



**Compudil 300  
Series  
Operator Manual**



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## Introduction

The Compudil 300 Series Syringe Drives are general purpose liquid handling instruments which feature interchangeable Syringes/Valve Blocks giving outstanding versatility. Four versions are available with either Solenoid Valve or Motor Valve operation with either Fixed Program or RS232 Control. The Fixed Program versions can have up to nine user defined programs entered at the factory.

Each of these is available with a choice of six Syringes (threaded connectors giving quick & easy interchangeability) & nine operating speeds to suit all of these variations.

SECTION 6 applies only to the RS232 Control versions.

This instrument complies with the appropriate Council Directives pertaining to EMC, Electrical & Mechanical Safety, a copy of our 'DECLARATION of CONFORMITY' detailing which directives are covered can be ordered separately.

### **WARNING!**

If the cover is removed for any reason Electrical/Mechanical Hazards can be exposed, it is therefore **IMPORTANT** that the power cable is **REMOVED** prior to gaining access to any internal components.

In case of difficulty or to obtain service information & advice contact the supplier of the Compudil or: -

Hook & Tucker Zenyx Ltd.

Vulcan Way

New Addington

Croydon

CR0 9UG

United Kingdom

Tel: 01689 843345 (UK)

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## Section 1

### 1.1 Product Specification

- 1.1.1 All versions of this instrument are suitable for operation on 230 volt 50 Hz supplies & 115 volt 50/60Hz supplies. The COMPUDIL 310 is the Fixed Program model fitted with a Solenoid Valve & the COMPUDIL 320 is the Fixed Program model fitted with a Motor Valve. The COMPUDIL 330 is the RS232 Control model fitted with a Solenoid Valve & the COMPUDIL 340 is the RS232 Control model fitted with a Motor Valve.

### 1.2 Cat. No: 9860/001

- 1.2.1 This is the COMPUDIL 310 Fixed Program model fitted with a Solenoid Valve & tubing (Syringes are ordered separately) & is supplied with: -

Qty.	Part No:	Description
1	2325/xxx	Power Cable <sup>1</sup>
2	2070/016	Spare 250 mA 'T' type fuse for 230 v or
2	2070/003	Spare 500 mA 'T' type fuse for 115 v
1	see section 1.9	Handset
1	see section 1.6	Tubing kit
as requested	see section 1.8	Syringes
1	9860/900	Instruction Manual
1	Form 1026	Calibration Certificate
-	Page 49	Program Summary supplied separate

### 1.3 Cat. No: 9860/002 <sup>2</sup>

- 1.3.1 This is the COMPUDIL 320 Fixed Program model fitted with a Motor Valve, complete with tubing (Syringes are ordered separately) & is supplied with: -

Qty.	Part No:	Description
1	2325/xxx	Power Cable <sup>1</sup>
2	2070/016	Spare 250 mA 'T' type fuse for 230 v or
2	2070/003	Spare 500 mA 'T' type fuse for 115 v
1	See section 1.9	Handset
1	See section 1.7	Tubing kit
As requested	See section 1.8	Syringes
1	9855/900	Instruction Manual
1	Form 1026	Calibration Certificate
-	Page 49	Program Summary supplied separate



## 1.4 Cat. No: 9860/003

- 1.4.1 This is the COMPUDIL 330 RS232 Control only model fitted with a Solenoid Valve, complete with tubing (Syringes are ordered separately) & it is supplied with: -

Qty.	Part No:	Description
1	2325/xxx	Power Cable <sup>1</sup>
2	2070/016	Spare 250 mA 'T' type fuse for 230 v or
2	2070/003	Spare 500 mA 'T' type fuse for 115 v
1	see section 1.6	Tubing kit
As requested	see section 1.8	Syringes
1	2020/009	Interface Cable
1	9860/900	Instruction Manual
1	Form 1026	Calibration Certificate

## 1.5 Cat. No: 9860/004 <sup>2</sup>

- 1.5.1 This is the COMPUDIL 340 RS232 Control only model fitted with a Motor Valve, complete with tubing (Syringes are ordered separately) & it is supplied with: -

Qty.	Part No:	Description
1	2325/xxx	Power Cable <sup>1</sup>
2	2070/016	Spare 250 mA 'T' type fuse for 230 v or
2	2070/003	Spare 500 mA 'T' type fuse for 115 v
1	see section 1.7	Tubing kit
As requested	see section 1.8	Syringes
1	2020/009	Interface Cable
1	9860/900	Instruction Manual
1	Form 1026	Calibration Certificate

<sup>1</sup> UK deliveries receive a Part No: 2325/007 power cable incorporating a 13 amp plug. Other European (non-UK) deliveries have a Part No: 2325/006 power cable with a Euro plug. 115v US deliveries receive a Part No: 2325/002 power cable incorporating a US type plug. All other deliveries have a Part No: 2325/001 power cable without a plug attached (see section 2.3.3).

<sup>2</sup> this version is fitted with an extra PCB P/No. 7750/049A for the Valve driver motor.

## 1.6 Tubing for 9860/001 & 003

Note: The Tubing kit supplied comprises of one Inlet tube, one Outlet tube & associated connectors. The types supplied are determined by the Syringe size &/or application.

Inlet	X	X			
Outlet			X	X	X
LDPE	X		X	X	
FEP		X			X
1mm I/D		X			X
2mm I/D	X		X	X	
Length 600mm	X	X			
Length 750mm				X	X
Length 1.2mtrs			X		
Part Number	9986/116	9986/131	9986/110	9986/130	9986/132
Type of end	2 P	2 P	2T	2T	2T

P = Plain

T = Tip

2 = 2 part connector

## 1.7 Tubing for 9860/002 & 004

Note: The Tubing kit supplied comprises of one Inlet tube, one Outlet tube & associated connectors. The types supplied are determined by the Syringe size &/or application.

Tubing Part No:	Material	Inlet	Outlet	I/D (mm)	Length (mm)	Valve Block Type (9553/xxx)			Associated connectors
						/261	/262	/263	
5550/051	FEP	X <sup>4</sup>		3.2	600	X	X		2540/001 Clamp
5550/083	PTFE	X <sup>4</sup>		3.2	600	X	X		2540/001 Clamp
5550/052	FEP		X <sup>3,4</sup>	3.2	750	X			2540/001 Clamp
5550/084	PTFE		X <sup>3,4</sup>	3.2	750	X			2540/001 Clamp
5550/089	PTFE		X <sup>2,3</sup>	1.6	750		X	X	
5550/040	LDPE		X <sup>2,3</sup>	1.6	750		X	X	
5550/039	PTFE		X <sup>2,3</sup>	0.86	750			X	
5550/087	LDPE	X <sup>1,2</sup>		1.6	600			X	
5550/088	PTFE	X <sup>1,2</sup>		1.6	600			X	

1 = Plain end tubing

2 = 2 part connector

3 = Tubing drawn down to a tip one end

4 = Tubing swaged out one end

## 1.8 Syringes/Valve Blocks

Syringe	Volume	Valve Block <sup>1,2</sup>
7350/114	500µl	9855/205 <sup>3</sup> , 9553/263
7350/107	1ml	9855/205 <sup>3</sup> , 9553/263
7350/108	2.5ml	9855/205 <sup>3</sup> , 9553/263
7350/109	5ml	9855/205, 9553/261, 9553/262, 9553/263
7350/110	10ml	9553/261, 9553/262, 9553/263
7350/113	25ml	9553/261

<sup>1</sup> to aid identification Valve Blocks are marked with the final three digits of the part number followed by the serial number.

<sup>2</sup> the 9855/205 part number is a Solenoid valve, all other part numbers are Motor valves.

<sup>3</sup> for Spares quote Part Number 9855/509

## 1.9 Handset

1.9.1 This is supplied with the Fixed Program models & is only an option for the RS232 Control models.

Handset Part No:	Tubing I/D	Comment
9557/201	3.2 mm only	for valve block /261 only.
9557/202	0.86mm	for valve block /262, /263
9557/203	1.6mm	for valve block /262, /263
9860/206	1.0mm	for solenoid valve 9855/205
9860/207	2.0mm	for solenoid valve 9855/205

1.9.2 When not in use the Handset can be 'parked' in the Handset Support on the side of the instrument.

## 1.10 Limitations

### 1.10.1 General

1.10.1.1 The COMPUDIL 300 Series offer a choice of: -

6	Syringes
3	Motor Valve Blocks
1	Solenoid Valve Block
9	Speeds (full stroke between 2 & 12 seconds)
5	Sizes of tubing (two for the Solenoid valve & three for the Motor valve)

1.10.1.2 Certain combinations of these are not practicable.

1.10.1.3 The main limitation is the rate of inflow of liquid into the Syringe through the Valve Block. To obtain consistent & accurate volumes the inlet tubing must be as short as possible & of a sufficient diameter to avoid any tendency to 'bubble'. Excessive aspiration speeds will cause some liquids to degas.

1.10.1.4 The following tables show the limitations of a Valve with a given size of outlet tubing & Syringe. The numbers in the following tables 1.10.2 to 1.10.6 give an indication of maximum recommended speed.

### 1.10.2 Solenoid Valve Block - Part No: 9855/205

Syringe Volume (ml)	Tubing i/d	
	1mm	2mm
0.5	1	1
1.0	1	1
2.5	2	1
5.0	3	2

**1.10.3 Motor Valve Block - Part No: 9553/261**

<b>Syringe Volume (ml)</b>	<b>Inlet + Outlet Tubing I/D 3.2 mm</b>
5	2
10	2
25	4

**1.10.4 Motor Valve Block - Part No: 9553/262**

<b>Syringe Volume (ml)</b>	<b>Inlet tubing 3.2 mm I/D Outlet Tubing I/D 1.6 mm</b>
5.0	2
10.0	3

**1.10.5 Motor Valve Block - Part No: 9553/263**

<b>Syringe Volume (ml)</b>	<b>Inlet Tubing 1.6mm I/D Outlet Tubing I/D</b>	
	<b>0.86mm</b>	<b>1.6mm</b>
0.50	2	1
1.0	2	1
2.5	3	2
5.0	4	3

## **1.11 Power Supply** (see Fig 1A)

- 1.11.1 When the rear panel voltage selector is set to '230 volts' the COMPUDIL may be used on power supplies ranging from 207 volts through to 253 volts.
- 1.11.2 When the rear panel voltage selector is set to '115 volts' the COMPUDIL may be used on power supplies ranging from 104 volts through to 126 volts.
- 1.11.2 The COMPUDIL 300 Series are rated at 30 VA.

## **1.12 Environment**

- 1.12.1 The COMPUDIL 300 is suitable for use within an ambient temperature range of 18 °C to 31 °C with a maximum relative humidity of 80% for temperatures up to 31 °C.
- 1.12.2 The COMPUDIL 300 should be located on a flat stable work surface clear of the effects of heat sources & preferably not in direct sunlight. They do not incorporate forced ventilation or external heat sinks & consequently may be located close to other equipment.

## **1.13 Dimensions**

- 1.13.1 The weight of the COMPUDIL 300's is approximately 4.5 kg. It is approximately 110 mm wide, 170 mm from front to back & 275 mm high. A space of not less than 100 mm is recommended at the rear for convenient access to cables.

## **1.14 Accuracy & Resolution**

- 1.14.1 The full stroke of every Syringe is 5000 steps with 5500 steps (110% of nominal Syringe volume) available. Actual delivered volume is  $\pm 1.0\%$  of the full Syringe volume.

## **1.15 Precision**

- 1.15.1 The Coefficient of Variation (C.V.) is better than 0.1%.

## **1.16 Chemical Resistance**

- 1.16.1 All valves, Syringes & tubing are manufactured from glass, Kel-F, PTFE, LDPE & FEP based materials for chemical resistance (except to HF & HF compounds).

## 1.17 Warranty

- 1.17.1 Hook & Tucker Zenyx Ltd. warrants to the Purchaser (for a period of twelve months) that the Company's instrument is free from defects in workmanship or material under normal use & service. This warranty commences on the date of shipment of the instrument to the Purchaser. In some cases where an instrument has been supplied to a third party this may be extended to 15 months.
- 1.17.2 During the warranty period the Company agrees to repair or replace, at its sole discretion, without charge to the Purchaser any defective component. The Purchaser must inform the Supplier of the instrument of any defects to arrange repair either by return or on-site. Shipping costs & any applicable taxes are excluded.
- 1.17.3 Repaired Instruments shall carry the same amount of outstanding warranty as from original purchase, or ninety days whichever is the greater.
- 1.17.4 This warranty is contingent upon proper use & does not cover parts such as tubing, syringes & valves blocks.



## Section 2:

### 2.1 Unpacking

- 2.1.1 Carefully unpack all items, check them against the packing list &/or the original order. If any discrepancies exist, do not use the instrument & inform your supplier or Hook & Tucker Zenyx Ltd. immediately.
- 2.1.2 Check that the carton & its contents have not been damaged in transit. If damage has occurred, do not use the instrument & inform your supplier or Hook & Tucker Zenyx Ltd. immediately.
- 2.1.3 Save the carton & its packing in case returning the instrument for repair or servicing is necessary at a later date.

### 2.2 Location

- 2.2.1 Place the reagent reservoir on the same level as the COMPUDIL & as close as practicably possible to it.

### 2.3 Initialisation

**WARNING!**  
DO NOT attempt to change the voltage selector or fuse before disconnecting the power cable.

#### 2.3.1 Voltage Selection (see Fig 1, 1A)

- 2.3.1.1 Check that the voltage selector switch is set to the same voltage as the supply voltage.
- 2.3.1.2 If it needed to use the instrument on a different voltage, switch the instrument off & remove the power cable then with a suitable tool move the voltage selector so that the correct voltage is displayed.

**2.3.2 Fuses** (see Fig 1A)

2.3.2.1 The COMPUDIL is protected by two fuses situated adjacent to the power socket. The fuses are rated at 250 mA for 230 volt supplies & 500 mA for 115 volt supplies.

2.3.2.2 Remove the power cable from its socket before attempting to replace or check the fuse rating.

2.3.2.3 Rotate the fuse holder anti-clockwise through 45° using a flat bladed screwdriver to gain access to the fuse. The correctly rated type 'A' fuse must always be used.

2.3.2.4 Fit the fuse in the holder & locate the two lugs of the holder in line with the slots of the fixed body. Fit the fuse holder into the body & rotate clockwise approximately 45°.

**2.3.3 Plug**

2.3.3.1 In certain countries fitting a plug to the power cable may be necessary. If this is necessary make the following connections: -

Live (Line)	Brown
Neutral	Blue
Earth (Ground)	Green/Yellow

2.3.3.2 It is essential that an earth is connected to any liquid handling equipment, especially if it has a filter fitted. If a fused plug is used, it requires a 3 amp fuse.

## Section 3

### 3.1 Power (see Fig 1A)

- 3.1.1 A rocker switch at the left-hand rear of the instrument connects power to the COMPUDIL, check the voltage before switching on (see section 2.3.1).
- 3.1.2 Press '1' for power ON & '0' for power OFF. The yellow 'POWER' LED on the front panel will be illuminated when the power is ON (this is the only LED on the front panel of the RS232 Control models).

### 3.2 Re-Set (see Fig 1)

- 3.2.1 Only on the COMPUDIL 310 & 320.
- 3.2.2 Pressing this will allow any change in program number to be down loaded.

### 3.3 Aspirate & Dispense Indicators (see Fig 1)

- 3.3.1 Only on the COMPUDIL 310 & 320.
- 3.3.2 These green LED's give an indication of the current syringe operating stage.

### 3.4 Program (see Fig 1)

- 3.4.1 Only on the COMPUDIL 310 & 320.
- 3.4.2 This thumb wheel switch allows up to nine (numbered 1 to 9) user defined programs to be selected (refer to section 12 for details of the specific Customer programs).

### 3.5 Connections (see Fig 1A)

- 3.5.1 Power is supplied via an IEC type socket in the rear panel.
- 3.5.2 Handset control is via a 4-pin DIN socket in the rear panel, & has the following connections: -

PIN	
1	0 Volts
2	LED Indicator
3	Go Command
4	Not Used

3.5.3 On the COMPUDIL's 330 & 340 the RS232 link is via a 25-pin D connector on the rear panel, & has the following connections: -

PIN	USE	DIRECTION
2	TX	Output to controller
3	RX	Input from controller
• 4	RTS	
5•	CTS	Output to controller
6•		Input from controller
7	GND	Signal ground
• 20	DTR	

3.4.4 As a guide the following connections have been used satisfactorily: -

Compudil 300			PC 'Clone'		
<b>Pin</b>	2	TX		• 3	RX
	3	RX	•	2	TX
	7	GND	•	• 7	GND

## Section 4

### 4.1 Setting Up

- 4.1.1 The instrument will be despatched with the ordered Syringe fitted, suitable tubing, designated Valve Block & with the internal switches preset for the type of valve fitted (Motor or Solenoid).
- 4.1.2 If it is required to change the Syringe or Valve Block refer to section 1.6 to ensure that the correct match between them is used. Also, refer to section 4.4 for instructions in changing the Syringe & section 4.5 for changing the Valve Block.
- 4.1.3 Ensure that the bottom knurled fixing nut on the Syringe is firmly screwed in, this can only be TIGHTENED BY HAND & NOT with the aid of a TOOL.
- 4.1.4 The Inlet tubing is connected to the left-hand side of the Valve Block & the Outlet to the right-hand side (when viewed from the front). These connections will be via a connector or a push fitting, dependent on Valve Block.
- 4.1.5 Care must be taken when fitting Inlet & Outlet tubing, finger tight connections for both push & screw types are adequate to avoid leaks. DO NOT OVER TIGHTEN.

### 4.2 Emergency Stop (see Fig 1A)

- 4.2.1 If the instrument is liable to spill liquid, damage other samples, damage itself or appear to become out of control then switch OFF the power to the COMPUDIL 300 immediately.
- 4.2.2 Mop up any liquid spillage immediately & remove any obstructions taking all necessary precautions before applying power to the instrument. Be prepared for further liquid dispensing when the instrument is switched back on, as it will go into auto reset & the syringe will drive up to the empty position.

### 4.3 Caution

- 4.3.1 The internal electrical component of this instrument are NOT explosion or fire proof & whenever highly inflammable liquids are being handled it is important that the inflammable vapours DO NOT reach the electrical parts of the instrument.

## 4.4 Changing Syringes (see Fig 2)

- 4.4.1 Before changing the Syringe refer to sections 1.6 & 1.7 to ensure that the Valve Block & tubing available will be suitable for the new Syringe. It is also essential that the correct Syringe Spacer is used (refer to spares drawings for types).
- 4.4.2 Ensure that the COMPUDIL 300 has been thoroughly washed clean by running distilled water through several times, then switch off. Stopping the Syringe near the bottom of its stroke is advisable.
- 4.4.3 Unscrew the knurled nut on the Syringe below the Syringe clamp block until the piston is free then slide the piston up into the Syringe barrel until the threaded end of the Syringe clears the Syringe clamp block.
- 4.4.4 Unscrew the Syringe from the Valve Block then remove the Syringe Adaptor. Carefully screw in the replacement Syringe into the Valve Block ensuring that it does NOT BECOME CROSS THREADED. The new Syringe should be finger tightened to avoid leakage. Do not use a tool or over tighten the thread as damage may occur to either the Syringe or the Valve Block.
- 4.4.5 Lower the end of the Syringe so that the thread fully enters the Syringe Spacer & Syringe clamp then replace the knurled nut. Tighten fully by hand do not use a tool.

## 4.5 Changing Valve Block

### 4.5.1 Motor Valve (see Fig 2)

- 4.5.1.1 Before changing the Valve Block refer to sections 1.6 & 1.7 to ensure that the Syringe & tubing available will be suitable for the new Valve Block.
- 4.5.1.2 Ensure that the COMPUDIL 300 has been thoroughly washed clean by running distilled water through several times, then switch off the associated equipment.
- 4.5.1.3 Remove the Syringe as in section 4.4.
- 4.5.1.4 Remove the two screws (with washers) in the Valve Block & keep with the stainless steel cover plate.
- 4.5.1.5 The Valve Block can now be removed complete with the Retainer & the Spacer Block, keep these safe.
- 4.5.1.6 Assemble the Retainer & the Spacer Block onto the new Valve Block, align the 'D' on the Valve Block with the drive & replace the new Valve Block.
- 4.5.1.7 The new Valve Block should now be rotated so that the screws line up (the engraved number on the new Valve Block will be at the top).
- 4.5.1.8 Replace the cover plate with the two screws & washers ensuring that it sits flat against the front panel then tighten the two screws just to hold.
- 4.5.1.9 Screw the Syringe into the Valve Block then slide the piston down to the clamp block & rock the valve block so that the screwed end of the piston enters the clamp block. Tighten the two screws on the Valve Block then the Syringe as per section 4.4.

### 4.5.2 Solenoid Valve (see Fig 2)

Note: There is only one type of Solenoid Valve therefore only the complete assembly is replaced.

- 4.5.2.1 Ensure that the COMPUDIL 300 has been thoroughly washed clean by running distilled water through several times, then switch off any associated equipment.
- 4.5.2.2 Remove the external cover then unplug the two pin Molex K-K plug from the Main PCB.
- 4.5.2.3 Remove the Syringe (with its adaptor) as in section 4.4.
- 4.5.2.4 Unscrew the fixing nut & washers then slide the Solenoid through the Front Plate.
- 4.5.2.5 Replace with the new Solenoid Valve Assembly, hold in place with the nut & washers.
- 4.5.2.6 Screw the Syringe into the Valve Assembly then slide the piston down to the clamp block & rock the valve so that the screwed end of the piston enters the clamp block. Tighten the nut on the Valve Assembly then the Syringe as per section 4.4.
- 4.5.2.7 Connect the Molex K-K plug to the PCB & refit the external cover.

## Section 5

### 5.1 COMPUDIL 310 & 320 General

- 5.1.1 On power up the COMPUDIL will switch the valve to the rear position, the syringe descends 200 steps then rises until the Home Opto's are found. The operation will not start until the button on the Handset is pressed.
- 5.1.2 These COMPUDIL's have Customer defined programs that are permanently stored in the memory at the factory. To change the operation of any program the COMPUDIL will require a new memory chip.
- 5.1.3 The table in Section 12 will give details of the operation of these program numbers 1 to 9 as supplied by the Customer (program 0 is usually dedicated to a 'Prime' function).
- 5.1.4 When changing a program press 'Reset' to download the new program before starting, the operation is now controlled via the button on the Handset.

### 5.2 Prime Mode (see Fig 1)

- 5.2.1 Select program 0 & press Reset, the instrument is now ready to begin the Prime cycle. This will aspirate a liquid via the inlet tubing & dispense via the outlet tubing/Handset therefore a container must be provided to avoid spillage.
- 5.2.2 When the Handset red light is on press the button & the instrument will go through three complete cycles before stopping automatically at the top of its stroke.
- 5.2.3 The instrument is now ready to start the selected program operation.



## 5.3 Diluter Mode (see Fig 1)

### 5.3.1 Diluter with REAR Reservoir Operation

- 5.3.1.1 Select the desired program number & press Reset to download the program.
- 5.3.1.2 When ready the Aspirate light on the front panel will come on, press the Handset button to aspirate the predefined volume from the reservoir. On completion of this stage the Aspirate light will come on again, then press the Handset button to Aspirate the predefined sample volume via the Handset tip.
- 5.3.1.3 When this stage has been completed the Dispense light on the front panel & the Handset Red light will come on, press the Handset button to Dispense the Sample & Diluent via the Handset tip. The syringe will now automatically move down to fill from the Reservoir ready to Aspirate from the Handset.
- 5.3.1.4 If an Airgap has been included in the pre-defined program an additional operation of the Handset button is required when the initial Aspirate cycle has been completed (with the Handset tip out of the Sample).
- 5.3.1.5 The instrument is now ready either to repeat the cycle or to have another program selected, if another type of program is to be selected it is advisable to 'Wash' the instrument using the Prime Mode (see section 5.2).

### **5.3.2 Diluter Aspirating through the Handset Tubing Operation**

- 5.3.2.1 Select the desired program number & press Reset to download the program.
- 5.3.2.2 When ready the Aspirate light on the front panel will come on, press the Handset button to aspirate the predefined diluent volume via the Handset tip. On completion of this stage the Aspirate light will come on again, then press the Handset button to Aspirate the predefined sample volume via the Handset tip
- 5.3.2.3 When this stage has been completed the Dispense light on the front panel & the Handset Red light will come on, press the Handset button to Dispense the Sample & Diluent via the Handset tip.
- 5.3.2.4 If an Airgap has been included in the pre-defined program an additional operation of the Handset button is required when the initial Aspirate cycle has been completed (with the Handset tip out of the Sample).
- 5.3.2.5 The instrument is now ready either to repeat the cycle or to have another program selected, if another type of program is to be selected it is advisable to 'Wash' the instrument using the Prime Mode (see section 5.2).

## 5.4 Dispenser Mode (see Fig 1)

### 5.4.1 Aspirates from the REAR & Dispense via the Handset Tubing

- 5.4.1.1 Select the desired program number & press Reset to download the program.
- 5.4.1.2 When ready the Aspirate light on the front panel will come on, press the Handset button to aspirate the predefined volume from the reservoir.
- 5.4.2.3 When this stage has been completed the Dispense light on the front panel & the Handset Red light will come on, press the Handset button to Dispense via the Handset tip.
- 5.4.2.4 The instrument is now ready either to repeat the cycle or to have another program selected, if another type of program is to be selected it is advisable to 'Wash' the instrument using the Prime Mode (see section 5.2).

### 5.4.2 Aspirates from the REAR & Dispense Multiple Aliquots via the Handset

- 5.4.1.1 Select the desired program number & press Reset to download the program.
- 5.4.1.2 When ready the Aspirate light on the front panel will come on, press the Handset button to aspirate the predefined volume from the reservoir.
- 5.4.2.3 When this stage has been completed the Dispense light on the front panel & the Handset Red light will come on for each of the aliquots, press the Handset button to Dispense via the Handset tip.
- 5.4.2.4 The instrument is now ready either to repeat the cycle or to have another program selected, if another type of program is to be selected it is advisable to 'Wash' the instrument using the Prime Mode (see section 5.2).

## Section 6

### 6.1 COMPUDIL 330 & 340 RS232 Introduction

- 6.1.1 On power up the COMPUDIL will switch the valve to the rear position, the syringe descends 200 steps then rises until the Home Opto's are found. The valve then switches to the front position. This also clears the RS232 buffer.
- 6.1.2 Commands are received as ASCII strings terminated by a carriage return character (<CR>, 13 decimal, 0DH).
- 6.1.3 No more than 32 non-<CR> characters should be sent before each <CR>. Space semicolon & line feed are not counted in the character count, upper & lower cases are equivalent.
- 6.1.4 Incoming command characters are executed in sequence upon receipt of a carriage return. These command strings are replied to in sequence to form a reply string.
- 6.1.5 The reply is terminated by a <CR>, the reply string is transmitted at completion of each command until a <CR> is encountered or a buffer overflow condition is detected.
- 6.1.6 On encountering a <CR> the processing of an immediately preceding fully received command results in a success code being transmitted on completion of the command. If the last command was cut short by the <CR> an 'illegal command' reply will be returned.
- 6.1.7 On encountering a buffer overflow any fully received commands will be executed returning an appropriate reply code, followed by an 'illegal command' error, followed by a <CR>.
- 6.1.8 If the last command was cut short by the 'buffer overflow' condition (this includes commands which normally allow missing digits but which are cut short precisely at the point at which the first digit was expected), an 'illegal command' error followed by a <CR> will be returned.
- 6.1.9 When 'buffer overflow' is encountered all un-executed characters in any erroneous incomplete command are ignored together with any characters up to the eventual <CR>.
- 6.1.10 Immediately upon sending the termination <CR> the controlling computer system should wait for a reply from each command in the string within a maximum of 25 seconds of the last reply having been received.
- 6.1.11 If the controlling system is unable to notice the receipt of replies until the reply <CR> is received, the length of time is multiplied by the number of commands in the string. This is the maximum length of time which any command may take to execute.

## 6.2 Baud Rate Selection

- 6.2.1 The instrument obeys commands received from a bidirectional serial interface.
- 6.2.2 This runs at a configurable baud rate, this being controlled by a switch on the Syringe Drive PCB.
- 6.2.3 Four baud rate settings are available & are selected using '1' & '2' of SW1 as follows: -

SW1 Position		Baud Rate Selection
1	2	
ON	ON	1200 Baud
OFF	ON	2400 Baud
ON	OFF	4800 Baud
OFF	OFF	9600 Baud

Down is 'ON'

- 6.2.4 Data is sent & received at the rate given above using 8 data bits with 1 stop bit. Incoming parity is ignored. No parity is transmitted.

## 6.3 Error Reply Codes

- 6.3.1 The instrument will reply with 'E00' <CR> if the command received was illegal or lost due to buffer overflow.

## 6.4 Multiple Diluter Connection (see Fig 3)

- 6.4.1 Where more than one COMPUDIL 300 is to be used they can be connected together as per this diagram, the values of the resistor & diodes are as follows: -

R1 - 10K at 1/4w.

Dn - Type IN4001

Note: The diode with a resistor in parallel is only required on the first COMPUDIL 300 subsequent instruments require the diode only. Always observe the correct direction of the diode.

## 6.5 RS232 Commands

### 6.5.1 @ n = Sign on (with replies)

6.5.1.1 This command is sent to an instrument before it will accept any others. The 'n' refers to the particular COMPUDIL 300 when multiple Syringe Drives are used (see Fig 5).

6.5.1.2 This first command needs no <CR>, the instrument will reply with n<CR>.

### 6.5.2 Z n = Sign on (without replies)

6.5.2.1 This command needs no <CR>, the 'n' refers to the particular COMPUDIL 300.

### 6.5.3 H = Home

6.5.3.1 <CR> required. This command will home the syringe as in 'power up' but the previous speed setting & any commands in the buffer are preserved.

6.5.3.2 The instrument will reply with 'X' <CR> after completion of the home sequence.

### 6.5.4 S(n) = Set Speed

6.5.4.1 <CR> required. Where (n) is any number from 1 to 9, speed 9 is the slowest setting & speed 1 is the fastest.

6.5.4.2 The instrument will reply with 'X' <CR>.

### 6.5.5 T(n) = Set Time Delay

6.5.5.1 <CR> required. Where (n) is in tenths of a second. The instrument will accept numbers up to 9999.

6.5.5.2 The instrument will reply with 'T' <CR> after completion of delay.

### 6.5.6 F = Set Valve to Front (Motor or Solenoid valve type)

6.5.6.1 <CR> required. The instrument will reply with 'X' <CR> after completion.

### 6.5.7 R = Set Valve to Rear (Motor or Solenoid valve type)

6.5.7.1 <CR> required. The instrument will reply with 'X' <CR> after completion.

### 6.5.8 D(nnnn) = Syringe Down

6.5.8.1 <CR> required. Where (nnnn) is the required number of steps & can be any number from 0 to 9999. The maximum number of steps is 5500.

6.5.8.2 The instrument will reply with 'X' <CR> after completion.

Note: NO checks are made to ensure that the syringe is being sent 'out of limits'. Care must be taken to avoid driving into the end stop.

Note: On the Compudil 330 it is essential the time the Solenoid valve is 'energised' is kept to a minimum.

**6.5.9 U(nnnn) = Syringe Up**

6.5.9.1 <CR> required. Where (nnnn) can be any number from 0 to 9999. The maximum number of steps is 5500.

6.5.9.2 The instrument will reply with 'X' <CR> after completion.

Note: NO checks are made to ensure that the syringe is being sent 'out of limits'. Care must be taken to avoid driving into the end stop.

**6.5.10 L6 = Set Handshake Out at -5v.**

**6.5.11 O6 = Set Handshake Out at +5v (Normal HIGH).**

**6.5.12 I1 = Wait for Handshake In to be Low ( Normally LOW).**

**6.5.13 M1 = Wait for Handshake In to be HIGH.**

**6.5.14 Q = Query position**

6.5.14.1 <CR> required. The instrument will reply with D(nnnn) S (n) (FR) where (nnnn) is the current syringe position, (n) is the current speed setting & F or R is the current valve position.

6.5.14.1 Any negative numbers shown in the (nnnn) position will imply that the syringe has been taken over its home position. If this does happen the syringe should be re-homed using the 'H' command or reset by removing the power.

**6.5.15 \* = Repeat**

6.5.15.1 This command must be placed at the FRONT of any command sequence that is required to be repeated. The series of commands must be terminated by <CR>.

6.5.15.2 The instrument will reply with '\*' <CR> for each completed loop, this command can be terminated by any further commands but the instrument will complete the loop first.

**6.5.16 / or. = Sign off**

6.5.16.1 <CR> required. The instrument will not reply to this command or any further commands until signed on again.

## 6.6 Programming Examples using Handshake

### 6.6.1 Using L6 & O6

@n L6 S6 R D5000 T10 F U5000 O6 /

Address the instrument n.

Set the handshake output to low.

Set the syringe speed to 6.

Set the valve to rear.

Send the syringe down 5000 steps.

Wait for 1 second.

Set the valve to front.

Send the syringe up 5000 steps.

Set the handshake back to normal (+5v).

Sign off.

### 6.6.2 Using M1

@n M1 S6 R D5000 T10 F U5000 /

Address the instrument n.

Wait for handshake to go high.

Set the syringe speed to 6.

Set the valve to rear.

Send the syringe down 5000 steps.

Wait for 1 second.

Set the valve to front.

Send the syringe up 5000 steps.

Sign off.



## Section 7

### 7.1 Cleanliness

- 7.1.1 It is of paramount importance that any electrical instrument handling liquids is kept CLEAN, DRY & SAFE.
- 7.1.2 If any spillage does occur, dependant on how the instrument is mounted turn it OFF & disconnect the power cable. Mop up any spillage using a damp cloth with mild liquid detergent before it can enter the electrical & mechanical parts. DO NOT use abrasive cleaning agents on any surface.
- 7.1.3 DO NOT allow dried chemical deposits to build up or performance & safety will suffer.

### 7.2 Servicing (Periodically check the following points)

#### 7.2.1 Mechanical Lubrication

- 7.2.1.1 Lightly re-grease the ball screw drive shaft with ISOFLEX NBU 15 & the two upper guide rods with CASTROL LM to avoid wear.
- 7.2.1.2 DO NOT allow the grease to build up, collect dust or become hard & dirty.

#### 7.2.2 Electrical

- 7.2.2.1 Check all connectors & wiring for corrosion & damage.

**WARNING!**

DO NOT attempt to carry out any Servicing before disconnecting the power cable.

## Section 8

### 8.1 Drive Motor

- 8.1.1 This is a stepper motor that drives a ball screw mechanism via a geared belt drive. The ball screw mechanism operates the syringe & is provided with a datum reference.

### 8.2 Motor Valve Drive

- 8.2.1 Only on COMPUDIL 320 & 340 versions.
- 8.2.2 This is a stepper motor that operates the valve via a direct shaft & switches the valve between Inlet & Outlet.

### 8.3 Solenoid Valve Assembly

- 8.3.1 Only on COMPUDIL 310 & 330 versions.
- 8.3.2 This is an alternative to the Motor Valve Drive in section 8.2 but does not require a drive shaft, as the switching is an integral part of the valve.

### 8.4 Syringe Drive PCB

- 8.4.1 This contains the program memory on an EPROM labelled 'COMPUDIL 300 VERSION x.x'.
- 8.4.2 The RS232 communication is also built into this board on the COMPUDIL 330 & 340 versions.

### 8.5 Valve Drive PCB

- 8.5.1 This is only fitted with the Motor Valve & is not required for the Solenoid Valve Assembly.

## 8.6 Brief Electrical Description

Note: The electronics for the COMPUDIL 300 is housed on either one or two PCB's. The Motor version has one 'mother' PCB with a secondary 'daughter' PCB fitted onto it. The Solenoid version has only the 'mother' PCB. The transformer supplies 5 v to the microprocessor & 24 v to the motors.

### 8.6.1 Mother Board (COMPUDIL 330 & 340 only)

- 8.6.1.1 This PCB contains an 8 bit processor that handles all of the required functions. These include the stepper motor control, the home position sensing & the serial communication.
- 8.6.1.2 The motor drive I.C.'s are switch current mode controllers, one I.C. is used per motor phase.
- 8.6.1.3 The motor is driven in half step mode (400 steps per revolution) & the gearing is arranged so that if the motor is driven down 5000 steps the syringe fitted will be at it's rated volume position (60mm).
- 8.6.1.4 The serial data is received & transmitted through a dedicated RS232 control I.C. & verified for correct command structure using the code in the processor.
- 8.6.1.5 A four-position DIP switch is used to set the following options: -
  - a. Baud rate selection for serial communications.
  - b. The valve type (Motor or Solenoid).
- 8.6.1.6 When the Solenoid Valve is used this plugs into the two pin connector.

### 8.6.2 Daughter Board

- 8.6.2.1 This PCB plugs into the 'mother' board & contains the motor drive I.C.'s required to drive the Motor Valve motor.
- 8.6.2.2 The circuitry is a copy of the motor drive circuit on the 'mother' board & uses the same switch current mode operation.

## 8.7 Brief Mechanical Description

- 8.7.1 A 1.8 degree stepper motor is coupled to the drive shaft via a geared-up toothed belt drive (this has a ratio of 1:1.6). The drive shaft translates this motor action into a vertical linear movement via a ball screw drive.
- 8.7.2 A Ball screw Housing runs vertically on the ball screw, to this is attached the Syringe Clamp Block, which holds one end of the syringe plunger. This moves vertically in a slot in the Front Plate, a rear Guide Rod controls any horizontal swivel.
- 8.7.3 A datum point is provided as a reference for the mechanism by a motor flag/ opto-slot on the motor drive wheel & a linear flag/opto-slot on the Ball screw Housing.
- 8.7.4 The Motor Valve is driven though 90<sup>0</sup> & is referenced by two motor flags/opto-slots on the valve drive shaft.

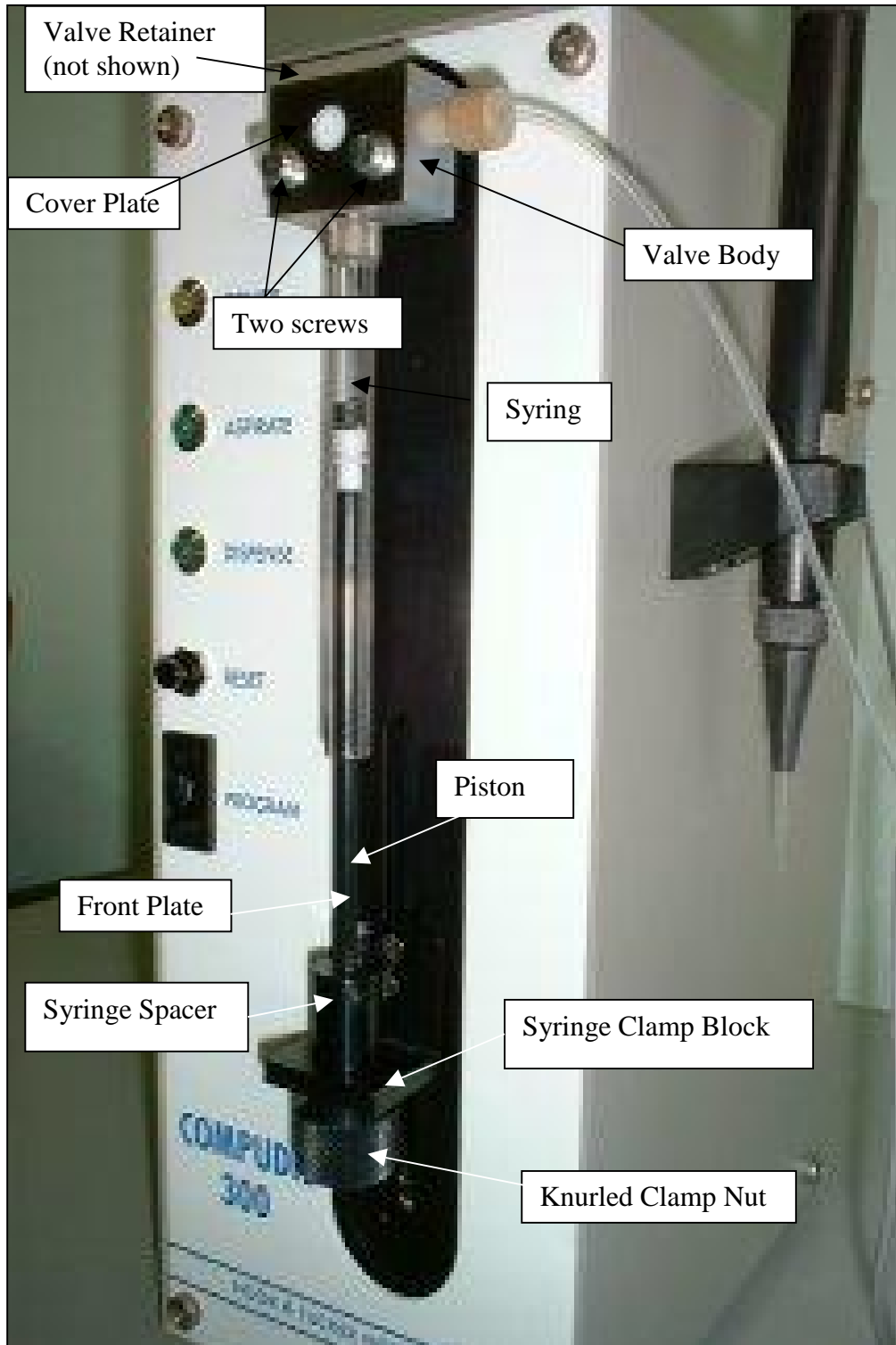
## Section 9



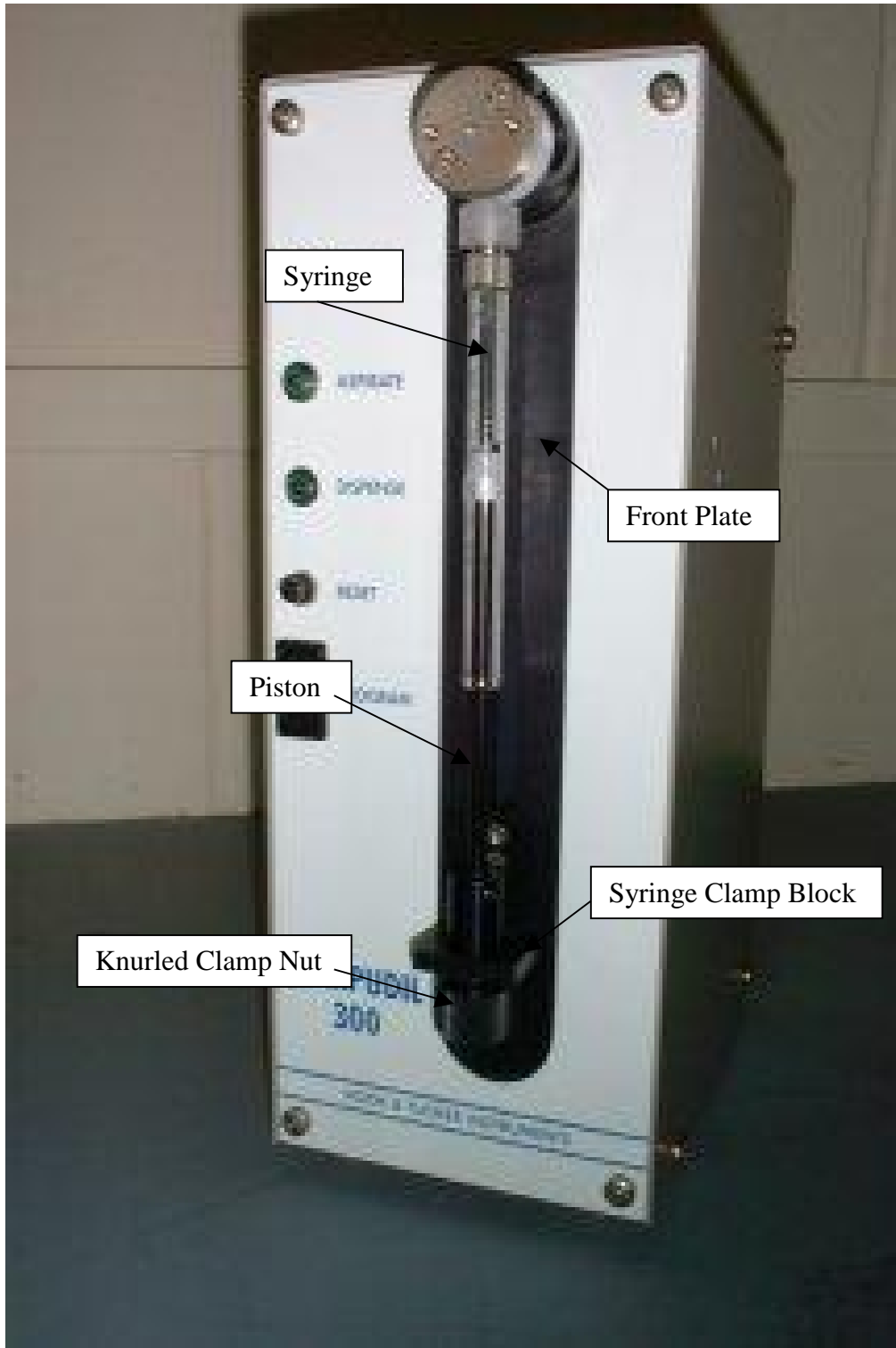
**Fig 1 Front View**



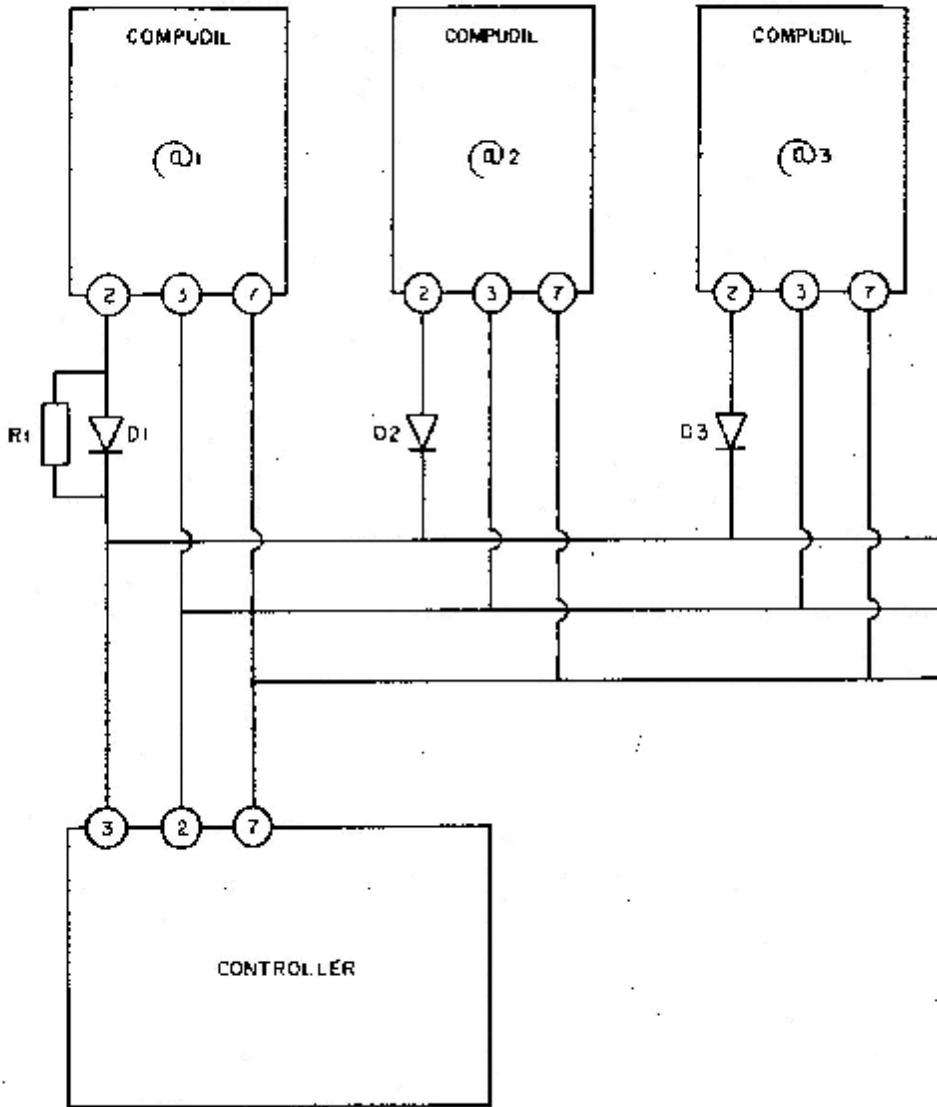
Fig 1A Rear View



**Fig. 2 Syringe & Valve Replacement - Motor Valve**



**Fig. 2A Syringe & Valve Replacement - Solenoid Valve**



**Fig. 3 Multiple Compudil Connections**



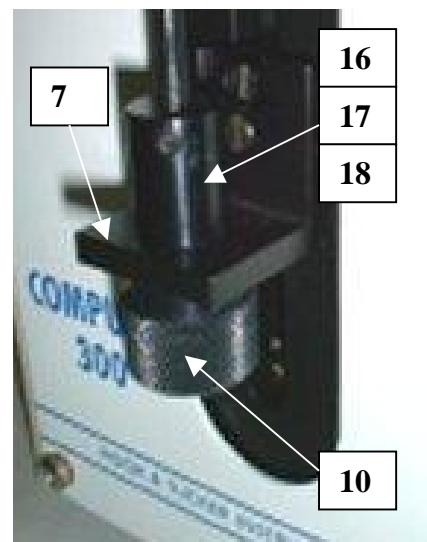
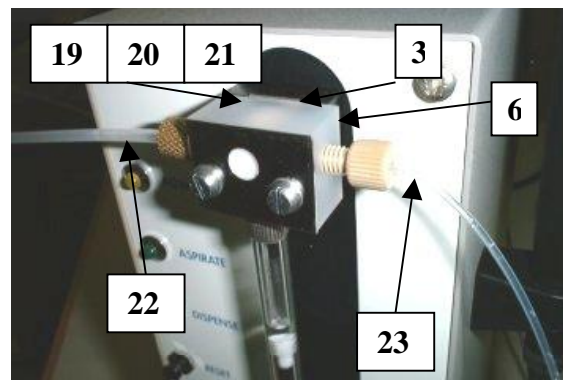
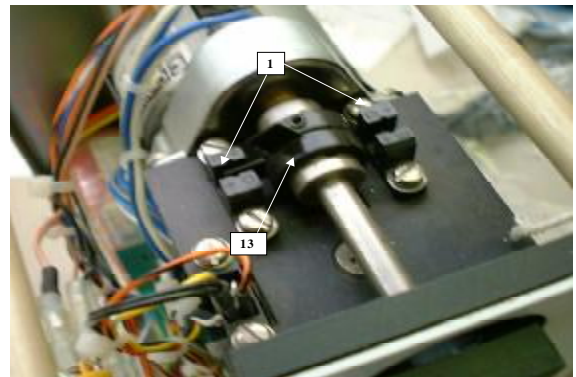
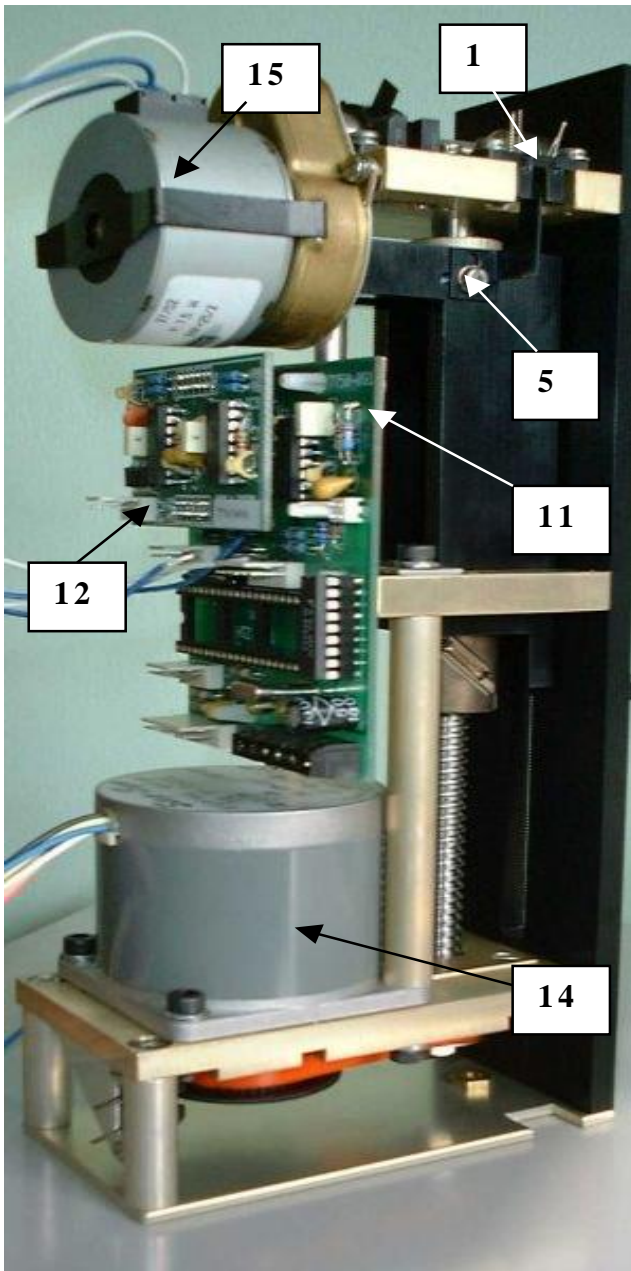
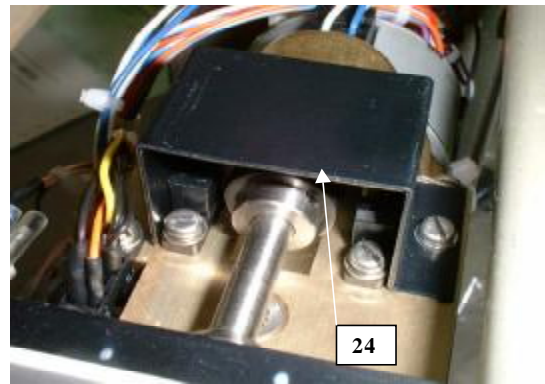
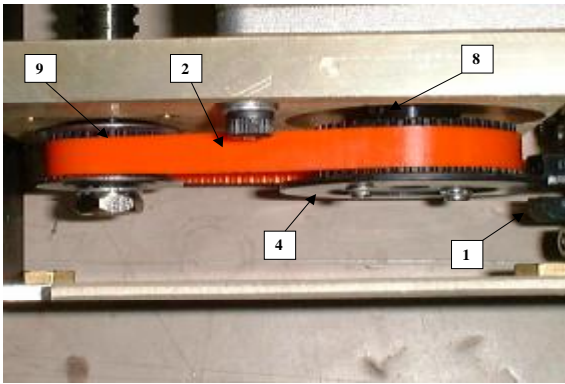
## Section 10

### 10.1 Spares for Compudil 320 & 340 (Motor Valve)

10.1.1 It is advisable whenever ordering spare parts to quote the **SERIAL** number of the instrument for which the parts are required.

10.1.2 Item numbers refer to the following pictures.

Item No:	Part No:	Description	Qty.
1	2165/001	Opto Switch	4
2	2670/023	Drive Belt	1
3	5600/111	Valve Retainer	1
4	5730/003	Opto Flag - Motor Pulley	1
5	5730/012	Opto Flag	1
6	6000/300	Valve Spacer Block	1
7	6000/360	Syringe Clamp Block	1
8	6100/137	Pulley - on Motor	1
9	6100/095	Pulley - on Lead Screw	1
10	7000/062	Knurled Clamp Nut	1
11	7750/048A	Syringe drive PCB (COMPUDIL 340) or	1
11	7750/091A	Syringe drive PCB (COMPUDIL 320)	1
12	7750/049A	Valve Drive PCB	1
13	9855/102	Opto Flag & Collar Assembly	2
14	9855/500	Motor Assembly Syringe Drive	1
15	9855/501	Motor Assembly Valve Change Over	1
16	7950/175	Syringe Spacer - 5ml	Opt.
17	7950/176	Syringe Spacer - 10ml	Opt.
18	7950/177	Syringe Spacer - 25ml	Opt.
19	9553/261	Valve Block Assembly	Opt.
20	9553/262	Valve Block Assembly	Opt.
21	9553/263	Valve Block Assembly	Opt.
22	-	Inlet Tubing - see section 1.4	Opt.
23	-	Outlet Tubing - see section 1.4	Opt.
24	6750/004	Opto Cover	1

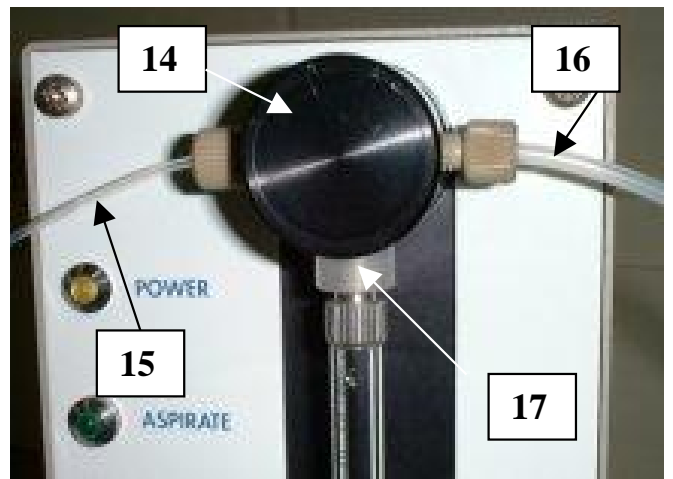
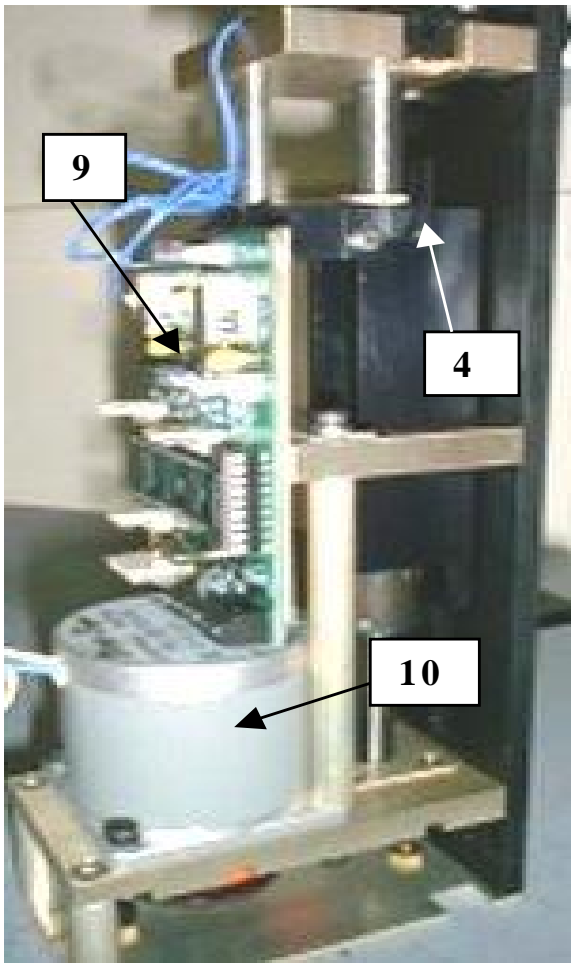
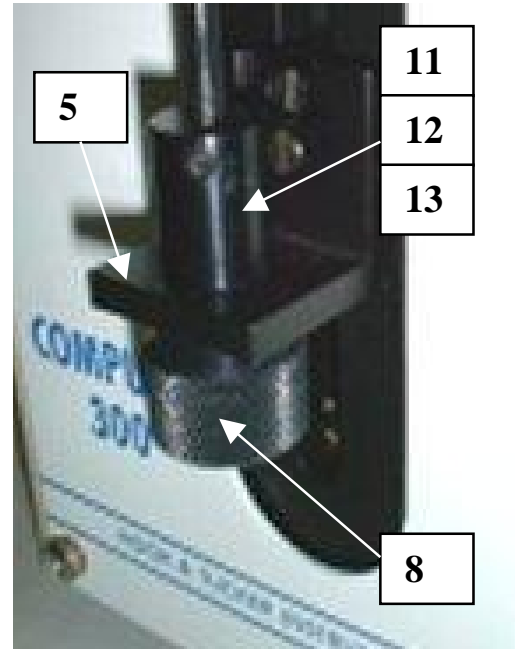
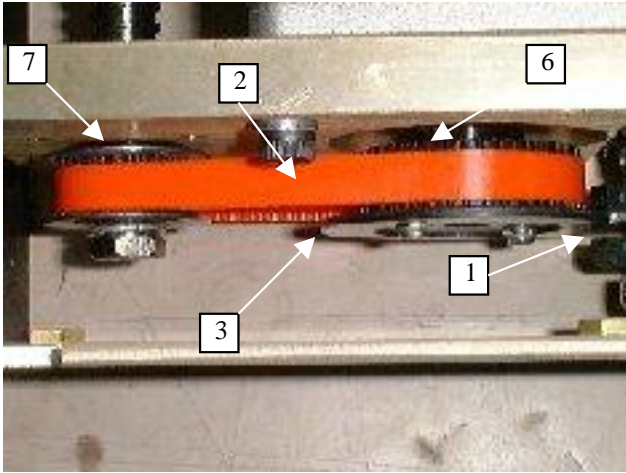


## 10.2 Spares for Compudil 310 & 330 (Solenoid Valve)

10.2.1 It is advisable whenever ordering spare parts to quote the **SERIAL** number of the instrument for which the parts are required.

10.2.2 Item numbers refer to the following pictures.

Item No:	Part No:	Description	Qty.
1	2165/001	Opto Switch	2
2	2670/023	Drive Belt	1
3	5730/003	Opto Flag - Motor Pulley	1
4	5730/012	Opto Flag	1
5	6000/325	Syringe Clamp Block	1
6	6100/137	Pulley - on Motor	1
7	6100/095	Pulley - on Lead Screw	1
8	7000/062	Knurled Clamp Nut	1
9	7750/048A	Syringe Drive PCB (COMPUDIL 330) or	1
9	7750/091A	Syringe Drive PCB (COMPUDIL 310)	1
10	9855/500	Motor Assembly Syringe Drive	1
11	7950/175	Syringe Spacer - 5ml	Opt.
12	7950/176	Syringe Spacer - 10ml.	Opt.
13	7950/177	Syringe Spacer - 25ml.	Opt.
14	9855/509	Complete Solenoid Valve Assembly	1
15	-	Inlet Tubing - see section 1.5	Opt.
16		Outlet Tubing - see section 1.5	Opt.
17	6305/007	Syringe/Valve Adapter	1



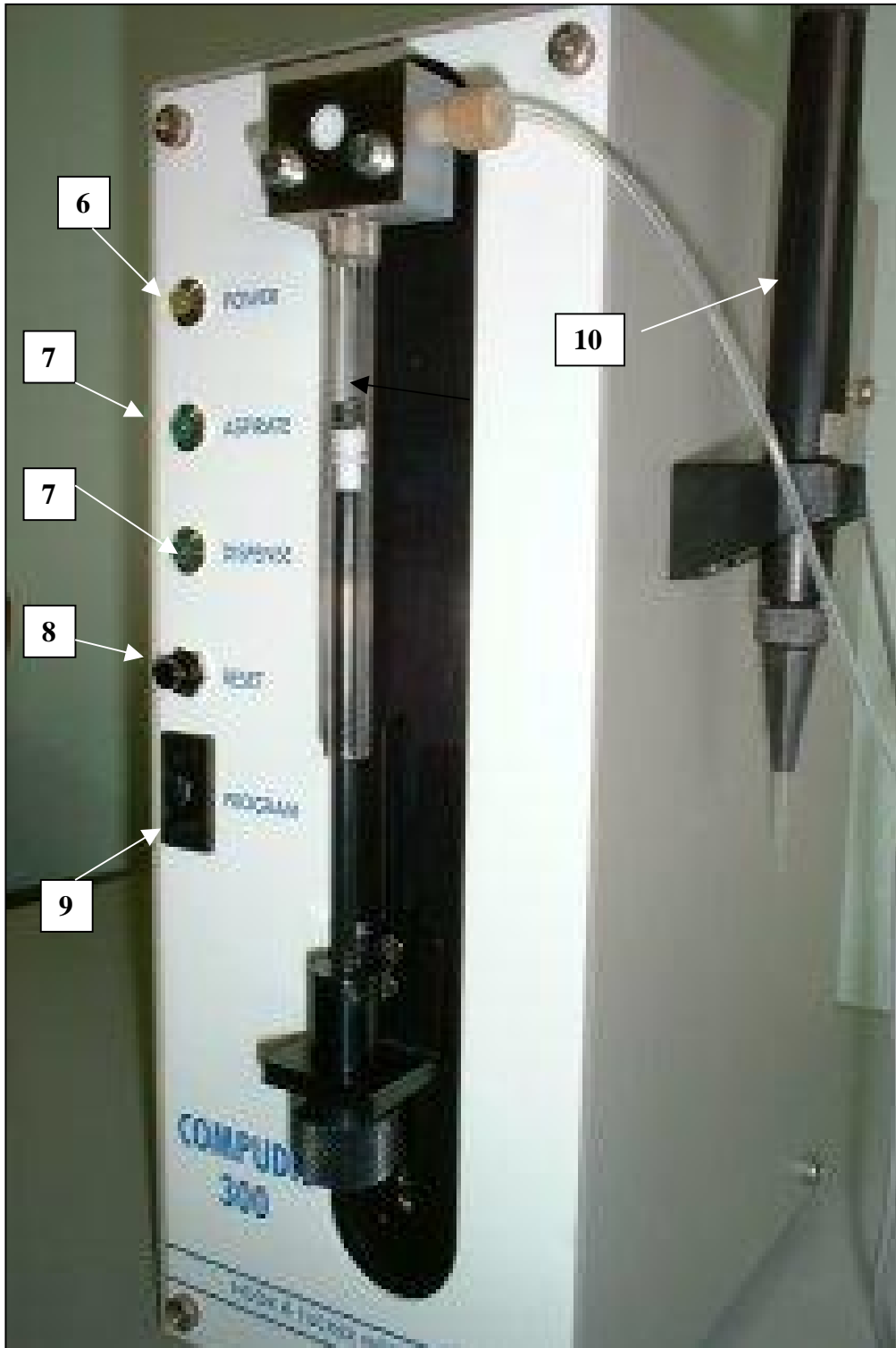
### 10.3 External Spares

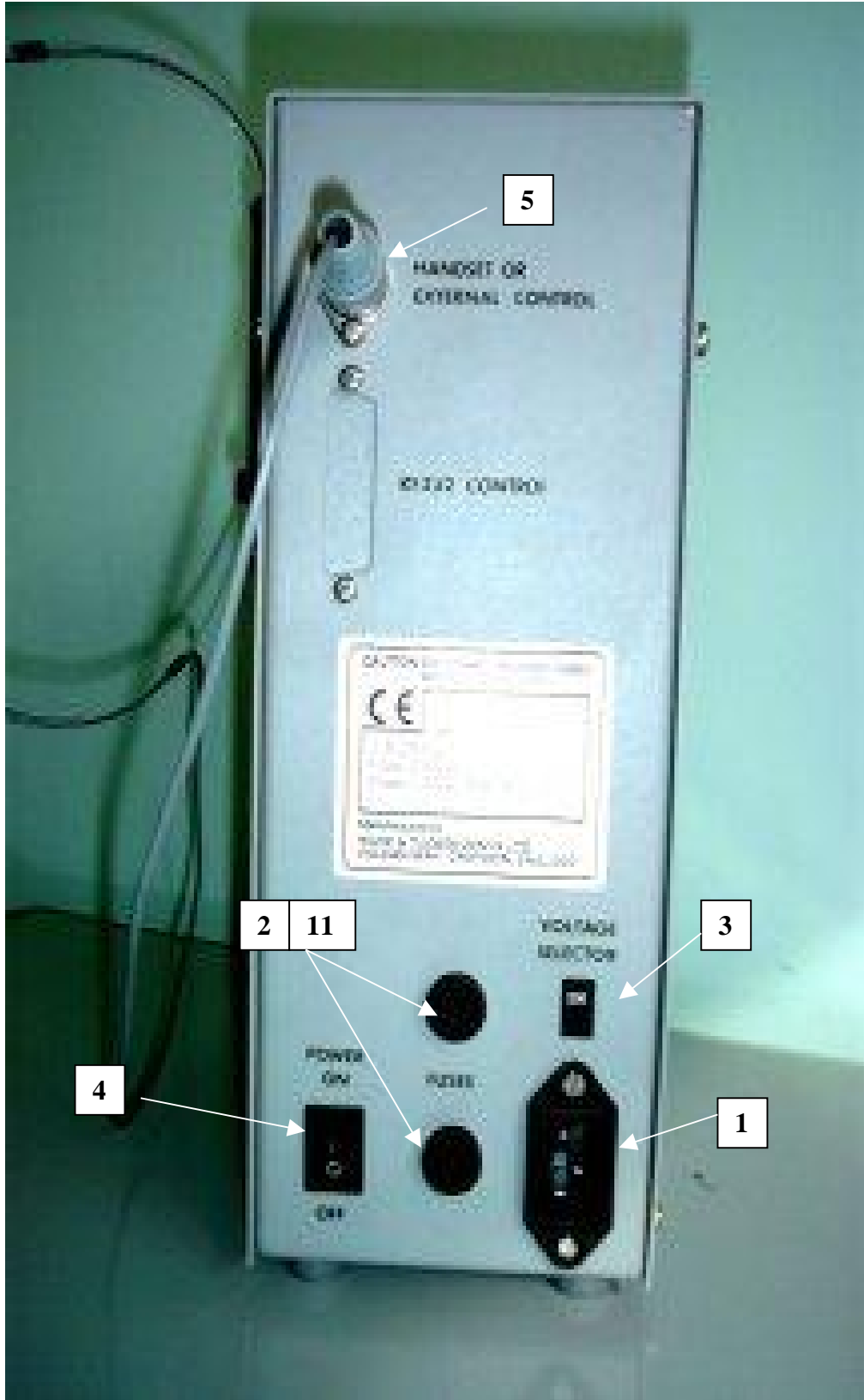
10.3.1 It is advisable whenever ordering spare parts to quote the **SERIAL** number of the instrument for which the parts are required.

10.3.2 Item numbers refer to the following pictures.

Item No:	Part No:	Description	Qty.
1	2360/013	Filter Plug	1
2	2080/001	Fuse Holder	2
3	2240/061	Voltage Selector Switch	1
4	2240/073	Power Switch	1
5	2057/061	4 pin DIN Socket	1
6	2160/073	Yellow LED - Power	1
7	2160/072	Green LED - Aspirate & Dispense *	2
8	2240/011	Reset Switch *	1
9	2240/085	Program Selector Switch *	1
10	see section 1.9	Handset *	1
11	2070/016	250 mA 'T' type fuse for 230 v use	2
11	2070/003	500 mA 'T' type fuse for 115 v use	2

\* Only fitted to the Fixed Program versions.





## Section 11

11.1.1 Appropriate markings are applied to this instrument to all relevant points as per the list below: -

These labels are used on the instrument for health & safety reasons. To enable their interpretation correctly each is explained.



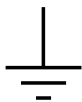
Background colour: yellow  
Symbol & outline: black

Meaning:  
Caution (refer to accompanying documentation)



Background colour: yellow  
Symbol & outline: black

Meaning:  
Laser radiation - do not stare into the beam. Class 2 laser product as defined in IEC 825-1:1993. The radiation is in the wavelength range 400 to 700 nm & eye protection is normally afforded by aversion responses including the blink reflex.



Background colour: green  
Symbol: black

Meaning:  
Earth (ground) terminal (IEC 417, No. 5017).



Background colour: green  
Symbol & outline: black

Meaning:  
Protective conductor terminal (IEC 417, No. 5019).



Alternating current - the frequency (Hz), voltage (V) & current (A) or power consumption (W or VA) will be specified (IEC 417, No. 5032).



## Section12

### 12.1 CompuDil 310, 320 Program Summary

Instrument Serial No. \_\_\_\_\_

Eprom No. \_\_\_\_\_

<b>Program No:</b>	<b>Program Details</b>
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	