rotations performed (XXX) is displayed.

0	XXX	1
Asp Dis exit		

In firmware versions with the prime valve, the Aerosol pump doesn't function.

If the pump is not running or there is no current flow to the pump, the following message is displayed:

0	0	0
Disp.Sens.Err.!!		

The instrument is now locked with this error message, switch the instrument off and on again.

If the pump is not running, the possible causes are:

Pump is defective Replace Pump

No power to the pump Replace Main Board, Power Supply Board

When the pump motor testing has been completed, switch all the pumps off and press the **exit**.

The following message is displayed:

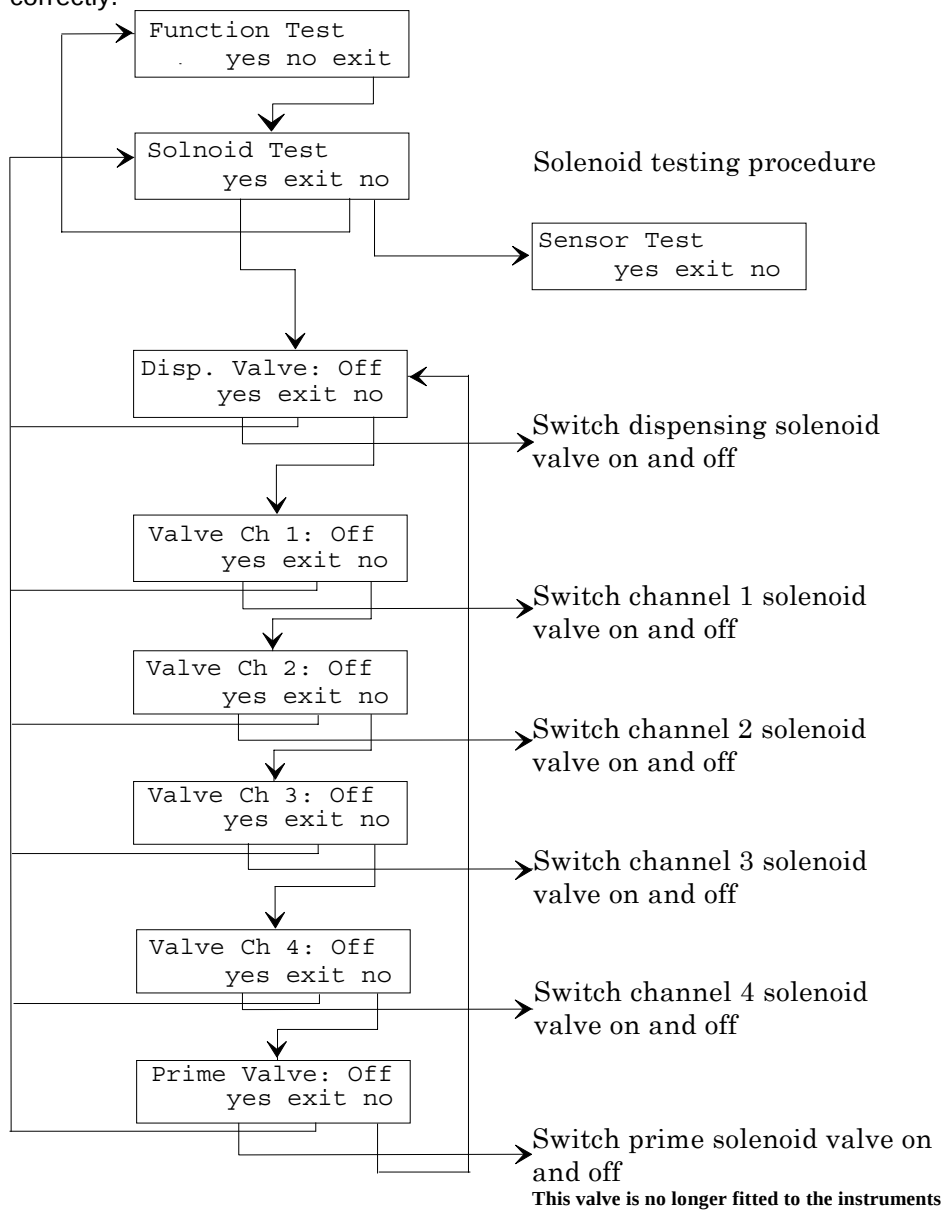
MotTest:Pumps			
yes	exit	no	

Press **no** to select the next motor to be tested or press **exit** to return to the Select Testing option.

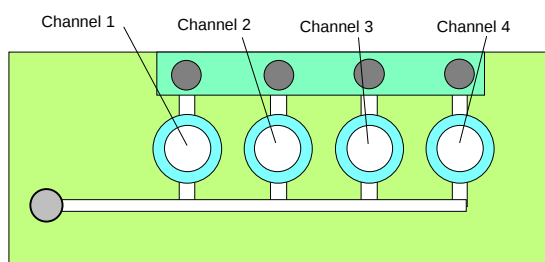
** In firmware versions with the prime valve, the aerosol pump does not function.*

Solenoid Testing

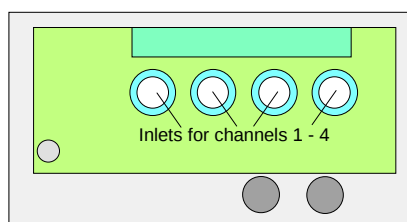
This option is used to check that the various solenoid valves are functioning correctly.



Pinch Valve



Solenoid Valve



The number of solenoid valves that is fitted is dependent on the number of dispensing channels fitted.

** Some of the instruments may include the prime valve.*

To select the Solenoid Testing procedure, press **no** until the following message is displayed:

Solenoid Test
yes exit no

Press **yes** to enter the testing procedure and the following message is displayed:

Disp.Valve: OFF
yes exit no

Press **yes** to switch the dispensing solenoid valve on and off.

Check that the solenoid valve is activated (pinch valve in) when valve is switched on.

Press **no** to select the next solenoid valve and the following message is displayed:

Valve Ch. 1: Off
yes exit no

Press **yes** to switch the channel 1 solenoid valve on and off.

Press **no** to select the next solenoid valve and the following message is displayed:

Valve Ch. 2: Off
yes exit no

Press **yes** to switch the channel 2 solenoid valve on and off.

Press **no** to select the next solenoid valve and the following message is displayed:

Valve Ch. 3: Off
yes exit no

Press **yes** to switch the channel 3 solenoid valve on and off.

Press **no** to select the next solenoid valve and the following message is displayed:

Valve Ch. 4: Off
yes exit no

Press **yes** to switch the channel 4 solenoid valve on and off.

Press **no** to select the next solenoid valve and the following message is displayed:

Prime Valve:Off
yes exit no

Press **yes** to switch the channel prime valve on and off.

Press **no** to select the next valve and the following message is displayed:

When all the required valves have been tested, press **exit** and the following message is displayed:

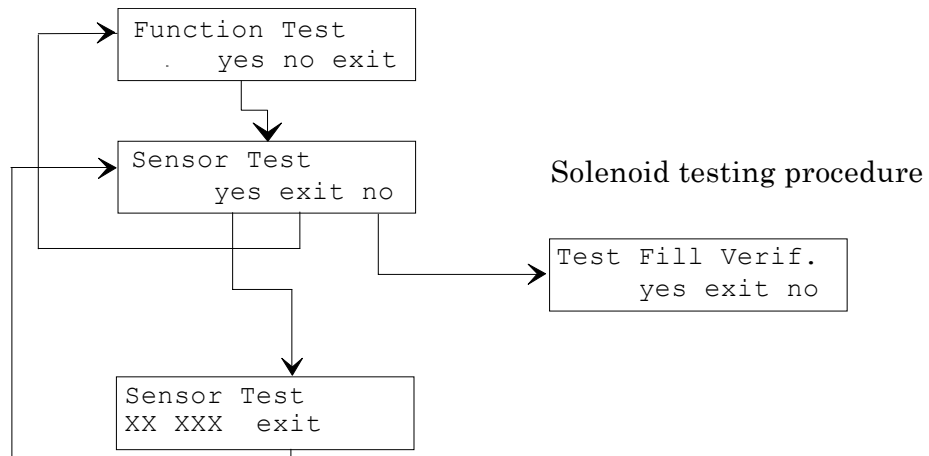
Solenoid Test
yes exit no

Press **no** to select the next testing procedure or press **exit** to return to the Function Test option.

** Some of the instruments may include the prime valve.*

Sensor Function Test

This option is used to check that the various sensors are functioning correctly.



To select the Sensor Testing procedure, press **no** until the following message is displayed:

```
Sensor Test
yes exit no
```

Press **yes** and the instrument disables all the motors and the following message is displayed:

```
Sensor Test
MM AXP exit
```

Where MM AXP WF is the displayed status of the various sensors

MM	Manifold type sensors	(00 = no manifold, 01 = 8 way, 10 = 16 way, 11 = 12 way)
A	Manifold arm home position sensor	(1 = home position)
X	Plate mismatch sensor	(1 = plate mismatch)
P	Plate support home position sensor	(0 = home position)

Move the various parts to check that the sensor are working correctly.

When the sensor testing has been completed, press **exit** and the following message is displayed:

```
Sensor Test
yes exit no
```

Press **no** to select the next testing procedure or press **exit** to return to the Function Test option.

When the sensor testing has been completed, press **exit** and the following message is displayed:

```
Sensor Test
yes exit no
```

Press **no** to select the next Testing procedure or press **exit** to return to the Function Test option.

Fill Verification Testing

If the Fill Verify manifold is fitted, it can be tested using the following procedure.

To select the Fill Verify testing procedure, press **no** until the following message is displayed:

```
Test Fill Verif.
  yes  exit  no
```

Press **yes** to enter the testing procedure and the following message is displayed:

```
XX: yyyyyyyyyyy
Asp Dis exit CLR
```

Where XX: is the type of manifold fitted (8,12 or 16) and yyyyyyyyyyy is the status of the needles.

Use the 1st and 2nd keys to start and stop the aspirating and dispensing pumps.

Pressing **Asp** starts and stops the aspirating pump.

Pressing **Dis** starts and stops the dispensing pump.

When the instrument is dispensing liquid the status of the needles changes.

Press the **CLR** key to clear the display and then redisplay the new status.

When the testing has been completed, press **exit** and the following message is displayed:

```
Test Fill Verif.
  Yes  exit  no
```

Press **no** to select the next testing procedure or press **exit** to return to the Function Test option.

Barcode Reader

If the Barcode Reader option is fitted, it can be tested using the following procedure.

To select the Barcode Testing procedure, press **no** until the following message is displayed:

Barcode Test yes exit no

Press **yes** to enter the testing procedure and the following message is displayed:

exit

Move the barcode reader over a barcode strip, when the barcode strip has been read the instrument beeps and displays the read barcode number. For example:

AE 2345 exit

This procedure can now be repeated for another barcode strip.

When the testing has been completed, press **exit** and the following message is displayed:

Barcode Test yes exit no

Press **no** to select the next testing procedure or press **exit** to return to the Function Test option.

Liquid Detection

If the Liquid Detection Option is fitted, it can be tested using the following procedure.

To select the Liquid Detection testing procedure, press **no** until the following message is displayed:

```
Liq.Sens.
yes  exit  no
```

Press **yes** to enter the testing procedure and the following message is displayed:

```
Liq.Sen.1 XXX Y
-  +  exit  yes
```

Where XXX is the displayed value and Y is the limit (0 = lower 1 = higher)

Use the - and + keys to select the required liquid sensor to be tested.
(1 - 4 & W*)

When the required sensor is displayed, gently press on the bottle and check that the displayed value has increased. Carefully lift the bottle and check that the value has decreased.

When the testing has been performed on the selected liquid sensor, use the - and + keys to select the next required sensor.

When the testing has been completed on all the sensors, press **exit** and the following message is displayed:

```
Liq.Sens.
yes  exit  no
```

Press **no** to select the next testing procedure or press **exit** to return to the Function Test option.

* 1 - 4 and W are the five sensors

- 1 Green
- 2 Gray
- 3 Blue (4 liquid channels)
- 4 Purple (4 liquid channels)
- W Waste

Show Detected CPU

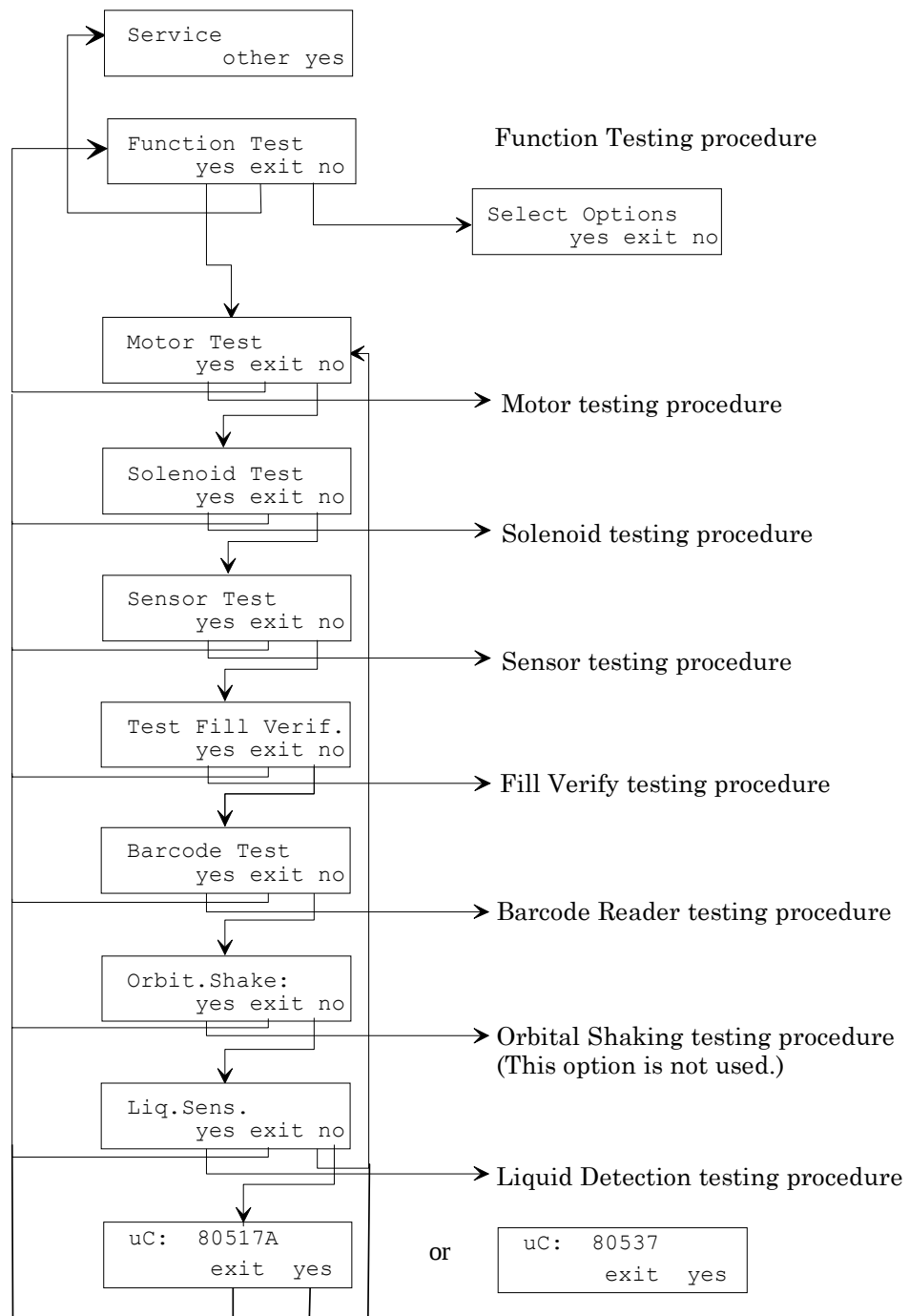
```
uC: 80C517A
exit yes
```

```
uC: 80537
exit yes
```

Shows which version of micro-controller that is used on the main board.

Exiting the Function Test

When all the required function tests have been performed, the function test procedure is exited by pressing **exit**.



The following message is displayed:

```

Function Test
yes exit no
  
```

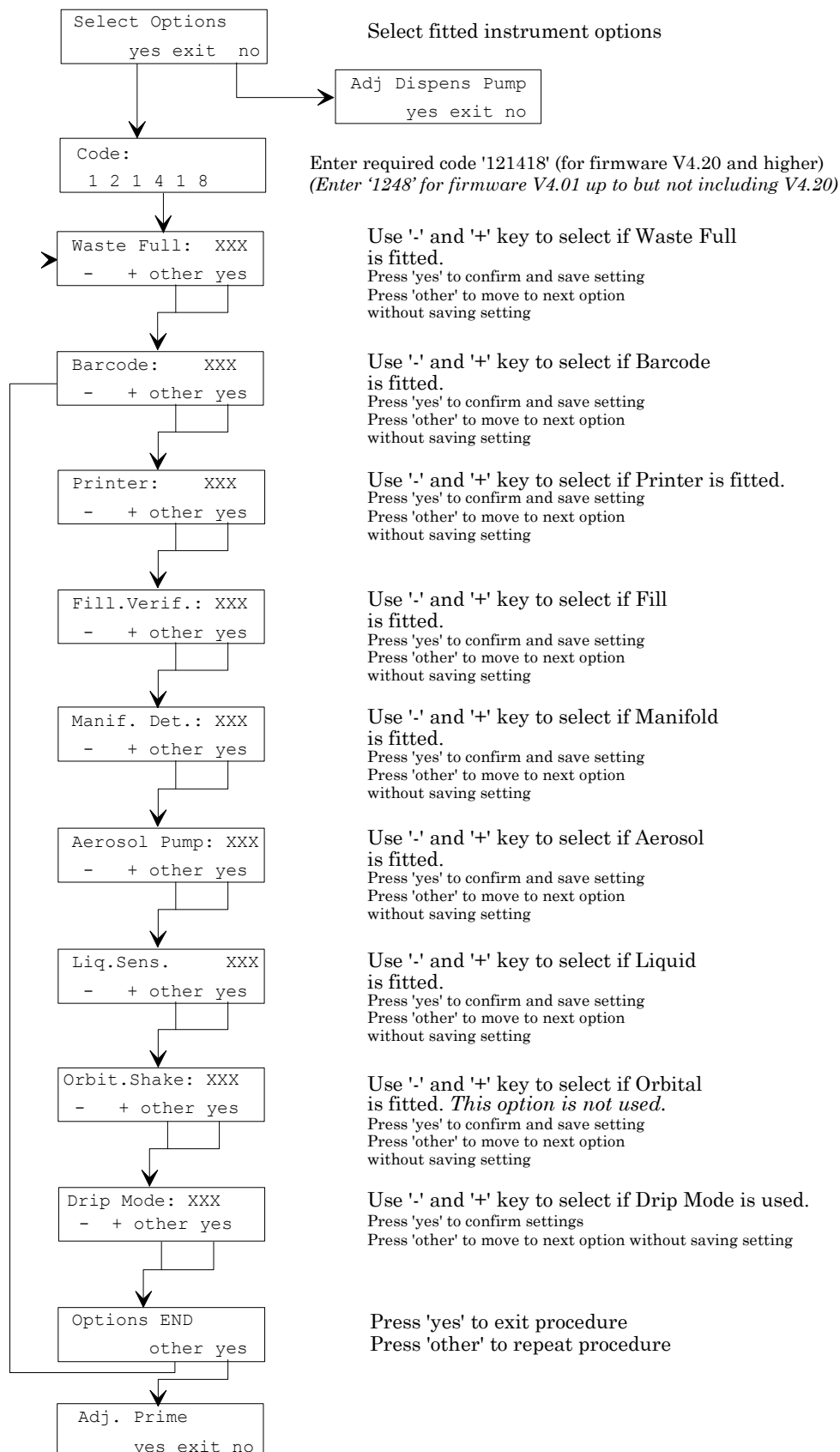
Press **yes** to re-enter the Function Test submenu.

Press **exit** to exit from the Service menu.

Press **no** to select the next option in the Service menu.

Select Options

This option is used to select which options that are fitted to the instrument.



When the following message is displayed:

Select Options
yes exit no

Press **yes** to enter the Select Options submenu and the following message is displayed:

Code:
1 2 4 8

The Select Options submenu can only be entered by entering the required code: 1248

When the code has been correctly entered, the following message is displayed:

Waste Full: NO
- + other yes

Use the - and + keys to set if the Waste Full Sensor option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Barcode: NO
- + other yes

Use the - and + keys to set if the Barcode option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Printer: NO
- + other yes

Use the - and + keys to set if the Printer option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Fill Verif.: NO
- + other yes

Use the - and + keys to set if the Fill Verify option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Manif Det.: NO
 - + other yes

Use the - and + keys to set if the Manifold Detection option is fitted and used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Aerosol Pump NO
 - + other yes

Use the - and + keys to set if the Aerosol Pump option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Liq.Sens. NO
 - + other yes

Use the - and + keys to set if the Liquid Detection option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

Pressing **other** moves to the next option without saving the setting.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Orbit.Shake: NO
 - + other yes

This option is not used.

Pressing **other** moves to the next option without saving the setting.

Drip Mode: NO
 - + other yes

This option is only available together with the cell wash manifold (M8, M12, M16).

Use the - and + keys to set if the Drip Mode option is fitted and to be used.

NO = option not fitted and not used

YES = option fitted and used

When selecting **yes** the dispensing pump must be calibrated for Drip Mode speed. For more information, see next page - Adjust Dispensing Pump.

When the required setting is displayed, press **yes** to save the setting and the following message is displayed:

Options END
other yes

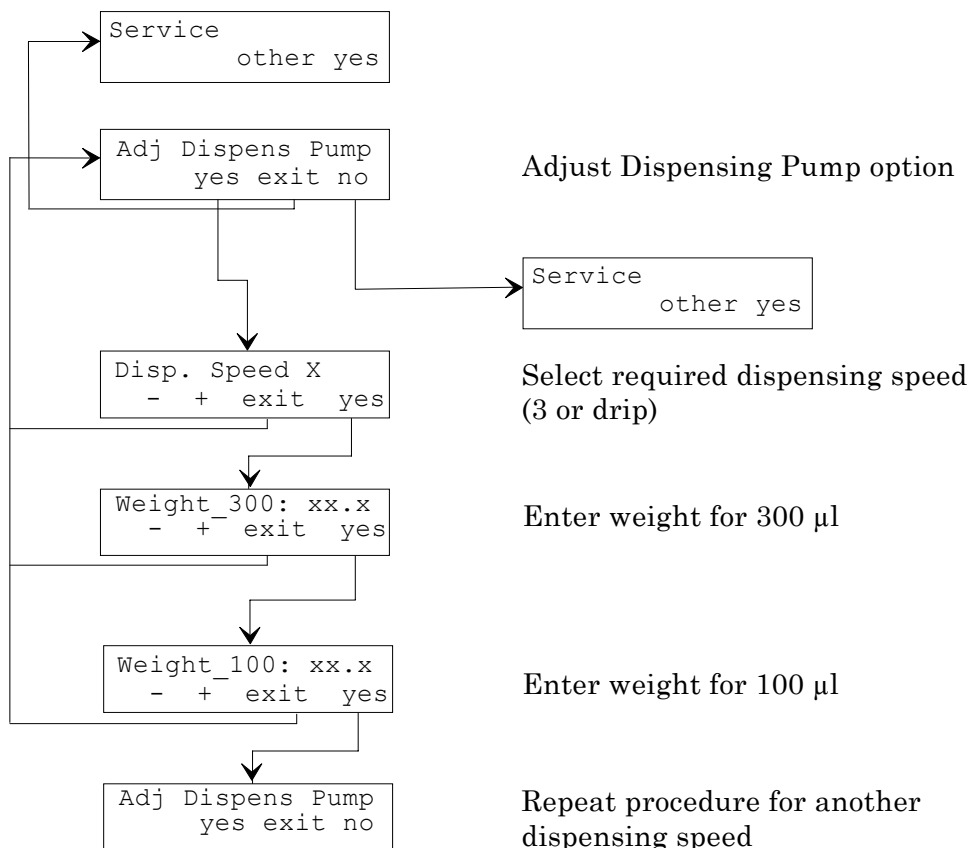
Press **other** to return to the start of the select options submenu.

Press **yes** to exit from the Select Options submenu and the following message is displayed:

Adj. Prime Pos.
yes exit no

Adjust Dispensing Pump

This option is used to calibrate the dispensing pump so that the correct volume of solution is dispensed with each manifold that is used.



The delivered instrument has been calibrated for the supplied manifolds. Calibration must be performed if another manifold is to be used or if the fitted manifold is exchanged for another manifold of the same type.

Before the calibration procedure can be performed, programs that dispense 300 µl and 100 µl solution into each well must be defined with the required dispensing speed.

The dispensing pump is calibrated using the following procedure:

Weight 300

1. Accurately weigh a clean dry microplate (x)
2. Select the program that dispenses 300 µl of solution into each well.
3. Accurately weigh the microplate containing the solution. (y)
4. Calculate the weight of solution ($y - x = \text{Weight 300}$)

Weight 100

1. Accurately weigh a clean dry microplate (x)
2. Select the program that dispenses 100 µl of solution in to each well.
3. Accurately weigh the microplate containing the solution. (z)
4. Calculate the weight of solution ($z - x = \text{Weight 100}$)

Enter the Service menu and scroll through the options until the following message is displayed:

Adj Dispens Pump
yes exit no

Press **yes** and the following message is displayed:

Disp. Speed X
- + exit yes

Use the - and + keys to select the required dispensing speed.(3 or drip)

When the required dispensing speed is displayed, press **yes** and the following message is displayed:

Weight_300: xx.x
- + exit yes

Where XX.X is the displayed weight of 300 µl solution in each well.

If the displayed weight is not correct use the 1st and 2nd keys to scroll the correct weight.

Pressing - decreases the weight by 0.1 g.

Pressing + increases the weight by 0.1 g.

When the required weight is displayed, press **yes** and the following message is displayed:

Weight_100: xx.x
- + exit yes

Where XX.X is the displayed weight of 100 µl solution in each well.

If the displayed weight is not correct, use the 1st and 2nd keys to scroll the correct weight.

Pressing - decreases the weight by 0.1 g.

Pressing + increases the weight by 0.1 g.

When the required weight is displayed, press **yes** and the following message is displayed:

Adj Dispens Pump
yes exit no

When the calibration has been performed press **exit** to exit from the Service menu or press **no** to select the next option in the Service menu.

Repeat the procedure with Disp. Rate: Drip if this option is enabled.



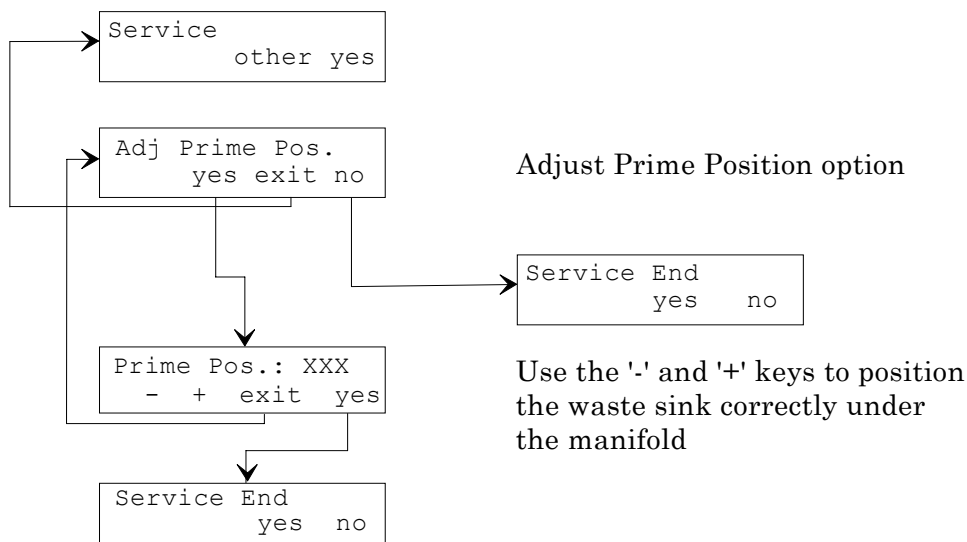
Ensure that the calibration procedure is repeated if the weight (300 µl) is greater than 33 g or less than 24 g before calibrating the instrument for the first time.

Adj. Prime Pos.

This option is used to adjust the position of the plate support for the Prime/Rinse procedures.

The defined position for 8 and 12 way manifolds is different to that of the 16 way manifold. It may be necessary to adjust the position of the 16 way manifold otherwise the solution could be dispensed outside the waste sink.

Use the following procedure to adjust the Prime Position.



When the following message is displayed:

```
Adj.Prime Pos.
yes exit no
```

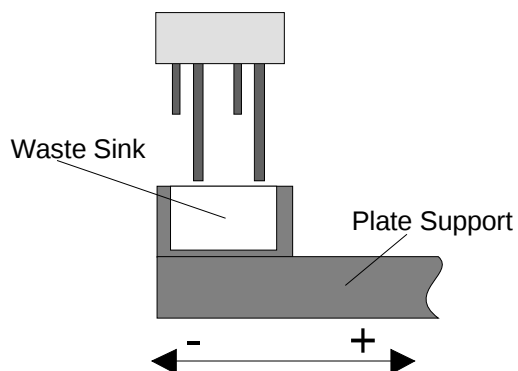
Press **yes** to enter the Prime Position following message is displayed:

```
Prime Pos.: 75
- + exit yes
```

Use the - and + keys to move the position of the plate support.

Pressing - moves the plate support more under the manifold.

Pressing + moves the plate support out from under the manifold.



When a key is pressed, the instrument first moves the plate support to the home position and then moves the plate support to the new prime / rinse position.

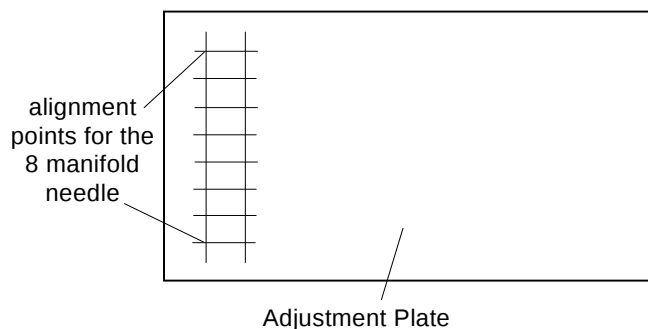
Each press of the key moves the plate support by five steps.

When the plate support is correctly positioned so that no solution is dispensed outside the waste sink, press **yes**, the position is saved and the following message is displayed:

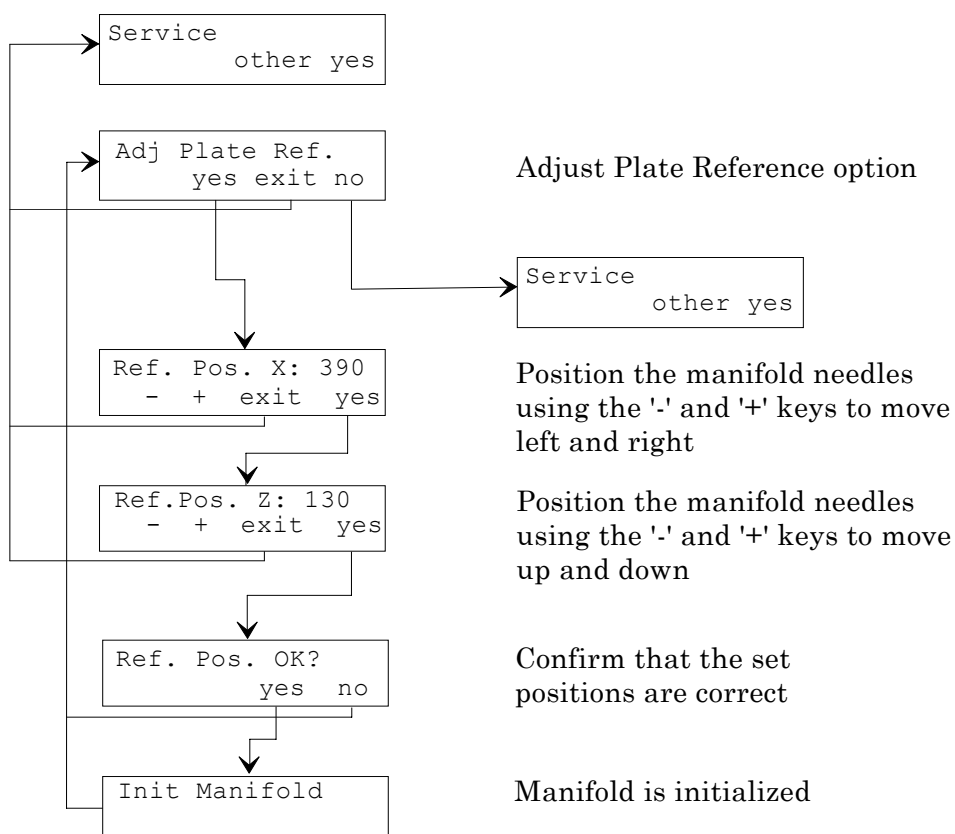
Service End
yes no

Adj. Plate Ref.

The Adjust Plate Reference is used to define the plate position in order that the manifold needles are correctly positioned. The adjustment should always be positioned as shown below for all manifolds. The procedure is the same for manifolds; 8, 12 and 16. Place the adjustment plate on the plate support and enter the Service menu.

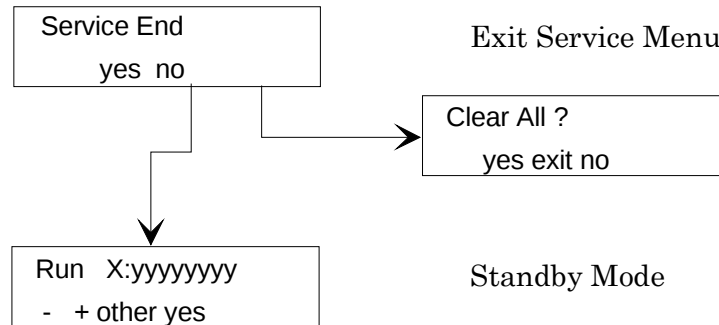


Use the - and + keys to move the manifold needles in the X (left and right) and Z (up and down) directions. The needles must be set exactly on the crosses marked on the adjustment plate.



Service End

This option is used to select if the Service menu is to be exited.



When the following message is displayed:

Service End
yes no

Select if the Service menu is to be exited.

Remain in Service Menu

Press **no** to remain in the Service menu and the following message is displayed:

Clear All ?
yes exit no

Select the required option in the Service menu.

Exit Service Menu

Press **yes** and the following message is displayed:

Run X:yyyyyyy
- + other yes

The instrument is now in the Standby mode and can be used to wash a microplate.

3.3 External Software

3.3.1 *Columbus Computer Software*

Consisting of WinWash and Download including the operating manual and RS232 interface cable.

3.3.2 *Firmware Update*

Consisting of the Download software, the latest version of the firmware 3.x, as well as 5 language software files (English, German, French, Spanish and Italian) that can change the on-board language of the Columbus (from firmware level 2.23 onwards) in the field.

3.4 Serial Interface

A description of the serial interface fitted to the instrument.

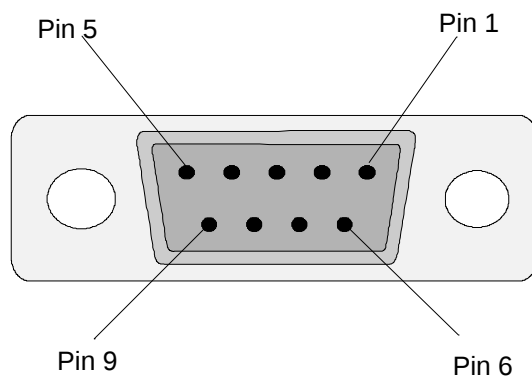
3.4.1 Hardware Specifications

The instrument is controlled by the computer and the communication between the computer and the instrument is done through a RS-232-C interface.

The interface specification may be either to the CCITT interface standard or to the EIA RS-232-C interface standard.

Pin Designation

The illustration below shows the pin assignment of the DB 9 connector fitted to the instrument.



All connected devices must be approved and listed as per EN 60950, UL 1950 or CSA C22.2 No. 950 for Data Processing Devices

RS-232-C Interface Lines

The Serial Interface of the instrument is connected to a start-stop synchronized serial RS-232-C circuit.

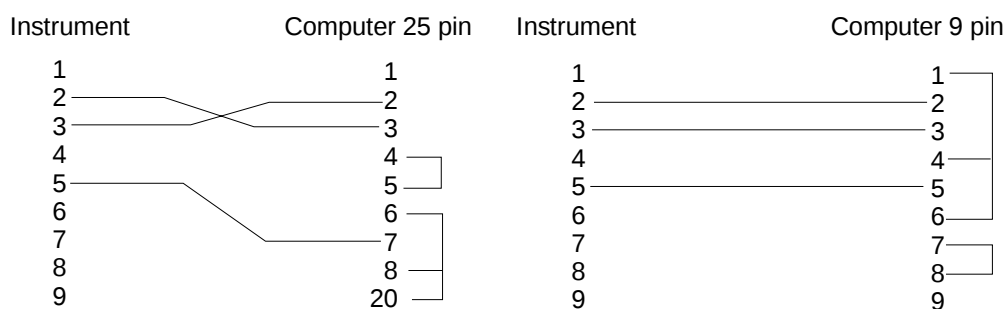
The list below names the interface lines of the instrument's 9 pin connector.

PIN Number	DESCRIPTION
1	RS 485 IN/OUT (Option)
2	(RS232) TD Transmit Data
3	(RS232) RD Receive Data
4	RS 485 IN/OUT
5	GND Ground
6	RS-config: if connected to GND RS 485, if open RS 232 is active (only if jumper x100 on the mainboard is open!)
7	No connection
8	RS232 CTS Clear To Send
9	+24V INPUT (Fused 4AF)

The connecting cable used to connect the instrument to the computer should be wired as given below:

INSTRUMENT	COMPUTER
TD	connected to RD
RD	connected to TD
GND	connected to GND
	RTS connected to CTS
	DSR connected to DCD and DTR

Use the computer handbook to find the correct pin connections.



Synchronization and Data Format

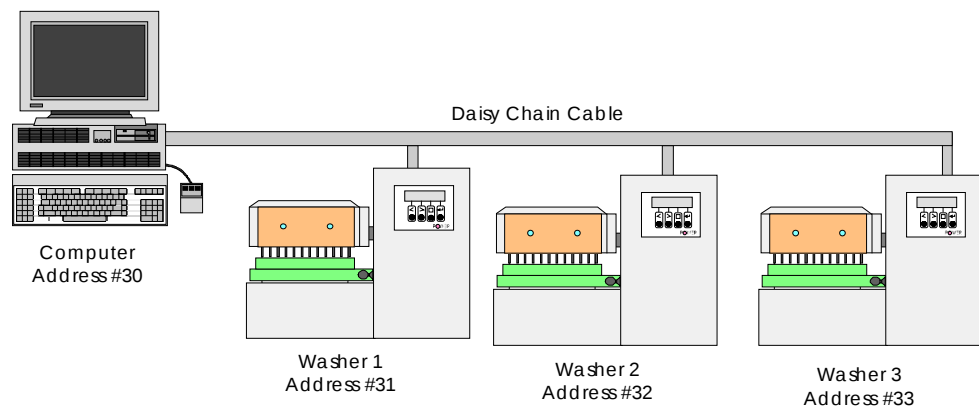
For the instrument to communicate with the computer correctly, the instrument and the computer must be set for the same communication parameters.

Check that following parameters are set correctly on both the computer and the instrument:

1. Start bit length: **1 Bit**
2. Stop bit length: **1 Bit**
3. Data format: **8 Bits**
4. Parity bit: **None**
5. Baud Rate: **9600 Baud**
6. Mode: **half duplex**

Daisy Chaining Instruments

The instrument can be connected to a computer, which controls a number of instruments using a **Daisy Chain** cable. (**RS 485 version only**).



Each of the instruments must be defined with a different device address

Each instrument can be controlled by sending the commands to the required device address.

To select a different device address, start the Remote Mode with the default device address (#31) and send the command to X 37 (to select the device address #37).

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Start Prime	3 – 86
Download Program	3 – 87
Download Plate	3 – 90
Download Rinse Parameter	3 – 91

3.4.3 A. Protocol

1. Data format

Baud Rate: 9600 Baud
 Databits: 8
 Parity: No
 Stop Bit: 1
 Mode: Half duplex

Command Block Format (Master -> COLUMBUS)

hex	dec	keyboard	hex	dec	ALT-'255'
0		Synchronization character	0xFF	255	ALT-'255'
1		STX	0x02	2	ALT-'2' / ^B
2		Device Address (Columbus Add.)	0x32	50	'2' (example)
3		Sequence Number	0x31	49	'1'
4		Datablock (n characters long)			
4 + n	ETX		0x03	3	ALT-'3' / ^C
5 + n	Checksum				

Answer Block Format (COLUMBUS -Master)

0	Synchronization character (FFh)	0xFF	255	ALT-'255'
1	STX (^B or 02h)	0x02	2	ALT-'2' / ^B
2	Master Address (30h)	0x30	48	'0'
3	Status Code			
4	Datablock (n characters long)			
4 + n	ETX (^C or 03h)	0x03	3	ALT-'3' / ^C
5 + n	Checksum			
6 + n	Line turn around character	0xFF	255	ALT-'255'

- Synchronization character for Bus Synchronization
- STX (^B or 02h) start of Command string
- Device Address is a hexadecimal number for every device on the bus (for addressing in 'Daisy Chain')
- Master Address is the address of the host system. This address is always 30hex.
- Status includes device status (Ready, Busy) and the error codes.
- Sequence Number (for repetitions of commands at incorrect transmission).
- Datablock includes data and/or commands received from or sent to the washer.
- ETX (^C or 03h) defines the end of the command/data-string (except CS character).
- Checksum is the last byte of the command/data-string. All bytes (except synchronization and checksum) are XOR-calculated. The receiver compares the sent checksum with the calculation. When they are different the command/data-string is ignored (Error).
- Line turn around character - to make sure that the last byte (Checksum) is received complete. It is possible that this character will not be sent complete.

3.4.4 Sequence Number

7	6	5	4	3	2	1	0
0	0	1	1	REP	SQ2	SQ1	SQ0

SQ0 ... SQ2	1 ... 7	Sequence Number, 0 not allowed
REP	1	Repeated Command
	0	First Command

Status Code

7	6	5	4	3	2	1	0
0	1	RDY	0	EC3	EC2	EC1	EC0

EC0 ... EC4	0	No Error
	1	Init Error
	2	Invalid Command
	3	Invalid Operand
	4	Invalid Command Sequence
	5	System Error (not used)
	6	res.
	7	Plate Mismatch
	8	Plate Transport Error
	9	Manifold Transport Error
	10	Dispense Pump Error
	11	Fill Verification Error
	12	Manifold Error
	13	Waste Full Error
	14	Test Not Defined
	15	Command Overflow
	16	Fill Verification Function Error
	17	Fill Verification Aspiration Error
RDY	1	Ready
	0	Busy

3.4.5 B. Commands - Overview

Command	Abr.	Parameter 1	Parameter 2	Page
Read Dispense Rates	A1	08/12/16		3 – 79
Define Dispense Rates	A2	08/12/16	Drip 005 - 050 6x 000 - 999	3 – 80
Read Aspirate Rates	A3			3 – 80
Define Aspirate Speed	A4	5x 000 - 999		3 – 80
Read Total_Test_Time & Power_On_Time	A6			3 – 81
Clear Total_Test_Time & Power_On_Time	A7			3 – 81
Set_Time (Sort_of_Time, Time)	AT	p / r / a	00 - 99 (24)	3 – 82
Download_Program (Prog. Nr., ...)	D	01 - 30		3 – 70
Clear Program (Prog. Nr)	DC	01 - 30		3 – 74
Download Header/Procedure (Select, ...)	DL	00 - 58		3 – 70
Remote_Mode_OFF	E			3 – 69
Start_Flash_Load_Mode	FL			3 – 82
Read Fill Verification Needle Status	FR			3 – 84
Enable / Disable Fill Verification	FV	0 / 1		3 – 83
Start_Prime (Liquid Channel)	GP	1 - 4		3 – 69
Start_Rinse (Modus, Liquid Channel)	GR	0 - 3	0 - 4	3 – 69
Stop Program / Prime procedure	HP			3 – 69
Stop_Rinse	HR			3 – 69
Read_Device_Status	I			3 – 76
Define Options 2	LA	'0' , '1'		3 – 78
Define Power On Header	LH	'Header'		3 – 76
Select Options	LO	'0' , '1'		3 – 78
Read_Manifold_Information	M			3 – 79
Define Manifold Type	MA	08 / 12 / 16		3 – 79
Define_Program_Lockstatus	N	'#', ''		3 - 70

Read_Program_Lockstatus	NL			3 – 73
Read Options_1	O			3 – 77
Read Options_2	OA			3 – 77
Read Plate ID (Barcode)	PI			3 – 82
Download_Plate (Plate Nr., ...)	PD	1-9	...	3 – 74
Read_Platename (Plate Nr.)	PR	1-9		3 – 75
Upload_Plate (Plate Nr.)	PU	1-9		3 – 75
Write_Platename (Plate Nr., ...)	PW	1-9	'Plate name'	3 – 74
Query	Q			3 – 78
Download_Rinse_Para. (Rtime,ARtime)	RD	01 - 99	01 - 24	3 – 75
Upload_Prime_Parameter	RP			3 – 76
Upload_Rinse_Parameter	RU			3 – 76
Read Setting	RS	0 - 8	0 - 4	3 – 83
Start_Program (Prog. Nr., Nr. of Strips)	S	01 - 30	01 - 12 (8, 6)	3 – 69
Start_Program (Prog. Nr., Sel. Strips)	ST	01 - 30	12 / 8 x 0 / 1	3 – 69
Upload_Program(Prog.Nr.)	U	01 - 30		3 – 73
Upload Header/Procedure (Select, ...)	UL	00 - 58		3 – 73
Calibrate Dispense Pump (Speed 1 – 5)	W	00.0 – 99.9		3 – 81
Calibrate Dispense Pump (Speed Drip)	WD	00.0 – 99.9		3 – 81
Write Settings	WS	0 - 8		3 – 83
Write Time & date	WT	...		3 – 83
Read_Number_Of_Solenoids	V			3 – 79
Change_Device_Address (New Address)	X	0x31 - 0x3F		3 – 82
Clear_All	XX			3 – 82
Remote_Mode_ON	Y / !	0 / 1 / 'M'		3 – 69
Read_Header & Firmware Version	Z / ?			3 – 76

For Genalyser – Firmware Version 3.06

Command	Abr.	Parameter	Validity	Page
Abort Program	FA	None	Run time	3 – 84
Continue Program	FC	None	Run time	3 – 85
Last Processed Strip	FS	None	Run time	3 – 85
Fill Verification Status	F?	None	Always	3 – 85

3.4.6 Commands - Description

1. Switch Communication On/Off

Command		Parameter	Answer
Remote ON	! or Y <p>	p = 0: send no end after program & prime p='M': MINILYSER Mode (no 'BUSY' in 'ACK' else: send end.	+CW
Remote OFF	E	-	ACK

2. Starting and Stopping a Program / Prime Procedure /Rinse Procedure

Command		Parameter	Answer
Start Program 1	S<p1><p2>	p1: number of program p2: number of strips	ACK
Start Program 2	ST<p1><p2>	p1: number of program p2: 8(12) x 0/1 selection of strips	ACK
Start Prime	GP<p>	p: liquid channel	ACK
Start Rinse	GR<p1><p2>	p1: Rinse mode 0:SOAK 1: DAY 2: NIGHT 3: AUTO p2: liquid channel (0 = all channels)	ACK
Stop Rinse	HR	-	ACK
Stop Program/Prime	HP	-	ACK

3. Define Programs

Command		Parameter	Answer
Download_Program	D<p1><p2> <p3><p4>...	p1: Program number p2: Number of following columns p3: common parameters p4: parameters of procedures	ACK

Define Header

Command		Parameter	Answer
Download_header	DL<p1><p2> <p3><p4>...	p1: Selection 00: Header p2: Program number p3: number of following columns p4: common parameters	ACK

Define Procedure

Command		Parameter	Answer
Download_procedure	DL<p1><p2> <p3><p4>...	p1: Procedure number 01 - 59 p2: Program number p3: parameter of procedures	ACK

Define Program Lock Status

Command		Parameter	Answer
Define Program Lock Status	N<p1> <p2>	p1: Program number p2: Lock Status P2 = '#' ⇒ Prog. locked P2 = '' ⇒ Prog. unlocked	ACK

Common Parameters

Program name:	' □ □ □ □ □ □ □ □ '	1 st & 8 th character	(8 characters)
Plate type:	1 - 9	9 th character	(1 character)
Manifold type:	08 / 12 / 16	10 th & 11 th character	(2 characters)
Dispense rate:	0 - 5 / 0=drip	12 th character	(1 character)
Aspirate rate:	1 - 5	13 th character	(1 character)
Aspirate mode:	0 - 3	14 th character	(1 character)

Global / Final Asp.

0: normal / normal

1: crosswise /
crosswise

2: normal /
crosswise

3: crosswise /
normal

Working mode:	0 / 1	plate / strip mode	15 th character	(1 character)
Strip selection:	0 / 1	NO / YES	16 th character	(1 character)
Printer mode:	0 / 1 / 2	NO / YES / ASK	17 th character	(1 character)
Final Asp. Time:	00 - 20	(in sec)/ 00 = NO	18 th & 19 th character	(2 characters)
Final Asp. Speed:	00 - 20	(in mm/s)	20 th & 21 th character	(2 characters)

Procedures

1. Wash

Code: 'W'			1 character
1. Parameter: Aspirate Speed	01-20		2 nd & 3 rd character
2. Parameter: Dispense / Aspirate Position	0/1		4 th character
Parameter	Dispense Postion	Aspirate position	
0	Bottom	Bottom aspirate	
1	Overflow	Bottom aspirate	
2	Bottom	Bottom wash	
3	Overflow	Bottom wash	
3. Parameter: Dispense Channel	1-4		5 th character
4. Parameter: Dispense Volume	0050-3000		6 th – 9 th character (in µl)

2. Aspirate

Code:	'A'	1 th character
1. Parameter: Aspirate Time	01-20	2 th & 3 th character
2. Parameter: Aspirate Speed	01-20	4 th & 5 th character

3. Dispense

Code:	'D'	1 th character
1. Parameter: Dispense Position	0/1	2 th character
2. Parameter: Dispense Channel	1-4	3 th character
3. Parameter: Dispense Volume	0050-0400	4 th & 7 th character (in µl)

4. Soak

Code:	'S'	1 character
1. Parameter: Soak Time	001-999	2 nd - 4 th character in sec
2. Parameter: Shake Speed	0-4	5 th character
0	No shaking	
1-3	Linear shaking	
4	Orbital shaking	
3. Parameter: Shake Mode	0-2	6 th character
Parameter: Shake Speed (orbital)	0-2	6 th character

5. End

a. End of Cycle

Code:	'E'	1 st character
1. Parameter: Type of END	0	2 nd character
2. Parameter: Cycle Number	00-30	3 rd & 4 th character
3. Parameter: Repeat Number	00-09	5 th & 6 th character
4. Parameter: Proc. in Cyc.	01-59	7 rd & 8 th character

b. End of Program

Code:	'E'	1 st character
1. Parameter: Type of END	1	2 nd character

4. Upload Program

Command		Parameter	Answer
Upload_Program	U<p1>	p1: Program number	p2: number of following columns p3: common parameters p4: parameters of procedures (see 3. Define Programs)

Upload Header

Command		Parameter	Answer
Upload_header	UL<p1><p2><p3><p4>	p1: Selection 00: Header p2: Program number	p3: number of following columns p4: common parameters

Upload Procedure

Command		Parameter	Answer
Upload_procedure	UL<p1><p2><p3>	p1: Procedure number p2: Program number	p3: parameters of procedures

Read Program Lock Status

Command		Parameter	Answer
Read Program Lock Status	NL	p1: Program number	p2: Lock Status p2 = '#' ⇒ Prog. Locked P2 = '' ⇒ Prog. unlocked

5. Clear Program

Command		Parameter	Answer
Clear_Program	DC<p1>	p1: Program number	ACK

6. Define Plates

Command		Parameter	Answer
Download_Plate	PD<p1><p2> <p3><p4>...	p1: Plate Number p2: Bottom Form p3: Bottom Aspirate Position p4: Bottom Wash Position p5: Overflow Position p6: Dispense Position p7: Aspirate Position 1 p8: Aspirate Position 2	ACK

Plate-Nr .: 1 - 9
 Bottom form 0 / 1 (0 -> flat, 1 -> round)
 Bottom aspirate position (4 characters)
 Bottom wash position (- || -)
 Overflow position (- || -)
 Dispense position (- || -)
 Aspirate position 1 (- || -)
 Aspirate position 2 (- || -)

Write Plate name / Define Plate Lock Status

Command		Parameter	Answer
Write_Platename	PW<p1><p2>	p1: Plate Number p2: 'PLATENAME'	ACK

Plate-Nr .: 1 - 9
 Platenname (9 characters): 1 - 8: Name
 9: Lock status of plate '#' ⇒ Plate locked
 '' ⇒ Plate unlocked

7. Upload Plate Data

Command		Parameter	Answer
Upload_Plate	PU<p1>	p1: Plate Number	<p2><p3><p4>...

- p2: Bottom Form
- p3: Bottom Aspirate Position
- p4: Bottom Wash Position
- p5: Overflow Position
- p6: Dispense Position
- p7: Aspirate Position 1
- p8: Aspirate Position 2

Read Plate name / Plate Lock Status

Command		Parameter	Answer
Read_Platename	PR<p1><p2>	p1: Plate Number	p2: 'PLATENAME'

Plate-Nr .: 1 - 9

Platename (9 characters): 1 - 8: Name

9: Lock status of plate '# ⇒ Plate locked

' ' ⇒ Plate unlocked

8. Define Rinse Parameters

Command		Parameter	Answer
Download_Rinse_Parameter	RD<p1><p2>	p1: Rinse Time p2: Auto Rinse Time	ACK

p1: Rinse Time (01 - 99 / in seconds)

p2: Auto Rinse Time (01 - 24 / in hours)

9. Upload Rinse Parameters

Command		Parameter	Answer
Upload_Rinse_Parameter	RU	-	<p1><p2>

p1: Rinse Time (01 - 99 / in seconds)

p2: Auto Rinse Time (01 - 24 / in hours)

Command		Parameter	Answer
Read_Prime_Time	RP	-	<p1>

p1: Prime Time (01 - 99 / in seconds)

10. Read Device Information

Command		Parameter	Answer
Read_Device_Information	I	-	<p1><p2><p3>

p1: Sort of Procedure (P, R, T, S)
 P: Prime active
 R: Rinse active
 T: Testrun (Program) active
 S: Standby

p1 = 'T':
 p2: Number of Program
 p3: Number of Strip in Progress

11. Read Header & Firmware Version

Command		Parameter	Answer
Read_Model&FW-Version	Z ?	-	<p1>

p1: String of 32 characters

- 0 ... 15: Power On Header
- 16 ... 31: Firmware Version

12. Define Power On Header

Command		Parameter	Answer
Define_Header	LH	<p1>	ACK

p1: String of 16 characters (Power On Header)

13. Read Option Status 1 & 2

Command		Parameter	Answer
Read_Options 1	O	-	<p1>

p1: String of 8 characters ('0' or '1' / 0 = no, 1 = yes)

- 1. Position: Orbital Shake
- 2. Position: Manifold Error Detection
- 3. Position: Aerosol Protection
- 4. Position: Manifold Detection
- 5. Position: Fill Verification
- 6. Position: Serial Printer (Real Time Clock)
- 7. Position: Barcode Pen
- 8. Position: Waste Full Detector

Command		Parameter	Answer
Read_Options 2	OA	-	<p1>

p1: String of 8 characters ('0' or '1' / 0 = no, 1 = yes)

- 1. Position: reserved
- 2. Position: reserved
- 3. Position: reserved
- 4. Position: reserved
- 5. Position: reserved
- 6. Position: reserved
- 7. Position: Dispense Drip Mode
- 8. Position: Liquid Sensors

14. Define Option Status 1 & 2

Command		Parameter	Answer
Define_Options 1	LO	<p1>	ACK

p1: String of 8 characters ('0' or '1' / 0 = no, 1 = yes)

- 1. Position: Orbital Shake
- 2. Position: Manifold Error Detection
- 3. Position: Aerosol Protection
- 4. Position: Manifold Detection
- 5. Position: Fill Verification
- 6. Position: Serial Printer (Real Time Clock)
- 7. Position: Barcode Pen
- 8. Position: Waste Full Detector

Command		Parameter	Answer
Define_Options 2	LA	<p1>	ACK

p1: String of 8 characters ('0' or '1' / 0 = no, 1 = yes)

- 1. Position: reserved
- 2. Position: reserved
- 3. Position: reserved
- 4. Position: reserved
- 5. Position: reserved
- 6. Position: reserved
- 7. Position: Dispense Drip Mode
- 8. Position: Liquid Sensors

15. Read Device Status

Command		Parameter	Answer
Query	Q	-	ACK

Used to check the Status Code of the communication (Busy/Ready & Error Codes)

16. Read Number of Liquid Channels

Command		Parameter	Answer
Read_Channels	V	-	<p1>

p1: 1 ... 4 (Number of Liquid Channels)

17. Read Manifold Information

Command		Parameter	Answer
Read_Manifold	M	-	<p1>

p1: 00 / 08 / 12 / 16 (Number of Dispense Needles / Manifold, 00 = no Manifold)

18. Define Manifold Type

Command		Parameter	Answer
Define_Manifold	MA	<p1>	ACK

p1: 08 / 12 / 16 (Number of Dispense Needles)

19. Read Dispense Rates

Command		Parameter	Answer
Read_Disp_Rates	A1<p1>	p1: Manifold Type	<p2,...<p8>

p1: Manifold Type (00 / 08 / 12 / 16)

p2: Dispense Rate for Speed 'drip' (3 characters) (005 – 050)

Impulses on dispensing pump optical switch per 100ms

p3: Dispense Rate for Speed Nr. 1 (3 characters) (000 - 999: 00.0% to 99.9%)

p4: Dispense Rate for Speed Nr. 2 (3 characters)

p5: Dispense Rate for Speed Nr. 3 (3 characters)

p6: Dispense Rate for Speed Nr. 4 (3 characters)

p7: Dispense Rate for Speed Nr. 5 (3 characters)

p8: Dispense Rate for priming (3 characters)

20. Define Dispense Rates

Command		Parameter	Answer
Define_Disp_Rates	A2<p1>...<p8> >	p1: Manifold Type p2: Disp. Rate for 'drip' p3: Disp. Rate Speed 1 p4: Disp. Rate Speed 2 p5: Disp. Rate Speed 3 p6: Disp. Rate Speed 4 p7: Disp. Rate Speed 5 p8: Disp. Rate for Prime	<p2,...<p8>

p1: Manifold Type (00 / 08 / 12 / 16)

p2: Dispense Rate for Speed 'drip' (3 characters) (005 – 050)

Impulses on dispensing pump optical switch per 100ms

p3: Dispense Rate for Speed Nr. 1 (3 characters) (000 - 999: 00.0% to 99.9%)

p4: Dispense Rate for Speed Nr. 2 (3 characters)

p5: Dispense Rate for Speed Nr. 3 (3 characters)

p6: Dispense Rate for Speed Nr. 4 (3 characters)

p7: Dispense Rate for Speed Nr. 5 (3 characters)

p8: Dispense Rate for priming (3 characters)

21. Read Aspirate Rates

Command		Parameter	Answer
Read_Asp_Rates	A3	-	<p1,...<p5>

p1: Aspirate Rate for Speed Nr. 1 (000 - 999: 00.0% to 99.9%)

p2: Aspirate Rate for Speed Nr. 2 (3 characters)

p3: Aspirate Rate for Speed Nr. 3 (3 characters)

p4: Aspirate Rate for Speed Nr. 4 (3 characters)

p5: Aspirate Rate for Speed Nr. 5 (3 characters)

22. Define Aspirate Rates

Command		Parameter	Answer
Define_Asp_Rates	A4	-	<p1,...<p5>

p1: Aspirate Rate for Speed Nr. 1 (000 - 999: 00.0% to 99.9%)

p2: Aspirate Rate for Speed Nr. 2 (3 characters)

p3: Aspirate Rate for Speed Nr. 3 (3 characters)

p4: Aspirate Rate for Speed Nr. 4 (3 characters)

p5: Aspirate Rate for Speed Nr. 5 (3 characters)

23. Calibrate Dispense Pump

Command		Parameter	Answer
Cal_Disp_Pump Speed 1 -5	W<p1>_<p2>	p1: Weight at 100 µl p2: Weight at 300 µl	ACK
Cal_Disp_Pump Speed Drip	WD<p1>_<p2>	p1: Weight at 100 µl p2: Weight at 300 µl	ACK

('_' between <p1> & <p2> = BLANK)

p1: Measured netto-weight when Dispense 100 µl in MTP. (00.0 to 99.9)

p2: Measured netto-weight when Dispense 300 µl in MTP. (00.0 to 99.9)

24. Read Total Test Time & Power On Time

Command		Parameter	Answer
Read_Test&_PowerOn_Time	A6	-	p1:Times

p1: Test & PowerOn Time (hhhhhh:mm:ss- hhhhhh:mm:ss)

25. Clear Total Test Time & Power On Time

Command		Parameter	Answer
Clear_Test&_PowerOn_Time	A7	-	ACK

26. Adjust Times

Command		Parameter	Answer
Set_Time	AT<p1><p2>	p1: Sort of Time p2: Time	ACK

p1: Sort of Time (p / r / a: p = PRIME, r = RINSE, a = AUTORINSE)

p2: Time @ p / r: 00 - 99 in seconds

@ a: 00 - 24 in hours

27. Change Device Address

Command		Parameter	Answer
Change_Address	X	p1: new address	ACK

p1: selected address (hex) in ASCII - format (2 characters). ('30' to '6F')

28. Read Plate Identity (Barcode)

Command		Parameter	Answer
Read_Plate_ID	PI	-	p1: Plate Identity

p1: 16 characters plate id. (when barcode option is enabled otherwise return ACK)

29. Clear All

Command		Parameter	Answer
Clear_All	XX	-	ACK

Resets all the device ram to 0xFF and waits for a reset from the external watchdog.

The device starts again and is out of remote mode.

(All settings are reset to factory settings and all programs are empty).

30. Start Flash Load Mode

Command		Parameter	Answer
Start Flash Load Mode	FL	-	ACK

31. Read / Write Settings

Command		Parameter	Answer
Read Settings	RS	<p1>	<p2>
Write Settings	WS	<p1><p2>	ACK

p1: Number of setting

0 ... access program
1 ... access adjust
2 ... channels
3 ... skip: Channel x primed?
4 ... skip: Plate inserted ?
5 ... skip: Waste bottle OK?
6 ... skip: Rinse_solution?
7 ... skip: Prime_solution?
8 ... skip: You should rinse

p2: select

0: not allowed, 1: allowed
1 - 4
0: show, 1: skip

32. Write Time & Date

Command		Parameter	Answer
Write time & date	WT	<p1>...<p6>	ACK

p1: hour 00 - 24
p2: minute 00 - 59
p3: second 00 - 59
p4: day 01 - 31
p5: month 01 - 12
p6: year 00 – 99

33. Enable/Disable Fillverification

Command		Parameter	Answer
Enable / Disable Fillverification	FV	p1: Selection	ACK

p1 = 0: disable fillverification p1 = 1: enable fillverification

34. Read Fillverification Needle Status

Command		Parameter	Answer	check
Read Fillverification Needle Status	FR	-	<p1>	

p1: Antwort: ABCD (4 Byte for needle status)

Byte A,B,C,D – Bit Structure:

Bit Nr.	7	6	5	4	3	2	1	0
Byte A	0	0	1	1	A3	A2	A1	A0
Byte B	0	0	1	1	B3	B2	B1	B0
Byte C	0	0	1	1	C3	C2	C1	C0
Byte D	0	0	1	1	D3	D2	D1	D0

Connection Bits – Needles:

8 Needle Manifold:

Needle	1	2	3	4	5	6	7	8
Buffer	A3	A2	A1	A0	B3	B2	B1	B0

12 Needle Manifold:

Needle	1	2	3	4	5	6	7	8	9	10	11	12
Buffer	A3	A2	A1	A0	B3	B2	B1	B0	C3	C2	C1	C0

16 Needle Manifold:

Needle rear	1	2	3	4	5	6	7	8
Buffer	A3	A2	A1	A0	B3	B2	B1	B0
Buffer	C3	C2	C1	C0	D3	D2	D1	D0
Needle front	1	2	3	4	5	6	7	8

When a Bit =1 then the needle had no contact and if the Bit = 0 the needle had contact.

Unused Bits for a used manifold are always 1.

Needle 1: right side Needle 8 (12): left side of manifold

35. Abort Program

Command		Parameter	Validity	Answer
Abort Program	FA	-	Run time	ACK

The current active wash program is stopped.

36. Continue Program

Command		Parameter	Validity	Answer
Continue Program	FC	-	Run time	ACK

The current active wash program is continued after the Fill Verification Error.

Note: The Fill Verification Error is diagnosed at the end of the faulty strip. Therefore, the wash step for the faulty strip is fully completed. The FC command then continues with the next strip or wash step. (The wash step for the faulty strip may not be completed).

37. Last Processed Strip

Command		Parameter	Validity	Answer
Last Processed Strip	FS	-	Run time	P2: Strip number

p2: 0 - 12 for 8 / 16 way manifold

0 - 8 with 12 way manifold

Gives a reply of the strip number in which the Fill Verification Error has occurred.

38. Fill Verification Status

Command		Parameter	Validity	Answer
Fill Verification Status	F?	-	Always	P2: Status Fill Verification

p2: 1 = On

0 = Off

3.4.7 D. Examples for Remote Control - Command Sequences

Enter Remote Mode

(FF)(STX)(ADR)(SNr.) : Start

Y0 : Command 'Y0'

(ETX)(CS) : End

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	59	089	Y	
	30	048	0	
ETX	03	003		ALT - '3' / ^C
CS	68	104		ALT - '104'

Leave Remote Mode

(FF)(STX)(ADR)(SNr.) : Start

E : Command 'E'

(ETX)(CS) : End

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	45	069	E	
ETX	03	003		ALT-'3' / ^C
CS	44	068		ALT-'68'

Change Device Address

(FF)(STX)(ADR)(SNr.) :Start

X37 : Command 'X', New Device Address: 37hex

(ETX)(CS) : End

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	58	088	X	
	33	051	3	
	37	055	7	
ETX	03	003		ALT-'3' / ^C
CS	5D	093		ALT-'93'

Start Program

(FF)(STX)(ADR)(SNr.) : Start

S0112 : Command 'S' (Start program Nr. 01 run 12 Strips)

(ETX)(CS) : End

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA	53	033	S	
	30	048	0	
	31	049	1	
	31	049	1	
	32	050	2	
ETX	03	003		ALT-'3' / ^C
CS	50	080		ALT-'80'

Start Prime

(FF)(STX)(ADR)(SNr.) : Start

GP1 : Command 'GP' (Start Prime with liquid channel Nr. 1)

(ETX)(CS) : End

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	47	071	G	
	50	080	P	
	31	049	1	
ETX	03	003		ALT - '3' / ^C
CS	27	039		ALT-'39'

Download Program

Example 1

```
(FF)(STX)(ADR)(SNr.)  Start
D0105                  Command 'D', Program-Nr. 01,
                        following columns 05
ASPIRATE               Name: 'ASPIRATE'
1082300000000         Plate type 1, Manifold 08, Dispense rate 2, Aspirate rate 3,
                        Aspirate mode normal/normal (0), Working mode Plate (0),
                        Strip Selection no (0), Printer Mode no (0),
                        fin.asp time NO (00), fin asp. speed NO (00)
A0210:                 Aspirate procedure, Aspirate time 02sec, Manifold speed
                        10mm/s
E0010202:              End of Cycle (0), Cycle Nr.01, Repeat Factor 02, Proc. in
                        Cycle 02
E1                     End of Program (1)
(ETX)(CS)              End
```

Resulting Character Sequence

Meaning	HEX FF	DEC 255	Character	Keyboard ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	44	068	D	
	30	048	0	
	31	049	1	
	30	048	0	
	35	053	5	
	41	065	A	
	53	083	S	
	50	080	P	
	49	073	I	
	52	082	R	
	41	065	A	
	54	084	T	
	45	069	E	
	30	048	1	
	30	048	0	
	38	056	8	
	32	050	2	
	33	051	3	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	41	065	A	
	30	048	0	
	32	050	2	

	31	049	1
	30	048	0
	45	069	E
	30	048	0
	30	048	0
	31	049	1
	30	048	0
	32	050	2
	30	048	0
	32	050	2
	45	069	E
	31	049	1
ETX	03	003	ALT-'3' / ^C
CS	32	050	ALT-'50'

Example 2

(FF)(STX)(ADR)(SNr.)	Start
D0207	Command 'D', Program-Nr. 02, following columns 07
WASH	Name: 'WASH'
1082300000000	Plate type 1, Manifold 08, Dispense rate 2, Aspirate rate 3, Asp. mode normal/normal (0), Working Mode Plate (0), Strip Selection no (0), Printer Mode no (0), fin.asp time NO (00), fin asp. speed NO (00)
W07110400	Wash procedure, Asp. time 07 sec., Dispense pos. Overfl.(1), Disp. channel 1, Dispense volume 0400µl
S01010	Soak procedure, Soak time 010 sec, Shake speed 1, Shake mode low (0)
A0214	Aspirate procedure, Aspirate time 02 sec, Manifold speed 14mm/s
E0010204	End of Cycle (0), Cycle Nr.01, Repeat Factor 02, Proc. in Cycle 04
E1	End of Program (1)
(ETX)(CS)	End

Resulting Character Sequence

Meaning	HEX	DEC	Character	Keyboard
	FF	255		ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	44	068	D	
	30	048	0	
	32	050	2	
	30	048	0	
	37	055	7	
	57	087	W	
	41	065	A	
	53	083	S	
	48	072	H	
	20	032	' '	
	20	032	' '	
	20	032	' '	
	20	032	' '	
	31	049	1	
	30	048	0	
	38	056	8	
	32	050	2	
	33	051	3	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	30	048	0	
	57	087	W	
	30	048	0	
	37	055	7	
	31	049	1	
	31	049	1	
	30	048	0	
	34	052	4	
	30	048	0	
	30	048	0	
	53	083	S	
	30	048	0	
	31	049	1	
	30	048	0	
	31	049	1	
	30	048	0	
	41	065	A	
	30	048	0	
	32	050	2	
	31	049	1	
	34	052	4	
	45	069	E	
	30	048	0	
	30	048	0	
	31	049	1	
	30	048	0	

	32	050	2
	30	048	0
	34	052	4
	45	069	E
	31	049	1
ETX	03	003	ALT-'3' / ^C
CS	02	002	ALT-'2'

Download Plate

(FF)(STX)(ADR)(SNr.) Start
 PD20028002700150037603200370 Command Plate type 2, Bottom Form
 Flat(0),
 Bottom aspirate position (0280), Bottom wash position (0270)
 Overflow position (0150), Dispense position (0376)
 Aspirate position 1 (0320), Aspirate position 2 (0370)
 (ETX)(CS) End

Meaning	HEX	DEC	Character	Keyboard
	FF	255		ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	50	080	P	
	44	068	D	
	32	050	2	
	30	048	0	
	30	048	0	
	32	050	2	
	38	056	8	
	30	048	0	
	30	048	0	
	32	050	2	
	37	055	7	
	30	048	0	
	30	048	0	
	31	049	1	
	35	053	5	
	30	048	0	
	30	048	0	
	33	051	3	
	37	055	7	
	36	054	6	
	30	048	0	
	33	051	3	
	32	050	2	
	30	048	0	
	30	048	0	
	33	051	3	
	37	055	7	
	30	048	0	
ETX	03	003		ALT-'3' / ^C
CS	1B	027		ALT-'27'

Download Rinse Parameter

(FF)(STX)(ADR)(SNr.): Start
RD1503: Command Rinse Time 15 sec, Auto Rinse Time 03 hours
(ETX)(CS): End

Meaning	HEX	DEC	Character	Keyboard
	FF	255		ALT-'255'
STX	02	002		ALT-'2' / ^B
ADR	31	049	1	
Snr	31	049	1	
DATA:	52	082	R	
	44	068	D	
	31	049	1	
	35	053	5	
	30	048	0	
	33	051	3	
ETX	03	003		ALT-'3' / ^C
CS	10	016		ALT-'16'

3.5 Description of Error Messages

The instrument can display the following error messages:

Standard Instrument

Program not defined

If the selected program has **not** been defined, the following message is displayed:

```
Program not def
exit
```

Press **exit** to remove the message and return to standby.

```
Run XX yyyyyyy
- + other yes
```

Select a defined program that is to be performed.

Wrong Manifold

If the selected program requires a different type of manifold than the manifold that is fitted to the instrument, the following message is displayed:

```
WRONG MANIFOLD
exit
```

Press **exit** to return to the standby mode.

Either exchange the manifold for the required type of manifold or re-program the procedure for the type of manifold that is fitted.

If the correct type of manifold is fitted, check the setting in the Adjust menu.

Manifold Arm Error Conditions

The following error conditions can occur with the manifold arm movement system:

1. Manifold arm does not move up and down.
2. Manifold arm continually moves up and down and the following message is displayed:

```
Init_Err. cont?
no yes
```

3. The following message is displayed:

```
Manif. arm Error !
Exit
```

When an error occurs, the Service menu can be used to check the various motors and sensors.

Manifold Arm does not Move Up and Down

This error can be caused by the following conditions:

Cam not fitted on the motor shaft.

Check that the cam is fixed onto the motor shaft.

Motor is defective or no power to the motor

Replace the motor

Replace the power supply board

Replace the main board

Manifold Arm Continually Moves Up and Down

This error can be caused by the following conditions:

Top Position Optical Switch incorrectly positioned

Check that the optical switch is correctly positioned and the positioning disk is in the center of the optical switch.

Top Position Optical Switch defective

Replace the optical switch.

Plate Carrier Error Conditions

When a plate transport error occurs and the instrument cannot detect the home position optical switch, the following message is displayed:

Init-Err. cont?
retry yes

The following error conditions can occur with the plate transport system:

1. Plate support not inserted or incorrectly inserted
2. Plate transport motor defective or blocked
3. Home position optical switch defective

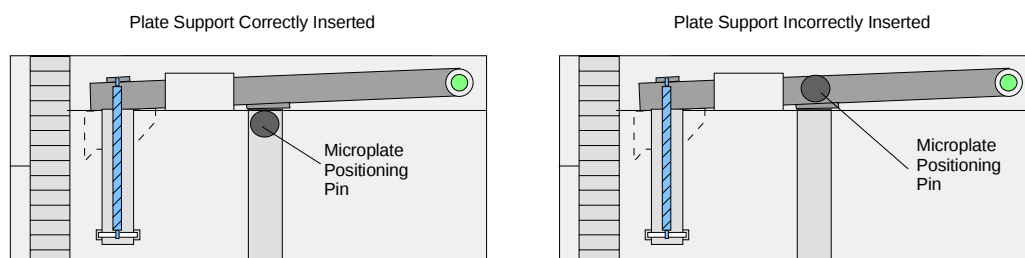
When an error occurs the Service menu can be used to check the motors and sensors.

Plate Support not Correctly Inserted

Check that the plate support is correctly positioned and can be pushed into the instrument when the instrument is switched off.

If the plate support can not be pushed in, remove the plate support and check the following:

1. The guide bar is clean and there is nothing that could stop the plate support moving.
2. Insert the plate support and ensure that it is fitted over the automatic microplate positioning pin.



The plate support cannot be moved under the manifold arm if it is not fitted over the pin.

Program too Big

If more than 60 process steps have been defined, the following message is displayed:

Program too Big
Cont

Press **cont** to remove the message and re-define the program using less than 60 process steps.

Dispensing Pump Error

If the instrument detects that the dispensing pump is not rotating during a procedure the following message is displayed:

XXXXXXXXXXXXXXXXX
Disp.Sens.Err.!!

Where XXXXXXXX is the displayed procedure message.

The instrument is now locked with this error message, switch the instrument off and then switch it on again.

Change the dispensing pump.

Instrument with Liquid Sensor and Bottle Holder

Waste Bottle Full at START

When the selected program is confirmed, the instrument checks if the waste bottle is full.

If the waste bottle is full, the following message is displayed:

Wastebottle Full
yes

Press **yes** to remove the message to return to the start and the following message is displayed:

Run XX yyyyyyy
- + other yes

Empty the waste bottle and restart the program.

Waste Bottle Full during PROCEDURE

If the waste bottle is full during the washing procedure, the following message is displayed after the washing procedure is completed:

Wastebottle Full
yes

Press **yes** to remove the message to proceed to the standby mode. The following message is displayed:

Run XX yyyyyyy
- + other yes

Empty the waste bottle and the instrument is ready to start the next procedure.

Liquid Bottle Empty

If the liquid bottle is empty before program is started, the following message is displayed:

Liq. Empty Ch: X
yes

Fill the liquid bottle and press **yes** to remove the message and continue with the program.

Waste Sensor Error

This message is displayed only when the Liquid Sensor option is set to **yes** in the service menu. The bottle holder should not be connected to the instrument.

Waste Sens Error
yes

Instrument Fitted with Printer

Printer Error

If the protocol can not be printed, the following message is displayed:

Printer Error cont retry

Check that the printer is connected to the instrument and switched on and that there is paper in the printer.

When the printer error has been corrected, press **retry** to repeat the printing procedure.

If the printout is not required, press **cont** to return to the standby mode.

Instrument Fitted with Manifold Detect Sensors

Manifold Arm Error

If the manifold arm is not lowered correctly due to the manifold catching on something. (For example: the side of the wells) The following message is displayed:

Manif. arm Error ! Exit

Press **exit** to remove the error message and the instrument returns to the standby mode.

Check that the microplate is correctly inserted into the plate support.

Check that the manifold arm is not blocked.

Check if the needles are catching on the side of the microplate, use the Adjust menu to adjust the positions for this type of microplate.

Wrong Manifold

The following message may be displayed when a program is started.

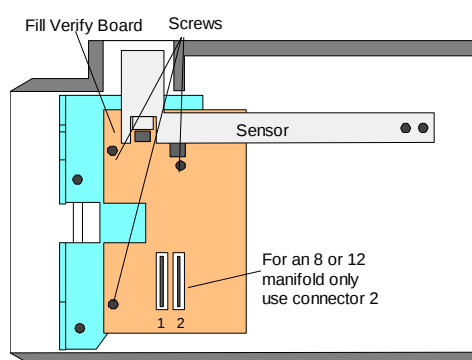
Wrong Manifold
exit

Press **exit** to remove the error message and the instrument returns to the standby mode.

Check that the correct manifold is fitted for this program.

If the correct manifold is fitted, use the Service menu to check the manifold type optical switches are working correctly.

If the Fill Verification option is fitted, check that the ribbon cable is connected correctly. Connector 1 should be used for 16 manifolds and connector 2 for 8 and 12 manifolds.



Instrument Fitted with Fill Verification

The Fill Verification option is a method of checking the filling of the wells in a microplate. Possible errors with the dispensing system as well as the aspiration system can be recognised.

The Fill Verification only works with the OVERFLOW wash procedure.

The wash buffer forms an electrical connection between the dispensing needles and the aspirating needles. As soon as the wash liquid touches the aspirating needles the electric circuit is closed.

The following errors occur using this method.

- Fill Comm. Error
- Fill Dispens Error
- Fill Aspiration Error
- Fill Function Error

Fill Comm. Err.

If there is no communication between the main board and the fill verification board, the following message is displayed:

Fill Comm. Err.
Call Service !

Check U14 on the main board and ensure that the fill verification cable is connected correctly.

Fill Dispens Error

If the instrument detects that any of the needles are dispensing no or too little solution, the instrument stops and the following error messages are scrolled on the display:

Inadequate Wash!
exit

Check Disp. Path
exit

Press the **exit** key to remove the error message and to return to the standby mode.

Possible errors could be a result of blocked dispensing needles, bubbles in the dispensing channels, empty liquid bottles, the dispensing pump no longer functions or a non-conductive liquid is being used.

If no connection between the dispensing needles and the relevant aspirating needles is made at least 30 µl before the end of the dispensing step, the wash program will be interrupted.

Check that the dispensing needles are clear and that the reagent bottle has enough solution and the inlet tube is in the solution.

Use the Prime menu to fill the liquid system with solution.

Fill Aspiration Error

When the well is not correctly aspirated the following error is displayed:

Fill Asp. Err ! exit

The problem is caused by a blocked aspirating needle or the aspirating pump may not be functioning correctly. Use the cleaning needles to clean the aspirating needles or replace the pump.

In order to prevent the wells from overflowing, the instrument checks when the individual aspirating needles come into contact with the wash solution. If this happens before 200 µl has been dispensed into the wells the program is stopped immediately. This can occur when the well was not or not completely aspirated, due to a blocked aspirating needle / tube or the general aspiration being too weak.

Fill Function Error

If the fill verification board needle status can not be deleted, the following error message is displayed:

Fill Funct.Err.! exit

Press **exit** to remove the error message and return to the standby mode.

The problem is caused by an electrical conducting liquid connection from the dispensing to the aspirating needles on the manifold. Disassemble the manifold and clean it. Test it using the Service menu/Function Test or change the manifold if the old manifold does not work.

The prerequisite for a definite identification of the above mentioned error, is the lack of an electrical connection between the dispensing and aspirating needle(s) before the wash procedure is started and after the priming procedure. The instrument checks this continually before the wash procedure is started and at the beginning of each row. If a connection already exists, the program is interrupted immediately or will not even be started.

The underside of the manifold must then be cleaned, as the deposits from the wash buffer can produce an electrical connection between the needles, which could prevent the Fill Verification option from functioning correctly.

Test Conditions

The following conditions are required for the Fill Verification to function flawlessly.

- The conductance of the wash buffer must be between 5 mS/cm and 30 mS/cm.
- The amount of wash liquid dispensed must be enough so excluding the Overflow Position at least 100 µl overflow is produced.
- At least 450 µl should be dispensed with an Overflow Position slightly above the upper well limit.

Conductance of a Standard Wash Buffer

Most of the commercial wash buffers lie in the mentioned conductance ranges. The conductance is proportional to the wash buffer concentration and can be changed.

The following values were measured using a normal dilution:

Wash buffer

Ortho Diagnostic System	1:20	14.0 mS/cm
SIGMA .Phosphate buffered saline Tablets	1 tablet in 200ml	14.7 mS/cm
bioMérieux. Phosphat buffer concentrate	1:25	13.7 mS/cm
BOUTY.Beta IgM	1:20	14.2 mS/cm
MUREX .Wash fluid (Glycine/Borate)	1:20	7.8 mS/cm
BIOTEST ELPHA . (Nr. 3+4)	1:10	28.1 mS/cm

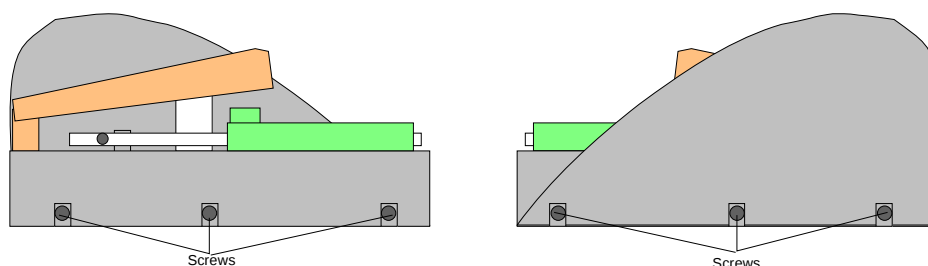
4. Removing and Replacing the Instruments Cover

4.1 Removal of Instruments Top Cover

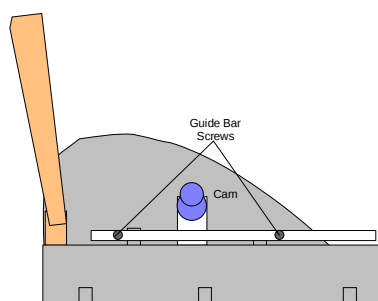
Before the manifold arm movement system can be serviced, the instrument's top cover must be removed.

The instrument cover is removed using the following procedure:

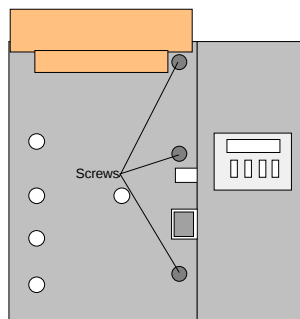
1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Loosen and remove the six screws on the sides of the instrument.



3. Raise the manifold arm so that it is in the fully open position.
4. Carefully tilt the plate support and pull the plate support away from the instrument.



5. Loosen and remove the two guide bar screws and remove the guide bar from the instrument.
6. Pull the cam off the motor shaft.
7. Loosen and remove the three cover screws on the right hand side of the manifold arm.

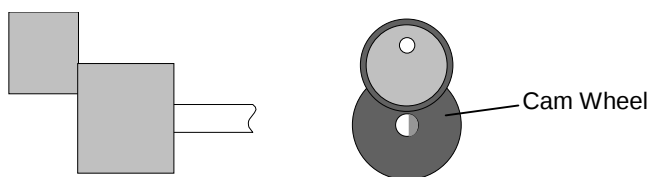


8. Carefully lift the cover a small distance away from the instrument.
9. Either place the cover by the side of the instrument or disconnect the keyboard/display connector from the main board.

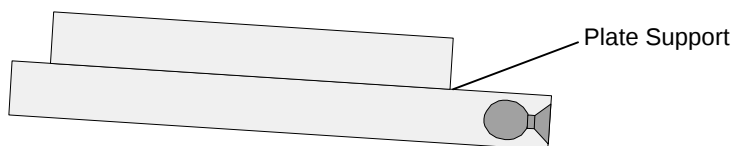
4.2 Replacing the Instruments Top Cover

The instrument's top cover is replaced using the following procedure:

1. Reconnect the keyboard / display connector, if it was removed.
2. Raise the manifold arm so that it is in the fully open position.
3. Carefully slide the cover over the instrument.
4. Insert and tighten the three cover screws on the right hand side of the manifold arm.
5. Replace the guide bar and insert and tighten the two guide bar screws.
6. Slide the cam onto the motor shaft. *The shaft has a flat area so that the cam can not be incorrectly fitted.*



7. Insert and tighten the six cover screws on the side of the instrument.
8. Slightly tilt the plate support towards the right.



The plate support must be slightly tilted so that it goes over the pin that activates the automatic microplate centering mechanism.

9. Carefully slide the plate support with the waste sink at the rear over the guide bar.
10. Push the plate support so that it is fully placed in the instrument.
11. Lower the plate support.
12. Lower the manifold arm.
13. Insert the mains power cable and switch the instrument on.

5. Liquid System

5.1 Introduction

This chapter contains the description of the liquid system of the instrument.

The liquid system consists of the following parts depending on the various instrument options:

Standard Instrument

Dispensing pump and solenoid valves for dispensing liquid into the microplate.

Aspirating pump for aspirating the liquids out of the microplate.

Instrument Options

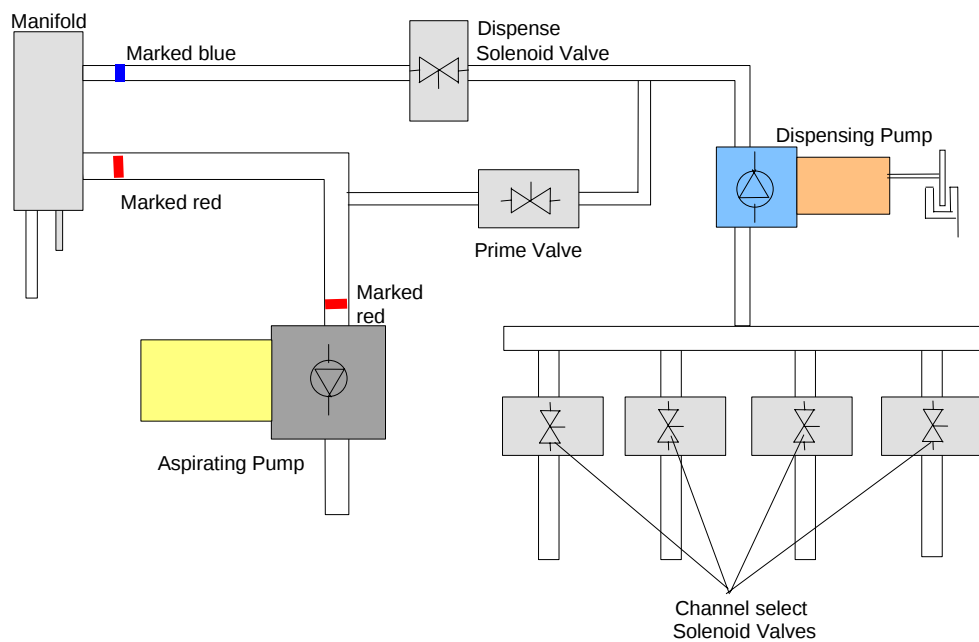
Aerosol pump and special manifold to aspirate any aerosol vapors away from the microplate when it washed.

Waste bottle full sensor to detect when the waste bottle is full.

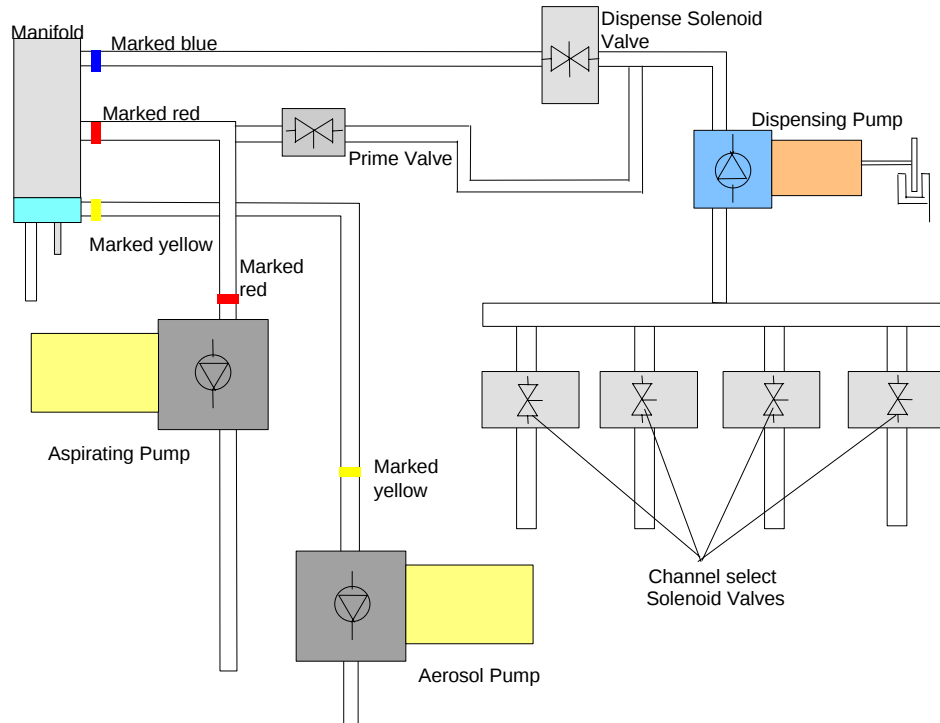
Fill Verification manifold to detect that each channel is dispensing liquid.

5.1.1 Liquid System Diagram

Standard Instrument *



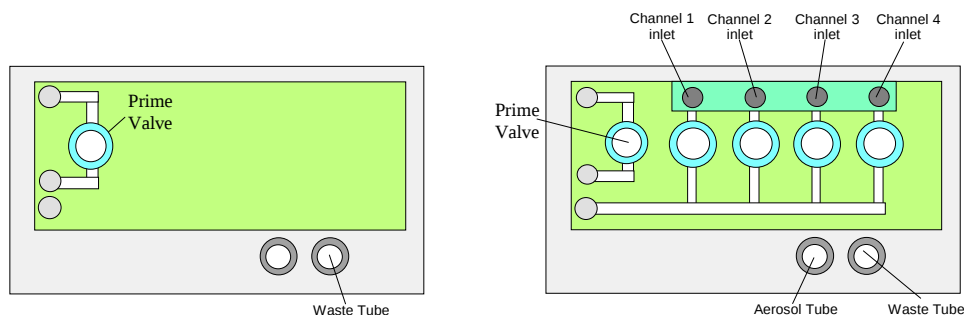
Instrument with Aerosol Aspiration *



* Some of the instruments may include the prime valve.

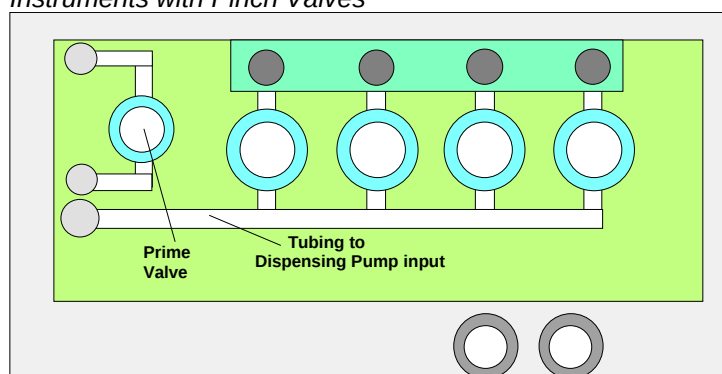
5.1.2 Dispensing System Description

The instrument can use up to four different solutions depending on the number of solenoid valves that are fitted.

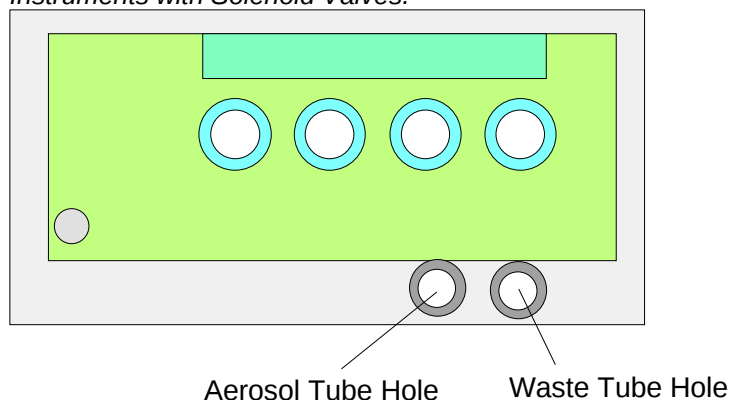


When the solution is to be dispensed, the instrument activates the solenoid valve for the required channel, starts the dispensing pump and activates the dispense solenoid valve.

Instruments with Pinch Valves



Instruments with Solenoid Valves.



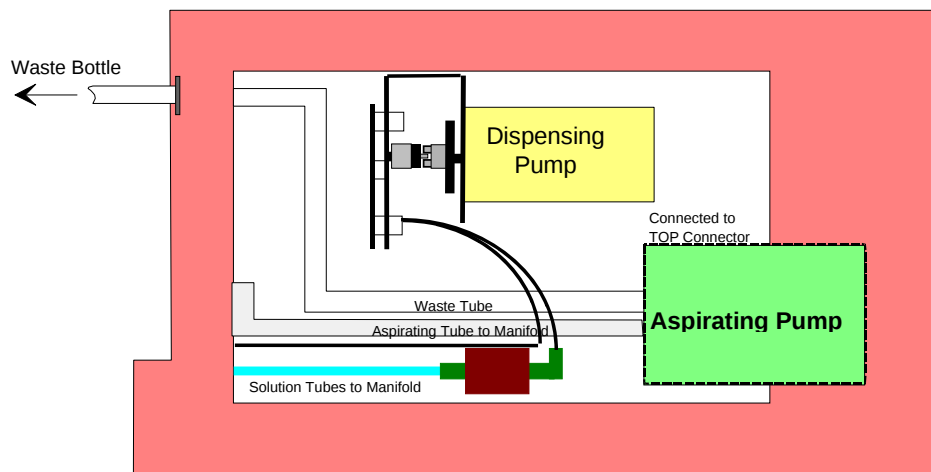
Some of the instruments may include the prime valve.

5.2 Replacement Procedure

5.2.1 Replacing the Dispensing Pump

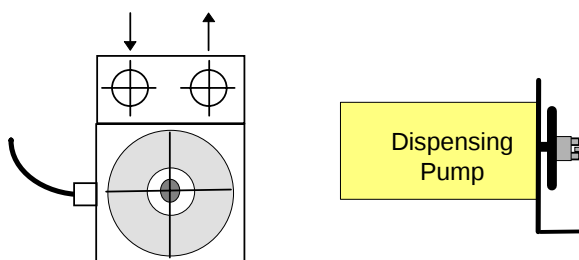
The dispensing pump is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover.
2. Remove the dispensing pump power connector from the main board.
3. Turn the instrument onto the right hand side.



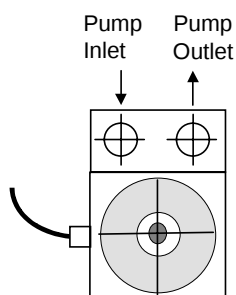
4. Disconnect the tubing from the dispensing pump.
5. Carefully pull the dispensing pump away from the instrument.

The pump is held in place by three screws.



6. Carefully pull cable and connector through the slot in the middle plate.
7. Remove the dispensing pump.
8. Exchange the dispensing pump.
9. Insert the cable and connector through the slot in the middle plate.
10. Carefully place the dispensing pump into position and secure it with the three screws.

11. Reconnect the tubing to the pump



12. Reconnect the dispensing pump power connector onto the main board.
13. Replace the instrument's cover.



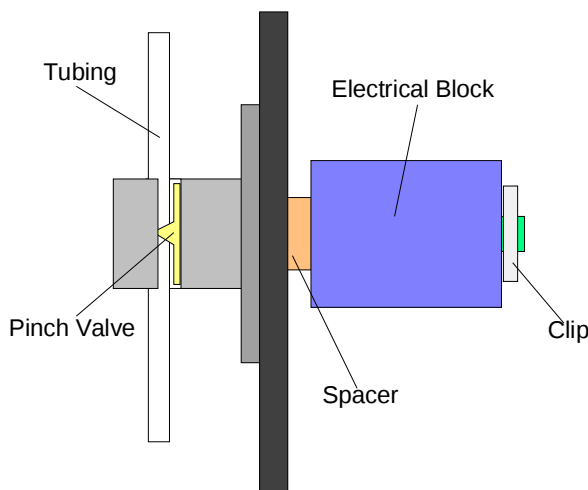
When the dispensing pump is replaced, perform Clear All in the service menu. The dispensing pump calibration must be performed. Ensure that the calibration procedure is repeated if the weight (300 μ l) is greater than 33 g or less than 24 g before calibrating the instrument for the first time.

Reset all features of the instrument (Plate Type, Customers specific programs, Manifold Type, Priming position, Adj. Plate. Ref, Options and select number of liquid channels).

5.2.2 Replacing the Solution Solenoid Valves (Instruments with Pinch Valves)

The solution solenoid valves are replaced using the following procedure:

1. Disconnect the instrument from the power supply.
2. Remove the inlet tubing connector from the holding plate above the solenoid valves.
3. On the end of the solenoid valve, press and hold the white center piece down and carefully remove the tubing from the pinch valve.

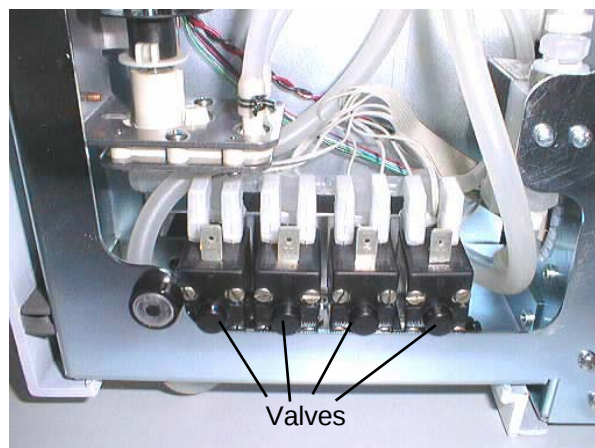
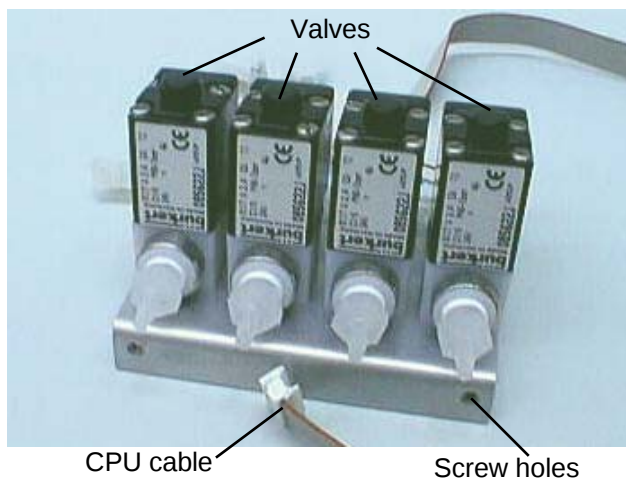


4. Remove the clip on the end of the shaft behind the electrical block.
5. Remove the electrical block from the shaft.
6. Disconnect the connectors from the electrical block.
7. Remove the two screws that hold the pinch valve unit onto the back panel.
8. Carefully remove the electrical block from the instrument.
9. Exchange the electrical block.
10. Connect the connectors onto the electrical block.
11. Exchange the Pinch valve unit.
12. Screw the new pinch valve unit onto the back panel.
13. Slide the electrical block over the shaft for the pinch valve.
Ensure that the spacer is fitted between the pinch valve and the electrical block.
14. Slide the clip onto the end of the shaft behind the electrical block.
15. Press and hold the white center piece down on the end of the solenoid valve and carefully insert the tubing into the pinch valve.
16. Insert the inlet tubing connector into the holding plate above the solenoid valves.
17. Adjust the tubing so that it is not bent.

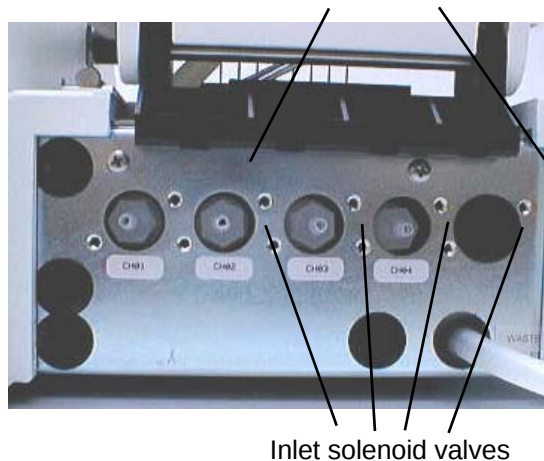
5.2.3 Replacing the Solution Solenoid Valves

The solution solenoid valves are replaced using the following procedure:

1. Disconnect the instrument from the power supply.
2. Remove the excenter from the motor axis.
3. Remove the plate transport.
4. Remove the plate transport bar by unscrewing the two screws.



5. Remove the housing by unscrewing the nine screws. Ensure that the cable connecting the display to the CPU is disconnected first!
6. Disconnect the solenoid cable from the CPU.
7. Remove the inlet and the outlet tubing from the valve block.
8. Unscrew the two screws securing the valve block on to the instrument.
Screws



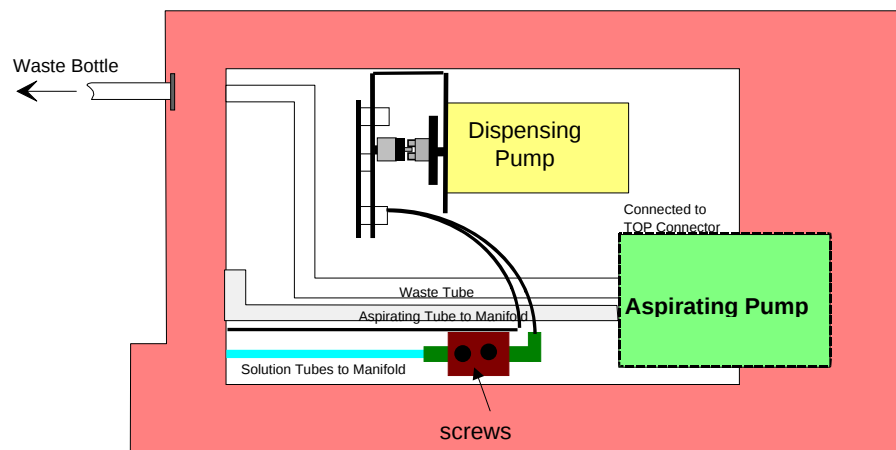
9. Remove the complete valve block from the instrument.

10. Position the new valve block into the instrument and secure it into place by tightening the two screws.
11. Replace the inlet and the outlet tubing into the valve block.
12. Connect the solenoid cable to the CPU.
13. Replace the housing and secure it with the nine screws.
Ensure that the cable connecting the display to the CPU does not get trapped!
14. Replace the plate transport bar and secure it by tightening the two screws.
15. Replace the excenter.
16. Connect the instrument to the power supply.

5.2.4 Replacing the Dispense Solenoid Valve

The dispense solenoid valve is replaced using the following procedure:

1. Disconnect the instrument from the power supply.
2. Turn the instrument onto the right hand side.
3. Remove the two screws that hold the solenoid valve onto the bottom plate.

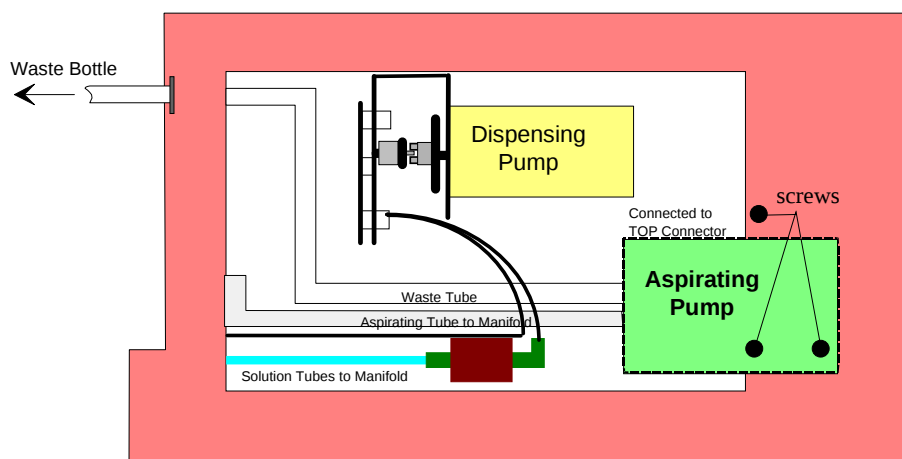


4. Carefully remove the solenoid valve a small distance away from the instrument.
5. Disconnect the electrical connectors.
6. Disconnect the tubing from the connectors.
7. Exchange the solenoid valve.
8. Reconnect the tubing onto the solenoid valve.
9. Reconnect the electrical connectors.
10. Screw the new solenoid valve into place on the bottom plate.

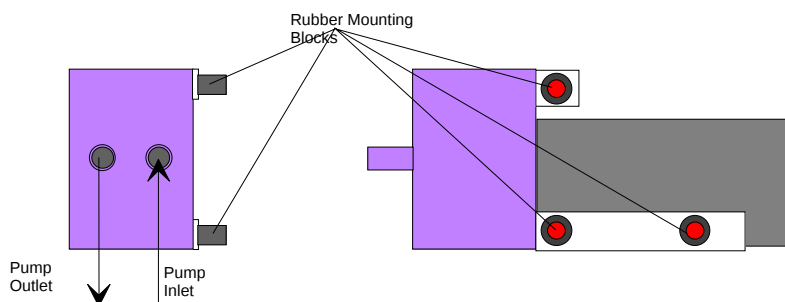
5.2.5 Replacing the Aspirating Pump

The aspirating pump is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover.
2. Remove the aspirating pump connector from the main board.
3. Disconnect the tubing from the aspirating pump.
4. Turn the instrument onto the right hand side.
5. Loosen and remove the three screws that hold the aspirating pump onto the bottom plate.



6. Carefully pull the pump cables and connector through the cable slot in the middle panel.
7. Carefully remove the aspirating pump from the instrument.
8. Exchange the aspirating pump.
9. Carefully push the pump cables and connector through the cable slot in the middle panel.
10. Carefully insert the aspirating pump into position and screw it into place with the three screws.
11. Ensure that the three rubber mounting blocks are fitted.

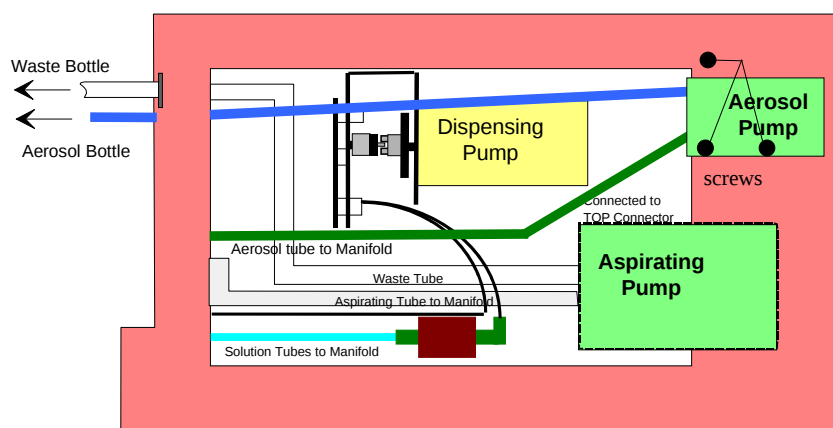


12. Reconnect the aspirating pump connector onto the main board.
13. Reconnect the tubing.
14. Replace the instrument's cover. (See chapter 4)

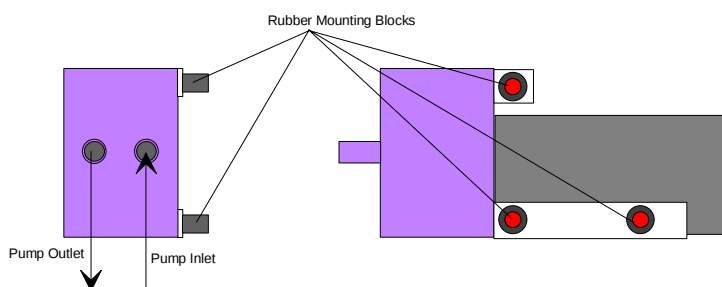
5.2.6 Replacing the Aerosol Pump

The aerosol pump is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover.
2. Remove the aerosol pump connector from the main board.
3. Disconnect the tubing from the aerosol pump.
4. Turn the instrument onto the right hand side.
5. Loosen and remove the three screws that hold the aerosol pump onto the bottom plate.



6. Carefully pull the pump cables and connector through the cable slot in the middle panel.
7. Carefully remove the aerosol pump from the instrument.
8. Exchange the aerosol pump.
9. Carefully push the pump cables and connector through the cable slot in the middle panel.
10. Carefully insert the aerosol pump into position and screw it into place with the three screws.
11. Ensure that the three rubber mounting blocks are fitted.



12. Reconnect the aerosol pump connector onto the main board.
13. Reconnect the tubing.
14. Replace the instrument's cover. (See chapter 4)

6. Mechanical System

6.1 Manifold Arm Movement System

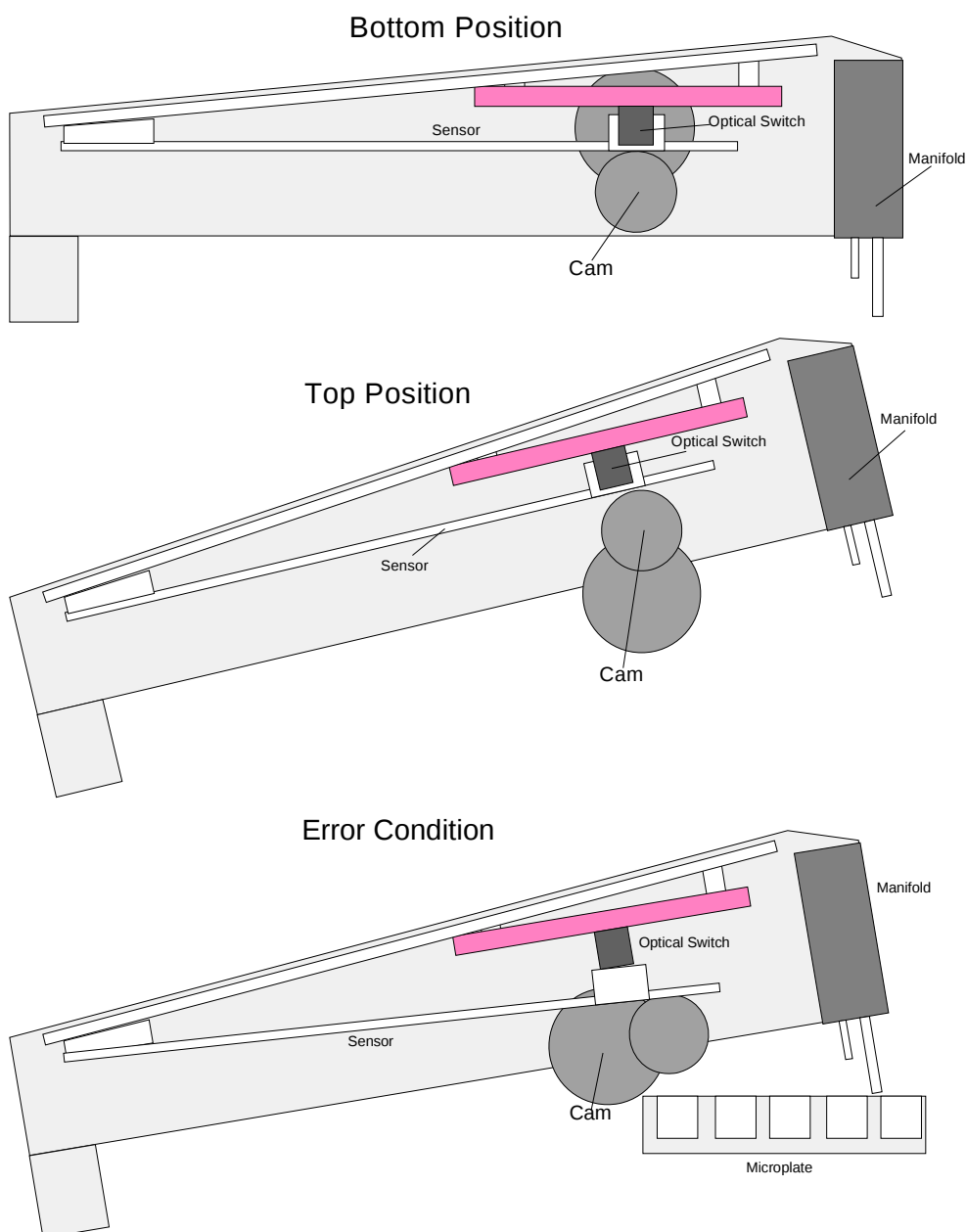
This option contains the description of the movement system for raising and lowering the manifold arm.

The manifold arm is raised and lowered by a cam, which is rotated by a motor.

The manifold arm is kept in the raised position, when the power is removed from the instrument, by a spring.

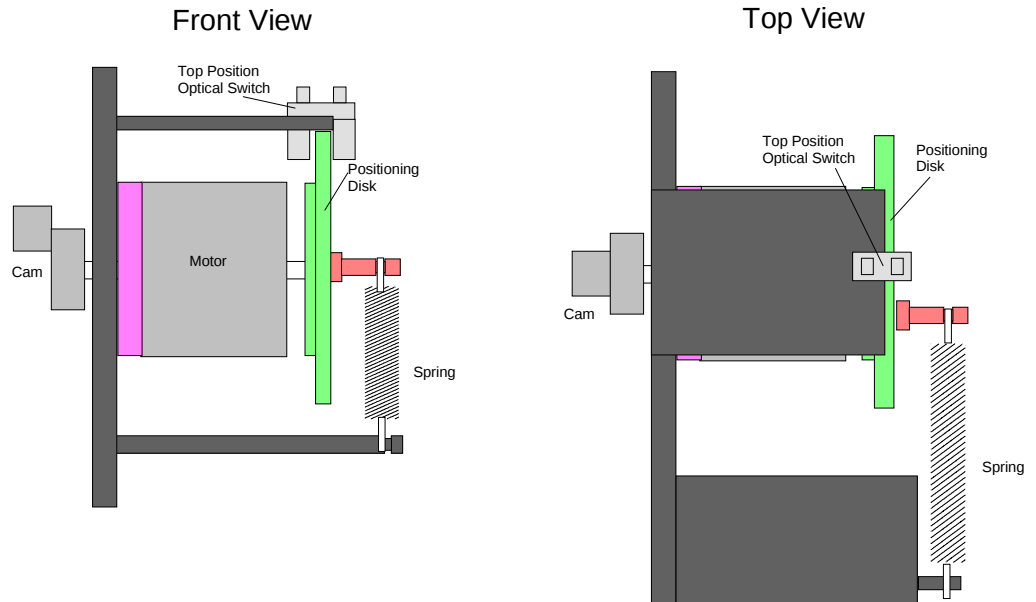
The top position is detected by an optical switch and a slot in the positioning disk.

If the Manifold Detect option is fitted, a sensor on the manifold arm detects when the manifold arm is not lowered correctly due to an error. For example: if the needles are incorrectly positioned and touch the microplate.



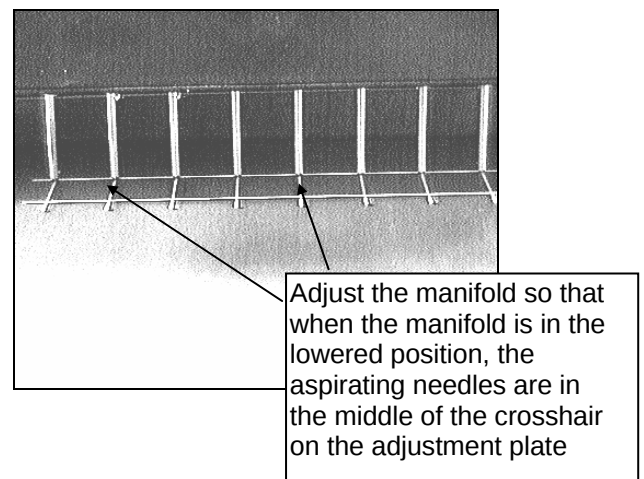
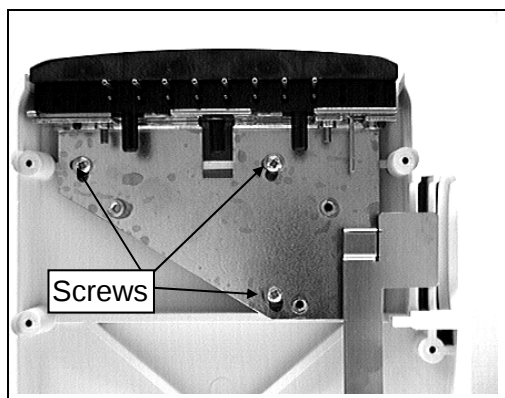
6.1.1 Description of Manifold Arm Movement Parts

The drawings below show the main components for the manifold arm movement system.



6.1.2 Adjusting the Manifold

Position the reference plate and remove the black cam wheel. Position the adapter plate manifold so that when the manifold is lowered, the aspirating needles are above the crosshairs on the reference plate. Secure the screws with adhesive.



6.2 Plate Transport System

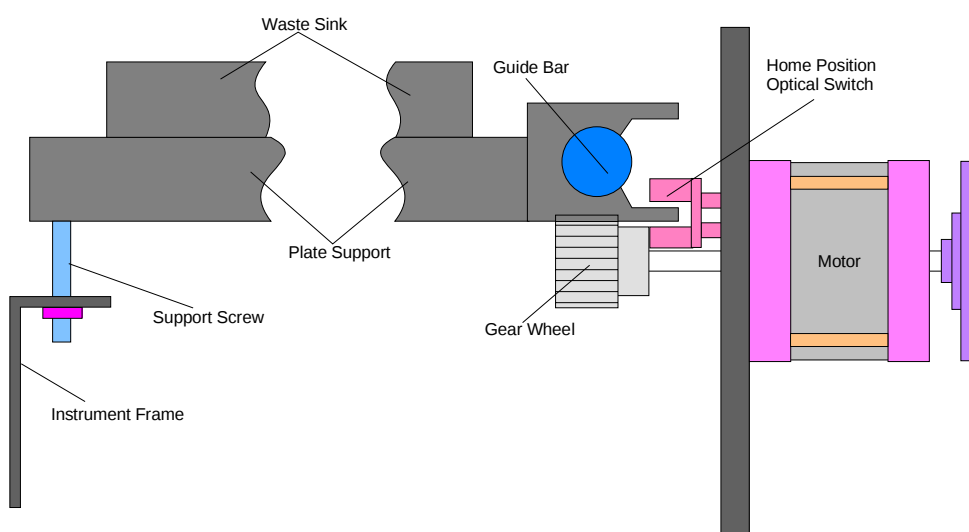
This option contains the description of the plate transport system for moving the plate support in and out of the instrument.

The plate support is moved by a motor, which drives a gear wheel that fits in the toothed rack on the bottom of the plate support.

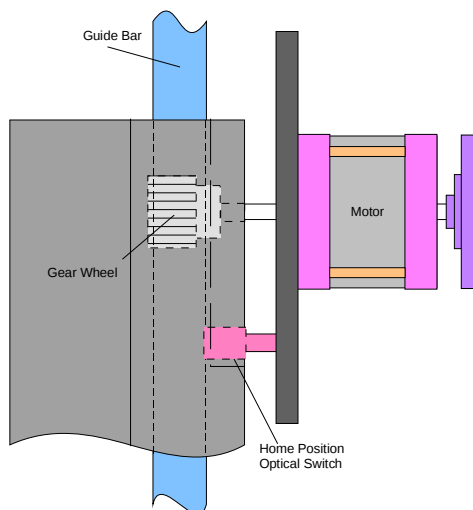
The home position is detected by an optical switch and an edge on the plate support.

The plate support is supported by the guide bar on the right hand side and a series of support pins on the left-hand side.

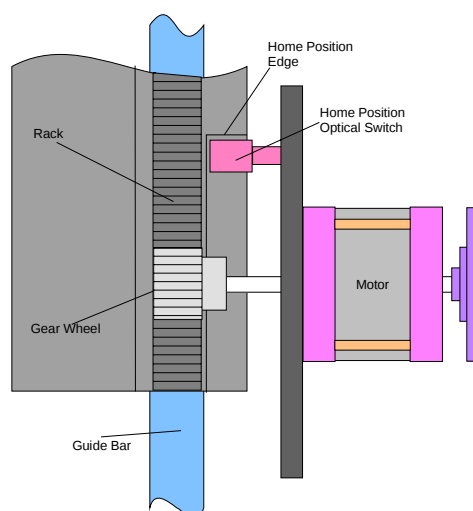
Front View



Top View

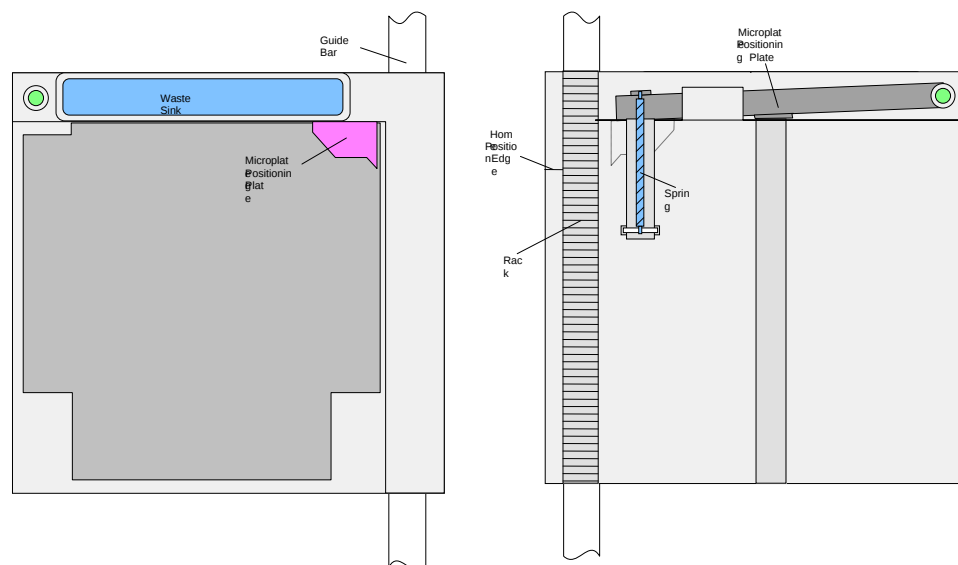


Bottom View



6.2.1 Plate Support

The plate support contains an automatic plate positioning system so that the microplate is always correctly positioned.

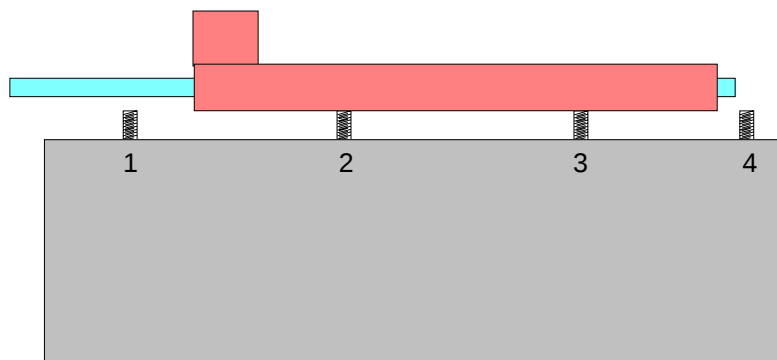


6.2.2 Leveling the Plate Support

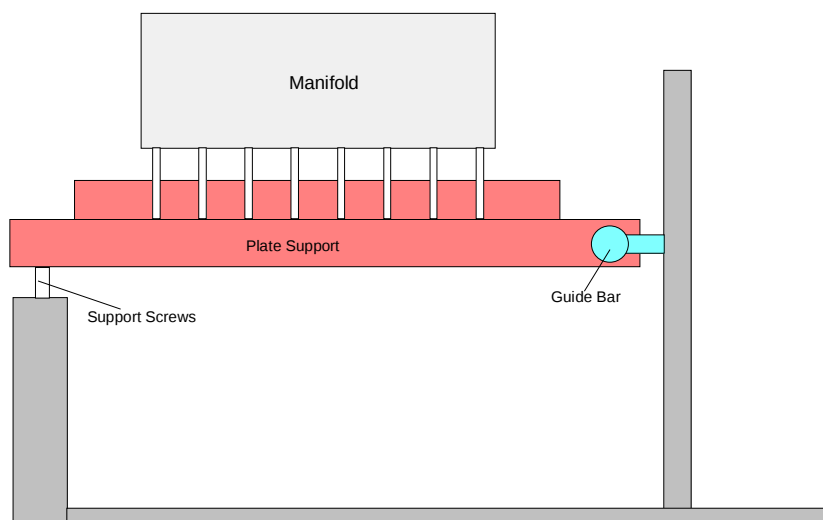
In order that all the wells in the microplate are correctly aspirated, it is important that the plate support is level with the manifold.

The plate support is leveled using the following procedure:

1. Insert the plate support and push it back so that it is positioned over the two middle support screws.



2. Using a strip of tape, temporarily stick the plate mismatch sensor in the top position.
3. Carefully lower the manifold arm so that the manifold needles touch the plate support.
4. Check that all the needles touch the plate support.



5. If all the needles do not touch the plate support, adjust the height of the second support screw until all the needles touch the plate support.

The support screws are locked in place with screw retaining liquid.

6. Raise the manifold arm to the fully back position.
7. Push the plate support in until it is over the first support screw.
8. Adjust the height of the first support screw until it just touches the plate support.

9. Push the plate support backwards and forwards to check that it can move over the first and second support screws.
10. Push the plate support in until it is over the third support screw.
11. Adjust the height of the third support screw until it just touches the plate support.
12. Push the plate support backwards and forwards to check that it can move freely over the support screws.
13. Push the plate support in until it is over the fourth support screw.
14. Adjust the height of the fourth support screw until it just touches the plate support.
15. Push the plate support backwards and forwards to check that it can move freely over all the support screws.

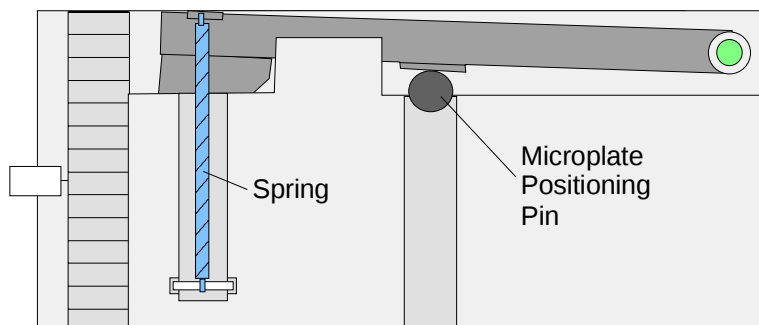
Lock the support screws into place with screw retaining liquid.

16. Remove the plate support.
17. Remove the guide bar.

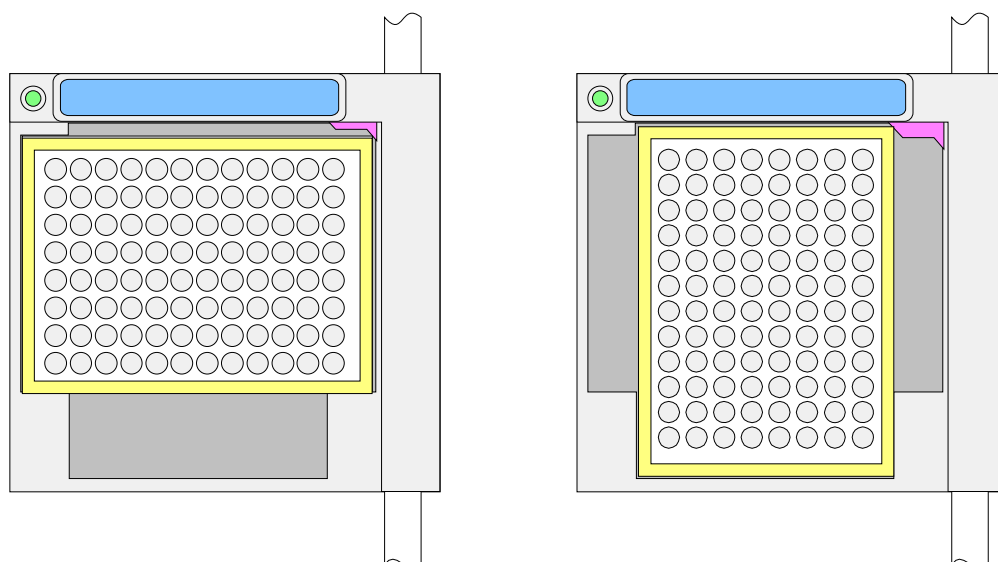
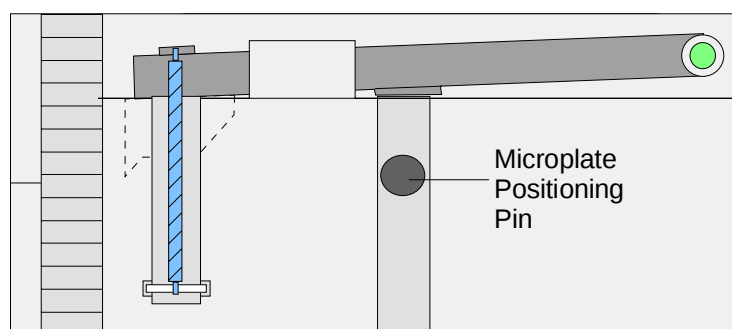
6.2.3 Microplate Positioning System

The microplate positioning system automatically positions the microplates correctly in the plate support.

The pin below the plate support (when it is in the home position) pushes the microplate positioning plate back so that the microplate can be inserted.



When the plate support moves away from the home position, the spring pulls the microplate positioning plate back and the plate then automatically positions the microplate.



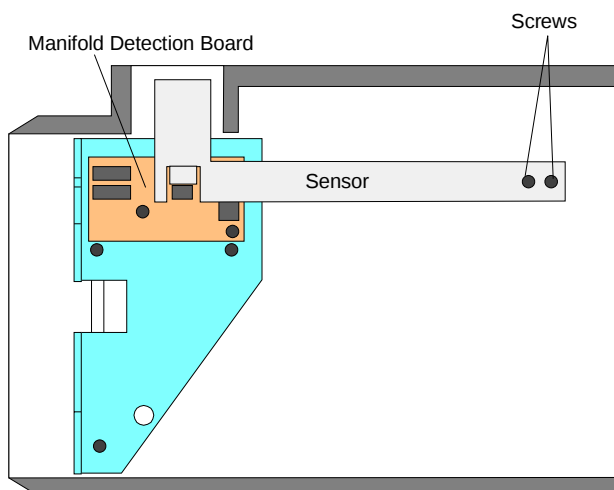
When the plate support is returned to the home position the pin pushes the plate back so that the microplate is released and can be removed.

6.3 Replacement Procedure

6.3.1 Replacing the Manifold Arm Error Sensor

The metallic cover is replaced using the following procedure:

1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Raise the manifold arm so that it is in the fully open position.
3. Disconnect the tubing from the manifold.
4. Remove the two screws that hold the manifold in place.
5. Remove the manifold from the instrument.
6. Remove the two screws that hold the sensor onto the cover of the manifold arm.

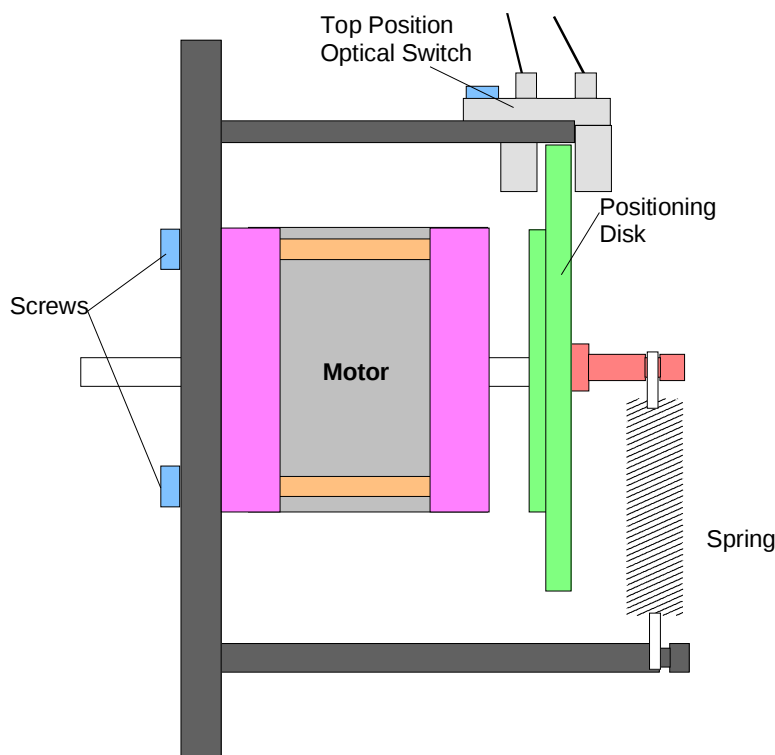


7. Exchange the sensor and secure it onto the cover.
8. Replace the manifold and secure it into place with the two screws.
Ensure that the manifold type indicator is correctly positioned in the front optical switches.
9. Reconnect the tubing onto the manifold.
10. Lower the manifold arm to the normal position.
11. Reconnect the instrument to the mains power supply and switch the instrument on.
12. Use the Service menu to check that the optical switch is working correctly.

6.3.2 Replacing the Motor

The manifold arm motor is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover.
2. Remove the spring from the pin on the positioning disk.
3. Remove the motor connector from the main board.
4. Remove the two screws that hold the motor onto the middle panel of the instrument.
5. Carefully remove the motor from the instrument, ensure that the optical switch is not damaged when the motor is removed.



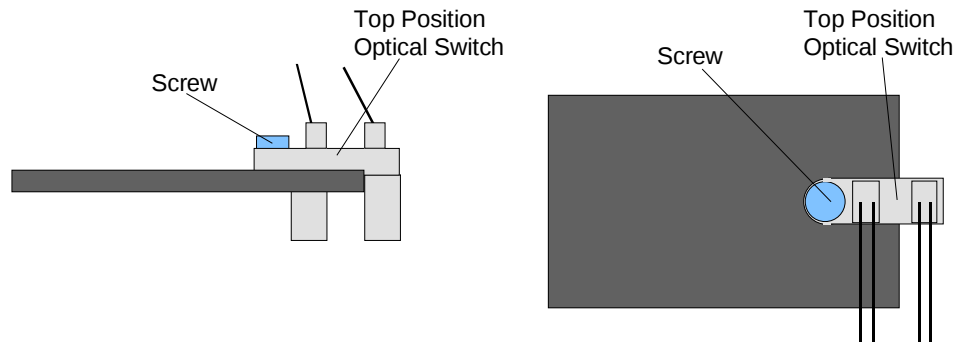
6. Exchange the motor with the positioning disk (positioning disk is glued onto the motor shaft).
7. Screw the motor into place on the middle panel of the instrument.
Position the motor so that the cables are on the right hand side.
8. Connect the motor connector onto the main board.
9. Connect the spring between the pin on the positioning disk and the bracket on the middle panel.
10. Replace the instrument's cover.

6.3.3 Replacing the Top Position Optical Switch

The top position optical switch is used to detect when the manifold arm is in the top position.

The top position optical switch is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover.
2. Disconnect the optical switch connector from the main board.
3. Loosen and remove the screw that holds the optical switch onto the sensor holding plate.

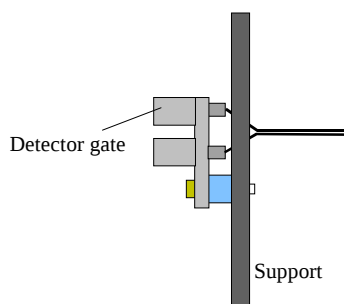


4. Exchange the optical switch.
5. Screw the new optical switch onto the sensor holding plate, ensure that the positioning disk is in the middle of the optical switch.
6. Connect the optical switch onto the main board.
7. Replace the instrument's cover.

6.3.4 Replacing the Plate Support Home Position Optical Switch

The home position optical switch is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the cover. (See chapter 4).
2. Disconnect the connector for the optical switch from the main board.
3. Remove the screw that holds the optical switch onto the middle plate.



4. Carefully pull the connector through the hole in the middle plate.
5. Exchange the optical switch.
6. Carefully insert the connector for the new optical switch through the hole in the middle plate.
7. Insert the optical switch on the middle plate and screw it into place.
Ensure that the spacer is placed between the optical switch and the middle plate and that the optical switch is vertical.
8. Secure the connector for the optical switch onto the main board.
9. Replace the instrument's cover. (See chapter 4).
10. Switch the instrument on and use the Service menu to check that the sensor is working correctly.
11. Use the Adjust menu to set the parameters for the plate definitions as these could be slightly different with the new optical switch.
12. If a 16 way manifold is used, use the Service menu to set the Prime and Rinse positions as these could be slightly different with the new optical switch.

7. Electronic System

7.1 Introduction

This chapter gives the replacement and adjustment procedures for the various electronic parts of the instrument.

This chapter also contains the connection diagrams that show how the various parts of the instrument are interconnected.

The instrument contains the following electronic parts:

1. Main Board

This is the major board in the instrument and contains the microprocessor and the EPROM.

2. Power Supply Board

This board is used to supply the various voltages that are required by the instrument.

3. Keyboard and Display Unit

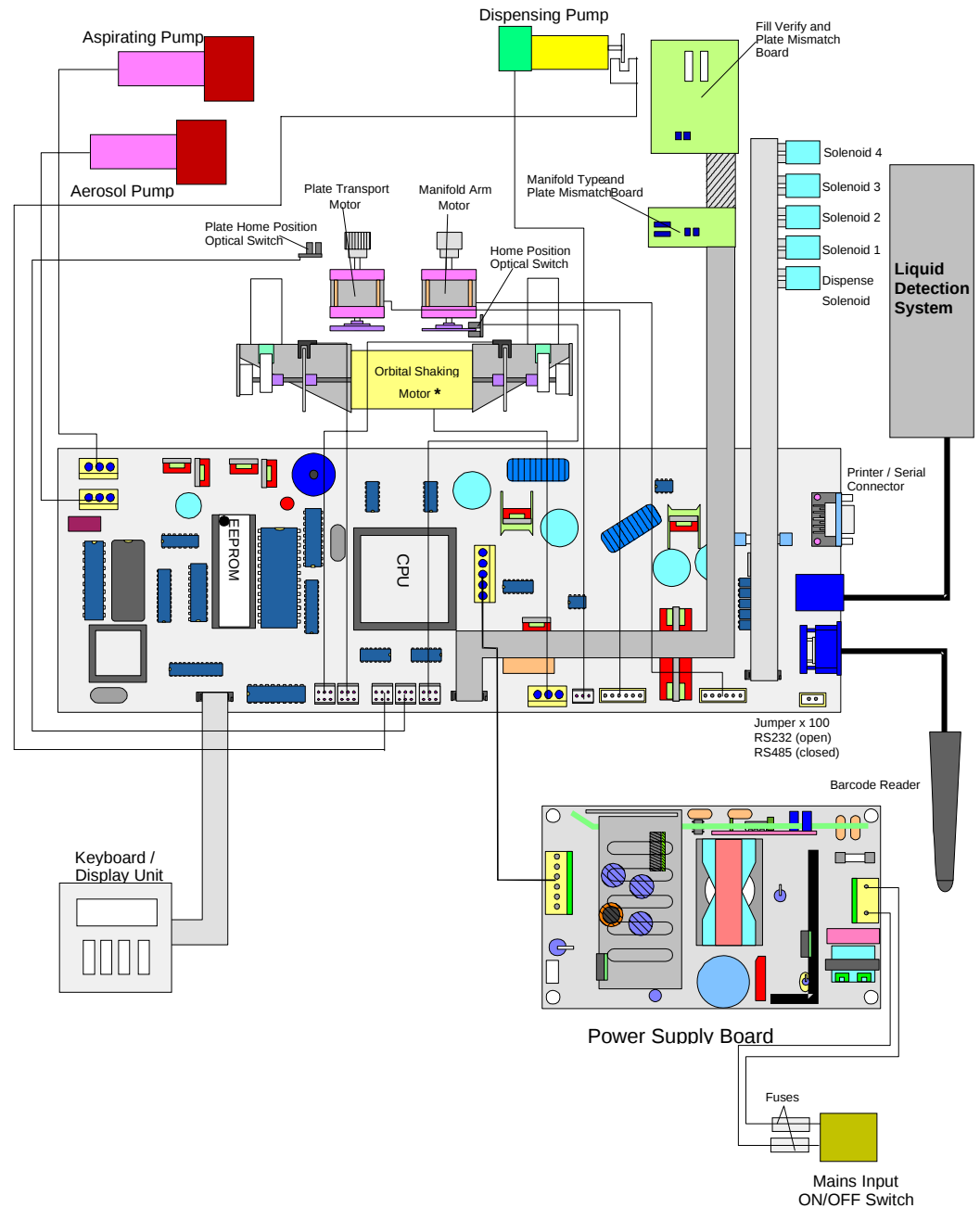
The keyboard and display unit is used to communicate with the instrument.

4. Other Switches

This section gives the layout and circuit diagrams for the other switches that are used in the instrument.

7.2 Interconnection Diagram

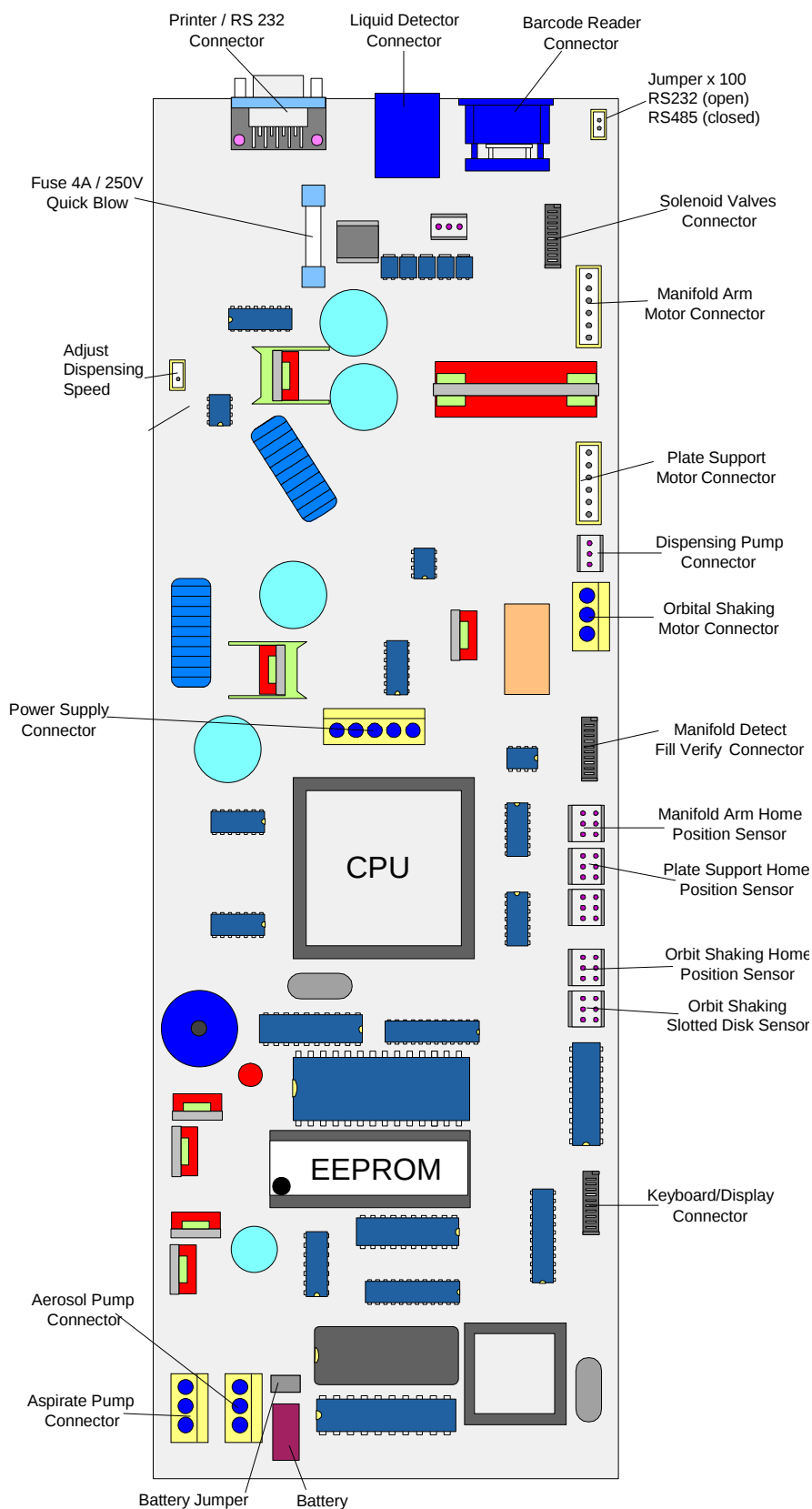
The diagram below shows how the various parts of the instrument are interconnected.



* The Orbital Shaking option is not used.

7.3 Main Board

The diagram below shows the main board:



Reprogramming the Instrument

The instrument is fitted with an **EEPROM** (Electrical Erasable Programmable Read Only Memory) which can be reprogrammed for new software versions or software versions in different languages using the serial interface and a computer.

It is now NOT necessary to exchange the chip as with the earlier versions of the instrument which were fitted with an EPROM (Erasable Programmable Read Only Memory).

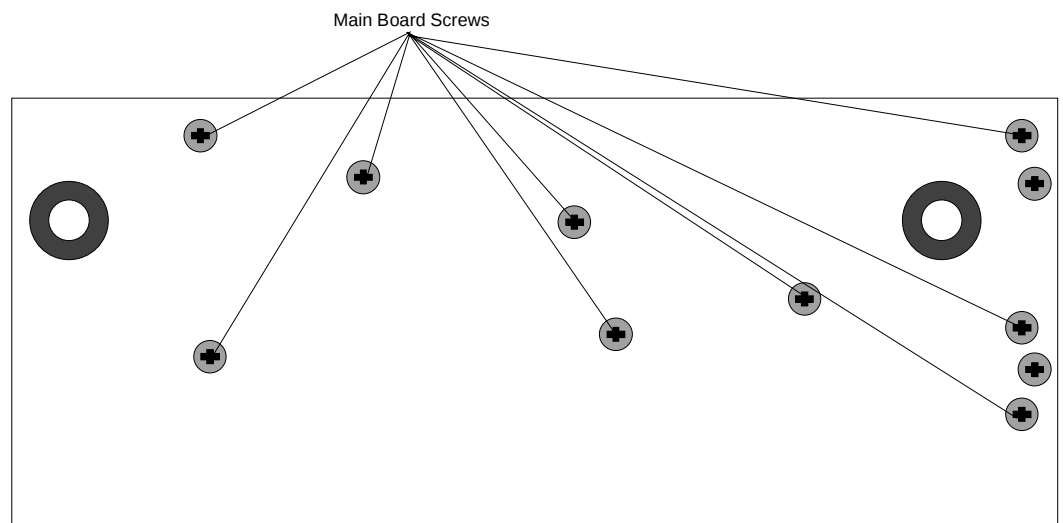
7.3.1 Replacing the Main Board

The Main Board is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the top cover. (See chapter 4).
2. Disconnect ALL the connectors from the main board.

Ensure that the connectors are identified so they can be reconnected correctly

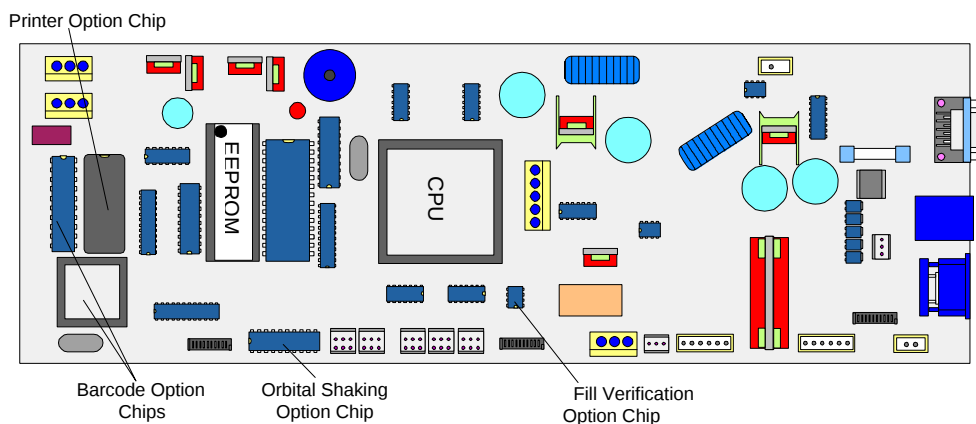
3. Turn the instrument onto the left-hand side.
4. From the bottom of the instrument, remove the nine screws that hold the main board onto the bottom plate.



5. Carefully remove the main board from the instrument.

6. Exchange the main board.

Ensure that the new main board contains all the required chips for the various instrument options.



7. Replace the new main board into the instrument and screw it in place with the nine screws. (Ensure that the battery jumper is set).
8. Reconnect all the connectors to the main board.
9. Replace the instrument's top cover.
10. Reconnect the instrument to the mains power supply and switch the instrument on.

7.3.2 Replacing the Battery

1. Remove the main board from the instrument.
2. Replace the battery using the solder iron.
3. Replace the main board.
4. Reconnect all connectors.
5. Reconnect the instrument to the mains power supply and switch the instrument on.

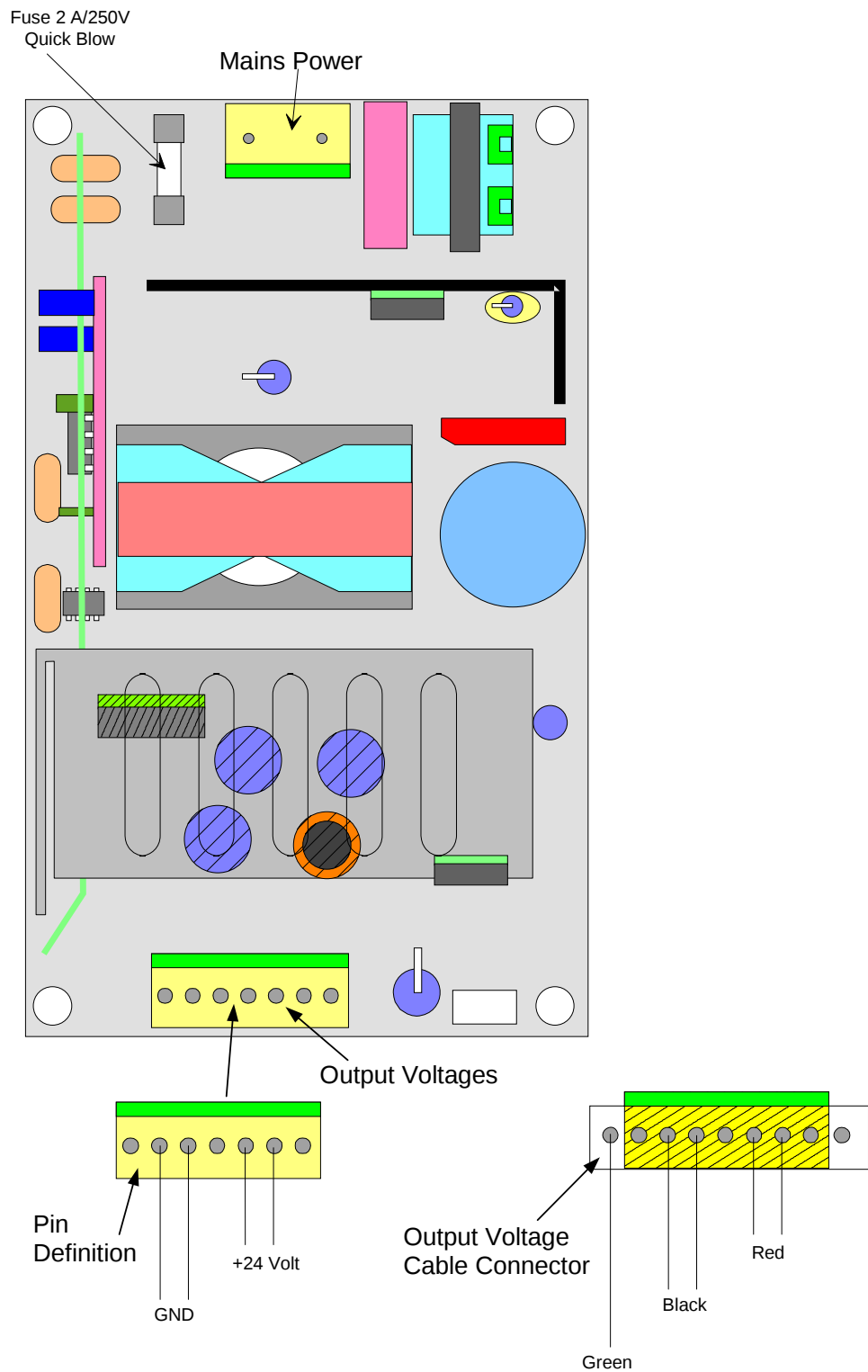


When the main board or the battery is replaced, perform Clear All in the service menu. The instrument must be calibrated for the dispensing pump and for the manifolds. Ensure that the calibration procedure is repeated if the weight (300 µl) is greater than 33 g or less than 24 g before calibrating the instrument for the first time.

Reset all features of the instrument (Plate Type, Customers specific programs, Manifold Type, Priming position, Adj. Plate. Ref, Options and select number of liquid channels).

7.4 Power Supply Board

The power supply board supplies all the required voltages for the instrument.



7.4.1 *Replacing the Power Supply Board*

The power supply board is replaced using the following procedure:

1. Disconnect the instrument from the power supply and remove the top cover.
2. Remove the two screws that hold the power supply board front cover in place.
3. Remove the two screws that hold the rear of the power supply board in place.
4. Carefully pull the power supply board a small distance out of the instrument.
5. Disconnect the mains input cable from the power supply board.
6. Disconnect the output voltage cable from the power supply board.
7. Remove the power supply board.
8. Remove the four screws that hold the spacing blocks onto the power supply board.
9. Exchange the power supply board.
10. Screw the four spacing blocks onto the new power supply board.
11. Connect the mains input cable to the power supply board.
12. Connect the output voltage cable to the power supply board.
13. Carefully fit the new power supply board into place and screw into place with the two rear screws.
14. Replace the cover for the power supply board and screw it into place.
15. Replace the instrument's top cover. (See chapter 4)
16. Reconnect the instrument to the mains power supply and switch the instrument on.

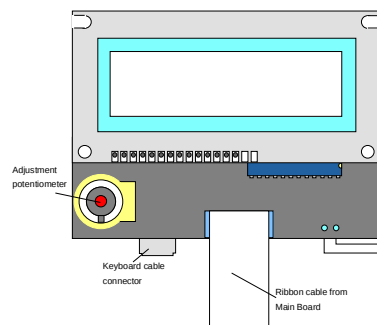
7.5 Keyboard and Display Unit

The keyboard and display unit are not repairable.

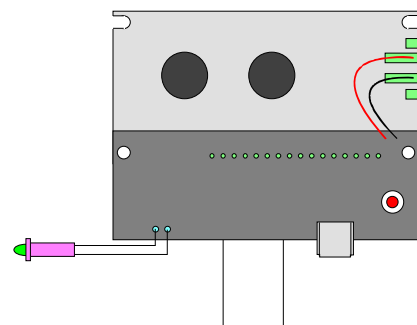
Display Unit

The display unit is a Liquid Crystal display unit with two rows of sixteen digits.

Display Unit Front View



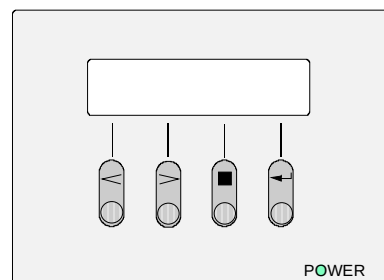
Display Unit Back View



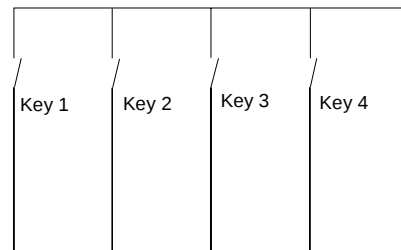
Keyboard

The keyboard is a membrane keyboard with four keys.

Keyboard View



Circuit Diagram



Display Contrast Adjustment

The potentiometer on the display board is used to adjust the contrast for the LCD display unit.

To adjust the display contrast, turn the potentiometer.

When the potentiometer is turned **clockwise**, the contrast is increased.

When the potentiometer is turned **anticlockwise**, the contrast is decreased.

Adjust potentiometer until the displayed messages can easily be read but the blocks that make up each segment can not be seen.

Correct



Too Dark



Too Light



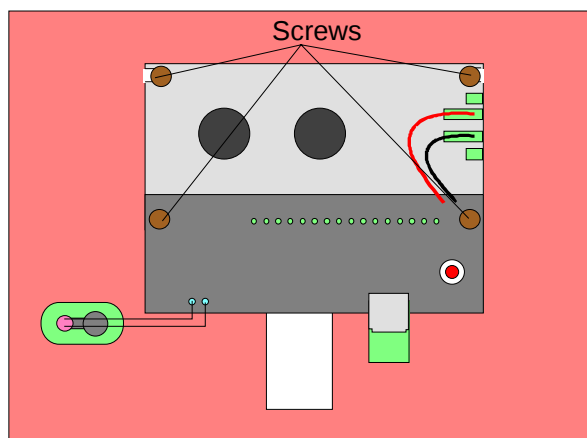
7.5.1 Replacing the Keyboard or Display Unit

The keyboard and display units are fitted to the instrument's top cover and replaced using the following procedures:

1. Disconnect the instrument from the power supply and remove the cover.
2. Disconnect the keyboard/display connector from the main board.

Replacing the Display Unit

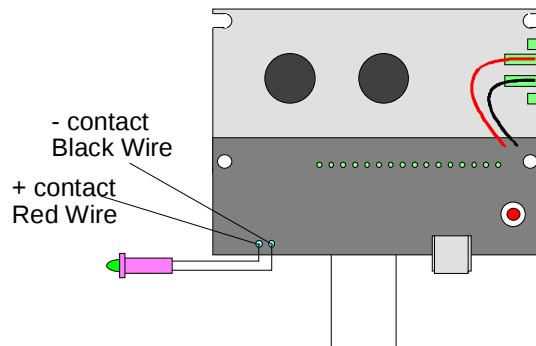
The display unit is held onto the bottom side of the instrument's top cover by four screws.



To replace the display unit, use the following procedure:

1. Remove the keyboard ribbon cable from the connector on the display unit.
2. Remove the four screws that hold the display unit in place.
3. Carefully lift the display unit a small distance away from the top cover.
4. If the keyboard function is correct, carefully unsolder the cables of the power On LED from the display unit board.
5. If the keyboard is defective or damaged, remove the keyboard from the instrument.
6. When the keyboard has been removed, push the power On LED through the hole in the instrument cover and slide the cables to the larger hole and pull the LED through the larger hole.
7. Disconnect the ribbon cable from the display unit.
8. Exchange the display unit.
9. If the LED was removed, push the LED through the large hole and slide the cables to the small hole and push the LED into the small hole.
10. Reconnect the ribbon cable onto the display unit.
11. Screw the display unit loosely into place with the four screws.

12. If the LED was not removed, carefully solder the LED cables onto the display unit board. (red = + left contact, black = - right contact)



13. Carefully turn the instrument's top cover over and check that the display unit is correctly positioned in the center of the window of the keyboard.
If the display unit is not centered, slide the display unit until it is centered.
14. Carefully turn the instrument's top cover over and tighten the four screws that hold the display unit into place.
15. Reconnect the keyboard ribbon cable.
16. Replace the instrument's top cover.
17. Reconnect the instrument to the mains power supply and switch the instrument on.

Replacing the Keyboard

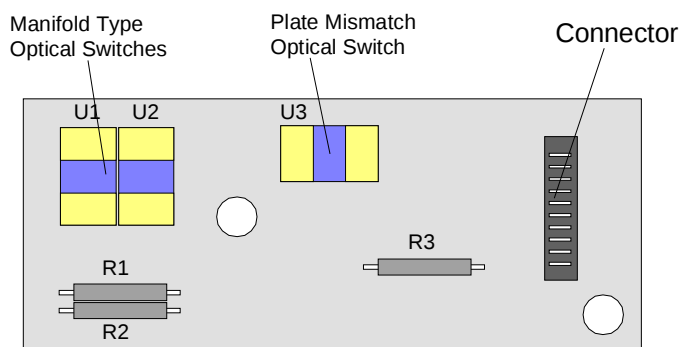
Use the following procedure to replace the keyboard:

1. Disconnect the keyboard ribbon cable from the display unit.
2. Then peel the old keyboard off the instrument's top cover.
3. Carefully pull the ribbon cable through the slot in the instrument's top cover.
4. Slide the ribbon cable for the new keyboard through the slot in the instrument's top cover.
5. Connect the ribbon cable onto the display unit.
6. Remove the backing paper from the back of the keyboard and carefully stick the keyboard into place on the instrument's top cover.
7. Replace the instrument's top cover.
8. Reconnect the instrument to the mains power supply and switch the instrument on.

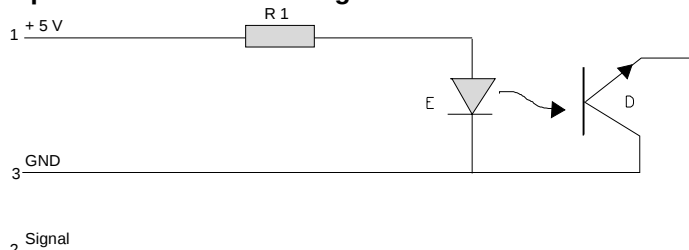
7.6 Manifold Detect Board

The manifold detect board is used to detect the type of manifold that is fitted to the instrument and if it is being lowered correctly.

Board Layout



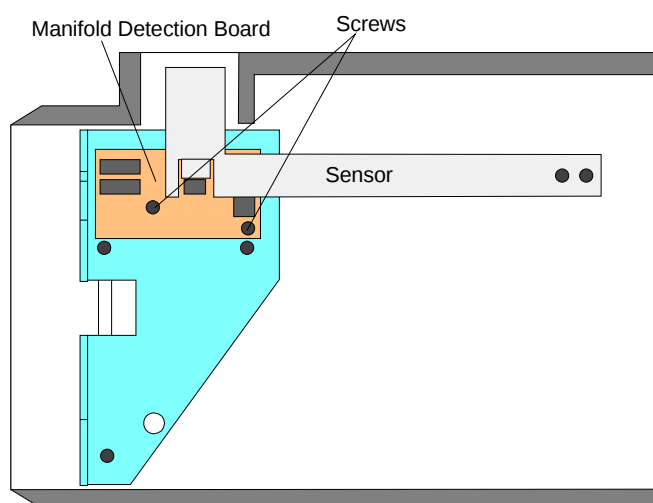
Optical Switch Circuit Diagram



7.6.1 Replacing the Manifold Detect Board

The manifold detect board is replaced using the following procedure:

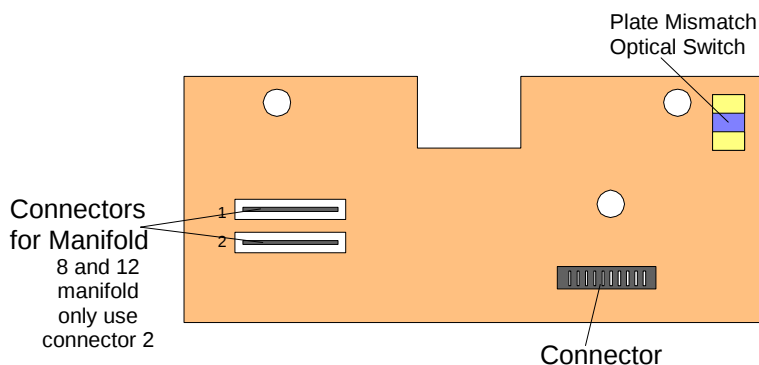
1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Raise the manifold arm so that it is in the fully open position.
3. Disconnect the tubing from the manifold.
4. Remove the two screws that hold the manifold in place.
5. Remove the manifold from the instrument.
6. Remove the two screws that hold the board in place.



7. Disconnect the ribbon cable from the manifold detect board.
8. Carefully remove the manifold detect board from under the sensor.
9. Exchange the manifold detect board.
10. Connect the ribbon cable to the manifold detect board.
11. Carefully place the manifold detect board under the sensor.
12. Screw the manifold detect board into place.
Ensure that the earth cable is screwed under one of the screws.
13. Replace the manifold and screw it into place with the two screws.
Ensure that the manifold type indicator is correctly positioned in the front optical switches.
14. Reconnect the tubing onto the manifold.
15. Lower the manifold arm to the normal position.
16. Reconnect the instrument to the mains power supply and switch the instrument on.
17. Use the Service menu to check that the optical switch is working correctly.

7.7 Fill Verification Board

The Fill Verification board is used to verify that the manifold is dispensing liquid through all the dispensing needles. The board also automatically detects the type of manifold fitted and if the manifold arm is being lowered correctly.

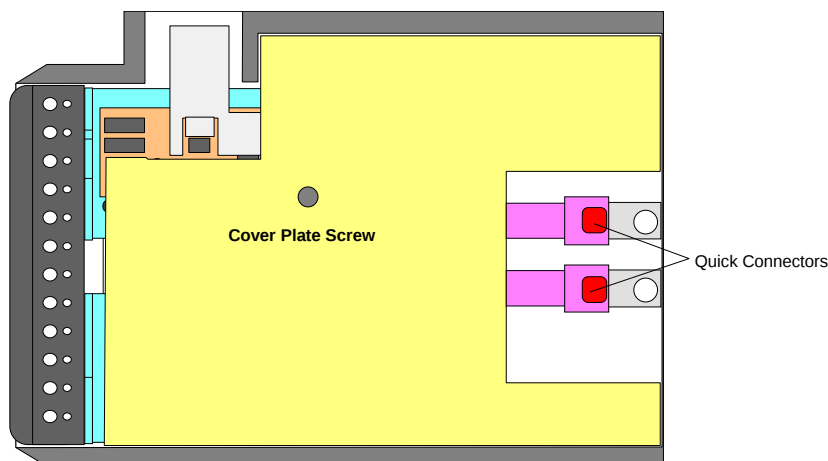


This board is not repairable.

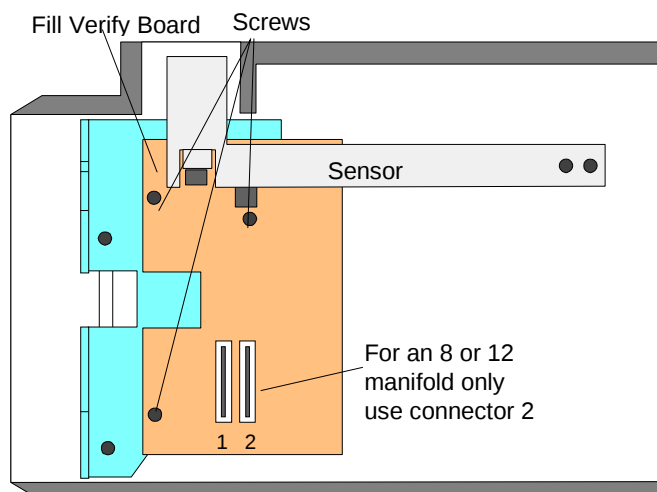
7.7.1 Replacing the Fill Verification Board

The Fill Verification board is replaced using the following procedure:

1. Switch the instrument off and remove the mains power cable from the connector.
2. Raise the manifold arm so that it is in the fully open position.
3. Disconnect the manifold tubing from the quick connectors.
4. Remove the screws that hold the cover plate in place and remove the cover plate.



5. Disconnect the manifold ribbon cables from the board.
6. Remove the two screws that hold the manifold in place.
7. Remove the manifold from the instrument.
8. Remove the three screws that hold the board in place.



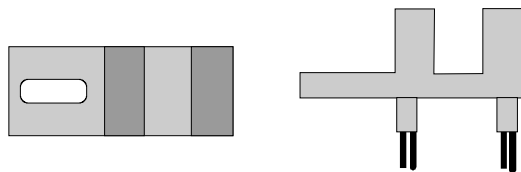
9. Disconnect the ribbon cable from the Fill Verification board.
10. Carefully remove the Fill Verification board from under the sensor and exchange it.
11. Connect the ribbon cable to the Fill Verification board.
12. Carefully place the Fill Verification board under the sensor.
13. Screw the Fill Verification board into place.
Ensure that the earth cable is screwed under one of the screws.
14. Replace the manifold and screw it into place with the two screws.
15. Connect the ribbon cables from the manifold into the connectors on the board.
16. Reconnect the manifold tubing onto the quick connectors.
17. Replace the cover plate and screw it into place.
18. Lower the manifold arm to the normal position.
19. Reconnect the instrument to the mains power supply and switch the instrument on.
20. Use the Service menu to check that the optical switch is working correctly.

7.8 Optical Switches

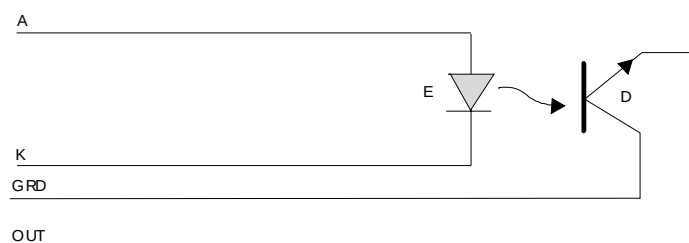
The instrument uses the following optical switches:

- Transport home position
- Manifold arm top position
- Orbital shaking home position
- Orbital shaking step counter

Switch Layout



Circuit Diagram



8. Serial Interface

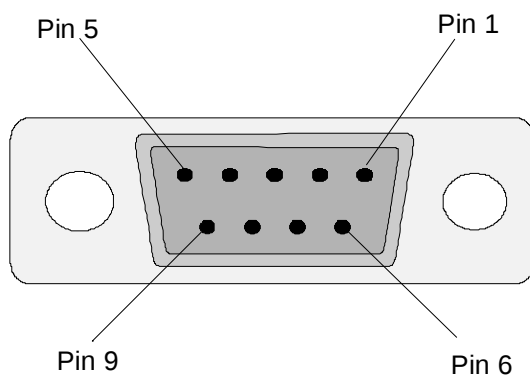
8.1 Hardware Specifications

The instrument is controlled by the computer and the communication between the computer and the instrument is done through an RS-232-C interface.

The interface specification may be either to the CCITT interface standard or to the EIA RS-232-C interface standard.

8.1.1 Pin Designation

The illustration below shows the pin assignment of the DB 9 connector fitted to the instrument.



All connected devices must be approved and listed as per EN 60950, UL 1950 or CSA C22.2 No. 950 for Data Processing Devices

8.1.2 RS-232-C Interface Lines

The Serial Interface of the instrument is connected to a start-stop synchronized serial RS-232-C circuit.

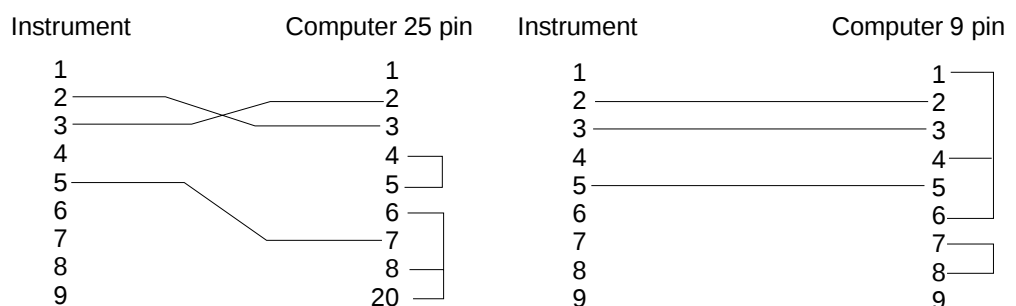
The list below names the interface lines of the instrument's 9 pin connector.

PIN Number	DESCRIPTION
1	RS 485 IN/OUT (Option)
2	(RS232) TD Transmit Data
3	(RS232) RD Receive Data
4	RS 485 IN/OUT
5	GND Ground
6	RS-config: if connected to GND RS 485, if open RS 232 is active (only if jumper x100 on the mainboard is open!)
7	No connection
8	RS232 CTS Clear To Send
9	+24V INPUT (Fused 4AF)

The connecting cable used to connect the instrument to the computer should be wired as given below:

INSTRUMENT		COMPUTER
TD	connected to	RD
RD	connected to	TD
GND	connected to	GND
		RTS connected to CTS
		DSR connected to DCD and DTR

Use the computer handbook to find the correct pin connections.



8.1.3 Synchronization and Data Format

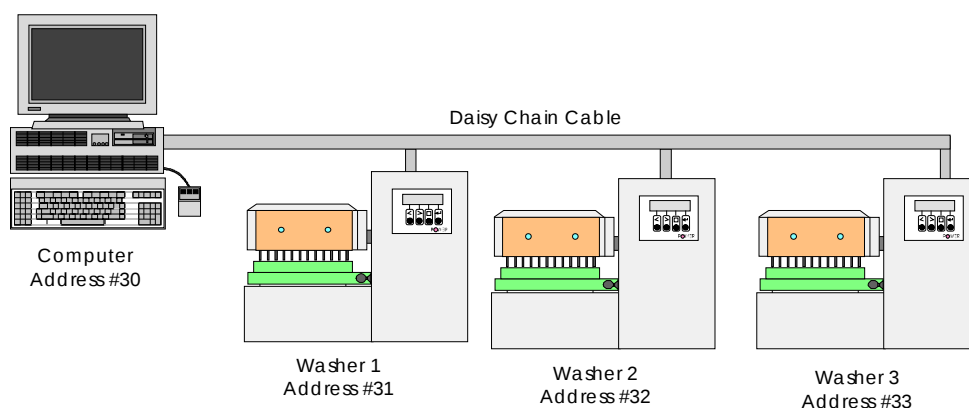
For the instrument to communicate with the computer correctly, the instrument and the computer must be set for the same communication parameters.

Check that following parameters are set correctly on both the computer and the instrument:

1. Start bit length: **1 Bit**
2. Stop bit length: **1 Bit**
3. Data format: **8 Bits**
4. Parity bit: **None**
5. Baud Rate: **9600 Baud**
6. Mode: **half duplex**

8.1.4 Daisy Chaining Instruments

The instrument can be connected to a computer, which controls a number of instruments using a **Daisy Chain** cable. **(RS 485 version only).**



Each of the instruments must be defined with a different device address

Each instrument can be controlled by sending the commands to the required device address.

To select a different device address, start the Remote Mode with the default device address (#31) and send the command to X 37 (to select the device address #37).

9. Description of Options

9.1 Instrument Options

The instrument can be fitted with the following options.

Please note that some of the options listed below require an instrument firmware level of 3.x. and 4.x.

Barcode Pen	HBCS-A300 pen (Hewlett Packard) or a compatible pen with a magnetic core for reading the microplate identification numbers for the printout of the washing protocol. Included in the HBCS-A300 pen is the Decoder IC: HBCR 1611 (Hewlett Packard) This decoder can read: Code 39, Interleaved 2 of 5, UPC A, E0, E1 EAN / JAN 8, 13 Codabar, Code 128
Printer	External printer for printing the washing protocol. We recommend a DPU - 201 GS hand held thermal printer (or EPSON compatible) with 27 character per line and a power supply. RS 232 interface, 9600 Baud, 8 data, 1 stop, no parity and hardware handshake (BUSY on pin8 on the Washer connector).
Fill Verification	This option checks whether the wash buffer was dispensed into each well during an overflow wash step (special manifold required, M8 or M16). The Fill Verification includes also the Manifold Detection function.



Note

The Fill Verification Option cannot be combined with the Aerosol Protection option. Not available for 384 Well Manifold. Possible from firmware level 3.23 onwards. Factory installation required!

Manifold Detection	Automatic detection for the type of manifold fitted: For 96 Well plate: M8, M12, M16. For 384 Well plate: only M32.
Aerosol Protection	Special manifold and pump to aspirate any aerosol vapors away from the microplate when it is washed.



Note

The Aerosol Protection option can not be combined with the Fill Verification option. Possible from firmware level 3.23 onwards. Factory installation required! Not available for 384 Well Manifold.

Liquid Channel Upgrade	Option to upgrade the number of liquid channels from 1 to a maximum of 4.
Liquid Sensor System	Allows the level of liquid in the bottles (wash buffer, rinse solution, waste and so on) to be controlled. An acoustic signal alerts the user when the bottles are empty or full.
Columbus PC Software	Consisting of WinWash and Download including the operating manual and RS232 interface cable.
Firmware Update	Consisting of the Download software, the latest version of the firmware 3.x, as well as 5 language software files (English, German, French, Spanish and Italian) that can change the on-board language of the Columbus (from firmware level 2.23 onwards) in the field.
Drip Mode (Cell Wash)	Drip Mode allows a wash buffer to be added drop by drop. (for example: for Cell Washing)

**Note**

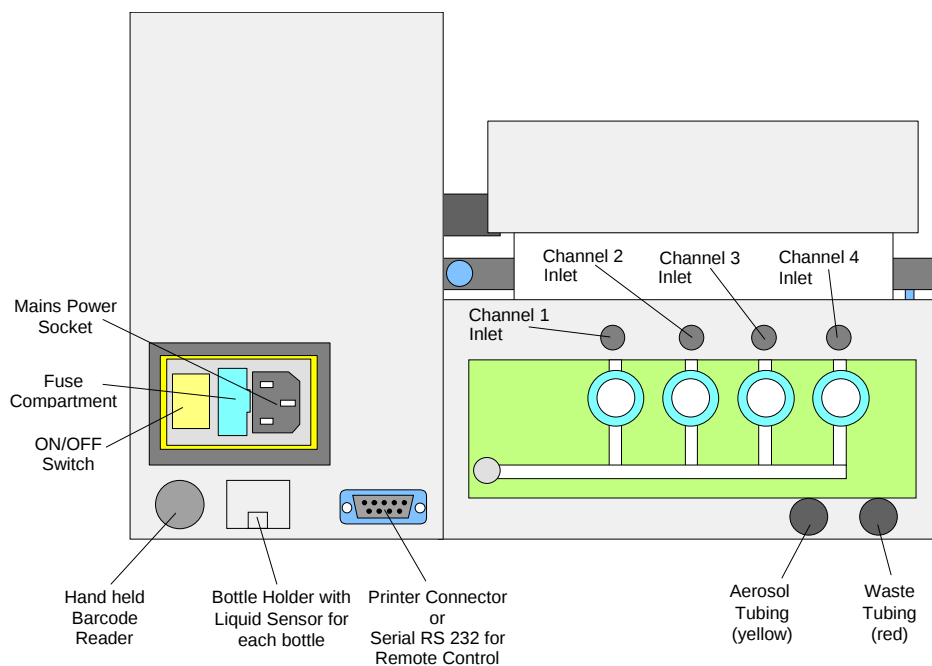
This option is only available together with our cell wash manifolds (M 8, M12, M16). Dispensing in Drip mode is possible with the 384 Well Manifold. Overflow washing using Drip mode is not possible with the 384 Well Manifold.

384 Well Manifold (starting at 4.x)	This option is used for washing the 384 well microplate in rows and can only be performed with a 32 way Manifold.
--	---

9.2 Liquid Detection Option

The liquid detection option is fitted to the instrument using the following procedure:

1. Place the liquid detection unit onto the bench.
2. Place the liquid bottles onto the correct positions on the liquid detection unit.
3. Place the waste bottle onto the liquid detection unit.
4. Connect the liquid detection unit to the instrument using the supplied cable.

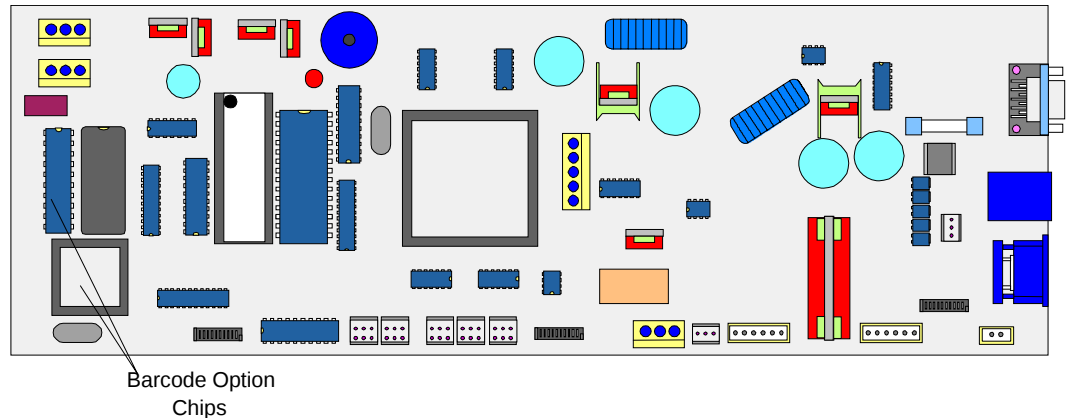


5. To set the instrument so that the Liquid Detection option is used, the option must be activated using the Set Options option in the Service menu.

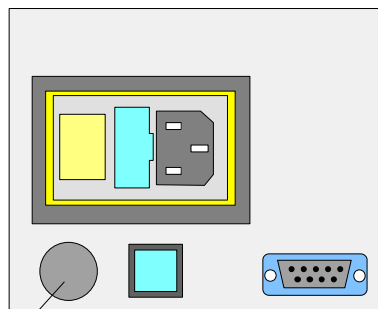
9.3 Barcode Reader Option

The Barcode Reader option is fitted to the instrument using the following procedure:

1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Remove the instrument cover. (See chapter 4)
3. Insert the supplied chips into the required holders on the main board.



4. Ensure that the chips are correctly orientated.
5. Replace the instrument's top cover. (See chapter 4)
6. Connect the barcode reader into the appropriate socket in the back panel of the instrument.

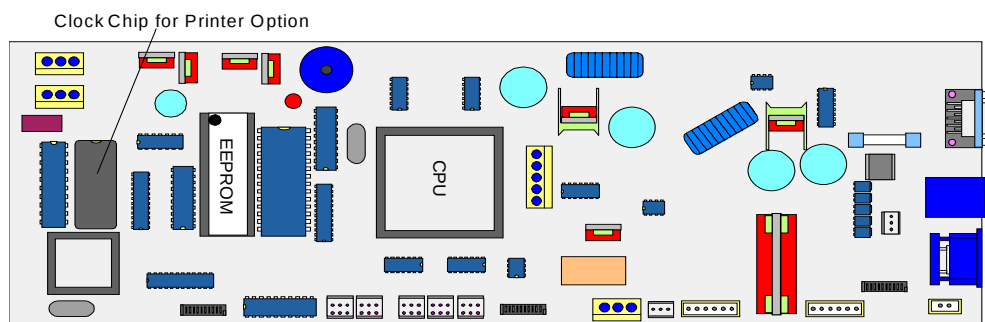


7. Switch the instrument on.
8. To set the instrument so that the Barcode option is used, the option must be activated using the Set Options option in the Service menu.

9.4 Printer Option

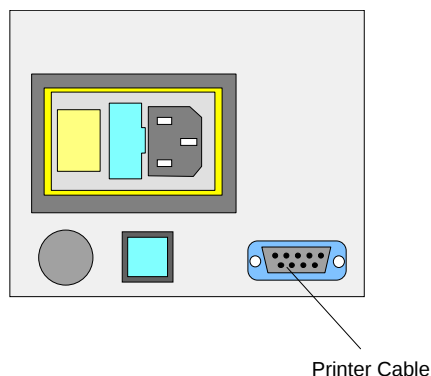
The Printer option is fitted to the instrument using the following procedure:

1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Remove the instrument cover. (See chapter 4)
3. Insert the supplied clock chip into the required holder on the main board.

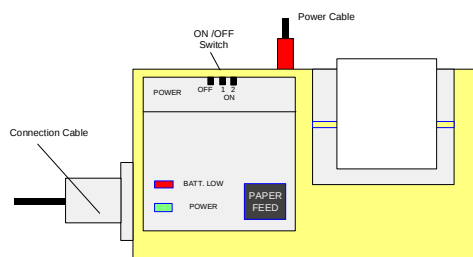


Ensure that the chip is correctly oriented.

4. Replace the instrument's top cover. (See chapter 4).
5. Plug the printer cable into the appropriate socket in the back panel of the instrument.



6. Connect the printer to the instrument using the supplied cable.
7. Connect the power supply cable to the printer.

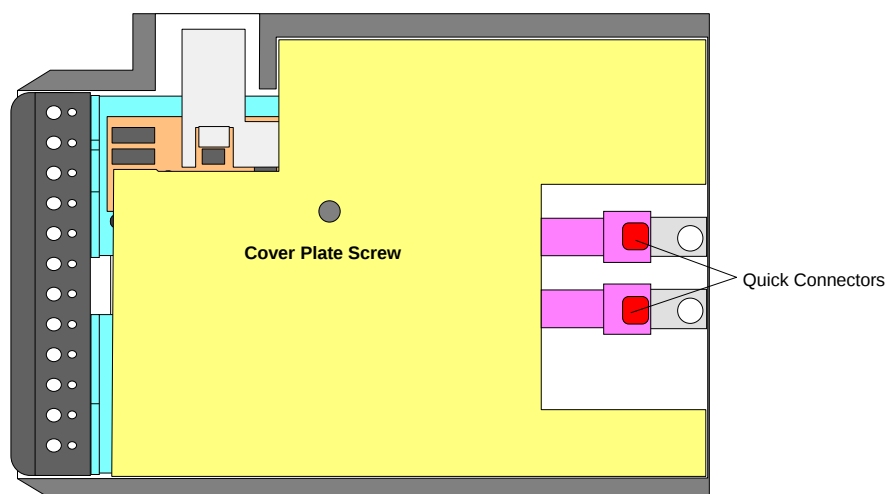


8. Switch the instrument on.
9. To set the instrument so that the Printer option is used, the option must be activated using the Set Options option in the Service menu.
10. Use the Date and Time options in the Service menu to set the correct date and time.

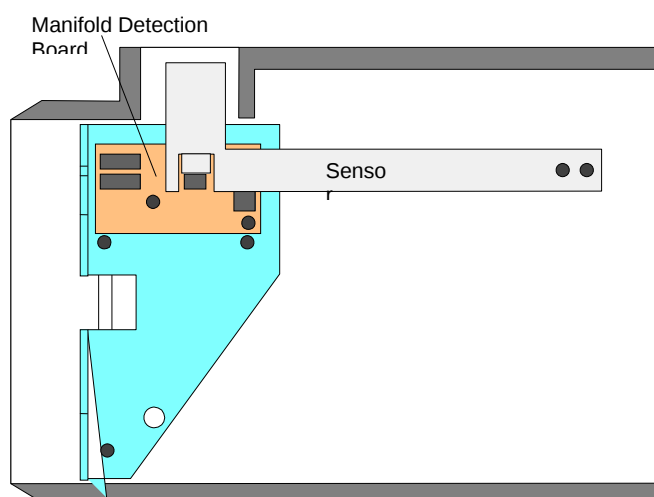
9.5 Manifold Detection Option

The Manifold Detection option is fitted to the instrument using the following procedure:

1. Switch the instrument off and remove the mains power cable from the mains power connector.
2. Remove the instrument cover. (See chapter 4)
3. Disconnect the manifold tubing from the quick connectors.
4. Remove the screw that holds the cover plate in place and remove the cover plate.



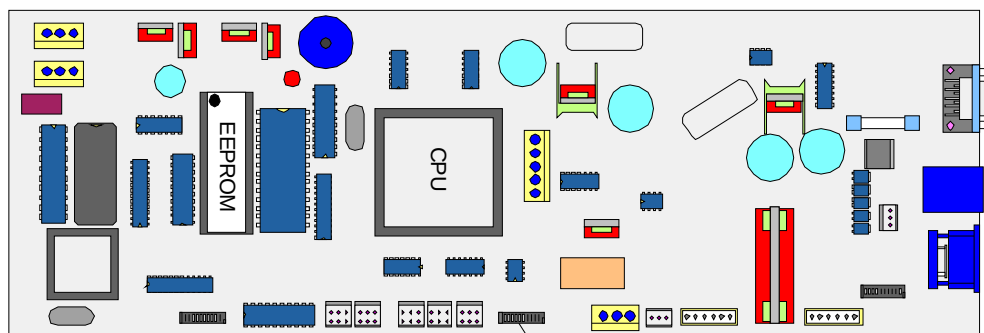
5. Remove the two screws that hold the manifold in place.
6. Remove the manifold from the instrument.
7. Screw the manifold detection board onto the manifold arm with two screws.



8. Turn the instrument on the right hand side.
9. Carefully feed the supplied ribbon cable through the instrument.
Slot it between the arm support and plate and then through the large slot in the middle plate.

Ensure that the cable does not block the movement of the manifold arm.

10. Connect the ribbon cable onto the manifold detection board and screw the earth cable under one of the holding screws.
11. Connect the other end of the ribbon cable onto the connector on the main board.



Ribbon cable connector
for manifold detection board

12. Reconnect the manifold tubing onto the quick connectors.
13. Replace the cover plate and screw it into place.
14. Replace the instrument's top cover. (See chapter 4).
15. Switch the instrument on.
16. To set the instrument so that the Manifold Detection option is used, the option must be activated using the Set Options option in the Service menu.

9.6 Fill Verification Option

This option can only be installed by Tecan Austria.

9.7 Aerosol Pump Option

This option can only be installed by Tecan Austria.

9.8 Activating the Options

When the required option has been fitted, the instrument must be configured for the option using the Select Options in the Service menu. For more information, see chapter 3.2.8.

10. Maintenance

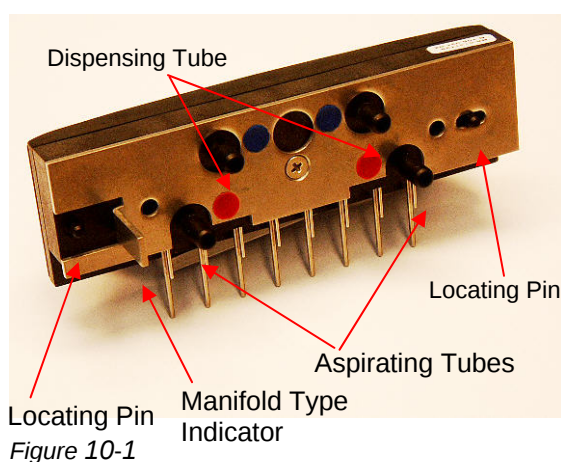
10.1 Cleaning Maintenance

10.1.1 Cleaning the Manifold

The manifold should be removed and thoroughly cleaned at least every 6 months or when any of the needles are blocked.

Use the following procedure to remove and clean the manifold.

Lift the manifold arm and carefully pull the tubing off the connectors on the rear of the manifold.



The manifold is removed from the instrument by removing the two screws that hold the manifold onto the holder.

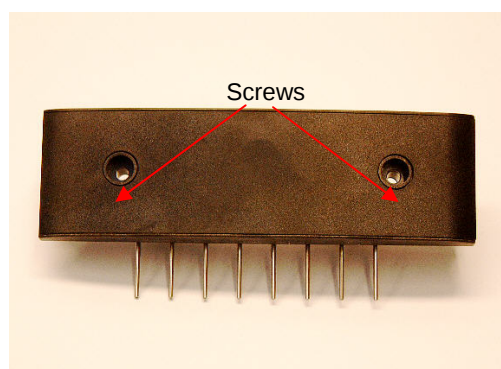


Figure 10-2

When the two screws have been removed, carefully pull the manifold away from the holder.

Manifold Cleaning

The most important cleaning procedure for this instrument is to rinse the wash system before the instrument is left to stand or switched off at the end of each day.



Caution

If the manifold is not rinsed, the needles will become blocked and it will either need expensive repairs or may be completely ruined.

The manifold is cleaned by the following procedure.

Carefully push the cleaning needles into the aspirating and dispensing needles.

The small cleaning needle is for the dispensing needles and the large cleaning needle is for the aspirating needles.

Rinse the manifold block with distilled water to ensure that all particles have been removed.

The manifold may also be cleaned using a gentle ultrasonic bath for 15 minutes.

When the manifold block is clean carefully reconnect the tubing and replace it into the instrument.

Tighten the manifold into place using the two screws, ensure that the screws are tight.

When the manifold has been refitted, switch the instrument on and perform the priming procedure using distilled water.

Thoroughly Cleaning the Manifold

The manifold can be taken apart to ensure thorough cleaning.

When the manifold has been removed from the instrument, remove the screw that holds the manifold together.

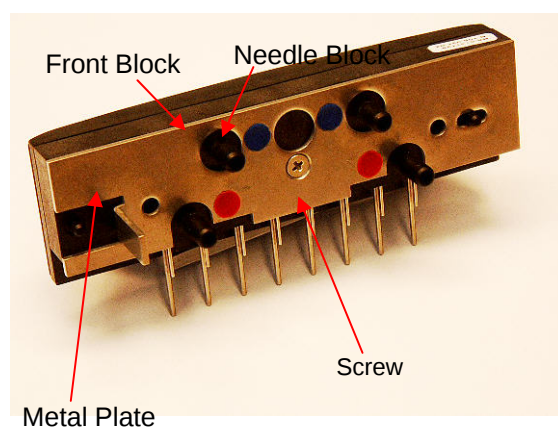


Figure 10-3

Carefully pull the metal plate away from the manifold.

Carefully pull the needle block away from the front block.

Ensure that the seals are not damaged.

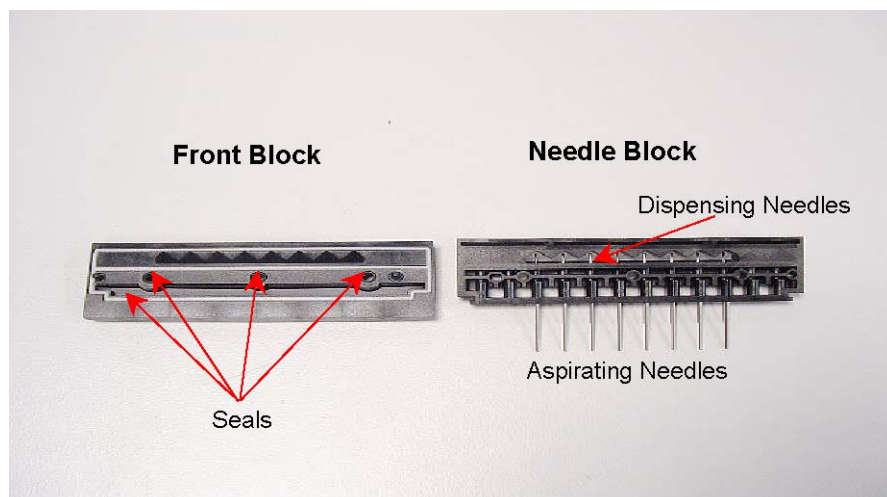


Figure 10-4

The needles and the chambers for the needles can now be thoroughly cleaned. When the manifold has been cleaned, carefully insert the seals into the slot in the front plate. *Ensure that the seals are correctly located.*

Twisted or missing seals may result in a leaking manifold.

Screw the front block, needle block and metal plate together.

Refit the manifold to the instrument.

If the manifold is replaced, the instrument must be calibrated for the new manifold.

Perform **Adj.Disp. Pump**, **Adj.Plate.Ref.** and **Adj.Prime.Position**, which is displayed in the service menu.

Select **Adjust Manifold Type** in the adjust menu.

10.1.2 Exchanging the Manifold

The instrument can be used with the following types of manifolds:

- Normal (8, 12 and 16)
- Normal with aerosol aspiration Factory installation required
- Fill verification Factory installation required
- Cell wash manifold (8, 12 and 16)

The manifolds are fitted to the instrument using the following procedures:

1. Lift the manifold arm.
2. Carefully fit the manifold onto the manifold arm and ensure that the locating pins are correctly inserted through the holes in the plate.
3. If the manifold detection option is fitted, ensure that the manifold type indicator is correctly fitted between the manifold type detector switches.
4. Tighten the manifold into place using the two screws.
5. Fit the dispensing tube onto the top connector on the rear of the manifold.
6. Fit the aspirating tubing (marked with red rings) onto the two bottom connectors on the rear of the manifold.
7. If the aerosol pump option is fitted, fit the aerosol tubing (marked with yellow rings) onto the aerosol connectors of the aerosol part.
8. If the Fill Verification option is fitted, connect the small ribbon cable onto the connector block on the left-hand side of the circuit board in the manifold arm.

Manifold for the Standard Instrument (without Aerosol Aspiration and Fill Verification)

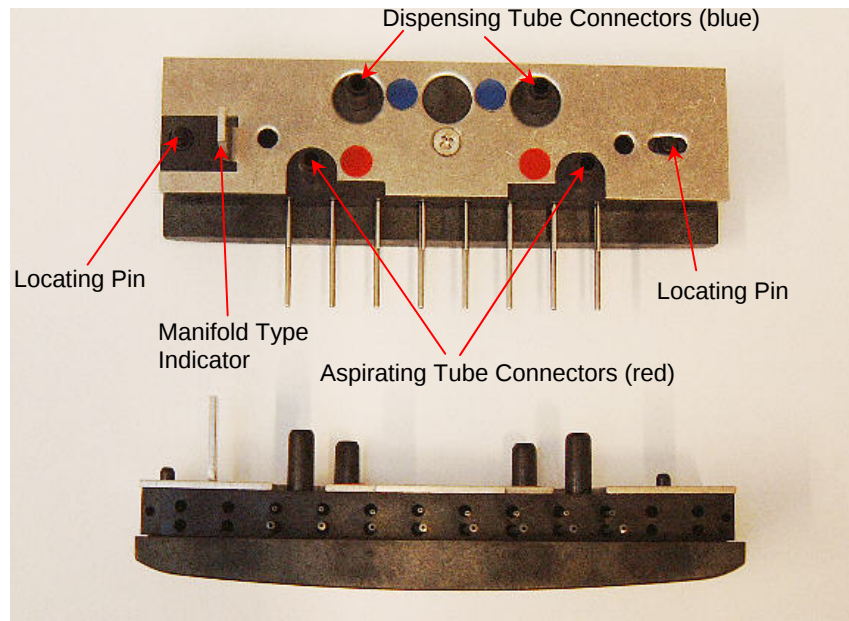


Figure 10-5

Manifold for Instrument with Aerosol Aspiration and Fill Verification

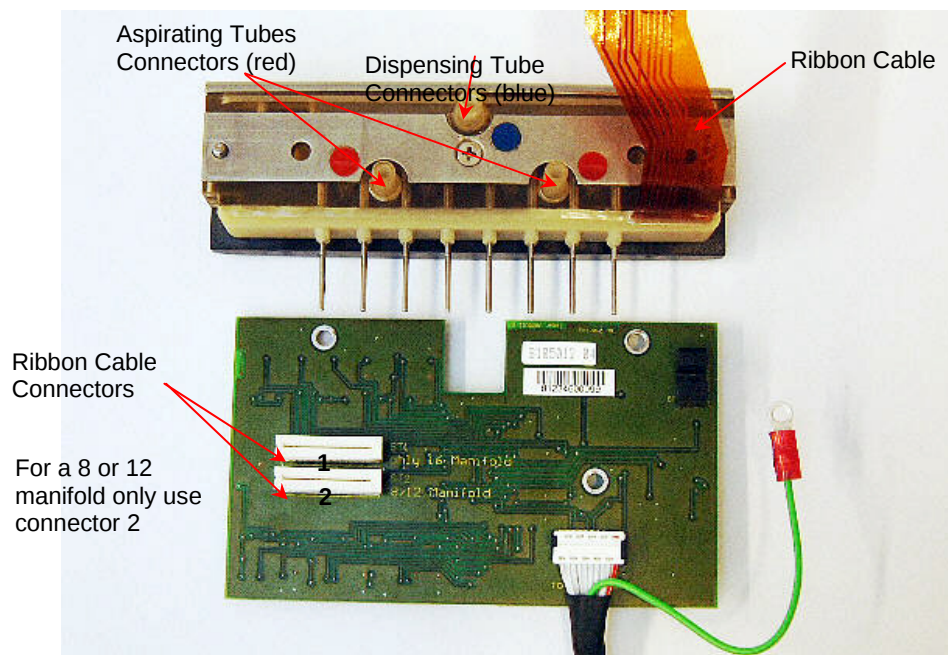


Figure 10-6

When all the required tubing and ribbon cable have been connected, lower the manifold arm.

10.1.3 Exchanging the Plate Support

The instrument is delivered with the plate support already installed. If the plate support is removed, for example: for cleaning, it can be replaced using the following procedure:

Lift the manifold arm

Slightly tilt the plate support towards the right.



Figure 10-7

Carefully slide the plate support with the waste sink at the rear over the guide bar.

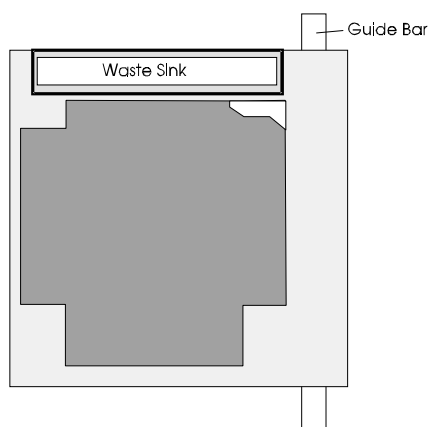


Figure 10-8

The plate support must be slightly tilted so that it goes over the pin that activates the automatic microplate centering mechanism.

To reinstall the plate support follow the procedure listed below:

Push the plate support so that it is fully inserted into the instrument.

Lower the plate support.

Lower the manifold arm.

10.1.4 Instrument Disinfection

All parts of the instrument that come into contact with the patient sera or positive control samples must be treated as potentially infectious areas.



It is advisable to wear gloves when performing the measurement procedure and also when making adjustments to the instrument.

It is very important that the instrument is thoroughly disinfected before it is removed from the laboratory or any servicing is performed on it.

Before the instrument is returned to the distributor for servicing, it must be disinfected and a disinfection certificate completed. If a disinfection certificate is not supplied, the instrument may not be accepted by the servicing center or it may be held by the customs authorities.

Disinfection Procedure



Caution

Before starting the disinfection procedure use a rinse procedure (Rinse Day) with distilled / deionized water (lab quality) to flush the system.

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

The instrument should be disinfected using one of the following solutions:

Lysetol	Manufacturer: Schülke & Mayr Ges.m.b.H.
Aseptisol	Manufacturer: Bode Chemie Hamburg

If neither of these solutions is available 70% ethanol should be used as an alternative.



WARNING

THE DISINFECTION PROCEDURE SHOULD BE PERFORMED BY AUTHORIZED TRAINED PERSONNEL IN A WELL VENTILATED ROOM WEARING DISPOSABLE GLOVES AND PROTECTIVE GLASSES AND CLOTHING.

Please note that the disinfectant can influence the performance of your instrument if it applied inside the instrument.

The following procedure should be used to disinfect the instrument.

1. Wear protective gloves, protective glasses and protective clothing.
2. Prepare an autoclaveable bag for all disposables used during the disinfection procedure and label it with autoclave tape.
3. Rinse the complete pump and tube system with the disinfectant. Fill the system with the disinfectant solution and allow a contact time of five hours.
4. Disconnect the instrument from the mains power supply.
5. Disconnect the instrument from any accessories that are used for example: printer, computer, cartridge and so forth. Accessories that should be shipped together with the instrument have to be included in the disinfection procedure.

6. Carefully spray the disinfectant solution (or use a disposable soft tissue paper towel soaked in the disinfectant) on all outer surfaces of the instrument.
7. After a minimum contact time of 10 minutes, repeat the previous step.
8. After a contact time of five hours wipe the instrument using a soft paper towel and a mild detergent or distilled water to remove all traces of the disinfectant.
9. Wipe dry the outer surfaces of the instrument.
10. Pack the instrument and its accessories.
11. Disinfect your hands and clean them with a mild detergent.
12. **Complete a disinfection certificate and attach it to the outside of the box so that it is clearly visible.** See below for an example of the disinfection certificate.

Disinfection Certificate

This disinfection certificate must be completed before the instrument is for servicing.

The certificate must be included at the top of the package in which the instrument is returned.

I declare that the instrument in this package has been decontaminated or disinfected to remove or inactivate any biological material, which could be dangerous to the service personnel, or that it has never been exposed to any hazardous biological material.

Name:.....

Firm:

Address:

.....

.....

Country:.....

Signature:.....

10.2 Preventive Maintenance Plan

10.2.1 Daily

- Perform Rinse Night with distilled water.

10.2.2 Weekly

- Perform Rinse Night with distilled water.
- Check the liquid filter(s) in wash bottle(s) for particles and rinse liquid filter(s) with water.

10.2.3 Every Six Months

- Clean the plate support guide bar with 70% ethanol.
- Check the centering mechanism of the plate carrier and clean if necessary with 70 % ethanol.
- Clean the Manifold aspirating and dispensing needles.

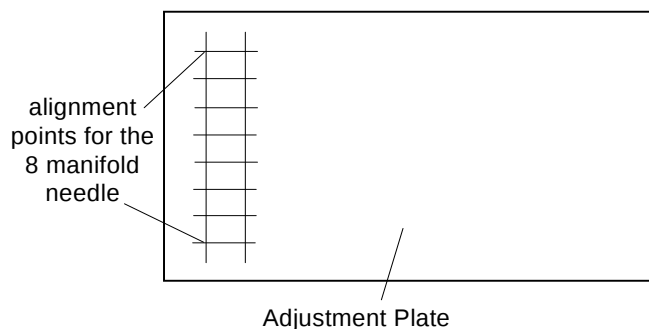
10.2.4 Yearly (Service Technician Required)

- Save the customers specific programs using the Winwash software.
- Disinfect the instrument. (See chapter 10.1.4)
- Replace all aspirating and dispensing tubings.
- Replace the liquid filter(s) in the wash bottle(s).
- Replace the manifold sealing and clean the inner parts of the manifold.
- Check the aspirating pump and replace if necessary.
- Recalibrate the dispensing pump. (See chapter 3)
- Download the specific saved programs to the washer.

10.3 Service Tools

10.3.1 Adjustment Plate (Reference Plate)

The Adjust Plate Reference is used to define the plate position in order that the manifold needles are correctly positioned. The adjustment should always be positioned as shown below for all manifolds. The procedure is the same for manifolds; 8, 12 and 16. Place the adjustment plate on the plate support and enter the Service menu.



For more information about Adjustment Plate Reference, see chapter 3.

10.4 Electrostatic Discharge Information

A sudden discharge of static electricity from your finger or other conductor can destroy static-sensitive devices or microcircuitry. Often the spark is neither felt nor heard, but damage occurs. An electronic device exposed to electrostatic discharge (ESD) may not be affected at all and can work perfectly throughout a normal cycle. Or it may function normally for a while, then degrade in the internal layers, reducing its life expectancy.

Networks built into many integrated circuits provide some protection, but in many cases, the discharge contains enough power to alter device parameters or melt silicon junctions.

10.4.1 Generating Static

Table 4-1 shows how different activities generate static electricity at different electrostatic voltage levels.

Table 4-1. Typical Electrostatic Voltages

Event	Relative Humidity		
	10%	40%	55%
Walking across carpet	35,000 V	15,000 V	7,500 V
Walking across vinyl floor	12,000 V	5,000 V	3,000 V
Motions of bench worker	6,000 V	800 V	400 V
Removing DIPs* from plastic tube	2,000 V	700 V	400 V
Removing DIPs* from vinyl tray	11,500 V	4,000 V	2,000 V
Removing DIPs* from Styrofoam	14,500 V	5,000 V	3,500 V
Removing bubble pack from PCB	26,500 V	20,000 V	7,000 V
Packing PCBs in foam-lined box	21,000 V	11,000 V	5,000 V

* *Dual Inline Packaging (DIP) is the packaging around individual microcircuitry. These are then multi-packaged inside plastic tubes, trays, or Styrofoam.*



Note
700 volts can degrade a product.

10.4.2 Preventing Electrostatic Damage to Equipment

Many electronic components are sensitive to ESD. Circuitry design and structure determine the degree of sensitivity. The following proper packaging and ground precautions are necessary to prevent damage to electric components and accessories:

- To avoid hand contact, transport products in static-safe containers such as tubes, bags, or boxes.
- Protect all electrostatic parts and assemblies with conductive or approved containers or packaging.
- Keep electrostatic sensitive parts in their containers until they arrive at static-free stations.
- Place items on a grounded surface before removing them from their container.
- Always be properly grounded when touching a sensitive component or assembly.
- Avoid contact with pins, leads or circuitry.
- Place reusable electrostatic-sensitive parts from assemblies in protective packaging or conductive foam.

10.4.3 Personal Grounding Methods

The method for grounding must include either a wrist strap or a foot strap at a grounded workstation. When seated, wear a wrist strap connected to a grounded system. When standing, use footstraps and a grounded floor mat. Wrist Straps are flexible straps with a minimum of one-megohm +/- 10% resistance in the ground cords. To provide proper ground, a strap must be worn snug against bare skin. The ground cord must be connected and fit snugly into the banana plug connector on the grounding mat or workstation.



Therefore Tecan recommends that you use a grounded wrist strap whenever you service or clean an instrument. For all components marked with ESD – Sticker it is absolutely necessary to use the grounded wrist strap to avoid damaging any electrical parts!



11. Trouble Shooting

11.1 Introduction

Error Description	Possible Causes	See Chapter
Program not defined	No test defined in the instrument memory	3
Program too Big	If more than 60 process steps have been defined	3
No END in Prog.	If the test definition (with END step) is not completed.	3
Wrong Manifold	Manifold not correctly defined in Adjust Menu	3
Transport Error ➔ INIT Error	Instrument cannot move plate support Check if the plate support is correctly inserted and the plate support is not blocked. Ensure the plate support motor is not defective or blocked and the home position optical switch is not broken.	6
Incorrect Plate Position	Plate parameters are not defined (Adjust Menu)	3
Disp. Sens. Err.	Dispensing pump, optical switch, disp. pump/ main board cable or main board broken	5 & 7
No figures in display but display light on	Display board broken	7
Display and LED dark	Power supply board broken Defective fuse	7
No or incorrect dispensing	Dispensing needles blocked Dispensing valve broken Dispensing pump broken	5
No or incorrect aspirating	Aspirating pump broken Aspirating needles blocked	5
Waste Bottle Full at Start	The instrument checks if the waste bottle is full at the beginning of a selected program	3
Waste Bottle Full during PROCEDURE	The waste bottle is full during the washing procedure	3
Liquid Bottle Empty	Before the program is started, the instrument can detect if the liquid bottle is empty	3
Printer Error	Defective printer or printer cable	3
Init.Error: BCR	Change barcode chips U21 and U22	9
Manifold Arm Error	The manifold arm does not move up and down	3
Fill Comm. Err	No communication between main board and fill verification board	3
Inadequate wash	Instrument detects that some of the needles are not dispensing solution	3
Check Disp. Path	The instrument detects if any of the needles are dispensing no or too little solution	3
Fill Funct. Err.	If the fill verification board needle status can not be deleted	3
Fill Asp. Err	When the well is not correctly aspirated	3
New Firmware Auto Clear All	Empty Battery	7

12. Instrument Specifications

12.1 Introduction

The table below lists the physical specifications for the instrument. All specifications listed below are based on the following instrument settings:

Dispensing speed: from 1 – 5 (standard setting is 3)

Aspirating rate: from 1 – 5 (standard setting is 3)

PARAMETERS	CHARACTERISTICS
General	
Display unit	Liquid Crystal Display with two rows of sixteen digits
Keyboard	Four key membrane keyboard
Number of dispensing channels	Up to four channels
Manifold types	8, 12 or 16 way or 384 Well Manifold
Variable	
Volume of solution dispensed	50 - 3000 µl in 50 µl steps for washing (50 - 400 µl if 'Dispense rate: drip' is selected) 50 - 400 µl in 50 µl steps for dispensing <i>For the 384 Well Manifold:</i> 10 - 120 µl in 10 µl steps for dispensing.
Dispensing accuracy	CV: ≤ 4% over the plate (300µl dispensing volume, dispensing rate: 3). <i>This is also for the 384 Well Manifold.</i>
Residual volume	Crosswise aspiration: ≤ 2 µl per well single aspiration - cell wash manifold: ≤ 5 µl per well (Asp. rate 5, Asp. time 4 sec., Asp. speed 10mm/sec) <i>For the 384 Well Manifold:</i> Crosswise aspiration: ≤ 2 µl per well (Asp. rate 5, Asp. time 4 sec., Asp. speed 10mm/sec)
Interface	
Serial RS 232 C	<i>All connected devices must be approved and listed as per EN 60950, UL 1950 or CSA C22.2 No. 950 for Data Processing Devices.</i> 9600 Baud (fixed)
Power	
Supply	Auto sensing for the settings 100 - 120 volt or 220 - 240 volt, 50 / 60 Hz
Consumption	< 65 VA
Main fuse	2 x 1.6 T Amp. (slow blow)

Physical

Outside dimensions Width : 28,5 cm, Depth : 39,5 cm, Height:: 22,0 cm
 Weight 8.2 kg

Environmental

Ambient temperature

Operation 15°C to 35°C (59°F to 95°F)

Non-operation Below: -10°C (14°F) Above: 43°C (109°F)

Storage -40°C to 70°C (-40°F to 158°F)

Relative Humidity

Operation 20 % to 90 % no condensing

Non-operation Below: 5 % Above: 95 %

Storage 5 % to 95 %

Others

Overvoltage category II

Pollution degree 2

Method of disposal Contaminated waste

Linear Shaking				
Mode		Shaking Speed		
		1	2	3
Low	1.2 mm	4 Hz	7.5 Hz	11.0 Hz
Normal	1.7 mm	2 Hz	5.0 Hz	8.0 Hz
High	2.6 mm	2 Hz	3.5 Hz	5.0 Hz

The instruments conform to the legal norms at date. For more information, see the **Declaration of Conformity Certificate** on the last page of this manual.

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Declaration of Conformity

Product Type: Microplate Washer
Model Designation: Columbus, Columbus plus
Manufacturer: TECAN AUSTRIA G.M.B.H.
Untersbergstraße 1A
5082 Grödig Austria/ Europe

The product complies with the requirements of the following European directive:

- In Vitro Diagnostic Directive 98/79/EC

Applied Standards:

DIN EN 61010-1/A2:1998

EN 55011-1:1991 Group 1 Class B
EN 61000-3-2:1995/prA14:2000
EN 61000-3-3:1995
EN 50082-1:1997
EN 50082-2:1995
EN 60601-1-2:1993
EN 61326-1:1997

EN 591
EN 1441

Furthermore, the product complies with the following Standards, which are not within the scope of the above EC-Directive:

Shock, Vibration & Drop Test:

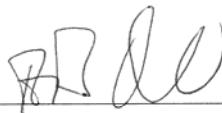
EN 60068-2-6
EN 60068-2-27
EN 60068-2-29

National Recognized Testing Laboratory (USA, Canada):

UL 3101-1
CAN/CSA-C22.2 No. 1010 -1

Place, Date: Grödig, 22st of October 2002

Legally binding signature:



Name:

Alois Krutzenbichler

Function:

Head of Research & Development



Michael Illek

Head of Logistics & Production